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BUREAU OF AIR REGULATION

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STATE OF FLORIDA
DEPARTMENT OF ENV. PROTECTION
NORTHEAST DISTRICT - JACKSONVILLE

Department of Environmental Protection

Division of Air Resource Management

APPLICATION FOR AIR PERMIT - LONG FORM

I. APPLICATION INFORMATION

Air Construction Permit – Use this form to apply for an air construction permit for a proposed project:
- subject to prevention of significant deterioration (PSD) review, nonattainment area (NAA) new source review, or maximum achievable control technology (MACT) review; or
- where the applicant proposes to assume a restriction on the potential emissions of one or more pollutants to escape a federal program requirement such as PSD review, NAA new source review, Title V, or MACT; or
- at an existing federally enforceable state air operation permit (FESOP) or Title V permitted facility.

Air Operation Permit – Use this form to apply for:
- an initial federally enforceable state air operation permit (FESOP); or
- an initial/revised/renewal Title V air operation permit.

Air Construction Permit & Revised/Renewal Title V Air Operation Permit (Concurrent Processing Option) – Use this form to apply for both an air construction permit and a revised or renewal Title V air operation permit incorporating the proposed project.

To ensure accuracy, please see form instructions.

Identification of Facility

1. Facility Owner/Company Name: **Florida Rock Industries, Inc.**
2. Site Name: **Thompson S. Baker Cement Plant**
3. Facility Identification Number: **0010087**
4. Facility Location...
   Street Address or Other Locator: **4000 NW CR 235**
   City: **Newberry** County: **Alachua** Zip Code: **32669**
5. Relocatable Facility? ☐ Yes ☒ No
6. Existing Title V Permitted Facility? ☒ Yes ☐ No

Application Contact

1. Application Contact Name: **O. Henry Gotsch, P.E.**
2. Application Contact Mailing Address...
   Organization/Firm: **Florida Rock Industries, Inc.—Thompson S. Baker Cement Plant**
   Street Address: **4000 NW CR 235**
   City: **Newberry** State: **FL** Zip Code: **32669**
3. Application Contact Telephone Numbers...
   Telephone: **(352) 472-4722** ext. **121** Fax: **(352) 472-2449**
4. Application Contact Email Address: **hgotsch@flarock.com**

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	3/6/06
2. Project Number(s):	0010087-020-AC
3. PSD Number (if applicable):	

* Permit Done in Jacksonville

Project 020-AC
Completeness Review due 3/22/06

APPLICATION INFORMATION

4. Siting Number (if applicable):	

APPLICATION INFORMATION

Purpose of Application

This application for air permit is submitted to obtain: (Check one)

Air Construction Permit

☒ Air construction permit.

Air Operation Permit

☐ Initial Title V air operation permit.

☐ Title V air operation permit revision.

☐ Title V air operation permit renewal.

☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is required.

☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is not required.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit (Concurrent Processing)

☐ Air construction permit and Title V permit revision, incorporating the proposed project.

☐ Air construction permit and Title V permit renewal, incorporating the proposed project.

Note: By checking one of the above two boxes, you, the applicant, are requesting concurrent processing pursuant to Rule 62-213.405, F.A.C. In such case, you must also check the following box:

☐ I hereby request that the department waive the processing time requirements of the air construction permit to accommodate the processing time frames of the Title V air operation permit.

Application Comment

The purpose of this air-construction permit is for authorization of tests to evaluate the addition of granulated blast furnace slag (GBFS) to the clinker cooler at the Thompson S. Baker Cement Plant. GBFS will be injected into the clinker-cooler's kiln hood and into the calciner.

The following temporary arrangement will be made: GBFS will be moved to a feed hopper from a storage pile by a front-end loader. The GBFS will be augered from the feed hopper into a sand-blasting pot. The sand-blasting pot will be charged from an air compressor, and the GBFS will be moved pneumatically via hose into the clinker cooler hood or into the calciner.

All limits—including emission, operational, and heat-input limits—of the Title V permit will be observed. Only the kiln and clinker cooler systems will be affected.

APPLICATION INFORMATION

Scope of Application

Emissions Unit ID Number	Description of Emissions Unit	Air Permit Type	Air Permit Proc. Fee
003	Kiln System		N/A
004	Clinker Handling		N/A

Application Processing Fee

Check one: ☐ Attached - Amount: $______________ ☒ Not Applicable

APPLICATION INFORMATION

Owner/Authorized Representative Statement

Complete if applying for an air construction permit or an initial FESOP.

1. Owner/Authorized Representative Name :
Chris Horner, Plant Manager

2. Owner/Authorized Representative Mailing Address...
Organization/Firm: **Florida Rock Industries, Inc.—Thompson S. Baker Cement Plant**
Street Address: **4000 NW CR 235**
City: **Newberry** State: **FL** Zip Code: **32669**

3. Owner/Authorized Representative Telephone Numbers...
Telephone: **(352) 472-4722** ext. **130** Fax: **(352) 472-2449**

4. Owner/Authorized Representative Email Address: **chrish@flarock.com**

5. Owner/Authorized Representative Statement:

I, the undersigned, am the owner or authorized representative of the facility addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other requirements identified in this application to which the facility is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit.

Signature

2/17/06
Date

APPLICATION INFORMATION

Professional Engineer Certification

1. Professional Engineer Name: **O. Henry Gotsch**
   Registration Number: **58039**

2. Professional Engineer Mailing Address...
   Organization/Firm: **Florida Rock Industries, Inc.—Thompson S. Baker Cement Plant**
   Street Address: **4000 NW CR 235**
   City: **Newberry** State: **FL** Zip Code: **32669**

3. Professional Engineer Telephone Numbers...
   Telephone: (352) 472-4722 ext. **121** Fax: **(352) 472-2449**

4. Professional Engineer Email Address: **hgotsch@flarock.com**

5. Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

(3) If the purpose of this application is to obtain a Title V air operation permit (check here ☐, if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.

(4) If the purpose of this application is to obtain an air construction permit (check here ☒, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here , if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.

(5) If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here ☐, if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

O. Henry Gotsch
Signature Feb. 16, 2006

Feb. 16, 2006
Date

(seal)

* Attach any exception to certification statement.

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates... Zone **17** East (km) **346.9** North (km) **3285.6**		2. Facility Latitude/Longitude... Latitude (DD/MM/SS) **29°41'26.6"** Longitude (DD/MM/SS) **82°34'56.6"**	
3. Governmental Facility Code: **0**	4. Facility Status Code: **A**	5. Facility Major Group SIC Code: **32**	6. Facility SIC(s): **3241**
7. Facility Comment :			

Facility Contact

1. Facility Contact Name: **O. Henry Gotsch**

2. Facility Contact Mailing Address...
Organization/Firm: **Florida Rock Industries, Inc.—Thompson S. Baker Cement Plant**
Street Address: **4000 NW CR 235**
City: **Newberry** State: **FL** Zip Code: **32669**

3. Facility Contact Telephone Numbers:
Telephone: **(352)472-4722** ext. **121** Fax: **(352)472-2449**

4. Facility Contact Email Address: **hgotsch@flarock.com**

Facility Primary Responsible Official
Complete if an "application responsible official" is identified in Section I. that is not the facility "primary responsible official."

