AP42 Section:	11.3
Background Chapter	4
Reference:	21
Title:	*Stationary Source Sampling Report: Chatham Brick And Tile Company, Sanford, NC, Kiln No. 2 Particulate Emissions Compliance Testing*, Entropy Environmentalists, Inc., Research Triangle Park, NC, July 1979.

BRICKS AND RELATED
CLAY PRODUCTS
AP-42 Section 8.3
Reference Number
16

CH4 ref 21

ENTROPY ENVIRONMENTALISTS, INC

SPECIALISTS IN AIR POLLUTION MEASUREMENT & MANAGEMENT

STATIONARY SOURCE SAMPLING REPORT

CHATHAM BRICK COMPANY

SANFORD, NORTH CAROLINA

PARTICULATE EMISSIONS COMPLIANCE TEST

JULY 1979

P.O. Box 12291, Research Triangle Park, North Carolina 27709
Phone 919 781 3550

REPORT CERTIFICATION

The sampling and analysis performed for this report was carried out under my direction and supervision.

Date July 27, 1979 Signature Frank J. Phoenix

Frank J. Phoenix

I have reviewed all testing details and results in this test report and hereby certify that the test report is authentic and accurate.

Date July 27, 1979 Signature D. James Grove

D. James Grove, P. E.

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INTRODUCTION

Stationary source sampling was performed on July 18-19, 1979 at Chatham Brick and Tile Company, Sanford, North Carolina to determine the particulate emissions from kiln #2 which is exhausted by two stacks - the waste heat stack and the dryer stack. Three sets of tests at each site were performed simultaneously.

Immediately following is the "Summary of Results" section, presenting a summary for all the tests. Detailed results of the six particulate tests appear in Appendix A.

A description of the process, including an air flow schematic, is given in the "Process Description and Operation" section.

The last section, "Sampling and Analytical Procedures," briefly describes the sampling strategy used. For a detailed description of the equipment and procedures, see Appendix D. Calibration data is given in Appendix E.

SUMMARY OF RESULTS

Presented in Table 1 below are the emission rates as determined by the six particulate emission tests performed on the waste heat and dryer exhaust stacks.

TABLE 1
PARTICULATE EMISSIONS
pounds per hour

Simultaneous Tests	Waste Heat Stack	Dryer Exhaust	Total
1 & 4	1.35	0.81	2.16
2 & 5	1.12	0.38	1.50
3 & 6	1.80	0.49	2.29
Average	1.42	0.56	1.98

According to North Carolina Regulation 2D.0515, the maximum allowable emission rate is 13.2 pounds per hour. This is based on a process rate of 5.75 tons per hour and includes an estimate of the sawdust being burned. Determination of the process rate is given in the "Process Description and Operation" section.

Tables 2 and 3 on the following pages give the individual test summaries for the tests performed at the waste heat stack and the dryer exhaust.

TABLE 2

PARTICULATE TESTS SUMMARY OF RESULTS

Waste Heat Stack

RUN NUMBER	1	2	3
DATE	7/18/79	7/18/79	7/19/79
STACK TEMPERATURE, DEG. F	341.	344.	323.
STACK FLOW RATE SCFM* DRY	12037.	11888.	12328.
STACK FLOW RATE ACFM, WET	19677.	19577.	19522.
VOLUME OF GAS SAMPLED SCF* DRY	50.91	49.83	52.34
PERCENT ISOKINETIC	102.3	101.3	102.6
PARTICULATES, EPA METHOD 5:			
MILLIGRAMS - CATCH	43.2	35.4	57.8
GRAINS PER DSCF*	.0131	.0110	.0170
POUNDS PER HOUR	1.35	1.12	1.80

* 68 DEG F, 29.92 IN. HG

TABLE 3

PARTICULATE TESTS SUMMARY OF RESULTS

Dryer Outlet Stack

RUN NUMBER	4	5	6
DATE	7/18/79	7/18/79	7/19/79
STACK TEMPERATURE, DEG. F	124.	124.	116.
STACK FLOW RATE SCFM* DRY	16272.	14877.	15246.
STACK FLOW RATE ACFM, WET	18917.	17596.	17527.
VOLUME OF GAS SAMPLED SCF* DRY	50.79	49.21	49.00
PERCENT ISOKINETIC	93.8	99.4	96.5
PARTICULATES, EPA METHOD 5:			
MILLIGRAMS - CATCH	19.1	9.6	12.0
GRAINS PER DSCF*	.0058	.0030	.0038
POUNDS PER HOUR	.81	.38	.49

* 68 DEG F, 29.92 IN. HG

PROCESS DESCRIPTION AND OPERATION

Chatham Brick and Tile Company in Sanford, North Carolina manufactures bricks, which involves the screening and blending of the raw materials and the drying and firing of the final, shaped product. The bricks travel through a tunnel consisting of three zones - brick dryer, firing zone, and cooling zone. The bricks are placed on cars which travel on rails through the kiln. When the car enters and leaves the tunnel, ambient air is allowed to enter uncontrolled. The dryer exhaust stack is located at the beginning of the tunnel.

