

**Koerner, Jeff**

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**From:** John Koogler [jkoogler@kooglerassociates.com]  
**Sent:** Wednesday, March 02, 2011 11:04 AM  
**To:** Koerner, Jeff  
**Cc:** 'Townsend, George'  
**Subject:** Cemex Brooksville South - Finish Mill No. 2 PM Limits  
**Attachments:** Project Description.zip

Jeff,

In accordance with our recent phone conversation, I've attached a draft project description for restating the PM/PM10 limits for the No. 2 Finish Mill at Cemex Brooksville South. As you suggested, I've framed this as just restating - from grains/dscf to pounds/ton of FM feed - the PM/PM10 limits that were in Permit 0530021-018-AC (PSD-FL-351C), issued on February 18, 2010. This is independent of the Line No. 2 rate increase, and it does not affect the combustion products emission limits for FM No. 2 that are included in 0530021-018-AC.

I'd appreciate it if you will take a look at this and let me have your comments. If this looks reasonable, we'll get a complete application to you shortly.

Thanks,  
John

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## Introduction

The purpose of this application is to restate the particulate matter and PM10 (PM/PM10) emission limits for the Finish Mill of Cement Production Line No. 2 at the Cemex Brooksville-South complex on a different bases than the limits were stated in Permit 0530021-018-AC (PSD-FL-351C), issued February 18, 2010. The reason for restating the PM/PM10 emission limits results from the fact that the limits are stack gas concentration limits (grains per dry standard cubic foot) carried over from the original permit issued for plant construction (Permit 0530021-009-AC (PSD-FL-351), issued July 6, 2005) and there are significant differences between the finish mill as originally permitted and the finish mill that is a component of the as-built plant. The as-built finish mill and other as-built modifications were addressed with Permit 0530021-018-AC, PSD-FL-351C.

As designed and originally permitted (-009-AC) Cement Production Line No. 2 was expected to be a Polysius plant. The plant as-built however, was an F.L. Smidth plant. Differences between the plant as originally permitted and the plant as-built were addressed with Permit 0530021-018-AC. This included major differences in the design and operating characteristics of the finish mill. As a result of these differences, the concentration based PM/PM10 emission limits for the finish mill in Permit -009-AC that were carried over into Permit -018-AC are not appropriate. In this application the differences in design and operating characteristics of the two types of finish mills are described and restated PM/PM10 emission limits are proposed for the as-built Line No. 2 Finish Mill.

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## **Polysius Designed Finish Mill**

The finish mill in the Polysius plant permitted by Permit -009-AC was a ball mill with a finished cement production rate of 138 tons per hour. In this mill, 138 tons per hour of clinker (~95 percent) and gypsum (~five percent) were to be blended with about 312 tons per hour of recycled over-sized material and ground in a ball mill. The mill was to be swept with air to remove particles that were at, and near the size required for finished cement. The product leaving the mill would have passed through a cyclonic separator where approximately 90 percent of the product would have been recovered and delivered to a recovered product air-slide. The 10 percent of the product that would have passed through the cyclonic dust collector would have been recovered in a baghouse dust collector and delivered to the same recovered product air-slide. Thus, of the 450 tons per hour of product swept from the finish mill, approximately 405 tons per hour would have been recovered by the cyclonic collector and about 45 tons per hour of the material would have entered the baghouse dust collector and would have been recovered there.

The 450 tons per hour of recovered product would have been transferred by elevator and air-slides to a classifier that separates finished cement from oversized product. Approximately 30 percent of the material entering the classifier would have been finished cement that would have been delivered to the cement silos and the remaining 70 percent would have been over-sized product that would have been returned to the finish mill. For the originally permitted Polysius plant, the finished cement production rate was 138 tons per hour and the oversized

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material recycle rate was about 312 tons per hour. A simplified flow diagram of the Polysius finish mill is presented as Figure 1.

At issue is the baghouse dust collector used for product recovery. The Polysius baghouse had a design air flow rate of approximately 40,000 actual cubic feet per minute at a nominal temperature of 230°F and a nominal moisture content of 10 percent. The standard gas flow rate through this baghouse was nominally 27,000 dry standard cubic feet per minute. As previously stated, the dust loading to the baghouse was approximately 45 tons per hour; 10 percent of the product swept from the finish mill.

