Department of Environmental Protection

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BUREAU OF AIR REGULATION

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: **CEMEX Cement, Inc.**	
2. Site Name: **Brooksville Plant**	
3. Facility Identification Number: **0530010**	
4. Facility Location...: Street Address or Other Locator: **1630 Ponce de Leon Blvd.** City: **Brooksville** County: **Hernando** Zip Code: **34601**	
5. Relocatable Facility? ☐ Yes ☒ No	6. Existing Title V Permitted Facility? ☒ Yes ☐ No

Application Contact

1. Application Contact Name: **John B. Koogler, Ph.D., P.E., Project Engineer**
2. Application Contact Mailing Address... Organization/Firm: **Koogler & Associates** Street Address: **4014 N.W. 13th Street** City: **Gainesville** State: **Florida** Zip Code: **32609**
3. Application Contact Telephone Numbers... Telephone: **(352) 377-5822** ext. Fax: **(352) 377-7158**
4. Application Contact Email Address: **jkoogler@kooglerassociates.com**

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	7-3-03
2. Project Number(s):	0530010-012-AC
3. PSD Number (if applicable):	
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

This application is for a non-PSD Air Construction Permit and a Title V revision to authorize the use of Whole Tire Derived Fuel (WTDF) as a supplemental fuel to provide up to 20 percent of the heat input to the No. 2 Kiln System. The heat input to Kiln No. 2 is permitted not to exceed 300 mmBTU/hr. The heat input from WTDF will be limited to no more than 60 mmBTU/hr (or to 2.14 tons per hour of WTDF). Project details are provided in the Technical Report supplementing this application.

The Department has expressed an opinion that the proposed project could affect CO emissions, but that other regulated emissions will remain unchanged. As a result, this application addresses only CO emissions.

APPLICATION INFORMATION

Scope of Application

Emissions Unit ID Number	Description of Emissions Unit	Air Permit Type	Air Permit Proc. Fee
014	No. 2 Cement Kiln	AC1C	-0-

Application Processing Fee

Check one: ☐ Attached - Amount: $ -0-   ☒ 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 : **N/A**
2.	Owner/Authorized Representative Mailing Address... Organization/Firm: Street Address: City: State: Zip Code:
3.	Owner/Authorized Representative Telephone Numbers... Telephone: ( ) - ext. Fax: ( ) -
4.	Owner/Authorized Representative Email Address:
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 Date

APPLICATION INFORMATION

Application Responsible Official Certification

Complete if applying for an initial/revised/renewal Title V permit or concurrent processing of an air construction permit and a revised/renewal Title V permit. If there are multiple responsible officials, the "application responsible official" need not be the "primary responsible official."

1. Application Responsible Official Name:
   Tom Delvecchio, Plant Manager and Responsible Official

2. Application Responsible Official Qualification (Check one or more of the following options, as applicable):
   - ☒ For a corporation, the president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit under Chapter 62-213, F.A.C.
   - ☐ For a partnership or sole proprietorship, a general partner or the proprietor, respectively.
   - ☐ For a municipality, county, state, federal, or other public agency, either a principal executive officer or ranking elected official.
   - ☐ The designated representative at an Acid Rain source.

3. Application Responsible Official Mailing Address...
   Organization/Firm: **CEMEX Cement, Inc.**
   Street Address: **Post Office** Box 6
   City: **Brooksville** State: **Florida** Zip Code: **34605-0006**

4. Application Responsible Official Telephone Numbers...
   Telephone: **(352) 796-7241** ext. Fax: **(352) 754-9836**

5. Application Responsible Official Email Address: **tdelvecchio@cemexusa.com**

6. Application Responsible Official Certification:

   I, the undersigned, am a responsible official of the Title V source 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 applicable requirements identified in this application to which the Title V source 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. Finally, I certify that the facility and each emissions unit are in compliance with all applicable requirements to which they are subject, except as identified in compliance plan(s) submitted with this application.

   Thomas J. Delvecchio — Signature   7/2/03 — Date

APPLICATION INFORMATION

Professional Engineer Certification

1.	Professional Engineer Name: **John B. Koogler, Ph.D., P.E.** Registration Number: **12925**
2.	Professional Engineer Mailing Address... Organization/Firm: **Koogler & Associates** Street Address: **4014 N.W. 13th Street** City: **Gainesville** State: **Florida** Zip Code: **32609**
3.	Professional Engineer Telephone Numbers... Telephone: **(352) 377-5822** ext. Fax: **(352) 377-7158**
4.	Professional Engineer Email Address: **jkoogler@kooglerassociates.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.* Signature Date 7/1/03 (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) **356.9** North (km) **3169.0**		2. Facility Latitude/Longitude... Latitude (DD/MM/SS) **28/38/34** Longitude (DD/MM/SS) **82/28/25**	
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 : **None**			

Facility Contact

1. Facility Contact Name: **Charles E. Walz, Environmental Manager**
2. Facility Contact Mailing Address... Organization/Firm: **CEMEX Cement, Inc.** Street Address: **Post Office Box 6** City: **Brooksville** State: **Florida** Zip Code: **34605-0006**
3. Facility Contact Telephone Numbers: Telephone: **(352) 796-7241** ext. Fax: **(352) 754-9836**
4. Facility Contact Email Address: **cwalz@cemexusa.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: **N/A**
2. Facility Primary Responsible Official Mailing Address... Organization/Firm: Street Address: City: State: Zip Code:
3. Facility Primary Responsible Official Telephone Numbers... Telephone: ( ) - ext. Fax: ( ) -
4. Facility Primary Responsible Official Email Address:

FACILITY INFORMATION

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:	

FACILITY INFORMATION

List of Pollutants Emitted by Facility

1. Pollutant Emitted	2. Pollutant Classification	3. Emissions Cap [Y or N]?
PM	**A**	**N**
PM10	**A**	**N**
NO_X	**A**	**N**
SO_2	**A**	**N**
CO	**A**	**N**
VOC	**A**	**N**
HCl	**A**	**N**

B. EMISSIONS CAPS

Facility-Wide or Multi-Unit Emissions Caps

1. Pollutant Subject to Emissions Cap	2. Facility Wide Cap [Y or N]? (all units)	3. Emissions Unit ID No.s Under Cap (if not all units)	4. Hourly Cap (lb/hr)	5. Annual Cap (ton/yr)	6. Basis for Emissions Cap

7. Facility-Wide or Multi-Unit Emissions Cap Comment:
Not Applicable

C. FACILITY ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1.	Facility Plot Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID:_____ ☒ Previously Submitted, Date:**Unknown**
2.	Process Flow Diagram(s): (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID:_____ ☒ Previously Submitted, Date:**Various**
3.	Precautions to Prevent Emissions of Unconfined Particulate Matter: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID:_____ ☒ Previously Submitted, Date:**Unknown**

Additional Requirements for Air Construction Permit Applications

1.	Area Map Showing Facility Location: ☐ Attached, Document ID:_____ ☒ Not Applicable (existing permitted facility)
2.	Description of Proposed Construction or Modification: ☒ Attached, Document ID:Technical Report
3.	Rule Applicability Analysis: ☒ Attached, Document ID:Technical Report
4.	List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.): ☐ Attached, Document ID:_____ ☒ Not Applicable (no exempt units at facility)
5.	Fugitive Emissions Identification (Rule 62-212.400(2), F.A.C.): ☐ Attached, Document ID:_____ ☒ Not Applicable
6.	Preconstruction Air Quality Monitoring and Analysis (Rule 62-212.400(5)(f), F.A.C.): ☐ Attached, Document ID:_____ ☒ Not Applicable
7.	Ambient Impact Analysis (Rule 62-212.400(5)(d), F.A.C.): ☐ Attached, Document ID:_____ ☒ Not Applicable
8.	Air Quality Impact since 1977 (Rule 62-212.400(5)(h)5., F.A.C.): ☐ Attached, Document ID:_____ ☒ Not Applicable
9.	Additional Impact Analyses (Rules 62-212.400(5)(e)1. and 62-212.500(4)(e), F.A.C.): ☐ Attached, Document ID:_____ ☒ Not Applicable
10.	Alternative Analysis Requirement (Rule 62-212.500(4)(g), F.A.C.): ☐ Attached, Document ID:_____ ☒ Not Applicable

FACILITY INFORMATION

Additional Requirements for FESOP Applications

1. List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.): ☐ Attached, Document ID: ☒ Not Applicable (no exempt units at facility)	

Additional Requirements for Title V Air Operation Permit Applications

1. List of Insignificant Activities (Required for initial/renewal applications only): ☐ Attached, Document ID:_____ ☒ Not Applicable (revision application)	
2. Identification of Applicable Requirements (Required for initial/renewal applications, and for revision applications if this information would be changed as a result of the revision being sought): ☐ Attached, Document ID:______ ☒ Not Applicable (revision application with no change in applicable requirements)	
3. Compliance Report and Plan (Required for all initial/revision/renewal applications): ☐ Attached, Document ID:______ Note: A compliance plan must be submitted for each emissions unit that is not in compliance with all applicable requirements at the time of application and/or at any time during application processing. The department must be notified of any changes in compliance status during application processing.	
4. List of Equipment/Activities Regulated under Title VI (If applicable, required for initial/renewal applications only): ☐ Attached, Document ID:______ ☐ Equipment/Activities On site but Not Required to be Individually Listed ☒ Not Applicable	
5. Verification of Risk Management Plan Submission to EPA (If applicable, required for initial/renewal applications only) : ☐ Attached, Document ID:_____ ☒ Not Applicable	
6. Requested Changes to Current Title V Air Operation Permit: ☒ Attached, Document ID:(1) ☐ Not Applicable	

Additional Requirements Comment

(1) Technical Report	

III. EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Application - For Title V air operation permitting only, emissions units are classified as regulated, unregulated, or insignificant. If this is an application for Title V air operation permit, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each regulated and unregulated emissions unit addressed in this application for air permit. Some of the subsections comprising the Emissions Unit Information Section of the form are optional for unregulated emissions units. Each such subsection is appropriately marked. Insignificant emissions units are required to be listed at Section II, Subsection C.

Air Construction Permit or FESOP Application - For air construction permitting or federally enforceable state air operation permitting, emissions units are classified as either subject to air permitting or exempt from air permitting. The concept of an "unregulated emissions unit" does not apply. If this is an application for air construction permit or FESOP, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air permitting are required to be listed at Section II, Subsection C.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit Application – Where this application is used to apply for both an air construction permit and a revised/renewal Title V air operation permit, each emissions unit is classified as either subject to air permitting or exempt from air permitting for air construction permitting purposes and as regulated, unregulated, or insignificant for Title V air operation permitting purposes. **The air construction permitting classification must be used to complete the Emissions Unit Information Section of this application for air permit.** A separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air construction permitting and insignificant emissions units are required to be listed at Section II, Subsection C.

If submitting the application form in hard copy, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application must be indicated in the space provided at the top of each page.

A. GENERAL EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Emissions Unit Classification

1. Regulated or Unregulated Emissions Unit? (Check one, if applying for an initial, revised or renewal Title V air operation permit. Skip this item if applying for an air construction permit or FESOP only.)

   ☒ The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

   ☐ The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in this Section: (Check one)

   ☒ This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

   ☐ This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

   ☐ This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Description of Emissions Unit Addressed in this Section: **Cement Kiln No. 2**

3. Emissions Unit Identification Number:

4. Emissions Unit Status Code:	5. Commence Construction Date:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code:	8. Acid Rain Unit?
A	**N/A**	**N/A**	**32**	☐ Yes ☒ No

9. Package Unit:
   Manufacturer: Model Number:

10. Generator Nameplate Rating: MW

11. Emissions Unit Comment: **The application is for the use of WTDF as supplemental fuel in the No. 2 Cement Kiln (EU 014). A less than significant increase in CO emissions (<100 tpy) is expected as a result of this proposed project. The project is expected to have no effect on the emissions rates of other regulated pollutants (PM, PM10, NO_X, CO and VOC). The requested tire usage rate is the same as for the No. 1 Kiln, previously permitted to burn tires. Continuous utilization/firing of whole tires as supplemental fuel to coal is requested. The maximum utilization/firing rate is 20.0% of the total BTU heat input ; about 2.15 tons per hour, or 60 mmBTU/hr.**

Emissions Unit Control Equipment

1. Control Equipment/Method(s) Description: **Particulate matter emissions from Kiln No. 2 are controlled by a Fuller Model 10744, 18 unit fabric filter dust collector (Baghouse E-19). The emission rates of NOX, SO2, CO and VOC are controlled by best management practices.**
2. Control Device or Method Code(s): **016**

B. EMISSIONS UNIT CAPACITY INFORMATION

(Optional for unregulated emissions units.)

Emissions Unit Operating Capacity and Schedule

1. Maximum Process or Throughput Rate: **165 tph; preheater feed**				
2. Maximum Production Rate:				
3. Maximum Heat Input Rate: **300** million Btu/hr				
4. Maximum Incineration Rate:	pounds/hr			
	tons/day	**N/A**		
5. Requested Maximum Operating Schedule:				
	hours/day			days/week
	weeks/year	**8760**		hours/year
6. Operating Capacity/Schedule Comment: **None**				

C. EMISSION POINT (STACK/VENT) INFORMATION
(Optional for unregulated emissions units.)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram: **No. 2 Kiln Stack**	2. Emission Point Type Code: **1**	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking: **N/A**		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common: **N/A**		
5. Discharge Type Code: **V**	6. Stack Height: **105 feet**	7. Exit Diameter: **140 feet**
8. Exit Temperature: **250°F**	9. Actual Volumetric Flow Rate: **345,500 acfm**	10. Water Vapor: **10.5%**
11. Maximum Dry Standard Flow Rate: **230,000 dscfm**	12. Nonstack Emission Point Height: N/A feet	
13. Emission Point UTM Coordinates... Zone: **17** East (km): **356.300** North (km): **3168.380**	14. Emission Point Latitude/Longitude... Latitude (DD/MM/SS) Longitude (DD/MM/SS)	
15. Emission Point Comment:		

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment 1 of 7

1. Segment Description (Process/Fuel Type): **Mineral Products : Cement Namufacturing – Dry Process : Preheater Kiln**		
2. Source Classification Code (SCC): **3-05-006-22**	3. SCC Units: **Tons Processed**	
4. Maximum Hourly Rate: **165**	5. Maximum Annual Rate: **1,314,000**	6. Estimated Annual Activity Factor: **N/A**
7. Maximum % Sulfur: **N/A**	8. Maximum % Ash: **N/A**	9. Million Btu per SCC Unit: **N/A**
10. Segment Comment: **Preheater feed rate 165 tph maximum 1,314,000 tpy maximum (based on 150 tph x 8760) No change requested.**		

Segment Description and Rate: Segment 2 of 7

1. Segment Description (Process/Fuel Type): **Mineral Products : Cement Manufacturing – Dry Process : Preheater Kiln**		
2. Source Classification Code (SCC): **3-05-006-22**	3. SCC Units: **Tons Clinker**	
4. Maximum Hourly Rate: **99.0**	5. Maximum Annual Rate: **788,400**	6. Estimated Annual Activity Factor: **N/A**
7. Maximum % Sulfur: **N/A**	8. Maximum % Ash: **N/A**	9. Million Btu per SCC Unit: **N/A**
10. Segment Comment: **Max hour rate = Max hourly Preheater Rate x 0.60 = 99.0 tph Annual rate = Annual Preheater Rate x 0.60 = 788,400 tpy No change requested.**		

D. SEGMENT (PROCESS/FUEL) INFORMATION (CONTINUED)

Segment Description and Rate: Segment 3 of 7

1. Segment Description (Process/Fuel Type): **In-Process Fuel Use : Distillate Oil : Cement Kiln**		
2. Source Classification Code (SCC): **3-90-005-02**	3. SCC Units: **1000 Gallons Burned**	
4. Maximum Hourly Rate: **2.1**	5. Maximum Annual Rate: **18536.2**	6. Estimated Annual Activity Factor: **N/A**
7. Maximum % Sulfur: **N/A**	8. Maximum % Ash: **N/A**	9. Million Btu per SCC Unit: **141.3**
10. Segment Comment: **No change requested.**		

Segment Description and Rate: Segment 4 of 7

1. Segment Description (Process/Fuel Type): **In-Process Fuel Use : Residual Oil : Cement Kiln**		
2. Source Classification Code (SCC): **3-90-004-02**	3. SCC Units: **1000 Gallons Burned**	
4. Maximum Hourly Rate: **2.0**	5. Maximum Annual Rate: **17660.2**	6. Estimated Annual Activity Factor: **N/A**
7. Maximum % Sulfur: **N/A**	8. Maximum % Ash: **N/A**	9. Million Btu per SCC Unit: **148.8**
10. Segment Comment: **No change requested.**		

D. SEGMENT (PROCESS/FUEL) INFORMATION (CONTINUED)

Segment Description and Rate: Segment 5 of 7

1. Segment Description (Process/Fuel Type): **In-Process Fuel Use : Natural Gas : Cement Kiln**		
2. Source Classification Code (SCC): **3-90-006-02**	3. SCC Units: **Million Cubic Feet Burned**	
4. Maximum Hourly Rate: **0.29**	5. Maximum Annual Rate: **2563.9**	6. Estimated Annual Activity Factor: **N/A**
7. Maximum % Sulfur: **N/A**	8. Maximum % Ash: **N/A**	9. Million Btu per SCC Unit: **1025**
10. Segment Comment: **No change requested.**		

Segment Description and Rate: Segment 6 of 7

1. Segment Description (Process/Fuel Type): **In-Process Fuel Use : Bituminous Coal: Cement Kiln**		
2. Source Classification Code (SCC): **3-90-002-01**	3. SCC Units: **Tons Burned**	
4. Maximum Hourly Rate: **12.0**	5. Maximum Annual Rate: **105120**	6. Estimated Annual Activity Factor: **N/A**
7. Maximum % Sulfur: **N/A**	8. Maximum % Ash: **N/A**	9. Million Btu per SCC Unit: **148.8**
10. Segment Comment: **No change requested.**		

D. SEGMENT (PROCESS/FUEL) INFORMATION (CONTINUED)

Segment Description and Rate: Segment 7 of 7

1. Segment Description (Process/Fuel Type): **In-Process Fuel Use : Tires**		
2. Source Classification Code (SCC): **3-90-012-99**	3. SCC Units: **Tons Burned**	
4. Maximum Hourly Rate: **2.14**	5. Maximum Annual Rate: **18746**	6. Estimated Annual Activity Factor: **N/A**
7. Maximum % Sulfur: **N/A**	8. Maximum % Ash: **N/A**	9. Million Btu per SCC Unit: **28**
10. Segment Comment: **Continuous utilization/firing of whole tires as supplemental fuel to coal is requested. The maximum utilization/firing rate is 20.0% of the total BTU heat input; about 2.14 tons per hour, or 60 mmBTU/hr. 20% x 300 mmBTU/hr = 60 mmBTU/hr** **60 mmBTU/hr ÷ 28 mmBTU/ton = 2.14 tph** **See attached supplemental information.**		

E. EMISSIONS UNIT POLLUTANTS

List of Pollutants Emitted by Emissions Unit

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
PM/PM10	**016**	**None**	**EL**
SO_2	**None**	**None**	**EL**
NO_X	**None**	**None**	**EL**
CO	**None**	**None**	**EL**
VOC	**None**	**None**	**EL**
DIOX	**None**	**None**	**EL**

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **PM/PM10**	2. Total Percent Efficiency of Control: **N/A**
3. Potential Emissions: **29.7** lb/hour **118.3** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): **Not Applicable** to tons/year	
6. Emission Factor: **0.18 lb/ton dry preheater feed** Reference: Permit No. **0530010-002-AV**	7. Emissions Method Code: **0**
8. Calculation of Emissions: **0.18 lb/ton x 165 tons/hr = 29.7 lb/hour** **@ 1,314,000 tons/yr = 118.3 tons/year**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: **No changes in actual or potential emissions are expected or requested as a result of this project.**	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **RULE**	2. Future Effective Date of Allowable Emissions: **N/A**
3. Allowable Emissions and Units: **0.18 lb/ton dry preheater feed**	4. Equivalent Allowable Emissions: **29.7** lb/hour **118.3** tons/year
5. Method of Compliance: **Method 5**	
6. Allowable Emissions Comment (Description of Operating Method): **No changes in allowable emissions are expected or requested as a result of this project.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **SO_2**	2. Total Percent Efficiency of Control: **N/A**
3. Potential Emissions: **16.5** lb/hour **65.7** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): **Not Applicable** to tons/year	
6. Emission Factor: **0.10 lb/ton dry preheater feed** Reference: Permit No. **0530010-002-AV**	7. Emissions Method Code: **0**
8. Calculation of Emissions: **0.10 lb/ton x 165 tons/hr = 16.5 lb/hour** **@ 1,314,000 tons/yr = 65.7 tons/year**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: **No changes in actual or potential emissions are expected or requested as a result of this project.**	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **RULE**	2. Future Effective Date of Allowable Emissions: **N/A**
3. Allowable Emissions and Units: **0.10 lb/ton dry preheater feed**	4. Equivalent Allowable Emissions: **16.5** lb/hour **65.7** tons/year
5. Method of Compliance: **Method 6C**	
6. Allowable Emissions Comment (Description of Operating Method): **No changes in allowable emissions are expected or requested as a result of this project.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **NO_X**	2. Total Percent Efficiency of Control: **N/A**
3. Potential Emissions: **283.8** lb/hour **1130.0** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): **Not Applicable** to tons/year	
6. Emission Factor: **0.72 lb/ton dry preheater feed** Reference: Permit No. **0530010-002-AV**	7. Emissions Method Code: **0**
8. Calculation of Emissions: **1.72 lb/ton x 165 tons/hr = 283.8 lb/hour** **@ 1,314,000 tons/yr = 1130.0 tons/year**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: **No changes in actual or potential emissions are expected or requested as a result of this project.**	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **RULE**	2. Future Effective Date of Allowable Emissions: **N/A**
3. Allowable Emissions and Units: **1.72 lb/ton dry preheater feed**	4. Equivalent Allowable Emissions: **283.8** lb/hour **1130.0**tons/year
5. Method of Compliance: **Method 7E**	
6. Allowable Emissions Comment (Description of Operating Method): **No changes in allowable emissions are expected or requested as a result of this project.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

<u>Potential/Estimated Fugitive Emissions</u>

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **CO**	2. Total Percent Efficiency of Control: **N/A**
3. Potential Emissions: 194.7 lb/hour 778 tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): **Not Applicable** to tons/year	
6. Emission Factor: **1.18 lb/ton dry preheater feed** Reference: Permit No. **0530010-002-AV**	7. Emissions Method Code: **0**
8. Calculation of Emissions: **1.18 lb/ton x 165 tons/hr = 194.7 lb/hour** **@ 1,314,000 tons/yr = 778 tons/year** **(See Technical Report for development of CO emission limit.)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: **The emissions rate of CO is reduced from 1.20 to 1.18 lb/ton preheater feed ; or from 788.4 to 778 tpy as a result of this project.**	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **RULE**	2. Future Effective Date of Allowable Emissions: **N/A**
3. Allowable Emissions and Units: **1.18 lb/ton dry preheater feed**	4. Equivalent Allowable Emissions: **194.7** lb/hour **778** tons/year
5. Method of Compliance: **Method 10**	
6. Allowable Emissions Comment (Description of Operating Method): **CO emissions are reduced from 1.20 to 1.18 pounds per ton of preheater feed.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **VOC**	2. Total Percent Efficiency of Control: **N/A**
3. Potential Emissions: **11.81** lb/hour **42.9** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): **Not Applicable** to tons/year	
6. Emission Factor: **0.09 lb/ton dry preheater feed** Reference: Permit No. **0530010-002-AV**	7. Emissions Method Code: **0**
8. Calculation of Emissions: **0.09 lb/ton x 165 tons/hr = 14.9 lb/hour** **@ 1,314,000 tons/yr = 59.1 tons/year**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: **No changes in actual or potential emissions are expected or requested as a result of this project.**	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **RULE**	2. Future Effective Date of Allowable Emissions: N/A
3. Allowable Emissions and Units: **0.09 lb/ton dry preheater feed**	4. Equivalent Allowable Emissions: **14.9** lb/hour **59.1** tons/year
5. Method of Compliance: **Method 25A; when required.**	
6. Allowable Emissions Comment (Description of Operating Method): **No changes in allowable emissions are expected or requested as a result of this project.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **DIOX**	2. Total Percent Efficiency of Control: **N/A**
2. Potential Emissions: **2.7 E-07** lb/hour (max) **7.1 E-07** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): **Not Applicable** to tons/year	
6. Emission Factor: – **0.4 ng/dscm at 7% O_2 - R.M. operating** **0.2 ng/dscm at 7% O_2 – R.M. not operating** Reference: Permit No. **40 CFR 63, Subpart LLL**	7. Emissions Method Code: **0**

8. Calculation of Emissions:

Assume Raw Mill (R.M.) operates 90% of the time.

R.M. Operating

0.4 ng/dscm x 3230 dscm/min @ 7% O2 x 60 min/hr x f (1) = 1.7 E-07 lb/hr (max hrly)

R.M. Not Operating

0.2 ng/dscm x 3230 dscm/min @ 7% O2 x 60 min/hr x f (1) = 0.85 E-07 lb/hr

Annual

[(1.7 x 0.9) + (0.85 x 0.1)] x E-07 x 8760 h/y x 1/2000 lb/ton = 7.1 E-07 tpy

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

(1) f = conversion from ng to lb

(2) No changes in actual or potential emissions are expected or requested as a result of this project.

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **RULE**	2. Future Effective Date of Allowable Emissions: N/A
3. Allowable Emissions and Units: **0.4 ng/dscm at 7% O_2 (T<400°F)** **0.2 ng/dscm at 7% O_2 (T≥400°F)**	4. Equivalent Allowable Emissions: **1.7 E-07** lb/hour **71. E-07** tons/year
5. Method of Compliance: **Method 23**	
6. Allowable Emissions Comment (Description of Operating Method): **No changes in actual or potential emissions are expected or requested as a result of this project.**	

Allowable Emissions Allowable Emissions 1of 1

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance	
6. Allowable Emissions Comment (Description of Operating Method):	

G. VISIBLE EMISSIONS INFORMATION

Complete if this emissions unit is or would be subject to a unit-specific visible emissions limitation.

Visible Emissions Limitation: Visible Emissions Limitation 1 of 1

1. Visible Emissions Subtype: **VE10**	2. Basis for Allowable Opacity: ☒ Rule ☐ Other
3. Allowable Opacity: Normal Conditions: **10%** Exceptional Conditions: **10%** Maximum Period of Excess Opacity Allowed: **0** min/hour	
4. Method of Compliance: **COM & Method 9**	
5. Visible Emissions Comment: **None**	

Visible Emissions Limitation: Visible Emissions Limitation _____ of _____

1. Visible Emissions Subtype:	2. Basis for Allowable Opacity: ☐ Rule ☐ Other
3. Allowable Opacity: Normal Conditions: % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance:	
5. Visible Emissions Comment:	

H. CONTINUOUS MONITOR INFORMATION

Complete if this emissions unit is or would be subject to continuous monitoring.

Continuous Monitoring System: Continuous Monitor 1 of 3

1. Parameter Code: **COM**	2. Pollutant(s): **Opacity**
3. CMS Requirement: ☒ Rule ☐ Other	
4. Monitor Information... Manufacturer: **Existing** Model Number: Serial Number:	
5. Installation Date: **Unknown**	6. Performance Specification Test Date: **Unknown**
7. Continuous Monitor Comment: **None**	

Continuous Monitoring System: Continuous Monitor 2 of 3

1. Parameter Code: **CEM**	2. Pollutant(s): **CO and/or O_2**
3. CMS Requirement: ☐ Rule ☒ Other	
4. Monitor Information... Manufacturer: **Existing** Model Number: Serial Number:	
5. Installation Date: **Unknown**	6. Performance Specification Test Date: **Unknown**
7. Continuous Monitor Comment: **Process Monitors, not for compliance**	

H. CONTINUOUS MONITOR INFORMATION (CONTINUED)

Complete if this emissions unit is or would be subject to continuous monitoring.

