AP42 Section:	11.3
Title:	Comments, correspondence and test summaries from contractor for August 1997 supplement PINE HALL SOURCE TESTS

MRI

Copy 3 of 3
9711-30-04
ISB-3-22

MIDWEST RESEARCH INSTITUT
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401 Harrison Oaks Boulevar
Cary, North Carolina 27513-241
Telephone (919) 677-024
FAX (919) 677-006

CONFIDENTIAL ... DETERMINATION

FILE COPY

Released
8-19-93

Date: September 2, 1992

Subject: Site Visit--Pine Hall Brick Company
Review and Update of Mineral Products Industry Sections of Chapter 8, AP-42
EPA Contract 68-D0-0123; MRI Project 9711-30

From: Brian Shrager

To: Ron Myers
EPA/EIB/EFMS (MD-14)
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711

I. Purpose

The purpose of the visit was to evaluate the feasibility of emission testing at this site for the purpose of developing emission factors for AP-42.

II. Place and Date

Pine Hall Brick Company
Plant Nos. 3 and 4
Box 836 Lindsey Bridge Road
Madison, NC 27025

July 21, 1992

III. Attendees

Pine Hall Brick Company (Pine Hall)

John Dowdle, Vice President of Production

U. S. Environmental Protection Agency (EPA)

Ron Myers, EIB
John Brown, EMB
Roy Huntley, EMB

Midwest Research Institute (MRI)

Brian Shrager
Richard Marinshaw

IV. Discussion

Mr. Myers explained the purpose of the visit, described the ongoing revisions to AP-42, and outlined the test program being conducted by the Emission Inventory Branch (EIB) to develop new emission factors for inclusion in AP-42. Following this discussion, Mr. Dowdle led the group on a tour of the facility.

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Figure 1 presents a process flow diagram for the plant. The raw material is fed to a primary crusher by front-end loaders. The crusher is located in a small two-story building located on the side of a hill. The top story is open on one side to allow access by the front-end loaders. The bottom story is open to allow access to the crusher and to provide an outlet for the crushed material. The emissions from the crushing operation consist of fugitive particulate matter (PM) that is emitted by the crusher itself, by front-end loader traffic, and by the transfer of material from the front-end loaders to the crusher. From the crusher, the material is transferred by conveyor to a storage area, which consists of a covered building with open sides to allow access to front-end loaders. Because the conveyor discharge point is located approximately 10 meters (m) (30 feet [ft]) above the ground, it is likely that fugitive dust emissions are high when material is first deposited in the storage pile (i.e., until the storage pile is built up to a height that approaches the conveyor discharge height).

Front-end loaders transfer the crushed material from the storage piles to hoppers. From the hoppers, the material is transferred by conveyor to a building that encloses the grinding and screening operations. In this building, the material is first screened for size. Oversize material is conveyed to a pan crusher that is open on the top, then returned to the vibrating screens. Undersize material is transferred by conveyor to storage piles in an adjacent building.

Bay doors on one end of the screening and grinding building allow access by front-end loaders. The building is ventilated by means of roof vent and five axial fans located near the top of the building's walls. The roof vent and fans create an induced draft, which enters through the bay doors and exits through the roof vents; air movement into the bay doors was noticeable at the time of the visit. Emissions from the screening, grinding

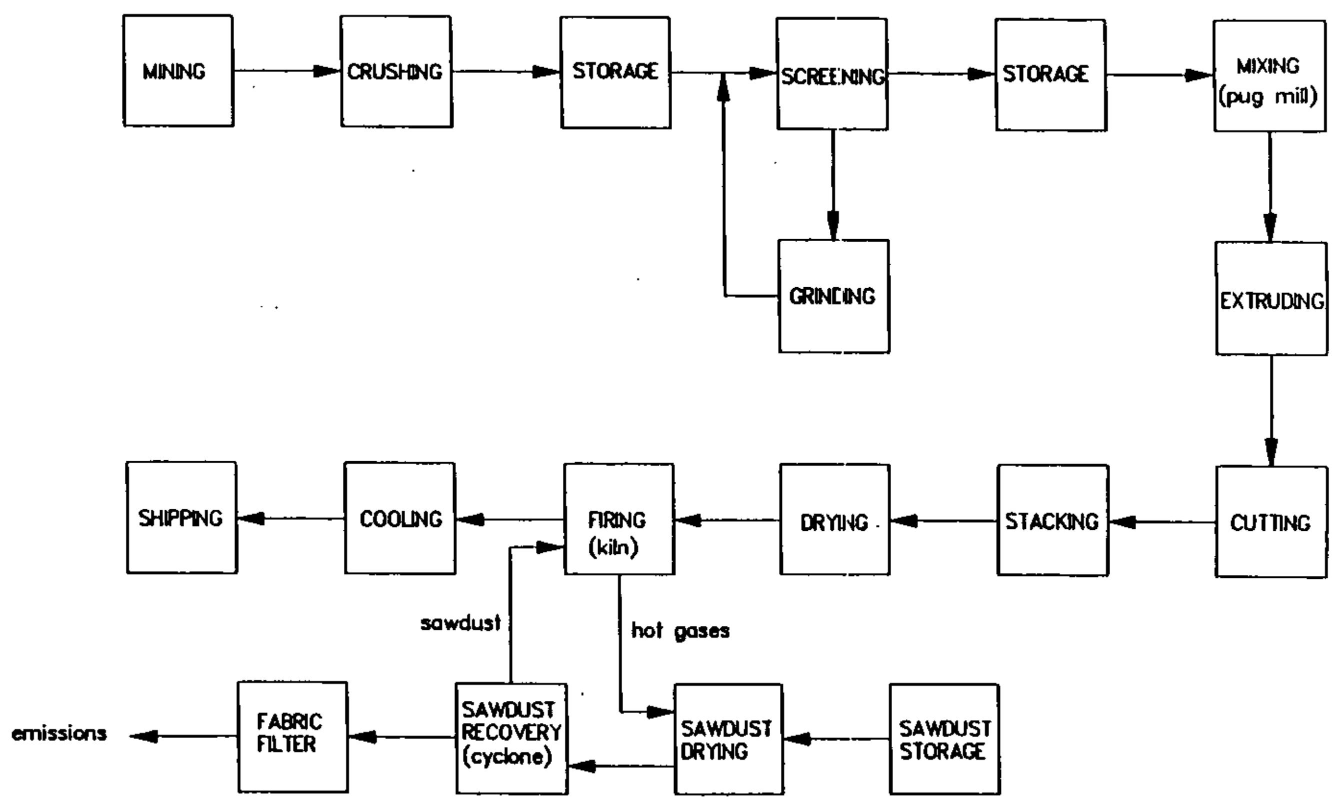

FIGURE 1. PROCESS FLOW DIAGRAM FOR PINE HALL BRICK

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After forming, the bricks are stacked by front-end loaders into "cubes" on pallets. From the stacking area, the bricks are transported to the tunnel kilns and are loaded onto railroad cars by forklift.

Plant No. 4

The tunnel kilns include a drying section, firing section, and a cooling section. The kilns are about 120 m (400 ft) long and are fired with sawdust. The drying section is heated with waste heat from the cooling section.

The unfired bricks enter the kiln on railroad cars and are fired for about 37 hours. The air temperature in the tunnel kiln ranges from approximately 204°C (400°F) at the beginning of the drying section to 1093°C (2000°F) in the firing section.

The sawdust used for firing the kilns first is dried from about 50 percent moisture to less than 10 percent moisture in a rotary dryer. The dryer is heated by exhaust gases that are vented from one or both kilns. From the dryer, the sawdust is recovered by means of a cyclone and then transported by screw conveyor to the kilns. The exhaust gases from the cyclone pass through a positive pressure baghouse and are emitted to the atmosphere.

Each kiln has one stack, which is not equipped with sampling ports. Emissions from the kilns are likely to be PM, fluorides, and products of combustion.

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V. Conclusions

With the exception of the tunnel kilns and sawdust dryers, emissions from all sources at Pine Hall are fugitive in nature. Most of these fugitive sources (crushing, screening, grinding, forming, stacking, and materials handling and storage operations) are enclosed. The primary crusher could be tested for PM emissions, but traffic from front-end loaders into and out of the crusher building could present problems. It would be difficult to isolate emissions from the fugitive sources in the screening and grinding building from one another. Because the building has few openings and a noticeable air flow from the bay doors to the roof vents, testing the entire building is feasible, however. Also, enclosing the crushing/grinding and screening operations in one building appears to be typical of the industry.

Testing plant No. 4 kiln stacks would be relatively straightforward. Although sampling ports would have to be installed, the duct from the kiln stack to the sawdust dryer is easily accessible and of adequate length for testing. By sampling the kiln exhaust (before the sawdust dryer) and the sawdust dryer exhaust, the dryer emissions could be calculated from the difference in the two measurements. Kiln and sawdust dryer emissions controlled by the baghouse could also be measured, although modifications to the baghouse outlet would be required. Baghouses, however, do not appear to be typical control devices in the brick industry.

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Front-end loader traffic on unpaved roads appeared to be a significant source of PM emissions. In addition, PM emissions from storage piles are likely to be significant.

CONFIDENTIAL PENDING DETERMINATION

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9711-30-04

DRAFT

Released 6-19-93

SUBJECT TO CONFIDENTIALITY CLAIM

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positive pressure

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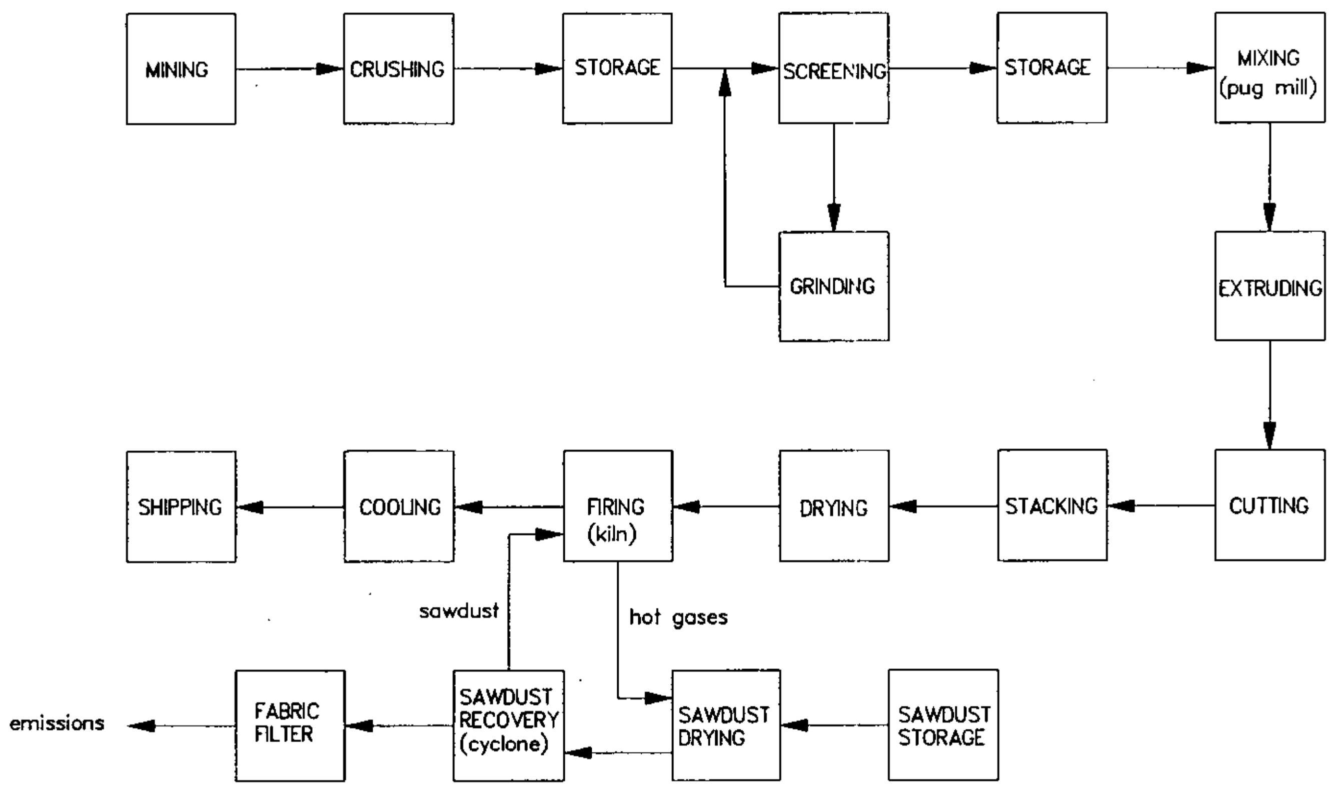

FIGURE 1. PROCESS FLOW DIAGRAM FOR PINE HALL BRICK

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D3005-2/CBI
08/11/92 1

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9711-30-04

Released 8-19-93

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DRAFT

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Pan Crusher

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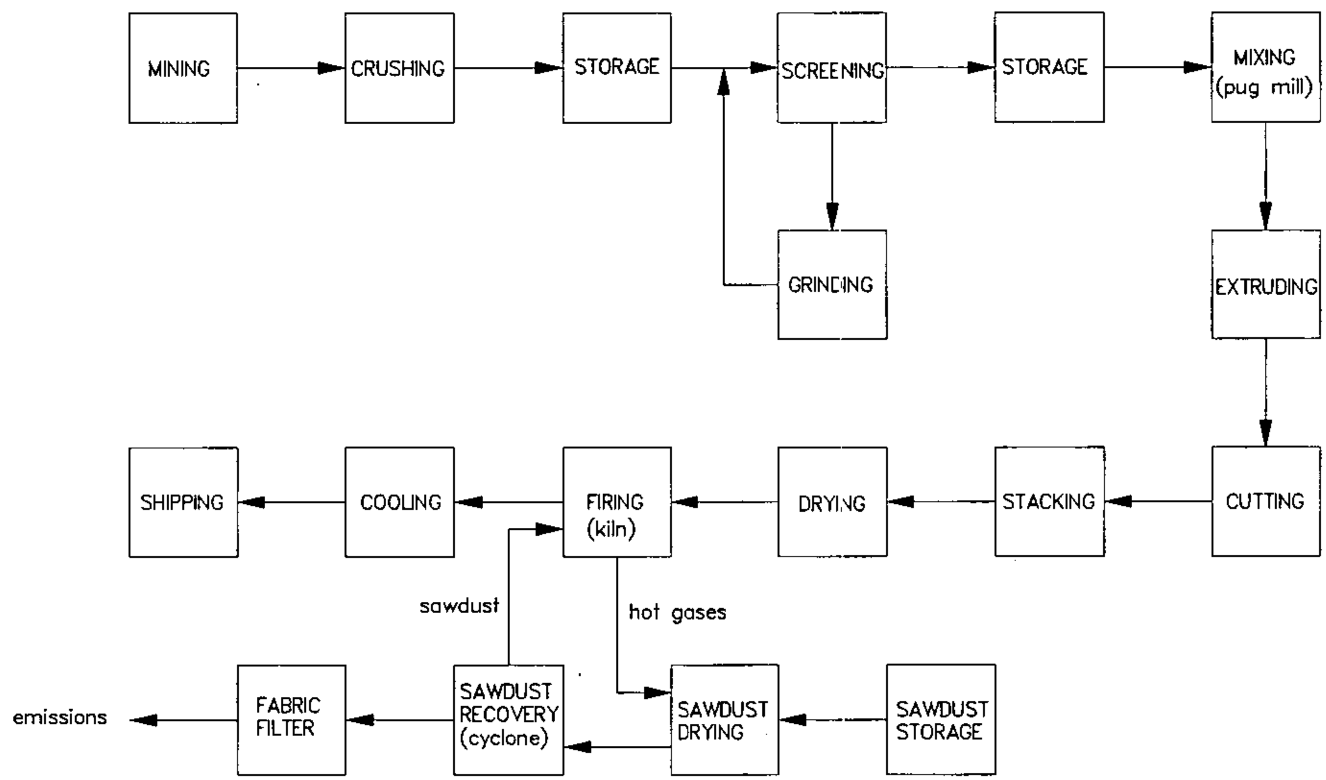


FIGURE 1. PROCESS FLOW DIAGRAM FOR PINE HALL BRICK

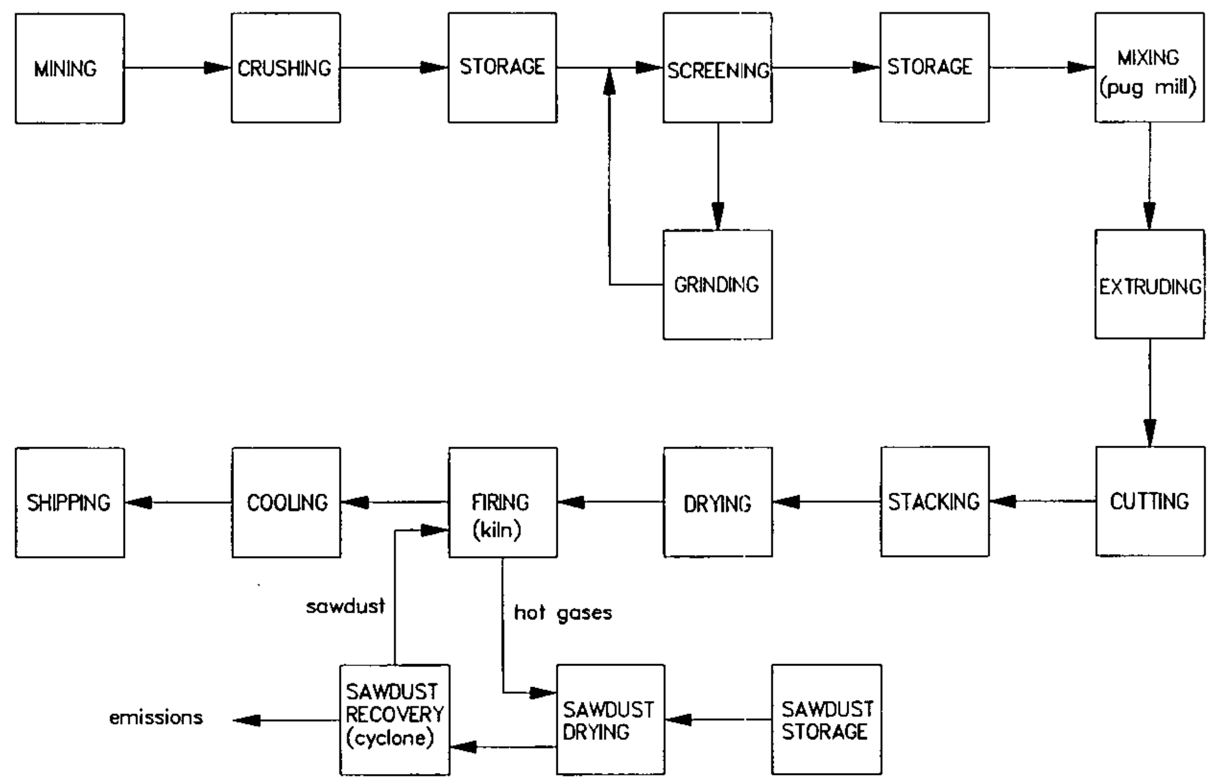


FIGURE 1. PROCESS FLOW DIAGRAM FOR SAWDUST-FIRED BRICK MANUFACTURING PLANT

T/R Released 8-19-93
Field Notebook Returned
R Marinshaw 11-1-93.

(1)

FIELD NOTEBOOK

MIDWEST RESEARCH INSTITUTE
ENVIRONMENTAL ENGINEERING DEPARTMENT
SUITE 350
401 HARRISON OAKS BLVD.
CARY, NC 27513
Telephone: (919) 677-0249
Facsimile: (919) 677-0065

ISSUED TO: R. MARINSHAW

SUBJECT: TRIP NOTES — PINE HALL BRICK

MRI PROJECT NO.: 9711-30

MRI CBI Pending No.:

EPA CBI Pending No.:

Declassified/Released:
(CDCO initial/date)

Facility Name: Pine Hall Brick Co.

Address:

Madison NC

Facility Contact: John Dowdle, Vice President of Production

Telephone: (919) 721-7500

Date and Time: 7/21/92 3:00-4:30 pm

Attendees: Roy Huntley, John Brown (EMB)
Ron Myers (EDB)
B. Shrager, R. Marinshaw (MRI)

Directions to Facility: From Greensboro follow 220 North
Turn left on 311 @ Madison, follow 1-2 miles
cross bridge then turn left.
Box 836 Lindsey Bridge Rd.
Madison, NC 27025

MIDWEST RESEARCH INSTITUTE

Project No. ______ Date/Time ______

Subject ______

FEL to HOPPER → ~~SOME~~ MATERIAL MINED ON SITE

~~Shale~~ Triassic Shale. ~11% Moisture

Facility operates 8 hrs/day 5 days/week

PRIM CRUSHING

SEPARATE BLDG.

OPEN ON ONE END

CONVEYOR TO STORAGE ENCLOSED

A LOT OF FUGITIVE DUST EMISSIONS FROM FEL TRAFFIC ON UNPAVED TRAFFIC LANES

FEL TO HOPPER CONVEYED TO GRINDING/SCREENING

SCREENING

5 ROOF FAN/EXHAUSTS

GRINDING

FINE SCREENING — HAMMERMILL

BUILDING ENCLOSED

BAY DOORS ~~ON~~ ONE SIDE

SAWDUST

DRYER — CY — BH STORAGE

SEPARATE STORAGE BLDG. ~30' DROP from conveyor to ground

NOTICABLE AIR MOVEMENT INTO BLDG.

KILN ~2000°F

FORMING (independent operations at each plant)

FF

CYCLONE

2 KILNS — 2 STACKS (1 each Kiln) SAWDUST

CAN DIRECT 1 OR BOTH TO DRYER

SAWDUST

SAW DUST BY CONVEYOR TO KILN

KILN EXHAUST → ROT. DRYER 160°F

NO PORTS FOR SAMPLING BUT CAN BE INSTALLED

Kilns are 400' long; Bricks fired for ~37 hrs.

MEASURE EMISSIONS

ADEQUATE STRAIGHT LENGTH → CAN GET BEFORE ; AFTER DRYER

PROBLEM WITH ~~BH~~ "BLINDING"

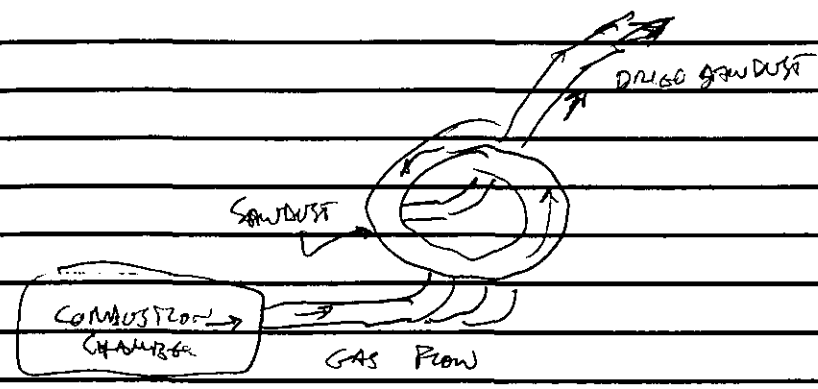
Heat for brick drying comes from cooling section exhaust.

