TECHNICAL EVALUATION

CEMEX Cement, Inc.
North Brooksville Cement Plant

Thallium and Mercury Sampling and Analysis

Kilns 1 and 2

Hernando County

DEP File No. 0530010-036-AC

Department of Environmental Protection
Division of Air Resource Management
Bureau of Air Regulation

April 4, 2008

I. APPLICATION INFORMATION

A. Applicant

Jimmy L. Rabon, Plant Manager
CEMEX Cement, Inc.
North Brooksville Cement Plant
16301 Ponce de Leon Blvd.
Brooksville, Florida 34601

B. Processing Schedule

- The Department's Bureau of Air Regulation (BAR) received an application (0530010-018-AC) on October 14, 2005 that included several requests, one of which was to remove the Kiln 1 filter dust thallium (Tl) sampling and analysis requirement from the applicable permits.
- On August 3, 2007 the Department distributed the Public Notice package for project 0530010-018-AC approving the requests with the exception of the request to remove Tl requirements.
- Cemex requested several extensions of time to file a petition with the Department Office of General Counsel. The final extension expired on November 15, 2007. A petition was not filed and the OGC case file was closed on December 5, 2007.
- On November 15, 2007 CEMEX submitted a proposal to reduce the frequency of thallium sampling and analysis of the filter dust in Kiln 1 and to implement mercury sampling and analysis of the raw materials and fuels used in Kilns 1 and 2.
- The Department issued the final permit on January 24, 2008. By previous agreement the present project (0530010-036-AC) was opened simultaneously to address CEMEX's proposal on thallium and mercury.
- The Department distributed the Public Notice Package for project 0530010-036-AC on April 4, 2008.

C. Facility Location

The CEMEX North Brooksville Cement Plant is located on Highway 98, northwest of Brooksville in Hernando County. The following figure shows the location of the facility.

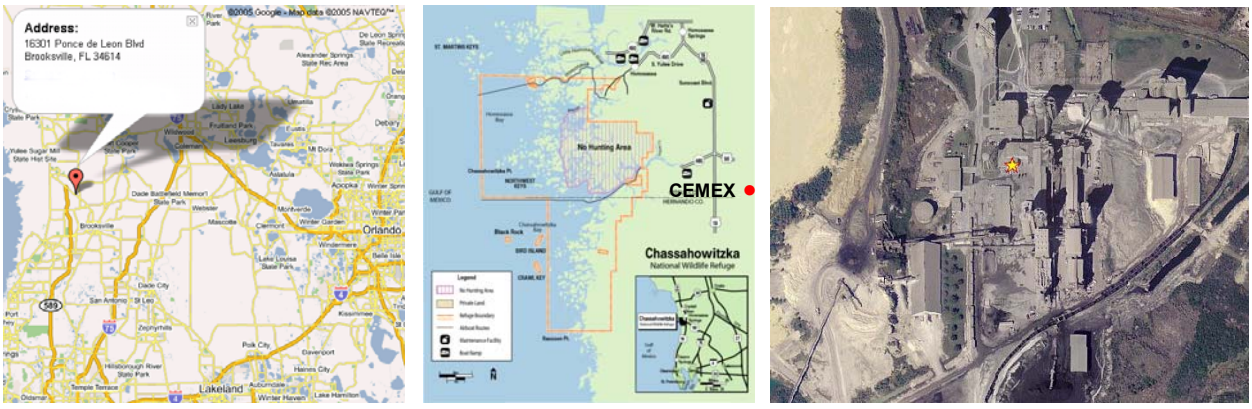

Figure 1. Location of CEMEX N. Brooksville Plant, Chassahowitzka NWR, Aerial Photograph

D. Facility Classification Code (SIC)

Major Group No. 32, Clay, Glass, and Concrete Products
Industry Group No. 324 Cement, Hydraulic

E. Regulatory Categories

This project is subject to the applicable environmental laws in Section 403 of the Florida Statutes (F.S.). The Florida Statutes authorize the Department of Environmental Protection (Department) to establish rules regarding air quality in the Florida Administrative Code (F.A.C.). The facility is classified according to the following major regulatory categories.

- The facility is a major source of hazardous air pollutants (HAP).
- The facility does not operate units subject to the acid rain provisions of the Clean Air Act.
- The facility is a Title V major source of air pollution in accordance with Chapter 213, F.A.C.
- The facility is a major stationary source pursuant to Rule 62-212.400, F.A.C. for the Prevention of Significant Deterioration (PSD) of Air Quality.

F. Facility Description

The existing North Brooksville Cement Plant consists of two lines (Lines 1 and 2). Lines 1 and 2 include Polysius GEPOL preheater kilns (Kilns 1 and 2) and clinker cooler (Coolers 1 and 2). A picture of one of the kilns with preheater tower and raw meal homogenizing silo can be seen in
Figure 2. Lines 1 and 2 are separately permitted with respect to preheater material feed rates and fuel heat input rates. Ancillary equipment at the plant includes a quarry, raw material handling and conveying equipment, raw mills, finish mills, cement and clinker handling equipment, coal handling equipment and silos, and particulate control/dust collection and recycling equipment.