The car enters the brick dryer where excess water is evaporated off. Hot air used to dry the brick is supplied by the firing zone of the tunnel. The firing zone is located near the middle of the kiln. Natural gas and sawdust are used to heat the firing zone. As shown in Figure 1, ambient air is used to cool the bricks. The beginning of the firing zone is exhausted by a fan.

Potential emissions from the kiln consist mainly of particulate matter in the form of dust generated by the handling of the bricks, and of combustion products from the sawdust. No pollution control equipment is presently in use.

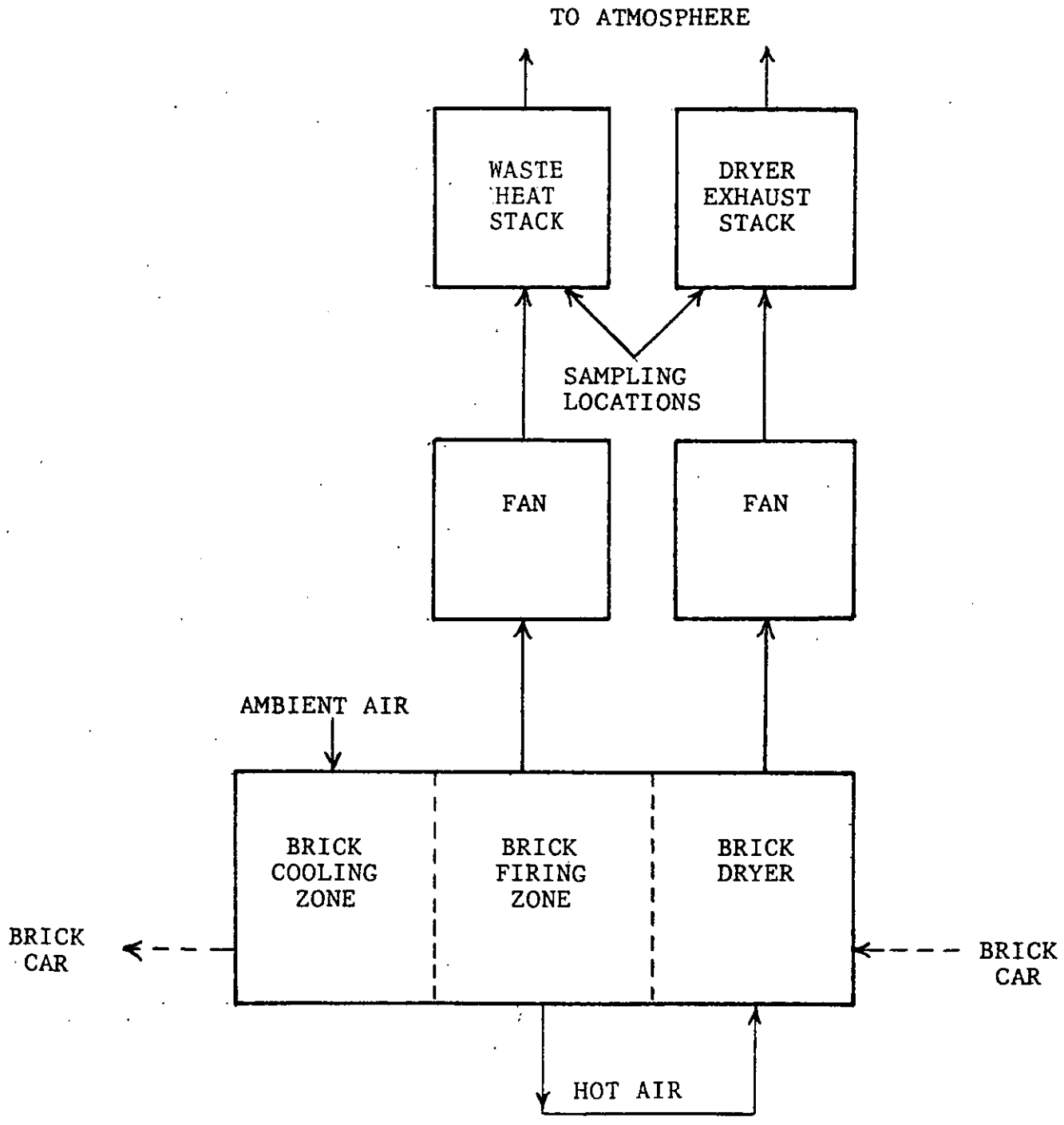


FIGURE 1. PROCESS AIR SCHEMATIC & SAMPLING LOCATIONS

During the testing performed at the two stacks, 2263 bricks per hour were being fired in the kiln. With an average brick weight of 4.6 pounds, this converts to a process rate of 5.2 tons of brick per hour. When the estimated sawdust usage rate of 0.55 tons per hour is added, the total process rate is 5.75 tons per hour.