HAVE BEE TRYING TO INSULATE DUCT WORK TO KEEP TEMP HIGH

PLANT NO. 3

1 FLUIDIZED BED DRYER (NEW, NOT YET IN OPERATION)
NOW (OLD) GAS BURNER DRYER (FLASH)
2 KILNS 2 STACKS

120,000 brick/day each Plant no. 4
80,000 " " Plant No. 3



NO. CONTAMINATED SOIL

CONCLUSIONS:

~~SAMPLE ENTIRE BLDG.~~

CRUSHING (PRIMARY) - COULD TEST ENTIRE BLDG.
BUT FEL TRAFFIC WILL CAUSE PROBLEMS

GRINDING, SCREENING - CAN'T ISOLATE SOURCES BUT
ALL ENCLOSED IN ONE BUILDING WHICH IS
AMENABLE TO TESTING
RECOMMEND TESTING ENTIRE BLDG.

KILN
- STACK EXHAUST SUITABLE FOR TESTING
- CAN SAMPLE ~~Before~~ KILN EXHAUST (BEFORE DRYER)
MUST INSTALL PORTS DRYER EXHAUST, & BAGHOUSE EXHAUST
~~But~~ DIFFERENCE OF KILN & DRYER EXHAUST
SHOULD GIVE DRYER EMISSIONS
NEED TO SAMPLE STORAGE PILES & TRAFFIC AREAS
FOR ESTIMATE FUGITIVE DUST EMISSIONS

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Subject ____________

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Subject ______

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Project No. ______ Date/Time ______

Subject ______

FIELD NOTEBOOK

MIDWEST RESEARCH INSTITUTE
ENVIRONMENTAL ENGINEERING DEPARTMENT
SUITE 350
401 HARRISON OAKS BLVD.
CARY, NC 27513
Telephone: (919) 677-0249
Facsimile: (919) 677-0065

ISSUED TO: Brian Shrager

SUBJECT: Pine Hall Brick Test

MRI PROJECT NO.: 9712-63-53

MRI CBI Pending No.:

EPA CBI Pending No.:

Declassified/Released:
(CDCO initial/date)

Facility Name: Pine Hall Brick Company

Address:

Madison, NC

Facility Contact: John Dowdle
Vernon Moore
Preston McMillan

Telephone: (919) 548-6007

Date and Time: 10/27/92 – 11/6/92

Attendees: Brian Shrager, Richard Marinshaw, MRI
EMB & ETS personnel,
John Dowdle, Vernon Moore, Preston McMillan, Kenny —, Henry Lowe } Pine Hall Brick

Directions to Facility:

Ron Myers 541-5407

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Constant Speed Conv.

Hopper inside Bldg stays ~ full. When full, feed from conveyor stops.

< 5/16" goes to screens

3 Inclda dry pan grinders + 1 hammermill

David Jones runs moisture contents Tues + Thurs

14 sec to fill front-end loader.

<u>Material Processed in Grinding Room</u>

Tues. 10/27	9:30 am	1,160 lb / 14 sec	* TIME INTERVAL TOO SHORT + SPILLAGE
TUES. 10/27	11:30 am	3260 lb / 30 sec	12:00 Soil a little dryer
TUES 10/27	1:30 am	3660 lb / 30 sec	1:30 Soil a little dryer

AT TEN O CLOCK AND 2 pm air appeared to be entering the bldg. through the front bay door.

* The third outlet fan was shut off @ 10:10 am.
The bay door @ the back of the building was shut @ 9:45 am and reopened @ 10:10 am. Shut again @ 10:45 am.
(half way)

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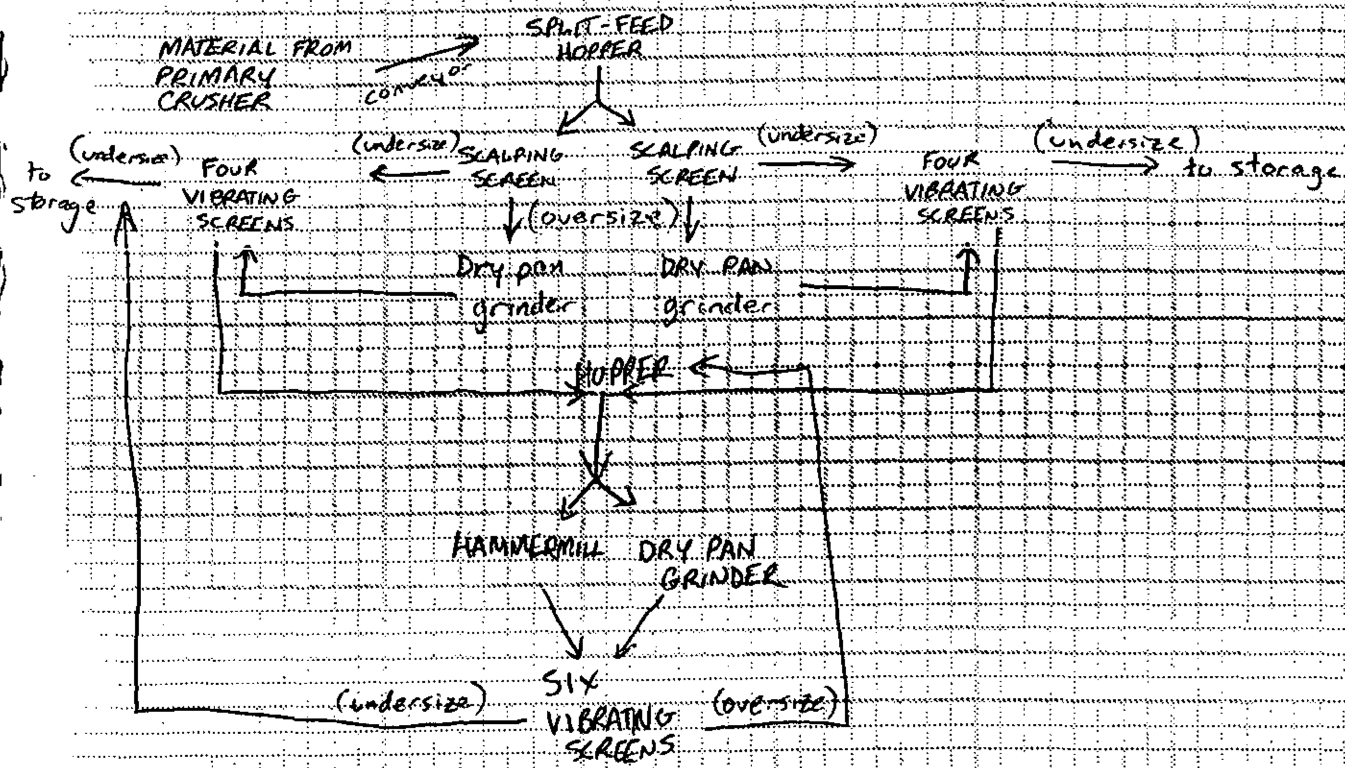
CRUSHING/GRINDING BEGUN AT 7:10 am - Operations running full at 7:25 am

GRINDING ROOM PROCESS



Production Rate

10/28 9:30 am $\frac{3720 \text{ lb}}{30 \text{ sec}}$

10/28 1:00 pm $\frac{3{,}520 \text{ lb}}{30 \text{ sec}}$

7:30 OPERATIONS NORMAL

OPERATOR SAYS GRINDING OPERATIONS ARE NORMAL.

11:00 "

OPERATOR SAYS GRINDING OPERATIONS ARE NORMAL

3:00 "

4:15 "

10/29/92

Fluorides test.

Method 13

At least measure air flows

outlet measurements for the purpose of checking if the sawdust absorbs fluorides

Get length, diameter, & speed of dryer.

Get sawdust moisture info.

RUN 1 KILN - Didn't get last sampling point
RUN 1 DRYER - Failed leak test at end of run.
RUN 2 KILN - OK
RUN 2 DRYER - METER BOX PUMP BROKE HALFWAY THROUGH
2nd TRAVERSE. FINISHED RUN ON 10/30.

10/30 RUN 2 FINISHED.
KILN + DRYER RUN 3 - OK, but Kiln test fell ~ 1/2 hour behind dryer test.

BOTH KILNS HOLD 38 CARS @ a time. "Schedule" on log sheet indicates how many cars exit + enter the Kiln per day.

Obtained log sheets for 10/29 and 10/30
all day 'til noon (Run 3 ended at ~1:30)

Sawdust Dryer operated @ ~200°F all week. (195°F - 215°F)

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11/2/92

\# of Front-end loader dumps (1:40 pm - 2:10 pm)

Primary Crusher Process Rate ~~||||~~ ~~||||~~ ~~||||~~ || 17 BAY #2

(no loads from 1:45-1:49)
(1:54-1:55)

Process Description: Front-end loader moves raw material from storage piles (located ~~[illegible]~~ in a three-bay building with open sides) to the primary crusher which is located in a small building. The front-end loader operates continuously until the hopper in the crushing building is full.

Kiln + dryer

ETS Had problems with a monitor in the morning. Began testing at about 12:30 pm. Anderson Impactor (201a + 202), HF (Method 26) and CO and NOx. TESTING finished at 7:45 pm

11/3/92

\# of Front-end loader dumps (9:18 am - 9:48 am)

Primary Crusher Process Rate ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ 20

~~||||~~ ~~||||~~ ~~||||~~ | 16 (12:54 pm - 1:24 pm)

(no loads from 1:02 - 1:09)

11/4/92

(7:30 - 8:00)

~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ |||| 24

(12:20 - 12:50)

~~||||~~ ~~||||~~ ~~||||~~ ||| 18

11/5/92

~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ||| 23 (7:30 - 8:00)

EACH FRONT-END LOADER DUMP WEIGHS APPROXIMATELY 5.9 TONS

PLANT REPORT SHOWED AN AVERAGE OF 38 DUMPS/HR

HISTORICAL INFORMATION PROVIDED BY PLANT ON SAWDUST USAGE

0.048 Tons of Dry Sawdust used per 1000 Bricks produced.

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EPA
Office of Air Quality Planning & Standards
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

EMISSION INVENTORY BRANCH

FAX TRANSMISSION

To:

DATE:

NAME: Rick Marenghan
PHONE NUMBER:
COMPANY: MRI
FAX NUMBER:

From:

NAME: Ron Myers
PHONE NUMBER: 541-5407

Reference:

SUBJECT: Our Telecon

Message:

Here is the summary test results from the Pine Hall Brick Test

This fax was sent from 919/541-0684. If you did not receive all the pages, or if there is a problem with the transmission, please contact the following person:

Name:

Phone No:

No. of Pages (including cover sheet):

EMISSIONS DATA SUMMARY - PINE HALL BRICK - OCT. 26 - NOV. 7, 1992

PLANT NO. 4

PROCESS SAMPLES

Grinding-Screening Soil (12 samples):
- Range; % > 20 mesh - 23.2 to 42.7
- Range; % < 20 > 200 mesh - 51.4 to 71.2
- Range; % < 200 mesh - 3.4 to 5.9
- Overall average; % > 20 mesh - 31.2
- Overall average; % < 20 > 200 mesh - 62.9
- Overall average; < 200 mesh - 4.5
- Range; % moisture - 13.0 to 14.2
- Overall average; % moisture - 13.4

Dried Sawdust (24 samples):
- Range; % > 20 mesh - 59.7 to 81.5
- Range; % < 20 > 200 mesh - 18.3 to 40.1
- Range; % < 200 mesh - .0034 to .028
- Overall average; > 20 mesh - 72.9
- Overall average; < 20 > 200 mesh - 27.2
- Overall average; < 200 mesh - 0.012
- Range; % moisture - 1.8 to 4.4
- Overall average; % moisture - 2.7

GRINDING-SCREENING SAMPLES 2B ton/h

PM_{10} Method 201 (6 samples):
- Range; lb/hr - 0.1623 to 0.4561 ug/M3 - 1.7 E3 to 4.2E3
- Overall average; lb/hr - 0.2404 ug/M3 - 2.3E3

Total Filterable Particulate (6 samples)
- Range; lb/hr - 1.689 to 3.905 ug/M3 - 16.9E3 to 36.3E3
- Overall average; lb/hr - 2.566 ug/M3 - 25.1E3

Ambient Background PM_{10} (2 samples):
- Range; ug/M3 - 53.6 to 64.4
- Overall average: ug/M3 - 59.0

Ambient Background TSP (2 samples):
- Range; ug/M3 - 81.4 to 126.7
- Overall average; ug/M3 - 104.1

PRIMARY CRUSHER SAMPLES

Ambient Inside PM_{10} (3 samples):
- Range; ug/M3 - 354.2 to 609.9
- Overall average; ug/M3 - 584.6

Ambient Inside TSP (3 samples):
- Range; ug/M3 - 1115.3 to 1598.5
- Overall average; ug/M3 - 1356.9

Inlet Air Flow (4 samples):
- Range; cfm - 2.99 to 13.04
- Overall average; cfm - 7.04

SAWDUST DRYER SAMPLES (Inlet and dual dryer cyclone outlets)

Inlet:

Total Fluorides Method 13B (3 samples):
Range; lb/hr - 0.257 to 0.802
Overall average; lb/hr - 0.576

Hydrogen Fluoride Method 26 (3 samples):
Range; lb/hr - 3.59 to 11.04
Overall average; lb/hr - 7.97

Particulate Method 5 (3 samples):
Range: lb/hr - 4.82 to 5.64
Overall average; lb/hr - 5.10

PM_{10} Method 201A-Includes condensible particulate (3 samples):
Range; lb/hr - 7.97 to 8.68
Overall average; lb/hr - 8.41

Condensible Particulate Method 202 (3 samples):
Range: lb/hr - 4.22 to 5.14
Overall average; lb/hr - 4.80

Particle Size Anderson Impactor (3 samples):
Overall average;

Aerodynamic Diameter - microns		% < Diameter
Stage 1	17.2	85.7
2	16.2	80.4
3	10.1	72.8
4	6.8	68.0
5	3.8	62.9
6	1.7	58.9
7	1.0	57.9
8	0.53	50.6

Trace Metals Multiple Metals Train (3 samples):
(< below detection limit)

Metal	Range; lb/hr	Average: lb/hr
Antimony	<1.2E-4 to 2.0E-4	<1.5E-4
Arsenic	7.5E-4 to 9.5E-4	8.7E-4
Beryllium	9.1E-6 to 1.8E-5	1.2E-5
Cadmium	1.6E-4 to 4.8E-4	2.9E-4
Chromium	9.2E-4 to 1.2E-3	8.9E-4
Lead	2.9E-3 to 8.0E-3	5.5E-3
Manganese	1.7E-2 to 6.2E-1	2.1E-1
Mercury	9.0E-5 to 2.5E-4	1.7E-4
Nickel	3.6E-4 to 7.8E-4	5.8E-4
Phosphorus	1.9E-2 to 3.1E-2	2.4E-2
Selenium	3.7E-4 to 2.0E-4	9.5E-4

CO Emissions Method 10 (CEM):
Range; lb/hr - 43.74 to 62.26
Overall average; lb/hr - 54.12

NO_x Emissions Method 7E (CEM):
Range; lb/hr - 5.55 to 9.04
Overall average; lb/hr - 7.29

Total Hydrocarbons Method 25A (CEM):
Range; lb/hr - 0.72 to 0.81
Overall average; lb/hr - 0.78

Methane & Ethane Integrated Bag (GC analysis):
All samples below the GC detection limit of 152 ppmdv for methane and 40 ppmdv for ethane.

VOST Emissions Method 0030 (18 samples):
Targeted VOST found; (< below detection limit)

Compound	Average lb/hr
Chloromethane	1.14E-2
Bromomethane	8.60E-4
Methylene chloride	1.25E-4
Trichlorofluoromethane	9.64E-5
Iodomethane	3.39E-3
Benzene	8.60E-3
Acetone	6.55E-3
Carbon disulfide	2.71E-4
Acrylonitrile	<3.63E-4
2-Butanone	<1.11E-4
Toluene	1.75E-3
Ethylbenzene	1.42E-4
O-Xylene	9.64E-5
M/P-Xylene	4.81E-4

Semi-VOST Emissions Method 0010 (3 samples):
Targeted Semi-VOST found; (< below detection limit)

Compound	Average lb/hr
Phenol	<1.20E-3
Naphthalene	<5.70E-3
Dimethlyphthalate	<1.70E-4
Dibenzofuran	<2.51E-4
Di-n-butylphthalate	<1.01E-4
bis(2-ethylhexyl)phthalate	4.77E-4

Outlet A:

Total Fluorides MEthod 13B (3 samples):
Range; lb/hr - 1.34 to 2.36
Overall average; lb/hr - 1.74

Hydrogen Fluoride Method 26 (3 samples):
Range; lb/hr - 0.329 to 3.094
Overall average; lb/hr - 1.54

Particulate Method 5 (3 samples):
Range; lb/hr - 2.19 to 3.07
Overall average; lb/hr - 2.49

PM_{10} Method 201A-Includes condensible particulate (3 samples):
Range; lb/hr - 2.05 to 4.12
Overall average; lb/hr - 2.80

Condensible Particulate Method 202 (3 samples):
Range; lb/hr - 0.26 to 1.48
Overall average; lb/hr - 0.59

Particle Size Anderson Impactor (4 samples):
Overall average;

	Aerodynamic Diameter - microns	% < Diameter
Stage 1	16.9	99.7
2	15.9	99.6
3	10.0	99.6
4	6.7	99.5
5	3.8	95.7
6	1.8	89.7
7	1.1	64.0
8	0.63	31.2

Trace Metals Multiple Metals Train (3 samples):
(< below detection limit)

Metal	Range; lb/hr	Average; lb/hr
Antimony	<2.7E-5 to 2.8E-5	<2.7E-5
Arsenic	2.0E-4 to 2.6E-4	2.3E-4
Berryllium	1.4E-6 to 8.8E-6	4.2E-6
Cadmium	5.8E-5 to 1.5E-4	9.7E-5
Chromium	1.5E-4 to 6.8E-4	3.7E-4
Lead	1.1E-4 to 2.4E-3	1.2E-3
Manganese	2.6E-3 to 6.4E-3	4.3E-3
Mercury	6.1E-5 to 1.3E-4	9.4E-5
Nickel	1.2E-4 to 4.5E-4	3.0E-4
Phosphorus	<4.7E-3 to 7.0E-3	<6.2E-3
Selenium	4.3E-4 to 4.6E-4	4.5E-4

CO Emissions Method 10 (CEM):
Range; lb/hr - 19.09 to 28.91
Overall average; lb/hr - 25.57

NO_x Emissions Method 7E (CEM):
Range; lb/hr - 1.85 to 3.00
Overall average; lb/hr - 2.73

Total Hydrocarbons Method 25A (CEM):
Range; lb/hr - 0.29 to 2.26
Overall average; lb/hr - 1.51

Methane & Ethane Integrated Bag (GC analysis):
All samples below the GC detection limit of 152 ppmdv for methane and 40 ppmdv for ethane.

VOST Emissions Method 0030 (18 samples):
Targeted VOST found; (< below detection limit)

Compound	Average lb/hr
Chloromethane	1.04E-2
Bromomethane	3.78E-4
Methylene chloride	8.19E-4
Tricholorfluoromethane	<1.33E-4
Iodomethane	1.81E-3
Benzene	4.08E-3
Acetone	7.67E-3
Carbon disulfide	1.31E-4
Acrylonitrile	<1.46E-4
2-Butanone	<2.16E-3
Toluene	3.91E-3
Ethylbenzene	8.63E-5
O-Xylene	6.64E-5
M/P-Xylene	2.96E-4

Semi-VOST Emissions Method 0010 (3 samples):
Targeted Semi-VOST found; (< below detection limit)

Compound	Average lb/hr
Phenol	<9.74E-4
Naphthalene	<1.92E-8
Dimethylphthalate	<1.92E-8
Dibenzofuran	<1.92E-8
Di-n-butylphthalate	<1.64E-4
bis(2-ethyulhexyl)phthalate	<2.21E-4

Outlet B:

Total Fluorides Method 13B (no samples):
Range; lb/hr -
Overall average; lb/hr -

Hydrogen Fluoride Method 26 (3 samples):
Range; lb/hr - 0.014 to 2.384
Overall average; lb/hr - 1.53

Particulate Method 5 (3 samples):
Range; lb/hr - 19.39 to 20.98
Overall average; lb/hr - 20.10

PM_{10} Method 201A-Includes condensible particulate (3 samples):
Range; lb/hr - 1.92 to 3.04
Overall average; lb/hr - 2.54

Condensible Particulate Method 202 (3 samples):
Range; lb/hr - 0.19 to 0.51
Overall average; lb/hr - 0.36

Particle Size Anderson Impactor (3 samples):
Overall average;

Aerodynamic Diameter - microns		% < Diameter
Stage 1	17.1	86.7
2	16.1	79.0
3	10.1	72.7
4	6.8	70.1
5	3.8	69.3
6	1.8	68.8
7	1.1	68.3
8	0.65	54.7

Trace Metals Multiple Metals Train (3 samples):
(< below detection limit)

Metal	Range; lb/hr	Average; lb/hr
Antimony	<7.1E-5 to 3.1E-5	<5.8E-5
Arsenic	9.8E-5 to 1.8E-4	1.3E-4
Berryllium	<1.5E-6 to 2.3E-6	<1.8E-6
Cadmium	2.6E-4 to 2.8E-4	2.7E-4
Chromium	2.4E-4 to 6.8E-4	4.4E-4
Lead	3.9E-5 to 2.1E-3	9.5E-4
Manganese	3.4E-3 to 3.8E-3	3.6E-3
Mercury	4.0E-5 to 1.6E-4	8.7E-5
Nickel	2.0E-4 to 3.7E-4	2.8E-4
Phosphorus	<7.1E-3 to 9.1E-3	<7.8E-3
Selenium	1.7E-4 to 4.7E-4	3.4E-4

CO Emissions Method 10 (CEM):
Range; lb/hr - 22.84 to 29.59
Overall average; lb/hr - 26.33

NO_x Emissions Method 7E (CEM):
Range; lb/hr - 2.35 to 3.01
Overall average; lb/hr - 2.67

Total Hydrocarbons Method 25A (CEM):
Range; lb/hr - 0.79 to 1.24
Overall average; lb/hr - 1.00

Methane & Ethane Integrated Bag (GC analysis):
All samples below the GC detection limit of 152 ppmdv for methane and 40 ppmdv for ethane.