1. Facility Primary Responsible Official Name: **Gary L. Sauer**

2. Facility Primary Responsible Official Mailing Address...
Organization/Firm: **Florida Rock Industries, Inc.**
Street Address: **155 E. 21st Street**
City: **Jacksonville** State: **FL** Zip Code: **32206-2104**

3. Facility Primary Responsible Official Telephone Numbers...
Telephone: **(904) 355-1781** ext. **307** Fax: **(904) 355-0469**

4. Facility Primary Responsible Official Email Address: **gsauer@flarock.com**

Facility Regulatory Classifications

Check all that would apply *following* completion of all projects and implementation of all other changes proposed in this application for air permit. Refer to instructions to distinguish between a "major source" and a "synthetic minor source."

1. ☐ Small Business Stationary Source	☒ Unknown
2. ☐ Synthetic Non-Title V Source	
3. ☒ Title V Source	
4. ☒ Major Source of Air Pollutants, Other than Hazardous Air Pollutants (HAPs)	
5. ☐ Synthetic Minor Source of Air Pollutants, Other than HAPs	
6. ☒ Major Source of Hazardous Air Pollutants (HAPs)	
7. ☐ Synthetic Minor Source of HAPs	
8. ☒ One or More Emissions Units Subject to NSPS (40 CFR Part 60)	
9. ☐ One or More Emissions Units Subject to Emission Guidelines (40 CFR Part 60)	
10. ☒ One or More Emissions Units Subject to NESHAP (40 CFR Part 61 or Part 63)	
11. ☐ Title V Source Solely by EPA Designation (40 CFR 70.3(a)(5))	
12. Facility Regulatory Classifications Comment: **NESHAPS Subpart LLL: National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry** **NSPS Subpart F: Standards of Performance for Portland Cement Plants** **NSPS Subpart Y: Standards of Performance for Coal Preparation Plants** **NSPS Subpart OOO: Standards of Performance for Non-Mineral Processing Plants**	

Supporting Documents For Application to Allow Slag-Addition Trials

Attachment 1	**Presentation of Slag-Addition Project**
Attachment 2	**Article Describing GBFS and Its Use in Cement Manufacture**
Attachment 3	**Request for Determination Regarding Performance Testing**
Attachment 4	**MSDS and Analytical Composition of GBFS**
Attachment 5	**Sketch of Proposed, Temporary GBFS-Feed Set-up**

Attachment 1

Presentation of Slag Addition Project

PRESENTATION OF SLAG-ADDITION PROJECT

PROJECT OVERVIEW

Florida Rock Industries, Inc.—Thompson S. Baker Cement Plant proposes to conduct trials involving the addition of granulated blast furnace slag to the clinker cooler and calciner vessel. A 60-day period is requested in which to conduct the project tests. Additional information is provided below.

AIM OF TRIALS

This project's aim is to (1) demonstrate the technical feasibility of introducing slag into the clinker cooler and calciner vessel, (2) establish stable and predictable operating parameters, (3) assess the impact on clinker and cement quality, and (4) measure the benefits of introducing slag into the clinker cooler and calciner vessel.

DESCRIPTION OF PROCESSING SYSTEM

The dry, blended, mixture of raw materials fed to the kiln is approximately 10% flyash, 3% sand, 2% iron, and 85% limestone. The kiln-feed system boosts this mixture to the top of the preheater tower, then gravity carries it down to the kiln through the four stages of the preheater tower countercurrent to exiting kiln gases which dry, preheat, and partially calcine the material. Calcining and sintering are completed in the kiln. Hot clinkered cement is discharged from the kiln into the clinker cooler, where it passes across traveling grates through which ambient air is blown. The cooled clinker is discharged from the clinker cooler onto a conveyor for transfer to storage silos. The heated air leaves the clinker cooler to provide combustion air in the kiln and calciner; to provide process air to the coal mill; or it is discharged to a stack via an electrostatic precipitator.

Nearly all the heat necessary to produce cement clinker from the raw material is provided by coal and petroleum coke. These are moved from railcar or storage bunker to a coal mill which grinds and dries the coal to a powder. The powdered coal/petroleum-coke mixture is injected and burned in the kiln and calciner. The unburnable mineral—or ash—portion of the fuel mixes with the incoming feed materials and is incorporated into the cement clinker. Whole tires introduced into the calciner provide a minor fraction of the heat input.

DESCRIPTION OF MATERIALS INVOLVED

Granulated blast furnace slag (GBFS) is a byproduct of the steel industry. The molten slag separated from molten iron in a blast furnace consists of silicon, alumina, calcium, and magnesium impurities; and volatile materials in the slag are driven off in the 3000-degree-Farenheit temperatures in the blast furnace. The molten slag is quenched and forms glassy, granulated, calcium and aluminum silicates. GBFS does not require calcination and may be added prior to or after the sintering zone for its mineral composition to be incorporated into or mixed with cement clinker.

DESCRIPTION OF PROJECT

Under the proposed trial, GBFS would be added to the clinker-cooler's kiln hood and to the calciner. GBFS would be received in bulk trucks and stockpiled alongside the clinker cooler. A front-end loader will load it into a hopper that feeds a sandblasting pot via auger. The GBFS will be conveyed by flexible hose from the sandblasting pot to the clinker-cooler's kiln hood and to the calciner using compressed air. The GBFS will either join incoming raw materials in the calciner or clinker as it exits the kiln and falls into the clinker cooler. The only additional equipment required will be the hopper/auger, sandblasting pot, air compressor, and hose.

The trial will consist of two phases. Phase One will be based on 2% slag (2% of total clinker production will be produced from dry slag) for a test run of 25 days. This will allow time to adjust and troubleshoot the feeding system, and transition the kiln operation, and train operators into the slag feeding. At the end of Phase I, the kiln system will be returned to traditional raw materials and 100% clinkered cement and the slag clinker that was produced will be thoroughly tested before beginning Phase 2 of the testing. After 5-day evaluation of the process, quality, and environmental data, Phase II would be started. Slag addition would slowly be increased to 5% over the course of 10 days to allow the kiln to be conditioned. At this rate, a more pronounced impact is expected on kiln fuel efficiency, clinker production, and kiln stability. After 15 days at steady, 5% slag addition, Phase II will be complete and the kiln system returned to traditional raw materials and 100% clinkered cement; and the slag clinker that was produced will be thoroughly tested. Process, quality, and continuous-emission monitoring data will be evaluated again at the end of Phase II for the incremental rates at which slag was fed up to 5%.

Depending upon the observed results in the course of the slag-addition testing, the test protocol may be modified to verify results or obtain additional data at certain increments below 5%.