Continuous Monitoring System: Continuous Monitor 3 of 3

1. Parameter Code: **TEMP**	2. Pollutant(s): **Temperature**
3. CMS Requirement:	☒ Rule ☐ Other
4. Monitor Information... Manufacturer: **Existing** Model Number:	Serial Number:
5. Installation Date: **Unknown**	6. Performance Specification Test Date: **Unknown**
7. Continuous Monitor Comment: **NESHAP Subpart LLL**	

Continuous Monitoring System: Continuous Monitor _____ of _____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	☐ Rule ☐ Other
4. Monitor Information... Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

I. EMISSIONS UNIT ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Process Flow Diagram (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID: _____ ☒ Previously Submitted, Date **Unknown**
2. Fuel Analysis or Specification (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: Tech Rpt. ☒ Previously Submitted, Date **Unknown**
3. Detailed Description of Control Equipment (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID: _____ ☒ Previously Submitted, Date **Unknown**
4. Procedures for Startup and Shutdown (Required for all operation permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID: _____ ☒ Previously Submitted, Date **Unknown** ☐ Not Applicable (construction application)
5. Operation and Maintenance Plan (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID: _____ ☒ Previously Submitted, Date **Unknown** ☐ Not Applicable
6. Compliance Demonstration Reports/Records ☐ Attached, Document ID: ______ Test Date(s)/Pollutant(s) Tested: ______ ______ ☒ Previously Submitted, Date: **September 2002; PM, NO_X, SO_2, CO, VE**______ Test Date(s)/Pollutant(s) Tested: ______ ______ ☐ To be Submitted, Date (if known):__________ Test Date(s)/Pollutant(s) Tested: ______ ______ ☐ Not Applicable Note: For FESOP applications, all required compliance demonstration records/reports must be submitted at the time of application. For Title V air operation permit applications, all required compliance demonstration reports/records must be submitted at the time of application, or a compliance plan must be submitted at the time of application.
7. Other Information Required by Rule or Statute ☐ Attached, Document ID: _____ ☒ Not Applicable

Additional Requirements for Air Construction Permit Applications

1. Control Technology Review and Analysis (Rules 62-212.400(6) and 62-212.500(7), F.A.C.; 40 CFR 63.43(d) and (e)) ☐ Attached, Document ID: _____ ☒ Not Applicable
2. Good Engineering Practice Stack Height Analysis (Rule 62-212.400(5)(h)6., F.A.C., and Rule 62-212.500(4)(f), F.A.C.) ☐ Attached, Document ID: _____ ☒ Not Applicable
3. Description of Stack Sampling Facilities (Required for proposed new stack sampling facilities only) ☐ Attached, Document ID: _____ ☒ Not Applicable

Additional Requirements for Title V Air Operation Permit Applications

1. Identification of Applicable Requirements ☐ Attached, Document ID: **Not Applicable**
2. Compliance Assurance Monitoring ☐ Attached, Document ID: _____ ☒ Not Applicable
3. Alternative Methods of Operation ☐ Attached, Document ID: _____ ☒ Not Applicable
4. Alternative Modes of Operation (Emissions Trading) ☐ Attached, Document ID: _____ ☒ Not Applicable
5. Acid Rain Part Application **Not Applicable** ☐ Certificate of Representation (EPA Form No. 7610-1) ☐ Copy Attached, Document ID:_____ ☐ Acid Rain Part (Form No. 62-210.900(1)(a)) ☐ Attached, Document ID:_____ ☐ Previously Submitted, Date:_____ ☐ Repowering Extension Plan (Form No. 62-210.900(1)(a)1.) ☐ Attached, Document ID:_____ ☐ Previously Submitted, Date:_____ ☐ New Unit Exemption (Form No. 62-210.900(1)(a)2.) ☐ Attached, Document ID:_____ ☐ Previously Submitted, Date:_____ ☐ Retired Unit Exemption (Form No. 62-210.900(1)(a)3.) ☐ Attached, Document ID:_____ ☐ Previously Submitted, Date:_____ ☐ Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.) ☐ Attached, Document ID:_____ ☐ Previously Submitted, Date:_____ ☐ Phase II NOx Averaging Plan (Form No. 62-210.900(1)(a)5.) ☐ Attached, Document ID:_____ ☐ Previously Submitted, Date:_____ ☐ Not Applicable

INFORMATION IN SUPPORT OF A PERMIT AMENDMENT TO AUTHORIZE THE USE OF WHOLE TIRE DERIVED FUEL

CEMEX USA, INC.
Brooksville Cement Plant
Hernando County, Florida

Airs ID No. 0530010

Kiln No. 2
Emission Unit 014

Koogler & Associates Environmental Services
4014 N.W. 13th Street
Gainesville, Florida 32609
352-377-5822

June 27, 2003
521-02-10

Table of Contents

1.0 APPLICATION INFORMATION

Applicant Name and Address

Cemex Cement, Inc.
1630 Ponce de Leon Blvd.
Brooksville, Florida 34601

Authorized Representative:

Mr. Tom Delvecchio, Plant Manager
352/796-7241
tdelvecchio@cemexusa.com

Facility ID:

0530010

Affected Emission Unit:

EU-014; Cement Kiln No. 2

Affected Permits:

0530010-003-AC
0530010-005-AC
0530010-002-AV

2.0 FACILITY INFORMATION

2.1 Facility Location

Cemex Cement, Inc.
Portland Cement Manufacturing Facility
UTM: Zone 17; 356.9 km East and 3169.0 km North
Directions: Highway 98, approximately 10 miles Northwest of Brooksville in Hernando County

2.2 Standard Industrial Classification Code

Major Group Number	*32*	*Clay, Glass and Concrete Products*
Group Number	*324*	*Cement, Hydraulic*
Industry Number	*3241*	*Cement, Hydraulic*

2.3 *Facility Category*

The Cemex facility includes two Portland cement plants, each consisting of a dry process preheater-type cement kiln, a clinker cooler and ancillary equipment. Both plants are classified as existing facilities for purposes of New Source Performance Standards (NSPS - 40 CFR 60, Subpart F) and for purposes of National Emission Standards for Hazardous Air Pollutants (NESHAP - 40 CFR 63, Subpart LLL).

Air pollutant emissions are over 100 tons per year of particulate matter (PM/PM10), sulfur dioxide (SO_2), nitrogen oxides (NO_X), carbon monoxide (CO) and volatile organic compounds (VOC). The facility is thus classified as a Major Facility in accordance with Rule 62-210.200(157), F.A.C. and a Major (Title V) Source and a Major Source of Hazardous Air Pollutants (HAPs) in accordance with Rule 62-210.200(159), F.A.C. The Portland cement industry is also listed in Table 62-212.400-1, F.A.C., *Major Facility Categories.*

The Cemex facility is subject to Federal New Source Performance Standards codified at 40 CFR 60, Subpart A-*General Provisions,* Subpart F - *Standards of Performance for Portland Cement Plants,* Subpart Y - *Standards of Performance for Coal Preparation Plants* and Subpart OOO - *Standards of Performance for Nonmetallic Mineral Processing Plants* as adopted by the Department and incorporated by reference into Rule 62-204.800, F.A.C. The facility is also subject to National Emission Standards for Hazardous Air Pollutants, codified at 40 CFR 63, Subpart A-*General Provisions,* and Subpart LLL - *Emission Standards for the Portland Cement Manufacturing Industry* also adopted by Rule 62-204.800, F.A.C. Certain requirements of 40 CFR 60, Subpart F, are superceded by requirements of 40 CFR 63, Subpart LLL.

3.0 RULE APPLICABILITY

The proposed project is subject to preconstruction review under the applicable provisions of Chapter 403, Florida Statutes, and Chapters 62-4, 62-204, 62-210, 62-212, 62-296 and 62-297 of the Florida Administrative Code (F.A.C.). This facility is located in Hernando County, an area designated as *attainment* or *unclassifiable* for each pollutant subject to a National Ambient Air Quality Standard; Rule 62-204.340, F.A.C.

The proposed project, potentially increasing CO actual emissions from Kiln No. 2, is subject to review under Rule 62-212.300, F.A.C., *General Preconstruction Review Requirements,* because the potential emission increase of CO is less than the significant emission rate given in Table 62-212.400-2, F.A.C.

The emission units affected by this modification (Kiln No. 2) will comply with all applicable provisions of the Florida Administrative Code (including applicable portions of the Code of Federal Regulations) and, specifically, the following chapters and rules:

•	Chapter 62-4	Permits
•	Rule 62-204.220	Ambient Air Quality Protection
•	Rule 62-204.240	Ambient Air Quality Standards
•	Rule 62-204.260	Prevention of Significant Deterioration Increments
•	Rule 62-204.360	Designation of Prevention of Significant Deterioration Areas
•	Rule 62-204.800	Federal Regulations Adopted by Reference
•	Rule 62-210.300	Permits Required
•	Rule 62-210.350	Public Notice and Comments
•	Rule 62-210.370	Reports
•	Rule 62-210.550	Stack Height Policy
•	Rule 62-210.650	Circumvention
•	Rule 62-210.700	Excess Emissions
•	Rule 62-210.900	Forms and Instructions
•	Rule 62-212.300	General Preconstruction Review Requirements
•	Rule 62-296.320	General Pollutant Emission Limiting Standards
•	Rule 62-297.310	General Test Requirements
•	Rule 62-297.400	EPA Methods Adopted by Reference
•	Rule 62-297.401	EPA Test Procedures
•	Rule 62-297.520	EPA Performance Specifications

Kiln No. 2 is subject to all applicable requirements of 40 CFR 60, Subpart A (General NSPS Provisions), 40 CFR 60, Subpart F (NSPS for Portland Cement Plants), 40 CFR 63, Subpart A (General NESHAP Provisions) and 40 CFR 63, Subpart LLL (NESHAP for Portland Cement Plants). Some requirements of 40 CFR 60, Subpart F have been superceded by requirements of 40 CFR 63, Subpart LLL.

4.0 PROJECT OVERVIEW

This project involves only Kiln No. 2 which is defined in Permit Nos.0530030-003-AC, PSD-FL-233 and 0530010-002-AV as Emission Unit 014. The proposed modification is to authorize the use of Whole Tire Derived Fuel (WTDF) as a supplemental fuel for Kiln No. 2. Kiln No. 1 was permitted to allow the continuous use of WTDF as a supplement to other permitted fuels by Permit AC27-240349, issued on or about April 18, 1994.

Kiln No. 2 is presently permitted by FDEP Permit No. 0530010-003-AC (PSD-FL-233) to operate at a maximum preheater feed rate of 165 tons per hour (1-hour maximum) and a 30-day average preheater feed rate of 150 tons per hour. The heat input rate to the kiln is not to exceed 300 mmBTU per hour. The heat input to the pyroprocessing system can be provided by coal, No. 6 fuel oil or a better grade of fuel oil, or natural gas. Additionally, the kiln is permitted to burn on-site generated non-hazardous waste oil, grease and rags at a rate of less than 5,000 gallons per year. None of these conditions will change as a result of this project.

The proposed project is to permit the use of whole tire derived fuel (WTDF) as a supplemental fuel in the No. 2 Kiln system. Cemex is requesting to use WTDF to provide up to 20 percent of the heat input to the No. 2 Kiln; the same as presently permitted for Kiln No. 1.

The utilization of WTDF as a supplemental fuel in Kiln No. 2 will not affect any Emission Units or Emission Points, either upstream or downstream of the kiln nor will it affect the operation of Kiln No. 2 or clinker quality. Furthermore, it is the opinion of Cemex that the use of up to 20 percent WTDF in Kiln No. 2 will not affect emissions from the kiln. This opinion is based on tests conducted on Kiln No. 1 under baseline (100 percent coal) and coal/WTDF firing conditions in May and June, 1993, and on approximately nine years experience in burning WTDF in Kiln No. 1. It is the opinion of the Department, however, that carbon monoxide (CO) emissions could be affected by the use of WTDF. This application provides documentation to support the opinion that the emission rates of particulate matter, sulfur dioxide, nitrogen oxides, volatile organic compounds and certain HAPs are not affected by the use of WTDF. The potential increase in carbon monoxide emissions is addressed as a less than Significant Emission Rate increase for carbon monoxide as defined in Table 62-212.400-2, *Regulated Air Pollutants-Significant Emission Rates.*

As background information for processing this application, the Department, during a pre-application telephone conversation, inquired about differences in the NO_X emission limits for Kiln No. 1 and Kiln No. 2. The present NO_X emission limit for Kiln No. 1 is 1.83 pounds of NO_X per ton of preheater feed and the limit for Kiln No. 2 is 1.72 pounds of NO_X per ton of kiln feed. It was asked if the higher NO_X emission limit for Kiln No. 1 was associated with the fact that Kiln No. 1 is permitted to fire WTDF. The answer to this question is no. The reasons for the difference in permitted NO_X emissions from the two kilns is summarized in the following paragraphs.

Kiln No. 1 was originally permitted in 1973, prior to the PSD Program. As a result, a permitted emission limit for Kiln No. 1 was not established at the time of initial permitting. Kiln No. 2 was permitted in 1980. In late 1995 or early 1996, Southdown (the owner of the facility at the time) requested to modify emissions from Kiln Nos. 1 and 2 and Clinker Cooler Nos. 1 and 2. At that time, there was still not a permitted NO_X emission limit for Kiln No. 1. As a result of the request, Permit No. 0530010-001-AC (PSD-FFL-233) was drafted and was public noticed but was not issued. In the BACT Determination for that permit (Attachment 1), it is stated:

> *Although this specific application does not necessitate a PSD Review and BACT Determination for nitrogen oxides (NO_X), past changes in production rates in Kiln No.1 presumably caused concurrent increases in this pollutant. Unless specific measures were taken at the time to ensure*

NO_X emission increases were kept at less than significant levels, such a review and determination would have been required. The Department is using this opportunity to resolve this outstanding issue by setting a non-BACT emission limit which can be reasonably assumed to be lower than emissions prior to the changes which were not subject appropriate review. Southdown has agreed that this limit should be no greater than 275 lb/hr (1.9 lb NO_X/ton $feed_{ph}$).

Southdown is not proposing any changes for Kiln 2 NO_X emissions. Currently, the emission level of 250 lb NO_X/hr is being met (equivalent to 1.72 lb/NO_X/ton $feed_{ph}$).

The NO_X emission limit of 250 pounds per hour for Kiln No. 2 was established by Permit AC27-138850 PSD-FL-124, dated November 3, 1987. The authorization to fire WTDF in Kiln No. 1 was granted under Permit AC27-240349 dated April 15, 1994. Both of these permitting actions preceded the BACT Determination associated with Permit No. 0530010-001-AC cited above.

The first NO_X emission limit permitted for Kiln No. 1 appeared in Permit No. 0530010-003-AC, dated June 22, 1997. In that permit, an NO_X emission limit for Kiln No. 1 of 1.83 pounds of NO_X per ton of preheater feed was established as BACT and the NO_X limit for Kiln No. 2 of 1.72 pounds of NO_X per ton of preheater feed was confirmed. That BACT Determination should be in Department files. If not, and if the BACT Determination is deemed necessary for the review of this application, the BACT Determination can be provided by Cemex.

5.0 PROCESS DESCRIPTION

5.1 General Information

Portland cement consists of a mixture of dicalcium silicate, tricalcium silicate, tricalcium aluminate, tricalcium aluminoferrite, and miscellaneous minerals to which one or more forms of calcium sulfate have been added. About 95 percent of the cement production in the U.S. is Portland cement. Masonry cement, also produced at the Portland cement plant, represents the balance of the domestic cement production.

There are several variations in cement manufacturing including the wet, dry, dry preheater and dry precalciner processes. The precalciner process also includes a preheater. These processes are essentially identical relative to the manufacture of cement from raw materials, however, the type of process does affect the equipment design, method of operation and fuel consumption. Because of its lower fuel requirements, most new Portland cement plants use the dry precalciner process. Kiln No. 2, which was originally permitted in 1980, is a dry, preheater kiln.

The choice of fuel is based on economics. The most commonly used kiln fuels are coal, natural gas and oil, all of which Kiln No. 2 is permitted to use. Supplementary fuels such as petroleum coke, tires, used oil and various kinds of wastes are burned at many plants. Fuel combustion differs between the wet, dry, dry preheater and dry precalciner process. In the first three, all primary fuel combustion typically occurs in the kiln. In the latter, some primary fuel combustion occurs in a separate calcining vessel located between the preheater and kiln. In all of the processes, it is possible to introduce additional fuels, such as tires, directly into the kiln. This is the process that will be employed by Cemex to introduce WTDF into Kiln No. 2. Details will be provided in subsequent sections of this report.

The production of Portland cement is a four-step process: (1) raw materials acquisition and handling, (2) kiln feed preparation, (3) pyroprocessing, and (4) finished cement grinding. The chemical reactions and physical processes that constitute the transformation are quite complex. The raw materials enter the pyroprocessing system in the uppermost preheater cyclones. They exit the preheater and enter the kiln at the elevated end. The rotation of the kiln causes the solid materials to be slowly transported downward through the kiln. Primary fuel is supplied at the lower or discharge end of the kiln. The hot, gaseous combustion products move countercurrent to the materials flow, thereby transferring heat to solids in the kiln and preheater.

Pyroprocessing may be conveniently divided into five stages, depending on location and temperature of the materials in the system:

1. Uncombined water evaporates from raw materials as material temperature increases to 212°F in the raw mill or upper preheater.

2. As the material temperature increases from 212°F to approximately 800°F in the preheater, combined water is liberated from the raw meal.

3. Between 800°F and 1650°F, partial calcination occurs in the lower preheater and is completed within the kiln. Carbon dioxide is liberated from the carbonates and calcium oxide is formed. At the base of the preheater, WTDF will be introduced as a supplemental fuel.

4. Following calcination, sintering of the oxides occurs in the burning zone of the rotary kiln at temperatures up to 2750°F. Lime, silica, and iron and aluminum compounds react to form calcium silicates, aluminates, ferrites and aluminoferrites. Alkali sulfates and chlorides evaporate.

5. Following sintering, clinker nodules are produced as the temperature of the material decreases (2500°F). The steel belting and beading from WTDF is incorporated into the clinker and is totally consumed.

The clinker enters the clinker cooler where it is cooled by air. Hot air from the clinker cooler is recovered and returned to the pyroprocessing system as combustion air. The cooled clinker is mixed with a form of calcium sulfate, usually gypsum, and ground in the finish mill to produce Portland cement.

The finished cement is transferred to silos from where it is shipped bulk or transferred to the packhouse where it is bagged and shipped.

5.2 Tire Derived Fuel in Kiln No. 2

CEMEX is requesting authorization to use WTDF as a supplemental fuel in the No. 2 Kiln System. It is requesting that up to 20 percent of the heat input to Kiln No. 2 be in the form of WTDF; the same as presently permitted for Kiln No. 1. This section addresses the effect of WTDF on potential kiln emissions and the handling and feed of WTDF.

5.2.1 WTDF Handling and Feed

CEMEX has received FDEP Permit No. 71066-001-WT for a waste tire facility at their Brooksville Cement Plant. The permit requires that all waste tires be stored and handled in accordance with Rules 62-711.530 and 540, F.A.C. The permit further limits the facility to the storage of 240 tons of waste tires at any one time. A copy of this permit can be provided if necessary.

The waste tires will be received and stored on site in enclosed trailers; each containing approximately 12 tons of tires. At a loading of 12 tons of waste tires per trailer, no more than 20 trailers will be on site at any one time. At the maximum requested feed rate of 60 mmBTU per hour (20 percent of 300 mmBTU per hour), the WTDF feed rate to each kiln will be approximately 2.15 tons of WTDF per hour. The maximum on-site storage of waste tires will be sufficient to fire one kiln for approximately 110 hours, or the two kilns for approximately 55 hours, assuming both kilns are firing WTDF at the maximum permitted rate.

The handling and feed of WTDF to Kiln No. 2 will be the same as at the CEMEX Clinchfield, Georgia plant. Photographs and drawings included in Attachment 2 detail this process.

The tires will be received on site in enclosed semi-trailers and stored in these trailers until used. The trailers will be emptied by a tilting truck dump and the tires will discharge in to a receiving bin. The receiving bin has a moving floor which advances the tires to a singulator. The singulator feeds the tires one-at-a-time at a controlled rate, onto a series of ground-level conveyor belts. These belts deliver the tires to a vertical elevator which transfers the tires to the base of the preheater/top of the kiln feed shelf. Here the tires will be dropped onto a short horizontal conveyor which delivers the tires one-at-a-time at a controlled rate to the double airlock feed system.

The double airlock feeder introduces the tires into the kiln system and onto the feed shelf. The tires travel down the feed shelf with the raw feed into the rotary kiln where they are combusted. The point of WTDF feed as just described is identical to where WTDF is fed into the Kiln No. 1 system.

As previously discussed, and documented by test and operating data, the introduction of WTDF as just described to provide up to 20 percent of the heat input to a preheater kiln has no effect on emissions from the kiln (with the possible exception of CO), on kiln operations, or on clinker quality.

The Department requested information on oxygen and carbon monoxide levels at all points in the kiln and preheater tower during the feed of WTDF. The relevant fact is that test data demonstrated that neither carbon monoxide emissions nor any other emissions from the kiln will increase as a result of using WTDF to provide up to 20 percent of the heat input to the kiln and these data have been provided. The other relevant factors are that the use of WTDF will not adversely effect kiln operations or clinker quality.

5.2.2 Effect of WTDF on Emissions

It is the opinion of CEMEX that the use of up to 20 percent WTDF in Kiln No. 2 will not effect emissions from the kiln, will not effect kiln operations and will not effect clinker quality. This opinion is based on tests conducted on Kiln No. 1 under baseline (100 percent coal) and coal/WTDF firing conditions in May and June, 1993, and on approximately nine years of experience in burning WTDF in Kiln No. 1. The 1993 tests were the basis for FDEP authorizing the use of WTDF to replace up to 20 percent of the heat input to Kiln No. 1. The 1993 Test Reports were provided to the Department, including a report entitled, *Comparison of Particulate Matter, Sulfur Dioxide, Total Hydrocarbons, Carbon Monoxide, Nitrogen Oxides, Hydrogen Chloride, Spaciated Volatile Organics, Metals and Dioxins/Furans Emission Measurements and Opacity of Emissions Under Baseline and Coal/TDF Firing Conditions, Kiln No. 1, May-June, 1993.* A copy of this latter report is included as Attachment 3. The conclusion of this report was:

> *"Based on the comparison of emission data and operating data collected during the baseline period (100 percent coal firing) on May 4-5, 1993 and during the coal/TDF period on June 8-9, 1993, it*

> *can be concluded that the use of TDF to provide up to 20 percent of the heat input to Kiln No. 1 has no effect on emissions, operations or clinker quality." [Emphasis added.]*

Prior to the CEMEX (f/k/a Florida Mining and Materials) tests in 1993, baseline (100 percent coal) and coal/WTDF emission tests were conducted at the Florida Crushed Stone Plant (FCS) located just southeast of the CEMEX Plant. The purpose of the FCS testing was also to support a request to FDEP for the use of WTDF as a supplemental fuel in their cement kiln.

As with the CEMEX tests, the FCS tests demonstrated that the use of WTDF had no impact on emissions from, or operations of, the kiln. Summaries of three FCS Test Reports, previously provided to the Department, are included as Attachment 4.

In addition to the baseline and WTDF emission tests conducted at the CEMEX Plant and at Florida Crushed Stone, similar tests were conducted at the Rinker Cement Plant in Miami, Florida. These tests were conducted in 1993 when Rinker was operating wet-process kilns. The Rinker data, while not summarized herein, were submitted to the Department in support of a request by Rinker to use WTDF as a supplemental fuel in their cement kilns. The Rinker data, like the CEMEX and FCS data, showed that the use of WTDF as a supplemental fuel had no impact on emissions or kiln operations.

The test data generated at CEMEX, and by FCS and Rinker, all resulted in FDEP-issued permit amendments authorizing the use of WTDF as a supplemental fuel. None of the amended permits required changes in permitted emission limits to accommodate the use of WTDF.

In October, 1997, EPA published a document entitled *"Air Emissions from Scrap Tire Combustion,* EPA-600-R-97-115, USEPA Office of Research and Development, Washington, DC. This report summarizes the results of pilot plant testing on a rotary kiln combuster and emission data from 19 utility boilers, two cement kilns and one lime kiln while using TDF as a supplemental fuel. In this report, EPA states:

> *"Based on the results of the (rotary kiln combuster) test program, it can be concluded that, with the exception of zinc emissions, potential emissions from TDF are not expected to be very much different than from other conventional fossil fuel..."*
>
> *"Test data, from (19 boilers, 2 cement kiln and one lime kiln)...indicate that properly designed existing solid fuel combusters can supplement their normal fuels, which typically consist of coal, wood, coke*

and various combinations thereof, with 10 to 20% TDF and still satisfy environmental compliance emissions limits."

EPA further states:

"Data from the analyses did not indicate that (semi-volatile organic compounds) were present in detectible concentrations.
...concludes that when TDF is combusted in a well-designed and well-operated facility, emissions of (semi-volatile organic compounds) are not significantly different from natural gas.

"(dioxins/furans) were collected during two test conditions: 0% TDF and 17% TDF (steady state). No (dioxins/furans) were detected in either test."

Regarding the data from the two cement plants, EPA states:

"The combination of long residence time and high temperature make cement kilns an ideal environment for TDF. Emissions (from cement plants) are not adversely affected (by TDF) compared to baseline fuels and often represent an improvement."

A copy of sections of the EPA report is included in Attachment 5.

Based on the aforementioned testing and reports, and the operating experience at CEMEX, FCS and Rinker, two new grass roots Portland cement plants (Florida Rock Industries and Suwannee American Cement) and one modernized cement plant (Rinker) were permitted in Florida to burn WTDF as a supplemental fuel with the same emission limiting standards as for 100 percent coal firing. During the development of these three permits, there was never a discussion of differences in emissions resulting from the use of WTDF.

The Department has previously concluded, and all data (that generated within Florida and that from published EPA and other reports) support the fact that the use of WTDF in a well controlled and operated combustion unit, will have no effect on emissions. With this application, however, the Department expressed an opinion during pre-application communication, that the use of WTDF could affect (increase) the emissions of carbon monoxide. The Department did agree that data provided supported the fact that the use of WTDF would have no affect on emissions of other air pollutants.

To address the potential increase in carbon monoxide emissions, past actual carbon monoxide emissions were determined and these emissions, on an annual basis, were increased by less than 100 tons per year to avoid a PSD Review.

5.2.3 Baseline Carbon Monoxide Emissions

Carbon monoxide emissions for the past five years (1998 through 2002), were calculated from annual hours of operation of Kiln No. 2 and the carbon monoxide emission rate measured during annual compliance testing for each of the five years. These data are summarized in Table 5-1. The carbon monoxide emissions for calendar years 2000 and 2001 were used to establish a past actual carbon monoxide emission rate from Kiln No. 2 at 679 tons per year. To this, a carbon monoxide emission rate increase of 99 tons per year (less than the 100 ton per year significant emission rate) was added; resulting in a future potential carbon monoxide emission rate of 778 tons per year.