Figure 2. Polysius GEPOL Preheater Kiln at CEMEX North Brooksville Plant

Large, fabric filter systems (baghouses) are used to capture PM/PM_{10} from each kiln and from each clinker cooler (four total). Smaller baghouses are used to limit particulate emissions from other process emissions points. Raw material properties, chemical reactions in the kilns,

absorption into the clinker, and combustion controls minimize emissions of NO_X, SO_2, CO, and VOC.

Both CEMEX North Brooksville kilns are limited to 150 tons dry preheater feed per hour (30 day average) with a maximum of 165 tons preheater feed in any given hour. Both kilns are permitted to burn a variety of fuels, including coal, No. 2 fuel oil, No. 4 fuel oil, No. 5 fuel oil, No. 6 fuel oil, natural gas, and on-site generated, non-hazardous waste used oil, grease, and rags. Kiln No. 1 is also permitted to fire whole tire derived fuel (TDF) at a rate up to 20 percent of the total heat input.

G. Application Requests

Simultaneously with the expiration of the extension of time to file a petition (November 15, 2007), the applicant submitted a proposal to reduce the frequency of Tl sampling of the Kiln 1 baghouse filter dust and to add requirements for Hg sampling of raw materials and fuel used in Kilns 1 and 2.

The present condition applicable to Kiln 1 is given in the facility Title V operating permit as:

B.20. *Daily sampling and recording of the baghouse dust for the No. 1 kiln is required. The concentration of thallium in the baghouse dust shall not exceed 1.5%, per sample. Compliance shall be demonstrated using the "Thallium Concentration Monitoring and Analysis Procedure" as described in Mr. Bob Roger's letter to Dr. John Koogler, dated January 12, 1994 (Attachment #9 of Construction Permit AC27-240349).*
[Air Construction Permit AC27-240349]

Originally the applicant requested removal of the Tl requirement. The language in the November 15, 2007 proposal is as follows:[1]

<u>Mercury and Thallium Compliance Demonstration</u>: The permittee shall determine monthly and annual emission rates for mercury (Hg) and monthly concentrations of thallium (Tl) by using the following procedures:

Weekly samples shall be taken of raw material components and coal fed to Kiln No. 1 and 2. A monthly composite sample will be made from weekly samples of raw material components and coal feed. Each monthly composite raw materials components sample shall be analyzed to determine Hg (Kilns 1 and 2) and Tl (Kiln 1 only) concentrations representative for the month and each monthly composite sample shall be analyzed to determine Hg concentrations representative for the month. The analytical methods used to determine Hg concentration shall be EPA or ASTM methods such as EPA 1631 or 7471A and to determine Tl concentration shall be by current in-house quality control (QC) laboratory x-ray analysis. If the concentrations are below the method detection limits or below the limits of quantification, the method detection limit will be assumed for the concentration of the raw material components or coal.

For mercury only: The monthly rate (lbs/month) shall be the product of the Hg concentration of the monthly samples and the respective mass of raw material components feed and coal introduced into the pyroprocessing system. The consecutive 12-month Hg throughput rate shall be the sum of the individual monthly records for the current month and the preceding eleven months (pounds of Hg per consecutive 12-months). Such records, including calculations and data, shall be completed no later than 30 days following each month.

II. DEPARTMENT REVIEW OF REQUEST

A. Behavior of Mercury and Tl in a Cement Kiln

Some of the following discussion was extracted from a report prepared by the Institut für Ökologie und Politik GmbH (Ökopol).[2] For the purposes of the discussion, the figure below was taken from a European Cement Bureau report and modified by the Department. The design shown includes a cyclone preheater rather than the GEPOL design used on Kilns 1 and 2.