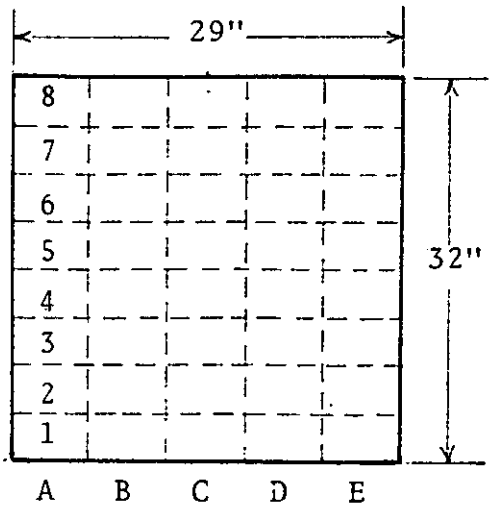
SAMPLING AND ANALYTICAL PROCEDURES

All sampling and analytical procedures used were those recommended by the United States Environmental Protection Agency and the North Carolina Department of Natural Resources and Community Development. Complete details of the equipment and procedures used are described in Appendix D, which is extracted from the Federal Register, August 18, 1977.

Method 1 was used to determine the number and location of the sampling points. A stack extension was added to both stacks. The waste heat stack cross section was divided into 40 equal areas with eight points on each of five traverse axes, as shown in Figure 2. The centroid of each area was sampled for two minutes, resulting in 80 minute tests. The dryer exhaust stack was divided into 36 equal areas, with nine points on each of four traverse axes, as shown in Figure 3. The points were sampled for two minutes each, for a total testing time of 72 minutes for each run.

Velocity measurements were in accordance with Method 2. Molecular weights for the stack gases were determined by Method 3 procedures. Particulate emissions were found using Method 5 analytical and sampling procedures.

All sampling equipment used was manufactured by Nutech Corporation or Entropy Environmentalists, Inc.



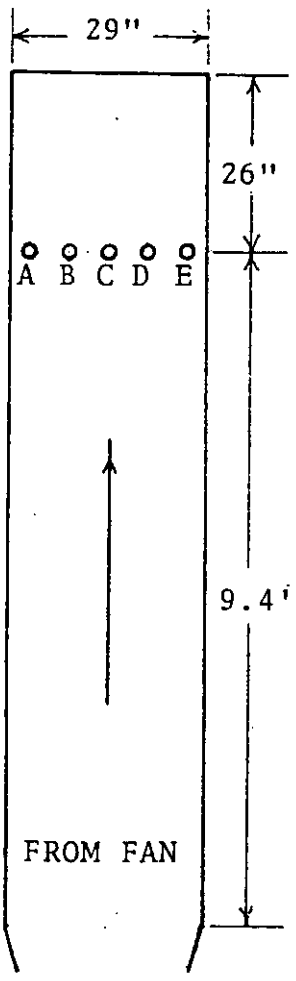
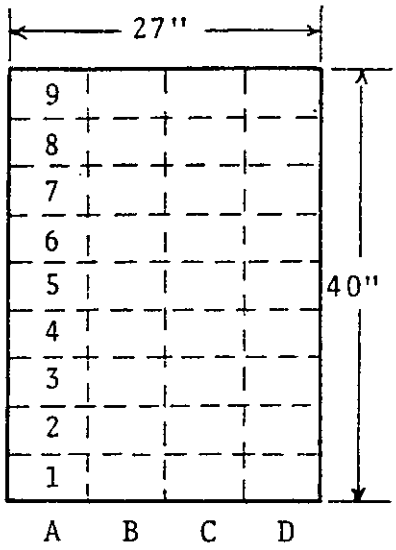


FIGURE 2. WASTE HEAT STACK DIMENSIONS AND SAMPLING POINT LOCATION



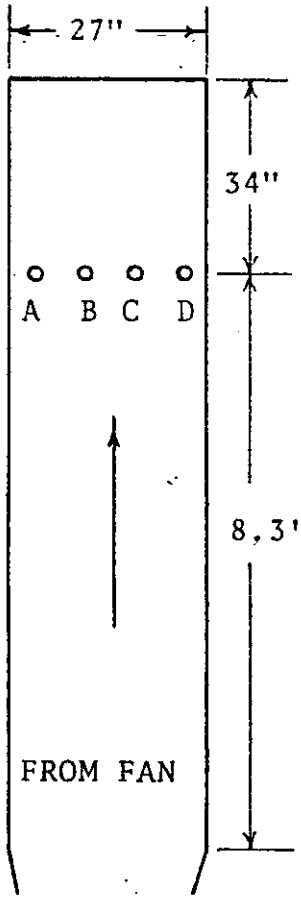


FIGURE 3. DRYER EXHAUST STACK DIMENSION AND SAMPLE POINT LOCATION

APPENDICES

APPENDIX A

APPENDIX A-1

APPENDIX A

(COMPUTER PRINTED)