The 778 tons per year emission rate is equivalent to 177.6 pounds per hour at an operating factor of 8760 hours per year and to an emission factor of 1.18 pounds of CO per ton of preheater feed at the average permitted preheater feed rate of 150 tons per hour. At the maximum hourly permitted preheater feed rate of 165 tons per hour, the carbon monoxide emission limit will be 194.7 pounds per hour.

5.2.4 The Effect of WTDF on Other Emissions

The use of WTDF as a supplemental fuel in Kiln No. 2 will have no affect on PM/PM10 emissions or opacity or on the emission rates of SO_2, NO_X or VOC. The emission rates of these pollutants will remain as currently permitted (Table 5-2).

The Department also expressed an interest in the affect of WTDF on mercury and vanadium emissions.

The use of WTDF to provide up to 20 percent of the heat input to Kiln No. 2 is not expected to have any impact on potential mercury or vanadium emissions from the kiln.

Data from the 1993 tests at the CEMEX Brooksville Cement Plant previously referenced (Attachment 3) show a typical mercury content for coal of 0.10-0.18 ppm and a typical mercury content for WTDF of 0.04 ppm. This fact alone would suggest that mercury emissions will decrease if WTDF is used as a fuel supplement. (No vanadium analyses were conducted on the coal or WTDF during this test program.)

The emission measurements made at the CEMEX Brooksville Cement Plant in 1993 and measurements made at the FCS Plant in 1990 (Attachment 4) both show a decrease in mercury emissions when WTDF was used as a fuel supplement. The data from the FCS tests further demonstrate that there was no change in vanadium emissions as a result of using WTDF.

Based on these data, CEMEX has concluded that the use of WTDF will have no adverse impact on mercury or vanadium emissions.

5.2.5 Effect of WTDF on Kiln Operations

In a December 12, 2002 letter related to the potential use of WTDF, the Department requested information on the fate of steel in WTDF and the ash content of the dry solids fuels (coal and WTDF) with respect to existing and proposed preheater feed limits. These issues will be addressed in this section.

Steel in Tires - A typical analysis of WTDF includes:

Weight	20 pounds per tire (typical)
Ash	8.5 percent (excluding steel)
Steel	10.0 percent
Mercury	0.04 ppm
Heating Value	13,950 BTU/pound (including steel)

At a maximum requested WTDF feed rate of 60 mmBTU per hour (20 percent of 300 mmBTU per hour), the mass feed rate of WTDF will be approximately 2.15 tons per hour; or approximately 215 tires per hour. This will result in approximately 430 pounds per hour of steel being introduced to the kiln along with the raw feed. The steel will constitute approximately 0.14 percent of the preheater feed at the average preheater feed rate of 150 tons per hour. All of this steel (iron) will be incorporated in the clinker produced in the kiln. The addition of this iron source will require a slight adjustment (reduction) in the amount of iron (mill scale) blended into the raw materials entering the raw mill.

Ash Content of Fuels - The ash content of WTDF is approximately 8.5 percent while the ash content of coal of approximately 10.6 percent. If WTDF supplies 20 percent of the heat input to the kiln system, the difference in the ash contents of coal and WTDF will result in approximately 150 lbs per hour less ash (when WTDF is fired). This difference represents approximately 0.05 percent of the preheater feed; and insignificant and immeasurable difference.

5.2.6 Fate of Recycled Cement Kiln Dust

This information on the recycling of kiln dust is in response to a question previously raised by the Department. Information in Attachment 6 describes the fate of recycled kiln dust and includes a flow diagram showing how this dust is handled.

The kiln dust re-circulation systems are the same for both kilns. The dust is normally returned to the kiln feed bin where it mixes with raw feed from the blend silo. From the kiln feed bin, the raw feed and re-circulated kiln dust enter the POLDOS which pneumatically transfers the material to the preheater.

Alternatively, the recycled dust is returned to the blend silo where it is mixed with raw feed from the raw mill. From the blend silo, the raw feed and recycled dust enter the kiln feed bin, pass through the POLDOS and are introduced to the preheater.

In either case, the recycled kiln dust is a fraction of the total measured preheater feed. The use of WTDF (the ash and steel content thereof) will have no impact on the measured preheater feed.

Table 5-1

Past Actual and Future Potential CO Emissions (tpy)
Kiln No. 2
Cemex Cement, Inc.
Brooksville (Florida) Plant

Reporting Year	Hours of Operation (hr/yr) (1)	Actual CO Emission Rate		Past Actual CO Emissions (tpy)	Future Permitted CO Emissions (tpy)
		(lb/hr) (2)	(tpy) (3)		
1998	7821	107.7	421	---	
1999	7957	156.0	621	---	
2000	8112	176.6	716	716	
2001	7560	169.7	642	642	
2002	6560	165.4	543	---	
Avg.				679 (4)	778 (5) (6)

(1) From AOR
(2) From annual compliance test; reported to FDEP
(3) Annual Emissions (tpy) = CO(lb/hr) x (hr/yr) / (2000 lb/ton)
(4) Average of the two highest annual emission rates
(5) 778 tpy = Past Actual Emissions (679 typ) + 99 tpy
(6) 778 tpy is equivalent to 177.6 lb/hr with an operating factor of 8760 hr/yr and to an emission factor of 1.18 lb CO/ton of preheater feed (@150 tph preheater feed)

Table 5-2
Currently Permitted Emission Limits
Kiln No. 2
Cemex Cement, Inc.
Brooksville (Florida) Plant

Pollutant	CO Emission Limits (1)		
	(lb/ton preheater feed)	(lb/hr) (2)	(tons per year)
PM/PM10	0.18	27.0	118.3
SO_2	0.10	15.0	65.7
NO_X	1.72	258.0	1130
VOC	0.09	13.6	59.6

(1) Permit 0530010-003-AC
(2) Hourly Emission Limit at the average preheater feed rate of 150 tph. A higher hourly emission rate is permitted at the maximum hourly preheater feed rate of 165 tons per hour.

6.0 AMBIENT AIR QUALITY STANDARDS

The proposed project will result in a decrease in CO emissions and will not effect the emission rates of any other regulated pollutant. Hence, the assurance provided by previous air quality analyses for this facility that neither Ambient Air Quality Standards nor PSD increments will be exceeded are still applicable for providing the same assurance for this project.

7.0 CONCLUSION

This Application and Report include all information required by Rule 62-212.300, F.A.C., *General Preconstruction Review Requirements.* This information demonstrates that the affected Emission Unit and facility will continue to operate in compliance with all applicable requirements of Chapter 403, F.S. and Department Rules referenced herein.

List of Attachments

1. FDEP BACT Determination for Permit 0530010-001-AC and PSD-FL-223, February 22, 1996

2. Description of WTDF Feed System

3. Comparative Emissions Report for Coal Firing and Coal/WTDF Firing Scenarios

4. Excerpts from Three Comparative Emissions Reports for Coal Firing and Coal/WTDF Firing Scenarios

5. Excerpts from EPA Report, *Air Emissions from Scrap Tire Combustion*

6. Description of Kiln Dust Return System

Attachment 1

BACT for Permit 0530010-001-AC
And PSD-FL-223
February 22, 1996

Cemex Cement, Inc
Brooksville Cement Plant
Hernando County, Florida

SOUTHDOWN, INC.
PORTLAND CEMENT FACILITY
PERMIT 0530010-001 AC (PSD-FL-233)
Hernando County

The applicant, Southdown Inc. (SI), owns a portland cement manufacturing facility in Brooksville. It consists of two kilns with a preheater design and two clinker coolers along with raw mill, finish mill, cement and clinker handling equipment, coal handling equipment, silos, and air pollution control equipment. A process description is included in the Technical Evaluation and Preliminary Determination.

Each kiln/cooler is permitted to process 165 tons per hour (TPH) of raw material fed to the preheater, 148 TPH to the kiln, and 90 TPH from the cooler on a 1-hr basis. Each is also permitted to process 145 TPH to the preheater, 130 TPH to the kiln, and 84 TPH from the cooler on a 30-day basis.

A single, large, fabric filter system (baghouse) is already in use to capture particulate matter from each kiln and cooler. Baghouses are also used to limit particulate emissions from other process emission points. All the emission units controlled by baghouses are listed in a Best Available Control Technology (BACT) determination performed for Cement Plant 2 in 1980. Kiln 2 has three (3) additional BACT determinations on file with the Department (1980, 1988 and 1993). No previous BACT determinations have been performed on Kiln 1.

Southdown requested to revise the allowable emissions limits for their kilns and coolers. Specifically, it was requested to increase emissions limits for particulate matter (PM/PM_{10}), carbon monoxide (CO), visible emissions (VE) and volatile organic compounds (VOC) from Kiln 2; decrease PM/PM_{10} (allowable emissions) and increase CO emission limits for Kiln 1; and increase the PM/PM_{10} limits for Coolers 1 and 2. The stated reason is to allow for fluctuations in emission rates during the normal operation.

The project and rule applicability are described in the separate Technical Evaluation and Preliminary Determination. A Best Available Control Technology (BACT) determination pursuant to Prevention of Significant Deterioration (PSD) is required for each pollutant exceeding the significant emission rates in Table 62-212.400-2, F.A.C., "Regulated Air Pollutants Significant Emissions Rates." The increase in emissions will subject Kilns 1 and 2 to PSD review for particulate matter and carbon monoxide and Coolers 1 and 2 to PSD review for particulate matter. The increase in the VOC emission limit for Kiln 2 will not trigger PSD. In this case, the determinations will be for particulate matter (PM/PM_{10}), and carbon monoxide (CO).

Following is the BACT determination proposed by the applicant. These are on the basis of feed to the kiln.

BACT DETERMINATION REQUESTED BY THE APPLICANT - KILN FEED BASIS:

POLLUTANT	EMISSION LIMIT
Particulate Matter (PM/PM_{10}) (kilns)	0.2 lb./ton of dry kiln feed
Particulate Matter (PM/PM_{10})(coolers)	0.1 lb/ton of dry kiln feed
Carbon Monoxide (kilns)	1.30 lb/ton dry kiln feed
Volatile Organic Compounds (Kiln 2)	0.1 lb/ton dry kiln feed
Visible Emissions (Kiln 2)	20 percent

The above limits are expressed in terms of pollutant emitted per ton of material reaching the kiln. Following a review of past permits, the exact process, requirements of the applicable NSPS for cement plants, and discussions with Southdown, the Department will limit only raw material fed to the kiln preheater. This is the most accurate and reliable measure of kiln operating rate in a preheater or precalciner kiln, particularly when there are no bypass streams and when little or no cement kiln dust is wasted. All limits will be expressed in terms of pounds of pollutant per ton of material fed to the kiln preheater ($kiln_{ph}$). Where appropriate, equivalent factors in terms of pounds of pollutant per ton of clinker produced will also be given for reference and comparison with industry or EPA reporting conventions. The above table is therefore adjusted as follows:

BACT DETERMINATION REQUESTED BY THE APPLICANT - PREHEATER BASIS:

POLLUTANT	EMISSION LIMIT
Particulate Matter (PM/PM_{10}) (kilns)	0.18 lb./ton of dry $kiln_{ph}$ feed
Particulate Matter (PM/PM_{10})(coolers)	0.09 lb/ton of dry $kiln_{ph}$ feed
Carbon Monoxide (kilns)	1.17 lb/ton dry $kiln_{ph}$ feed
Volatile Organic Compounds (Kiln 2)	0.09 lb/ton dry $kiln_{ph}$ feed
Visible Emissions (Kiln 2)	20 percent

DATE OF RECEIPT OF A BACT APPLICATION:

February 22, 1996

REVIEW GROUP MEMBERS:
Teresa Heron, and A. A. Linero of the New Source Review Section.

BACT DETERMINATION PROCEDURE:

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

(a) Any Environmental Protection Agency determination of BACT pursuant to Section 169, and any emission limitation contained in 40 CFR Part 60 - Standards of Performance for New Stationary Sources or 40 CFR Part 61 - National Emission Standards for Hazardous Air Pollutants.

(b) All scientific, engineering, and technical material and other information available to the Department.

(c) The emission limiting standards or BACT determination of any other state.

(d) The social and economic impact of the application of such technology.

The EPA currently stresses that BACT should be determined using the "top-down" approach. The first step in this approach is to determine, for the emission unit in question, the most stringent control available for a similar or identical emission unit or emission unit category. If it is shown that this level of control is technically or economically infeasible for the emission unit in question, then the next most stringent level of control is determined and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any substantial or unique technical, environmental, or economic objections.

The air pollutant emissions from this facility can be grouped into categories based upon the control equipment and techniques that are available to control emissions from these emission units. Using this approach, the emissions can be classified as follows:

- Particulate matter from kilns and coolers (PM/PM_{10}, and VE). Controlled generally by add-on particulate collection equipment such as baghouses or electrostatic precipitators.

- Products of combustion and incomplete combustion (e.g., SO_2, NO_x, CO, VOC). Control is largely achieved by good combustion practices and reactions with clinker and raw materials.

o Emissions from materials handling, conveyance, and storage (primarily PM). Controlled generally by fabric filters and reasonable precautions.

Grouping the pollutants in this manner facilitates the BACT analysis because it enables the equipment available to control the type or group of pollutants emitted and the corresponding energy, economic, and environmental impacts to be examined on a common basis. Although all of the pollutants addressed in the BACT analysis may be subject to a specific emission limiting standard as a result of PSD review, the control of "non-regulated" air pollutants is considered in imposing a more stringent BACT limit on a "regulated" pollutant (i.e., PM, SO_2, H_2SO_4, fluorides, etc.), if a reduction in "non-regulated" air pollutants can be directly attributed to the control device selected as BACT for the abatement of the "regulated" pollutants.

BACT ANALYSIS

PARTICULATE MATTER (PM/PM_{10})

Particulate Matter is generated by the various physical and chemical processes at a cement manufacturing plant. Sources of particulate matter at cement plants include (1) quarrying and crushing, (2) raw material storage, (3) grinding and blending, 4) clinker production, 5) finish grinding, and 6) packaging and loading. Additional sources of PM are raw material storage piles, conveyers, storage silos, and unloading facilities.

The largest emission source of PM within cement plants is the pyroprocessing system that includes the kiln and clinker cooler exhaust stacks (in this case, common kiln/cooler stack). Emissions from kilns are affected by several factors, including differences in convective patterns, material movement patterns, burner locations and insertion lengths, heat transfer mechanisms, and the type of clinker cooler that supplies secondary air to the kiln for combustion. Typically, dust from the pollution control equipment servicing the kiln and cooler is collected and recycled into the kiln and thus incorporated into the clinker. Southdown has stated that the great majority of the cement kiln dust (CKD) captured in the baghouse is returned to the pyroprocessing system as raw material.

Common control devices for stack gases include settling chambers, inertial separators, impingement separators, wet scrubbers, fabric filters, and electrostatic precipitators. Fabric filters (baghouses) and electrostatic precipitator (ESPs) are generally considered equivalent for particulate control. Both types of devices can achieve removal efficiencies of over 99 percent. ESPs and baghouses are used extensively as control devices at cement plants. ESPs are generally specified for kiln and clinker cooler exhaust gases because of their ability to operate effectively at varying temperatures. Baghouses are also used at various facilities for particulate control from kilns and coolers. Both types of control equipment provide for the recovery/recycling of collected dust back into the process stream. Baghouses are also used to control particulate emissions from most other material processing operations at cement plants.

Common controls to limit particulate emissions from fugitive sources (such as roadways, stockpiles, and material processing and conveying equipment) include wet suppression, sweeping, application of

surfactants, paving of roads and covering of stockpiles to reduce wind erosion. Wet suppression of fugitive particulate emissions is considered as BACT for most material handling operations and unpaved roads. Dust from stockpiles can be minimized by relatively high material moisture content with additional water spraying as necessary.
A review of the BACT Clearinghouse shows that baghouses and ESPs are widely used to control particulate matter from process emission units at cement plants. They are commonly accepted as BACT. This facility, particulate matter sources are controlled by baghouses.

Southdown has proposed to change the allowable emission rates for particulate matter (PM/PM_{10}) from Kilns 1 and. 2 and Clinker Coolers 1 and 2 to allow for the fluctuations in emission rates during normal operating conditions. The permitted PM/PM_{10} limits would be increased for Kiln 2 from 13.5 pounds per hour (lb/hr) to 26.0 lb/hr, while PM/PM_{10} emissions for Kiln 1 are proposed to be decreased from 39.0 lb/hr (allowable emissions) to 26.0 lb/hr. The proposed limit for the two clinker coolers would be increased from 7.13 lb/hr (kiln 1) and 5.0 lb/hr (kiln 2) to 13.0 lb/hr. The proposed kiln particulate emission limits are equivalent to 0.18 pounds per ton of dry feed to each kiln preheater (lb/ton $feed_{ph}$). This is a standard lower than the New Source Performance Standard NSPS limit of 0.3 pounds per ton of dry feed (kiln). For the coolers the proposed limits are equivalent to 0.09 lb/ton $feed_{ph}$ which is less than the applicable NSPS limit.

Southdown also requested to increase VE (which is largely linked to particulate emissions) from 10 percent for Kiln 2 to 20 percent.

PRODUCTS OF COMBUSTION AND INCOMPLETE COMBUSTION

Carbon Monoxide and Nitrogen Oxides

Carbon monoxide (CO) is a pollutant formed by the incomplete combustion (oxidation) of carbon containing compounds in the cement kiln fuel and during the transformation of cement raw materials to cement clinker. When insufficient oxygen is provided, more CO and less CO_2 are formed than under excess air conditions. Substantial quantities of CO and CO_2 are also generated through calcining of limestone and other calcareous material. This calcining process thermally decomposes $CaCO_3$ to CaO and CO_2. The calcining of limestone in the cement manufacturing process liberates large amounts of CO_2, which is available for dissociation into CO.

Flyash, a constituent of the raw feed mix, contains unburnt carbon which can vary in concentration depending on the source of the flyash. As the raw feeds travels down the preheater tower, most of the carbon present in the flyash is burned off. However, some of it is emitted as carbon monoxide. This contributes to fluctuations in carbon monoxide emissions.

Although this specific application does not necessitate a PSD review and BACT determination for nitrogen oxides (NO_x), past changes in production rates in Kiln 1 presumably caused concurrent increases in this pollutant. Unless specific measures were taken at the time to insure NO_x emissions increases were kept at less than significant levels, such a review and determination would have been required. The Department is using the opportunity to resolve this outstanding issue by setting a non-BACT emission limit which can be reasonably assumed to be lower than emissions prior to the changes which were not subjected to appropriate review. Southdown has agreed that this limit should be no greater than 275 lb/hr (1.9 lb NO_x/ton $feed_{ph}$).

Southdown is not proposing any changes for Kiln 2 NO_x emissions. Currently, the emission level of 250 lb NO_x/hr is being met (equivalent to 1.72 lb NO_x/ton $feed_{ph}$)

The generation of CO and NO_x is inversely related to that of NO_x and is linked to the oxygen level that is present in the kiln system. As the oxygen level increases, the formation of NO_x increases and the formation of CO decreases. Conversely, when the oxygen level decreases, the formation of NO_x decreases and the formation of CO increases. Southdown will meet CO and NO_x emission levels by controlling excess oxygen in the kiln to a level between one and one-half to three percent excess oxygen. A continuous CO process monitor will assist in the control of the CO content in the kiln.

Emissions of CO can potentially be reduced at portland cement plants through utilization of proper combustion practices to maximize the oxidation of CO to CO_2 and reducing the quantity of CO in the flue gas stream (flue gas control). The high temperatures and control of excess air and fuel, typically results in simultaneous optimization for CO and NO_x. The applicant proposes proper combustion practices as BACT to control emissions of CO from this plant. A review of the BACT Clearinghouse reveals that for cement plants, BACT for CO is proper combustion practices.

The applicant proposes a CO limit of 1.17 lb/ton of $feed_{ph}$ and good combustion practice as BACT for CO for each Kiln. This represents an emission increases for Kiln 1 from 57.7 lb/hr to 169.9 lb/hr and for Kiln 2 from 64.0 to 169.9 lb/hr respectively. This increase is proposed in order to allow for more representative on a year-round basis compared with what is achievable during an annual test. It also accounts for fluctuations due to normal process oscillations and varying characteristics of raw materials and fuels.

Volatile Organic Compounds

VOC is also a pollutant formed due to incomplete combustion of fuel and organic material in the feed material to the kiln system. Limestone contains very low levels of VOCs. An additional source of VOC is oil from mill scale which is sometimes used as a raw material for its iron.

Southdown will reduce the VOC emissions by controlling the temperatures in the kiln system. In the kiln, the feed material will reach about 2700 degrees Fahrenheit. The temperature of the gases in the kiln will reach between 3700 to 3800 degrees Fahrenheit. At these high temperatures, virtually all VOCs will be consumed or destroyed regardless of their source (limestone, mill scale, coal, fuel oil, etc.). Clinker production requires certain temperatures, residence time, and turbulence within the kiln. These factors are sufficient to ensure the destruction of almost all VOCs at cement plants.

Emissions of VOC can also be controlled by add-on control devices, by the mechanisms of adsorption, absorption, or incineration (afterburning). Incineration processes include flame incineration, thermal incineration, and catalytic incineration. No add-on controls for VOC have been demonstrated for cement plants.

A review of the BACT Clearinghouse reveals that for cement plants, BACT for VOCs is proper combustion practices. The applicant estimates low emissions of VOC such that the kilns will not be subject to BACT for this pollutant.

For VOC, the applicant has estimated 13.0 lb/hr (an increase of 8.0 lb/hr) for Kiln 2. The applicant is utilizing good combustion practices for both kilns to reduce VOCs emissions.

BACT DETERMINATION RATIONALE:

The existing BACT VE limit of 10 percent for Kiln 2 is more stringent than the NSPS for Portland Cement Plant, 40 CFR 60, Subpart F for Kiln 2. It is also consistent with various recent BACT determinations made throughout Florida. There is no good basis for considering the higher VE limit proposed by Southdown than the one already established. Although Kiln 1 has a VE limit of 20 percent, the kilns are operated similarly and will have identical PM limits. The efforts to maintain the lower Opacity limit at Kiln 2 will probably result in fairly low opacity from Kiln 1.

BACT for PM (0.2 lb/ton kiln feed) from Kilns 1 and 2 proposed by Southdown is more stringent than the NSPS for Portland Cement Plants, 40 CFR 60, Subpart F. The basis is the BACT determinations made by the Department for Florida Rock Industries and Florida Crushed Stone and the original BACT determination for Southdown (then FM&M). The Department accepts the applicant's proposed limit (as corrected to 0.18 lb/ton $kiln_{ph}$ feed) for both Kiln 1 and 2.

BACT for PM (0.1 lb/ton $kiln_{ph}$) feed from Coolers 1 and 2 proposed by Southdown is equal to that given in the NSPS for Portland Cement Plants. Southdown was unable to achieve lower limits set in the past as a result of permit conditions they agreed to comply with in order to avoid PSD/BACT. The basis is also the BACT determinations made by the Department for Florida Rock Industries and Florida Crushed Stone. The Department accepts the applicant's proposed limit (corrected to 0.09 lb/ton $kiln_{ph}$ feed) for both Cooler 1 and 2 with the understanding that it is being met at all times rather than just during annual emission tests.

During this review, the Department discovered that, miscellaneous PM sources (other than the kilns and coolers) controlled by baghouses were limited in the original permit (July 1, 1980) for Cement Plant 2 to "0" percent Opacity. These values have been changed in subsequent operating permit reviews, but the original enforceable permit was not changed. Since a 0 percent Opacity limitation is not generally feasible to achieve or demonstrate, the Department is rectifying the value in this construction permit. For each small baghouse associated with Cement Plant 2, the exhaust gases must not exhibit greater than 5 percent opacity. The Department has determined that 5 percent opacity is BACT and is attainable with a baghouse. This is consistent with recent BACT determinations.

BACT for CO was proposed by Southdown to be 1.17 lb/ton $kiln_{ph}$ feed (2.0 lb/ton clinker at a clinker production rate of 84 TPH) for both Kilns. This value will provide sufficient flexibility to minimize NO_x and SO_2 emissions. The value is with the Department's recent BACT determination to Florida Crushed Stone (FCS) with a CO limit of 2.0 lb/ton clinker. However the Department encourages Southdown to continue to be judicious in selecting sources of coal ash. Some of the local power companies are trying to recover the unburned carbon in the coal ash by reburning it, taking advantage of the heat content, and producing a more salable coal ash for customers such as the cement industry. If Southdown revises its specifications and accepts poor quality flyash, it can be counter-productive for this pollution prevention effort affecting both industries.

No BACT determination was required for VOC for either Kiln. The Department accepts the limit requested by Southdown which will result in annual emissions less than the PSD threshold. It will allow Southdown sufficient flexibility in control for all combustion products.

No BACT determination was requested or required for metals such as mercury, beryllium, lead arsenic, fluorides and sulfuric acid mist (PSD pollutants). Original emission estimates submitted for previous applications provided assurance that emissions of these pollutants are less than the PSD significant threshold values.

No new BACT determinations were requested for NO_x and SO_2. The actual BACT emission levels of 250 lb NO_x/hr and 15 lb SO_2/hr for Kiln 2 are being met. These are equal to 1.72 lb NO_x/ton $kiln_{ph}$ feed and 0.10 lb SO_2/ton $kiln_{ph}$ feed. For comparison with industry conventions, these values are equal to 2.98 lb NO_x/ton clinker and 0.18 lb SO_2/ton clinker at a production rate of 84 TPH. A new non-BACT emission limit of 275 lb NO_x/hr (equal to 1.9 lb/ton $kiln_{ph}$ feed or 3.27 lb/ton of clinker at a production rate of 84 TPH) is being set for Kiln 2. Kiln 1 also meets the same SO_2 limit as Kiln 2.