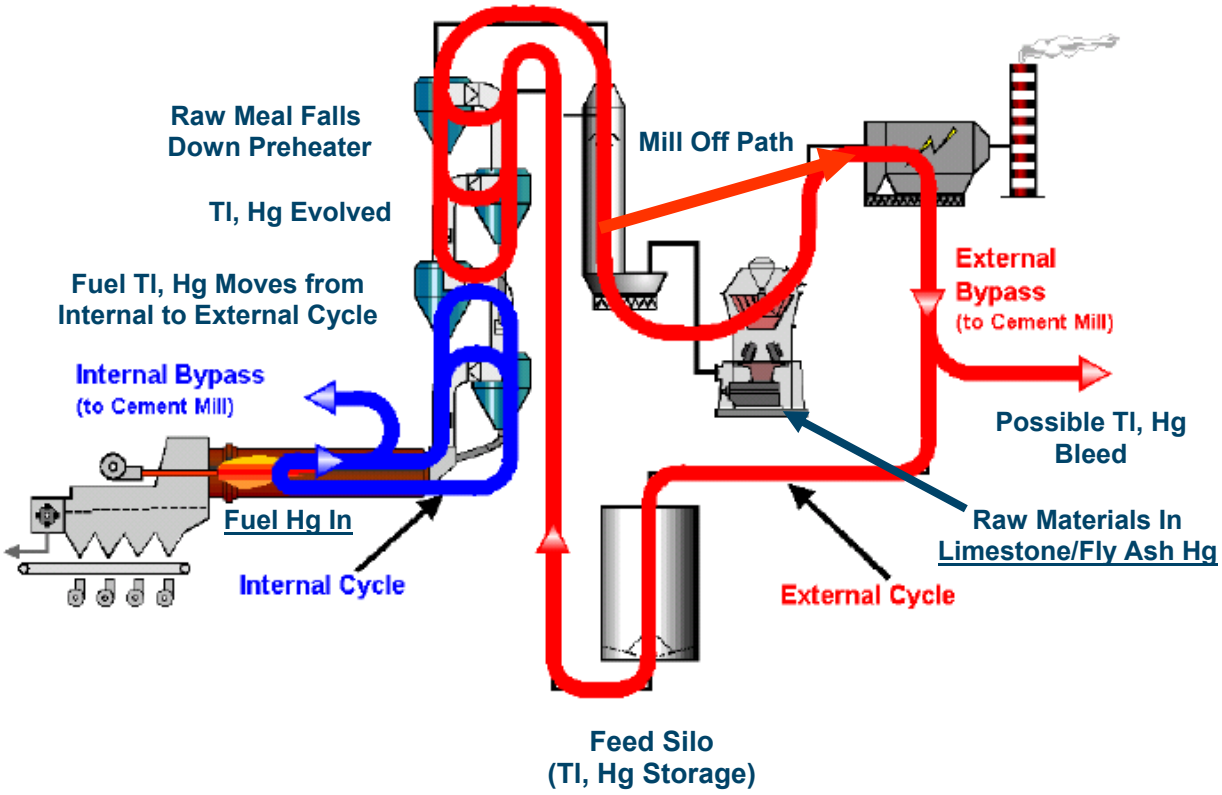

Figure 3. Cycles and Behavior of Tl and Hg in a Cement Kiln including possible Bleed Streams

A fundamental feature of cement production in rotary kilns is the counter-current principle: solid material moves in one direction from the cold side to the hot end of the system (top to bottom and right to left in the diagram) while hot gases are moving the opposite way towards the cold end of the system. In a preheater, the solid material passes through a temperature gradient from roughly 300 °C at the entrance of the preheater to more than 800 °C at the point where the material enters the rotary kiln.

Some chemical elements (and also organic substances) will be absorbed to the solid material at 300 °C but will eventually evaporate as the material moves down to hotter zones of the preheater. The evaporated substances are transported back upwards in the preheater by the hot gases that come from the main burner of the rotary kiln. At lower temperatures, they will condense again on the surface of new raw material and thus travel down the preheater, until they evaporate again.[3]

The most prominent element which is trapped inside the preheater by this mechanism is Tl. Continuous addition of traces of Tl contained in natural raw materials can thus lead to an enormous enrichment in the "inner circuit" of the preheater within the external cycle shown in the figure above. This leads to an increase of Tl emissions over time.[4]

The described phenomenon can be visualized from Figure 4 below that was taken from Dr. Siegbert Sprung's highly respected cement industry book.[5] The Tl material flows within the process are indicated by the width of the various lines. By comparison with the incoming raw materials and fuel, the flows trapped within the system are enriched by at least an order of magnitude. If there is no bypass such as shown in Figure 3, enrichment will continue until the Tl flows in with the raw materials and fuel equal the Tl flows out with the filtered exhaust gas and the clinker.

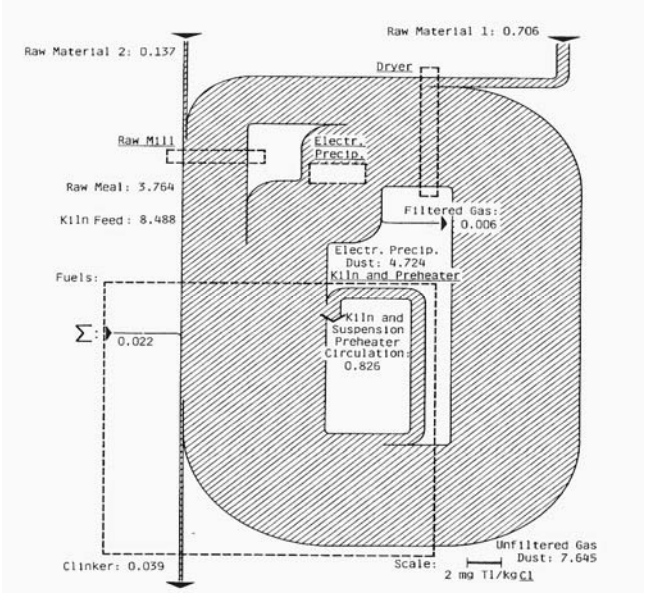

Figure 4. Tl in Preheater Kiln with Mill on

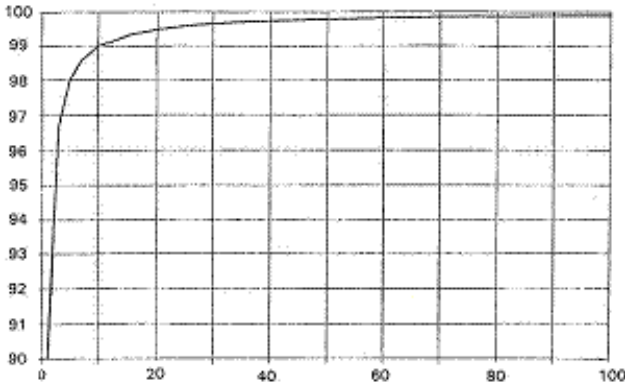

Figure 5. Hg removed (%) versus Electrostatic Precipitator Dust removed (%)

Hg is even more volatile than Tl and depending on operating conditions will form its own inner circuit or be almost completely emitted. Depending on their physico-chemical properties, the maximum enrichment levels of different elements will be at different positions along the temperature gradient inside the preheater.[6] The maximum enrichment point can also occur in the raw mill, raw meal recovery equipment and the final particulate matter control device (PMCD) such as an electrostatic precipitator (ESP) or fabric filter baghouse.