PARTICULATE TESTS RESULTS

WITH EXAMPLE CALCULATIONS

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 1

Waste Heat Stack

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = 17.64 * VM * Y * (PB+PM/13.6) / (TM+460)

$$VMSTD = \frac{17.64 * 53.956 * 1.006 * (29.77 + 1.520/13.6)}{562.0} = 50.910 \text{ DSCF}$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWV = .04707 * VW

VWV = .04707 * 77.0 = 3.624 SCF

PERCENT MOISTURE IN STACK GAS

PMV = (100 * VWV)/(VMSTD+VWV)

$$PMV = \frac{100. * 3.62}{50.910 + 3.62} = 6.6 \text{ PERCENT}$$

MOLE FRACTION OF DRY STACK GAS

MD = (100.-PMV)/100.

$$MD = \frac{100. - 6.6}{100.} = .934$$

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MWD = (PCO2 * .44)+(PO2 * .32)+(PN2+PCO) * .28

MWD = (1.8*0.44)+(18.7*0.32)+((79.5+0.0)*0.28) = 29.04 LB/LB MOLE

MOLECULAR WEIGHT OF STACK GAS

MW = MWD * MD + 18 * (1-MD)

MW = 29.04 * .934 + 18 * (1- .934) = 28.30 LB/LB MOLE

STACK GAS VELOCITY AT STACK CONDITIONS

VS = 85.49 * CP * SQRT[(DPS * (TS+460))/(PS * MW)]

VS = 85.49 * .84 * SQRT[(.528 * 801.)/(29.76 * 28.30)] = 50.9 FPS

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QA = VS * AS * 60 / 144

QA = 50.9* 928. * 60 / 144 = 19677. ACFM

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QS = (17.64 * QA * PS * MD) / (TS+460)

$$QS = \frac{17.64 * 19677. * 29.76 * .934}{801.0} = 12037.\ SCFM$$

PERCENT ISOKINETIC

PERI = (17.3 * (TS+460) * VMSTD)/(VS * TT * PS * MD * DN * DN)

$$PERI = \frac{17.3 * 801. * 50.910}{50.9 * 80.0 * 29.76 * .934 * .247 * .247} = 102.3\ PERCENT$$

PARTICULATE LOADING -- EPA METHOD 5
(AT STANDARD CONDITIONS)

CAN = 0.01543 * FMF/VMSTD

CAN = 0.01543 * (43.2/ 50.91) = .0131 GR/DSCF

PARTICULATE LBS/HR--EPA METHOD 5

CAW = 0.00857 * CAN * QS

CAW = 0.00857 * .0131* 12037. = 1.35 LBS/HR

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT: Chatham Brick & Tile Company, Sanford, N. C.

TEST TEAM LEADER: Frank J. Phoenix

TEST 1 Waste Heat Stack

TEST 2 Waste Heat Stack

TEST 3 Waste Heat Stack

RUN NUMBER		1	2	3
TEST DATE		7/18/79	7/18/79	7/19/79
TB	TIME-START	920	1115	1028
TF	TIME-FINISH	1048	1312	1240
TT	NET TIME OF TEST, MIN.	80.0	80.0	80.0
FNP	NET SAMPLING POINTS	40.	40.	40.
DN	SAMPLING NOZZLE DIA., IN.	.247	.247	.247
CP	PITOT TUBE COEFFICIENT	.84	.84	.84
Y	DRY GAS METER CAL. FACTOR	1.006	1.006	1.006
PM	AVERAGE ORIFICE PRESSURE DROP, IN. H2O	1.52	1.51	1.54
VM	VOLUME OF DRY GAS SAMPLED CU. FT. AT METER CONDITIONS	53.956	53.466	54.259
TM	AVERAGE GAS METER TEMP. DEGREES F	102.	109.	94.
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*, SCF	50.910	49.826	52.338
VW	TOTAL H2O COLLECTED IN IMPINGERS & SILICA GEL, ML.	77.0	79.5	77.5
VWV	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*, SCF	3.62	3.74	3.65
PMV	PERCENT MOISTURE BY VOL.	6.6	7.0	6.5
MD	MOLE FRACTION DRY GAS	.934	.930	.935
PCO2	PERCENT CO2 BY VOL., DRY	1.8	1.8	1.8
PO2	PERCENT O2 BY VOL., DRY	18.7	18.7	18.7

PCO	PERCENT CO BY VOL.,DRY	0.0	0.0	0.0
PN2	PERCENT N2 BY VOL.,DRY	79.5	79.5	79.5
MWD	MOLECULAR WT-DRY STACK GAS	29.04	29.04	29.04
MW	MOLECULAR WT-STACK GAS	28.30	28.27	28.32
PB	BAROMETRIC PRESSURE,IN. HG.	29.77	29.77	30.00
PSI	STATIC PRES OF STACK GAS IN. H2O	-.2	-.2	-.2
PS	STACK PRES,ABS., IN. HG.	29.76	29.76	29.99
TS	AVERAGE STACK TEMP. DEG. F	341.	344.	323.
DPS	AVERAGE VELOCITY HEAD OF STACK GAS,IN. H2O	.528	.520	.536
VS	AVE STACK GAS VELOCITY, FPS	50.9	50.6	50.5
AS	STACK AREA, SQUARE INCHES	928.	928.	928.
QS	STACK FLOW RATE, DRY SCFM*	12037.	11888.	12328.
QA	ACTUAL STACK FLOW RATE, ACFM	19677.	19577.	19522.
PERI	PERCENT ISOKINETIC	102.3	101.3	102.6
	PARTICULATES, EPA METHOD 5:			
FMF	MILLIGRAMS - CATCH	43.2	35.4	57.8
CAN	GRAINS PER DSCF*	.0131	.0110	.0170
CAW	POUNDS PER HOUR	1.35	1.12	1.80