ANTICIPATED EFFECTS UPON LIMITS OF THE TITLE V AIR PERMIT

This project would operate within the requirements of the Title V air permit. Only the kiln system and clinker-cooler system would be affected, and no permitted limits on production, total heat input, or pollutant emissions will be exceeded. Under the proposed trial, the total clinker production will remain within the limits of the permit. Preheater-feed rates would be reduced as GBFS is added so that the clinker production remains below the 24-hour-average of 110.2 tph. Clinker production rate is directly proportional to the rate of raw meal fed to the kiln, and it is calculated as Clinker Rate = Kiln Feed Rate / 1.66. Because the slag contains no volatile compounds and does not undergo calcinations, its contribution to clinker production is essentially 100%, and the clinker rate can be calculated as follows:

Clinker Rate = (Kiln Feed Rate / 1.66) + Feed Rate of Dry Slag

To ensure production does not exceed the permit's 24-hour limit of 110.2 tph while adding slag during these trials, maximum kiln feed rate will be lowered from 183.4 tph at 0% slag to 179 tph at 2% slag and to 174 tph at 5% slag according to the factor

Kiln Feed Rate Reduction = Feed Rate of Dry Slag * 110 * 1.66

AP-42, Section 11.6.1, includes metal-smelting slags among the materials that are typically used at Portland-cement plants. Because the slag is essentially glass, without a volatile fraction, there will be no increase in emission of regulated gases. Electrostatic precipitators provide particulate-matter control on both the kiln and clinker-cooling systems. Because of the coarse size of GBFS, the consistent feed-rate loading of the kiln and clinker cooler, and because of the good electrical-charging characteristics of slag particles, the performance of the ESPs will not be affected by GBFS use. PM emissions and opacity are not expected to increase.

Fugitive emissions from storing and handling will be slight (if at all) as a result of the coarse particle size of the GBFS and the damp (typically 8% moisture) nature of the source material offered for this trial. From AP-42, Section 13.2.4, the emission rate for particulate matter while handling slag is expected to be about 0.0006 lb/ton, when the emission-rate calculation of that section is worked with the assumption of $k = 0.74$, $U = 8$ mph, and $M = 8\%$. Assuming 6000 tons are handled in the course of the trial, the fugitive emissions are estimated to be less than 10 pounds. From the hopper, the GBFS is handled through enclosed auger and hose to the points of injection and there are no fugitive emissions.

POTENTIAL BENEFITS

It is expected that addition of slag to the calciner vessel and clinker-cooler's kiln hood would cause:

-Reduction in emissions of NOx as a result of lowering the kiln's burning-zone temperatures.

-Reduced fuel use per ton of clinker since GBFS does not undergo calcination.

-Conversion of a low-value industrial by-product to a high-value cement clinker.

PERMIT MODIFICATION

Based upon results of this project, some modifications of the Title V permit may be requested. In particular:

-Inclusion of GBFS as a feed material to the kiln system and/or clinker cooler system.

-Handling and storage requirements to minimize fugitive dust.

-The maximum kiln feedrate of raw meal would be reduced, a limit on the feedrate of GBFS would be established, and the ratio of kiln raw-meal feedrate to clinker production rate might be modified.

CONCLUSION

These trials to inject GBFS into the calciner vessel and clinker cooler are expected to demonstrate the feasibility of incorporating slag into clinker while maintaining product quality and reducing fuel consumption per ton of clinker product.

Attachment 2

Article Describing GBFS and Its Use in Cement Manufacture

Breathing Easier with Blast Furnace Slag

With usage estimated to double in the next five years, cement made with blast furnace slag is growing more popular thanks to well-promoted environmental and energy-related benefits

by Frank Hogan, Jerry Meusel and Lou Spellman

In the United States, the production and marketing of ground granulated blast furnace slag (GGBFS) has seen extraordinary growth since its introduction in 1982. Used as a partial replacement for portland cement, this byproduct of the steel industry can significantly improve the durability of ordinary portland cement concrete and, at the same time, have a positive impact on the environment. This article will enumerate the enhanced properties of concrete utilizing granulated blast furnace slag and the environmental benefits derived from its use.

History

In the 1950s, separate GGBFS was successfully marketed in South Africa and the concept spread to other nations, including Australia, Canada, the United States, and the United Kingdom. GGBFS was first marketed in the states in 1982 when Atlantic Cement Co. built a granulating and grinding plant to process slag from the Bethlehem Steel "L" furnace at Sparrows Point, Md. The quality of the GGBFS was quickly recognized, and the annual sales reached 800,000 tpy within three years. As a separate component, GGBFS added at the concrete mixer allowed the user to optimize the performance of the concrete.

There are presently more than a dozen plants in the United States producing GGBFS with an estimated capacity of more than 2.5 million tpy, with more facilities in the planning or construction phase.

Oxide	Wgt. %
SiO_2	31-38
Al_2O_3	8-16
Fe_2O_3	0.4-30
CaO	33-45
MgO	4-15
S	0.3-2.5
MnO	0.2-1.1
TiO_2	0.4-0.9
Na_2O	0.1-0.4
K_2O	0.2-1.0

Table 1– Typical Range of Chemical Analyses of BFS

Constituent	mg/L
As	< 0.0001
Cd	< 0.0005
Cr	< 0.001
Cu	< 0.001
F	< 0.2
Hg	< 0.0005
Ni	< 0.002
Pb	< 0.001
SO_4	30
Zn	< 0.002
pH	10

Table 2– Typical Analyses of Aqueous Leachant from GBFS

Specifications

ASTM C989 provides a specification for separate GGBFS. Three grades are specified by strength: Grade 120, Grade 100, and Grade 80. Grade 120 provides the greatest strength and is targeted by the majority of U.S. producers. The strength of a GGBFS is primarily determined by the quality of the slag and the fineness to which it is ground.

ASTM C595 allows for the use of granulated blast furnace slag in blended cements either by intergrinding with portland cement clinker or by blending portland cement with GGBFS, or a combination of blending and intergrinding.

Granulated blast furnace slag also is being used as a processing addition in accordance with ASTM C465 at addition levels to 5%.

Environmental aspects

The cement kiln system is the main source of gas emissions from a cement plant generating substantial quantities of carbon dioxide(CO_2) and lesser amounts of sulfur oxides (SOX) and nitrous oxides (NOx). The concerns over increasing levels of CO_2 and the impact on global warming—often referred to as the "greenhouse effect"—is the subject of ongoing debate.

Several gases, including carbon dioxide, water vapor, ozone, and nitrous oxide, in the earth's atmosphere have the capacity to trap solar radiation and cause the surface of the earth to heat up. Carbon dioxide has been identified as the most important of these greenhouse gases. Studies have clearly confirmed that the atmospheric concentration of CO_2 has increased about 25% in the last 200 years or since the beginning of the Industrial Revolution (*EPA Global Warming Web Site*) and is continuing to increase exponentially. The scientific community is not questioning the data showing the increase, nor that the increase will have an influence on heating the earth, but rather the debate centers on how dramatic the impact.

Action taken at the Kyoto Conference in 1997 attempted to develop an international strategy to reduce the emissions of greenhouse gases in order to curb global warming. The 1998 EPA rankings of U.S. sources of CO_2 emission by category indicates that the combustion of fossil fuel is responsible for the majority of the total CO_2 emissions, with cement manufacturing ranking a distant second.