In order to interrupt the continuous enrichment of elements, Dr. Sprung suggested removal of a certain proportion of dust from the preheater and adding it directly to the product cement without passing it through the hot rotary kiln. This operational procedure is usually called a bypass and is regularly installed in many cement kilns in Europe.

Figure 5 above was developed during testing conducted at the Siggenthal Cement Plant in Switzerland.[7] It suggests that relatively low level ESP dust withdrawal (external bypass) is very effective in reducing Hg emissions for that particular installation. According to a report regarding the Siggenthal Plant:

"The purposeful partial removal of the finest particle fractions from the electrostatic precipitator bin relieves the Hg cycle. This collected dust (as direct addition to clinker or cement) comprises approximately 2 tons per hour of the cement supplied for concrete production."

Similarly, the following paraphrased abstract is from a paper by the Forschungsinstitut der Verein Deutscher Zementindustrie (VDZ) regarding operational factors that affected Hg emissions from two German cement kilns.[8]

"Because of its vapor pressure characteristics, the Hg is not retained in the kiln or preheater. Depending on exhaust gas temperature it passes with the raw gas into the downstream systems. The Hg which has been introduced builds up in the external recirculation system between the preheater, PMCD and raw mill. The feed silo serves as a temporary buffer which feeds the Hg back into the preheater after a time delay. To limit the external Hg recirculating system and to minimize the Hg emissions it is expedient to remove some of the meal (actually dust) from the PMCD especially during periods of direct (raw mill down) operation."

B. Present Mercury and Thallium Sampling Requirements

There are no sampling, analysis and reporting requirements for Hg under the present permits applicable to the North Brooksville Cement Plant. The requirement (previously described as condition B.20) to conduct daily sampling for Tl in the control equipment dust was included in a 1993 permit at the request of the Hernando County Board of County Commissioners. The permit was issued as an approval by the Department of a request by the previous owner (Florida Mining and Manufacturing) to burn tires in Kiln 1. According to the previous operator:

"[t]he Tl concentration is in the kiln/mill baghouse dust. We monitor the concentration of Tl on a daily basis and as we see the concentration increase, we remove a portion of the dust from the system and dispose of it in an authorized landfill. The removal is generally done on a day when the raw mill is down and the baghouse load is at minimum level, which conversely brings the Tl concentration in the dust to maximum level. This allows us to remove maximum Tl from the system.

"Immediately upon taking the raw mill down, we start to take samples of the baghouse dust every hour. These samples are analyzed by X-Ray Fluorescence (XRF) and the indicated concentration is recorded. When concentration level reaches approximately 0.8% we begin to load a tanker truck with the dust. We continue to monitor the concentration as the truck is being loaded and the final dust sample is taken at the end of the loading operation. The indicated concentration at the end of the truck loading will generally be in the 0.3% to 0.4% range. We average the first and last sample that went into the truck for the average concentration of the load. The normal average will be approximately 0.5% to 0.6% on the truck load of 14 to 16 tons of dust."

The purpose of the requirement was to control the tendency of Tl to build up in the external cycle comprised of the upper preheater, raw mill, control equipment and feed silo. As described in the previous section, relief of the Tl buildup via a bypass reduces both short term maximum Tl emissions and long term emissions. The sampling and analysis does not directly or indirectly measure Tl emissions; however the effect is to reduce both short term and long term average emissions of Tl by removing the dust based upon the analysis.

The above discussion is consistent with the behavior of Tl as described in the previous section and the concept of dust removal is similar to that proposed by Dr. Sprung. Finally, it is also

noted that 14 to 16 tons of dust in the described truckload from Kiln 1 would represent about 165 pounds (lb) of Tl at the average concentration of 0.5 to 0.6% Tl. This is a seemingly large amount of Tl.

Assuming 1,400,000 tons per year of raw materials and fuel used in Kiln 1 per year and 1 part per million (ppm) by weight of Tl in the fuels and raw materials there would be approximately 1.4 tons (2,800 lb) of Tl introduced into the system per year. The removal rate for a truck seems consistent with such an assumption. However, the origin of the Tl would most likely be skewed towards one of two specific raw material or fuel sources.

C. Dust Removal Practices from Kiln 1.

The permit requires daily Tl sampling and recording and limits the Tl concentration in the dust to 1.5% (15,000 ppm). It does not actually specify dust removal, which was already routinely practiced and apparently triggered by much lower Tl concentrations than 1.5% before that value was included in the permit. A concentration of 1.5% if actually reached would represent a much than the degree of enrichment than the scenario shown in Figure 4.

CEMEX stated in a response to a request for additional information (RAI) that they have not wasted baghouse dust for the past four years (as of March 2006) for purpose of controlling the thallium concentration of the dust or for any other purpose.[9, 10] They also stated:

"Tl monitoring for the past two years (as of March 1, 2006) has shown that the concentration of Tl in kiln dust has consistently been below the action level of 1.5%. The monthly average Tl concentration for the two year period has been 0.31% and the range of individual Tl concentrations has been 0.02-1.33%."