VOST Emmissions Method 0030 (18 samples):
Targeted VOST found; (< below detection limit)

Compound	Average lb/hr
Chloromethane	1.22E-2
Bromomethane	<4.26E-4
Methylene chloride	2.07E-4
Trichlorofluoromethane	<8.35E-5
Iodomethane	2.26E-3
Benzene	5.23E-3
Acetone	9.64E-3
Carbon disulfide	1.75E-4
Acrylonitrile	<2.12E-4
2-Butanone	<1.88E-3
Toluene	3.30E-3
Ethylbenzene	8.27E-5
O-Xylene	5.46E-5
M/P-Xylene	1.80E-4

Semi-VOST Emissions Method 0010 (3samples):
Targeted Semi-VOST found; (< below detection limit)

Compound	Average lb/hr
Phenol	7.59E-4
Naphthalene	<1.95E-8
Dimethylphthalate	<1.95E-8
Dibenzofuran	<1.95E-8
Di-n-butylphthalate	9.98E-5
bis(2-ethylhexyl)phthalate	2.10E-3

PARTICULATE SAMPLES AT PLANT BOUNDARIES

Ambient PM_{10} (15 samples):

East boundary;

Range; ug/M3 - 9.6 to 45.1

Overall average; ug/M3 - 26.0

West boundary;

Range; ug/M3 - 9.1 to 51.3

Overall average; ug/M3 - 30.9

Ambient TSP (17 samples):

East boundary;

Range; ug/M3 - 13.6 to 140.4

Overall average; ug/M3 - 61.5

West boundary;

Range; ug/M3 - 7.8 to 85.6

Overall average; ug/M3 - 45.6

MRI

MIDWEST RESEARCH INSTITUTE
Suite 350
401 Harrison Oaks Boulevard
Cary, North Carolina 27513-2412
Telephone (919) 677-0249
FAX (919) 677-0065

Date: March 2, 1993

Subject: Draft Test Report for Pine Hall Brick
Review and Update Remaining Sections of Chapter 8
(Mineral Products Industry) of AP-42
EPA Contract 68-D2-0159, Work Assignment 012
MRI Project 3612

From: Richard Marinshaw

To: Ron Myers
EPA/EIB/EFMS (MD-14)
U. S. Environmental Protection Agency
Research Triangle Park, N.C. 27711

We have reviewed the draft test report prepared by ETS, Inc. for the emission test conducted at the Pine Hall Brick (Pine Hall) plant in Madison, North Carolina. The following paragraphs summarize our comments on the report.

1.1 Summary of Test Program, page 1, second paragraph.

The primary reasons for selecting Pine Hall were (1) the facility was identified by the North Carolina Brick Association as being representative of sawdust-fired brick manufacturing plants, and (2) the grinding, sawdust drying, and brick firing (kiln) operations were configured in such a way that facilitated emission testing.

1.2 Key Personnel, page 2.

Brian Shrager's name is misspelled.

2.0 PROCESS DESCRIPTION AND SAMPLING LOCATIONS, page 2.

Emissions from storage operations were not covered by the test.

3.3.2.3 Analytical Changes and Problems, page 6.

The statement in paragraph 2 of this section--that several of the values for the semivolatile samples had to be estimated--seems to pertain also to the VOST samples, based on the data presented in Appendix B.6.1. In addition, the method used and the basis for making these estimations should be explained more clearly. Finally, the summary tables, such as Table 3.4.2-16, should be footnoted accordingly. In doing so, it may be appropriate to differentiate between pollutant emission rates for which a few of the sample catches were estimated, such as acetone for sawdust dryer inlet Run 1, and emission rates for which <u>all</u> sample catches were estimated, such as benzene for sawdust inlet Run 1, or ethylbenzene for sawdust inlet Run 2.

In a related matter, it appears that for the VOST data if any of the six sample catches were below detection limit for a specific test run, the emission rate in the summary tables, such as Table 3.4.2-16, is reported as below detection limit. However, in some cases, such as for o-xylene for sawdust dryer inlet Run 1, only one of the sample catches was below detection limit. In such cases, it may be appropriate to assume a value, such as one-half the detection limit, for that single catch and present the resulting emission rate, footnoted accordingly.

3.4.1.3 Process Sampling, page 8.

Process samples were collected from the conveyor at the exit of the grinding building, not from the floor of the grinding room.

3.4.2.7 THC Emissions, page 9.

The total hydrocarbon emission data are reported (in this paragraph and throughout the report) as carbon. Should these emission concentrations and rates be reported as methane?

4.1.1 Ambient Particulate Matter (PM and PM_{10}) - Hi-Vol

The anemometer recordings for the crusher building should be provided somewhere in the report. Also, the crusher emission rate based on the anemometer readings should be provided.

Tables 3.4.2-1 to 3.4.2-3

The particulate data should be labeled as "filterable particulate."

Tables 3.4.2-4 to 3.4.2-6

Since the new format for presenting PM data in AP-42 separates the condensible organic and condensible inorganic PM, should the organic and inorganic fractions of the condensible data be presented here (and elsewhere in the report)?

cc: John Brown, EMB (MD-19)

PINE HALL BRICK

SUMMARY OF METHOD 13 TOTAL FLUORIDES TESTS

RUN	CONCENTRATION mg/SCF	lbs/hr
1F1	0.0680	0.290
2F1	0.0650	0.160
3F1	0.0770	0.190
1E	0.0153	0.072
2E	0.0290	0.140
3E	0.0490	0.270

> WORST CASE ~600 [illegible]

note: F-sawdust dryer outlet
E-sawdust dryer inlet

Analytical sample information

Sample	L	total mg	mg/L
1F1	.884	7.4	8.4
2F1	.657	5.3	8.0
3F1	.981	3.4	3.5
3AF1	.329	3.3	10.1
1E	1.043	1.9	1.8
2E	.782	2.7	3.4
2AE	.546	1.7	3.1
3E	.954	3.6	3.8
3AE	.306	21.4	70.0

Ron,

These are [illegible] of data available on the Pine Hall Brick test.

Thanks,
[illegible]

PINE HALL BRICK M-201 TEST SUMMARY

		PM10			TOTAL PARTICULATE	
RUN NO.	DATE	MG/DNCM	GR/DCF	% TOTAL	MG/DNCM	GR/DCF
1 D1	10/27/92	2.1	.00094	7.8	26.7	.01166
1 D2	"	4.2	.00185	11.6	36.3	.01584
2 D1	10/28/92	1.8	.00077	10.1	17.8	.00777
2 D2	"	2.2	.00097	13.0	16.9	.00736
3 D1	"	1.7	.00072	5.9	28.6	.01284
3 D2	"	2.0	.00088	8.9	24.4	.01064
		OVERALL AVERAGES				
		2.33	.00102	9.55	25.1	.01102

Typeover

Doc 1 Pg 1 Ln 3.5" POS 6.2"

PINE HALL WEST END TSP

START DATE	TIME	DURATION HH:MM	FILTER NUMBER	INITIAL WT GMS	FINAL WT GMS	NET WT GMS	FLOW CFM	CONCEN. UG/M3
10/27/92	7:28	8:19	23391	4.3724	4.3895	0.0171	36.48	33.2
10/28/92	7:36	8:34	23187	4.4354	4.4700	0.0346	42.05	56.6
10/29/92	7:42	7:59	23175	4.3568	4.4053	0.0485	41.81	85.6
11/02/92	8:32	8:56	23621	4.4331	4.4545	0.0214	41.53	34.0
11/03/92	7:38	9:14	23617	4.4333	4.4627	0.0294	40.84	45.9
11/04/92	7:00	8:20	23180	4.4339	4.4576	0.0237	43.18	38.8
11/06/92	7:15	8:48	23644	4.2133	4.2214	0.0081	41.30	13.1
11/06/92	16:15	16:48	23632	4.3849	4.3946	0.0097	43.83	7.8

PINE HALL WEST END PM10

START DATE	TIME	DURATION HH:MM	FILTER NUMBER	INITIAL WT GMS	FINAL WT GMS	NET WT GMS	FLOW CFM	CONCEN. UG/M3
10/27/92	7:28	8:20	23392	4.3532	4.3759	0.0227	40.00	40.1
10/28/92	7:26	8:41	23188	4.4500	4.4770	0.0270	40.00	45.8
10/29/92	7:34	8:04	23183	4.4184	4.4465	0.0281	40.00	51.3
11/02/92	8:30	9:02	23622	4.4588	4.4705	0.0117	40.00	19.1
11/03/92	7:30	8:58	23174	4.4226	4.4392	0.0166	40.00	27.3
11/04/92	7: 5	8:15	23181	4.4422	4.4586	0.0164	40.00	29.3
11/06/92	7:15	8:30	23645	4.2329	4.2403	0.0074	40.00	12.8
11/06/92	16:16	16:16	23631	4.3711	4.3812	0.0101	40.00	9.1

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29.3

PINE HALL EAST END TSP

START DATE	START TIME	DURATION HH:MM	FILTER NUMBER	INITIAL WT GMS	FINAL WT GMS	NET WT GMS	FLOW CFM	CONCEN. UG/M3
10/27/92	7:44	8:30	23393	4.3572	4.3646	0.0074	37.58	13.6
10/28/92	6:42	9:12	23191	4.4834	4.5345	0.0511	41.46	78.9
10/29/92	7:10	8:21	23186	4.3918	4.4357	0.0439	40.52	76.4
11/02/92	8:00	9:50	23624	4.4721	4.4908	0.0187	43.42	25.8
11/03/92	8:10	8:00	23620	4.4504	4.4855	0.0351	40.27	64.2
11/04/92	6:45	8:55	23182	4.3921	4.4185	0.0264	41.60	41.9
11/05/92	7:05	8:15	23176	4.4308	4.4394	0.0086	40.28	15.2
11/06/92	7:00	9:25	23629	4.4989	4.5926	0.0937	41.73	140.4
11/06/92	16:43	16:32	23633	4.3944	4.4216	0.0272	42.76	22.7

Avg 53.2

PINE HALL EAST END PM10

START DATE	START TIME	DURATION HH:MM	FILTER NUMBER	INITIAL WT GMS	FINAL WT GMS	NET WT GMS	FLOW CFM	CONCEN. UG/M3
10/27/92	7:44	8:34	23389	4.3629	4.3745	0.0116	40.00	19.9
10/28/92	6:38	VOIDED - FLOW RATE INCONSISTENT						
10/29/92	7:05	8:16	23184	4.4538	4.4791	0.0253	40.00	45.1
11/02/92	8:05	9:38	23625	4.4781	4.4844	0.0063	40.00	9.6
11/03/92	8:08	VOIDED - FLOW RATE INCONSISTENT						
11/04/92	6:45	9:01	23626	4.4929	4.5050	0.0121	40.00	19.8
11/05/92	7:05	8:14	23177	4.4550	4.4646	0.0096	40.00	17.2
11/06/92	7:05	9:17	23630	4.4768	4.5039	0.0271	40.00	43.0
11/06/92	16:48	16:26	23634	4.4072	4.4212	0.0140	40.00	12.5

A[illegible] 39

PINE HALL CRUSHER TSP

START DATE	TIME	DURATION HH:MM	FILTER NUMBER	INITIAL WT GMS	FINAL WT GMS	NET WT GMS	FLOW CFM	CONCEN. UG/M3
11/02/92	7:00	VOIDED - FILTER NOT CENTERED IN SAMPLER						
11/03/92	6:55	8:16	23618	4.4654	5.3970	0.9316	41.52	1598.5
11/04/92	6:40	8:16	23179	4.3957	5.0626	0.6669	42.60	1115.3

PINE HALL CRUSHER PM10

START DATE	TIME	DURATION HH:MM	FILTER NUMBER	INITIAL WT GMS	FINAL WT GMS	NET WT GMS	FLOW CFM	CONCEN. UG/M3	
11/02/92	7:00	8:27	23627	4.4861	4.6894	0.2033	40.00	354.2	
11/03/92	6:50	8:14	23619	4.4670	4.7797	0.3127	40.00	559.2	35
11/04/92	6:45	8:21	23178	4.4408	4.7867	0.3459	40.00	609.9	55

PINE HALL GRINDING BUILDING TSP

START DATE	START TIME	DURATION HH:MM	FILTER NUMBER	INITIAL WT GMS	FINAL WT GMS	NET WT GMS	FLOW CFM	CONCEN. UG/M3
10/27/92	7:00	8:17	23394	4.3663	4.4093	0.0430	37.55	81.4
10/28/92	7:08	9:38	23190	4.4571	4.5406	0.0835	40.30	126.7

PINE HALL GRINDING BUILDING PM10

START DATE	START TIME	DURATION HH:MM	FILTER NUMBER	INITIAL WT GMS	FINAL WT GMS	NET WT GMS	FLOW CFM	CONCEN. UG/M3	
10/27/92	7:00	8:19	23390	4.3464	4.3828	0.0364	40.00	64.4	79%
10/28/92	7:00	9:37	23189	4.4153	4.4503	0.0350	40.00	53.6	[illegible]

the Outlet B meterbox. These changes are not expected to affect the results.

3.4 Presentation of Results

3.4.1 Crushing, Grinding and Storage Operation Sampling

3.4.1.1 Ambient Sampling: Ambient particulate sampling was conducted in order to determine background particulate concentrations at the plant boundaries and at the air intake to the grinding building. To determine particulate emission rates from the grinding building, the ambient particulate concentrations at the air intake vents are important. Ambient PM and PM_{10} measurements were made at the grinding building air intake location coinciding with EMB exhaust duct testing for particulates. Table 3.4.1-1 shows the average concentration for the ambient PM and PM_{10} at the specified locations. The field and laboratory data for the ambient monitoring is contained in Appendix B.12.

The following observations are made:

1) The ambient particulate concentrations at the grinding building are approximately two times greater than the ambient concentrations at the plant boundaries.

2) The ambient PM_{10} at the grinding building was approximately 57% of the total PM concentration.

3) The fenceline particulate concentrations varied considerably from day to day. There was reasonable correlation between the "upwind" and "downwind" stations. The average "downwind" PM was 61.5 ug/m^3. The average "upwind" PM was 45.6 ug/m^3.
The average "downwind" PM_{10} was 26.0 ug/m^3. The average "upwind" PM_{10} concentration was slightly higher at 30.9 ug/m^3.

Ambient particulate monitoring was also performed at the crusher building in order to determine emissions of PM and PM_{10} resulting from the crushing operation. The monitors were suspended from the roof joist of the crusher building and operated during the day during the normal hours while the crusher was operating. The average PM concentration was determined to be 1357 ug/m^3 and the average PM_{10} concentration was 585 ug/m^3. These are averages of two consecutive days of sampling.

3.4.1.2 (NOTE: The results of the EMB sampling at the grinding building should be incorporated here).

3.4.1.3 Process Sampling: Process samples of soil from the grinding room floor were collected for sieve and moisture analyses. The data for the sieve and moisture analyses is contained in Appendix B.11. The sieve analysis was consistent for three of four samples collected. The fourth sample showed a greater amount of larger (> 20 mesh) particles. The average of the three consistent samples was 27.5% compared to 42.5% for the apparent outlier. The mid-range (< 20 > 200 mesh) average for the three consistent samples was 66.5% compared to 52.0% for the apparent outlier. All four soil samples had comparable composition of fine particles (< 200 mesh). The average of the four samples was 4.5%. Moisture analyses for the four soil samples ranged from 13.0% to 14.2%.

3.4.2 Sawdust Drier Sampling: The sawdust drier was sampled at the inlet and two outlets simultaneously. The inlet of the sawdust drier is the outlet of the kiln. The sawdust drier outlet splits to feed two identical cyclones. The outlet of each cyclone was tested. The test log for all sawdust drier testing is contained in appendix A.0.

3.4.2.1 PM, PM_{10}, CPM Emissions and Particle Sizing: Method 5 particulate testing was combined with the multiple metals sampling. The total particulate emissions for the inlet averaged 0.0557 grains per dry standard cubic foot corrected to 7% O_2 (gr/dscf @ 7% O_2). The total particulate emissions for the cyclone outlets averaged 0.0636 gr/dscf @ 7% O_2 for outlet A and 0.5630 gr/dscf @ 7% O_2 for outlet B. The high particulate concentrations for outlet B are consistent over 3 runs performed over two days. A comparison of the metals analyzed from the same runs do not show correspondingly high values for the cyclone outlet B. Tables 3.4.2-1, 3.4.2-2 and 3.4.2-3 contain summaries of the detailed data contained in Appendix B.1.

PM_{10} was sampled simultaneously at the sawdust drier inlet and outlets using Method 201A. Method 202 was used to measure the condensible particulate matter (CPM). These runs were performed together over two sampling days. The PM_{10} emissions for the inlet averaged 0.0928 gr/dscf @ 7% O_2. The PM_{10} emissions for the cyclone outlets averaged 0.0722 gr/dscf @ 7% O_2 for outlet A and 0.0596 gr/dscf @ 7% O_2 for outlet B. The CPM for the inlet averaged 57%. The CPM for the cyclone outlets averaged 16.7% for outlet A and 14.0% for outlet B. Tables 3.4.2-4, 3.4.2-5 and 3.4.2-6 contain summaries of the detailed data contained in Appendix B.2.

Particle size distribution was determined on samples collected simultaneously on the dryer inlet and two outlets using Anderson impactors. The data for each run is shown in Figures 3.4.2-1, 3.4.2-2 and 3.4.2-3 and detailed data is contained in Appendix B.10.

3.4.2.2 Trace Metals Emissions: Trace metal sampling was performed together with total particulate sampling. Tables 3.4.2-1, 3.4.2-2 and 3.4.2-3 contain summaries of the detailed data contained in Appendix B.1. The trace metal emissions were in agreement within a factor of 2 of the mean from run to run except for a high manganese on the inlet run 3 (IN-MM/TSP-R3). This result was voided due to suspected backhalf contamination by permanganate. Samples were analyzed for antimony, arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, nickel, phosphorous and selenium. Detectable quantities of all of the metals were present in one or more of the sample runs.

3.4.2.3 **(NOTE: Total fluorides results should be incorporated here).**

3.4.2.4 Hydrogen Fluoride Emissions: The hydrogen fluoride emissions were inconsistent and highly variable. The inlet concentrations ranged from 118 to 281 ppmdv @ 7% O_2. The outlet A concentrations ranged from 27 to 194 ppmdv @ 7% O_2. The outlet B concentrations ranged from 1.0 to 159 ppmdv @ 7% O_2. Tables 3.4.2-7, 3.4.2-8 and 3.4.2-9 contain summaries of the detailed data contained in Appendix B.5.

3.4.2.5 CO Emissions: Carbon monoxide emissions were monitored instrumentally (Method 10) throughout the sawdust drier test program. The averages for CO are contained in the summary tables for each wet method test series. The CO concentration at the inlet averaged 450 ppmdv. The CO concentration at the outlet averaged 342 ppmdv for outlet A and 345 ppmdv for outlet B. Detailed data for CEM testing is contained in Appendix C.0.

3.4.2.6 NOx Emissions: Nitrogen oxide emissions were monitored instrumentally (Method 7E) throughout the sawdust drier test program. The averages for NOx are contained in the summary tables for each wet method test series. The NOx concentration at the inlet averaged 34.4 ppmdv. The NOx concentration at the outlet averaged 22.7 ppmdv for outlet A and 22.0 ppmdv for outlet B. Detailed data for CEM testing is contained in Appendix C.0.

3.4.2.7 THC Emissions: Total hydrocarbon emissions were monitored instrumentally (Method 25A) during the VOST and semi-VOST sampling. THC emissions averaged 14.90 ppmdv as carbon at the inlet, 45.39 ppmdv as carbon at outlet A and 32.64 ppmdv as carbon at outlet B. The results show a significant increase in

THC emissions following the sawdust drier. Tables 3.4.2-10, 3.4.2-11 and 3.4.2-12 contain summaries of the detailed data contained in Appendix C.0.

Methane and ethane samples were collected as integrated bag samples during the VOST and semi-VOST sampling. These samples were analyzed by gas chromatography in the laboratory. The samples were all below the detection limit of 40 ppmdv for ethane and 152 ppmdv for methane for all inlet and outlet samples except Run 2 on outlet A (0A-M18-R2) which gave a value of 9223 ppmdv for methane. Tables 3.4.2-13, 3.4.2-14 and 3.4.2-15 contain summaries of the detailed data contained in Appendix B.9.

3.4.2.8 VOC Emissions: VOST samples were analyzed for chloromethane, bromomethane, methylene chloride, chloroform, trichlorofluoromethane, iodomethane, carbon tetrachloride, trichloroethene, benzene, tetrachloroethene, acetone, carbon disulfide, acrylonitrile, 2-butanone, 1,1,1-trichloroethane, vinyl acetate, 2-hexanone, toluene, ethylbenzene, styrene, o-xylene, and m-/p-xylene using Method 0030. Detectable quantities of chloromethane, bromomethane, methylene chloride, trichlorofluoromethane, iodomethane, benzene, acetone, carbon disulfide, acrylonitrile, 2-butanone, toluene, ethylbenzene, o-xylene, and m-/p-xylene were found in one or more of the sample runs. Tables 3.4.2-16, 3.4.2-17 and 3.4.2-18 contain summaries of the detailed data contained in Appendix B.6.

3.4.2.9 SVOC Emissions: Semi-VOST samples were analyzed for phenol, naphthalene, 2-methylphenol, dimethylphthalate, dibenzofuran, di-n-butylphthalate and bis(2-ethylhexyl)phthalate and were scanned for compounds on the list of 189 Hazardous Air Pollutants (HAPs) using Method 0010. Detectable quantities of phenol, naphthalene, dimethylphthalate, dibenzofuran, di-n-butylphthalate, bis(2-ethylhexyl)phthalate were found in one or more of the sample runs. Tables 3.4.2-19, 3.4.2-20 and 3.4.2-21 contain summaries of the detailed data contained in Appendix B.7.

3.4.2.10 Process Sampling: Process samples of sawdust were collected for sieve and moisture analysis. Eight samples of dried sawdust were taken on successive days. One sample represented the wet feed sawdust. The data for the sieve and moisture analyses is contained in Appendix B.11. The sieve analysis was consistent for all nine samples collected. The sawdust samples showed a greater amount (73.6%) of larger (> 20 mesh) particles. The mid-range (< 20 > 200 mesh) average for all samples was 26.3%. Less than 0.1% of the composition of all of the samples consisted of fine particles (< 200 mesh). The wet sawdust had a moisture content of 47.2%. The average of the eight dried sawdust samples was 2.7% moisture.