The decarbonation of limestone in a cement rotary kiln system represents an essential part of the clinkering process and constitutes the major source of CO_2 emissions. Typically, an efficient cement plant will release about 0.56 ton of CO_2 for each ton of cement produced; if carbon fuel is used to burn the clinker, an additional 0.35 ton of CO_2 is released. Taking into account all U.S. cement plants, at an average of nearly 1 ton of CO_2 per ton of cement, some 80 million tons of CO_2 is emit-

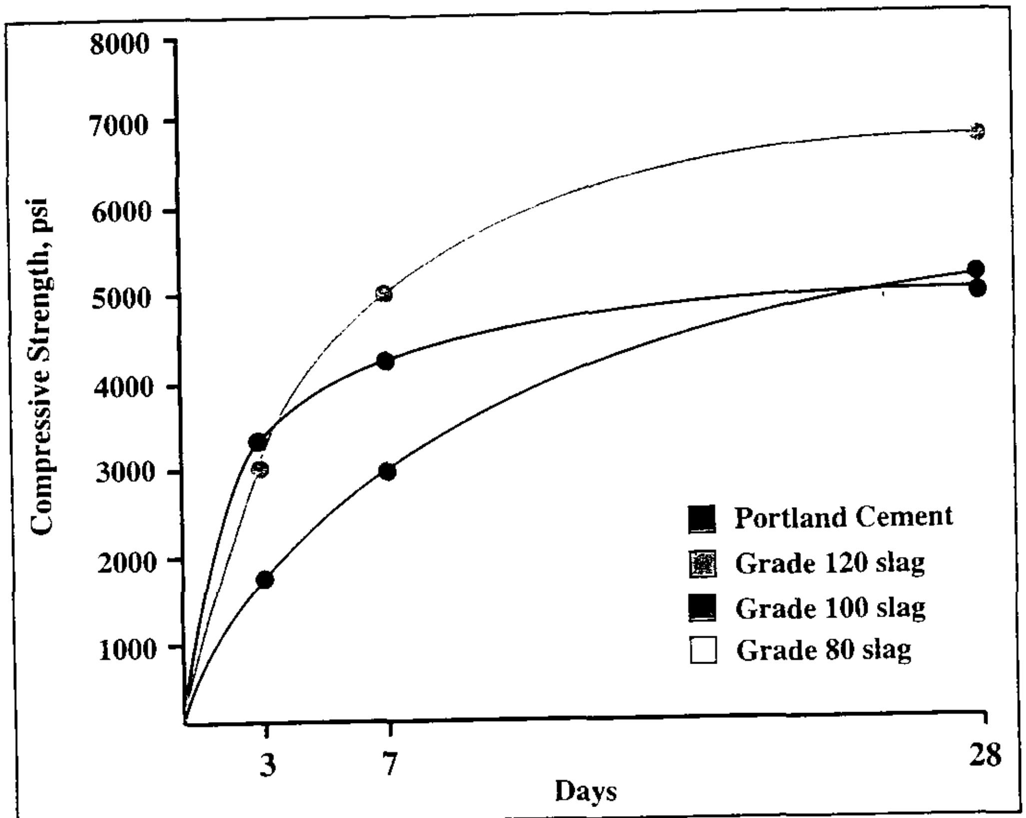


Figure 1 – Strength relationship of mortar containing typical GGBFS meeting ASTM C 989 requirements, compared to portland cement mortar (data originates from Task Group E-38.06.02 report)

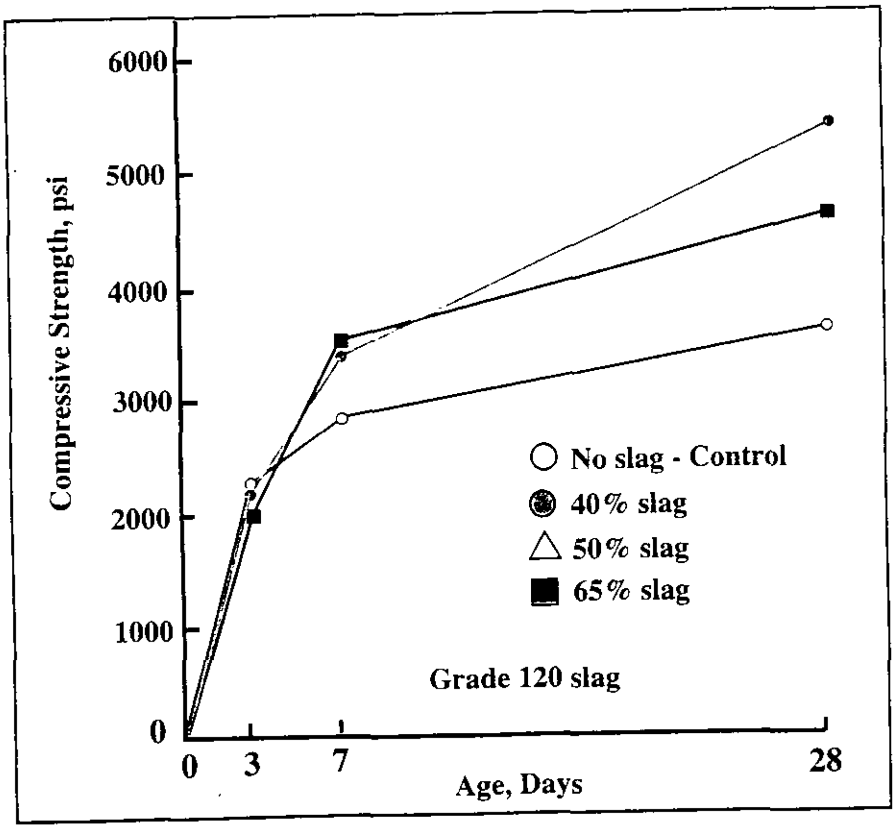


Figure 2 – Compressive strength of concrete containing various blends of GGBFS, compared to concrete using only portland cement as cementitious material (Hogan and Meusel, 1981)

ted into the atmosphere each year (*Environmental Building News Web Site*).

GGBFS typically replaces 35% to 65% portland cement in concrete. Thus, a 50% replacement of each ton of portland cement would result in a reduction of approximately 0.5 ton of CO_2.

Blast furnace slag is a byproduct from steel making. An integrated steel manufacturer must begin the process by extracting iron from iron ore. This process takes place in a blast furnace where the ore, limestone or dolomite, and fuel (coke) are introduced into a furnace to effect the separation of molten iron from the impurities. The impurities consisting of silicon and alumina combine with calcium and magnesium to form molten slag. The molten iron is tapped from the furnace and handled separately for steel making. Temperatures in the blast furnace are typically 1,650°C, driving off carbon dioxide and sulfurous gases and leaving no volatile materials in the iron or slag. The molten slag is tapped from the furnace and directed either to an open pit to be air-cooled or to the granulator.

In the granulator, the molten slag is quickly quenched and converted to an amorphous glassy form of calcium and aluminum silicates, with only minute amounts of crystalline material. Slag not subject to granulation (air-cooled) is mostly crystalline and not significantly hydraulic. The typical chemical composition of GGBFS is shown in Table 1. The granules arrive at the grinding plant with a moisture content from 8% to 12%, having the appearance of damp beach sand. Levels of leachable constituents are given in Table 2. The levels encountered are generally below the limits set for drinking water standards, providing assurance that water that might drain from the stockpile will not present a potential environmental risk.