In a subsequent letter, CEMEX further updated previous comments as follows:[11]

"Currently, the sampling of Kiln No. 1 baghouse dust for thallium concentrations is performed daily. In the last 5 years (as of March 2007) none of these tests have shown any thallium concentrations that would exceed the permit limit of 1.5%. The area currently being mined for limestone on the plant property has gradually turned toward the southwest over the last 6 years. The old mining area directly west of the plant was mined out and closed in the mid to late 1990's.

"It seems as CEMEX has moved its' mining area toward the south/southwest of the plant area, the thallium levels have dropped in the limestone, therefore, the thallium concentrations in the baghouse dust have also dropped. Because of this, CEMEX is requesting removal of the sampling requirement, or a less frequent sampling schedule ***(e.g., quarterly sampling)*** *for thallium concentrations in Kiln No. 1." (Bolding and underlining by the Department)*

D. Typical Mercury Monitoring and Analysis Practices for Cement Kilns in Florida

The CEMEX North Brooksville Cement Plant and recently acquired South Brooksville Cement Plant are the only ones Florida that do not sample and analyze raw material and fuel samples as a surrogate to long term Hg emissions measurement.

While the existing CEMEX South Brooksville Cement Plant does not have Hg monitoring requirements, CEMEX is presently completing construction of a new kiln at the South Brooksville Cement Plant. The new kiln is actually subject to annual Hg emission limit based on Hg sampling, analysis and reporting of the incoming raw materials and fuels.

Following is a graphic representation of the manner by which samples of the Hg inputs are collected by most operators of cement kilns in Florida.[12]

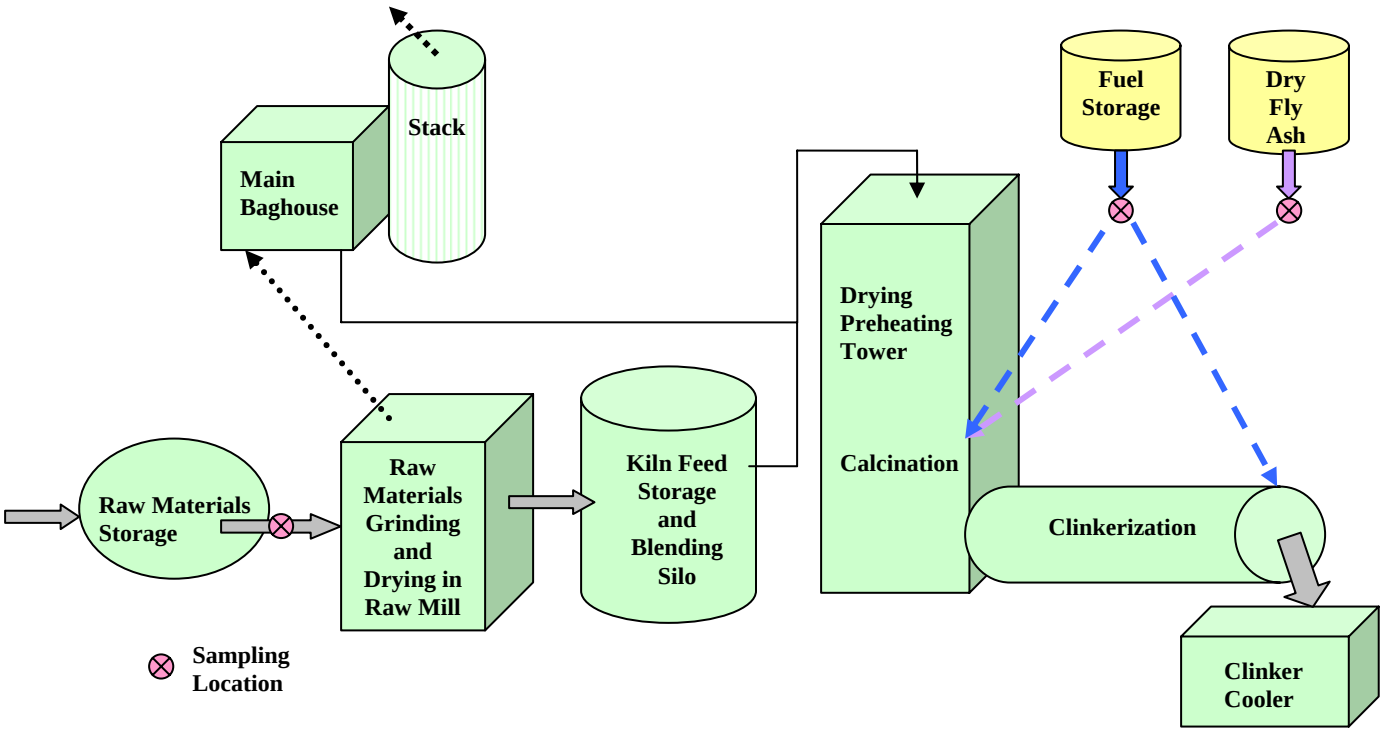

Figure 6. Hg Monitoring Sampling Locations.

The following figure shows a typical breakdown (though not necessarily representative of the CEMEX plant) of the raw material and fuel sources of Hg entering the cement process.