* 68 DEG F, 29.92 IN. HG

APPENDIX A-2

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT: Chatham Brick & Tile Company, Sanford, N. C.

TEST TEAM LEADER: Chris M. Wrenn

TEST 4 Dryer Outlet Stack

TEST 5 Dryer Outlet Stack

TEST 6 Dryer Outlet Stack

RUN NUMBER		4	5	6
TEST DATE		7/18/79	7/18/79	7/19/79
TB	TIME-START	920	1119	1134
TF	TIME-FINISH	1043	1257	1254
TT	NET TIME OF TEST, MIN.	72.0	72.0	72.0
FNP	NET SAMPLING POINTS	36.	36.	36.
DN	SAMPLING NOZZLE DIA., IN.	.252	.252	.252
CP	PITOT TUBE COEFFICIENT	.84	.84	.84
Y	DRY GAS METER CAL. FACTOR	1.000	1.000	1.000
PM	AVERAGE ORIFICE PRESSURE DROP, IN. H2O	1.79	2.31	1.74
VM	VOLUME OF DRY GAS SAMPLED CU. FT. AT METER CONDITIONS	53.444	52.086	50.800
TM	AVERAGE GAS METER TEMP. DEGREES F	95.	99.	91.
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*, SCF	50.792	49.210	48.998
VW	TOTAL H2O COLLECTED IN IMPINGERS & SILICA GEL, ML.	49.5	67.0	59.0
VWV	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*, SCF	2.33	3.15	2.78
PMV	PERCENT MOISTURE BY VOL.	4.4	6.0	5.4
MD	MOLE FRACTION DRY GAS	.956	.940	.946
PCO2	PERCENT CO2 BY VOL., DRY	1.8	1.8	1.8
PO2	PERCENT O2 BY VOL., DRY	18.7	18.7	18.7

PCO	PERCENT CO BY VOL.,DRY	0.0	0.0	0.0
PN2	PERCENT N2 BY VOL.,DRY	79.5	79.5	79.5
MWD	MOLECULAR WT-DRY STACK GAS	29.04	29.04	29.04
MW	MOLECULAR WT-STACK GAS	28.55	28.37	28.44
PB	BAROMETRIC PRESSURE,IN. HG.	29.77	29.77	30.00
PSI	STATIC PRES OF STACK GAS IN. H2O	.2	.2	.2
PS	STACK PRES,ABS., IN. HG.	29.78	29.78	30.01
TS	AVERAGE STACK TEMP. DEG. F	124.	124.	116.
DPS	AVERAGE VELOCITY HEAD OF STACK GAS,IN. H2O	.499	.429	.436
VS	AVE STACK GAS VELOCITY, FPS	42.0	39.1	38.9
AS	STACK AREA, SQUARE INCHES	1080.	1080.	1080.
QS	STACK FLOW RATE, DRY SCFM*	16272.	14877.	15246.
QA	ACTUAL STACK FLOW RATE, ACFM	18917.	17596.	17527.
PERI	PERCENT ISOKINETIC	93.8	99.4	96.5
	PARTICULATES, EPA METHOD 5:			
FMF	MILLIGRAMS - CATCH	19.1	9.6	12.0
CAN	GRAINS PER DSCF*	.0058	.0030	.0038
CAW	POUNDS PER HOUR	.81	.38	.49

* 68 DEG F, 29.92 IN. HG

APPENDIX B

APPENDIX B-1

Plant Name CHATHAM BRICK & TILE CO.

Sampling Location WASTE HEAT STACK

Run and/or Sample No. _____ Leak Test? ✓ Date 7-19 Operator CW

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
11:00 → 12:30	15:00	1.8	20.5	-	18.7	-	—
							—
							—
	Avg.	1.8			Avg. 18.7		79.5

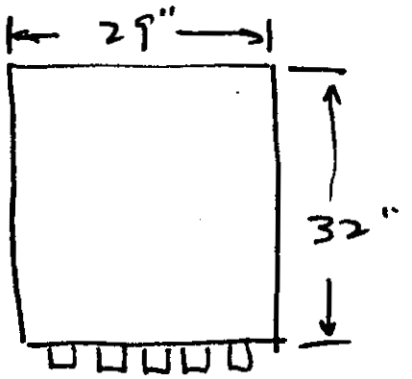
Run and/or Sample No. _____ Leak Test? _____ Date _____ Operator _____

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
							—
							—
							—
	Avg.				Avg.		