GGBFS is a 100% recycled material, using significantly less energy at reduced levels of CO_2 emissions during production as compared to portland cement. Because of this environ-

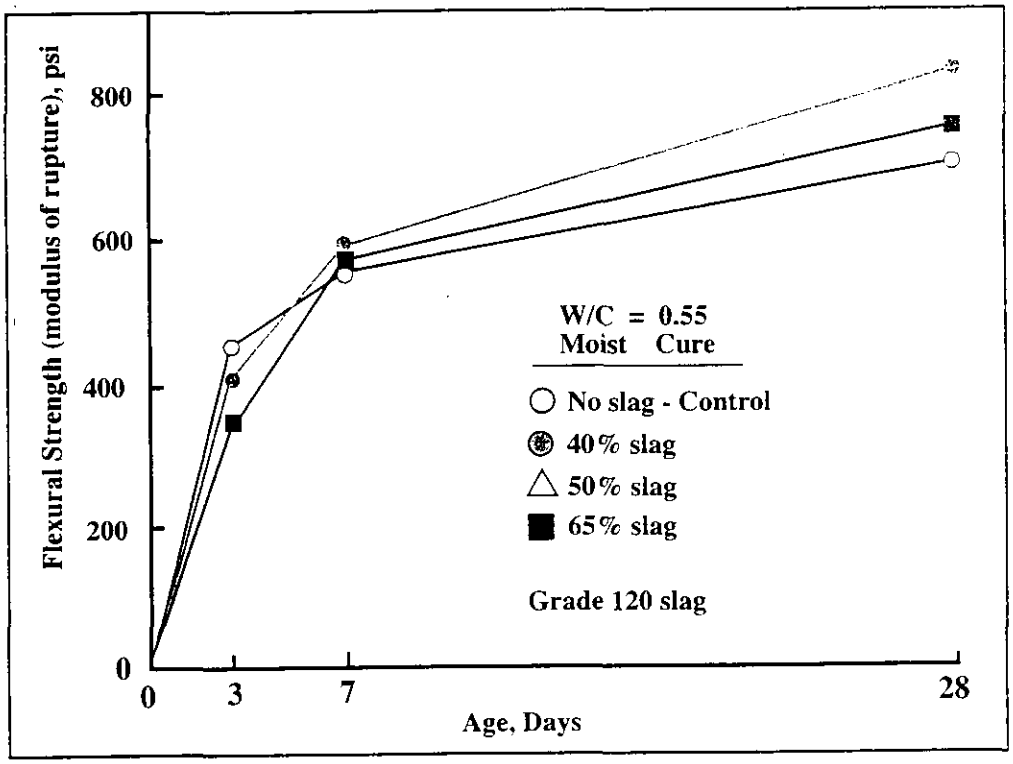


Figure 3 – Flexural strength (modulus of rupture) of concrete containing various blends of GGBFS, compared to concrete using only portland cement as cementitious material (Hogan and Meusel, 1981)

mental posture, GGBFS is included in the list of recommended materials in the National Institute of Standards and Technology study entitled Building for Environmental and Economic Sustainability. GGBFS also has been recommended by the U.S. Green Building Council's program called Leadership in Energy and Environmental Design.

The EPA recognizes the environmental and energy-saving values of GGBFS by favoring its procurement and use in federally funded projects (*EPA 40 CFR Part 247*).

Properties of GGBFS

The hydration of GGBFS initially proceeds much slower than portland cement, but the products of hydration are similar in terms of chemical make-up, i.e. calcium-silicate hydrates. This hydration of the GGBFS depends on the activation of the glassy structure by the hydroxyl and soluble alkali ions available from the portland cement hydration. The activation of the glass is relatively slow and causes a delay in the hydration of slag, which is reflected in slower setting and lower early strength development compared to portland cement.

The GGBFS hydration products are generally found to be more gel-like, as compared to cement, and tend to fill voids contributing denseness to the cement paste. It is this property that is responsible for the increased ultimate strength and the enhanced durability in terms of sulfate resistance, penetration of chlorides, and alkali-silica reactivity.

A number of factors influence the hydraulic activity of GGBFS including, chemical composition, glass content, fineness, and the composition of the portland cement used. Performance evaluation of strength using the slag activity index is specified in ASTM C989. Other properties such as workability and durability are best assessed using performance methods with the same proportions and materials for the intended application.

Compressive Strength—Figure 1 shows mortar compressive strengths of 50/50 GGBFS/portland blends when tested in accordance with ASTM C989. This specification provides for three grades of GGBFS based on strength.

The concrete compressive strengths of blends consisting of 40%, 50%, and 65% Grade 120 GGBFS and the base portland cement are given in Figure 2. The strength relationship of all three blends is similar to that of the Grade 120 mortar strengths. The 40% and 50% gave the greatest 28-day strengths.

Flexural Strength—Concrete prepared with GGBFS will generally provide increased modulus of rupture when compared to a corresponding portland cement concrete. This important property enhancement is responsible for the acceptance of GGBFS on many structural and highway jobs and is illustrated in Figure 3. Blends consisting of 40%, 50%, and 65% all show greater modulus of rupture values than the 100% portland concrete.

Resistance to Sulfate Attack—In most cases as much as 65% replacement of portland cement with GGBFS will improve the sulfate resistance of concrete.

Resistance to Alkali-Silica Reaction (ASR)—The improved resistance to ASR resulting from the partial replacement of portland cement with GGBFS is well documented. The use of GGBFS for this application has gained a broad approval with specifying agencies.

Figure 4 shows the dramatic reduction in expansion measured in ASTM C227 mortar bars using a very reactive Pyrex glass as aggregate.

Temperature Rise in Mass Concrete—In mass concrete, the GGBFS tends to delay the peak temperature because of the slower reaction rate. The peak temperature, which is the critical measurement for mass concrete, will be lower with GGBFS concrete than a comparable portland cement concrete. This benefit is clearly shown in Figure 5, depicting the work of Bamforth (1980). The figure compares in-situ measurements of concrete without GGBFS with concrete having 30% fly ash and concrete having 75%

GGBFS typically replaces 35% to 65% portland cement in concrete. Thus, a 50% replacement of each ton of portland cement would result in a reduction of approximately 500,000 tons of CO_2.

GGBFS. The concrete with the 75% GGBFS shows the lowest peak temperatures.

Time of Setting—An increase in the time of setting can be expected when GGBFS is used. The degree of effect is primarily dependent on temperature and secondarily on the setting characteristics of the portland cement being used in the concrete, as well as the level of cement replacement. At 50% replacement, the time of setting will typically be extended about one-half to one hour at 23°C, while at 29°C little or no change will occur compared to the 100% portland cement. Even in cold temperatures GGBFS can still be used, and significant retardation should be expected below 5°C. Common accelerators or heated concrete can offset extended setting times in winter concreting.

In conditions of winter cold, reducing the GGBFS replacement level is an effective way to minimize the extended setting. On the other hand, at higher temperatures, the slower setting is acceptable and increased levels of GGBFS may be advantageous. In tropical climates, the need for retarding admixtures can be eliminated with the use of GGBFS.

Color—Characteristically, GGBFS is lighter in color than ordinary portland cement and, correspondingly, concrete with some GGBFS replacement will be noticeably lighter in color. In the early stages of curing, concrete containing GGBFS may develop a blue-green coloration. This condition is attributed to the reaction of the sulfide in the GGBFS with certain compounds in the portland cement. The color will generally dissipate with exposure to the atmosphere within a few days.