As the emission rates of PM/PM10 (and other pollutants) from the originally designed Polysius plant triggered a PSD review, a Best Available Control Technology (BACT) review was required for all PM/PM10 emission units. This included the product recovery baghouse dust collector in the finish mill.

In the application for the permit (-009-AC), the applicant proposed PM/PM10 concentration limits in the air stream discharged from the finish mill baghouse as BACT. The concentration limits proposed were 0.01 grains per dry standard cubic foot for PM and 0.007 grains per dry standard cubic foot for PM10. These concentration limits and the standard gas flow rate through the baghouse (27,000 dscfm) resulted in PM mass emission rates of 2.3 pounds per hour and 10.12 tons per year and PM10 emission rates of 1.62 pounds per hour and 7.08 tons per year. Note that while these mass emission rates were derived from the PM/PM10 BACT concentration limits, they were not BACT limits themselves.

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FDEP agreed with the applicant's proposal and the PM/PM10 concentration limits (but not the mass emission limits) became BACT for the product recovery dust collector in the finish mill. It should be noted, that these concentration limits were consistent with PM/PM10 BACT limits permitted for product recovery dust collectors on finish mills at other Polysius designed plants in Florida (e.g., Suwannee American Cement, Florida Rock Industries and American Cement).

## **F.L. Smidth Designed Finish Mill**

The plant that was constructed was a F.L. Smidth plant rather than a Polysius plant. The finish mill of the F.L. Smidth plant is a vertical roller mill rather than a ball mill and product recovery depends entirely upon a baghouse dust collector, rather than a combination of a cyclonic collector followed by a baghouse as is the case in a Polysius design. As previously stated, the differences between the Polysius design and the F.L. Smidth design were addressed with Permit 0530021-018-AC (PSD-FL-351C).

The F.L. Smidth finish mill is a vertical roller mill with a throughput capacity of 240 tons per hour of clinker (~95 percent) and gypsum (~five percent). The roller mill is swept with an air stream of approximately 270,000 actual cubic feet per minute (acfm) at a nominal temperature of 230°F and a nominal moisture content of five percent. This flow translates to a standard flow rate of approximately 200,000 dry standard cubic feet per minute (dscfm).

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The entire 240 ton per hour output of the finish mill is delivered to a baghouse dust collector for product recovery in the 270,000 acfm air stream. The recovered finished cement is delivered to cement silos while the airstream discharged from the baghouse is split with one fraction discharged to the atmosphere and the remaining fraction recirculated back to the finish mill.

The fraction of the airstream re-circulated back to the finish mill varies. For permitting purposes, it was determined that the maximum amount of air discharged to the atmosphere through the baghouse stack would be 50 percent of the flow through the baghouse; or 100,000 dry standard cubic feet per minute. It should be noted that the fractions of air leaving the baghouse that are discharged to the atmosphere and re-circulated back to the finish mill have no affect on the airflow through the baghouse or the dust loading to the baghouse. The flow through the baghouse remains at 200,000 dry standard cubic feet per minute and the dust loading to the baghouse remains at approximately 240 tons per hour. As a side note, the purpose of gas recirculation is to recover the heat in the gas stream for purposes of energy conservation. A diagram of the F.L. Smidth finish mill and product recovery dust collector is presented as Figure 2.

Because of the change from a Polysius to a F.L. Smidth plant, Permit 0530021-018-AC (PSD-FL-351C) was issued to address the differences. In the application for this permit and in supplemental information provided to the Department in response to Requests for Additional Information, the BACT concentration limits of 0.01 and 0.007 grains per dry standard cubic foot for PM and PM10, respectively, were retained for the finish mill baghouse, and a maximum stack gas discharge

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rate of 100,000 dry standard cubic feet per minute was established (50 percent of the flow through the baghouse).