TABLE 3.4.2-1: SUMMARY OF PARTICULATE AND METALS EMISSIONS: SAWDUST DRYER

RUN I.D.	IN-MM/TSP-R1	IN-MM/TSP-R2	IN-MM/TSP-R3	AVERAGE
DATE	11/04/92	11/05/92	11/05/92	
TIME STARTED	19:40	09:28	13:25	
TIME ENDED	22:41	11:53	15:50	
SAMPLING PARAMETERS				
Metered Volume - dcf	74.087	83.040	76.204	77.777
Corrected Volume - dscf	73.648	82.184	74.533	76.789
Total Test Time - min	120	120	120	120
% Isokinetics	102.3	99.8	100.5	100.9
GAS PARAMETERS				
Gas Temperature - oF	496.9	494.6	495.0	495.5
Oxygen - %	15.5	16.1	16.1	15.9
Carbon Dioxide - %	4.9	4.8	4.6	4.8
Moisture - %	7.97	6.52	7.37	7.29
GAS FLOWRATE				
Velocity - ft/sec	58.50	65.49	60.11	61.36
Actual Volume - acfm	55826	62490	57357	58558
Standard Volume - dscfm	28005	32033	28862	29634
PARTICULATE EMISSIONS				
Concentration - gr/dscf	0.0201	0.0206	0.0196	0.0201
Conc. - gr/dscf @ 7% O2	0.0514	0.0595	0.0561	0.0557
Mass Rate - lb/hr	4.82	5.64	4.84	5.10
METALS EMISSIONS - lb/hr				
Antimony	<7.55E-05	<7.37E-05	7.48E-05	<7.47E-05
Arsenic	5.17E-04	5.58E-04	4.90E-04	5.22E-04
Beryllium	3.02E-06	3.09E-06	7.17E-06	4.43E-06
Cadmium	4.33E-05	1.08E-04	1.93E-04	1.15E-04
Chromium	2.67E-04	3.25E-04	4.52E-04	3.48E-04
Lead	2.03E-03	1.05E-03	3.05E-03	2.04E-03
Manganese	6.61E-03	6.79E-03	5.99E-01	2.04E-01
Mercury	1.65E-04	9.02E-05	2.45E-04	1.67E-04
Nickel	1.28E-04	2.49E-04	4.08E-04	2.62E-04
Phosphorus	6.74E-03	1.09E-02	8.20E-03	8.62E-03
Selenium	6.89E-04	1.61E-04	1.94E-04	3.48E-04
CO EMISSIONS				
Conc. - ppmdv	453.23	401.98	369.35	408.19
Mass Rate - lb/hr	55.36	56.16	46.50	52.67
NOx EMISSIONS				
Conc. - ppmdv	34.12	39.39	34.02	35.84
Mass Rate - lb/hr (NO_2)	6.85	9.04	7.03	7.64

TABLE 3.4.2-2: SUMMARY OF PARTICULATE AND METALS EMISSIONS: SAWDUST DR[illegible] [illegible]

RUN I.D.	OA-MM/TSP-R1	OA-MM/TSP-R2	OA-MM/TSP-R3	AVERAGE
DATE	11/04/92	11/05/92	11/05/92	
TIME STARTED	19:40	09:29	13:25	
TIME ENDED	22:41	11:53	15:50	
SAMPLING PARAMETERS				
Metered Volume - dcf	81.477	80.045	83.415	81.646
Corrected Volume - dscf	78.602	77.167	80.166	78.645
Total Test Time - min	120	120	120	120
% Isokinetics	102.7	103.3	104.1	103.3
GAS PARAMETERS				
Gas Temperature - oF	180.9	190.8	194.2	188.6
Oxylgen - %	17.2	17.1	17.2	17.2
Carbon Dioxide - %	3.3	3.4	3.3	3.4
Moisture - %	12.22	11.37	11.85	11.81
GAS FLOWRATE				
Velocity - ft/sec	44.78	43.91	46.11	44.93
Actual Volume - acfm	24634	24157	25365	24719
Standard Volume - dscfm	17170	16756	17273	17066
PARTICULATE EMISSIONS				
Concentration - gr/dscf	0.0150	0.0153	0.0207	0.0170
Conc. - gr/dscf @ 7% O2	0.0564	0.0563	0.0780	0.0636
Mass Rate - lb/hr	2.21	2.19	3.07	2.49
METALS EMISSIONS - lb/hr				
Antimony	<4.33E-05	<4.28E-05	<4.13E-05	<4.25E-05
Arsenic	1.39E-04	1.56E-04	1.75E-04	1.57E-04
Beryllium	8.67E-07	<8.62E-07	3.14E-06	<1.62E-06
Cadmium	3.44E-05	5.98E-05	2.28E-05	3.90E-05
Chromium	1.47E-04	2.40E-04	5.27E-05	1.46E-04
Lead	9.20E-04	4.07E-04	6.01E-05	4.62E-04
Manganese	1.06E-03	1.49E-03	4.45E-03	2.33E-03
Mercury	1.34E-04	8.62E-05	6.10E-05	9.39E-05
Nickel	1.77E-04	1.93E-04	6.30E-05	1.44E-04
Phosphorus	<4.32E-03	1.67E-03	<4.14E-03	<3.38E-03
Selenium	1.71E-04	1.59E-04	1.58E-04	1.63E-04
CO EMISSIONS				
Conc. - ppmdv	346.92	360.91	349.77	352.53
Mass Rate - lb/hr	25.98	26.38	26.35	26.24
NOx EMISSIONS				
Conc. - ppmdv	24.40	26.86	19.91	23.72
Mass Rate - lb/hr (NO_2)	3.00	3.22	2.46	2.90

TABLE 3.4.2-3: SUMMARY OF PARTICULATE AND METALS EMISSIONS: SAWDUST DRYER [illegible]

RUN I.D.	OB-MM/TSP-R1	OB-MM/TSP-R2	OB-MM/TSP-R3	AVERAGE
DATE	11/04/92	11/05/92	11/05/92	
TIME STARTED	19:40	09:28	13:25	
TIME ENDED	22:41	11:53	15:50	
<u>SAMPLING PARAMETERS</u>				
Metered Volume - dcf	75.403	72.906	72.615	73.641
Corrected Volume - dscf	75.053	72.342	70.768	72.721
Total Test Time - min	120	120	120	120
% Isokinetics	102.0	101.1	101.8	101.6
<u>GAS PARAMETERS</u>				
Gas Temperature - oF	180.6	181.5	180.1	180.8
Oxygen - %	17.3	17.3	17.3	17.3
Carbon Dioxide - %	3.3	3.3	3.2	3.2
Moisture - %	11.77	10.56	11.25	11.20
<u>GAS FLOWRATE</u>				
Velocity - ft/sec	42.73	40.99	40.37	41.36
Actual Volume - acfm	23505	22551	22208	22754
Standard Volume - dscfm	16507	16044	15595	16048
<u>PARTICULATE EMISSIONS</u>				
Concentration - gr/dscf	0.1370	0.1465	0.1554	0.1463
Conc. - gr/dscf @ 7% O2	0.5247	0.5625	0.6019	0.5630
Mass Rate - lb/hr	19.39	20.14	20.78	20.10
<u>METALS EMISSIONS - lb/hr</u>				
Antimony	<4.19E-05	<4.40E-05	3.15E-05	<3.91E-05
Arsenic	9.19E-05	1.32E-04	9.80E-05	1.07E-04
Beryllium	8.73E-07	<8.80E-07	<8.75E-07	<8.76E-07
Cadmium	9.40E-05	1.07E-04	9.45E-05	9.84E-05
Chromium	7.91E-05	2.54E-04	1.36E-04	1.56E-04
Lead	7.39E-04	2.78E-04	1.37E-05	3.43E-04
Manganese	1.48E-03	1.98E-03	1.20E-03	1.55E-03
Mercury	1.39E-04	1.58E-05	3.62E-05	6.35E-05
Nickel	1.21E-04	1.47E-04	1.48E-04	1.39E-04
Phosphorus	3.00E-03	<4.41E-03	<4.28E-03	<3.89E-03
Selenium	5.70E-05	1.75E-04	1.30E-04	1.21E-04
<u>CO EMISSIONS</u>				
Conc. - ppmdv	345.75	352.00	335.80	344.52
Mass Rate - lb/hr	24.89	24.63	22.84	24.12
<u>NOx EMISSIONS</u>				
Conc. - ppmdv	19.85	23.73	25.14	22.91
Mass Rate - lb/hr (as NO_2)	2.35	2.73	2.81	2.63

TABLE 3.4.2-4: SUMMARY OF PM10 AND M202 RESULTS: SAWDUST DRYER INLET.

RUN I.D.	IN-M201A-R1	IN-M201A-R2	IN-M201A-R3	AVERAGE
DATE	11/03/92	11/04/92	11/04/92	
TIME STARTED	16:54	10:15	14:12	
TIME ENDED	19:36	12:55	16:49	
SAMPLING PARAMETERS				
Metered Volume - dcf	59.176	56.140	58.603	57.973
Corrected Volume - dscf	58.972	56.639	58.246	57.952
Total Test Time - min	131.25	125.5	129.75	128.83
% Isokinetics	114.8	95.5	98.8	103.0
D50	9.59	9.58	9.63	9.60
GAS PARAMETERS				
Gas Temperature - oF	486.0	492.0	503.2	493.7
Oxygen - %	15.63	15.7	15.4	15.6
Carbon Dioxide - %	4.8	4.9	5.1	4.9
Moisture - %	6.66	6.35	6.05	6.35
GAS FLOWRATE				
Velocity - ft/sec	49.89	60.58	59.01	56.49
Actual Volume - acfm	47604	57812	56312	53909
Standard Volume - dscfm	24714	29814	28690	27739
PM DISTRIBUTION				
% Filterable	40.04	41.81	47.09	42.98
% Condensible	59.96	58.19	52.91	57.02
PARTICULATE EMISSIONS				
Concentration - gr/dscf	0.0405	0.0340	0.0324	0.0356
Mass Rate - lb/hr	8.57	8.68	7.97	8.41
CO EMISSIONS				
Conc. - ppmdv	405.75	478.80	485.13	456.56
Mass Rate - lb/hr	43.74	62.26	60.71	55.57
NOx EMISSIONS				
Conc. - ppmdv	31.32	37.20	35.73	34.75
Mass Rate - lb/hr (as NO_2)	5.55	7.95	7.34	6.94

TABLE 3.4.2-5: SUMMARY OF PM10 AND M202 RESULTS: SAWDUST DRYER OUTLET A.

RUN I.D.	OA-M201A-R1	OA-M201A-R2	OA-M201A-R3	AVERAGE
DATE	11/03/92	11/04/92	11/04/92	
TIME STARTED	16:54	10:15	14:12	
TIME ENDED	19:27	12:42	16:45	
SAMPLING PARAMETERS				
Metered Volume - dcf	52.652	46.381	56.995	52.009
Corrected Volume - dscf	52.724	47.097	55.901	51.907
Total Test Time - min	120.9	117	135.1	124.33
% Isokinetics	112.2	101.6	99.1	104.3
D50	8.97	9.41	9.21	9.20
GAS PARAMETERS				
Gas Temperature - oF	186.9	185.9	183.7	185.5
Oxygen - %	17.55	17.0	17.3	17.3
Carbon Dioxide - %	2.6	3.5	3.2	3.1
Moisture - %	10.93	11.50	11.48	11.30
GAS FLOWRATE				
Velocity - ft/sec	43.35	44.54	47.01	44.97
Actual Volume - acfm	23848	24502	25861	24737
Standard Volume - dscfm	16845	17177	18099	17374
PM DISTRIBUTION				
% Filterable	88.37	97.29	64.15	83.27
% Condensible	11.63	2.71	35.85	16.73
PARTICULATE EMISSIONS				
Concentration - gr/dscf	0.0155	0.0139	0.0266	0.0187
Mass Rate - lb/hr	2.24	2.05	4.12	2.80
CO EMISSIONS				
Conc. - ppmdv	259.80	385.83	337.84	327.82
Mass Rate - lb/hr	19.09	28.91	26.67	24.89
NOx EMISSIONS				
Conc. - ppmdv	15.33	24.09	22.40	20.61
Mass Rate - lb/hr (as No_2)	1.85	2.96	2.90	2.57

TABLE 3.4.2-6: SUMMARY OF PM10 AND M202 RESULTS: SAWDUST DRYER OUTLET E.

RUN I.D.	OB-M201A-R1	OB-M201A-R2	OB-M201A-R3	AVERAGE
DATE	11/03/92	11/04/92	11/04/92	
TIME STARTED	16:54	10:15	14:12	
TIME ENDED	19:24	12:55	16:41	
SAMPLING PARAMETERS				
Metered Volume - dcf	45.427	65.889	50.230	53.849
Corrected Volume - dscf	44.870	66.492	50.122	53.828
Total Test Time - min	114.1	146.7	127.9	129.57
% Isokinetics	94.3	108.6	92.8	98.6
D50	0.00	0.00	0.00	0.00
GAS PARAMETERS				
Gas Temperature - oF	176.2	178.5	179.2	178.0
Oxygen - %	17.08	17.08	17.12	17.09
Carbon Dioxide - %	3.41	3.36	3.40	3.39
Moisture - %	11.19	9.37	11.02	10.53
GAS FLOWRATE				
Velocity - ft/sec	45.78	45.18	46.90	45.95
Actual Volume - acfm	25181	24852	25801	25278
Standard Volume - dscfm	18067	18081	18311	18153
PM DISTRIBUTION				
% Filterable	83.23	90.03	84.71	85.99
% Condensible	16.77	9.97	15.29	14.01
PARTICULATE EMISSIONS				
Concentration - gr/dscf	0.0196	0.0124	0.0170	0.0163
Mass Rate - lb/hr	3.04	1.92	2.67	2.54
CO EMISSIONS				
Conc. - ppmdv	338.85	375.25	367.27	360.46
Mass Rate - lb/hr	26.70	29.59	29.33	28.54
NOx EMISSIONS				
Conc. - ppmdv	19.04	20.29	22.97	20.77
Mass Rate - lb/hr (as NO_2)	2.46	2.63	3.01	2.70

TABLE 3.4.2-7: HF DATA AND RESULTS: EPA METHOD 26: SAWDUST DRYER INLET.

RUN NUMBER	IN-M26-R1	IN-M26-R2	IN-M26-R3	AVERAGE
DATE	11/02/92	11/02/92	11/03/92	
START TIME	13:11	17:33	09:15	
END TIME	15:28	19:42	11:32	
SAMPLING DATA				
Initial Meter Volume - l	2158.380	2289.670	2411.150	2286.400
Final Meter Volume - l	2278.440	2409.690	2531.190	2406.440
Net Meter Volume - l	120.060	120.020	120.040	120.040
Average Meter Temp. - F	77.4	79.4	80.0	78.9
Barometric Pres. - in.Hg	29.48	29.57	29.72	29.59
Avg. Meter Pres. - in.W.C.	1.0	1.0	1.0	1.0
Meter Cal. Factor - Gamma	1.0047	1.0047	1.0047	
Corr. Meter Volume - dscf	4.132	4.128	4.145	4.135
Oxygen - %dv	15.22	14.46	15.59	15.09
GAS FLOWRATE DATA				
Velocity - ft/sec	54.90	55.55	51.22	53.89
Actual Volume - acfm	52390	53009	48878	51426
Standard Volume - dscfm	27292	27249	25509	26683
LABORATORY DATA				
Fluoride Analysis				
Total Liquid Volume - ml	40.0	40.0	33.0	37.7
Fluoride Conc. - mg/liter	252.0	300.0	127.0	226.3
HF EMISSIONS				
Concentration - ppmdv	109.071	129.977	45.209	94.752
Conc. - ppmdv @ 7% O2	266.916	280.540	118.343	221.933
Concentration - mg/dscm	90.731	108.122	37.607	78.820
Mass Rate - lb/hr	9.275	11.036	3.593	7.968

TABLE 3.4.2-8: HF DATA AND RESULTS: EPA METHOD 26: SAWDUST DRYER OUTLET A.

RUN NUMBER	OA-M26-R1	OA-M26-R2	OA-M26-R3	AVERAGE	DATE
11/02/92	11/02/92	11/03/92			
START TIME	13:11	17:33	09:15		
END TIME	15:28	19:42	11:32		

<u>SAMPLING DATA</u>

Initial Meter Volume - l	211.050	457.060	716.460	461.523
Final Meter Volume - l	453.850	714.760	1092.400	753.670
Net Meter Volume - l	242.800	257.700	375.940	292.147
Average Meter Temp. - F	64.3	65.3	68.0	65.9
Barometric Pres. - in.Hg	29.46	29.57	29.72	29.58
Avg. Meter Pres. - in.W.C.	1.0	1.0	1.0	1.0
Meter Cal. Factor - Gamma	1.0007	1.0007	1.0007	
Corr. Meter Volume - dscf	8.525	9.065	13.225	10.272
Oxygen - %dv	16.79	16.65	17.76	17.07

<u>GAS FLOWRATE DATA</u>

Velocity - ft/sec	42.15	41.12	41.96	41.74
Actual Volume - acfm	23185	22622	23081	22963
Standard Volume - dscfm	17478	16774	17029	17094

<u>LABORATORY DATA</u>

Fluoride Analysis				
Total Liquid Volume - ml	40.0	40.0	40.0	40.0
Fluoride Conc. - mg/liter	105.0	300.0	45.8	150.3

<u>HF EMISSIONS</u>

Concentration - ppmdv	22.028	59.190	6.194	29.138
Conc. - ppmdv @ 7% O2	74.499	193.587	27.420	98.502
Concentration - mg/dscm	18.324	49.238	5.153	24.238
Mass Rate - lb/hr	1.200	3.094	0.329	1.541

TABLE 3.4.2-9: HF DATA AND RESULTS: EPA METHOD 26: SAWDUST DRYER OUTLET B.

RUN NUMBER	OB-M26-R1	OB-M26-R2	OB-M26-R3	AVERAGE
DATE	11/02/92	11/02/92	11/03/92	
START TIME	13:11	17:33	09:15	
END TIME	15:28	19:42	11:32	
SAMPLING DATA				
Initial Meter Volume - l	455.560	703.230	955.120	704.637
Final Meter Volume - l	702.150	956.900	1198.630	952.560
Net Meter Volume - l	246.590	253.670	243.510	247.923
Average Meter Temp. - F	73.2	75.7	85.6	78.2
Barometric Pres. - in.Hg	29.48	29.57	29.72	29.59
Avg. Meter Pres. - in.W.C.	1.0	1.0	1.0	1.0
Meter Cal. Factor - Gamma	1.0009	1.0009	1.0009	
Corr. Meter Volume - dscf	8.521	8.753	8.291	8.522
Oxygen - %dv	16.81	16.64	16.91	16.79
GAS FLOWRATE DATA				
Velocity - ft/sec	35.79	38.62	38.55	37.65
Actual Volume - acfm	19690	21243	21209	20714
Standard Volume - dscfm	15377	15734	16346	15819
LABORATORY DATA				
Fluoride Analysis				
Total Liquid Volume - ml	40.0	40.0	40.0	40.0
Fluoride Conc. - mg/liter	1.4	238.0	200.0	146.5
HF EMISSIONS				
Concentration - ppmdv	0.294	48.635	43.145	30.691
Conc. - ppmdv @ 7% O2	0.999	158.691	150.304	103.331
Concentration - mg/dscm	0.244	40.457	35.890	25.531
Mass Rate - lb/hr	0.014	2.384	2.197	1.532

TABLE 3.4.2-13

SUMMARY OF ETHANE AND METHANE EMISSIONS
- SAWDUST DRYER INLET -

RUN I.D.	IN-M18-R1	IN-M18-R2	IN-M18-R3	AVERAGE
DATE	11/06/92	11/06/92	11/07/92	
TIME STARTED	11:37	17:42	09:02	
TIME ENDED	15:19	21:02	13:12	
GAS PARAMETERS*				
Gas Temperature - oF	502.3	494.8	498.5	498.6
Oxygen - %	16.42	16.0	16.3	16.3
Carbon Dioxide - %	4.5	4.3	4.4	4.4
Moisture - %	5.60	4.43	5.79	5.27
GAS FLOWRATE				
Velocity - ft/sec	54.94	55.78	57.83	56.18
Actual Volume - acfm	52427	53228	55184	53613
Standard Volume - dscfm	26998	27968	28623	27863
ETHANE EMISSIONS				
Conc. - ug/ml	< 0.050	< 0.050	< 0.050	< 0.050
Conc. - ppm	< 40.012	< 40.012	< 40.012	<40.012
Conc. - mg/m3	< 50.000	< 50.000	< 50.000	<50.000
Mass Rate - lb/hr	< 5.056	< 5.238	< 5.361	< 5.218
METHANE EMISSIONS				
Conc. - ug/ml	< 0.101	< 0.101	< 0.101	< 0.101
Conc. - ppm	<151.469	<151.469	<151.469	<151.469
Conc. - mg/m3	<101.000	<101.000	<101.000	<101.000
Mass Rate - lb/hr	< 10.214	< 10.581	< 10.829	< 10.541

(*) Gas flowrate data was taken from IN-M0010-R1,R2, and R3, respectively.

TABLE 3.4.2-14

SUMMARY OF ETHANE AND METHANE EMISSIONS
- SAWDUST DRYER OUTLET A -

RUN I.D.	OA-M18-R1	OA-M18-R2	OA-M18-R3	AVERAGE
DATE	11/06/92	11/06/92	11/07/92	
TIME STARTED	11:37	17:32	09:02	
TIME ENDED	15:19	21:02	13:12	
GAS PARAMETERS*				
Gas Temperature - oF	185.7	185.5	186.0	185.7
Oxygen - %	16.97	17.2	17.2	17.1
Carbon Dioxide - %	3.5	3.4	3.4	3.4
Moisture - %	9.67	10.51	9.51	9.90
GAS FLOWRATE				
Velocity - ft/sec	44.93	45.00	45.21	45.05
Actual Volume - acfm	24718	24755	24869	24781
Standard Volume - dscfm	17689	17558	17918	17722
ETHANE EMISSIONS				
Conc. - ug/ml	< 0.050	< 0.050	< 0.050	< 0.050
Conc. - ppm	< 40.012	< 40.012	< 40.012	<40.012
Conc. - mg/m3	< 50.000	< 50.000	< 50.000	<50.000
Mass Rate - lb/hr	< 3.313	< 3.288	< 3.356	< 3.319
METHANE EMISSIONS				
Conc. - ug/ml	< 0.101	6.150	< 0.101	< 2.117
Conc. - ppm	<151.469	9223.083	<151.469	<3175.340
Conc. - mg/m3	<101.000	6150.000	<101.000	<2117.333
Mass Rate - lb/hr	< 6.692	404.468	< 6.779	< 139.313

(*) Gas flowrate data was taken from OA-M0010-R1,R2, and R3, respectively.

TABLE 3.4.2-15

SUMMARY OF ETHANE AND METHANE EMISSIONS
- SAWDUST DRYER OUTLET B -

RUN I.D.	OB-M18-R1	OB-M18-R2	OB-M18-R3	AVERAGE
DATE	11/06/92	11/06/92	11/07/92	
TIME STARTED	11:37	17:32	09:02	
TIME ENDED	15:19	21:02	13:12	
GAS PARAMETERS*				
Gas Temperature - oF	181.9	182.3	182.3	182.2
Oxygen - %	17.19	17.5	17.3	17.3
Carbon Dioxide - %	3.3	3.2	3.2	3.2
Moisture - %	6.46	8.46	8.05	7.65
GAS FLOWRATE				
Velocity - ft/sec	41.11	42.17	38.98	40.75
Actual Volume - acfm	22612	23200	21443	22419
Standard Volume - dscfm	16895	16954	15821	16557
ETHANE EMISSIONS				
Conc. - ug/ml	< 0.050	< 0.050	< 0.050	< 0.050
Conc. - ppm	< 40.012	< 40.012	< 40.012	<40.012
Conc. - mg/m3	< 50.000	< 50.000	< 50.000	<50.000
Mass Rate - lb/hr	< 3.164	< 3.175	< 2.963	< 3.101
METHANE EMISSIONS				
Conc. - ug/ml	< 0.101	< 0.101	< 0.101	< 0.101
Conc. - ppm	<151.469	<151.469	<151.469	<151.469
Conc. - mg/m3	<101.000	<101.000	<101.000	<101.000
Mass Rate - lb/hr	< 6.392	< 6.414	< 5.985	< 6.264

(*) Gas flowrate data was taken from OB-M0010-R1,R2, and R3, respectively.