The future of GGBFS

During the past two decades, concretes made with GGBFS have proven their performance over 100% portland cement concrete. The future growth of GGBFS usage will be significant, estimated to double within the next five years.

Bulk Materials International has been promoting the use of slag over the last 10 years and encourages everyone (DOTs, ready-mix companies, builders, contractors, engineers, and architects) to do the same, thus producing better concrete as well as saving energy and reducing the CO_2 emissions in the environment.

Frank Hogan, Jerry Meusel, and Lou Spellman are currently working with Bulk Materials International Co.

References

EPA Global Warming Web Site, May 15, 2001, http://www.epa.gov/globalwarming/emissions/national/co2.html.

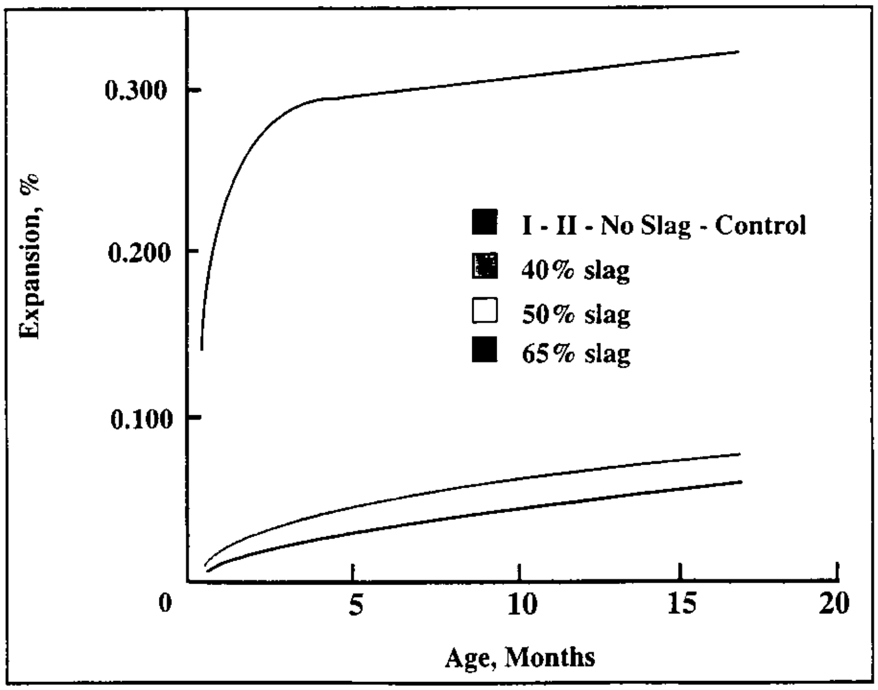
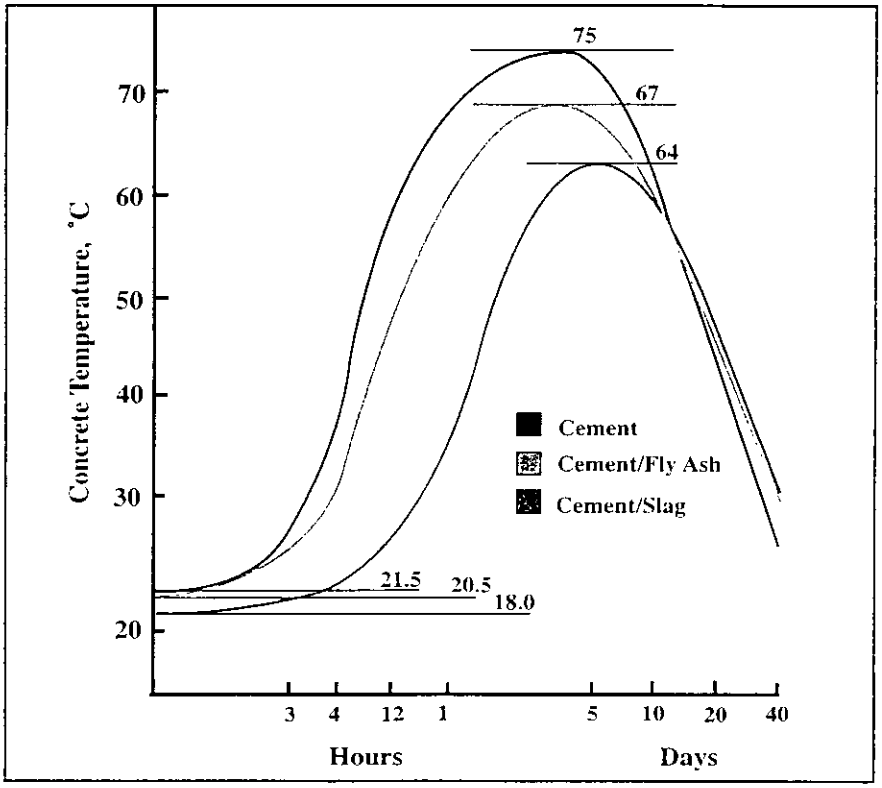


Figure 4 – ASTM C 227 potential alkali-aggregate reactivity for various slag replacements (Hogan and Meusel, 1981)

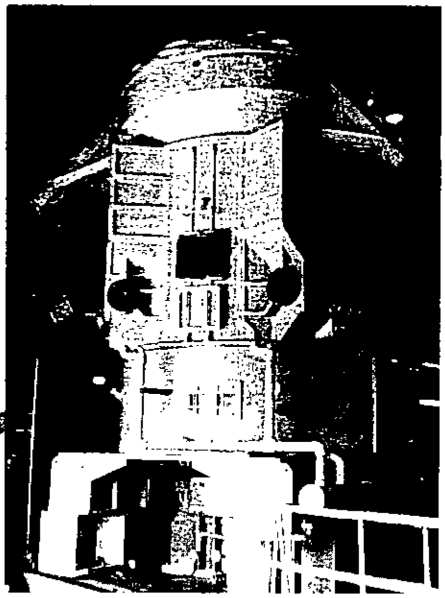


Environmental Building News, Web Site, http://www.buildinggreen.com/features/cem/cementconc.html, from EBN Volume2, No.2, March/April 1993.

Bamforth, P.B., "In Situ Measurement of the Effect of Partial Portland Cement Replacement Using Either Fly Ash or Ground Granulated Blast-Furnace Slag on the Performance of Mass Concrete" Proceedings Institution of Civil Engineers (London), Part 2, V.69, Sept. 1980, pp 777-800.

Hogan F.J. and Meusel, J.W., "Evaluation for Durability and Strength Development of a Ground Granulated Blast Furnace Slag," Cement, Concrete and Aggregates, V.3, No.1, Summer 1981, pp 40-52. CA

Figure 5 – Comparison of heat generated in mass concrete with portland cement, portland cement-fly ash, and portland cement-slag concrete mixtures. (Bamforth, 1980)



Attachment 3

Request for Determination Regarding Performance Testing

FLORIDA ROCK INDUSTRIES INC
CEMENT GROUP / 4000 N.W. CR 235 / P.O. Box 459 / Newberry, FL 32669 / (352) 472-4722

February 16, 2006

Mr. Christopher Kirts, P.E.,
District Air Program Administrator
Florida Department of Environmental Protection
7825 Baymeadows Way, Suite B200
Jacksonville, FL 32256-7590

RE: Request for determination regarding performance testing
Florida Rock Industries, Inc.—Thompson S. Baker Cement Plant
Facility ID 0010087, E.U.s 003 and 004

Dear Mr. Kirts:

I am writing to request from you a determination that performance testing under NESHAPS Subpart LLL will not be necessary during the slag-addition trials that Florida Rock Industries proposes to conduct. The change would be to add granulated blast furnace slag (GBFS) to the calciner and clinker cooler at incremental rates up to 5% of the clinker production rate. No increases in total feed rate, production rate, ESP-inlet temperature, or other operational changes from the conditions of the most recent performance tests will occur.