The mass emission rates corresponding to these BACT PM and PM10 concentration limits (at a total baghouse flow rate of 200,000 dscfm) are 8.57 pounds per hour and 37.5 tons per year for PM and 6.00 pounds per hour and 26.3 tons per year for PM10.

The differences in the PM and PM10 emission limits between the originally permitted plant and the permitted as-built plant are summarized in Table 1. It will be noted that the BACT concentration limits for PM and PM10 remained the same in the two permits while the mass emission rates of PM and PM10 increased by a factor of approximately 3.7 with the as-built plant. The increases in PM and PM10 emissions were addressed by air quality modeling associated with Permit -018-AC (PSD-FL-351C).

**TABLE 1**

PM/PM10 Emission Limits for Finish Mill No. 2  
 Permit 0530021-009-AC; Original Permit  
 Permit 0530021-018-AC; As-built Permit  
 Cemex Construction Materials, LLC - Brooksville South Cement Plant  
 Brooksville, Florida

Permit	BACT Limits		Equivalent non-BACT Mass Limits			
	(grains/dscf)		(lb/hr)		(tons/year)	
	PM	PM10	PM	PM10	PM	PM10
0530021-009-AC	0.01	0.007	2.31	1.62	10.1	7.1
0530021-018-AC	0.01	0.007	8.57	6.00	37.5	26.3

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## Comparison of PM/PM10 Emission Limits

In the originally permitted plant (Permit -009-AC), the finished cement recovery system included a cyclonic collector which removed approximately 90 percent of the 450 tons per hour of material swept from the finish mill and a baghouse dust collector that recovered the remaining 10 percent of product; or approximately 45 tons per hour of product. The 450 tons per hour is comprised of 138 tons per hour of finished cement and 312 tons per hour of over-sized material that is recycled back to the finish mill. The airflow rate through the baghouse was approximately 40,000 ACFM at a temperature of 230°F and a moisture content of approximately 10 percent (27,000 dscfm). The BACT limits for PM and PM10 established for this baghouse were concentration limits of 0.01 and 0.007 grains per dry standard cubic foot for PM and PM10, respectively. These limits were based on BACT limits that had been permitted and achieved at other Polysius designed plants in Florida.

In contrast to the original design, the as-built plant has a vertical roller mill with a production capacity of 240 tons per hour of finished cement. This product is recovered entirely in a baghouse dust collector designed for an airflow rate of approximately 270,000 actual cubic feet per minute at a temperature of 230°F and a moisture content of approximately five percent (200,000 dscfm). The baghouse has 3,300 singed acrylic bags, each 14 feet long and 6 inches in diameter. The BACT limits for PM and PM10 for the as-built baghouse were carried over from the original permit and remain at 0.01 and 0.007 grains per dry standard cubic foot for PM and PM10, respectively. These concentration limits are not appropriate for a



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baghouse the size of the Finish Mill No. 2 product recovery baghouse and a baghouse with an inlet dust loading of approximately 240 tons per hour.

As a point of comparison, the main baghouse used to control PM/PM10 emissions from the kiln/raw mill/cooler of the as-built plant has a design airflow rate of 330,000 ACFM at a temperature of 260°F and a moisture content of approximately 10 percent (220,000 dscfm). The dust loading to this baghouse is approximately 16 tons per hour (compared with 240 tons per hour of dust entering the finish mill baghouse).

With the main baghouse, the dust loading to the baghouse is approximately 16 tons per hour and the BACT emission limits for PM/PM10 are 0.23 and 0.20 pounds per ton of clinker produced, respectively; or 28.8 and 25.0 pounds per hour at a permitted clinker production rate of 125 tons per hour. The required baghouse efficiency to meet these emission limits is 99.91 percent and the equivalent PM/PM10 concentrations in the discharged gas stream (based on a flow of 220,000 dscfm) are 0.015 and 0.013 grains per dry standard cubic foot, respectively.