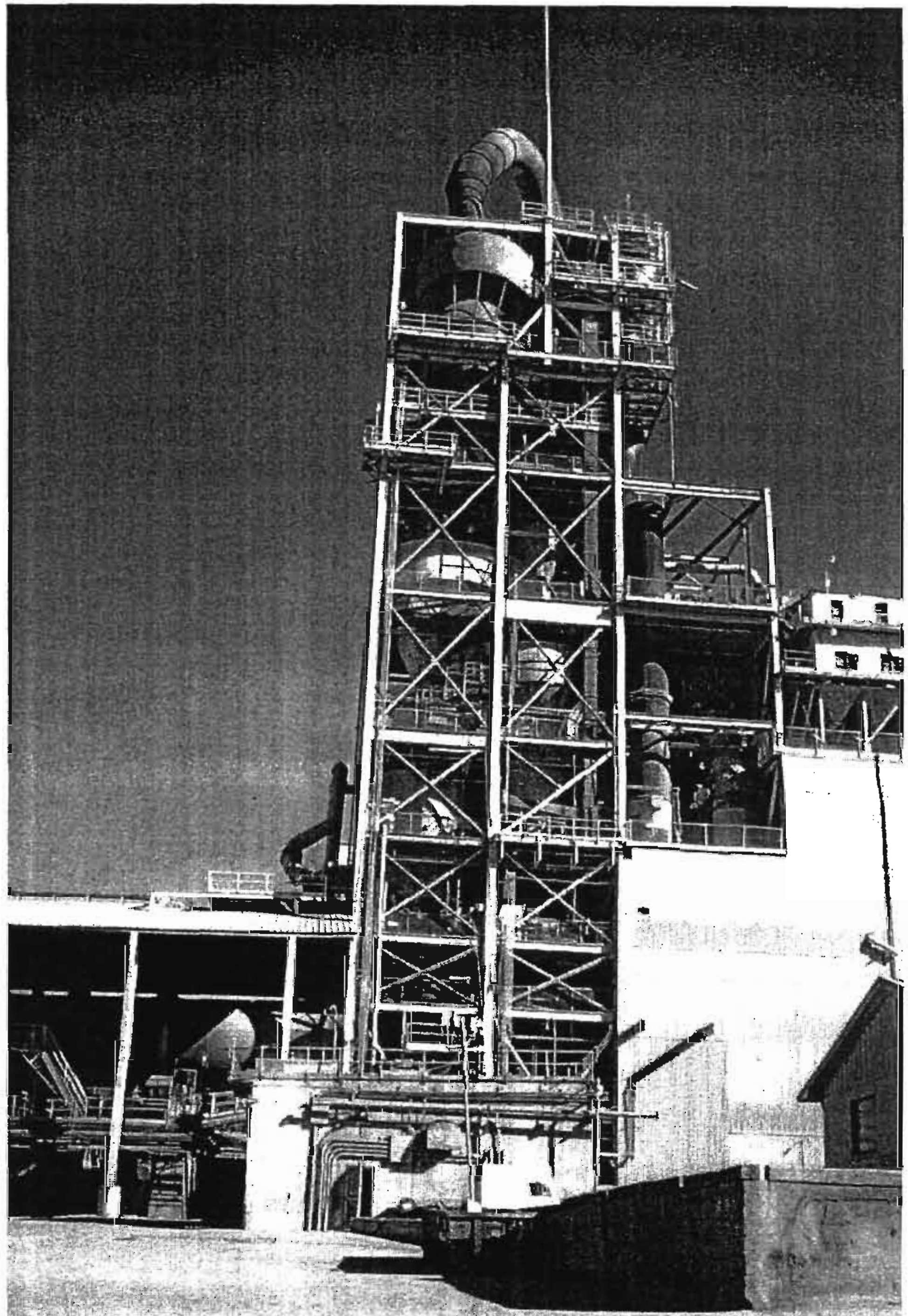
Attachment 2

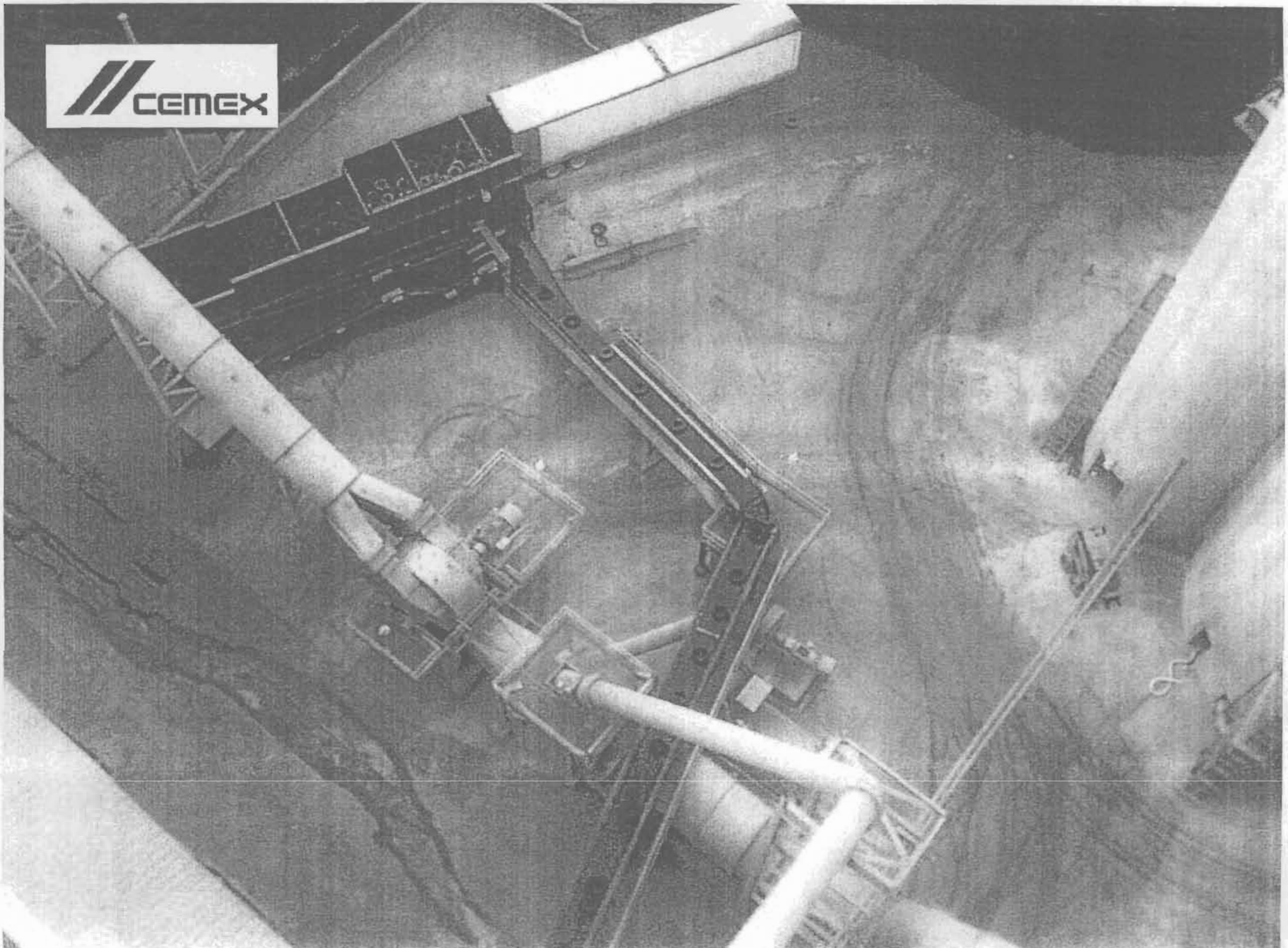
Description of WTDF Feed System

Cemex Cement, Inc
Brooksville Cement Plant
Hernando County, Florida

CEMEX
Clinchfield, Georgia
Plant

CEMEX

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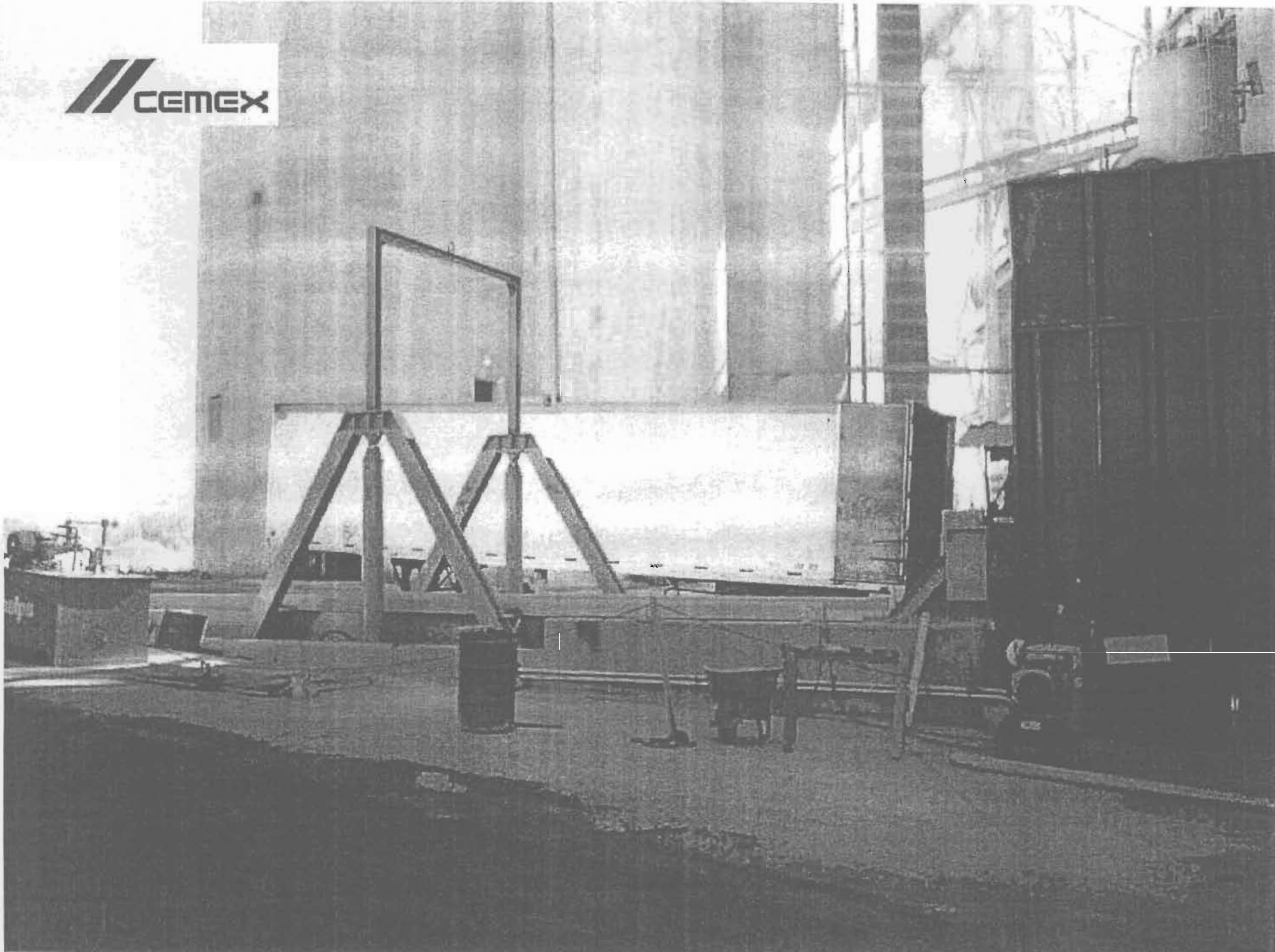


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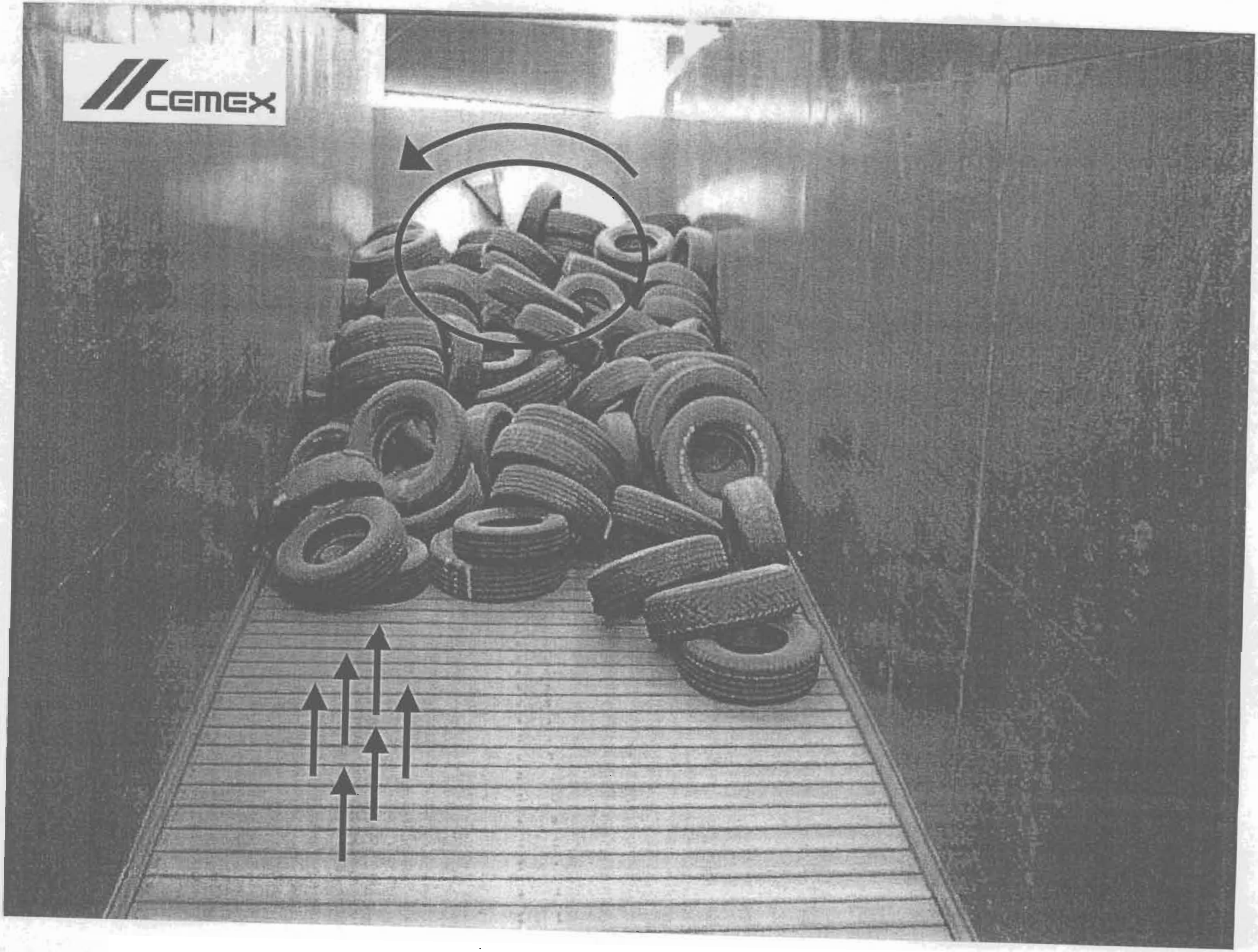


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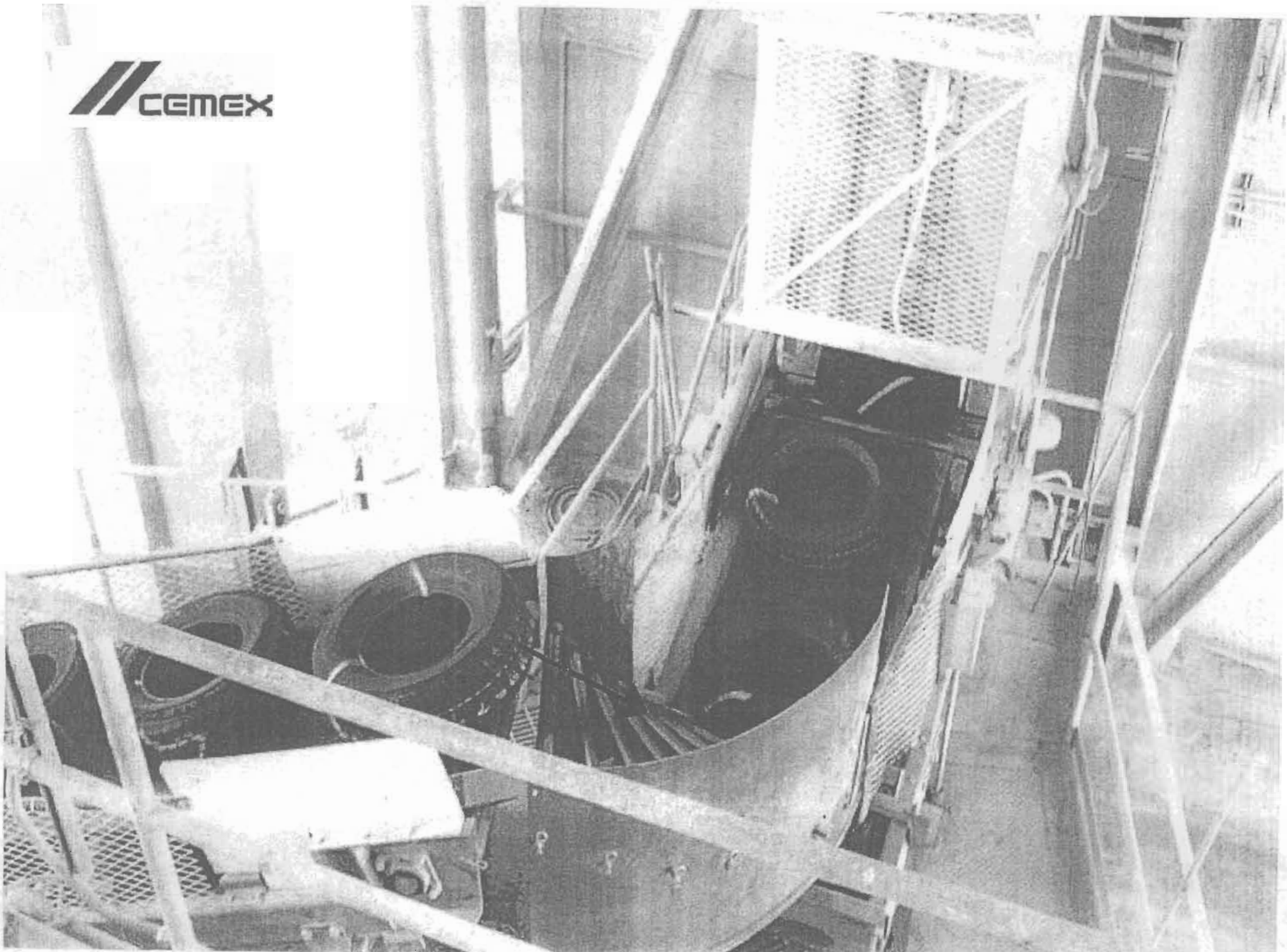

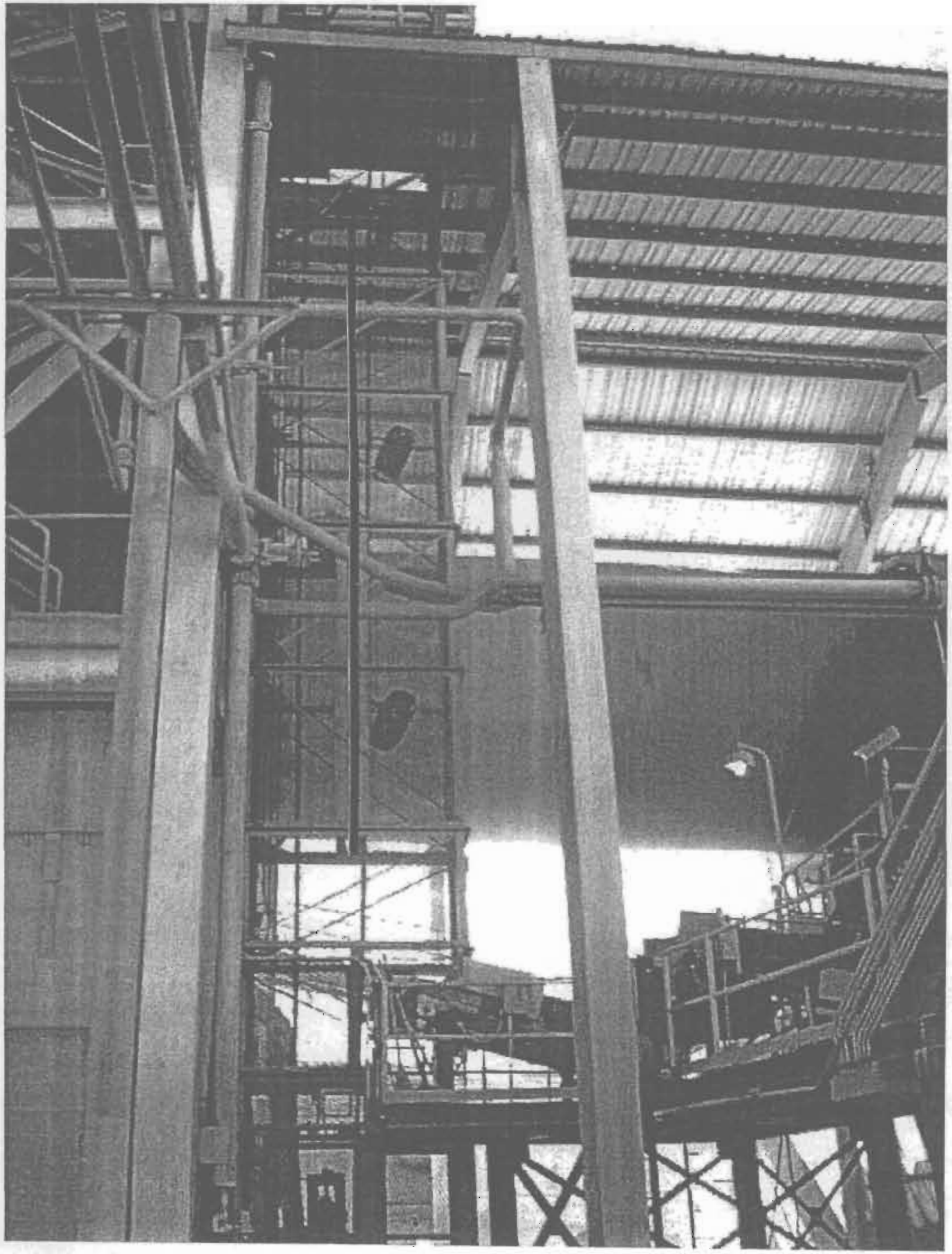

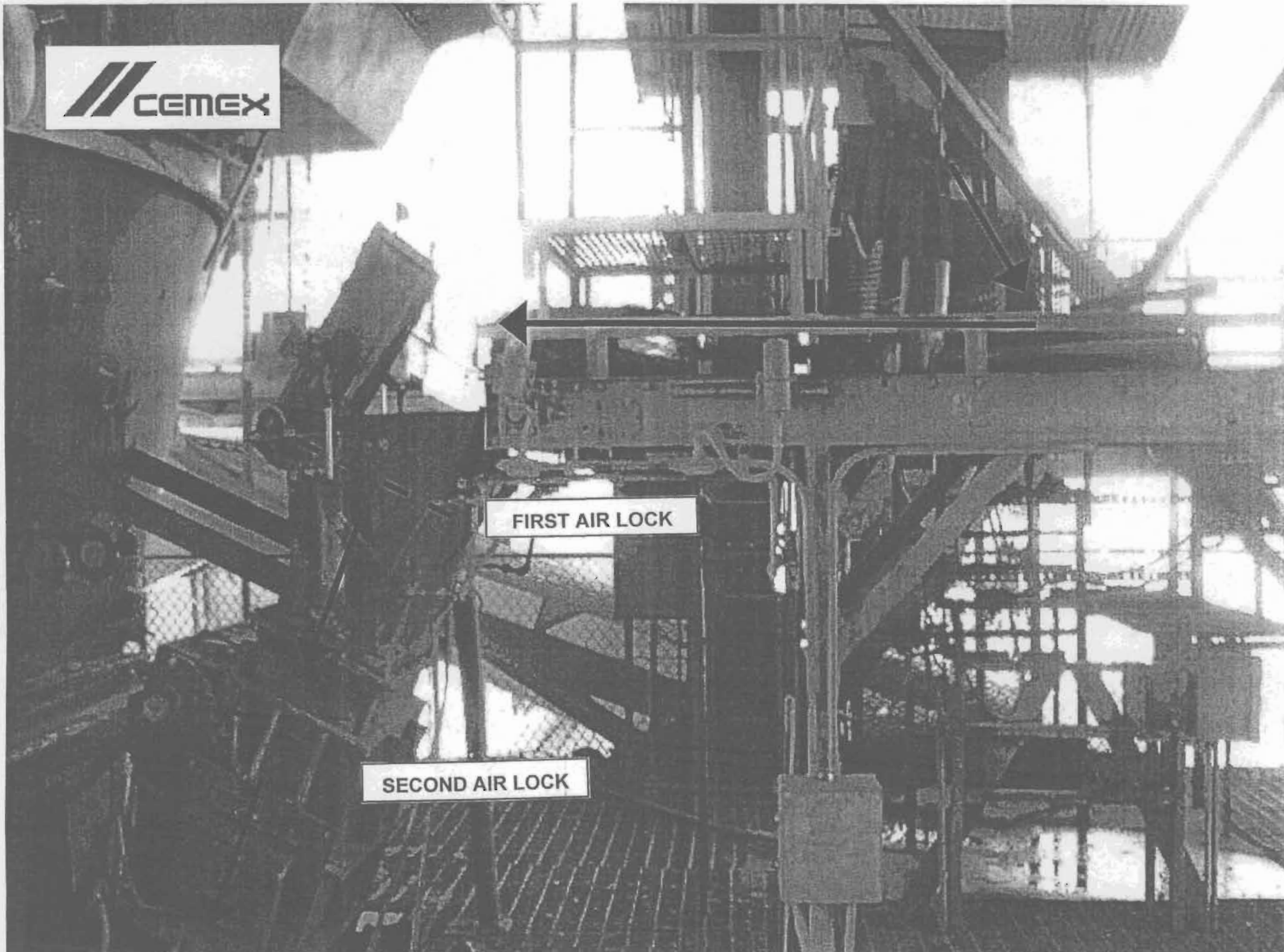
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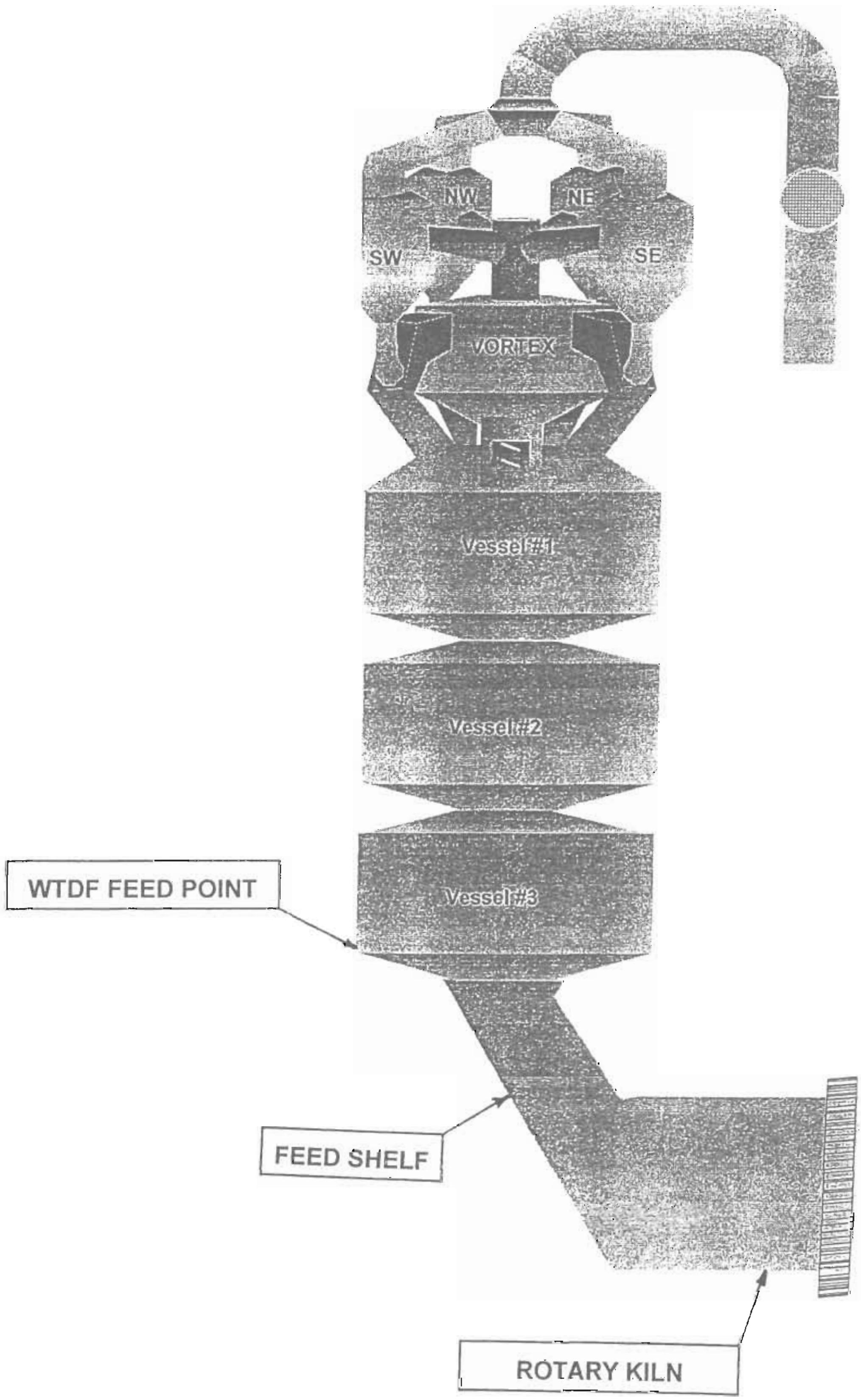

Attachment 3

Comparative Emissions Report For Coal Firing and Coal/WTDF Firing Scenarios

Cemex Cement, Inc
Brooksville Cement Plant
Hernando County, Florida

COMPARISON OF PARTICULATE MATTER, SULFUR DIOXIDE, TOTAL HYDROCARBONS, CARBON MONOXIDE, NITROGEN OXIDES, HYDROGEN CHLORIDE, SPECIATED VOLATILE ORGANICS, METALS AND DIOXINS/FURANS EMISSION MEASUREMENTS AND OPACITIES OF EMISSIONS UNDER BASELINE AND COAL/TDF FIRING CONDITIONS

KILN NO.1

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA

MAY 4-5, 1993
AND
JUNE 8-9,1993

KOOGLER & ASSOCIATES
ENVIRONMENTAL SERVICES
4014 N.W. 13TH STREET
GAINESVILLE, FL 32609
(904) 377-5822

KOOGLER & ASSOCIATES

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KOOGLER & ASSOCIATES

1.0 INTRODUCTION

Southdown, Incorporated, doing business as Florida Mining & Materials (FM&M), operates two dry process cement kilns at the Brooksville facility located south of Highway 98 in Hernando County, Florida. On February 5, 1993, FM&M received approval from the Florida Department of Environmental Protection (FDEP) to conduct tests on the No. 1 cement kiln to evaluate the effect of burning a combination of coal and whole tire derived fuel (TDF).