40 CFR 63.1349, NESHAPS Subpart LLL, states the following:

> (e)(1) If a source plans to undertake a change in operations that may adversely affect compliance with an applicable D/F standard under this subpart, the source must conduct a performance test and establish new temperature limit(s) as specified in paragraph (b)(3) of this section.
>
> (2) If a source plans to undertake a change in operations that may adversely affect compliance with an applicable PM standard under § 63.1343, the source must conduct a performance test as specified in paragraph (b)(1) of this section.

No difficulty complying with the Subpart LLL standards is expected based upon (1) EPA's published comments regarding Subpart LLL rules that indicate this feed change alone would not increase Subpart LLL emissions, (2) evaluation of the expected effects of the feed change that indicate that Subpart LLL emissions will remain below the standards, and (3) low emissions demonstrated by numerous D/F and PM emission tests conducted over the past 40 months. Therefore, I request that the feed changes stated in the first paragraph of this letter be allowed without additional performance testing. Parts I (EPA Rules and Comments), II (Expected

Effects of Feed Changes on Emissions), and III (Previous Performance-Test Results) explain the bases for our expectations.

Please review this letter and contact me at (352) 472-4722, ext. 130, or Henry Gotsch, at ext. 121, if you have any questions or would like additional information. I look forward to hearing from you.

Sincerely,

FLORIDA ROCK INDUSTRIES, INC.

Chris Horner
Plant Manager

Part I—EPA Rules and Comments

EPA makes it clear that operational changes would not lead to additional testing unless compliance with the standards is in doubt.

1. EPA indicated the operational change should be "significant" when it stated that it would "…require a new performance test if a plant anticipates making a significant operational change that may adversely affect compliance with an applicable D/F or PM emission limitation." [See Federal Register, December 6, 2002 (V. 67, No. 235, Pg. 16617), section II. C, "Performance Test Requirements When Operating Conditions Change".]
2. EPA amended the language of the original rule, which formerly stated that a new performance test is required if there is a "significant change in feed or fuel from that used in the previous performance test", to the current language. It wrote that this "allows sources the flexibility to make changes in their kiln's operation without having to retest…if the change will not adversely affect compliance". [See Federal Register, April 5, 2002 (V. 67, No. 66, Pg. 72583), section II. C, "Performance Testing Requirements".]

EPA expects that low exhaust temperatures and proper operating practices will limit dioxin/furan emissions:

1. "The predominant factor affecting D/F emissions is the temperature of gases at the inlet to the PMCD….The highest D/F emissions (near 40 ng TEQ/dscm) occurred at the highest gas temperatures (between 500 deg. F and 700 deg. F) while the lowest emissions (near 0.02 ng TEQ/dscm) occurred at the lowest temperature (at approximately 210 deg. F)". [See Federal Register, March 24, 1998 (V. 63, No. 56, Pg. 14200), section V. D, "Selection of Proposed Standards for Existing and New Sources".]
2. "Temperature reduction to 400 deg. F, in conjunction with proper control of kiln and PMCD operation and efficient combustion will limit D/F emissions to 0.2 ng TEQ/dscm in most (if not all) cases, and the proposed D/F standard for existing kilns is set at this level." [See Federal Register, March 24, 1998 (V. 63, No. 56, Pg. 14201), section V. D, "Selection of Proposed Standards for Existing and New Sources".]
3. "The EPA is influenced here, similarly to the situation for existing kilns, by the fact that most new sources appear to be able to achieve a 0.2 ng TEQ/dscm emission level solely through the use of temperature control." [See Federal Register, March 24, 1998 (V. 63, No. 56, Pg. 14202), section V. D, "Selection of Proposed Standards for Existing and New Sources".]

EPA identifies control of PM and hydrocarbon as necessary to reduce HAP emissions:

1. "Controlling PM emissions will control the emissions of non-volatile metal HAPs (and also the condensed organic HAPs including D/F which are adsorbed on particulates). The available technologies used in the cement manufacturing industry for the control of non-volatile HAP metals are the same technologies (FFs and ESPs) as the proposed MACT floor technologies for control of PM." [See Federal Register, March 24, 1998 (V. 63, No. 56, Pg. 14198), section V. C, "Selection of Pollutants".]

2. "Methods used in the cement manufacturing industry for the control of organic HAP emissions would be the same methods used to control THC emissions. These emission control methods include using feed materials with relatively low levels of organic matter and achieving good combustion." Regarding monitoring, "Total hydrocarbon, which is less expensive to test for and monitor, can be used as a surrogate for organic HAPs." [See Federal Register, March 24, 1998 (V. 63, No. 56, Pg. 14198), section V. D, "Selection of Pollutants".]
3. "One THC control method available is feed material selection. Total hydrocarbon emissions from kilns can be limited by avoiding feed materials which have excessive organic contents. [See attached Register, March 24, 1998 (V. 63, No. 56, Pg. 14203), section V. D, "Selection of Proposed Standards for Existing and New Sources".]

Part II—Expected Effects of Feed Changes on Kiln/Raw Mill Emissions

A. Particulate Matter (PM)

Granulated blast furnace slag provides the chemical components necessary for cement production—calcium, iron, aluminum, and silica. GBFS is a coarse, dense material (specific gravity of 2.9) with typical granular diameter of 1/20th of an inch. Control of particulate-matter emissions from the kiln is dependent upon the electrostatic precipitator (ESP) which, in general, provides efficiency based upon gas velocity, particle-size distribution, and PM concentration in the gas stream entering the control device. Because the GBFS is larger and heavier than raw meal, it is unlikely to be entrained into exhaust gases exiting the kiln and preheater tower, it would not contribute to the PM loading on the ESP. The rate of gas flow through the ESP is regulated by the operator according to best-operational controls, and it would not be affected by the addition of GBFS. Because the control of emissions of particulate matter will not be affected by introducing GBFS, the HAP emissions associated with PM emissions will not increase.

B. Dioxin/furans (D/F)

The organic-material feedrate, particularly the hydrocarbon fraction, will not increase as a result of the planned feed changes. EPA identified control of organic content in feeds as a method of controlling organic HAPs. Because GBFS is an inorganic material by-product formed from a 3000-degree-Farenheit blast furnace, it has no organic component. The emission rate of organic HAPs would not be increased when slag is injected.

Part III—Previous Performance-Test Results

Over the past 40 months, Florida Rock has conducted numerous emission tests on the kiln/raw-mill stack to demonstrate compliance with Subpart LLL requirements for dioxin/furan and particulate-matter emissions. The average results for each set of test runs is provided below, along with the limits for PM and D/F from the permit and federal rules. Each test demonstrated that emissions have been well within the limits.