The finish mill product recovery baghouse in comparison is required to reduce an inlet dust loading of 240 tons per hour to PM/PM10 emission rates of 8.57 and 6.00 pounds per hour; emission rates corresponding to the BACT PM/PM10 limits of 0.01 and 0.007 grains per dry standard cubic foot. This means that the baghouse must have a collection efficiency of 99.998 percent to meet the PM/PM10 emission limits

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Again, comparing the kiln and finish mill baghouses, the main baghouse has a flow of approximately 220,000 dry standard cubic feet per minute, an inlet dust loading of 16 tons per hour, a required efficiency of 99.91 percent and equivalent PM/PM10 concentration limits of 0.015 and 0.013 grains per dry standard cubic foot. The finish mill baghouse on the other hand, has a flow of approximately 200,000 dry standard cubic feet per minute and an inlet dust loading of 240 tons per hour. The efficiency required of this baghouse is 99.998 percent and the BACT PM/PM10 concentration limits are 0.01 and 0.007 grains per dry standard cubic foot (a PM10 limit approximately half the concentration limit required of the main baghouse). Clearly, the PM/PM10 BACT emission limits for the finish mill baghouse are not consistent with the BACT limits for the kiln baghouse, and are not appropriate.

### **Proposed Finish Mill PM/PM10 Emission Limits**

The BACT established PM/PM10 limits in Permit 0530021-018-AC (PSD-FL-351C) are concentration limits that were carried over from BACT limits in the original plant permit; Permit 0530021-009-AC (PSD-FL-351). These limits are 0.01 and 0.007 grains per dry standard cubic foot for PM and PM10, respectively. Based on a stack gas flow rate established for the finish mill in Permit 0530021-018-AC (100,000 dscfm) and 8760 hours per year operation, the corresponding mass emission limits are 8.57 pounds per hour and 37.5 tons per year for PM and 6.0 pounds per hour and 26.3 tons per year for PM10. To establish reasonable PM/PM10 emissions for the finish mill going forward, it is proposed to retain the mass equivalent BACT PM/PM10 limits, and to restate these limits in terms of feed

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to the finish mill. This concept is analogous to relating the PM/PM10 emission limits for the kiln/raw mill/cooler to the preheater feed rate (or to the clinker production rate, which is a function of preheater feed rate).

Following this approach, if the annual PM/PM10 emission limits of 37.5/26.3 tons per year are divided by the permitted annual cement production rate of 1,301,138 tons per year, a PM emission limit of 0.058 pounds per ton of finish mill feed and a PM10 limit of 0.040 pounds per ton of finish mill feed are derived. This assumes the cement production rate is equivalent to the finish mill feed rate which is a valid assumption as all finished cement passes through the finish mill.

If the proposed PM/PM10 emission limits of 0.058/0.040 pounds per ton of finish mill feed are converted to equivalent concentration limits at a finish mill feed rate of 240 tons per hour and the stack gas discharge rate of 100,000 dry standard cubic feet per minute established by Permit 0530021-018-AC, stack gas PM/PM10 concentrations of 0.016/0.012 grains per dry standard cubic foot are derived. These concentrations compare to the BACT equivalent PM/PM10 concentration limits for the kiln/raw mill/cooler baghouse of 0.015/0.013 grains per dry standard cubic foot.

In summary, the size of the finish mill baghouse is comparable to the size of the kiln/raw mill/clinker cooler baghouse. The dust loading to the finish mill baghouse however is approximately 15 times greater than the dust loading to the kiln/raw mill/clinker cooler baghouse (240 tons per hour vs. 16 tons per hour). Even with these differences, the proposed PM/PM10 emission limits for the finish mill

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baghouse are comparable to the BACT emission limits for the kiln/raw mill/clinker cooler baghouse (based on a comparison of equivalent stack gas PM/PM10 concentration limits). The proposed limits for the finish mill are comparable to BACT established PM/PM10 limits established for a comparable Emission Unit at the same facility and therefore should be considered reasonable and acceptable as restated BACT based limits for PM/PM10 emissions from the finish mill.