TABLE 3.4.2-16

SUMMARY OF VOLATILE ORGANICS EMISSIONS
- SAWDUST DRYER INLET -

RUN I.D.	IN-VST-R1	IN-VST-R2	IN-VST-R3	AVERAGE
DATE	11/06/92	11/06/92	11/07/92	
TIME STARTED	11:37	17:42	09:02	
TIME ENDED	15:05	20:47	12:27	

VOLATILE ORGANIC EMISSIONS - lb/hr

Acetone	3.94E-03	2.79E-03	1.29E-02	6.55E-03
Acrylonitrile	4.43E-04	< 3.46E-04	< 3.00E-04	<3.63E-04
Benzene	9.60E-03	9.50E-03	6.70E-03	8.60E-03
Bromomethane	5.62E-04	7.44E-04	1.19E-03	8.32E-04
2-butanone	< 3.23E-04	< 5.05E-06	< 5.13E-06	<1.11E-04
Carbon Disulfide	2.66E-04	3.32E-04	2.15E-04	2.71E-04
Carbon Tetrachloride	< 4.94E-06	< 5.05E-06	< 5.13E-06	<5.04E-06
Chloroform	< 4.94E-06	< 5.05E-06	< 5.13E-06	<5.04E-06
Chloromethane	1.50E-02	1.68E-02	2.30E-03	1.14E-02
Ethylbenzene	2.20E-04	1.07E-04	1.00E-04	1.42E-04
2-Hexanone	< 4.94E-06	< 5.05E-06	< 5.13E-06	<5.04E-06
Iodomethane	2.66E-03	3.64E-03	3.88E-03	3.39E-03
Methylene Chloride	1.72E-04	6.90E-05	1.33E-04	1.25E-04
M-/p-xylene	4.23E-04	1.85E-04	8.35E-04	4.81E-04
O-xylene	< 1.39E-04	< 5.97E-05	9.00E-05	9.64E-05
Styrene	< 4.94E-06	< 1.17E-05	< 5.13E-06	<7.27E-06
Tetrachloroethane	< 4.94E-06	< 5.05E-06	< 5.13E-06	<5.04E-06
Toluene	2.05E-03	1.08E-03	2.14E-03	1.75E-03
1,1,1-trichloroethane	< 4.94E-06	< 5.05E-06	< 5.13E-06	<5.04E-06
Trichloroethene	< 4.94E-06	< 5.05E-06	< 5.13E-06	<5.04E-06
Trichlorofluoromethane	1.17E-04	7.75E-05	9.50E-05	9.64E-05
Vinyl Acetate	< 4.94E-06	< 5.05E-06	< 5.13E-06	<5.04E-06

TABLE 3.4.2-17

SUMMARY OF VOLATILE ORGANICS EMISSIONS
- SAWDUST DRYER OUTLET A -

RUN I.D.	OA-VST-R1	OA-VST-R2	OA-VST-R3	AVERAGE
DATE	11/06/92	11/06/92	11/07/92	
TIME STARTED	11:47	17:34	09:02	
TIME ENDED	16:38	21:42	12:47	

VOLATILE ORGANIC EMISSIONS - lb/hr

Acetone	5.96E-03	6.15E-03	1.09E-02	7.67E-03
Acrylonitrile	< 7.39E-05	1.48E-04	2.18E-04	< 1.46E-04
Benzene	3.87E-03	4.24E-03	4.12E-03	4.08E-03
Bromomethane	3.27E-04	3.38E-04	4.70E-04	3.78E-04
2-butanone	1.03E-03	< 6.53E-04	4.79E-03	< 2.16E-03
Carbon Disulfide	1.07E-04	1.35E-04	1.50E-04	1.31E-04
Carbon Tetrachloride	< 3.30E-06	< 3.25E-06	< 3.33E-06	< 3.29E-06
Chloroform	< 3.30E-06	< 3.25E-06	< 3.33E-06	< 3.29E-06
Chloromethane	8.41E-03	1.12E-02	1.16E-02	1.04E-02
Ethylbenzene	8.16E-05	6.73E-05	1.10E-04	8.63E-05
2-Hexanone	< 3.30E-06	< 3.25E-06	< 3.33E-06	< 3.29E-06
Iodomethane	1.55E-03	1.83E-03	2.07E-03	1.81E-03
Methylene Chloride	2.59E-04	1.76E-03	4.41E-04	8.19E-04
M-/p-xylene	4.64E-04	1.68E-04	2.56E-04	2.96E-04
O-xylene	7.60E-05	4.77E-05	7.56E-05	6.64E-05
Styrene	< 3.30E-06	< 3.25E-06	< 9.28E-06	< 5.28E-06
Tetrachloroethane	< 3.30E-06	< 3.25E-06	< 3.33E-06	< 3.29E-06
Toluene	3.91E-03	4.00E-03	3.82E-03	3.91E-03
1,1,1-trichloroethane	< 1.89E-05	< 3.25E-06	< 3.33E-06	< 8.50E-06
Trichloroethene	< 3.30E-06	< 3.25E-06	< 3.33E-06	< 3.29E-06
Trichlorofluoromethane	< 1.51E-04	< 9.15E-05	1.56E-04	< 1.33E-04
Vinyl Acetate	< 3.30E-06	< 3.25E-06	< 3.33E-06	< 3.29E-06

TABLE 3.4.2-18

SUMMARY OF VOLATILE ORGANICS EMISSIONS
- SAWDUST DRYER OUTLET B -

RUN I.D.	OB-VST-R1	OB-VST-R2	OB-VST-R3	AVERAGE
DATE	11/06/92	11/06/92	11/07/92	
TIME STARTED	11:47	17:32	09:05	
TIME ENDED	16:37	21:46	12:45	

VOLATILE ORGANIC EMISSIONS - lb/hr

Acetone	9.61E-03	9.47E-03	9.83E-03	9.64E-03
Acrylonitrile	2.21E-04	< 2.03E-04	2.13E-04	<2.12E-04
Benzene	6.12E-03	4.99E-03	4.59E-03	5.23E-03
Bromomethane	4.35E-04	< 3.73E-04	4.69E-04	<4.26E-04
2-butanone	1.44E-03	< 1.59E-03	2.60E-03	<1.88E-03
Carbon Disulfide	1.80E-04	1.63E-04	1.81E-04	1.75E-04
Carbon Tetrachloride	< 3.10E-06	< 3.09E-06	< 2.87E-06	<3.02E-06
Chloroform	< 3.10E-06	< 3.09E-06	< 2.87E-06	<3.02E-06
Chloromethane	1.29E-02	1.02E-02	1.35E-02	1.22E-02
Ethylbenzene	1.19E-04	6.89E-05	6.00E-05	8.27E-05
2-Hexanone	< 3.10E-06	< 3.09E-06	< 2.87E-06	<3.02E-06
Iodomethane	2.19E-03	2.17E-03	2.41E-03	2.26E-03
Methylene Chloride	2.07E-04	3.45E-04	6.79E-05	2.07E-04
M-/p-xylene	2.26E-04	1.47E-04	1.66E-04	1.80E-04
O-xylene	7.16E-05	4.65E-05	4.56E-05	5.46E-05
Styrene	< 8.52E-05	< 1.04E-04	< 2.62E-05	<7.18E-05
Tetrachloroethane	< 3.10E-06	< 3.09E-06	< 2.87E-06	<3.02E-06
Toluene	3.52E-03	2.93E-03	3.44E-03	3.30E-03
1,1,1-trichloroethane	< 3.10E-06	< 1.19E-05	< 2.87E-06	<5.97E-06
Trichloroethene	< 3.10E-06	< 3.09E-06	< 2.87E-06	<3.02E-06
Trichlorofluoromethane	1.05E-04	< 5.84E-05	8.71E-05	<8.35E-05
Vinyl Acetate	< 3.10E-06	< 3.09E-06	< 2.87E-06	<3.02E-06

TABLE 3.4.2-19

SUMMARY OF EMISSIONS FOR SEMIVOLATILE COMPOUNDS
- SAWDUST DRYER INLET -

RUN I.D.	IN-M0010-R1	IN-M0010-R2	IN-M0010-R3	AVERAGE
DATE	11/06/92	11/06/92	11/07/92	
TIME STARTED	11:37	17:42	09:02	
TIME ENDED	15:19	21:02	13:12	
SAMPLING PARAMETERS				
Metered Volume - dcf	104.311	105.158	108.266	105.912
Corrected Volume - dscf	105.646	108.272	111.242	108.387
Total Test Time - min	180	180	180	180
% Isokinetics	101.5	100.4	100.8	100.9
GAS PARAMETERS				
Gas Temperature - oF	502.3	494.8	498.5	498.6
Oxygen - %	16.42	16.0	16.3	16.3
Carbon Dioxide - %	4.5	4.3	4.4	4.4
Moisture - %	5.60	4.43	5.79	5.27
GAS FLOWRATE				
Velocity - ft/sec	54.94	55.78	57.83	56.18
Actual Volume - acfm	52427	53228	55184	53613
Standard Volume - dscfm	26998	27968	28623	27863
SEMIVOLATILE EMISSIONS (lb/hr)				
Bis(2-ethylhexy)phthalate	6.49E-04	4.68E-04	3.13E-04	4.77E-04
Dibenzofuran	5.81E-04	1.73E-04	< 3.40E-08	<2.51E-04
Dimethylphthalate	< 3.38E-08	< 3.42E-08	5.10E-04	<1.70E-04
Di-n-butylphthalate	< 3.38E-08	3.04E-04	< 3.40E-08	<1.01E-04
2-methylphenol	< 3.38E-08	< 3.42E-08	< 3.40E-08	<3.40E-08
Naphthalene	1.71E-02	< 3.42E-08	< 3.40E-08	<5.70E-03
Phenol	< 3.38E-08	3.18E-03	4.36E-04	<1.20E-03
CO EMISSIONS				
Conc. - ppmdv	433.13	474.74	493.83	467.23
Mass Rate - lb/hr	51.00	57.91	61.65	56.86
NOx EMISSIONS				
Conc. - ppmdv	39.36	26.47	32.00	32.61
Mass Rate - lb/hr (as NO_2)	7.61	5.30	6.56	6.49

TABLE 3.4.2-20

SUMMARY OF EMISSIONS FOR SEMIVOLATILE COMPOUNDS
- SAWDUST DRYER OUTLET A -

RUN I.D.	OA-M0010-R1	OA-M0010-R2	OA-M0010-R3	AVERAGE
DATE	11/06/92	11/06/92	11/07/92	
TIME STARTED	11:37	17:32	09:02	
TIME ENDED	15:19	21:02	13:12	
SAMPLING PARAMETERS				
Metered Volume - dcf	120.273	120.553	121.899	120.908
Corrected Volume - dscf	120.642	121.676	123.588	121.969
Total Test Time - min	180	180	180	180
% Isokinetics	102.0	103.6	103.1	102.9
GAS PARAMETERS				
Gas Temperature - oF	185.7	185.5	186.0	185.7
Oxygen - %	16.97	17.2	17.2	17.1
Carbon Dioxide - %	3.5	3.4	3.4	3.4
Moisture - %	9.67	10.51	9.51	9.90
GAS FLOWRATE				
Velocity - ft/sec	44.93	45.00	45.21	45.05
Actual Volume - acfm	24718	24755	24869	24781
Standard Volume - dscfm	17689	17558	17918	17722
SEMIVOLATILE EMISSIONS (lb/hr)				
Bis(2-ethylhexy)phthalate	3.44E-04	< 1.91E-08	3.21E-04	< 2.21E-04
Dibenzofuran	< 1.94E-08	< 1.91E-08	< 1.92E-08	< 1.92E-08
Dimethylphthalate	< 1.94E-08	< 1.91E-08	< 1.92E-08	< 1.92E-08
Di-n-butylphthalate	3.63E-04	< 1.91E-08	1.28E-04	< 1.64E-04
2-methylphenol	< 1.94E-08	< 1.91E-08	< 1.92E-08	< 1.92E-08
Naphthalene	< 1.94E-08	< 1.91E-08	< 1.92E-08	< 1.92E-08
Phenol	< 1.94E-08	1.33E-03	1.59E-03	< 9.74E-04
CO EMISSIONS				
Conc. - ppmdv	325.22	353.45	349.82	342.83
Mass Rate - lb/hr	25.09	27.07	27.34	26.50
NOx EMISSIONS				
Conc. - ppmdv	23.78	24.11	23.24	23.71
Mass Rate - lb/hr (as NO_2)	3.01	3.03	2.98	3.01

TABLE 3.4.2-21

SUMMARY OF EMISSIONS FOR SEMIVOLATILE COMPOUNDS
- SAWDUST DRYER OUTLET B -

RUN I.D.	OB-M0010-R1	OB-M0010-R2	OB-M0010-R3	AVERAGE
DATE	11/06/92	11/06/92	11/07/92	
TIME STARTED	11:37	17:32	09:02	
TIME ENDED	15:19	21:02	13:12	
SAMPLING PARAMETERS				
Metered Volume - dcf	110.613	113.298	107.111	110.341
Corrected Volume - dscf	111.720	115.140	109.810	112.223
Total Test Time - min	180	180	180	180
% Isokinetics	98.9	101.5	103.8	101.4
GAS PARAMETERS				
Gas Temperature - oF	181.9	182.3	182.3	182.2
Oxygen - %	17.19	17.5	17.3	17.3
Carbon Dioxide - %	3.3	3.2	3.2	3.2
Moisture - %	6.46	8.46	8.05	7.65
GAS FLOWRATE				
Velocity - ft/sec	41.11	42.17	38.98	40.75
Actual Volume - acfm	22612	23200	21443	22419
Standard Volume - dscfm	16895	16954	15821	16557
SEMIVOLATILE EMISSIONS (lb/hr)				
Bis(2-ethylhexy)phthalate	8.94E-04	4.49E-03	9.08E-04	2.10E-03
Dibenzofuran	< 2.00E-08	< 1.95E-08	< 1.91E-08	< 1.95E-08
Dimethylphthalate	< 2.00E-08	< 1.95E-08	< 1.91E-08	< 1.95E-08
Di-n-butylphthalate	3.82E-05	8.63E-05	1.75E-04	9.98E-05
2-methylphenol	< 2.00E-08	< 1.95E-08	< 1.91E-08	< 1.95E-08
Naphthalene	< 2.00E-08	< 1.95E-08	< 1.91E-08	< 1.95E-08
Phenol	5.86E-04	9.24E-04	7.67E-04	7.59E-04
CO EMISSIONS				
Conc. - ppmdv	313.89	341.50	338.45	331.28
Mass Rate - lb/hr	23.13	25.25	23.35	23.91
NOx EMISSIONS				
Conc. - ppmdv	24.84	21.78	20.58	22.40
Mass Rate - lb/hr (as NO_2)	3.01	2.65	2.33	2.66

Emission Inventory Branch
Technical Support Division (MD-14)
Office of Air Quality Planning and Standards
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711
FAX Number: (919) 541-0684

FAX TRANSMISSION

Date: 4/8/93

TO:

NAME	PHONE NUMBER
Rick Marenshaw / John Brown	
COMPANY/OFFICE	**FAX NUMBER**
MRI / EMB	

FROM:

NAME	PHONE NUMBER
Ron Myers	541-5407

COMMENTS:

Here is a copy of a letter from the N.C. Brick Assn. I would agree w/ item 3, 5. We need to talk about the other items - most are in EMB's area of expertise.

Number of Pages (including cover sheet): 3

If you did not receive all the pages, please contact the following person:

Name: Ron Myers Phone Number:

Brick Association
of North Carolina

Post Office Box 13290
Greensboro, NC 27415-3290
Telephone 919/273-5566
FAX 919/273-3463

Park Center Building
324 W. Wendover Ave., Suite 210
Greensboro, NC 27408

April 5, 1993

Mr. Ron Myers,
Environmental Protection Agency
79 T.W. Alexander Drive
4201 Building
Mail Drop 14
Research Triangle Park, NC 27711

Re: Partial response to Pine Hall Brick emissions test

Dear Mr. Myers:

The following is a partial response by the North Carolina brick industry regarding the EPA Draft Test Final Report and Emissions Factors as supplied to us by you on March 23.

This report is partial because of our need to evaluate the Appendix volumes prior to further comment on emission factors for particulate matter. These documents have been sent to Dr. Denis Brosnan at Clemson University for study and comment on our behalf.

1. We ask for your assistance in interpreting the results from the "Trace Metals Multiple Metals Train" contained in the subject report. In particular, our information is that the method used in this test would include any metals held on a molecular level within sawdust particulates. In other words, the emission was primarily sawdust which contained the metals.

It is my information, that it is possible using the multiple metals train to distinguish between metals contained within particulates and metals which pass through the filter and are captured in the flow train. On discussing this matter with ETS, we find that such distinctions were not made at Pine Hall.

Please provide us with your interpretation of the Pine Hall results with respect to metals. We suggest clarification in the final report reflecting that interpretation.

2. We believe a summary table is in order for the crusher building (reference to pp. 7 - 8) in the main body of the report for clarity.

3. The word "unique" on page 1, paragraph 2, line 3, with respect to Pine Hall is objectionable. Pine Hall was an "advantageous test site" but the plant and raw material are "typical" for a sawdust operation and not "unique." The word unique could be construed as justification to apply other factors to everybody else.

BRICK
Smarter than you think

4. With respect to paragraph 3.4.1.2, we calculate the PM^{10} to average 0.001021 rather than 0.001022 gr/dscf. While this is a small difference, EPA should use conventional rules on rounding.

5. With respect to paragraph 3.4.1.3, the word "soil" should be replaced with the term "brick raw material" or "clay". Use of the term "soil" can cause confusion for future users of the report.

6. In paragraph 3.4.2.3, the third sentence should be clarified to read"...1.34 to 2.36 at the one outlet tested." In the fifth sentence, "since" is misspelled.

7. In paragraph 3.4.2.4, we believe the EPA should clarify if the corrected Method 26A published in the Federal Register of February 26, 1993, was used or if the older or uncorrected method was used. In essence, we want to know if the data is valid per the February 26th publication. If the data is valid, why not give the emission rate of 3.07 lb/hr (1.54 Outlet A + 1.53 Outlet B) for clarity.

8. We are confused about about the number given for "Flourides." You give a dryer outlet of 0.19 lb/ton, and our calculation for Method 26 is 0.176 lb/ton. Please clarify as to the test method used and its basis.

9. We are concerned about the rounding of numbers for several factors to the highest level. Nitrogen Dioxide: your number is 0.4 our calculations show 0.31. We believe you may have left a 0 out of the manganese number. Yours reads 0.005. Shouldn't it read 0.0004?

10. Please explain the phenol number of $<1\times10^{-4}$ We cannot see how any number can be estimated from the data.

Further comments should be forthcoming shortly. In the meantime, we appreciate being able to forward these questions to you and look forward to your response.

Cordially,

Peter P. Cieslak

Peter P. Cieslak
General Manager

cc: Shannon Vogel
NC D.E.M.