Run and/or Sample No. _____ Leak Test? _____ Date _____ Operator _____

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
							—
							—
							—
	Avg.				Avg.		

PRELIMINARY FIELD DATA



Sketch of stack cross section showing sampling ports.

Stack Geometry

Plant Name CHATHAM BRICK & TILE

Plant Location SANFORD, N.C.

Sampling Location WASTE HEAT STACK

Date(s) 7/17 - 19 /79

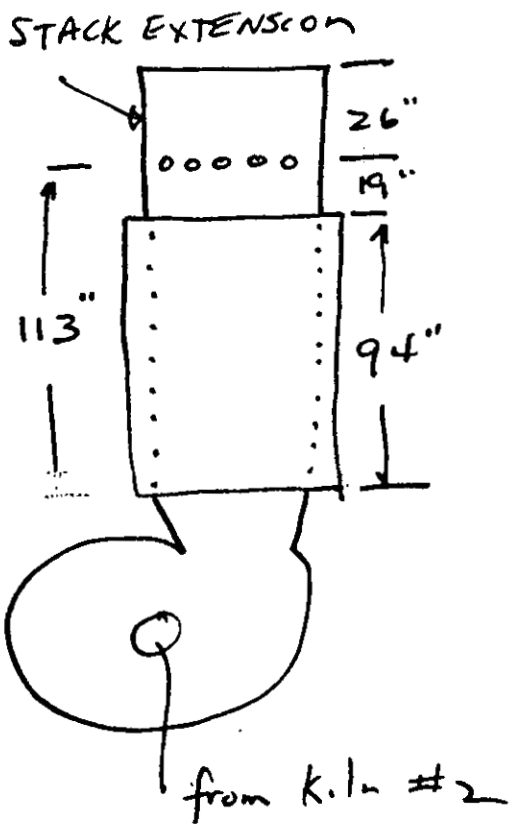
A. Dist. from inside of far wall to outside of near wall: 32" inches

B. Wall thickness: Neg. inches

Inside diameter of stack (A-B): — inches

Stack Area: 928 square inches

Comments: 5 PORTS / 8 points per port



Sketch of stack dimensions and location of sampling ports.

Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	1/16	2	
2	3/16	6	
3	5/16	10	
4	7/16	14	
5	9/16	18	
6	11/16	22	SAME
7	13/16	26	
8	15/16	30	

PARTICULATE FIELD DATA

Company/Location CHATHAM BRICK AND TILE CO.

Run # 1

Sample Box # 1 @ Heat Setting 5

Sampling Location: WASTE HEAT STACK

Start: 9:20

Probe # 4' @ Heat Setting 5

Date 7-18-79 Test Participants FJP, JN

Finish: 10.48

Nozzle # 505 with Dia., inches .247

Bar. Press., in. Hg 29.77 Meter Box # N-4

$\Delta H/\Delta P = K = 2.83$

Pitot Leak Tests: Before ✓ After ✓

Static Press., in. H_2O -.15 ΔH@ 1.87

Filter # 3947 Tare Wt. .4712

Sampling Train Leak Test (from nozzle)

Ambient Temp, °F 90 C Factor 1.09

Before @ ≥ 15 in. Hg = .003 cfm

Est. Moisture, % 6 Temp. Device T/C

After @ 6 in. Hg = .000 cfm

Avg. Δp .65 at ΔH of 1.84

Point	Clock Time	988.445 Dry Gas Meter, Cu. Ft.	Pitot Manometer (Δp) in. H_2O	Orifice Manometer (ΔH) in. H_2O Desired	Orifice Manometer (ΔH) in. H_2O Actual	Average Meter Temp. °F	Pump Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
A 1	0	~~988.350~~	.18	.51	.51	95	1	260	68	310
2	2	989.27	.31	.878	.878	96	1	–	–	321
3	4	990.3	.39	1.10	1.10	97	3	–	–	331
4	6	991.4	.44	1.25	1.25	97	3	255	60	341
5	8	992.7	.43	1.22	1.22	98	3	–	–	345
6	10	993.9	.44	1.25	1.25	99	3	–	–	346
7	12	995.1	.38	1.08	1.08	99	3	250	60	344
8	14	996.3	.35	.96	.96	100	3	–	–	341
B 1	1-0	997.449	.22	.63	.63	98	2	–	–	312
2	2	998.3	.40	1.13	1.13	99	3	255	60	329
3	4	999.5	.48	1.36	1.36	100	3	–	–	340
4	6	000.8	.55	1.56	1.56	100	3	–	–	349
5	8	002.2	.56	1.59	1.59	100	3	260	69	352
6	10	003.6	.60	1.70	1.70	101	3	–	–	354
7	12	005.0	.56	1.59	1.59	101	3	–	–	351
8	14	006.3	.52	1.47	1.47	101	3	260	68	347
C 1	1-0	007.722	.36	1.02	1.02	100	3	–	–	331
2	2	009.	.55	1.55	1.55	101	3	260	68	340
3	4	010.18	.60	1.70	1.70	102	3	260	68	345
4	6	011.61	.75	2.12	2.12	102	4	260	68	348
5	8	013.155	.75	2.12	2.12	102	4	260	68	351