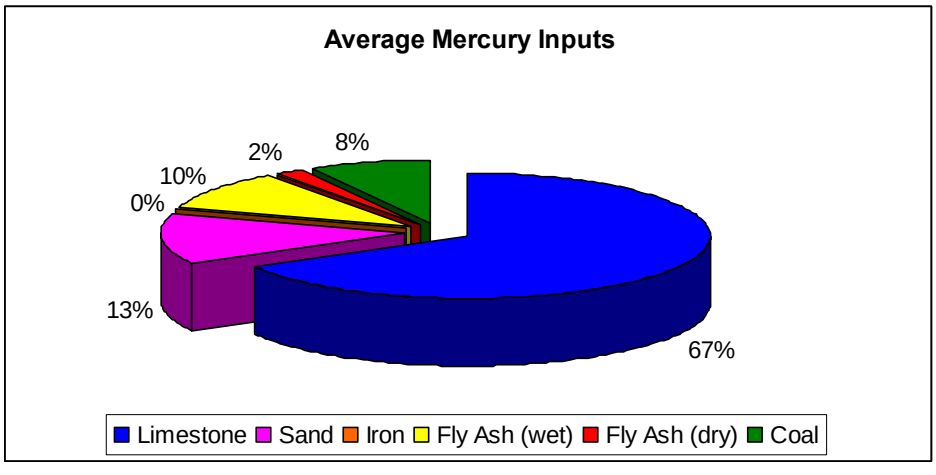

Figure 7. Sources of Hg into Cement Process

Several samples are collected on a **daily** basis from all of the material inputs to the process and then made into a daily composite. The daily composites are made into monthly composites. These monthly composites are then analyzed for Hg concentrations.

If a monthly sample is below the detection limit, the operator assumes the detection limit which overestimates the amount of Hg input. By assuming that all input Hg exits via the stack and no mercury exits via the clinker, conservative estimates of emissions are made that insure annual emissions will be less than the permitted annual Hg limit. According to operators who rely on this method of compliance, the limestone is the primary source of Hg inputs to the system and comprises about 2/3 of the total.

E. Potential Impacts from use of High Carbon Fly Ash in Pyroprocessing

The contribution from power plant fly ash shown in the above diagram is on the order of 23 percent (%) of total Hg input. Because of the controls to be implemented at power plants pursuant to the Clean Air Interstate Rule (CAIR) and the recently vacated Clean Air Mercury Rule (CAMR) there is reason to believe that more fly ash will become available as raw material or even as fuel to the cement industry as less is directly useful as a concrete product. The subject fly ash will tend to contain more Hg than what has been generally available in the past. This topic is discussed in detail in a recent paper prepared by a Department expert.[13]

A more specific example is derived from annual audit reports (covering 2005-2007) routinely submitted by one operator in Florida for a single kiln that is subject to a Hg input limit. Because the plant does not practice dust removal, the Hg emissions are equal to the Hg input. It is clear from the following figure that the Hg contribution of both typical fly ash and high carbon fly ash (HCFA) to the total Hg input has progressively increased to more than 50%. That value is for a kiln that, unlike CEMEX North Brooksville Kilns 1 and 2, has a Hg limit.

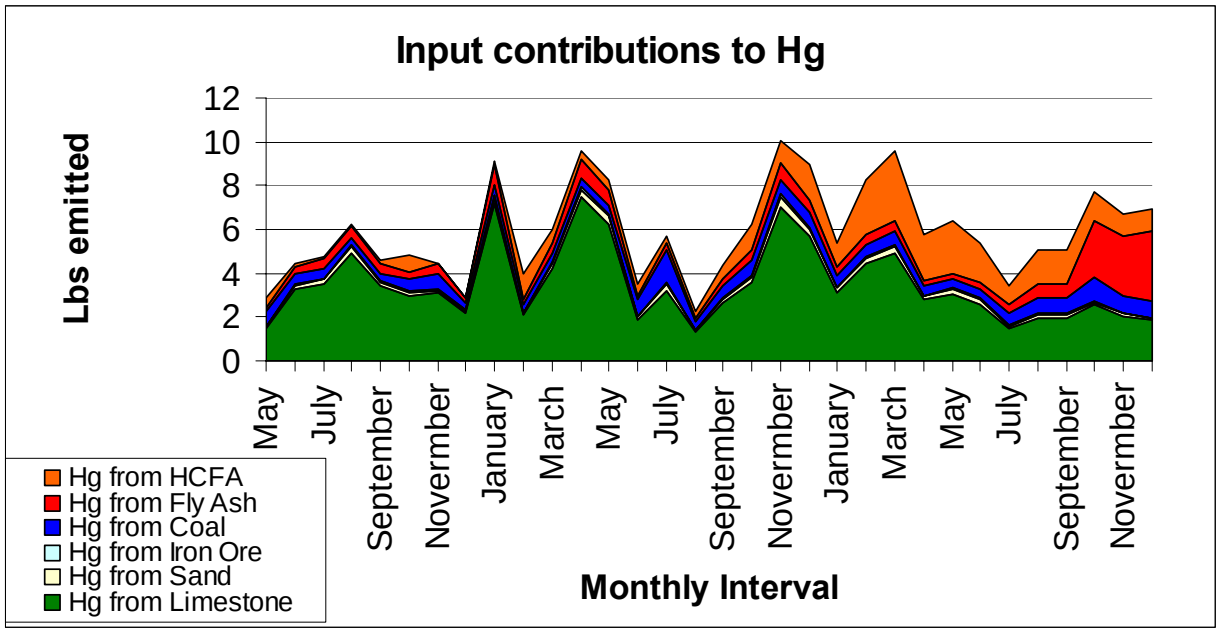

Figure 8. Feed Material and Fuel Contributions to monthly Hg Inputs and Emissions.