Kiln No. 1 is presently operating under Permit A027-213207. The permit limits the feed rate to the kiln to 130 tons per hour (corresponding to a preheater feed rate of 145 tons per hour), limits the clinker production rate to 79.6 tons per hour and limits the heat input to the kiln to 300 MMBTU per hour. The permit also limits the emission rate of particulate matter from the kiln to 39.0 pounds per hour and limits the opacity of emissions to 20 percent, maximum six-minute average.

The primary heat input to Kiln No. 1 is pulverized coal. The amendment to Permit A027-213207, issued on February 5, 1993, allows FM&M to test using TDF to provide up to 20 percent of the heat input to the kiln. The TDF is fed through a double air lock feeder at the base of the preheater (near the point where feed material enters the kiln).

The TDF test was scheduled for a 43-day period; an initial 30-day period when TDF would be used to provide up to 20 percent of the heat input to the No. 1 kiln system, a four-day period for the plant to stabilize on coal, a two-day period for baseline testing (100 percent coal), a five-day period for the plant to stabilize on coal/TDF and a two-day test period with coal providing approximately 80 percent of the heat input and TDF providing approximately 20 percent of the heat input. The time periods proposed were operating days as opposed to calendar days.

The 30-day period of TDF firing began on March 29, 1993. The baseline tests were conducted on May 4-5, 1993 and the coal/TDF tests were conducted on June 8-9, 1993. Between the baseline test period (May 4-5, 1993) and the coal/TDF test period (June 8-9, 1993), the No. 1 kiln system was shut down for repair and maintenance. The extent of the repair and maintenance was documented in a separate transmittal to FDEP and Hernando County. The documentation demonstrated that the repairs had no effect on kiln operations.

During both test periods, the test protocol required the monitoring of certain plant operating conditions and the measurement of emission rates of various constituents from the Kiln No. 1 stack. The plant operating conditions included the preheater feed rate, the fuel feed rate (coal and TDF), the temperatures at the feed end of the kiln and at the preheater exit, and the oxygen concentration at the feed end of the kiln. Additionally, the raw material fed into the kiln, the clinker and the fuel were to be analyzed for specified constituents.

Emission measurements were to be made for particulate matter, certain metals, hydrogen chloride, nitrogen oxides, sulfur dioxide, carbon monoxide, total VOCs, speciated VOCs, dioxins and furans. Additionally, the stack gas characteristics were to be measured, including the carbon dioxide and oxygen concentration of the stack gas, and visible emission observations were to be conducted.

In the following sections, the results of the measurements and operating rates under baseline and coal/TDF conditions are compared.

2.0 PLANT OPERATING CONDITIONS

The plant operating conditions that were to be monitored during the two test periods were documented in an FDEP-approved Test Protocol. Plant operating parameters monitored during the baseline and coal/TDF periods are summarized in Tables 1 and 2. A comparison of these data demonstrates that Kiln No. 1 was operating under similar conditions during both test periods. The feed rates to the preheater and other kiln conditions were within the normal range of plant operations during the two test periods and the preheater feed rates were near the maximum permitted rate of 145 tons per hour. During the baseline period, 100 percent of the heat input to Kiln No. 1 (212 MMBTU/hr) was provided with coal. During the coal/TDF test period, coal provided about 78.3 percent of the heat input (182.8 MMBTU/hr) and TDF provided the remaining 21.7 percent (50.8 MMBTU/hr).

Clinker, raw feed and fuel analyses for the baseline and TDF test periods are included in Tables 3, 4, 5 and 6. These data demonstrate that there are no significant differences in the feed, clinker or fuel during the two test periods; other than variations within the normal day-to-day range of these parameters.

TABLE 1
PLANT OPERATING DATA
FLORIDA MINING & MATERIALS
KILN # I - BASELINE CONDITIONS

BROOKSVILLE, FLORIDA
MAY 4 AND 5, 1993

May 4, 1993

Time	Kiln Feed (tph)	Coal Feed (tph)	Coal Heat Input (MMBTU/hr)	Kiln Exit Temp. (oF)	Preheater Exit Temp. (oF)	Kiln Exit O2 (%)
0900	144.7	8.66	220.6	1600	750	2.2
1100	142.7	8.43	214.8	1650	760	0.6
1300	147.8	8.55	217.8	1620	750	0.1
1500	139.0	8.45	215.3	NR	NR	NR
1700	139.0	8.19	208.6	1610	750	1.5
1900	139.0	8.65	220.4	1600	740	2.2
2100	139.0	7.92	201.8	1610	750	2.0
Avg	141.6	8.41	214.18	1615	750	1.4

May 5, 1993

Time	Kiln Feed (tph)	Coal Feed (tph)	Coal Heat Input (MMBTU/hr)	Kiln Exit Temp. (oF)	Preheater Exit Temp. (oF)	Kiln Exit O2 (%)
0900	104.8	8.32	208.9	1720	820	1.3
1100	141.5	7.08	177.8	1650	760	1.4
1300	146.7	9.29	233.3	1640	760	0.6
1500	145.7	8.67	217.7	NR	NR	NR
1700	145.7	8.50	213.4	1625	750	1.0
1900	145.7	8.31	208.7	1620	750	0.8
2100	145.7	8.31	208.7	1640	760	0.2
Avg	139.4	8.35	209.8	1649	767	0.9

NR - Not reported in control room log.

TABLE 2
PLANT OPERATING DATA
FLORIDA MINING & MATERIALS
KILN # 1 - COAL/TDF CONDITIONS

BROOKSVILLE, FLORIDA
JUNE 8 AND 9, 1993

June 8, 1993

Time	Kiln Feed (tph)	Coal Feed (tph)	Coal Heat Input MMBTU/hr	TDF Feed (tph)	TDF Heat Input MMBTU/hr	Kiln Exit Temp. (oF)	Preheat. Exit Temp. (oF)	Kiln Exit 02 (%)
0900	138.5	7.07	174.5	1.65	53.46	1610	760	5.0+
1100	101.9	7.07	174.5	1.64	53.14	1800	770	3.2
1300	142.6	7.07	174.5	1.34	43.42	1760	760	3.5
1500	133.3	7.39	182.4	1.60	51.84	NR	NR	NR
1700	133.3	7.39	182.4	1.64	53.14	1740	735	2.8
1900	136.3	7.39	182.4	1.64	53.14	1730	720	4.2
2100	140.3	7.39	182.4	1.72	55.73	1630	750	4.5
Avg	132.3	7.25	179.0	1.60	51.98	1712	749	3.9

June 9, 1993

Time	Kiln Feed (tph)	Coal Feed (tph)	Coal Heat Input MMBTU/hr	TDF Feed (tph)	TDF Heat Input MMBTU/hr	Kiln Exit Temp. (oF)	Preheat. Exit Temp. (oF)	Kiln Exit 02 (%)
0900	142.4	7.70	185.3	1.37	44.39	1720	760	2.3
1100	142.4	7.70	185.3	1.52	49.25	1800	770	2.4
1300	142.4	7.70	185.3	1.56	50.55	1820	760	3.1
1500	140.2	7.80	187.7	1.46	47.31	NR	NR	NR
1700	140.2	7.80	187.7	1.62	52.49	1760	755	2.6
1900	140.2	7.80	187.7	1.61	52.17	1780	765	3.4
2100	140.2	7.80	187.7	1.58	51.20	1740	760	3.2
Avg	141.1	7.76	186.7	1.53	49.62	1770	762	2.8

NR - Not reported in control room log.

TABLE 3
KILN FEED AND CLINKER ANALYSIS
FLORIDA MINING & MATERIALS
KILN # 1 - BASELINE CONDITIONS

BROOKSVILLE, FLORIDA
MAY 4 AND 5, 1993

Element	KILN FEED - 5/4/93 Conc. (%)		CLINKER - 5/4/93 Conc. (%)	
SiO2	20.42	C3S = 81.76	21.64	C3S = 62.24
Al2O3	4.90	C2S = -3.14	5.17	C2S = 15.10
Fe2O3	4.06	C3A = 6.12	4.35	C3A = 6.33
CaO	67.72	C4AF = 12.34	66.12	C4AF = 13.24
MgO	0.70	S/R = 2.28	0.68	S/R = 2.27
SO3	0.01	A/F = 1.21	0.52	A/F = 1.19
Na2O	0.10	LP = 26.49	0.15	LP = 26.50
K2O	0.10	LSF = 101.56	0.62	LSF = 93.58
	-------	Na2O Equiv = 0.16	------	Na2O Equiv = 0.56
Total	98.01	Burn.F = 121.68	99.25	Burn.F = 111.96
		Burn.I = 4.43		Burn.I = 3.18
		Factor = 0.9856		Factor = 1.0000

Element	KILN FEED - 5/5/93 Conc. (%)		CLINKER - 5/5/93 Conc. (%)	
SiO2	19.32	C3S = 94.66	21.53	C3S = 64.43
Al2O3	4.86	C2S = -16.02	5.26	C2S = 13.13
Fe2O3	4.09	C3A = 5.96	4.42	C3A = 6.47
CaO	68.79	C4AF = 12.45	66.58	C4AF = 13.44
MgO	0.74	S/R = 2.16	0.73	S/R = 2.23
SO3	0.01	A/F = 1.19	0.45	A/F = 1.19
Na2O	0.10	LP = 26.48	0.15	LP = 26.87
K2O	0.09	LSF = 108.25	0.52	LSF = 94.41
	------	Na2O Equiv = 0.16	------	Na2O Equiv = 0.49
Total	98.00	Burn.F = 127.05	99.64	Burn.F = 112.47
		Burn.I = 5.14		Burn.I = 3.24
		Factor = 0.9837		Factor = 1.0000

TABLE 4
KILN FEED AND CLINKER ANALYSIS
FLORIDA MINING & MATERIALS
KILN # 1 - COAL/TDF CONDITIONS

BROOKSVILLE, FLORIDA
JUNE 8 AND 9, 1993

Element	KILN FEED - 6/8/93 Conc. (%)		CLINKER - 6/8/93 Conc. (%)	
SiO2	20.23	C3S = 81.48	20.88	C3S = 64.64
Al2O3	5.05	C2S = -3.47	5.37	C2S = 11.09
Fe2O3	4.20	C3A = 6.27	4.79	C3A = 6.13
CaO	67.61	C4AF = 12.79	65.70	C4AF = 14.56
MgO	0.71	S/R = 2.19	0.70	S/R = 2.06
SO3	0.03	A/F = 1.20	0.44	A/F = 1.12
Na2O	0.10	LP = 25.24	0.15	LP = 27.94
K2O	0.07	LSF = 101.75	0.49	LSF = 95.24
	------	Na2O Equiv = 0.15	------	Na2O Equiv = 0.47
Total	98.00	Burn.F = 120.97	98.52	Burn.F = 111.79
		Burn.I = 4.28		Burn.I = 3.12
		Factor = 0.9864		Factor = 1.0000

Element	KILN FEED - 6/9/93 Conc. (%)		CLINKER - 6/9/93 Conc. (%)	
SiO2	19.26	C3S = 92.45	20.78	C3S = 66.49
Al2O3	5.08	C2S = -14.52	5.26	C2S = 9.40
Fe2O3	4.23	C3A = 6.30	4.78	C3A = 5.84
CaO	68.53	C4AF = 12.87	65.82	C4AF = 14.56
MgO	0.72	S/R = 2.07	0.69	S/R = 2.07
SO3	0.00	A/F = 1.20	0.50	A/F = 1.10
Na2O	0.10	LP = 24.41	0.15	LP = 27.64
K2O	0.08	LSF = 107.44	0.53	LSF = 96.06
	------	Na2O Equiv = 0.15	------	Na2O Equiv = 0.50
Total	98.00	Burn.F = 125.43	98.51	Burn.F = 112.64
		Burn.I = 4.82		Burn.I = 3.26
		Factor = 0.9892		Factor = 1.0000

TABLE 5
FUEL ULTIMATE ANALYSIS
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILE, FLORIDA

May 4-5, 1993
AND
JUNE 8-9, 1993

Parameter	UNIT	BASELINE COMPOSITE COAL 5/4-5/93	COAL/TDF COMPOSITE COAL 6/8-9/93	COAL/TDF COMPOSITE TDF 6/8-9/93
Moisture	(%)	6.34	7.75	0.47
Carbon	(%)	70.5	67.77	74.35
Hydrogen	(%)	4.69	4.55	7.08
Nitrogen	(%)	1.39	1.24	0.41
Sulfur	(%)	0.83	0.96	1.02
Ash	(%)	9.91	11.28	9.40
Oxygen	(%)	6.36	6.45	0.73
Heating Value	(Btu/lb)	12646	12186	15141

All parameters reported AS RECEIVED

TABLE 6
KILN FEED, COAL AND CLINKER METAL ANALYSES
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIAL
BROOKSVILLE, FLORIDA

MAY 4-5, 1993
AND
JUNE 8-9, 1993

Metal	UNIT	BASELINE COMPOSITE KILN FEED 5/4-5/93	COAL/TDF COMPOSITE KILN FEED 6/8-9/93	BASELINE COMPOSITE COAL 5/4-5/93	COAL/TDF COMPOSITE COAL 6/8-9/93	BASELINE COMPOSITE CLINKER 5/4-5/93	COAL/TDF COMPOSITE CLINKER 6/8-9/93	COAL/TDF COMPOSITE TIRE 6/8-9/93
Arsenic	(ug/g)	16	25	6	16	29	34	<1
Chromium	(ug/g)	35	47	6	6	73	97	5
Lead	(ug/g)	66	66	8	4	83	100	5
Mercury	(ug/g)	0.24	0.24	0.10	0.18	<0.02	<0.02	0.04
Zinc	(ug/g)	38	59	10	6	92	82	4400
Chlorine	(% Wt)	0.12	0.12	0.16	0.16	0.07	0.07	0.07

3.0 PARTICULATE MATTER EMISSION COMPARISON

Particulate matter emission rates were measured during the baseline period on May 4, 1993, and during the coal/TDF firing period on June 8, 1993. Under both sets of operating conditions, the particulate matter emission rates were well below the permitted emission rate of 39 pounds per hour and within the range of particulate matter emissions measured from the kiln on other occasions.

The data presented in Table 7 show an average emission rate of 9.13 pounds per hour during the coal/TDF period and an emission rate of 7.04 pounds per hour during the baseline period. These emission rates are not significantly different. Therefore, it can be concluded that the use of TDF to provide up to 20 percent of the heat input has no significant effect on the particulate matter emission rate of Kiln No. 1.

TABLE 7
COMPARISON OF PARTICULATE MATTER EMISSION RATES
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	6.15	11.33
	2	6.98	7.30
	3	8.00	8.75
Mean		7.04	9.13
S var		0.86	4.17
n		3.00	3.00
Pooled est		1.59	
t stat.		1.61	
t' (95% C.I.)		2.132	

Difference is not significant

4.0 METALS EMISSION RATES

The emission rates of arsenic, total chromium, lead, mercury, and zinc were measured with the EPA multi-metals train (EPA Method 29). The measurements under baseline operating conditions were made on May 4, 1993, and the measurements under coal/TDF conditions were made on June 8, 1993. The emission rates measured under the two sets of conditions are summarized in the following table:

Metal	Baseline Average Emissions (lb/hr)	TDF Average Emissions (lb/hr)
Date	May 4, 1993	June 8, 1993
Arsenic	<0.00174	<0.00143
Chromium	<0.00202	<0.00287
Lead	<0.00781	<0.00201
Mercury	0.01299	<0.00036
Zinc	0.00579	0.01026*

*Significantly greater

Comparisons of these data (Tables 8A-8E) demonstrate that the emission rates of arsenic, chromium and lead are below the detectable limit and are therefore of no concern under either operating condition. The data also show that there is no significant difference in the emission rate of mercury. Statistically however, the emission rate of zinc measured under coal/TDF conditions was greater than the emission rate measured under the baseline firing conditions. The apparent increase in zinc emissions could be due to the zinc content of the TDF.

It can be concluded that the use of TDF to supply up to 20 percent of the heat input to Kiln No. 1 has no effect on metals emissions, with the possible exception of zinc.

TABLE 8A
COMPARISON OF METAL EMISSION RATES
ARSENIC
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	<0.00176	<0.00143
	2	<0.00172	<0.00143
	3	<0.00173	<0.00143
Mean		<0.00174	<0.00143

Emissions too close to detection limit.
No meaningful comparison possible.

TABLE 8B
COMPARISON OF METAL EMISSION RATES
CHROMIUM
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	<0.00205	<0.00287
	2	<0.00201	<0.00287
	3	<0.00201	<0.00287
Mean		<0.00202	<0.00287

Emissions too close to detection limit.
No meaningful comparison possible.

TABLE 8C
COMPARISON OF METAL EMISSION RATES
LEAD
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	<0.00763	<0.00201
	2	<0.00747	<0.00201
	3	0.00834	<0.00201
Mean		<0.00781	<0.00201

Emissions too close to detection limit.
No meaningful comparison possible.

TABLE 8D
COMPARISON OF METAL EMISSION RATES
MERCURY
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	0.02935	<0.00037
	2	0.00233	<0.00035
	3	0.00728	<0.00037
Mean		0.01299	<0.00036
S var		2.07E-04	1.33E-10
n		3.00	3.00
Pooled est		1.02E-02	
t stat.		1.52	
t' (95% C.I.)		2.132	

Difference is not significant

TABLE 8E
COMPARISON OF METAL EMISSION RATES
ZINC
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	0.00558	0.00832
	2	0.00546	0.01392
	3	0.00633	0.00853
Mean		0.00579	0.01026
S var		2.22E-07	1.01E-05
n		3.00	3.00
Pooled est		2.27E-03	
t stat.		2.41	
t' (95% C.I.)		2.132	

Difference is significant

5.0 TOTAL HYDROCARBONS

The total hydrocarbon concentration in the stack gas of the plant was measured for two 12-hour periods under baseline conditions and for two 12-hour periods under coal/TDF firing conditions using EPA Method 25A as described in 40CFR60, Appendix A. These data were summarized as 12 two-hour average hourly emission rates for each test condition and were calculated from stack gas flow rates measured during each day of monitoring.

The average emission rate under baseline conditions was 3.36 pounds per hour while the average emission rate under coal/TDF firing conditions was 3.26 pounds per hour. The difference in the emission rates is not statistically significant (Table 9). It can be concluded that the use of TDF to provide up to 20 percent of the heat input does not affect total hydrocarbon emissions from Kiln No. 1.

TABLE 9
COMPARISON OF TOTAL HYDROCARBON EMISSION RATES
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4-5 AND JUNE 8-9, 1993

Run	Baseline lb/hr	TDF lb/hr
1	2.36	2.80
2	3.54	2.62
3	4.06	2.61
4	3.07	3.37
5	3.07	2.6
6	3.44	2.9
7	2.75	4.79
8	4.64	3.69
9	3.92	3.17
10	3.11	3.24
11	3.48	3.65
12	2.88	3.63
Mean	3.36	3.26
S var	0.39	0.40
n	12.00	12.00
Pooled est	0.63	
t stat.	0.40	
t' (95% C.I.)	1.717	

Difference is not significant

6.0 NITROGEN OXIDES

The nitrogen oxides concentration in the stack gas from the plant was measured for two 12-hour periods under baseline conditions and for two 12-hour periods under coal/TDF firing conditions. The method of sampling was EPA Method 7E, 40CFR60, Appendix A. The mass emission rates were calculated using stack gas flow rates measured during each day of monitoring and are reported as 12 two-hour average hourly emission rates.

These data, summarized in Table 10, show an average nitrogen oxides emission rate under baseline conditions of 197 pounds per hour and an average emission rate of 188 pounds per hour under coal/TDF firing conditions. Statistically, there is no difference in these emission rates. It can be concluded that the use of TDF to provide up to 20 percent of the heat input does not affect nitrogen oxides emissions from Kiln No. 1.

TABLE 10
COMPARISON OF NITROGEN OXIDE EMISSION RATES
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4-5 AND JUNE 8-9, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	205.95	118.78
	2	236.35	92.30
	3	205.38	133.55
	4	193.97	161.73
	5	190.08	227.33
	6	166.42	215.70
	7	134.01	166.34
	8	185.79	189.05
	9	200.64	242.46
	10	242.86	265.64
	11	212.71	243.96
	12	194.41	201.78
Mean		197.38	188.22
S var		832.05	2973.08
n		12.00	12.00
Pooled est		43.62	
t stat.		0.51	
t′ (95% C.I.)		1.717	

Difference is not significant

7.0 SULFUR DIOXIDE

The sulfur dioxide concentration in the stack gas from the cement plant was measured for two 12-hour periods under baseline conditions and for two 12-hour periods under coal/TDF firing conditions. The method of sampling was EPA Method 6C, 40CFR60, Appendix A. The mass emission rates were calculated using stack gas flow rates measured each day of monitoring and are reported as 12 two-hour average hourly emission rates. The data are summarized in Table 11 and show an average sulfur dioxide emission rate under baseline conditions of less than 1.9 pounds per hour and an average emission rate under coal/TDF firing conditions of less than 0.8 pounds per hour.

These emission rates were both below the detection limit of Method 6C and no statistical analysis was possible. It can be concluded, however, that the use of TDF in the cement plant does not affect sulfur dioxide emissions from Kiln No. 1.

TABLE 11
COMPARISON OF SULFUR DIOXIDE EMISSION RATES
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4-5 AND JUNE 8-9, 1993

Run	Baseline lb/hr	TDF lb/hr
1	<1.71	<1.05
2	<1.71	<0.35
3	<1.78	<0.84
4	<1.78	<0.5
5	<1.78	<1.42
6	<1.78	<0.71
7	<1.9	<0.9
8	<1.9	<0.18
9	<1.9	<1.25
10	<1.98	<0.71
11	<1.98	<0.7
12	<2.06	<0.7
Mean	<1.86	<0.78

Emissions too close to detection limit
No meaningful comparison posible.

8.0 CARBON MONOXIDE

The carbon monoxide concentration in the stack gas was continuously monitored for two 12-hour periods during the baseline tests and two 12-hour periods during the coal/TDF tests. The measurements were made in accordance with EPA Method 10, 40CFR60, Appendix A. The mass emission rates of carbon monoxide were calculated using stack gas flow rates measured during each day of monitoring and were initially reported as 12 two-hour average hourly emission rates for each of the two test periods. These data are summarized in Table 12.

The carbon monoxide emission data summarized in Table 12 show an average emission rate of 31.5 pounds per hour under baseline conditions and an average emission rate of 49.1 pounds per hour under coal/TDF firing conditions. Statistically, the carbon monoxide emission rate under coal/TDF firing conditions was greater than the emission rate measured under baseline conditions. This matter was further investigated as measurements made at other cement plants under coal and coal/TDF firing conditions have shown that TDF has no effect on carbon monoxide or other emission rates.

The carbon monoxide emission measurements made under baseline conditions (24 hours of monitoring) and under coal/TDF conditions (24 hours of monitoring) were reduced to one-hour average emission rates and carbon monoxide emission data for FM&M Kilns No. 1 and No. 2, measured on other dates, were abstracted from previous reports. These hourly average emission rates are summarized in Table 13.

The carbon monoxide data from the previous tests were analyzed and no difference was found between emission rates from Kiln No. 1 while burning coal (2/28/92) and while burning coal and flolite (2/28/92). Likewise, there was no difference in the emission rates from Kiln No. 2 (a kiln identical to Kiln No. 1) on 3/24/92 and on 2/10/93. It was also determined that there was no difference in the carbon monoxide emission rates from Kiln No. 1 and Kiln No. 2. As a result of these analyses, the data from previous tests were treated as a single set of "baseline" data (i.e. operations without TDF).

When the data from previous tests were compared with carbon monoxide emission data from the current baseline tests (5/4/93, 5/5/93 and 5/4-5/93), it was determined that the previously measured emission rates were significantly greater than the emission rates measured on both 5/4/93 and 5/5/93 and on 5/4-5/93 (all current baseline dates handled collectively). The analysis further showed there was no significant difference between carbon monoxide emission rates measured on 5/4/93 and 5/5/93.

When comparing the previously measured "baseline" data with the coal/TDF carbon monoxide emission measurements, it was statistically determined that:

1. There was no difference between the previous baseline emission rate and the 6/9/93 coal/TDF emission rate;

2. The carbon monoxide emission rates measured on 6/8/93 (coal/TDF) were greater than those measured under previous baseline conditions; and

3. The carbon monoxide emission rate measured on 6/8/93 (coal/TDF) was greater than that measured on 6/9/93 (coal/TDF). In both cases, kiln operating conditions were the same.

In summary:

1. The carbon monoxide emission rate measured under 5/4-5/93 baseline (coal) conditions was less than the emission rates measured under "previous baseline" (coal and coal/flolite) conditions; demonstrating that there can be significant differences in carbon monoxide emission rates with the kiln operating under the same conditions.

2. The carbon monoxide emission rate measured on 6/8/93 with Kiln No. 1 fired with coal/TDF was significantly greater than that measured on 6/9/93 with Kiln No. 1 fired with coal/TDF. This again demonstrates that there can be significant differences in carbon monoxide emission rates with the kiln operating under the same conditions.

3. The carbon monoxide emission rate measured under coal/TDF conditions on 6/9/93 was no different than that measured under "previous baseline" conditions. This demonstrates that the use of coal/TDF does not result in increased carbon monoxide emissions.

4. These data collectively, and data reported from other cement plants, demonstrate that there are significant fluctuations in carbon monoxide emissions from cement plants. These fluctuations results from several factors that vary within the normal range of cement plant operating parameters and not, in this case, from the use of TDF.