Kiln/Raw Mill
PM Emission Limits: 0.3 lb/ton of preheater feed (NESHAPS Subpart LLL)
0.14 lb/ton of preheater feed (Title V permit)

D/F Emission Limit: 0.4 ng TEQ per dscm at 7% oxygen (NESHAPS Subpart LLL)

Dec. 2-8, 2002	Kiln/Raw Mill	PM- 0.033 lb/ton of preheater feed
	Kiln only	PM- 0.036 lb/ton of preheater feed
		D/F- (No data; samples ruined by testing lab)
Jan. 15-28, 2003	Kiln/Raw Mill	PM- 0.009 lb/ton of preheater feed
	Kiln only	PM- 0.051 lb/ton of preheater feed
	Kiln/Raw Mill	D/F- 0.0097 ng TEQ per dscm at 7% oxygen
	Kiln only	D/F- 0.0085 ng TEQ per dscm at 7% oxygen
Mar. 31-Apr. 4, 2003	Kiln/Raw Mill	PM- 0.020 lb/ton of preheater feed
	Kiln only	PM- 0.025 lb/ton of preheater feed
	Kiln/Raw Mill	D/F- 0.064 ng TEQ per dscm at 7% oxygen
	Kiln only	D/F- 0.16 ng TEQ per dscm at 7% oxygen
Apr. 6, 2005	Kiln/Raw Mill	D/F- 0.045 ng TEQ per dscm at 7% oxygen
	Kiln only	D/F- 0.015 ng TEQ per dscm at 7% oxygen
July 20, 2004	Kiln/Raw Mill	PM- 0.025 lb/ton of preheater feed
July 18, 2005	Kiln/Raw Mill	PM- 0.044 lb/ton of preheater feed
July 19-22, 2005	Kiln/Raw Mill	D/F- 0.004 ng TEQ per dscm at 7% oxygen
	Kiln only	D/F- 0.008 ng TEQ per dscm at 7% oxygen

Attachment 4

MSDS and Analytical Composition of GBFS

Revision date	July 1, 2004
Document No.	Kura−MSDS−D
Regulation No.	21

Material Safety Data Sheet

1. Product and company information

(1) Product name: Granulated slag blast furnace

(2) Company information:
①Company name
②Address
③Responsible division
④Phone
⑤Fax
⑥Emergency contact and phone number

2. Composition and ingredients

(1) Classification: Fused solid substance consisting of the ingredients indicated below.
Normal compound.

(2) Principal ingredients: Ingredients are as shown in the table below.

Ingredient	Concentration (%)	CAS No.	Government ordinance specification No.
CaO	40〜50	1305-78-8	196
SiO2	30〜40	7699-41-4	319
Al2O3	10〜20	1344-28-1	195
MgO	0〜10	1309-48-4	
TiO2	0〜2	13463-67-7	197

"Government ordinance specification No." refers to The number stipulated by government ordinance in Article 57 Section 2 of the Occupational Health and Safety Law.

3. Hazards identification

(1) Classification name : Does not correspond to classification standards.

(2) There is no useful information at this time concerning risk or health hazards under a normal environment. Will produce Ca(OH) 2, etc. in contact with water, however, with an alkalinity of pH 9~11.

4. First-aid measures

Necessary first aid measures : Consult a physician for a diagnosis if necessary.
① Eyes : Rinse eyes with plenty of clean water.
② Skin contact : Flush area of contact with water without scrubbing.
③ If inhaled : Move individual to a location with fresh air.
④ If swallowed : Induce vomiting and rinse mouth well.

5. Fire-fighting measures

Nonflammable material : No special measures required.

6. Accidental release measures

Solid material : Recover by sweeping and collecting.

7. Handling and storage precautions

(1)Handling Wear protective clothing (Eye goggles, dustproof mask, gloves, etc.).

(2)Storage When preserving for long periods in the presence of moisture, solidification of the material may occur.

8. Exposure control and personal protection	There is no useful information at this time under a normal use environment. Depending upon operating conditions, however, appropriate protective clothing (gloves, eye goggles, dustproof mask, etc.) should be worn.
9. Physical and chemical properties	(1) Physical properties : Solid under a normal environment. (2) Form : Granules (3) Color : Ash white (4) Smell : Odorless (5) Other : Will produce Ca(OH) 2, etc. in contact with water, however, with an alkalinity of pH 9-11.
10. Stability and reactivity	Is stable under a normal environment, but will show alkalinity when in contact with water. Will solidify during long periods of storage and alkali stimulation.
11. Toxicological information	There is currently no useful epidemiological information concerning individuals. As a single element in the ingredients, however, in operations such as those in the proviso for Item 8 there are situations where toxicological effects have been indicated in cases where a certain concentration (for example, the maximum permissible concentration) has been exceeded. Toxicity information may be obtained from sources such as the Reasons for Permissible Density Proposals manual (Japan Society for Occupational Health).
12. Ecological information	There is currently no useful information available. There are situations, however, where an environmental effect has been indicated as a single element of the ingredients. Toxicity information may be obtained from sources such as the Reasons for Permissible Density Proposals manual (Japan society for Occupational Health).
13. Disposal considerations	Basically product is consigned to a waste management company that has obtained legal permits.
14. Transport information	Transport using procedures that prevent dust emissions.
15. Regulatory information	None in particular
16. Other information	None in particular

This data was created based on Japan Industrial Standard Z7250:2000, "Chemical Material Safety Data Sheet (MSDS) Part 1: Order of Details and Items" (Referred to below as "JIS"). Definitions of terms are in accordance with JIS.

As "reference information" for operators who oversee operations, this data provides all of the information possessed by our company at the time this data sheet was created in order to ensure the safe handling of the product. Individuals who oversee operations are responsible for using this as a reference and must take all measures that are appropriate for each separate handling of this substance.

Accordingly, this data sheet does not guarantee the safety of the product and there is a possibility of risks of which our company is unaware and which have not been described on this data sheet

QUALITY CERTIFICATE

This is to certify that the undermentioned sample has been analyzed by us with the following results.

1.NAME OF ARTICLE : WATER QUENCHED (GRANULATED)
BLAST FURNACE SLAG
2.DATE OF LOADING : SEPTEMBER 1, 2005
3.NAME OF VESSEL : M.V."NAVIOS IONIAN"
4.CHEMICAL ANALYSIS AND TEST RESULTS

MOISTURE ———— (at 110℃) 7.8 (%)
CaO (Calcium oxide) ———— 44.9 (%)
SiO_2 (Silicon dioxide) ———— 35.2 (%)
Al_2O_3 (Aluminum oxide) ———— 15.0 (%)
MgO (Magnesium oxide) ———— 4.7 (%)
MnO (Manganese oxide) ———— 0.31 (%)
FeO (Ferros oxide) ———— 0.40 (%)
TiO_2 (Titanium dioxide) ———— 0.53 (%)
S (Sulfur) ———— 0.78 (%)
BASICITY ($CaO+Al_2O_3+MgO/SiO_2$) ———— 1.84
GLASS CONTENT ———— 95.8 (%)
SIZE UNDER 10mm ———— 100.0 (%)

SLAG INJECTION

To be tested as addition to calciner or kiln hood. Injection rate up to 5% of clinker production