The Department does not have details regarding the characteristics of Hg in the raw materials and fuels used at the CEMEX North Brooksville Cement Plant. However, based on past publications it is clear that HCFA (also known as high loss on ignition - high LOI) fly ash was used to a high degree in the past at the plant.

According to Figure 9, about 225,000 tons of fly ash were used in a year at the North Brooksville Cement Plant.[14] According to Figure 10, there can be significant Hg concentrations in high LOI fly ash (>6% LOI) available from coal-fueled power plants in Florida.[15]

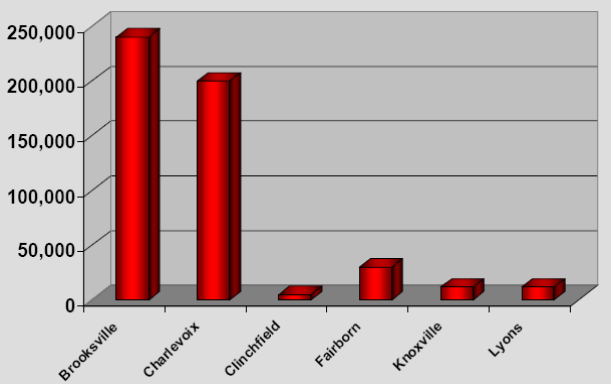

Figure 9. CEMEX Flyash Use Circa 2002

Plant	Unit	Coal Hg	Flyash Hg	Flyash LOI	Gypsum Hg
A	1	0.039	0.151	Under Review	0.259
	2	0.054	0.107		0.342
B	1 HS	0.069	0.038	~10%	No Scrubber
	1 CS	0.069	0.850	~20%	
	2 HS	0.071	0.007	~10%	
	2 CS	0.071	0.456	~10%	
	3	0.065	0.850	~20%	
	4	0.076	0.456	~10%	

Figure 10. Flyash from two Florida Power Plants

Assuming 0.5 ppm of Hg in the fly ash used at the North Brooksville Cement Plant, yields 225 lb Hg/year circa 2002 from fly ash alone. Interestingly, according to the U.S. Environmental Protection Agency Toxic Release Inventory (EPA TRI) 235 lb of Hg were emitted in 2005 from the North Brooksville Cement Plant. TRI Hg emissions were listed as zero (possibly less than reporting threshold) during 2000-2004 and 2006.

Stack test results for Hg, beryllium and lead were submitted to the Department by CEMEX in 2000. When extrapolated to annual estimates, the results reported for Hg suggested emissions << 1 lb Hg/year for Kiln 1 and 0.28 lb Hg/year for Kiln 2.[16] The purpose was to confirm as required by Permit No. 0530010-003-AC that emissions "are less than the PSD threshold levels".

III. COMMENTS FROM HERNANDO COUNTY PLANNING DEPARTMENT

The Hernando County Planning Department (the County) was an original contributor to the present requirement to sample Tl from the Kiln 1 baghouse dust. The County submitted the following comments regarding this issue during the prior permit process:[17]

"Hernando County Planning Staff have reviewed the Technical Evaluation associated with the pending CEMEX Cement Air Construction Permit, and specifically the issue of thallium sampling. Per the Technical Evaluation, the Department does not propose to make the applicant's requested change with respect to thallium sampling. The County supports DEP's position to potentially modify the applicant's request with respect to thallium sampling, however, we would be more amenable to a modification if the applicant agreed to Hg sampling which is currently not required for this facility. The County would prefer a permit condition for continuous emissions stack monitoring system (CEMS), a sorbent trap, or at the very least, require Hg monitoring in the raw materials being processed (a mass balance approach that includes fuels)."

IV. DEPARTMENT PROPOSAL AND RATIONALE

Tl is not a regulated air pollutant. For example, it is not on the list of hazardous air pollutants (HAP) maintained by the EPA pursuant to 40 Code of Federal Regulations Part 63 (40CFR63). Accordingly, Tl was not addressed in the EPA cement industry maximum achievable control technology (MACT) development pursuant to 40CFR63, Subpart LLL-National Emission Standards for Hazardous Air Pollutants From the Portland Cement Manufacturing Industry.

Over the years, the plant operators have curtailed the practice of dust removal from Kiln 1 that seems to have been conducted even when Tl concentrations were less than the threshold value of 1.5%. Ultimately all Tl exits the stack via the finest particles not captured by the baghouse. For at least five years, the applicant claims that measurements of Tl in the dust have not been great enough to trigger dust removal.

For the two years preceding submittal of the first application to remove the Tl limit, the applicant stated that Tl levels as high as 1.33% were measured. The Department has requested the actual data but has not yet received it. Without the actual sampling data, the Department cannot conclude that elimination or even reduction of sampling is appropriate at this time.