TABLE 12
COMPARISON OF CARBON MONOXIDE EMISSION RATES
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4-5 AND JUNE 8-9, 1993

Run	Baseline lb/hr	TDF lb/hr
1	28.10	66.08
2	30.73	39.91
3	31.21	66.63
4	33.56	49.7
5	36.24	47.63
6	31.17	70.04
7	30.9	52
8	33.06	41.16
9	29.9	39.76
10	30.32	37.11
11	30.97	39.13
12	31.56	39.51
Mean	31.48	49.06
S var	4.19	146.81
n	12.00	12.00
Pooled est	8.69	
t stat.	4.96	
t' (95% C.I.)	1.717	

Difference is significant

TABLE 13
CARBON MONOXIDE DATA REVIEW
FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 5 AND JUNE 9, 1993

Baseline Data - (No TDF)					Coal/TDF Data			
Kiln Number	Test Date	Fuel Type	Preheater Feed Rate (tph)	Hourly Average Carbon Monoxide (lb/hr)	Kiln Number	Test Date	Preheater Feed Rate (tph)	Hourly Average Carbon Monoxide (lb/hr)
1	02/28/92	Coal	144	40.1	1	06/08/93	140-142	64.2
				37.5				67.9
				40.7				32.9
1	02/28/92	Coal/Flolite	144	32.6				46.2
				37.5				52.4
				40.7				80.9
2	03/24/92	Coal	139	38.6				55.5
				40.7				43.9
				41.4				44.8
2	02/10/93	Coal	139	41.6				50.5
				47.3				71.3
				41.8				68.8
			Set Average	40.0			Set Average	56.6
1	05/04/93	Coal	139-145	27.0	1	06/09/93	101-143	56.1
				29.2				47.9
				31.5				37.7
				30.0				44.6
				32.0				39.6
				30.4				39.9
				32.8				35.1
				34.3				39.2
				35.1				38.6
				37.4				39.7
				33.5				34.8
				28.8				44.2
			Set Average	31.8			Set Average	41.5
1	05/05/93	Coal	105-146	33.8				
				28.0				
				30.7				
				35.3				
				29.1				
				30.7				
				32.3				
				32.3				
				32.9				
				29.0				
				30.7				
				32.5				
			Set Average	31.4				

9.0 HYDROGEN CHLORIDE

The emission rate of hydrogen chloride was measured under both baseline and coal/TDF firing conditions using EPA Method 26, as described in 40CFR60, Appendix A. The mass emission rates of hydrogen chloride were calculated using stack gas flow rates measured during each day of monitoring.

The hydrogen chloride emission data summarized in Table 14 show an emission rate of 0.44 pounds per hour under baseline conditions and an emission rate of less than 0.35 pounds per hour under coal/TDF firing conditions. Statistically, the hydrogen chloride emission rate under baseline firing conditions is greater than the emission rate measured under coal/TDF conditions.

Under neither condition would the emission rate of hydrogen chloride be of consequence; even if the chlorides present were as hydrogen chloride. The presence of several cations in the Method 26 sampling train (along with chloride) demonstrates that the chlorides are present as salts of the cations (aluminum, ammonia, sodium, etc.) and not as hydrogen chloride.

TABLE 14
COMPARISON OF HYDROGEN CHLORIDE EMISSION RATES
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 5 AND JUNE 9, 1993

Run	Baseline lb/hr	TDF lb/hr
1	0.47	0.36
2	0.44	<0.32
3	0.42	<0.38
Mean	0.44	<0.35
S var	6.33E-04	9.33E-04
n	3.00	3.00
Pooled est	2.80E-02	
t stat.	3.94	
t' (95% C.I.)	2.132	

Difference is significant

10.0 SPECIATED VOLATILE ORGANIC COMPOUNDS

The emission rates of 13 specific volatile organic compounds were measured under both baseline and coal/TDF firing conditions using the VOST system as described in EPA Method M-0300. This method is also an equivalent EPA Method 18, 40CFR60, Appendix A. The mass emission rates of the compounds were calculated using stack gas flow rates measured during each day of monitoring.

The emission data in Tables 15A-15M are summarized below.

VOC	Emission Rate (lb/hr) Baseline	Emission Rate (lb/hr) Coal/TDF
Acetone	<0.0001	0.0210*
Benzene	0.0580*	0.0410
Bromomethane	<0.0003	0.0013*
Carbon Disulfide	0.0039	0.0057
Chlorobenzene	0.0160*	0.0130
Ethylbenzene	0.0058	0.0055
n-Hexane	0.0050*	0.0023
Toluene	0.0490*	0.0340
1,1,1-Trichloroethane	<0.0001	<0.0001
Trichloroethylene	<0.0001	<0.0001
Styrene	0.0270*	0.0120
m-\p-Xylene	0.0170*	0.0110
o-Xylene	0.0069*	0.0044

* Significantly greater

The emission data show greater emission rates of two compounds (acetone and bromomethane) under coal/TDF conditions, greater emission rates of seven compounds under baseline conditions and either no change or concentrations below the detection limits for four compounds. A reasonable conclusion regarding the emission rates of these specific volatile organic compounds is that there is considerable fluctuation at very low emission rates of these organic compounds from cement kilns and that TDF as a fuel supplement has no effect on the magnitude of these emission rates.

TABLE 15A
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
ACETONE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run	Baseline lb/hr	TDF lb/hr
1	<4.3E-05	1.2E-02
2	<4.3E-05	1.2E-02
3	<4.5E-05	4.9E-02
4	<4.5E-05	1.7E-02
5	<4.5E-05	1.7E-02
6	<4.5E-05	1.9E-02
Mean	<4.4E-05	2.1E-02
S var	1.1E-12	2.0E-04
n	6	6
Pooled est	0	
t stat.	3.66	
t' (95% C.I.)	1.812	

Difference is significant

TABLE 15B
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
BENZENE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	Coal/TDF lb/hr
	1	4.5E-02	4.1E-02
	2	4.8E-02	4.2E-02
	3	5.7E-02	3.9E-02
	4	6.3E-02	4.1E-02
	5	6.2E-02	4.1E-02
	6	7.3E-02	4.3E-02
Mean		5.8E-02	4.1E-02
S var		1.1E-04	1.8E-06
n		6	6
Pooled est		0	
t stat.		3.95	
t' (95% C.I.)		1.812	

Difference is significant

TABLE 15C
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
BROMOMETHANE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	<2.1E-05	1.3E-03
	2	1.5E-03	9.4E-04
	3	<2.2E-05	2.4E-03
	4	<2.2E-05	1.3E-03
	5	<2.2E-05	8.5E-04
	6	<2.2E-05	8.2E-04
Mean		<2.7E-04	1.3E-03
S var		3.6E-07	3.5E-07
n		6	6
Pooled est		0	
t stat.		2.89	
t' (95% C.I.)		1.812	

Difference is significant

TABLE 15D
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
CARBON DISULFIDE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	5.5E-03	8.7E-03
	2	4.4E-03	5.8E-03
	3	6.0E-03	5.6E-03
	4	7.3E-03	4.8E-03
	5	<2.2E-05	4.5E-03
	6	<2.2E-05	5.1E-03
Mean		3.9E-03	5.7E-03
S var		9.8E-06	2.3E-06
n		6	6
Pooled est		0	
t stat.		1.32	
t' (95% C.I.)		1.812	

Difference is not significant

TABLE 15E
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
CHLOROBENZENE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	1.4E-02	9.6E-03
	2	1.3E-02	1.4E-02
	3	1.5E-02	1.3E-02
	4	1.6E-02	1.4E-02
	5	1.8E-02	1.2E-02
	6	1.9E-02	1.3E-02
Mean		1.6E-02	1.3E-02
S var		5.4E-06	2.7E-06
n		6	6
Pooled est		0	
t stat.		2.79	
t' (95% C.I.)		1.812	

Difference is significant

TABLE 15F
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
ETHYLBENZENE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	5.0E-03	5.0E-03
	2	5.0E-03	6.1E-03
	3	5.1E-03	5.3E-03
	4	5.8E-03	5.9E-03
	5	6.8E-03	4.9E-03
	6	7.1E-03	6.0E-03
Mean		5.8E-03	5.5E-03
S var		8.9E-07	2.8E-07
n		6	6
Pooled est		0	
t stat.		0.60	
t' (95% C.I.)		1.812	

Difference is not significant

TABLE 15G
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
n-HEXANE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	3.8E-03	1.3E-03
	2	4.7E-03	1.6E-03
	3	4.4E-03	2.3E-03
	4	5.0E-03	2.8E-03
	5	5.3E-03	2.9E-03
	6	7.0E-03	2.9E-03
Mean		5.0E-03	2.3E-03
S var		1.2E-06	4.9E-07
n		6	6
Pooled est		0	
t stat.		5.16	
t' (95% C.I.)		1.812	

Difference is significant

TABLE 15H
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
TOLUENE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	3.2E-02	2.9E-02
	2	4.5E-02	3.6E-02
	3	4.7E-02	3.1E-02
	4	5.4E-02	3.3E-02
	5	6.2E-02	4.0E-02
	6	5.5E-02	3.5E-02
Mean		4.9E-02	3.4E-02
S var		1.1E-04	1.5E-05
n		6	6
Pooled est		0	
t stat.		3.35	
t' (95% C.I.)		1.812	

Difference is significant

TABLE 15I
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
1,1,1-TRICHLOROETHANE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	<2.1E-05	<2.2E-05
	2	<2.1E-05	<2.2E-05
	3	<2.2E-05	<2.1E-05
	4	<2.2E-05	<2.1E-05
	5	<2.2E-05	<2.2E-05
	6	<2.2E-05	<2.2E-05
Mean		<2.2E-05	<2.2E-05

Emissions too close to detection limit.
No meaningful comparison possible.

TABLE 15J
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
TRICHLOROETHENE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run	Baseline lb/hr	TDF lb/hr
1	<2.1E-05	<2.2E-05
2	<2.1E-05	<2.2E-05
3	<2.2E-05	<2.1E-05
4	<2.2E-05	<2.1E-05
5	<2.2E-05	<2.2E-05
6	<2.2E-05	<2.2E-05
Mean	<2.2E-05	<2.2E-05

Emissions too close to detection limit.
No meaningful comparison possible.

TABLE 15K
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
STYRENE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	1.9E-02	1.0E-02
	2	1.8E-02	1.4E-02
	3	2.5E-02	1.3E-02
	4	3.1E-02	1.4E-02
	5	3.4E-02	9.8E-03
	6	3.3E-02	1.3E-02
Mean		2.7E-02	1.2E-02
S var		5.0E-05	3.7E-06
n		6	6
Pooled est		0	
t stat.		4.81	
t' (95% C.I.)		1.812	

Difference is significant

TABLE 15L
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
m-\p-XYLENE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	1.4E-02	9.1E-03
	2	1.5E-02	1.3E-02
	3	1.6E-02	1.1E-02
	4	1.9E-02	1.2E-02
	5	2.1E-02	1.0E-02
	6	1.8E-02	1.2E-02
Mean		1.7E-02	1.1E-02
S var		7.0E-06	2.1E-06
n		6	6
Pooled est		0	
t stat.		4.87	
t' (95% C.I.)		1.812	

Difference is significant

TABLE 15M
COMPARISON OF SPECIATED VOLATILE ORGANICS EMISSION RATES
o-XYLENE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4 AND JUNE 8, 1993

Run		Baseline lb/hr	TDF lb/hr
	1	5.7E-03	3.7E-03
	2	5.6E-03	4.9E-03
	3	6.4E-03	4.3E-03
	4	7.6E-03	4.9E-03
	5	8.4E-03	4.0E-03
	6	7.7E-03	4.9E-03
Mean		6.9E-03	4.4E-03
S var		1.4E-06	2.8E-07
n		6	6
Pooled est		0	
t stat.		4.70	
t' (95% C.I.)		1.812	

Difference is significant

11.0 DIOXIN AND FURAN EMISSION COMPARISON

Dioxin and furan emission rates were measured over three two-hour periods during the baseline test on May 5, 1993, and for the same duration during the coal/TDF firing period on June 9, 1993. The measurements were made in accordance with EPA Method 23 (40CFR60, Appendix A). Under both sets of operating conditions, the dioxin and furan concentrations in all samples were below the limit of detection of the analytical method.

It can therefore be concluded that dioxins and furans are not present in the stack gas from Kiln No. 1 under either baseline conditions or coal/TDF conditions.

12.0 OPACITY OF EMISSIONS

The opacity of emissions was observed during four one-hour periods during both the baseline tests and the coal/TDF tests. No visible emissions were observed during any of the observation periods. It can therefore be concluded that the use of TDF has no effect on the opacity of emissions from Kiln No. 1.

13.0 STACK GAS FLOW AND CHARACTERISTICS

The stack gas flow rate, temperature and moisture were measured during six test runs under baseline conditions and six test runs under coal/TDF firing conditions and oxygen and carbon dioxide concentrations were measured during each two-hour period during the 12 hours of monitoring conducted on each of the four test dates.

The stack gas flow rate averaged 187,443 dscfm under baseline conditions and 176,009 dscfm under coal/TDF firing conditions (Table 16). The stack gas temperature averaged 248^{o}F under baseline conditions and 251^{o}F under coal/TDF conditions (Table 17). The stack gas moisture averaged 9.6 percent under baseline conditions and 10.2 percent under coal/TDF firing conditions (Table 18). The oxygen (Table 19) and carbon dioxide (Table 20) concentrations averaged 14.0 and 13.7 percent and 11.6 and 11.6 percent, respectively, under baseline and coal/TDF conditions.

Although there was a slight difference in the stack gas flow rates (as a result of a higher flow rate measured on the second day of baseline testing [5/5/93]), there were no significant differences in the other parameters and all of the stack gas parameters were within ranges normally observed. It can be concluded that the use of TDF as a fuel supplement has no effect on stack gas characteristics.

TABLE 16
COMPARISON OF STACK GAS FLOW RATE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4-5 AND JUNE 8-9, 1993

Run	Baseline dscfm	TDF dscfm
1	171750	175893
2	178834	167984
3	178597	178353
4	190365	180008
5	198498	178665
6	206616	175148
Mean	187443	176009
S var	179398377	18739215
n	6	6
Pooled est	9953	
t stat.	1.99	
t' (95% C.I.)	1.812	

Difference is significant

TABLE 17
COMPARISON OF STACK TEMPERATURE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4-5 AND JUNE 8-9, 1993

Run		Baseline F	TDF F
	1	251.20	258.00
	2	249.60	264.00
	3	241.30	240.00
	4	250.88	242.00
	5	247.83	255.00
	6	244.54	247.00
Mean		247.56	251.00
S var		15.36	90.40
n		6.00	6.00
Pooled est		7.27	
t stat.		0.82	
t′ (95% C.I.)		1.812	

Difference is not significant

TABLE 18
COMPARISON OF STACK GAS MOISTURE
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4-5 AND JUNE 8-9, 1993

Run		Baseline %	TDF %
	1	10.50	9.90
	2	10.70	10.20
	3	10.70	11.80
	4	9.00	10.00
	5	8.30	9.50
	6	8.30	10.10
Mean		9.58	10.25
S var		1.39	0.64
n		6.00	6.00
Pooled est		1.01	
t stat.		1.15	
t' (95% C.I.)		1.812	

Difference is not significant

TABLE 19
COMPARISON OF STACK GAS OXYGEN CONCENTRATION BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4-5 AND JUNE 8-9, 1993

Run	Baseline %	TDF %
1	13.03	14.20
2	12.50	14.30
3	14.13	13.10
4	14.10	12.30
5	13.13	13.30
6	13.20	13.80
7	14.27	14.50
8	14.57	14.00
9	14.43	13.10
10	15.00	13.90
11	15.00	13.80
12	15.17	13.70
Mean	14.04	13.67
S var	0.78	0.38
n	12.00	12.00
Pooled est	0.76	
t stat.	1.21	
t' (95% C.I.)	1.717	

Difference is not significant

TABLE 20
COMPARISON OF STACK GAS CARBON DIOXIDE CONCENTRATION
BASELINE AND COAL/TDF CONDITIONS

FLORIDA MINING & MATERIALS
BROOKSVILLE, FLORIDA
MAY 4-5 AND JUNE 8-9, 1993

Run	Baseline %	TDF %
1	12.37	11.80
2	12.83	9.70
3	12.20	11.90
4	12.57	11.70
5	12.20	11.70
6	11.47	12.20
7	10.85	10.50
8	10.86	12.00
9	10.57	11.90
10	11.00	12.10
11	11.00	12.20
12	10.83	12.10
Mean	11.56	11.65
S var	0.66	0.58
n	12.00	12.00
Pooled est	0.79	
t stat.	0.27	
t' (95% C.I.)	1.717	

Difference is not significant

14.0 CONCLUSIONS

Based on the comparison of emission data and plant operating data collected during the baseline period (100 percent coal firing) on May 4-5, 1993 and during the coal/TDF period on June 8-9, 1993, it can be concluded that the use of TDF to provide up to 20 percent of the heat input to Kiln No. 1 has no effect on emissions, operations or clinker quality.

Attachment 4

Excerpts from Three Comparative Emissions Reports For Coal Firing and Coal/WTDF Firing Scenarios

Cemex Cement, Inc
Brooksville Cement Plant
Hernando County, Florida

SUMMARY OF PARTICULATE MATTER, BENZENE, TOTAL HYDROCARBONS, CARBON MONOXIDE AND NITROGEN OXIDES EMISSION RATES UNDER BASELINE AND WHOLE-TIRE TDF FIRING CONDITIONS

FLORIDA CRUSHED STONE COMPANY
CEMENT/LIME PLANT

BROOKSVILLE, FLORIDA

NOVEMBER 13 - 21, 1991

KOOGLER & ASSOCIATES
ENVIRONMENTAL SERVICES
4014 N.W. 13TH STREET
GAINESVILLE, FL 32609
(904) 377-5822

KOOGLER & ASSOCIATES

To the best of my knowledge, all applicable field and analytical procedures comply with Florida Department of Environmental Regulation requirements and all test data and plant operating data are true and correct.

John B. Koogler, PH.D., P.E.

State of Florida
Registration No. 12925

1/13/92
Date

SEAL

KOOGLER & ASSOCIATES

TABLE OF CONTENTS

KOOGLER & ASSOCIATES

1.0 INTRODUCTION

The Florida Crushed Stone Company (FCS) operates a cement/power/lime (CPL) plant in Hernando County, northwest of Brooksville. The cement plant was permitted under Florida Department of Environmental Regulation (FDER) Air Construction Permit AC27-118674 and the facility was permitted under Permit PSD-FL-091. The CPL plant includes a Portland cement plant having a kiln feed rate of 123.5 tons per hour and a clinker production rate of 75 tons per hour. The plant is normally fired with low-sulfur coal.

In March 1990, FCS applied to FDER requesting approval to burn tire derived fuel (TDF) as a supplemental heat source in the cement kiln of the CPL plant. On June 6, 1990, FDER issued an amendment to the referenced permits authorizing performance tests on the cement plant while using TDF to supply up to 15 percent of the heat input to the kiln. In September 1990, the tests were conducted to measure air pollutant emissions from the CPL plant while the plant was operating under baseline conditions and with shredded TDF supplying up to 15 percent of the heat input to the plant. In September 1991, FCS requested approval from FDER to conduct additional tests with TDF. On October 9, 1991, FDER authorized FCS to conduct tests under baseline conditions and while using whole-tire TDF to provide up to 15 percent of the heat input to the plant. These tests were conducted during the period November 13 - 21, 1991, and the results are reported herein.

The approval granted by FDER on October 9, 1991, authorized two test periods; one representing baseline or normal plant operating conditions and the second representing whole-tire TDF firing conditions. The baseline test was conducted during the period 0942-1412 on November 13, 1991. The whole-tire TDF firing test was conducted during the period 1130-1633 on November 21, 1991. Prior to the test on November 21, 1991, the plant had operated for seven days with whole-tire TDF providing 15 percent of the heat input to the kiln in order to assure equilibrium operating/emissions conditions had been achieved.

During the whole-tire TDF test period, TDF provided 14.6 percent of the heat input to the cement plant; or approximately 39.8 MMBTU per hour heat input. The TDF firing rate corresponding to this heat input averaged 1.2 tons per hour over the three one hour TDF test periods.

During the baseline period, the particulate matter emission rate averaged 11.36 pounds per hour and during the TDF test period, the particulate matter emission rate averaged 9.61 pounds per hour. The allowable particulate matter emission rate is 49.4 pounds per hour.

During the baseline period, the total hydrocarbons emission rate averaged 3.6 pounds per hour and during the TDF test period averaged 1.22 pounds per hour as measured by EPA Method 25A. Emission rates of individual organic compounds generally ranged from 0.001 - 0.0001 pounds per hour under both baseline and TDF test conditions.

The nitrogen oxides emission rate averaged 353 pounds per hour during the baseline period and 199 pounds per hour during the TDF test period. The allowable nitrogen oxides emission rate is 359 pounds per hour.

During the baseline period, the carbon monoxide emission rate averaged 58.5 pounds per hour and during the TDF test period averaged 79.9 pounds per hour.

During the baseline period, benzene emissions averaged ~~0.0013~~ 0.13 pounds per hour, and during the TDF test period, averaged ~~0.0006~~ 0.06 pounds per hour.

The results of the testing demonstrate that the use of TDF has no effect on the emissions from the plant. The small change in carbon monoxide emissions while firing TDF is not significant; i.e., the change would be less than that defined by Rule 17-2.500(2)(e)2, FAC even with the plant operating 8760 hours per year. The change that did occur was, in all probability, the result of normal fluctuations in plant operations. The fact that neither total hydrocarbon emissions nor the emissions of individual hydrocarbons changed during the firing of TDF confirm that the change in carbon monoxide emissions resulted from plant operating fluctuations and not from a reduced combustion efficiency.

2.0 PROCESS DESCRIPTION

The Florida Crushed Stone CPL plant consists of a Portland cement plant, a power and a lime calciner. The Portland cement plant has a permitted kiln feed rate of 123.5 tons per hour and a permitted clinker production rate of 75 tons per hour. The plant is normally fired with coal at a maximum rate of 10.0 tons per hour, resulting in a heat input rate of approximately 240 MMBTU per hour. During the baseline test period, the coal feed rate to the plant averaged 9.1 tons per hour (at 12550 BTU per pound) for an average heat input rate of 228.4 MMBTU per hour. During the TDF test period, the coal feed rate averaged 8.2 tons per hour and the TDF feed averaged 1.2 tons per hour for a total heat input rate of 245.5 MMBTU per hour. During the baseline test period, the kiln feed rate averaged approximately 120 tons per hour and the clinker production rate averaged approximately 78 tons per hour. During the TDF test periods, the kiln feed rate averaged approximately 119 tons per hour and the clinker production rate averaged approximately 77 tons per hour. The cement plant operating data for both test periods are summarized in Tables 1 and 2.

SUMMARY OF EMISSIONS AND STACK GAS PARAMETERS
DURING BASELINE AND TDF TESTS

FLORIDA CRUSHED STONE COMPANY
HERNANDO COUNTY, FLORIDA

TEST	BASELINE	TDF
Date	9/18-20/90	9/20-24/90
PM, mass (lb/hr)	56.80	52.21
conc (gr/dscf)	0.0104	0.0103
O_2 (%)	10.4	11.7
CO_2 (%)	9.3	9.9
CO (ppm)	323	197
SO_2, mass (lb/hr)	595	551
conc (ppm)	94.1	93.5
Organics (lb/hr)*	5.187	1.420
Volatile organics	(0.177)	(0.520)
(Semi-volatile organics)	(5.01)	(0.90)
PCDD/DF (lb/hr)	0.114×10^{-6}	0.008×10^{-6}
Metals (lb/hr - Blank Corrected)		
Al	0.030	0.948
As	<0.004	<0.004
Ba	0.005	0.004
Cd	<0.005	<0.005
Cr	0.010	0.004
Co	0.005	<0.002
Cu	0.003	<0.001
Fe	0.992	0.892
Pb	0.130	0.036
Mg	0.036	0.081
Hg	0.025	0.006
Mo	0.018	0.018
Ni	<0.018	<0.018
Se	<0.004	<0.004
Ag	<0.001	<0.001
Ti	<0.001	0.017
Va	<0.018	<0.018
Zn	3.094	1.643

SUMMARY OF EMISSIONS AND STACK GAS PARAMETERS
DURING BASELINE AND TDF TESTS
(continued)

TEST	BASELINE	TDF
Date	9/18-20/90	9/20-24/90
<u>Stack Gas</u>		
Flow (dscfm)	637,713	599,633
Temp (°F)	385	372
Moisture (%)	7.2	7.4

*See following supplemental table for specific organic compounds.

SUMMARY OF ORGANIC COMPOUND EMISSIONS
DURING BASELINE AND TDF TESTS

FLORIDA CRUSHED STONE COMPANY
HERNANDO COUNTY, FLORIDA

TEST	BASELINE	TDF
Date	9/18-20/90	9/20-24/90
Volatile Organic Compounds		
Acetone	0.0247	0.0203
Benzene	0.1005	0.1712
Toluene	0.0136	0.2457
Tetrachloroethylene	<0.0025	<0.0022
Chlorobenzene	0.0074	0.0093
Ethylbenzene	<0.0026	0.0041
Xylene	0.0078	0.0151
Chloromethane	<0.0095	0.0425
Bromo methane	<0.0027	<0.0022
Carbon disulfide	<0.0029	<0.0024
Styrene	<0.0024	<0.0046
TOTAL VOCs	<0.1766	<0.5196
Semi-volatile Organic Compounds		
C_{16} - C_{18} aliphatics	5.01	0.90
Total All Organic Compounds	5.187	1.420

SUMMARY OF PLANT AND BAGHOUSE OPERATING CONDITIONS

FLORIDA CRUSHED STONE COMPANY
CEMENT/POWER/LIME PLANT
BROOKSVILLE, FLORIDA

SEPTEMBER 18-24, 1990

	Cement Plant			Power Plant		Lime Plant	
Date	Kiln Feed (tph)	Clinker Prod (tph)	Coal Feed (tph)	Power output (MW/hr)	Boiler Coal Feed (tph)	Calciner Feed (tph)	Coal to Calciner (tph)
Baseline							
9/18/90	127.25	76.35	8.54	114.08	42.1	34.7	10.8
9/19/90	123.64	74.18	8.15	113.92	43.9	30.4	9.3
9/20/90	123.06	73.84	8.23	92.54	42.2	3.29	0 (3)
AVG	124.65	74.79	8.31	106.85	42.7		
TDF							
9/20/90	122.95	73.77	7.82	92.54	42.2	3.29	0 (3)
9/21/90	125.00(1)	75.00(1)	7.20(1)	109.38	46.6	17.41	6.78
9/24/90	113.81	68.29	7.56	115.92	51.8	1.29	0 (3)
AVG	120.59	72.35	7.69	105.95	46.9		

	Baghouse			
Date	Inlet Temp. (°F)	Fan Speed (%)	Fan Current (Amps)	Pressure Drop ("H_2O)
Baseline				
9/18/90	328.5	34.88	479.33	6.5
9/19/90	327.1	34.73	474.09	6.6
9/20/90	357.2	34.90	470.20	6.3
AVG	337.6	34.83	474.54	6.5
TDF				
9/20/90	337.2	34.95	477.40	6.2
9/21/90	(2)	(2)	(2)	(2)
9/24/90	350.4	33.38	448.90	6.3
AVG	343.8	34.16	463.15	6.3

(1) Data obtained from operator's logbook rather than computer printouts.

(2) Baghouse data not available for this day.

(3) Calciner beds reconditioned.