**BAGHOUSE CHARACTERISTICS**

Flow: 40,000 acfm/27,000 dscfm

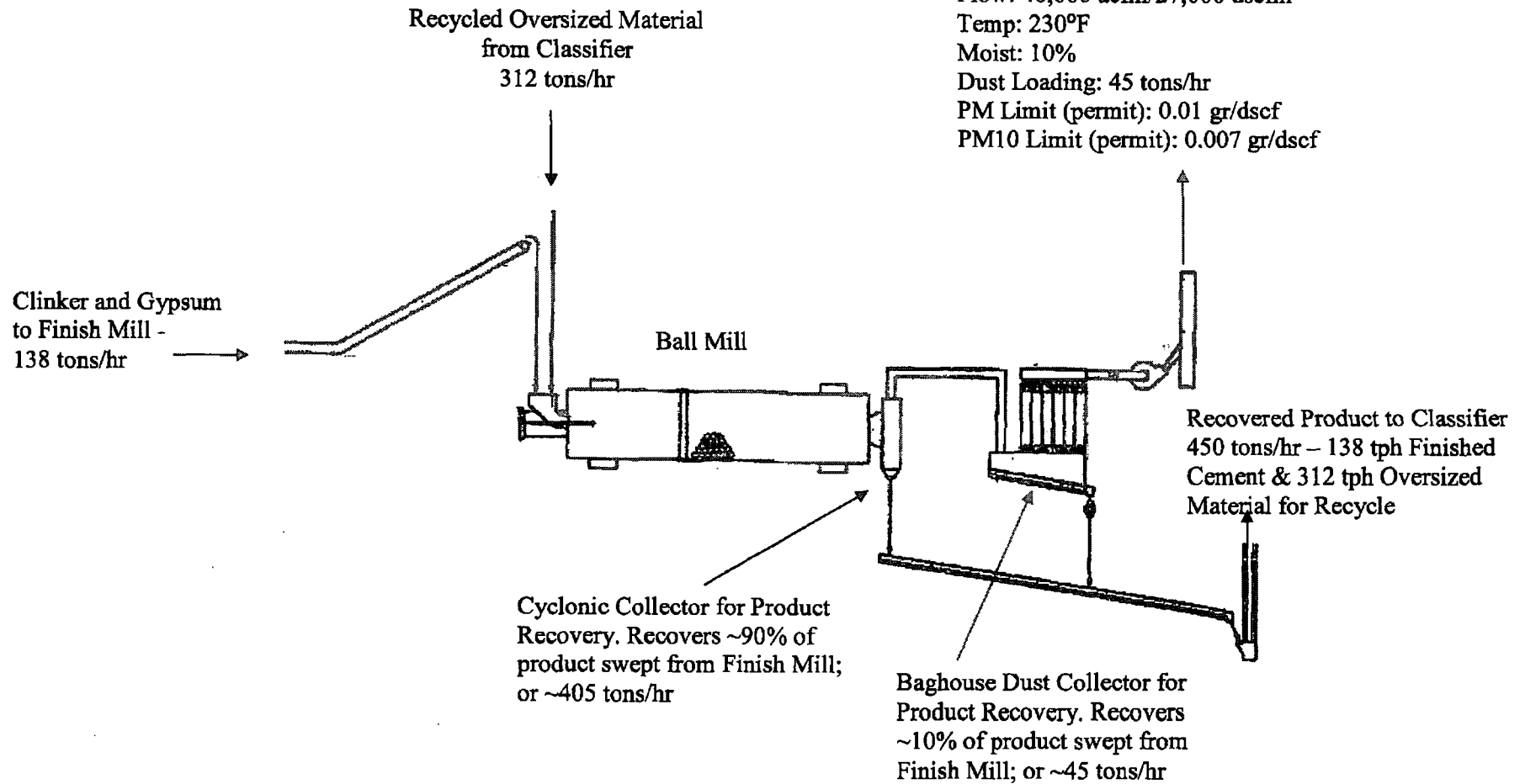
Temp: 230°F

Moist: 10%

Dust Loading: 45 tons/hr

PM Limit (permit): 0.01 gr/dscf

PM10 Limit (permit): 0.007 gr/dscf



**FIGURE 1**

**Polysius Finish Mill Permitted with Original Plant Design – Permit 0530021-009-AC (PSD-FL-351)**

**Cement Production Line No. 2**

**Cemex Construction Materials, LLC – Brooksville South Cement Plant**

**Brooksville, Florida**

**BAGHOUSE CHARACTERISTICS**

Flow: 270,000 acfm/200,000 dscfm