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL # of pages ▶ 3

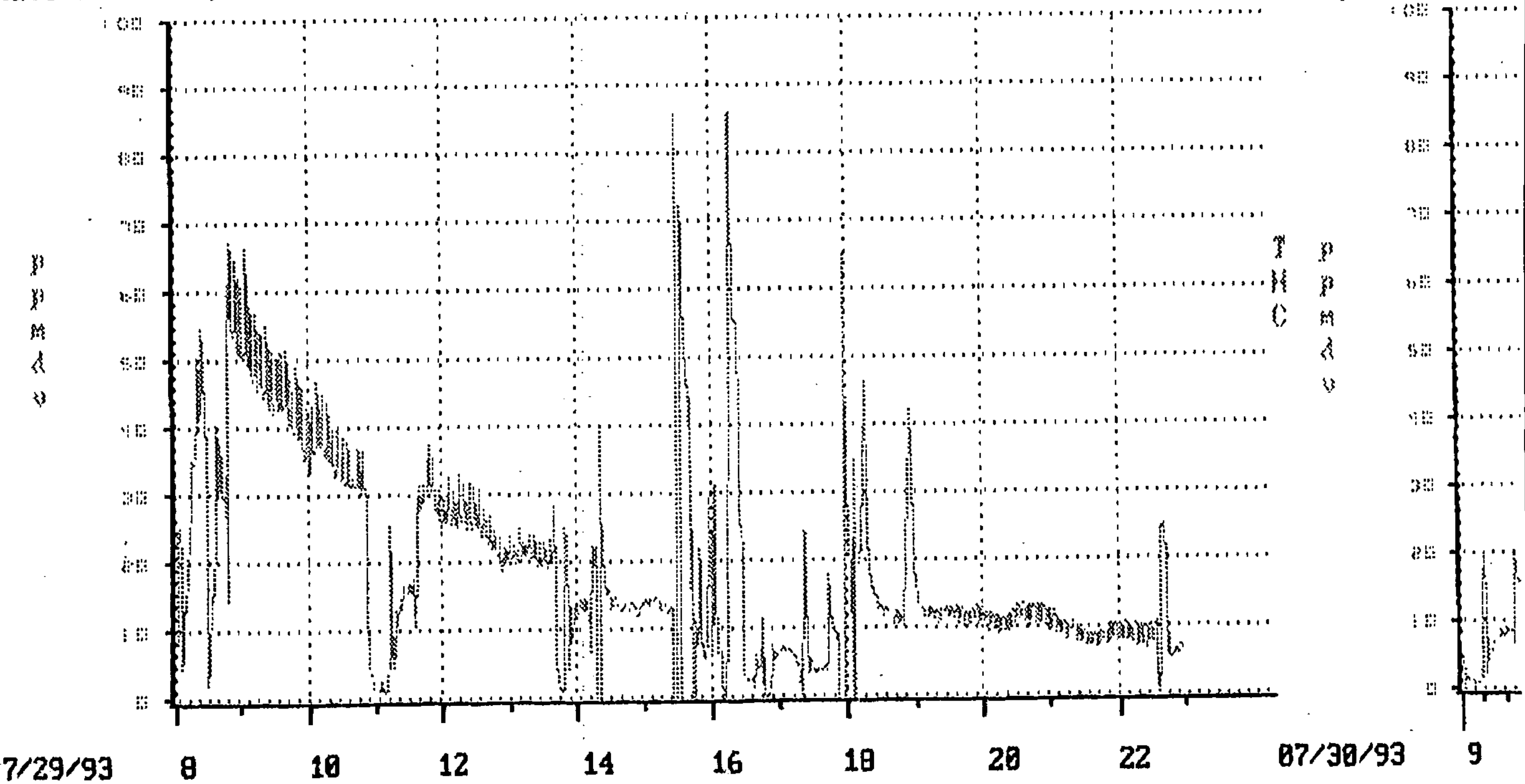
To Rick Marinshaw	From John Brown
Dept./Agency MRI	Phone #
Fax # 677-0065	Fax #

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

VOC 100 - over 15 Hour(s)

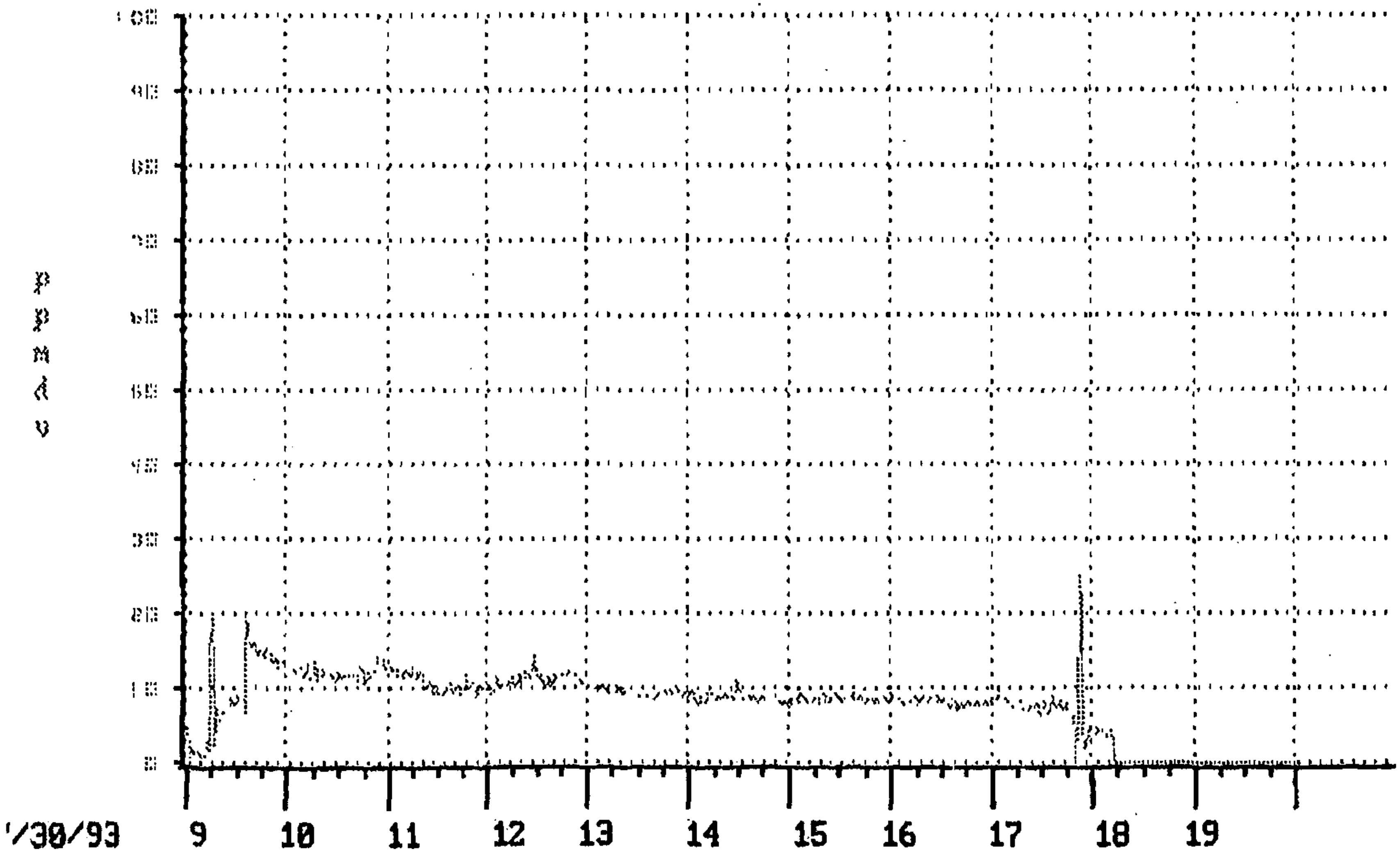
tation: 92652, EPA Brick, Section 14

Start @ 07/29/93 Station: 92652,



VOC 100 - over 11 Hour(s)

:ation: 92652, EPA Brick, Section 14 Start @ 07/30/93

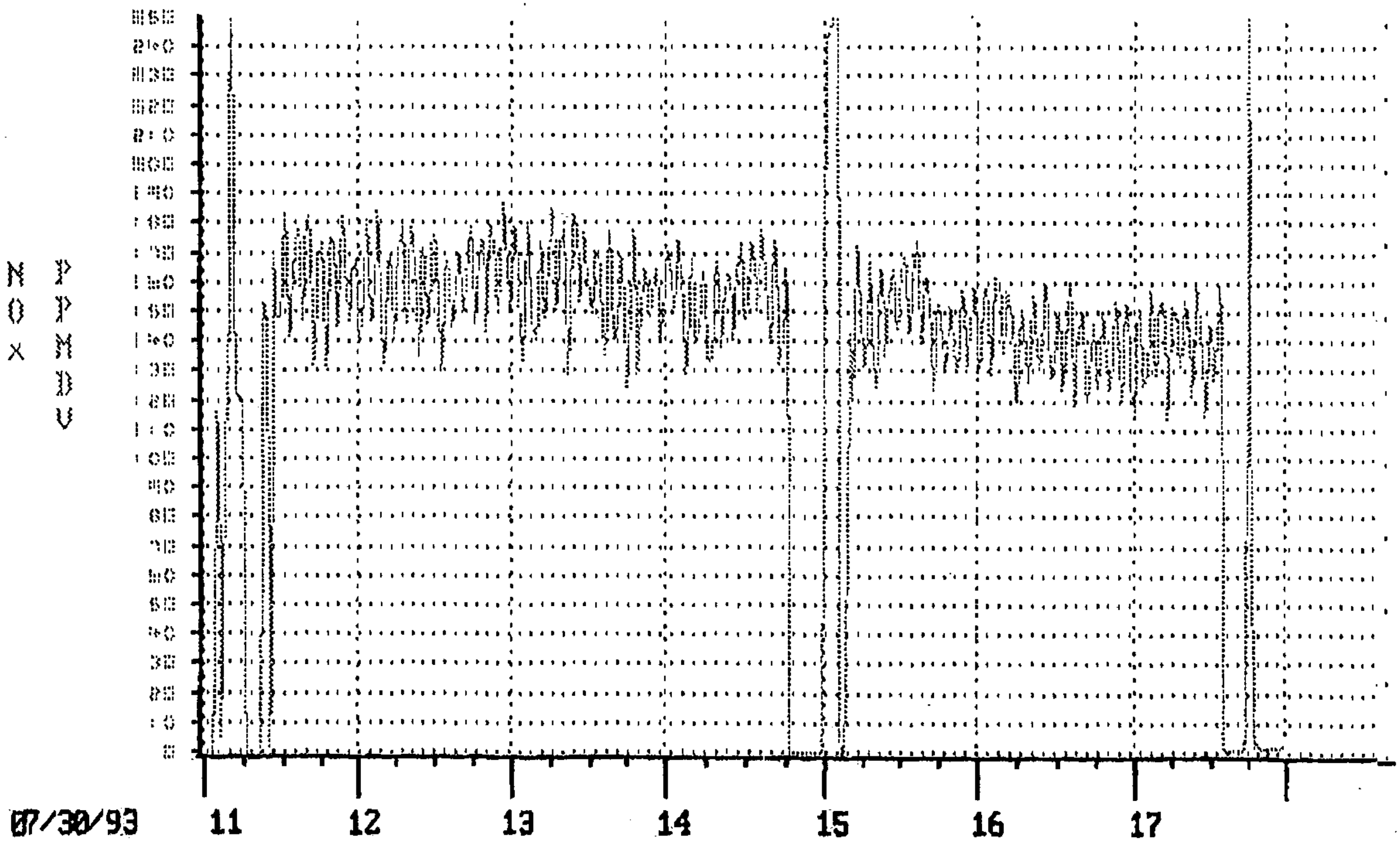


08/02/93 09:41 919 541 1039 EML/EPA 003/003

NOx 250 - over 7 Hour(s)

Station: 92652, EPA Brick, Section 14

Start @ 07/30/93



Date: August 20, 1992

Subject: Recommendation for Emissions Testing at Pine Hall Brick Company, Madison, North Carolina
Review and Update of AP-42 Chapter 8, Mineral Products
EPA Contract 68-D0-0123; MRI Project 9711-30

From: Richard Marinshaw

To: Ron Myers
EPA/EIB/EFMS (MD-14)
U. S. Environmental Protection Agency
Research Triangle Park, N.C. 27711

I. Basis for Selection

Pine Hall Brick Company (Pine Hall) plant located in Madison, North Carolina, is recommended for emissions testing for the following reasons:

1. Process operations at the plant are typical of a sawdust-fired brick manufacturing plant;

2. The building in which the screening and grinding operations are located is easily enclosable, thereby lending itself to testing; and

3. The exhaust ducts from the kiln and sawdust dryer (Plant No. 4) are easily accessible and are of sufficient length for isokinetic testing.

II. Facility Description

See confidential trip report for facility description.

III. Relationship of Test Data to Development of Emission Factors

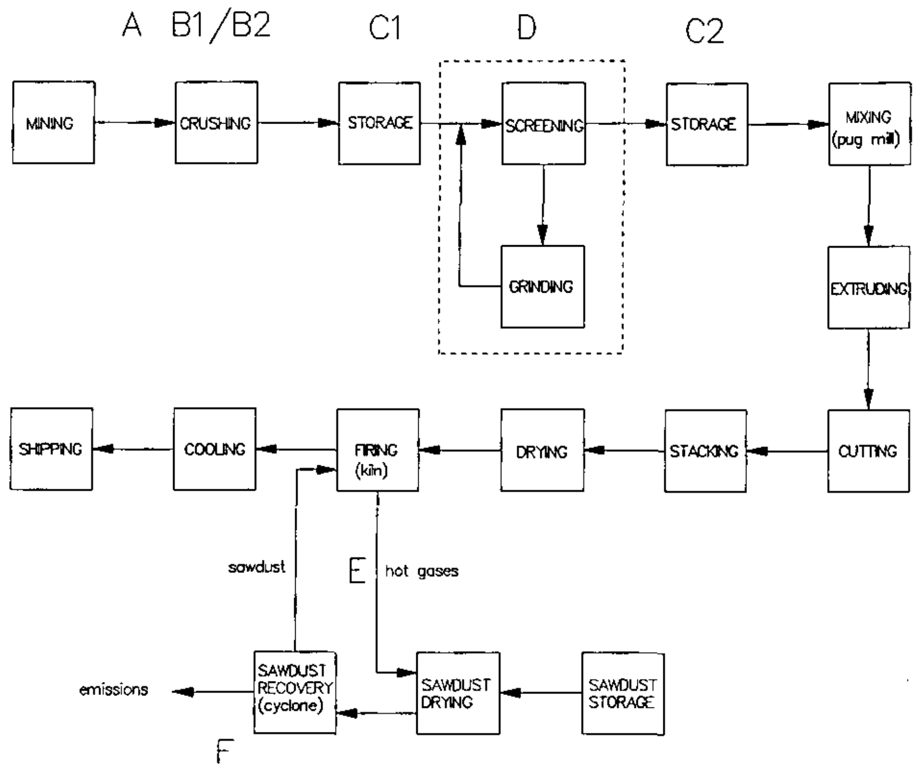
The purpose of this testing program is to obtain data to characterize emissions from a typical sawdust-fired brick manufacturing plant from which emission factors can be developed for AP-42. Specifically, the primary objectives of the test are to quantify emissions of particulate matter (PM), PM-10, metals, hydrogen fluoride, total hydrocarbons, volatile hazardous air pollutants (HAP's), semi-volatile HAP's, carbon monoxide (CO), carbon dioxide (CO_2) and nitrogen oxides (NOx) from the various processes associated with brick manufacturing. Emission factors will be calculated based on the emission data and the process rates recorded during the testing program.

IV. Test Program

Table 1 summarizes the processes and pollutants to be tested and the test methods to be used. Figure 1 provides a process flow diagram with the proposed sampling points identified.

TABLE 1. SUMMARY OF PROCESSES TO BE TESTED

Process	Sampling Point	Pollutant	Test method
vehicle traffic	A	PM	material sample
		PM-10	material sample
primary crushing	B1/B2	PM (filterable)	5
		PM-10	201/201a
storage piles	C1	PM	material sample
		PM-10	material sample
	C2	PM	material sample
		PM-10	material sample
		PM	exposure profiling
		PM-10	exposure profiling
screening & grinding	D	PM (filterable)	5
		PM-10	201/201a
firing	E	total hydrocarbons	25a
		volatile HAP's	0030 (VOST)
		semi-volatile HAP's	0010 (modified 5)
		hydrogen fluoride	26
		metals	0012 (multi-metal)
		PM (filterable)	5
		PM-10 (filterable)	201/201a
		PM-10 (condensible)	202
		CO	10
		NOx	7E (instrument)
		CO2	3A
sawdust drying	F	total hydrocarbons	25a
		volatile HAP's	0030 (VOST)
		semi-volatile HAP's	0010 (modified 5)
		hydrogen fluoride	26
		metals	0012 (multi-metal)
		PM (filterable)	5
		PM-10 (filterable)	201/201a
		PM-10 (condensible)	202
		CO	10
		NOx	7E (instrument)
		CO2	3A



SAMPLING POINTS

A: UNPAVED ROADS
B1: PRIMARY CRUSHER
B2: CRUSHER HOPPER
C1: CRUSHED MATERIAL STORAGE PILES
C2: FINISHED MATERIAL STORAGE PILES
D: SCREENING & GRINDING BUILDING
E: KILN EXHAUST
F: SAWDUST DRYER/CYCLONE EXHAUST

FIGURE 1. SAMPLING POINTS FOR PINE HALL BRICK PLANT

Bulk material samples will be taken from unpaved roads, which are denoted by Sampling Point A in Figure 1. These samples will be analyzed for silt and moisture content, which can then be used with the predictive emission factor equations in Chapter 11 of AP-42 for estimating PM and PM-10 emissions from these sources.

For the primary crushing operation (Sampling Point B), filterable PM and PM-10 emissions will be measured using temporary total enclosures (TTE's). A TTE will be constructed around the hopper that feeds the crusher, and a second TTE will be constructed around the crusher itself. The TTE procedure was originally developed to characterize fugitive VOC emission sources, and the criteria established in Method 30 were developed for that application. Care must be taken to assure that objectives that form the basis of these criteria are achieved when the method is applied to a fugitive PM source. In particular, emissions from PM sources are likely to be influenced substantially by air flow disturbances in the vicinity of the emission point and settling may have a substantial effect on measured emissions if the enclosure has dead spots. Consequently, the natural draft openings or forced air make-up systems must be designed to provide minimal air disturbances on emission points. Also, they should be designed to provide a general air flow pattern that "sweeps" air through the enclosure toward the exhaust stream in a manner that limits the potential for settling within the enclosure. Finally, because the sources to be measured at this facility are located in the vicinity of other fugitive PM sources, the test protocol must account for the background PM concentrations created by these other sources.

Methods 5 and 201/201a will be used to quantify emissions from this primary crushing. Nine runs of each sampling train will be conducted.

Bulk material samples also will be taken from storage piles (Sampling Points C1 and C2) of crushed material (primary crusher product) and finished material. These samples will be analyzed for silt and moisture content. In addition, the feasibility of using exposure profiling to characterize PM and PM-10 emissions from the deposit of finished material onto storage piles (Sampling Point C2) also must be assessed. The exposure profiling method requires steady state wind conditions across the source being tested. Because the finished product storage piles are enclosed in a building, it may not be possible to meet this requirement for sampling the storage piles. In addition, because emissions are likely to be a function of drop height, a parametric analysis will be necessary to characterize emissions as the storage pile builds up (and the drop height decreases). If feasible, PM and PM-10 emissions from the finished product storage piles will be measured by exposure profiling.

The screening and grinding operations are contained in the same building (Sampling Point D). Filterable PM and PM-10 emissions from these sources (in the aggregate) will be measured by enclosing the building and sampling the exhaust using Methods 5 and 201/201a, respectively.

The brick firing kiln exhaust (Sampling Point E) and sawdust rotary dryer exhaust (Sampling Point F) will be sampled for several pollutants, including total hydrocarbons (Method 25A), methane, ethane, nonmethane nonethane hydrocarbons, volatile HAP's (Method 0030--VOST), semi-volatile HAP's (Method 0010--modified Method 5), hydrogen fluoride (Method 26/26A), metals (Method 0012--multi-metals train), PM (Method 5 front half and back half), PM-10 (Methods 201/201a and 202), CO (Method 10), CO_2 (Method 3A), and NO_x (Method 7E--instrument analysis). Sampling of the sawdust dryer will be conducted at the outlet of the sawdust recovery cyclone. Sampling ports must be installed on both the kiln and sawdust dryer exhaust ducts. Three runs of each sampling train will be conducted on both the kiln and the sawdust dryer. Sampling of kiln emissions and sawdust dryer emissions must be conducted simultaneously for each particular type of pollutant or sampling train. For example, volatile HAP emissions must be sampled from both the kiln exhaust and sawdust dryer exhaust simultaneously.

The samples collected using Method 0012 (multi-metals train) will be analyzed only for those compounds listed as HAP's under Section 112 of the Clean Air Act. These include chromium, cadmium, arsenic, nickel, manganese, beryllium, lead, selenium, antimony, phosphorus, and mercury.

The Method 0030 (VOST) and Method 0010 (modified Method 5) samples should be analyzed to quantitate emissions of those HAP's that are likely to be detected in the sample and for which the methods have been validated. Table 2 lists those compounds detected using these two methods to test emissions from a wood flake dryer at a waferboard plant (EMB Report 91-WAF-02). The table also indicates which of the compounds have been validated. The samples should also be analyzed to screen for the other compounds listed in Table 2 for which the methods have not been validated.

The attachment provides the source sampling and analysis schedule for the proposed test program at Pine Hall.

V. Quality Assurance

To ensure and document the quality of measurements recorded during the testing, performance audits using audit materials developed by and available from AREAL should be provided to the test contractor. For the test program described in Section IV, the following audit materials are available:

TABLE 2. TARGET COMPOUNDS EMITTED BY KILN AND SAWDUST DRYER

Compound	Validated?
Method 0010 (modified method 5)	
phenol	yes
2-methylphenol[b]	
naphthalene	yes
dimethylphthalate	
dibenzofuran	
di-n-butylphthalate[b]	
bis(2-ethylhexy)phthalate	
Method 0030 (VOST)	
chloromethane	yes
bromomethane	yes
methylene chloride	yes
acetone[b]	
carbon disulfide	
chloroform	yes
trichlorofluoromethane[b]	yes
acrylonitrile	
iodomethane	yes
2-butanone	
1,1,1-trichloroethane	
carbon tetrachloride	yes
vinyl acetate	
trichloroethene[b]	yes
benzene	yes
2-hexanone[b]	
tetrachloroethene	yes
toluene	
ethylbenzene	
styrene	
o-xylene	
m-/p-xylene	

[a]Source: EMB Report 91-WAF-02
[b]Not a listed HAP

Test Method	Audit Material and AREAL Contact
Method 0030 (VOST)	cylinder gases (PPB concentration) to audit both sampling and analysis. Contact: Bob Lampe at 541-4531.
25A	cylinder gases (PPM concentration) to audit both sampling and analysis. Contact: Bob Lampe at 541-4531.
0012 (metals)	glass fiber filters spiked with Sb, As, Be, Cd, Cr, Pb, Mn, Ni, and Se, to audit analysis. Contact: Ellen Streib at 541-7834.

VI. Responsibility of MRI

Prior to testing, a representative of MRI will maintain close coordination between the facility, the test contractor, and EPA to ensure that all necessary arrangements are made.

During the testing, representatives of MRI will monitor process operating parameters that indicate proper operation and that are needed for the development of emission factors, including raw material feed/product throughput rates and kiln and sawdust dryer temperatures. Testing may be conducted only while the process being tested is operating normally. Due to the number of sampling trains required it is expected that the entire test program at Pine Hall will take several weeks to complete.

VII. Coordination

Continued coordination will be required among the EMB project officer, the EIB work assignment manager, the testing contractor, and MRI personnel prior to and during testing. Coordination with Pine Hall personnel is equally important. Mr. John Dowdle, is the main facility contact (telephone: [919] 548-6007).

Attachment

Attachment

SOURCE SAMPLING AND ANALYSIS SCHEDULE(a)				Contract No.:			Assignment Number:					
				Company Name: Pine Hall Brick			Company Location: Madison, North Carolina					
				Industry: brick manufacturing			Process: brick manufacturing			Control Equipment: none to be tested		
Sampling Point Figure	Total No. of Samples	Sample Type	Sampling Method	Sample Collected By**	Minimum Sampling Time	Minimum Gas Volume Sampled ft3	Initial Analysis			Final Analysis		
							Type	Method	By**	Type	Method	By**
A	TBD	road dust	grab	CTR								
B1*	9	filterable PM	5 (front half)	CTR	TBD	TBD						
B1*	9	filterable PM-10	201/201a	CTR	TBD	TBD						
B2*	9	filterable PM	5 (front half)	CTR	TBD	TBD						
B2*	9	filterable PM-10	201/201a	CTR	TBD	TBD						
C1	TBD	storage pile material	grab	CTR								
C2	TBD	PM PM-10	exposure profiling	CTR	TBD	TBD						
D*	9	filterable PM	5 (front half)	CTR	TBD	TBD						
D*	9	filterable PM-10	201/201a	CTR	TBD	TBD						
E(b)	3	total hydrocarbons	25a	CTR	TBD	TBD						
E(b)	3	volatile HAP's	0030 (VOST)	CTR	2 hr	120 L						
E(b)	3	semivolatile HAP's	0010 (modified 5)	CTR	4 hr	150 dscf						
E(b)	3	HF	26/26a	CTR	TBD	TBD						
E(b)	3	metals	0012 (multi-metal)	CTR	TBD	TBD				Cr, Cd, As, Ni, Mn, Be, Pb, Se, Sb, Hg, P		
E(b)	3	filterable PM	5 (front half)	CTR	TBD	TBD						
E(b)	3	filterable PM-10	201/201a	CTR	TBD	TBD						
E(b)	3	condensible PM-10	202	CTR	TBD	TBD						
E(b)	3	CO	10	CTR	TBD	TBD						
E(b)	3	NOx	7E (instrument)	CTR	TBD	TBD						
E(b)	3	CO2	3A	CTR	TBD	TBD						

SOURCE SAMPLING AND ANALYSIS SCHEDULE(a)				Contract No.:			Assignment Number:					
				Company Name: Pine Hall Brick			Company Location: Madison, North Carolina					
				Industry: brick manufacturing			Process: brick manufacturing			Control Equipment: none to be tested		
Sampling Point Figure	Total No. of Samples	Sample Type	Sampling Method	Sample Collected By**	Minimum Sampling Time	Minimum Gas Volume Sampled ft3	Initial Analysis			Final Analysis		
							Type	Method	By**	Type	Method	By**
F(b)	3	total hydrocarbons	25a	CTR	TBD	TBD						
F(b)	3	volatile HAP's	0030 (VOST)	CTR	2 hr	120 L						
F(b)	3	semivolatile HAP's	0010 (modified 5)	CTR	4 hr	150 dscf						
F(b)	3	HF	26/26a	CTR	TBD	TBD						
F(b)	3	metals	0012 (multi-metal)	CTR	TBD	TBD				Cr, Cd, As, Ni, Mn, Be, Pb, Se, Sb, Hg, P		
F(b)	3	filterable PM	5 (front half)	CTR	TBD	TBD						
F(b)	3	filterable PM-10	201/201a	CTR	TBD	TBD						
F(b)	3	condensible PM-10	202	CTR	TBD	TBD						
F(b)	3	CO	10	CTR	TBD	TBD						
F(b)	3	NOx	7E (instrument)	CTR	TBD	TBD						
F(b)	3	CO2	3A	CTR	TBD	TBD						

* Simultaneous sampling required.