CEMENT PLANT PRODUCTION DATA

Best Available Copy

Kiln Feed / Coal Feed

* Clinker Production = Kiln feed * 0.6
9/18/90

19SEP90 WEDNESDAY DAILY OPERATIONS REPORT TREND LOG 7 DAY END

~~H1P01~~ ~~KILN~~ FEED TOTAL — K1Q04

~~G1F01~~ ~~COAL~~ TOTAL — ~~K1F07-S FLOW~~ KILN FUEL OIL

		~~H1P01~~	~~G1F01~~	K1Q04 SMP	K1F07-S
		TPH	TPH	%	GPM
18SEP90	08:00	~~127.50~~	~~8.2612~~	39.500	*
	09:00	127.75	8.3750	43.000	*
	10:00	127.75	8.5938	29.613	*
	11:00	~~127.50~~	~~8.6875~~	35.750	*
	1 12:00	126.00	8.6563	50.375	*
	2 13:00	126.75	8.6250	33.500	*
	3 14:00	127.50	8.5938	31.500	*
	4 15:00	127.75	8.5625	30.000	*
	5 16:00	~~127.75~~	~~8.4375~~	30.875	*
	6 17:00	127.75	8.3438	25.313	*
	18:00	127.75	8.4063	21.063	*
	19:00	~~127.75~~	~~8.3125~~	26.000	*
	20:00	127.75	8.3438	24.563	*
	21:00	~~127.75~~	~~8.3750~~	21.750	*
	22:00	126.50	8.3750	52.125	*
	23:00	121.25	8.3750	*	*
19SEP90	00:00	~~119.75~~	~~8.3125~~	*	*
	01:00	114.50	8.3438	35.000	*
	02:00	~~114.50~~	~~8.4063~~	32.625	*
	03:00	114.75	8.4375	21.938	*
	04:00	116.75	8.4375	29.625	*
	05:00	~~119.75~~	~~8.4375~~	33.875	*
	06:00	123.25	[illegible]	21.938	*
	07:00	121.25	8.2813	19.375	*

Average Kiln feed = 127.25 tph
average Clinker production = 127.25 * 0.6 = 76.35 tph
average Coal feed = 8.54 tph

Kiln feed / Coal feed **Best Available Copy** * Clinker Production = Kiln feed * 0.6

9/19/90

20SEP90 THURSDAY DAILY OPERATIONS REPORT TREND LOG DAY END

H1P01 KILN FEED TOTAL K1Q04

S1F01 COAL TOTAL K1F07-S FLOW KILN FUEL OIL

	H1P01	S1F01	K1Q04 SHP	K1F07-S
	TPH	TPH	%	GPM
19SEP90 08:00	120.75	8.1875	27.938	*
09:00	120.75	8.0938	33.938	*
10:00	121.25	8.1875	40.000	*
11:00	121.50	8.1563	15.344	*
12:00	122.25	8.4063	34.625	*
13:00	123.50	8.3438	47.125	*
14:00	124.25	8.3125	34.000	*
15:00	125.50	7.8750	30.750	*
16:00	126.75	7.8750	23.375	*
17:00	125.75	8.0625	27.250	*
18:00	125.75	8.1875	28.250	*
19:00	125.50	8.2813	42.313	*
20:00	125.75	8.3125	17.625	*
21:00	125.75	8.3125	29.000	*
22:00	126.75	8.3438	37.250	*
23:00	126.50	8.3438	19.688	*
20SEP90 00:00	127.25	8.2813	26.688	*
01:00	127.75	8.1875	36.125	*
02:00	126.75	8.0938	26.938	*
03:00	124.75	7.7188	36.125	*
04:00	120.75	7.9844	56.000	*
05:00	119.75	8.2813	27.063	*
06:00	119.75	8.2813	38.750	*
07:00	122.00	8.2813	41.500	*

average Kiln feed = 123.64 tph
average Clinker production = 74.18 tph
average Coal feed = 8.15 tph

Best Available Copy

Kiln feed / Coal feed

Clinker Production = Kiln feed * 0.6

9/20/90

21SEP90 FRIDAY DAILY OPERATIONS REPORT TREND LOG 7

HIP01 KILN FEED TOTAL — K1Q04

SIF01 COAL TOTAL — K1F07-S FLOW KILN FUEL OIL

	HIP01	SIF01	K1Q04	K1F07-S	
	TPH	TPH	%	GPM	
20SEP90 08:00	123.25	8.2500	35.375		*
3 09:00	123.75	8.0938	30.625		*
4 10:00	123.75	8.0625	47.625		*
5 11:00	~~123.75~~	~~8.0625~~	42.375		*
6 12:00	123.75	8.2813	55.750		*
7 13:00	122.50	8.2063	35.000		*
8 14:00	~~121.75~~	~~8.40[illegible]~~	~~39.625~~		*
15:00	122.50	8.0000	46.250		*
16:00	123.25	7.8594	26.438		*
17:00	124.50	7.4688	43.750		*
18:00	122.50	7.3750	23.000		*
19:00	119.75	7.7032	40.625		*
20:00	118.00	8.0000	13.625		*
21:00	116.25	8.1563	7.1563		*
22:00	114.75	8.2188	29.813		*
23:00	115.25	8.3438	34.125		*
21SEP90 00:00	116.75	8.3438	21.688		*
01:00	117.50	8.2500	23.688		*
02:00	117.75	8.2188	24.000		*
03:00	117.75	8.2188	25.750		*
04:00	115.75	8.2500	50.250		*
05:00	114.75	8.3438	27.938		*
06:00	114.00	8.0313	4.6594		*
07:00	109.75	8.0313	10.594		*

average Kiln feed = 123.06 tph
average Clinker production = 73.84 tph
average coal feed = 8.23 tph

average Kiln feed = 122.95 tph
average Clinker Production = 73.77 tph
~~average coal feed = 7.82 tph~~

Baseline average Kiln feed = 124.65 tph
Baseline average Clinker Production = 74.79 tph
Baseline average coal feed = 8.31 tph

9/24/90

Kiln feed / Coal feed

Clinker Production = Kilnfeed * 0.6

[illegible] DAILY OPERATIONS REPORT [illegible]

HIPOI KILN FEED TOTAL KIQ04

[illegible] TOTAL KIROYRS FLOW KILN FUEL OIL

#	Date	Time	HIPOI	SIFOI	KIQ04	KIF...
			[illegible]	[illegible]	%	SPM
	24SEP90	08:00	[illegible]	[illegible]	38.600	
1		09:00	[illegible]	[illegible]	36.500	
2		[illegible]	119.75	8.5000	[illegible]	
3		[illegible]	120.25	8.4375	23.938	
4		[illegible]	121.75	8.2188	[illegible]	
5		13:00	[illegible]	[illegible]	[illegible]	
6		14:00	[illegible]	[illegible]	22.563	
7		15:00	131.50	7.4688	[illegible]	
8		16:00	126.00	7.7657	19.250	
9		17:00	100.00	7.5469	19.313	
10		18:00	[illegible]	[illegible]	29.[illegible]	
		19:00	[illegible]	[illegible]	[illegible]	
		20:00	4.6563	-.0469	[illegible]	
		21:00	4.2344	-.0489	[illegible]	
		[illegible]	3.8860	.0469	[illegible]	
		23:00	[illegible]	[illegible]	28.250	
	25SEP90	00:00	[illegible]	[illegible]	88.000	
		01:00	[illegible]	[illegible]	[illegible]	
		02:00	2.7344	-.0469	[illegible]	
		03:00	[illegible]	-.0437	[illegible]	
		04:00	[illegible]	[illegible]	89.750	
		05:00	[illegible]	[illegible]	*	
		06:00	[illegible]	[illegible]	*	
		[illegible]	4.7032	-.0461		

average Kiln feed = 113.81 tph
average Clinker Production = 68.29 tph
average Coal feed = 7.56 tph

TDF Average Kiln feed = 120.59 tph

TDF Average Clinker Production = 72.35 tph

TDF Average Coal feed rate = 7.69 tph

NITROGEN OXIDES EMISSION RATES UNDER BASELINE AND SHREDDED TDF FIRING CONDITIONS

FLORIDA CRUSHED STONE COMPANY
CEMENT/POWER/LIME PLANT

BROOKSVILLE, FLORIDA

OCTOBER 14-16, 1991

KOOGLER & ASSOCIATES
ENVIRONMENTAL SERVICES
4014 N.W. 13TH STREET
GAINESVILLE, FL 32609
(904) 377-5822

KOOGLER & ASSOCIATES

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KOOGLER & ASSOCIATES

1.0 INTRODUCTION

The Florida Crushed Stone Company (FCS) operates a cement/power/lime (CPL) plant in Hernando County, northwest of Brooksville. The cement plant was permitted under Florida Department of Environmental Regulation (FDER) Air Construction Permit AC27-118674 and the facility was permitted under Permit PSD-FL-091.

In March 1990, FCS applied to FDER requesting approval to burn tire derived fuel (TDF) as a supplemental heat source in the cement kiln of the CPL plant. On June 6, 1990, FDER issued an amendment to the referenced permits authorizing performance tests on the cement plant while using TDF to supply up to 15 percent of the heat input to the kiln. In September 1990, the tests were conducted to measure air pollutant emissions from the CPL plant while the plant was operating under baseline conditions and with shredded TDF supplying up to 15 percent of the heat input to the plant. During this test period, the nitrogen oxides emission measurements were flawed by laboratory analyses. In September 1991, FCS requested approval from FDER to conduct additional tests with shredded TDF so that nitrogen oxides emissions could be measured. On October 9, 1991, FDER authorized FCS to conduct tests for nitrogen oxides under baseline conditions and while using shredded TDF to provide up to 15 percent of the heat input to the plant. These tests were conducted during the period October 14-16, 1991, and the results are reported herein.

The CPL plant consists of a Portland cement plant having a kiln feed rate of 123.5 tons per hour and a clinker production rate of 75 tons per hour, a power plant with a maximum permitted generating rate of 125 megawatts, and a lime calciner with a nominal production rate of 20 tons per hour. All three of the plants are normally fired with low-sulfur coal.

The approval granted by FDER on October 9, 1991, authorized two 24-hour test periods; one representing baseline or normal plant operating conditions and the second representing shredded TDF firing conditions. The baseline test was conducted during the period 0830 on October 14, 1991, through 0800 on October 15, 1991. The shredded TDF firing test was conducted during the period 0940 on October 15, 1991, through 0940 on October 16, 1991.

During the TDF test period, shredded TDF was used to provide 14.5 percent of the heat input to the cement plant; or approximately 33 MMBTU per hour heat input. The shredded TDF firing rate corresponding to this heat input averaged 1.0 tons per hour over the 24-hour TDF test period.

During the baseline period, the nitrogen oxides emission rate averaged 678.1 pounds per hour and during the shredded TDF test period, the nitrogen oxides emission rate averaged 654.0 pounds per hour. The results of the testing demonstrate that the use of shredded TDF has no effect on nitrogen oxides emissions from the CPL plant.

2.0 PROCESS DESCRIPTION

The Florida Crushed Stone CPL plant consists of a Portland cement plant, a power and a lime calciner. The Portland cement plant has a permitted kiln feed rate of 123.5 tons per hour and a clinker production rate of 75 tons per hour. The plant is normally fired with coal at a maximum rate of 10.0 tons per hour, resulting in a heat input rate of approximately 240 MMBTU per hour. During the baseline test period, the coal feed rate to the plant averaged 8.5 tons per hour (at 12550 BTU per pound) for an average heat input rate of 213.4 MMBTU per hour. During the shredded TDF test period, the coal feed rate averaged 8.1 tons per hour and the shredded TDF feed averaged 1.0 tons per hour for a total heat input rate of 236.4 MMBTU per hour. During both test periods, the kiln feed rate averaged approximately 120 tons per hour and the clinker production rate averaged approximately 78 tons per hour. The cement plant operating data for both test periods are summarized in Tables 1 and 2.

The CPL power plant has a maximum permitted generating capacity of 125 megawatts and a maximum permitted heat input of 1234 MMBTU per hour. During the baseline test period, the generating rate of the power plant averaged 100 megawatts and the coal feed rate averaged 37.1 tons per hour (a heat input rate of 931.2 MMBTU per hour). During the shredded TDF tests, the generating rate of the plant averaged 96 megawatts and the coal feed rate averaged 35.8 tons per hour (898.6 MMBTU per hour).

The lime calciner is an integral part of the power plant. During the baseline test period, the feed rate to the calciner averaged 25.9 tons per hour and the lime production rate 9.2 tons per hour. The coal feed rate to the calciner averaged 11.4 tons per hour for a heat input rate of 286.1 MMBTU per hour. During the shredded TDF test period, the feed rate to the calciner averaged 23.6 tons per hour and the lime production rate averaged 5.2 tons per hour. The coal feed rate to the lime plant averaged 8.2 tons per hour, or 205.8 MMBTU per hour.

The operating parameters of the power plant and lime plant during the two test periods are summarized in Tables 1 and 2.

Attachment 5

Excerpts from EPA Report
Air Emissions from Scrap Tire Combustion

Cemex Cement, Inc
Brooksville Cement Plant
Hernando County, Florida

United States
Environmental Protection
Agency

Office of Research
and Development
Washington, DC 20460

EPA-600/R-97-115
October 1997

EPA

CLEAN
AIR
TECHNOLOGY
CENTER
EPA

AIR EMISSIONS FROM SCRAP TIRE COMBUSTION

Prepared for:

Office of Air Quality Planning and Standards
and
U.S. - Mexico Border Information Center on Air Pollution
Centro Información sobre Contaminación de Aire

C I C A

FOREWORD

The U.S. Environmental Protection Agency is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory is the Agency's center for investigation of technological and management approaches for reducing risks from threats to human health and the environment. The focus of the Laboratory's research program is on methods for the prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites and groundwater; and prevention and control of indoor air pollution. The goal of this research effort is to catalyze development and implementation of innovative, cost-effective environmental technologies; develop scientific and engineering information needed by EPA to support regulatory and policy decisions; and provide technical support and information transfer to ensure effective implementation of environmental regulations and strategies.

This publication has been produced as part of the Laboratory's strategic long-term research plan. It is published and made available by EPA's Office of Research and Development to assist the user community and to link researchers with their clients.

E. Timothy Oppelt, Director
National Risk Management Research Laboratory

EPA REVIEW NOTICE

This report has been peer and administratively reviewed by the U.S. Environmental Protection Agency, and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

EPA-600/R-97-115
October 1997

AIR EMISSIONS FROM SCRAP TIRE COMBUSTION

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Work Assignment No. III-111

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Washington, DC 20460

ABSTRACT

Two to three billion (2-3 x10^9) scrap tires are in landfills and stockpiles across the United States, and approximately one scrap tire per person is generated every year. Scrap tires represent both a disposal problem and a resource opportunity (e.g., as a fuel and in other applications). Of the many potential negative environmental and health impacts normally associated with scrap tire piles, the present study focuses on (1) examining air emissions related to open tire fires and their potential health impacts, and (2) reporting on emissions data from well designed combustors that have used tires as a fuel.

Air emissions from two types of scrap tire combustion are addressed: uncontrolled and controlled. Uncontrolled sources are open tire fires, which produce many unhealthful products of incomplete combustion and release them directly into the atmosphere. Controlled combustion sources (combustors) include boilers and kilns specifically designed for efficient combustion of solid fuel.

Very little data exist for devices that are not well-designed and use scrap tires for fuel. These sources include fireplaces, wood stoves, small kilns, small incinerators, or any device with poor combustion characteristics. Air emissions from these types of devices are likely between that of open burning and a combustor. However, there is serious concern that the emissions are much more similar to those of an open tire fire than a combustor.

Open tire fires are discussed. Data from a laboratory test program on uncontrolled burning of tire pieces and ambient monitoring at open tire fires are presented and the emissions are characterized. Mutagenic emission data from open burning of scrap tires are compared to mutagenic data for other fuels from both controlled and uncontrolled combustion.

A list of 34 target compounds representing the highest potential for health impacts from open tire fires is presented. The list can be used to design an air monitoring plan in order to evaluate the potential for health risks in future events.

Methods for preventing and managing tire fires are reviewed. Recommendations are presented for storage site design, civilian evacuation, and fire suppression tactics.

Air emissions data from the use of tires as fuel are discussed. The results of a laboratory test program on controlled burning of tire-derived fuel (TDF) in a Rotary Kiln Incinerator Simulator (RKIS) are presented. Based on the results of the RKIS test program, it was concluded that, with the exception of zinc emissions, potential emissions from TDF are not expected to be very much different than from other conventional fossil fuels, as long as combustion occurs in a well-designed, well-operated, and well-maintained combustion device.

Source test data from 22 industrial facilities that have used TDF are presented: 3 kilns (2 cement and 1 lime) and 19 boilers (utility, pulp and paper, and general industrial applications). In general, the results indicate that properly designed existing solid fuel combustors can supplement their normal fuels (coal, wood, and various combinations of coal, wood, oil, coke, and sludge) with 10 to 20% TDF and still satisfy environmental compliance emissions limits. Furthermore, results from a dedicated tires-to-energy (100% TDF) facility indicate that it is possible to have emissions much lower than produced by existing solid-fuel-fired boilers (on a heat input basis), when properly designed and the facility is controlled.

ACKNOWLEDGMENTS

This document was prepared for Paul M. Lemieux of EPA's National Risk Management Research Laboratory (NRMRL) by Joel I. Reisman of E. H. Pechan and Associates, Inc., Sacramento, CA. The author would like to thank Michael Blumenthal of the Scrap Tire Management Council for his assistance in collecting source test data and his valuable referrals and insightful thoughts on the utilization of scrap tires for productive purposes. Thanks are also extended to Paul Ruesch, EPA Region 5, for his assistance in providing contacts and other useful information. Others who provided valuable assistance are Rich Nickle, Agency for Toxic Substances and Disease Registry; Paul Koziar, Wisconsin Department of Natural Resources; Bruce Peirano, EPA ORD; Alan Justice, Illinois Department of Commerce and Community Affairs; Jim Daloia, EPA Response and Prevention Branch, Edison, NJ; and Gary Foureman, EPA National Center for Environmental Assessment.

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ABBREVIATIONS AND ACRONYMS

ATSDR	Agency for Toxic Substances and Disease Registry
AWMA	Air and Waste Management Association
BaP	benzo(a)pyrene
BTU	British thermal unit
CTPV	coal tar pitch volatiles
EPA	U.S. Environmental Protection Agency
ERT	EPA's Emergency Response Team
ESP	electrostatic precipitator
GC/MS	gas chromatography/mass spectroscopy
HAP	hazardous air pollutant
HPLC	high-pressure liquid chromatography
IAFC	International Association of Fire Chiefs
IDLH	Immediately Dangerous to Life and Health
NAAQS	National Ambient Air Quality Standard
NIOSH	National Institute for Occupational Safety and Health
NSP	Northern States Power
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDD	polychlorinated p-dibenzodioxins
PCDF	polychlorinated dibenzofurans
PIC	product of incomplete combustion
PM	particulate matter
PM_{10}	particulate matter less than 10 μm in aerodynamic diameter
PNA	polynuclear aromatic hydrocarbon
RfC	inhalation reference concentration
RKIS	rotary kiln incinerator simulator
STMC	Scrap Tire Management Council
TDF	tire-derived fuel
TLV	threshold limit value
TPCHD	Tacoma-Pierce County Health Department
TSP	total suspended particulate
TWA	time-weighted average
UPA	United Power Association
VOC	volatile organic compound
VOST	Volatile Organic Sampling Train
WDNR	Wisconsin Department of Natural Resources
WP&L	Wisconsin Power and Light

EXECUTIVE SUMMARY

Two to three billion (2-3 x10^9) scrap tires are in landfills and stockpiles across the United States, and approximately one scrap tire per person is generated every year. Scrap tires represent both a disposal problem and a resource opportunity (e.g., as a fuel and in other applications). Of the many potential negative environmental and health impacts normally associated with scrap tire piles, the present study focuses on (1) examining air emissions related to open tire fires and their potential health impacts, and (2) reporting on emissions data from well designed combustors that have used tires as a fuel.

Air emissions from two types of scrap tire combustion are addressed: uncontrolled and controlled. Uncontrolled sources are open tire fires, which produce many unhealthful products of incomplete combustion and release them directly into the atmosphere. Controlled combustion sources (combustors) are, for example, boilers and kilns specifically designed for efficient combustion of solid fuel. Combustor emissions are much lower and more often than not, these sources also have appropriate add-on air pollution control equipment for the control of particulate emissions.

Very little data exist for devices that are not well-designed and use scrap tires for fuel. These sources include fireplaces, wood stoves, small kilns, small incinerators, or any device with poor combustion characteristics. Air emissions from these types of devices are likely between that of open burning and a combustor. There is serious concern that emissions would be more like those of an open tire fire than a well-designed combustor; however, emissions testing would have to be conducted to confirm this.

Open Tire Fires

Air emissions from open tire fires have been shown to be more toxic (e.g., mutagenic) than those of a combustor, regardless of the fuel. Open tire fire emissions include "criteria" pollutants, such as particulates, carbon monoxide (CO), sulfur oxides (SO_x), oxides of nitrogen (NO_x), and volatile organic compounds (VOCs). They also include "non-criteria" hazardous air pollutants (HAPs), such as polynuclear aromatic hydrocarbons (PAHs), dioxins, furans, hydrogen chloride, benzene, polychlorinated biphenyls (PCBs); and metals such as arsenic, cadmium, nickel, zinc, mercury, chromium, and vanadium. Both criteria and HAP emissions from an open tire fire can represent significant acute (short-term) and chronic (long-term) health hazards to firefighters and nearby residents. Depending on the length and degree of exposure, these health effects could include irritation of the skin, eyes, and mucous membranes, respiratory effects, central nervous system depression, and cancer. Firefighters and others working near a large tire fire should be equipped with respirators and dermal protection. Unprotected exposure to the visible smoke plume should be avoided.

Data from a laboratory test program on uncontrolled burning of tire pieces and ambient monitoring at open tire fires are presented and the emissions are characterized. Mutagenic emission data from open burning of scrap tires are compared to other types of fuel combustion. Open tire fire emissions are estimated to be 16 times more mutagenic than residential wood combustion in a fireplace, and 13,000 times more mutagenic than coal-fired utility emissions with good combustion efficiency and add-on controls.

A list of 34 target compounds representing the highest potential for inhalation health impacts from open tire fires was developed by analyzing laboratory test data and open tire fire data collected at nine tire fires. The list can be used to design an air monitoring plan in order to evaluate the potential for health risks in future events.

Methods for preventing and managing tire fires are presented. Recommendations are presented for storage site design, civilian evacuation, and fire suppression tactics. For example, tire piles should not exceed 6 m (20 ft) in height; maximum outside dimensions should be limited to 76 m (250 ft) by 6 m (20 ft). Interior fire breaks should be at least 18 m (60 ft) wide. Civilians should be evacuated when they may be subject to exposure by the smoke plume. Fire suppression tactics are site and incident-specific and firefighters should have specialized training to deal effectively with them.

Other Impacts from Open Tire Burning

The scope of this report is limited to airborne emissions. However, significant amounts of liquids and solids containing dangerous chemicals can be generated by melting tires. These products can pollute soil, surface water, and ground water and care must be taken to properly manage these impacts as well.

Controlled Combustion

The results of a laboratory test program on controlled burning of tire-derived fuel (TDF) in a Rotary Kiln Incinerator Simulator (RKIS) are presented. In all, 30 test conditions were run, with the TDF feed rate varying from 0 to 21.4% of heat input. The test conditions were achieved by varying kiln firing rate, combustion air flow rate, and tire feed rate. The majority of the tests were conducted with a steady-state feed of TDF. However, variations in the mode of TDF feeding were simulated in two tests to evaluate the impact of transient operation on air emissions.

Based on the results of the RKIS test program, it can be concluded that, with the exception of zinc emissions, potential emissions from TDF are not expected to be very much different than from other conventional fossil fuels, as long as combustion occurs in a well-designed, well-operated and well-maintained combustion device. However, as with most solid fuel combustors, an appropriate particulate control device would likely be needed in order to obtain an operating permit in most jurisdictions in the United States.

Test data, from 22 industrial facilities that have used TDF are presented: 3 kilns (2 cement and 1 lime) and 19 boilers (utility, pulp and paper, and general industrial applications). All sources had some type of particulate control. In general, the results indicate that properly designed existing solid fuel combustors can supplement their normal fuels, which typically consist of coal, wood, coke and various combinations thereof, with 10 to 20% TDF and still satisfy environmental compliance emissions limits. Furthermore, results from a dedicated tires-to-energy (100% TDF) facility indicate that it is possible to have emissions much lower than produced by existing solid-fuel-fired boilers (on a heat input basis) with a specially designed combustor and add-on controls.

Depending on the design of the combustion device, some tire processing is usually necessary before it is ready to be used as a fuel. Processing includes dewiring and shredding and/or other sizing techniques. Some specially designed boilers and cement kilns have had their feed systems designed to accept whole tires.

TDF has been used successfully in properly designed combustors with good combustion control and appropriate add-on controls, particularly particulate controls, such as electrostatic precipitators or fabric filters. The resultant air emissions can usually satisfy environmental compliance limits even with TDF representing up to 10 to 20% of the fuel requirements. Twenty percent supplemental TDF is perceived as an upper limit in most existing boilers because of boiler limitations on fuel or performance. However, dedicated tire-to-energy facilities specifically designed to burn TDF as their only fuel have been demonstrated to achieve emission rates much lower than most solid fuel combustors.

Conclusion

Air emissions have been documented from open burning of scrap tires and from TDF in well-designed combustors. Laboratory and field studies have confirmed that open burning produces toxic gases that can represent significant acute and chronic health hazards. However, field studies have also confirmed that TDF can be used successfully as a 10 - 20% supplementary fuel in properly designed solid-fuel combustors with good combustion control and add-on particulate controls, such as electrostatic precipitators or fabric filters. Furthermore, a dedicated tire-to-energy facility specifically designed to burn TDF as its only fuel has been demonstrated to achieve emission rates much lower than most solid fuel combustors.

No field data were available for well-designed combustors with no add-on particulate controls. Laboratory testing of an RKIS indicated that efficient combustion of supplementary TDF can destroy many volatile and semi-volatile air contaminants. However, it is not likely that a solid fuel combustor without add-on particulate controls could satisfy air emission regulatory requirements in the U.S.

No data were available for poorly designed or primitive combustion devices with no add-on controls. Air emissions from these types of devices would depend on design, fuel type, method of feeding, and other parameters. There is serious concern that emissions would be more like those of an open tire fire than a well-designed combustor. Stack emissions test data would need to be collected and analyzed to confirm this.

3.0 TIRES AS FUEL

Tire-derived fuel (TDF) has been successfully utilized as a source of energy in cement and lime manufacturing, steam generation for electricity, and other industrial processes. Results of source test reports have been collected and are summarized by source type. Typical sources that have been successful in integrating TDF with other fuels are:

- Cement Kilns;
- Pulp and Paper Mills;
- Utilities (including dedicated Tire-to-Energy facilities); and
- General Industrial Boilers.

TDF has long been recognized as a potential fuel. It compares favorably to coal, as presented in Table 16. It has a higher heating value than coal, and less moisture content. TDF contains more carbon, about as much sulfur as medium-sulfur coal, but much less fuel-bound nitrogen.

Whether burning TDF in a new facility or as a modification to an existing facility, several issues must be considered. One consideration is the need convert scrap tires into a useable fuel. This requires a system to dewire, and shred, or otherwise size the tires so they can accommodated by a combustor. In addition to aiding in feeding, the sized fuel generally allows for more efficient combustion. However, some large combustor configurations, such as cement kilns, wet-bottom boilers, and stoker-grate boilers can be modified to accept whole tires. Modifications to hardware, combustion practices and/or other operating practices may also be necessary in order to burn TDF. These modifications are case-specific, and must be addressed by engineering staff when considering using TDF.