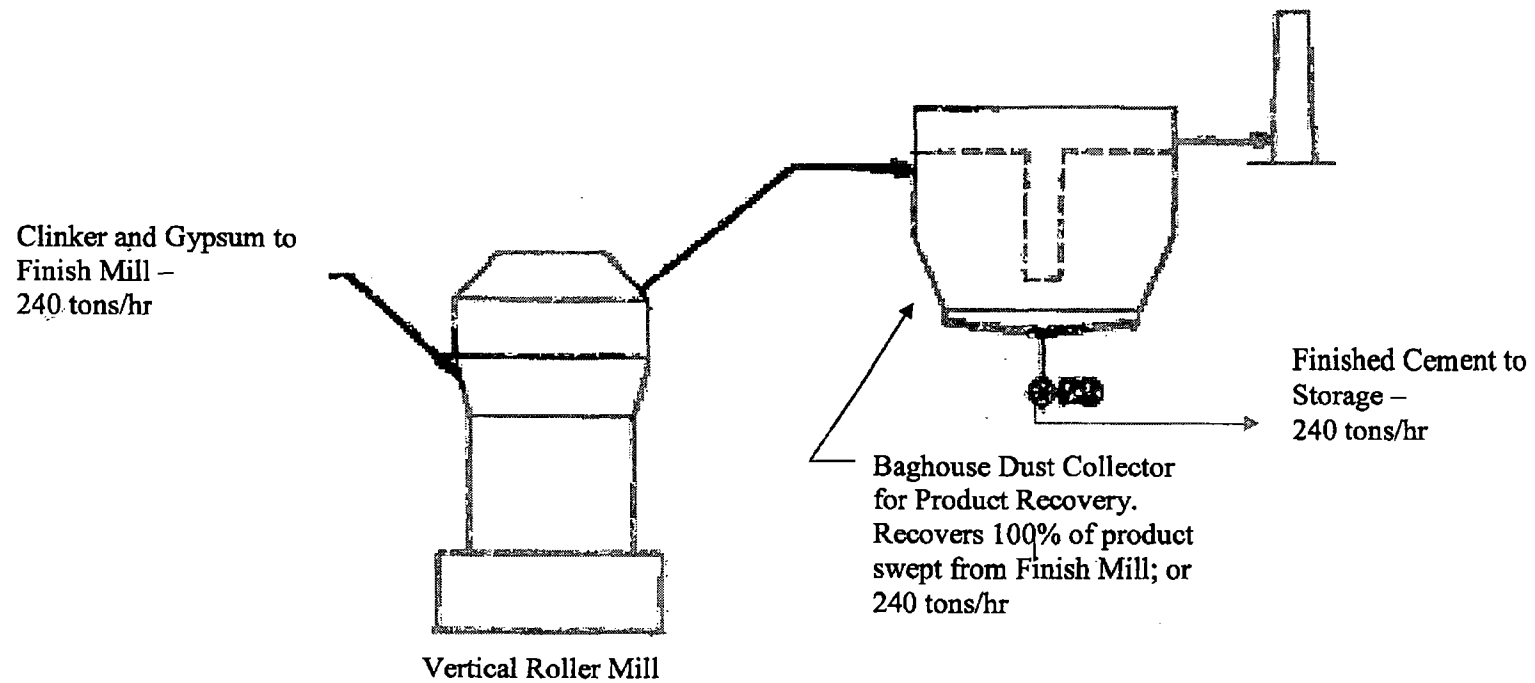
Temp: 230°F

Moist: 5%

Dust Loading: 240 tons/hr

PM Limit (permit): 0.01 gr/dscf

PM10 Limit (permit): 0.007 gr/dscf



**FIGURE 2**

**FLSmidth Finish Mill Permitted with As-built Plant Design - Permit 0530021-018-AC (PSD-FL-351C)**

**Cement Production Line No. 2**

**Cemex Construction Materials, LLC - Brooksville South Cement Plant  
Brooksville, Florida**