** CTR = Contractor, EPA = Environmental Protection Agency.

(a) The sampling methodologies to be used will be selected by EMB.

(b) For the same sampling train, simultaneous sampling of kiln and sawdust dryer required.

REMARKS

1. Sampling shall be performed within +/-10% isokinetic conditions.
2. Methods are EPA unless otherwise indicated.
3. Impingers and analysis of impinger catch will be per the Federal Register, Volume 36. No. 159, Part II, Tuesday Aug. 17, 1991, unless specifically changed by the Project Officer.
4. Sampling time and gas volume for each sample.

DOCUMENT CONTROL SHEET

Page

Project No.: 9711-30 (Subtask No.) 55

Document Name: Puc Hull Test Request

Originator: R. Marinshaw

WP ID No.: D3001-12

WP COMMENTS:

1 DATE TO WP: 8/18 FORMAT: ( ) EPA ( ) MRI ( ) Special SPACING: ( ) Single ( ) 1 1/2 ( ) Double OUTPUT: (✓) Draft ( ) Final C ( ) Final ( ) Rainbow

DESIRED DUE DATE: 8/19 PM TODAY

Flexible ( )

Firm (✓)

OPERATOR'S INITIALS: TAW

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W-2

2 DATE TO WP: 8/20 FORMAT: ( ) EPA ( ) MRI ( ) Special SPACING: ( ) Single ( ) 1 1/2 ( ) Double OUTPUT: (✓) Draft (✓) Final C ( ) Final ( ) Rainbow

DESIRED DUE DATE: 8/20 ~~AM~~

Flexible ( )

Firm (✓)

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COMMENTS:

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7413

3 DATE TO WP: 8/20 FORMAT: ( ) EPA ( ) MRI ( ) Special SPACING: ( ) Single ( ) 1 1/2 ( ) Double OUTPUT: (✓) Draft ( ) Final C ( ) Final ( ) Rainbow

DESIRED DUE DATE: 8/20

Flexible ( )

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OPERATOR'S INITIALS: db

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COMMENTS: ONE MINOR CORRECTION. ALSO PLEASE KEEP IT DRAFT (DOUBLE SPACED) FOR NOW (THE TABLE CAN REMAIN SINGLE SPACED.)

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7439

Project No.: ______________ Document name: ______________

4 DATE TO WP: ______________

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OPERATOR'S INITIALS: ______________

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OUTPUT: (___) Draf (___) Fina (___) Fina (___) Rain

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ROUTE:	ACTION:	DATE:	COMMENTS:

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WP PROOF: (___) Yes (___) No

OUTPUT: (___) Draf (___) Fina (___) Fina (___) Rain

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Flexible (___)
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OPERATOR'S INITIALS: ______________

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WP PROOF: (___) Yes (___) No

OUTPUT: (___) Draf (___) Fina (___) Fina (___) Rain

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7 DATE TO WP: ______________

DESIRED DUE DATE: ______________
Flexible (___)
Firm (___)

OPERATOR'S INITIALS: ______________

FORMAT: (___) EPA (___) MRI (___) Special

PREPARE: (___) Envelope (___) Label

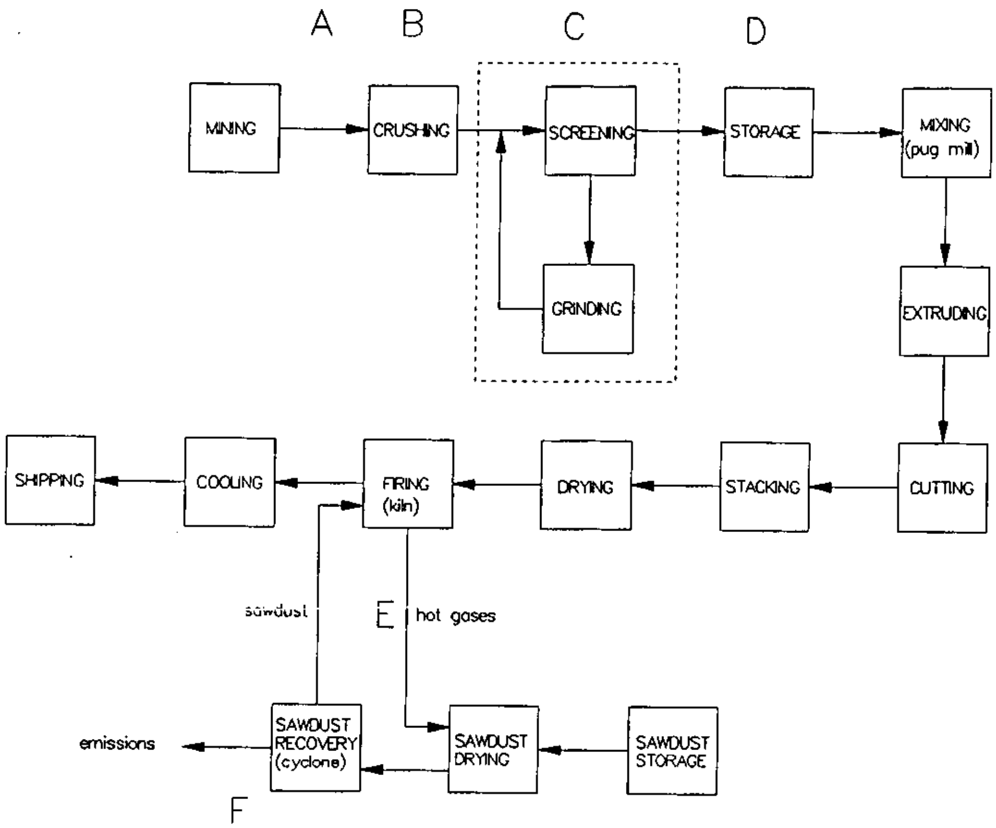
SPACING: (___) Single (___) 1 1/2 (___) Double

WP PROOF: (___) Yes (___) No

OUTPUT: (___) Draf (___) Fina (___) Fina (___) Rain

COMMENTS: ______________

ROUTE:	ACTION:	DATE:	COMMENTS:



SAMPLING POINTS

A: UNPAVED ROADS
B: PRIMARY CRUSHER
C: SCREENING & GRINDING BUILDING
D: FINISHED MATERIAL STORAGE PILES
E: KILN EXHAUST
F: SAWDUST DRYER/CYCLONE EXHAUST

Figure 1. Sampling points for Pine Hall Brick Plant.

CVER.SHE
7/1/91

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Technical Support Division
Emission Measurement Branch
Emission Measurement Laboratory

Research Triangle Park, North Carolina 27711
Mail Drop 19

COVER SHEET

TO:
Rick Marinshaw

FAX NUMBER:	TELEPHONE NUMBER:
677-0065	677-0249, ext 5359

OFFICE:
MRI

****

FROM:
Solomon Ricks

FAX NUMBER:	TELEPHONE NUMBER:
	541-5242

OFFICE:
EMB

DATE:	NUMBER OF PAGES TO INCLUDE THIS SHEET
10/26/92	3

Please number all pages

REMARKS

BRICK MANUFACTURING TESTING FOR EMISSION INVENTORY

Pine Hall Brick - Madison, NC

SUGGESTED EMB TEST SCHEDULE AND PERSONNEL REQUIREMENTS

NOTE: This schedule is based on collecting a minimum of four simultaneous particulate and three simultaneous fluorides runs at respective sampling points. The minimum anticipated sampling time is 2 hours per run but may be 4 hours or more depending on loading. Sampling site constraints require 5 people for collection.
EGR Team Leader-Roy Huntley Fluorides Team Leader-Frank Clay
Test scheduled for Oct 26-30.
Stand-by tester: Terry Harrison.

DAY NO.	PERSONNEL	ACTIVITY
1 am:	Brown Clay	Depart EML, travel to Madison, NC. Inspect test sites. Set up recovery laboratory.
pm:	Huntley McCrackan Ricks Segall Shea	Depart EML, travel to Madison, NC. Set up testing equipment at sampling points D, E, and F. Perform preliminary test preparations. Prepare trains for particulate, PM10, and total fluorides tests.
	Brown	Assist as needed.
	Clay	Data reduction.
2 am:	Huntley-Ricks McCrackan-Shea	Two simultaneous EGR runs at D1/D2.
	Segall/McAlister	Sample recovery.
pm:	Huntley-Ricks McCrackan-Shea	Two simultaneous EGR runs at D1/D2
	Segall/McAlister	Sample recovery.
	Brown	Assist as needed.
	Clay	Data reduction.
3 am:	Huntley-Ricks McCrackan-Shea	Two simultaneous EGR runs at D1/D2.
	Segall/McAlister	Sample recovery.
pm:	Huntley-Ricks	Two simultaneous EGR runs at D1/D2.
	McCrackan-Shea	Contingency EGR smpling at D1/D2.
	Segall/McAlister	Sample recovery.
	Brown	Assist as needed.
	Clay	Data reduction.

DAY	PERSONNEL	ACTIVITY
4 am:	Clay, Ricks, Shea, Harrison	Three simultaneous M-13 runs at E, and F1/F2.
	Segall/McAlsiter	Sample recovery.
pm:	Clay, Ricks, Shea, Harrison	Three simultaneous M-13 runs at E, and F1/F2.
	Segall/McAlister	Sample recovery.
	Brown	Assist as needed.
	Clay	Data reduction.
	Shea	Make training video as convenient.
5 am:	Clay, Ricks, Shea, Harrison	Three simultaneous M-13 runs at E, and F1/F2.
	Segall/McAlister	Sample recovery.
pm:	Clay, Ricks, Shea, Harrison	Contingency M-13 sampling at E, and F1/F2.
	Segall/McAlister	Sample recovery. Sampling personnel return to EML.
	Brown	Assist as needed.
	Clay	Data reduction.
	Shea	Make training video as convenient.
		Recover sampling equipment, prepare samples for shipment for analysis. Prepare mobile laboratory for return.
		Return to EML.

MEETING WITH RON
ROY & JOHN BROWN
8/12

ATS will do testing (contract)

B. Primary Crushing
- wet down the road/access way
Then combine (enclose entire bldg.) } ?

method { PM-10 only
PM (filterable) Method 5

- Ron wants to get them separately - loading hopper - crushing   2 ENCLOSURES 9 RUNS

C. Storage Piles
- material sample for materials handling
& MOISTURE CONTENT

RUN 2 HRS INITIALLY IF HEAVY DUST LOAD THEN CUT BACK
ON SAMPLING TIME TO MAYBE 1 HR

- CONSIDER EXPOSURE PROFILING LET CTR EVALUATE

D. SCREENING & GRINDING BLDG.
PM, PM-10, enclosure building

M25a gives ~~total nonmethane~~ hydrocarbons, then quantify ethane separately & subtract out

E.

- Total hydrocarbons, methane, ethane, nonmethane, nonethane
M 25a (mention ethane)

maybe only HF rather than total fluorides

26a, 26 both for HF

	# RUNS
- VOST semi VOST	3 analyses
- HF (26), total Fluorides (13b) } simultaneous	3
- metals (including mercury) mention	3
- PM-10 (201, 202)	3
- PM (5)	3

probably won't be simultaneous except VOST, semi VOST

- CO, NOx (instrument / continuous monitor for NOx) 3

F - Same & simultaneous with E sampling

→ more accurate for filt PM-10

NOTE M201 (EGR) FILTERABLE ONLY, NO IMPINGERS (CAN'T USE IMPINGERS WITH)

TECHNICAL DIRECTIVE NO. 2

Date September 3, 1992

Task Title Brick Manufacturing for Emission Factors

ESD Project No.

Contractor ETS Inc.

Contract Number 68D20020 WA # 2

Task Manager John Brown

Verbal Directions Given To Mike Visneski

Subject- Emissions testing at Pine Hall Brick in Madison, NC

Directive:

Prepare sampling sites at the primary crusher building, grinding operations building, sawdust dryer inlet, and sawdust cyclones outlets. Conduct emissions tests for total suspended particulates and PM10 at the primary crusher and at designated background ambient locations. Conduct emissions tests for total particulates, PM10, particle sizing, hydrogen fluoride, CO, NOx, total hydrocarbons, non-methane hydrocarbons, methane, ethane, multiple metals, and kiln and sawdust dryer targeted compounds for VOST and Semi-VOST. Analyze all emissions sampled and additional fluorides samples.

cc: John McKenna
Contractor Project Manager

Mike Visneski
Contractor Task Manager

J.W. Brown
Task Manager, EMB

Peter Westlin
Section Chief, EMB

Ed McCarley
Contract Project Officer, EMB

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL

# of pages ▶ 2	
To Rick Mzinshar	From Ron Myers
Dept./Agency MRI	Phone #
Fax #	Fax #

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

WORK ASSIGNMENT #2: Brick Manufacturing for Emission Factors

SUGGESTED TEST METHODS

LOCATION	POLLUTANT	TEST METHOD
Primary Crusher	TSP	Ambient Hi-Vol Sampler
	PM-10	Ambient Hi-Vol Sampler
Grinding Bldg.	TSP/PM-10*	EPA Method 201/202
	Background:	
	TSP	Ambient Hi-Vol Sampler
	PM-10	Ambient Hi-Vol Sampler (Sieve and Moisture Analyses on Process Material)
Storage Bldg.		(Sieve and Moisture Analyses on Process Material)
All Dryer Locations (3 locations; simultaneously)	TSP/MMTS	EPA Method 5 w/MMTS
	PM-10	EPA Method 201A/202
	Part. Sizing	Andersen Impactor
	Fluorides**	EPA Method 13B
	HF	EPA Method 26
	CO	EPA Method 10
	NO_x	EPA Method 7E
	Organics	
	THC	EPA Method 25A
	CH_4	Bag Sample/GC Analysis
	C_2H_6	Bag Sample/GC Analysis
	VOST***	Method 0030
	SVOST***	MM5

* Sampling and Analysis by EPA
** Sampling by EPA with Analysis by ETS
*** Additional Analysis for the 189 HAPS

DRAFT SOURCE TEST PLAN FOR BRICK MANUFACTURING

1.0 INTRODUCTION

This source test plan describes the scope of emission testing required to provide data to characterize emissions of particulate matter, PM-10, metals, fluorides, and volatile organic compounds (VOC's) from the brick manufacturing process. The emissions test results will be used to update emission factors for Section 3 of Chapter 8 -- Mineral Products Industry, of EPA's Compilation of Air Pollutant Emission Factors (AP-42). The emission factors developed for AP-42 can then be used by persons working in air pollution control to prepare emissions inventories.

The manufacture of brick and related products, such as clay pipe and some types of refractory brick, involves the mining, grinding, screening, and blending of the raw materials, and the forming, cutting, drying, and firing of the final product.

After mining, the clay is crushed to remove stones, stirred, and then screened to segregate the material by particle size. The resulting product is then mixed with water, usually in a pug mill, and then formed into brick. The wet bricks are then dried before firing. Typically, the dryer uses waste heat from the kiln.

Two types of kilns, the downdraft periodic kiln and the tunnel kiln, are commonly used for firing brick. The periodic kiln is a permanent brick structure with a number of fireholes where fuel enters the furnace. Hot gases from the fuel are drawn up over the bricks, down through them by underground flues, and out of the oven to the chimney. In most tunnel kilns, cars carrying about 1,200 bricks travel on rails through the kilns at the rate of one 1.83-meter (6-foot) car per hour. The fire zone is located near the middle of the kiln and is stationary.

In all kilns, firing takes place in six steps: evaporation of free water, dehydration, oxidation, vitrification, flashing, and cooling. Gas, residual oil, coal or sawdust may all be used for heating. Maximum temperatures of about 1090°C (2000°F) are used in firing common brick.

Particulate matter is the primary emission in the manufacturing of brick. Particulate matter may be emitted from almost all steps in the manufacturing process including crushing and storage, pulverizing, screening, drying, and firing. Volatile organic compounds, metals, and fluorides may be emitted during the drying process and from the kiln during the firing process.

2.0 DATA REQUESTS

To develop emission factors for the brick manufacturing process, test data are required to characterize emissions from the material handling and preparation processes, the drying process, and the firing of the brick. These data needs include the following:

1. Measurement of particulate matter emissions, both total particulate and PM-10, and determination of the particle size distribution from storage, crushing, and screening operations;
2. Measurement of particulate matter emissions, both total particulate and PM-10, particle size distribution, volatile and semivolatile organic emissions, and metal and fluoride emissions from the dryers; and
3. Measurement of particulate matter emissions, both total and PM-10, particle size distribution, volatile and semivolatile organic emissions, and metal and fluoride emissions from the kilns.

3.0 TEST METHODS

Sampling for total particulate matter emissions from storage, crushing, and screening operations will be conducted using EPA's Method 5 sampling train. Both the front and back halves of the train will be analyzed in order to determine total particulate emission rates for these operations. Methods 201a and 202 will be used in order to determine total PM-10 emissions (both filterable and condensable) from these operations. Cascade impaction will be used to determine the particle size distribution.

For the dryers and kilns, Modified Method 5 (Method 0010) will be used to determine emission rates for total particulate matter and for semivolatile organics. Methods 201a and 202 will be used to determine total PM-10 emissions and a Volatile Organic Sampling Train (VOST - Method 0030), will be used to determine emissions of volatile organics from the dryer and kiln. Cascade impaction will be used to determine the particle size distribution. Draft Method 0012 will be used to determine emissions of metals and EPA Method 13b will be used to determine fluoride emissions. Table 1 shows the sources to be tested, the pollutants emitted from each source, and the test methods to be used.

4.0 PLANTS TO BE TESTED

Although specific plants to be tested have not yet been decided upon, test sites will be selected based on the following criteria:

1. Type of kiln;
2. Type of fuel used for heating;
3. Plant size;
4. Type of emission controls; and
5. Location.

As discussed earlier, there are two types of kilns commonly used by the brick manufacturing industry, tunnel kilns and periodic kilns. Because the method for firing the bricks is different for each of these kilns, emission levels may also be different. The current AP-42 emission factors indicate that emission rates for periodic kilns are higher than for tunnel kilns. Therefore, testing should be done on both types of kilns.

In addition to differences in the types of kilns used, different fuels are used for heating the kilns. Gas, oil, coal, and sawdust are all used as fuels. Because the type of fuel used

TABLE 1. SOURCES, POLLUTANTS, AND TEST METHODS FOR BRICK MANUFACTURING

Source	Pollutant	Test method
Material handling operations (e.g., storage, crushing, screening)	Particulate matter (PM) (filterable and condensable)	Method 5
	PM-10 (filterable)	Method 201a
	PM-10 (condensable)	Method 202
	Particle size distribution	Cascade impaction
Dryers & kilns	PM (filterable & condensable)	Modified Method 5
	PM-10 (filterable)	Method 201a
	PM-10 (condensable)	Method 202
	Particle size distribution	Cascade impaction
	Semivolatile organics	Modified Method 5
	Volatile organics	VOST
	Metals	Draft Method 0012
	Fluorides	Method 13b

may impact both the type of emissions and the emission rate, testing should be done at facilities using different fuels for heating.

The size of the plant will also be considered in making decisions on testing sites. Plant production levels will impact emissions so larger plants will probably be targeted.

The type of control equipment used by a plant may also be a factor in selecting a test site. Plants using control equipment that is typical of that used by the industry will be considered, but plants using innovative control equipment may also be tested.

Because a number of trips are required to determine appropriate test sites, location is an important factor in selecting test sites. There are 195 brick manufacturing plants nationwide, with 27 located in North Carolina. Therefore, it is expected that there will be several appropriate test sites that require minimal travel.

Because brick manufacturing is a fairly large industry in terms of numbers of plants, testing should be done at a minimum of three plants in order to try and obtain representative test data. All of the factors discussed above will be considered in determining the best sites for testing.

DOCUMENT CONTROL SHEET

Project No.: 9711-30 (Subtask No.) 55
Document Name: Draft Source Test Plan
WP COMMENTS:

Originator: Susan Resor
WP ID No.: D3001-2

1 T26

DATE TO WP: 3/24/92 | FORMAT: ( ) EPA ( ) MRI ( ) Special | SPACING: ( ) Single ( ) 1 1/2 ( ) Double | OUTPUT: ( ) Draft (✓) Final Draft ( ) Final ( ) Rainbow

DESIRED DUE DATE: 3/25/92 am
Flexible ( )
Firm (✓)

PREPARE: ( ) Envelope ( ) Label | WP PROOF: ( ) Yes ( ) No

OPERATOR'S INITIALS: SG

COMMENTS: Few minor changes + format. Please File name is TESTPLAN.
Please do not delete other files on disk

ROUTE: | ACTION: | DATE: | COMMENTS:

2 M21

DATE TO WP: 4/6/92 | FORMAT: ( ) EPA ( ) MRI ( ) Special | SPACING: ( ) Single ( ) 1 1/2 ( ) Double | OUTPUT: ( ) Draft (✓) Final Draft ( ) Final ( ) Rainbow

DESIRED DUE DATE: 4/7/92
Flexible ( )
Firm (✓)

PREPARE: ( ) Envelope ( ) Label | WP PROOF: ( ) Yes ( ) No

OPERATOR'S INITIALS: TAW

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3 332

DATE TO WP: 4/8/92 | FORMAT: ( ) EPA ( ) MRI ( ) Special | SPACING: ( ) Single ( ) 1 1/2 ( ) Double | OUTPUT: ( ) Draft ( ) Final Draft (✓) Final ( ) Rainbow

DESIRED DUE DATE: 4/9/92
Flexible ( )
Firm (✓)

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OPERATOR'S INITIALS: [signature]

COMMENTS:

ROUTE: | ACTION: | DATE: | COMMENTS:

Project No.: ____________________ Document name: ____________________

4 DATE TO WP: ________ FORMAT: (__) EPA (__) MRI (__) Special SPACING: (__) Single (__) 1 1/2 (__) Double OUTPUT: (__) Draft (__) Final Draft (__) Final (__) Rainbow

DESIRED DUE DATE: ________
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OPERATOR'S INITIALS: ________

COMMENTS: ________

ROUTE: ________ ACTION: ________ DATE: ________ COMMENTS: ________

5 DATE TO WP: ________ FORMAT: (__) EPA (__) MRI (__) Special SPACING: (__) Single (__) 1 1/2 (__) Double OUTPUT: (__) Draft (__) Final Draft (__) Final (__) Rainbow

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ROUTE: ________ ACTION: ________ DATE: ________ COMMENTS: ________

6 DATE TO WP: ________ FORMAT: (__) EPA (__) MRI (__) Special SPACING: (__) Single (__) 1 1/2 (__) Double OUTPUT: (__) Draft (__) Final Draft (__) Final (__) Rainbow

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PREPARE: (__) Envelope (__) Label WP PROOF: (__) Yes (__) No

OPERATOR'S INITIALS: ________

COMMENTS: ________

ROUTE: ________ ACTION: ________ DATE: ________ COMMENTS: ________

7 DATE TO WP: ________ FORMAT: (__) EPA (__) MRI (__) Special SPACING: (__) Single (__) 1 1/2 (__) Double OUTPUT: (__) Draft (__) Final Draft (__) Final (__) Rainbow

DESIRED DUE DATE: ________
Flexible (__)
Firm (__)

PREPARE: (__) Envelope (__) Label WP PROOF: (__) Yes (__) No

OPERATOR'S INITIALS: ________

COMMENTS: ________

ROUTE: ________ ACTION: ________ DATE: ________ COMMENTS: ________

ETS, INC.