CEMEX has proposed to conduct raw materials and fuel Tl sampling on a *weekly* rather than a *daily* basis and to initiate *weekly* sampling of Hg. As proposed, it appears that CEMEX would discontinue Tl sampling of the baghouse dust.

The Department proposes continuation of sampling of baghouse dust from Kiln 1 for Tl in the present manner and frequency, but actually conducting the analysis on a weekly basis for Tl and on a monthly basis for Hg. The company can review the weekly and monthly summaries and determine the necessity of reinstituting dust removal practices. Additionally the Department proposes initiation of raw material and fuel sampling for Hg as required by other kilns in Florida at this time (including the new CEMEX kiln at the South Brooksville Cement Plant that will start up in the summer of 2008.

There is no presently applicable Hg limit on the CEMEX North Brooksville Cement Plant. However, it is imperative that all cement companies in Florida collect information regarding Hg flows into their facilities, especially given the changing character of the fly ash available as a raw material for cement pyroprocessing.

All facilities, however, must be mindful that any physical change or change in the method of operation that increases Hg by 200 lb is subject to PSD. The data for the CEMEX facility is quite variable as stated previously. It appears that a change could have occurred increasing Hg by 200 or more lb/yr between 2000 and 2005. The Department and CEMEX need to have accurate sampling data to ensure PSD is not triggered in light of operational changes in raw materials (like high LOI fly ash) and the cessation of bleeding off dust some time ago.

The Department proposes to issue an air construction permit with a condition that will in effect revise the present condition (previously cited as condition B.20) as follows in strikethrough (~~strikethrough~~) and <u>double underline</u> format:

1. <u>Thallium Concentration in the Kiln 1 Baghouse Dust:</u> The concentration of thallium in the baghouse dust shall not exceed 1.5%, per sample. [Air Construction Permit AC27-240349]

2. Kiln 1 Thallium Sampling and Recording Requirements: Daily sampling and weekly analysis and recording of the baghouse dust for the No. 1 kiln is required. Compliance shall be demonstrated using the "Thallium Concentration Monitoring and Analysis Procedure" as described in Mr. Bob Roger's letter to Dr. John Koogler, dated January 12, 1994 (Attachment #9 of Construction Permit AC27-240349 and included as Appendix Tl of this permit). [Applicant Request; Rule 62-4.070, F.A.C.; Air Construction Permit AC27-240349]
3. Kilns 1 and 2 Mercury Material Balances: The owner or operator shall determine monthly and rolling 12-month mercury thoughput for Kilns 1 and 2 and maintain the records as an estimate of mercury emissions using the material balance method as follows:
   a. Samples of the raw mill feed, kiln baghouse dust and all fuels, including fly ash, shall be collected each day. A monthly composite sample shall be made from each of the daily composite samples. Each monthly composite sample shall be analyzed to determine the mercury concentration of the materials representative for the month.
   b. For each raw material and fuel, the monthly mercury throughput rate (pounds per month) shall be the product of the mercury concentration from the monthly composite sample and the mass of raw material or fuel used during the month. If the mercury concentration is below detection limit or below the limits of quantification, the detection limit will be assumed for the concentration of the raw material or fuel.
   c. The permittee shall have the option of collecting, compositing, analyzing and calculating the Hg leaving the process via the clinker. If the Hg concentration is below the detectable limit or limits of quantification, a value of zero will be assumed for the concentration in the clinker.
   d. The permittee shall collect, composite and analyze the Hg in the kiln baghouse dust for a period of 12 months. The permittee shall have the option of calculating the Hg leaving the process via the permanent withdrawal of baghouse dust. If the Hg concentration is below the detectable limit or limits of quantification, a value of zero will be assumed for the concentration in the dust when calculating the amount of Hg leaving the system.
   e. For each month, the mass of mercury introduced into the pyroprocessing system (pounds per month) shall be the sum of the monthly mercury throughput rate for each raw material and fuel minus the amounts in the clinker and permanently withdrawn dust if any. The consecutive 12-month mercury throughput rate shall be the sum of the individual monthly records for the current month and the preceding eleven months (pounds of mercury per consecutive 12-months). Such records, including calculations and data, shall be completed no later than 25 days following the month of the records.
   f. The analytical methods used to determine mercury concentration shall be EPA or ASTM methods such as EPA Method 7471A (Mercury in Solid or Semisolid Waste) or EPA Method 1631. No other methods may be used unless prior written approval is received from the Department.

References

[1] Letter. Lee, M., PhD. to Linero, A.A. Permit Projects 0530010-018-AC and 019-AC; Outstanding questions. CMEX Cement Inc., Brooksville facility. November 15, 2007.

[2] Lohse, J. Dr.; Wulf-Schnabel, J. "Expertise on the Environmental Risk Associated with the Co-Incineration of Wastes in the Cement Kiln "Four E" of CBR Usine de Lixhe, Belgium." Institut für Ökologie und Politik GmbH. Report compiled for Greenpeace, Nederland. Circa 1996.

[3] Winteler, S.; Lohse, J. Dr. Gefährlicher Kreislauf. "Der Schadstoffeintrag in Zementwerke muß verringert werden." - Müllmagazin, Heft 1/1994, p. 66-70.

[4] Sprung, S. Dr. "Spurenelemente - Anreicherung und Minderungsmaßnahmen." Zement-Kalk-Gips Nr. 5/1988, p. 251-257.

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