Company CHATHAM BRICK & TILE CO. Run # 1

Point	Clock Time	Dry Gas Meter, Cu. Ft.	Pitot Manometer (Δp) in. H_2O	Orifice Manometer (ΔH) in. H_2O Desired	Orifice Manometer (ΔH) in. H_2O Actual	Average Meter Temp. °F	Pump Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
6	10	014.78	.80	2.27	2.27	102	4.5	260	68	349
7	12	016.59	.70	1.98	1.98	102	4.0	260	68	346
8	14	018.06	.55	1.56	1.56	102	3.0	260	67	342
D 1	1-0	019.461	.30	.85	.85	102	2.5	260	68	334
2	2	020.48	.50	1.42	1.42	103	3.0	260	68	343
3	4	021.79	.60	1.70	1.70	103	3.5	260	68	349
4	6	023.21	.75	2.12	2.12	105	4.0	260	68	351
5	8	024.84	.85	2.42	2.42	105	4.5	260	68	353
6	10	026.58	.85	2.42	2.42	106	4.5	260	68	350
7	12	028.36	.75	2.12	2.12	106	4.0	260	68	344
8	14	030.01	.60	1.42	1.42	107	3.5	260	68	334
E 1	1-0	031.356	.25	0.71	0.71	106	2.0	260	68	329
2	2	032.28	.40	1.13	1.13	106	2.5	260	68	334
3	4	033.40	.50	1.42	1.42	107	3.0	260	68	342
4	6	034.71	.65	1.83	1.83	108	3.5	260	68	346
5	8	036.17	.75	2.12	2.12	108	4.0	260	68	345
6	10	037.79	.75	2.12	2.12	108	4.0	260	68	344
7	12	039.41	.75	2.12	2.12	108	4.5	260	68	341
8	14	041.04	.50	1.42	1.42	108	3.0~~5~~	260	68	326
	1-0	042.401								
40	80									
	diff	53.956								
	avg		.528		1.52	102				341
			(.7267)							

CO_2 2%
" 2.5%
" 1.5%

PARTICULATE FIELD DATA

Company/Location CHATHAM BRICK AND TILE CO.

Run # 2

Sample Box # 4 @ Heat Setting 5

Sampling Location: WASTE HEAT STACK

Start: 11:15

Probe # 4' @ Heat Setting 5

Date 7-18-79 Test Participants FJP, JTN

Finish: 13:12

Nozzle # 505 with Dia., inches .247

Bar. Press.,in. Hg 29.77 Meter Box # N-4

K = 2.833

Pitot Leak Tests: Before ✓ After ___

Static Press.,in. H_2O -.15 ΔH@ 1.87

Filter # 3945 Tare Wt. .4625

Sampling Train Leak Test (from nozzle)

Ambient Temp,°F 95 C Factor 1.09

Before @ ≥ 15 in. Hg = .00 cfm

Est. Moisture,% 6 Temp. Device T/C 0004

After @ 10 in. Hg = .00 cfm

Avg. Δp .65 at ΔH of 1.84

Point	Clock Time	Dry Gas Meter, Cu. Ft.	Pitot Manometer (Δp) in. H_2O	Orifice Manometer (ΔH) in. H_2O Desired	Orifice Manometer (ΔH) in. H_2O Actual	Average Meter Temp. °F	Pump Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
A1	0	043.427	.28	.79	.79	105	3	300	85	335
2	2	044.4	.35	1.01	1.01	105	3	280	80	336
3	4	045.6	.55	1.56	1.56	105	10	270	65	343
4	6	046.8	.55	1.56	1.56	106	10	260	60	343
5	8	048.1	.70	1.98	1.98	106	10	260	60	344
6	10	0523	.76	2.16	2.16	108	5	250	60	345
7	12	053.9	.65	1.84	1.84	108	5	251	61	347
8	14	055.5	.50	1.42	1.42	108	4	252	62	329
B1	1-0	056.84	.40	1.13	1.13	108	3	260	62	341
2	2	057.9	.50	1.42	1.42	109	3	260	65	346
3	4	059.3	.57	1.62	1.62	108	4	260	65	352
4	6	060.7	.68	1.93	1.93	109	4	260	65	356
5	8	062.4	.76	2.15	2.15	110	5	260	66	358
6	10	063.8	.84	2.38	2.38	110	5	255	66	356
7	12	665.6	.75	2.11	2.11	110	5	255	62	350
8	14	067.3	.56	1.59	1.59	111	4	250	65	342
C1	1-0	068.75	.34	.96	.96	110	3	250	65	331
2	2	69.8	.50	1.42	1.42	110	3	250	65	348
3	4	71.1	.55	1.56	1.56	110	3	250	65	348
4	6	72.5	.68	1.93	1.93	110	3	250	65	355
5	8	7260	.76	2.15	2.15	110	4	250	65	356