Proudly serving industry and government since 1973. Providing: Toxic Emission Measurement & Control

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FAX TRANSMITTAL October 1, 1992

TO: John Brown
U.S. EPA
Emission Measurement Lab
Research Triangle Park, NC
FAX # (919) 541-1039

FROM: Michael J. Visneski, Ph.D.
ETS, Inc.
FAX # (703) 265-0131
TEL # (703) 265-0004

RE:

John,

Here is the text of the Work Plan for the testing at Pine Hall Brick. I still need to update the cost estimates for the testing.

If you have any questions give me a call.

Mike

ETS, INC. - 1401 Municipal Road, NW - Roanoke, Virginia 24012-1309 - Telephone: 703-265-0004 - FAX: 703-265-0131

1.0 INTRODUCTION

Emission factors for the brick manufacturing industry will be determined for this work assignment. During the course of the work assignment three brick manufacturing facilities will be tested. The first facility to be tested will be Pine Hall Brick located in Madison, North Carolina. The results of the emissions testing at Pine Hall Brick will be used to determine the scope of testing at the subsequent manufacturing facilities. This work plan will focus primarily on the emissions testing to be performed at Pine Hall Brick.

Three areas of the manufacturing facility will be tested; the crushing, grinding, and storage operations, the kilns, and the sawdust dryers. Sampling at the crushing and grinding operations will be for particulate matter (PM), particulate matter less than or equal to ten microns (PM_{10}), ~~condensible particulate matter (CPM)~~. At the storage and grinding operations process material will be sampled and sieve and moisture analyses will be performed on the material.

Sampling at the kilns and sawdust dryers will be for PM, PM_{10}, CPM, particle sizing, multiple metals, total fluorides, hydrogen fluorides, carbon monoxide, nitrogen oxides, total hydrocarbons, methane, ethane, volatile organics, and semivolatile organics.

The following description of the process and outline of the test plan are specific to Pine Hall Brick. Additionally, site modifications need to be made at Pine Hall Brick before testing can be initiated. Although the following is site-specific, the general procedures and test methods are applicable to all the brick manufacturing facilities that will be tested.

2.0 TECHNICAL OBJECTIVES

(1) Determine emission factors for the crushing, grinding, and storage operations for the brick manufacturing industries for:

   (1) Particulate Matter
   (2) PM_{10}
   ~~(3) Condensible Particulate Matter~~

(2) Determine emission factors for the kiln and sawdust dryer operations for the brick manufacturing industries for :

   (1) Particulate Matter
   (2) PM_{10}

(3) Condensible Particulate Matter
(4) Multiple Metals
(5) Total Fluorides
(6) Hydrogen Fluoride
(7) Carbon Monoxide
(8) Nitrogen Oxides
(9) Total Hydrocarbons
(10) Methane
(11) Ethane
(12) Volatile Organics
(13) Semivolatile Organics

3.0 PROCESS DESCRIPTION

The kiln outlets are targeted for testing at the three brick plants. At Pine Hall Brick the kiln outlet is also the sawdust dryer inlet. In the following the kiln outlet is referred to as the sawdust dryer inlet.

3.1 Sawdust Dryer

A simplified process schematic for the sawdust dryer operations is given in Figure 3.1-1. This figure also shows the locations for the emissions testing.

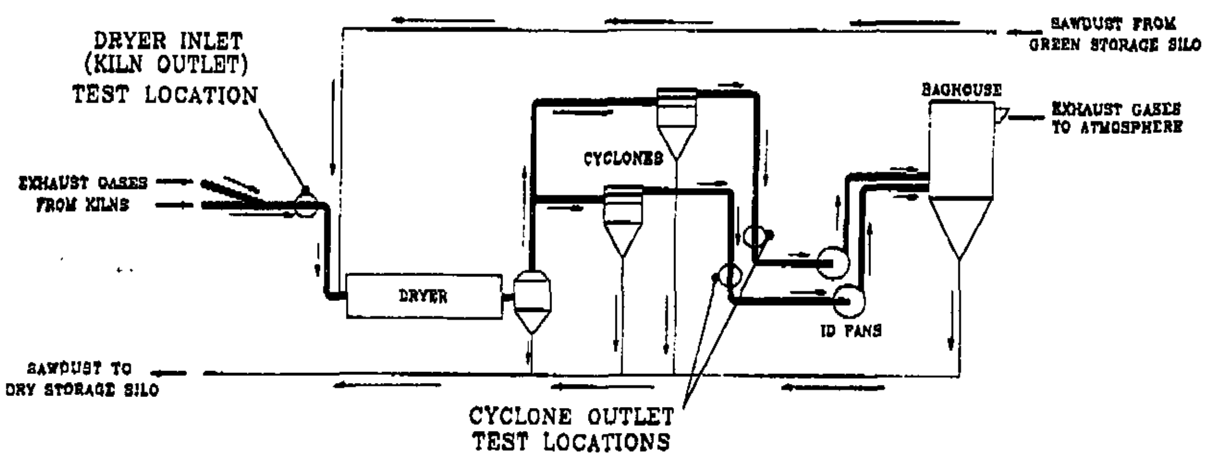

Figure 3.1-1: Sawdust dryer process schematic and emissions testing locations at Pine Hall Brick.

The exhaust gases from two kilns are combined into a single inlet to the sawdust dryer. The kiln exhaust gases and the green sawdust enter the dryer together. At the opposite end of the dryer the dried sawdust is removed and the gas stream is split into parallel paths. Each path consists of a cyclone and induced draft fan. Following the ID fans the two gas streams are independently introduced into a single baghouse. The gases are then exhausted into the atmosphere at the top of the baghouse.

The dried sawdust is collected from the end of the dryer, the cyclones, and the baghouse onto a common conveyor. The sawdust is then transported to the dry storage silo.

The emissions testing for the sawdust drying operations will be performed at three locations simultaneously. These locations are the dryer inlet (which is also the kiln outlet) and both of the cyclone outlets. The baghouse at Pine Hall Brick is atypical of sawdust drying operations at a brick manufacturing facility. Therefore, the exhaust gases from the baghouse will not be tested.

3.2 Crushing, Grinding, and Storage

A simplified process schematic for the crushing, grinding, and storage operations is given in Figure 3.2-1. This figure also shows the locations for the emissions testing.

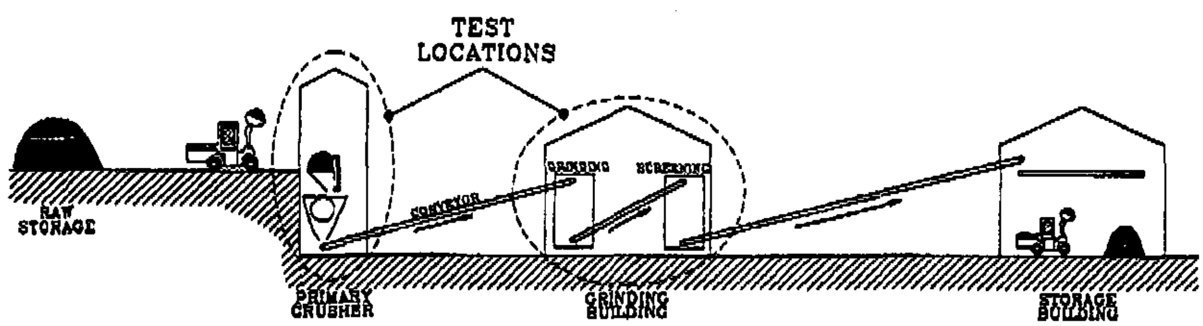

Figure 3.2-1: Crushing, grinding, and storage operations process schematic and emissions testing locations at Pine Hall Brick.

The raw material is kept in a covered storage pile. From this pile the process material is loaded into the primary crusher. In the primary crusher the large pieces of material are broken apart. From the primary crusher the material is transported into the grinding building, where it is first ground and then screened. From the screening operations the undersized material is transport into the storage building. The material is kept in the storage building until it is loaded into the brick making operations.

Emissions from the primary crusher and the grinding building will be measured. Process material will be sampled at the grinding building and at the storage building for sieve and moisture analyses.

4.0 SITE MODIFICATIONS

In order for the emissions testing to be performed, several site modifications need to be made. At the sawdust dryer test ports will need to be installed as well as providing access to the test ports. For testing at the grinding building, duct extensions will need to be fabricated and installed and access provided to the test areas.

4.1 Sawdust Dryer

The following modifications need to be made at the sawdust dryer inlet:

(1) Install two (2) 6" Test Ports and one (1) 3" Test Port. The 6" ports must be in the same cross-sectional plane and at a 90° angle. The 3" port will be downstream of the 6" ports.

(2) Cut hand rail on existing catwalk and replace with a chain to allow equipment access to test port.

(3) Erect scaffolding to access the 6" test port that will be facing the ground.

The following modifications need to be made at both of the sawdust dryer cyclone outlets:

(1) Install two (2) 6" Test Ports and one (1) 3" Test Port. The 6" ports must be in the same cross-sectional plane and at a 90° angle. The 3" port will be downstream of the 6" ports.

(2) Erect scaffolding to access the test ports at each duct.

4.2 Crushing, Grinding, and Storage

The following modifications need to be made at the primary crusher:

(1) At the base of the crusher, cover all openings (except for the doorway) with plastic.

(2) Install pulleys in the roof of the crusher to suspend the ambient samplers.

The following modifications need to be made at the grinding building:

(1) Install ductwork from the two (2) outlet fans facing the primary crusher. Each duct will contain two (2) 6" Tests Ports at a 90° angle.

(2) Erect scaffolding to access test ports.

(3) Erect scaffolding between the two inlet fans to accommodate ambient air samplers.

(4) When setting up for emissions testing, cover ridge vent and the outlet fan facing the storage area with plastic.

Since there will be no emissions testing at the storage building, only sampling of the process material, no modifications need to be made at this location.

5.0 EMISSIONS TESTING

All emissions testing will be performed using EPA approved test methods and procedures. Additionally, all QA/QC procedures listed in each method, as well as those constituting good laboratory and sampling practices will be followed.

5.1 Sawdust Dryer

Table 5.1-1 lists the pollutants of interest and the test methods for each of these pollutants for the sawdust dryer emissions testing. Tables 5.1-2 and 5.1-3 list the semivolatile and volatile compounds, respectively, which are of interest for this emissions testing program. Finally, Table 5.1-4 lists the metals of interest. These lists are applicable for all three dryer test locations.

Table 5.1-1: Pollutants and Test Methods for Emissions Testing at the Sawdust Dryer.

POLLUTANT	TEST METHOD
Multiple Metals and Particulate Matter (PM)	Method 0012 Modified for PM[a]
PM_{10} and Condensible PM	Method 201A/202[b]
Particle Sizing	Andersen Impactor
Total Fluorides	Method 13B[c]
Hydrogen Fluoride (HF)	Method 26[c]
Carbon Monoxide (CO)	Method 10[c]
Nitrogen Oxides (NO_x)	Method 7E[c]
Organics	
Total Hydrocarbons (THC)	Method 25A[c]
Methane (CH_4)	Method 18[c,d]
Ethane (C_2H_6)	Method 18[c,d]
Volatile Organics	Method 0030[b]
Semivolatile Organics	Method 0010[b]

[a]40 CFR 51 Appendix M

[b]*Test Methods for Evaluating Solid Waste*, Third Edition, Report SW-846, U.S. EPA, Office of Solid Waste and Emergency Response, Washington, DC, 1986.

[c]40 CFR 60 Appendix A

[d]Method 18 utilizing an integrated bag sample with GC analysis.

TABLE 5.1-2: Targeted Semivolatile Compounds for the Sawdust Dryer using Method 0010.

COMPOUND (VALIDATED)	COMPOUND (NOT VALIDATED)
phenol	2-methylphenol*
naphthalene	dimethylphthalate
	dibenzofuran
	di-n-butylphthalate*
	bis(2-ethylhexy)phthalate

*Not a listed HAP.

TABLE 5.1-3: Targeted Volatile Compounds for the Sawdust Dryer using Method 0030.

COMPOUND (VALIDATED)	COMPOUND (NOT VALIDATED)
chloromethane	acetone*
bromomethane	carbon disulfide
methylene chloride	acrylonitrile
chloroform	2-butanone
trichlorofluoromethane*	1,1,1-trichloroethane
iodomethane	vinyl acetate
carbon tetrachloride	2-hexanone*
trichloroethene*	toluene
benzene	ethylbenzene
tetrachloroethene	styrene
	o-xylene
	m-/p-xylene

*Not a listed HAP.

Table 5.1-4: Targeted Metals for the Sawdust Dryer using Method 0012.

METAL
antimony
arsenic
beryllium
cadmium
chromium
lead
manganese
mercury
nickel
phosphorus
selenium

A minimum of three valid sampling runs will be performed at each of the test locations for each of the test methods. The test methods utilizing CEMs (Methods 3A, 7E, and 10) will be run throughout the test program.

The field testing team will consist of one test team coordinator, one QA/QC officer, one CEM technician, and recovery and sampling technicians. The number of recovery and sampling technicians will vary from day to day depending upon the scheduled testing.

5.2 Crushing, Grinding, and Storage

Emissions testing for the crushing, grinding, and storage operations will be performed for particulate matter only. Particulate emissions will be measured at the primary crusher and at the grinding building. Because of the difficulty of totally enclosing the storage building, no emissions testing will be performed. At the storage building the process material will be sampled and sieve and moisture analyses will be performed on this material. The process material will also be sampled at the grinding building. The emissions testing will involve both ambient and in-duct measurements. Table 5.2-1 summarizes the testing to be performed at the crushing, grinding, and storage operations.

A minimum of three valid sampling runs will be performed at each of the test locations for each of the test methods. Each ambient sampling run at the primary crusher will last eight hours. The background ambient sampling at the crushing building will be performed during the in-duct sampling period.

The field test team will consist of one test team coordinator, one QA/QC officer, and recovery and sampling technicians. The number of recovery and sampling technicians will vary from day to day depending upon the scheduled testing.

Table 5.2-1: Pollutants and Test Methods for Emissions Testing for the Crushing, Grinding and Storage Operations.

TEST LOCATION	POLLUTANT	TEST METHOD
Primary Crusher	Particulate Matter(PM)	Ambient Hi-Vol[a]
	PM_{10} ~~and Condensible PM~~	Ambient Hi-Vol[b]
Grinding Building	PM, PM_{10}, ~~and CPM~~	Method 201/202[c]
	Background PM	Ambient Hi-Vol[a]
	Background PM_{10}	Ambient Hi-Vol[b]
	(Sieve and Moisture Analyses on Process Material)	
Storage Building		
	(Sieve and Moisture Analyses on Process Material)	

[a]40 CFR 50 Appendix B

[b]40 CFR 50 Appendix J

[c]40 CFR 51 Appendix M

BACKGROUND AMBIENT PM & PM_{10} AT BOUNDARY

UPWIND - DOWNWIND

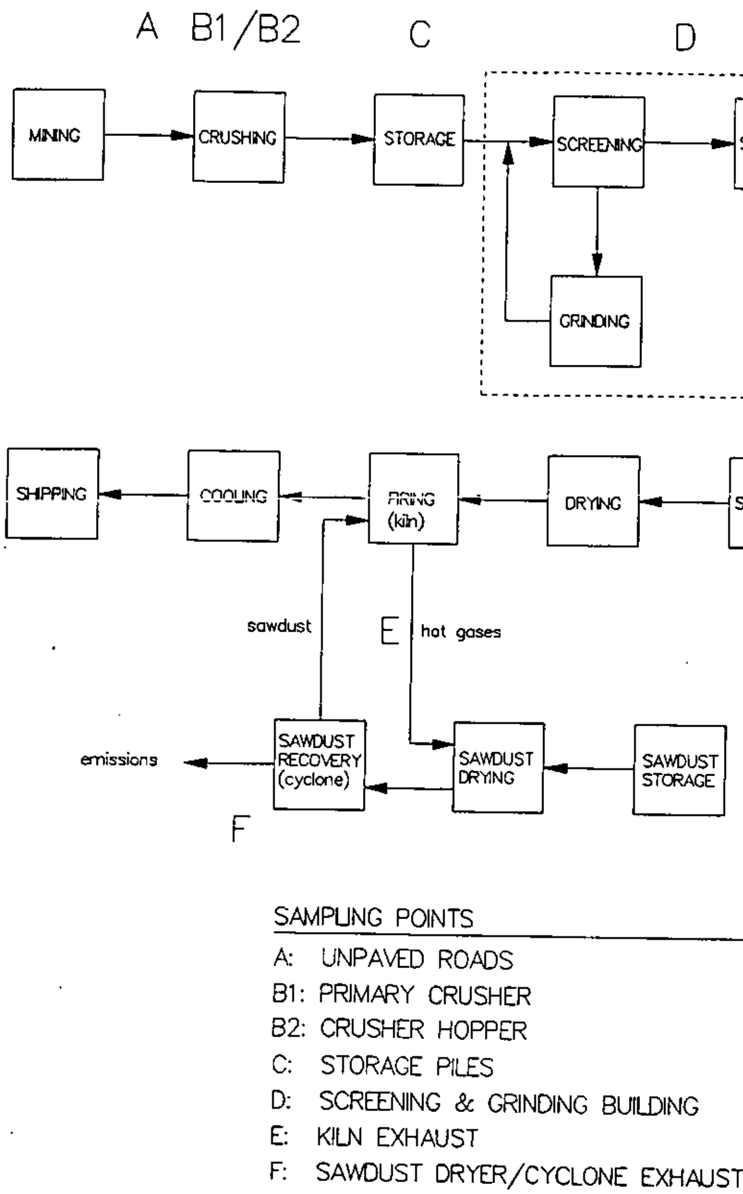

Figure 1. Sampling points for Pine Hall Brick Plant.

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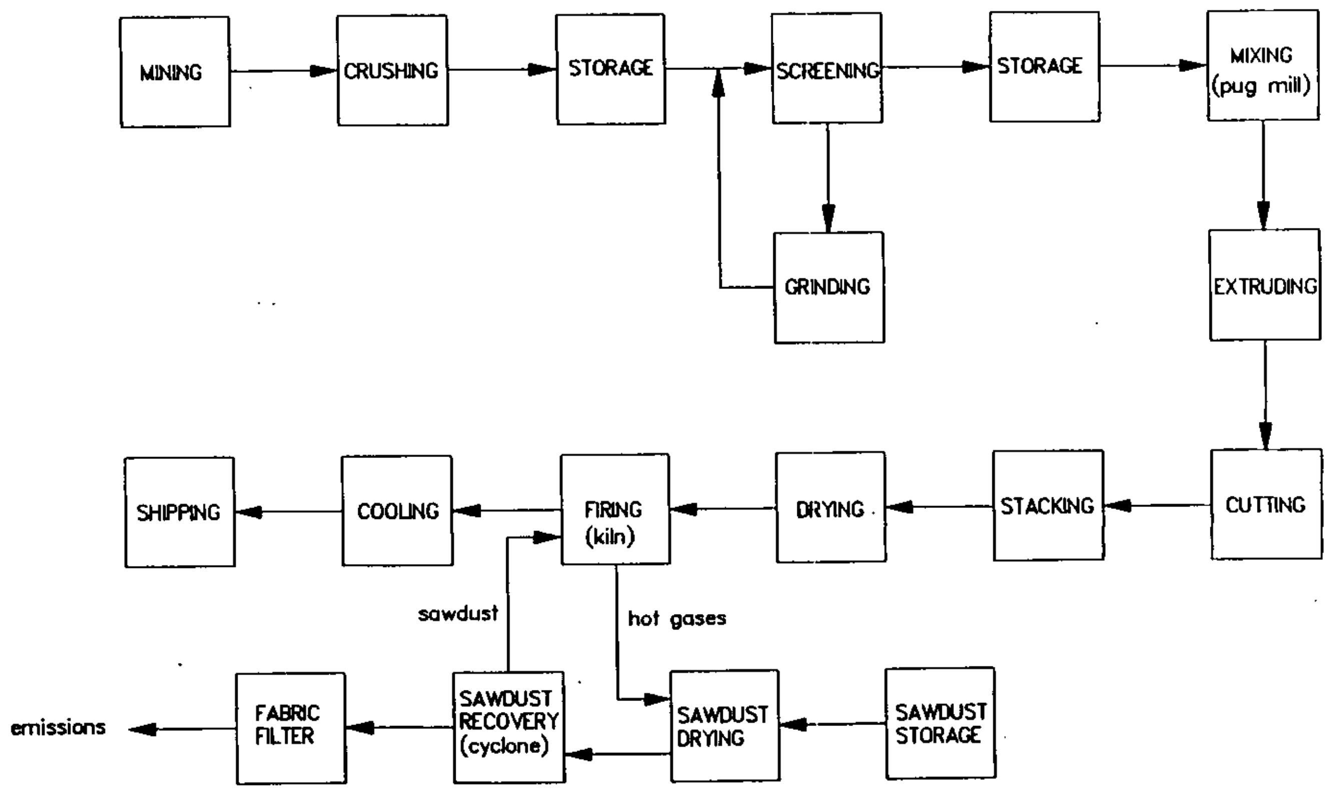

FIGURE 1. PROCESS FLOW DIAGRAM FOR PINE HALL BRICK