3.1 Laboratory Simulation of TDF Emissions

Pilot-scale emissions testing of TDF was conducted in a 73 kW (250,000 BTU/hr) rotary kiln incinerator simulator (RKIS) in EPA's Environmental Research Center in Research Triangle Park, NC (Lemieux, 1994). This size simulator has been established as exhibiting the salient features of full-scale units with ratings 20 to 40 times larger.

The test program was undertaken to provide assistance to state and local pollution agencies in establishing permitting guidelines and evaluating permit applications for facilities seeking to supplement its fuel with tires or TDF. A list of analytes would defer some of the expenses of stack sampling.

The purposes of the test program were to (1) generate a profile of target analytes for guidance in preparing a full-scale stack sampling program and (2) provide insight into the technical issues related to controlled combustion of scrap tires. Because of the differences in scaling, such as gas-phase mixing phenomena and other equipment-specific factors, Lemieux specifically states that emission factors from the RKIS cannot be directly

TABLE 16. COMPARATIVE FUEL ANALYSIS BY WEIGHT (JONES, 1990)

Fuel	Composition (percent)							Heating Value	
	Carbon	Hydrogen	Oxygen	Nitrogen	Sulfur	Ash	Moisture	kJ/kg	Btu/lb
TDF	83.87	7.09	2.17	0.24	1.23	4.78	0.62	36,023	15,500
Coal	73.92	4.85	6.41	1.76	1.59	6.23	5.24	31,017	13,346

extrapolated to full-scale units. Furthermore, there are significant differences between kilns and other combustion devices, such as boilers, and the study does not address these issues. Nevertheless, the simulator is useful in examining the fundamental phenomena of TDF combustion and to gain an understanding of the qualitative trends that would be found in a full-scale rotary kiln.

The TDF tested was wire-free crumb rubber sized to <0.64 cm (<1/4 in.). It was combusted at several combinations of feed rate, temperature, and kiln oxygen concentration. The TDF was combusted with natural gas as the primary fuel. Samples were taken to examine volatile and semi-volatile organics, PCDD/PCDF, and metal aerosols. Data were collected to determine the effects of feed rates, type of feeding, i.e., continuous versus batch, and combustion controls on emissions. The data were taken in the exhaust stream prior to any add-on air pollution control devices.

The study addressed two issues: (1) the influence of the mode of tire feeding, for example, whole tires versus shredded tires, on the PICs, and (2) the potential for air toxic emissions not normally found when burning conventional fuels.

The TDF material used in the test program was analyzed and the proximate and ultimate analyses and metals analysis results are presented in Table 17. TDF contains significant amounts of zinc, since zinc is used extensively in the tire manufacturing process.

In all, thirty test conditions were run, with the TDF feed rate varying from 0% to 21.4% of heat input. The test conditions were achieved by varying kiln firing rate, combustion air flow rate, and tire feed rate. The majority of the tests were conducted with a steady-state feed of TDF. Variations in the mode of TDF feeding were evaluated in two tests. In one test, the kiln air flow rate was ramped up and down every 10 minutes ("ramp") to change the kiln oxygen concentration to simulate transient operation. In the other, TDF was introduced in 300 g batches spaced ten minutes apart ("batch") to simulate transient operation, such as feeding whole tires at periodic intervals.

VOCs were collected by a Volatile Organic Sampling Train (VOST) and analyzed with a gas chromatograph/mass spectrometer (GC/MS). The majority of the VOCs were very near to or below the detection limits of the equipment. Estimated emissions of VOCs for five representative test runs are presented in Table 18.

PAHs were analyzed with a Continuous Emission Monitor (CEM) PAH analyzer. PAH emissions were fairly insensitive to temperature and oxygen for the range of conditions studied, however, increasing TDF feed rates tended to increase PAH emissions for all oxygen levels. Overall, it was observed that supplementing natural gas with TDF tended to increase PAH emissions, but not dramatically, provided that steady-state operation is maintained.

Semi-volatile organic compounds (SVOC) and bulk particulate were collected by isokinetic sampling protocols with a Modified Method 5 (MM5) train. Data from the analyses did not indicate that SVOC were present in detectable concentrations. Lemieux

TABLE 17. PROXIMATE AND ULTIMATE ANALYSIS OF RKIS TEST TDF

Proximate Analysis	
Moisture	0.84%
Volatile Matter	65.52%%
Ash	7.20%
Fixed Carbon	26.44%
Ultimate Analysis	
Moisture	0.84%
Carbon	76.02%
Hydrogen	7.23%
Kjeldahl Nitrogen l Nitrogen Nitro	0.34%
Sulfur	1.75%
Total Halogens (calculated as chlorine)	0.31%
Ash	7.20%
Metals	
Cadmium	<5 ppm
Chromium	<5 ppm
Iron	295 ppm
Lead	51 ppm
Zinc	2.14%
Heating Value	37,177 kJ/kg

TABLE 18. ESTIMATED EMISSIONS OF VOCS - RKIS TEST RESULTS (BASE FUEL - NATURAL GAS)

Compound	0% TDF (Natural Gas Only)		7% TDF (steady-state)		17% TDF (steady-state)		19% TDF (ramp)		15% TDF (batch)	
	ng/J	lb/MMBtu	ng/J	lb/MMBtu	ng/J	lb/MMBtu	ng/J	lb/MMBtu	ng/J	lb/MMBtu
1,1,1 Trichloroethane	2.24E-04	5.21E-07	3.75E-04	8.72E-07	4.41E-04	1.03E-06	2.24E-04	5.21E-07	2.17E-04	5.05E-07
2-Methyl propene	9.60E-04	2.23E-06	2.30E-03	5.35E-06	1.94E-03	4.51E-06	7.37E-04	1.71E-06	2.33E-04	5.42E-07
2-Methyl-2-propanol benzene	2.13E-04	4.95E-07	2.15E-04	5.00E-07	1.81E-03	4.21E-06	2.24E-04	5.21E-07	2.33E-04	5.42E-07
Benzene	6.71E-04	1.56E-06	1.25E-04	2.91E-07	1.25E-04	2.91E-07	7.36E-03	1.71E-05	2.19E-02	5.09E-05
Bromomethane	2.00E-04	4.65E-07	2.15E-04	5.00E-07	2.58E-04	6.00E-07	1.22E-03	2.84E-06	3.82E-04	8.88E-07
Carbon disulfide	2.13E-04	4.95E-07	3.43E-04	7.98E-07	2.30E-04	5.35E-07	2.24E-04	5.21E-07	9.43E-04	2.19E-06
Chlorobenzene	2.13E-04	4.95E-07	2.15E-04	5.00E-07	2.30E-04	5.35E-07	2.24E-04	5.21E-07	2.20E-04	5.12E-07
Chloromethane	2.40E-04	5.58E-07	7.15E-04	1.66E-06	3.90E-03	9.07E-06	2.38E-02	5.53E-05	5.16E-02	1.20E-4
Ethylbenzene	2.13E-04	4.95E-07	2.15E-04	5.00E-07	2.70E-04	6.28E-07	2.24E-04	5.21E-07	4.96E-04	1.15E-06
Heptane	2.13E-04	4.95E-07	2.83E-04	6.58E-07	2.48E-04	5.77E-07	2.24E-04	5.21E-07	2.33E-04	5.42E-07
Hexane	2.01E-04	4.67E-07	2.45E-04	5.70E-07	2.45E-04	5.70E-07	2.24E-04	5.21E-07	2.36E-04	5.49E-07
Iodomethane	2.13E-04	4.95E-07	2.15E-04	5.00E-07	2.30E-04	5.35E-07	2.35E-04	5.47E-07	2.33E-04	5.42E-07
m,p-Xylene	6.21E-04	1.56E-06	4.17E-04	9.70E-07	1.06E-03	2.47E-06	2.64E-04	6.14E-07	1.78E-03	4.14E-06
Nonane	2.77E-04	6.44E-07	7.29E-04	1.70E-06	4.25E-04	9.88E-07	2.24E-04	5.21E-07	2.71E-04	6.30E-07
o-Xylene	1.85E-04	4.30E-07	2.15E-04	5.00E-07	3.18E-04	7.40E-07	2.24E-04	5.21E-07	5.24E-04	1.22E-06
Styrene	2.63E-04	6.12E-07	7.85E-04	1.83E-06	7.16E-04	1.67E-06	7.03E-04	1.63E-06	7.80E-04	1.81E-06
Toluene	3.97E-04	9.23E-07	5.02E-04	1.17E-06	4.64E-04	1.08E-06	3.48E-04	8.09E-07	1.29E-03	3.00E-06

(1994) concludes that when TDF is combusted in a well-designed and well-operated facility, emissions of SVOCs are not significantly different from natural gas.

PCDD and PCDF were collected during two test conditions: 0% TDF and 17% TDF (steady-state). No PCDD/PCDF were detected in either test.

Metal aerosol samples were collected during two test conditions; 0% TDF and 17% TDF (steady-state). Estimated metals emissions from these tests are presented in Table 19. The TDF-only column is a linear extrapolation and was calculated by dividing the values in the TDF+natural gas column by 17% (0.17). Elevated emissions of arsenic, lead, and zinc were found in the stack gas. Zinc was present in significant concentrations.

Total particulate matter (PM) measurements were made from the MM5 and MultiMetals trains. The PM results are presented in Table 20. The PM emissions represent uncontrolled emissions, such as found prior to any installed PM control device. As expected, the PM emissions during TDF combustion are higher than those from natural gas combustion alone.

The PM results from the batch feed run are significantly higher than for any of the others. This may suggest that burning TDF in batches, which roughly approximates feeding of whole tires, has the potential to form significant transient emissions. This phenomenon could be exacerbated in a system that exhibits significant vertical gas-phase stratification, or operates at low excess air levels, such as cement kilns. However, Lemieux (1994) believes that the size of the facility will serve to mitigate the intensity of transient emissions resulting from batch charging of tires of TDF, because for an extremely large facility, a constant stream of whole tires may roughly approximate steady-state operation. Even so, Lemieux (1994) cautions that the potential for generation of large transients should not be ignored, especially in smaller facilities.

Based on this test program, it is concluded that, with the exception of zinc emissions, potential emissions from TDF are not expected to be very much different than from other conventional fossil fuels, as long as combustion occurs in a well-designed, well-operated and well-maintained combustion device. If unacceptable particulate loading occurs as a result of zinc emissions, an appropriate particulate control device would need to be installed.

3.2 Source Test Data - Utility and Industrial Facilities

Source test data from a variety of source types have been collected and are presented in Table 21 and Appendix Tables A-1 through A-22. Test data of criteria pollutant emissions from seven utility boilers are summarized in Table 21. In general, particulates and NO_x decreased as the percent TDF increased. Emissions of SO_x did not follow a pattern. There are insufficient data on CO emissions from utilities to draw a conclusion.

Data summaries from field source tests are presented in the Appendix. Beginning with Table A-1, each table is divided into two parts. Part "a" presents a summary of

TABLE 19. ESTIMATED EMISSIONS OF METALS - RKIS TEST RESULTS (BASE FUEL - NATURAL GAS)

Metal	0% TDF (Natural Gas Only)		17% TDF (steady-state)		TDF Only (estimated)	
	ng/J	lb/MMBTU	ng/J	lb/MMBTU	ng/J	lb/MMBTU
Antimony	7.72E-05	1.80E-07	9.05E-04	2.10E-06	5.32E-03	1.24E-05
Arsenic	4.80E-04	1.12E-06	1.59E-02	3.70E-05	9.35E-02	2.17E-04
Beryllium	nd	nd	2.14E-05	4.98E-08	1.26E-04	2.93E-07
Cadmium	1.76E-04	4.09E-07	4.54E-04	1.06E-06	2.67E-03	6.21E-06
Chromium	2.78E-04	6.46E-07	1.66E-03	3.86E-06	9.76E-03	2.27E-05
Lead	3.45E-03	8.02E-06	2.83E-02	6.58E-05	1.66E-01	3.86E-4
Manganese	1.21E-03	2.81E-06	2.48E-03	5.77E-06	1.46E-02	3.40E-05
Nickel	3.00E-04	6.98E-07	1.50E-03	3.29E-06	8.82E-03	2.05E-05
Selenium	3.56E-04	8.28E-07	1.93E-03	4.49E-06	1.14E-02	2.65E-05
Zinc	1.23E-01	2.86E-04	15.21	3.54E-02	89.47	2.08E-01

TABLE 20. PARTICULATE MATTER (PM) LOADING - RKIS TEST PROGRAM

% TDF	Feed Type	Particulate Loading (mg/Nm^3)[1]
0.00	Steady-state	4.14
0.00	Steady-state	17.37
14.97	Batch	285.46
15.50	Steady-state	95.28
16.95	Steady-state	43.67
17.14	Steady-state	137.24
17.30	Steady-state	101.01
19.18	Ramp	132.95

[1] Nm^3 is a normal cubic meter of gas at 0° C and 1 atmosphere pressure.

TABLE 21. CRITERIA POLLUTANT EMISSIONS AT UTILITIES USING TDF

Power Plant	Particulates (Total)		Sulfur Oxides		Nitrogen Oxides		Carbon Monoxide	
	g/MJ	lb/MMBTU	g/MJ	lb/MMBTU	g/MJ	lb/MMBTU	g/MJ	lb/MMBTU
<u>Facility A</u>								
100% Tires	9.5×10^{-7}	2.2×10^{-6}	6.0×10^{-6}	1.4×10^{-5}	4.2×10^{-5}	9.8×10^{-5}	3.1×10^{-5}	7.2×10^{-5}
<u>Facility B</u>								
0% TDF	0.090	0.21	0.606	1.41	0.34	0.78	NT	NT
5% TDF	0.0064	0.015	0.774	1.80	0.25	0.58	NT	NT
10% TDF	0.004	0.009	0.658	1.53	0.13	0.30	NT	NT
<u>Facility C</u>								
0% TDF	0.22	0.52	0.490	1.14	0.34	0.79	0.654	1.52
7% TDF	0.060	0.14	0.37	0.87	0.39	0.91	3.12	7.26
<u>Facility D</u>								
0% TDF	0.027	0.063	2.28	5.30	0.258	0.601	NT	NT
5% TDF	0.0308	0.0717	2.46	5.73	0.219	0.510	NT	NT
10% TDF	0.0242	0.0564	2.46	5.71	0.188	0.436	NT	NT
15% TDF	0.0350	0.0815	2.35	5.47	0.190	0.443	NT	NT
20% TDF	0.0195	0.0453	2.30	5.34	0.166	0.387	NT	NT
<u>Facility E</u>								
0% TDF	0.036	0.083	0.0090	0.021	0.082	0.19	NT	NT
7% TDF	0.133	0.310	0.032	0.074	0.0537	0.125	NT	NT
<u>Facility F</u>								
2% TDF	0.073	0.17	2.49	5.78	NT	NT	NT	NT

NT = Not tested or data not available.

Note: Above data taken directly from reference; no adjustment was made to significant digits.

information on the facility, source type, baseline fuels, air pollution controls, test conditions, test methods, and fuel handling/feed data, as available. Part "b" of the table presents the source test data.

Individual power plant test data are presented in Tables A-1 through A-8. Table A-1 presents emissions data from utility "A", the only dedicated tires-to-energy facility examined in this report. Data for utilities B through H are given in Tables A-2 through A-8, respectively. All plants are coal-fired, except for plant E, which burns wood, plant G, which burns coal and wood, and plant H, which burns coal and/or petroleum coke.

Data from two cement kilns and one lime kiln are presented in Tables A-9 through A-11. Cement kilns burn a variety of fuels. Facility I burns natural gas and coal, while facility J burns a mixture of coal and coke. Facility K, a lime kiln, burns natural gas. The combination of long residence time and high temperatures make cement kilns an ideal environment for TDF. Emissions are not adversely affected compared to baseline fuels and often represent an improvement (Clark, et al., 1991).

Emissions data from pulp and paper mills are presented in Tables A-12 through A-17 for facilities L through Q, respectively. Pulp and paper mills burn various mixtures of wood, coal, oil, and sludge from onsite wastewater treatment facilities. For the pulp and paper boilers reported here, particulate, zinc, and SO_x emissions tended to increase with percent TDF added. Emissions of PAHs from facility M decreased, while those from facility L varied. Zinc is used in the tire manufacturing process, and is expected to increase with increasing TDF supplementation. Furthermore, zinc oxide has a small particle size and may not be controlled efficiently by venturi scrubbers.

Emissions from general industrial boiler applications are presented in Tables A-18 through A-22 for facilities R through V, respectively. These facilities are coal-fired, except for facility V which burns wood. They cover cogeneration and process heat for manufacturing and food processing.

The data presented in the appendix tables are taken from many data sources and are presented in various formats. Some source data are expressed in an emission factor format, i.e., mass of pollutant per unit of heat input [e.g., grams per megajoule (g/MJ) or pounds per million British Thermal Units (lb/MMBTU)]. The emission factor format is the most useful, because these results can be compared to a similar combustion/control system. However, these data should not be considered as recognized emission factors, because they have not undergone all the rigors of quality assurance and statistical analysis that are necessary before EPA will consider them valid emission factors.

Because many of the source tests were conducted in response to an environmental compliance requirement, they are reported in the source test as an emission limit on a mass per unit time basis (e.g., kg/hr or lb/hr). This type of data is less useful for comparison between facilities. In these cases, often the best information that can be inferred is how the TDF emission rate compares with the baseline (no TDF) emission rate for any given pollutant.

In the summary, or "a" section of the tables, the "Test Methods" entry may indicate "Unknown." While the details may be unavailable, all facilities with the reference "Clark, et al., (1991)," refer to the EPA report *Burning Tires for Fuel and Tire Pyrolysis: Air Implications,* and have had their methods procedures evaluated and accepted as creditable by EPA as a condition of being included in that report.

It is extremely difficult to establish a universal emission factor, or even a range of emission factors as a function of TDF added, because of the limited amount of emissions data when compared to all the other variables influencing the emission rate of any pollutant, such as:

- Baseline fuel type and variability, such as sulfur, nitrogen, ash, metals, chlorine, moisture content, etc. Furthermore, many sources were tested with multiple fuels (e.g., coal and wood), making it even more difficult to identify the impact of TDF.

- Air pollution control device efficiency varies with the type of fuel. For example, the efficiency of a venturi scrubber typically falls when handling the smaller particulate common to TDF. Fabric filters and electrostatic precipitators (ESPs) are preferable for particulate control for TDF exhaust streams.

- Combustor design. There are several boiler design types; suspension (fluidized bed and cyclone types) and grate firing (traveling, reciprocating, and chain stokers; stokers may be either spreader, underfeed, or overfeed). TDF combustion efficiency varies for each design type. For example, TDF is typically difficult to burn in suspension (e.g., in fluidized bed and cyclone-type boilers), because of its size and weight. However, this problem may be remedied with further research and development. To date, the spreader stoker is the most successful and widely used boiler configuration with TDF. However, with consistent and well-controlled processing of TDF (i.e., sizing and de-wiring), most well-maintained solid fuel combustors can successfully accommodate TDF as a supplemental fuel.

- The amount and type of processing/sizing that is used to convert a scrap tire to TDF. Size of TDF (whole tires, chunk, shredded, or crumb rubber) and type (wire-included or de-wired) influences the rate and type of air emissions.

Table A-9a. Facility I - Cement Kiln

Source Description

Facility Name, Location:	Ash Grove Cement Durkee, OR
Facility Type:	Cement Plant
Source Type:	Cement Kiln
Test Dates:	October 18 - 20, 1989
Other fuel(s):	Natural gas and coal
Air pollution control device(s) used:	ESP
Test Conditions:	Unknown
Test Methods:	Unknown
Fuel Handling/Feeding:	Unknown
Testing Company:	Unknown
Environmental Agency:	Oregon DEQ
Reference:	Clark, et al (1991)

Source Test Data Evaluation

	Yes	No	Unknown

Test Witnessed by or Prepared for

Table A-9a. Facility I - Cement Kiln

Source Description

Facility Name, Location:	Ash Grove Cement Durkee, OR
Facility Type:	Cement Plant
Source Type:	Cement Kiln
Test Dates:	October 18 - 20, 1989
Other fuel(s):	Natural gas and coal
Air pollution control device(s) used:	ESP
Test Conditions:	Unknown
Test Methods:	Unknown
Fuel Handling/Feeding:	Unknown
Testing Company:	Unknown
Environmental Agency:	Oregon DEQ
Reference:	Clark, et al (1991)

Source Test Data Evaluation

	Yes	No	Unknown
Data Expressed in Emission Factor Form	some		
Baseline Fuel Test Data Available	X		
Accurate Fuel Feed Rates		X	
Multiple Baseline Fuels	X		
Test Witnessed by or Prepared for Governmental Agency	X		

Table A-9b. Facility I - Cement Kiln

Pollutant		Baseline, 0% TDF	9-10% TDF	% Change
Particulate	g/MJ	0.417	0.382	-8
	lb/MMBtu	0.969	0.888	-8
SO_2	g/MJ	0.119	0.0950	-20
	lb/MMBtu	0.276	0.221	-20
CO	ppm	0.046	0.036	-27
Aliphatic compounds	g/MJ	0.00047	0.0004	-18
	lb/MMBtu	0.0011	0.0009	-18
Nickel	ug	30	ND	NA
Cadmium	ug	3.0	2.0	-33
Chromium	ug	30	ND	NA
Lead	ug	ND	ND	NA
Zinc	ug	35	35	0
Arsenic	ug	0.2	0.2	0
Chloride	kg/hr	0.122	0.0895	-26
	lb/hr	0.268	0.197	-26
Copper	ug	37	13	-65
Iron	ug	400	200	-50

ND = Not detected.
NA = Not applicable.

Table A-10a. Facility J - Cement Kiln

Source Description

Facility Name, Location:	Holnam Incorporated Industries Seattle, WA
Facility Type:	Cement Plant
Source Type:	Cement Kiln
Test Dates:	October 15 - 19 1990
Other fuel(s):	Coal/coke
Air pollution control device(s) used:	ESP
Test Conditions:	0%, 11%, 14% TDF (as heat input)
Test Methods:	EPA Methods 1, 2, 3A, 4, 5 (front and backhalf extraction), 6C, 7E, 10, 12, 0010 (Semi-Volatile Organic Sampling Train), TO-14 .
Fuel Handling/Feeding:	Tire chips
Testing Company:	Am Test, Inc.
Environmental Agency:	Washington DOE
Reference:	Am Test (1991), Clark, et al (1991)

Source Test Data Evaluation

	Yes	No	Unknown
Data Expressed in Emission Factor Form	X		
Baseline Fuel Test Data Available	X		
Accurate Fuel Feed Rates			X
Multiple Baseline Fuels		X	
Test Witnessed by or Prepared for Governmental Agency	X		

Table A-10b. Facility J - Cement Kiln

Pollutant	Baseline, 100% Coal, 0% TDF		11% TDF			14% TDF		
	10^{-6} g/MJ	10^{-6} lb /MMBtu	10^{-6} g/MJ	10^{-6} lb /MMBtu	% Change	10^{-6} g/MJ	10^{-6} lb /MMBtu	% Change
Acenaphthalene	1.19	2.76	0.864	2.01	-27	0.886	2.06	-26
Acenaphthylene	0.095	0.22	ND	ND	-100	ND	ND	-100
Anthracene	1.06	2.46	ND	ND	-100	ND	ND	-100
Benzo(b)anthracene	4.25	9.88	ND	ND	-100	ND	ND	-100
Benzoic Acid	4.498	10.46	ND	ND	-100	ND	ND	-100
Benzo(a)pyrene	0.877	2.04	ND	ND	-100	ND	ND	-100
Benzo(g,h,i)perylene	ND	ND	1.34	3.11	NA	4.442	10.33	NA
Bis(2-chloroethoxy)methane	95.641	222.42	74.583	173.45	-22	118.57	275.75	+24
Butyl Benzyl Phthalate	2.57	5.98	ND	ND	-100	ND	ND	-100
Dibenz(g,h)phthracene	45.877	106.69	20.50	47.67	-55	28.88	67.17	-37
Di-N-Butylphthalate	0.959	2.23	ND	ND	-100	ND	ND	-100
1,2-Dichlorobenzene	1.38	3.21	ND	ND	-100	ND	ND	-100
2,4-Dinitrotoluene	5.749	13.37	4.29	9.97	-25	3.87	9.00	-33
Fluorene	3.29	7.65	3.02	7.03	-8	3.06	7.12	-7

(Continued)

Table A-10b. Facility J - Cement Kiln (Cont.)

Pollutant	Baseline, 100% Coal, 0% TDF		11% TDF			14% TDF		
	10^{-6} g/MJ	10^{-6} lb /MMBtu	10^{-6} g/MJ	10^{-6} lb /MMBtu	% Change	10^{-6} g/MJ	10^{-6} lb /MMBtu	% Change
Hexachlorobenzene	31.60	73.49	17.38	40.42	-45	22.99	53.46	-27
Naphthalene	146.20	340.00	76.944	178.94	-47	68.456	159.20	-53
2-Nitroanaline	2.01	4.67	ND	ND	-100	2.16	5.02	+7
N-Nitrosodiphenyl-amine	39.05	90.81	20.47	47.60	-48	21.47	49.92	-45
Pyrene	2.14	4.97	1.02	2.38	-52	0.959	2.23	-55
1,2,4-Tricholrobenzene	7.504	17.45	1.11	2.57	-85	ND	ND	-100
4,6-Dinitro-2-methylphenol	2.38	5.53	ND	ND	-100	ND	ND	-100
4-Methyl Phenol	8.407	19.55	3.93	9.13	-53	6.570	15.28	-22
2-Nitrophenol	83.846	194.99	72.747	169.18	-13	74.012	172.12	-12
4-Nitrophenol	ND	ND	21.34	49.62	NA	12.80	29.77	NA
Pentachlorophenol	ND	ND	ND	ND	NA	ND	ND	NA
Phenol	140	32	69.247	161.04	-50	131.89	306.71	-4
2,4,5-Trichlorophenol	ND	ND	ND	ND	NA	ND	ND	NA

NA = Not applicable.
ND = Not detected.

Attachment 6

Description of Kiln Dust Return System

Cemex Cement, Inc
Brooksville Cement Plant
Hernando County, Florida

Kiln Dust Return System

CEMEX Cement, Inc.
Brooksville Cement Plant
521-02-10

The Brooksville Cement Plant has two dry process preheater kiln systems, each having a large dust collecting baghouse that controls particulate matter from the process air before it leaves the stack. The is dust collected in each baghouse is handled in one of two ways. **Normally** the dust is moved by screw conveyors and bucket elevators to the **kiln feed bin** which receives raw feed from the blending silo. This bin is mounted on weighing devices called load cells that are used in the calculation of the kiln feed rate to the preheater. The material is fed out of the **kiln feed bin** at a determined rate to the **POLDOS** which pneumatically transfers the raw feed and recycled kiln dust to the preheater. This transfer is the measured and reported **preheater feed rate.** [It should be noted that there is a separate feed system for each of the two kiln systems.]

Alternatively, if the kiln feed chemistry is such that the baghouse dust cannot be returned directly to the kiln, or if there's an equipment problem, the baghouse dust is returned and blended with the raw feed just produced by the raw mill. This material is pneumatically conveyed to the kiln blending silo. From the blending silo, the raw feed is transferred to the **kiln feed bin**, to the **POLDOS** and into the **preheater.**

In either case, the kiln dust is returned through the **kiln feed bin** and **POLDOS** to the preheater and is a fraction of the measured **preheater feed rate**.

The attached flow chart shows the flow of the kiln dust.

Dust and Hot Gas Flow Path