SMITH & GREENBURG Industries

051.9
049.2
-2.7

ENTROPY ENVIRONMENTALISTS, INC

SPECIALISTS IN

Company CHATHAM BRICK & TILE CO. Run # 2

Point	Clock Time	Dry Gas Meter, Cu. Ft.	Pitot Manometer (Δp) in. H_2O	Orifice Manometer (ΔH) in. H_2O Desired	Orifice Manometer (ΔH) in. H_2O Actual	Average Meter Temp. °F	Pump Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
6	10	075.70	.80	2.27	2.27	111	4.0	260	65	354
7	12	077.47	.70	1.98	1.98	111	4.0	260	65	349
8	14	079.01	.60	1.70	1.70	111	3.5	260	65	346
D1	1-0	080.553	.25	0.71	0.71	110	2.0	260	65	319
2	2	081.46	.40	1.13	1.13	111	2.5	260	65	334
3	4	082.58	.49	1.40	1.40	111	3.0	260	65	348
4	6	083.89	.60	1.70	1.70	111	3.0	260	65	354
5	8	085.33	.60	1.70	1.70	111	3.5	260	65	357
6	10	086.77	.60	1.70	1.70	111	3.5	260	68	357
7	12	088.22	.60	1.70	1.70	110	3.5	255	68	354
8	14	089.65	.55	1.56	1.56	110	3.5	255	68	346
E1	1-0	090.688	.20	0.61	0.61	110	2.0	255	68	313
2	2	091.69	.25	0.71	0.71	110	2.0	255	68	328
3	4	092.54	.40	1.13	1.13	110	2.5	255	68	338
4	6	093.68	.45	1.27	1.27	110	3.0	255	68	345
5	8	094.94	.45	1.27	1.27	110	3.0	255	68	347
6	10	096.21	.40	1.13	1.13	110	2.5	255	68	347
7	12	097.38	.40	1.13	1.13	110	2.5	255	68	346
8	14	098.53	.35	0.99	0.99	109	2.5	255	68	341
	1-0	099.653								
40	80									
	diff	53.466								
	avg		.5195 (7208)		1.51	109				344

PARTICULATE FIELD DATA

Company/Location CHATHAM BRICK AND TILE CO. #2 KILN

Sampling Location: WASTE HEAT STACK

Date 7-19-79 Test Participants FSP, JTN

Bar. Press., in. Hg 30.00 Meter Box # N-4

Static Press., in. H_2O -.15 $\Delta H_@$ 1.87

Ambient Temp, °F 85 C Factor 1.07

Est. Moisture, % 6 Temp. Device T/C 0004

Run # 3

Start: 10:28

Finish: 12:40

Filter # 3944 Tare Wt. .4618

Sample Box # 1 @ Heat Setting 5

Probe # 4' @ Heat Setting 5

Nozzle # 505 with Dia., inches .247

Pitot Leak Tests: Before ✓ After ✓

Sampling Train Leak Test (from nozzle)

Before @ ≥ 15 in. Hg = 0.00 cfm

After @ 4.5 in. Hg = 0.00 cfm

Avg. Δp .65 at ΔH of 1.84

Point	Clock Time	Dry Gas Meter, Cu. Ft.	Pitot Manometer (Δp) in. H_2O	Orifice Manometer (ΔH) in. H_2O Desired	Orifice Manometer (ΔH) in. H_2O Actual	Average Meter Temp. °F	Pump Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp. °F	Stack Temp. °F	
A 1	0	100.203	0.18	0.51	0.51	84	1.0	250	65	295	
2	2	100.91	0.28	0.78	0.78	84	2.0	250	65	305	
3	4	101.95	0.40	1.12	1.12	85	2.0	250	65	317	
4	6	103.04	0.35	0.98	0.98	85	2.0	250	65	325	
5	8	104.21	0.45	1.28	1.28	86	2.0	250	65	331	→ STOPPED BECAUSE TROUBLE B-SIDE
6	10	105.34	0.45	1.28	1.28	90	2.0	250	65	329	
7	12	106.58	0.43	1.21	1.21	90	2.5	250	65	328	
8	14	107.77	0.40	1.12	1.12	90	2.5	250	65	324	
B 1	1-0	108.905	0.24	0.68	0.68	91	2.0	250	65	301	→ BOX NOT HEATING B-SIDE
2	2	109.83	0.40	1.12	1.12	91	2.0	250	65	314	
3	4	110.95	0.50	1.40	1.40	91	2.5	250	65	325	
4	6	112.24	0.55	1.55	1.55	91	2.5	250	65	331	
5	8	113.59	0.60	1.70	1.70	92	3.0	250	65	333	
6	10	115.01	0.65	1.81	1.86	93	3.0	250	65	329	
7	12	116.47	0.55	1.55	1.55	94	3.0	250	65	327	
8	14	117.84	0.55	1.55	1.55	94	3.0	250	65	326	
C 1	1-0	119.213	0.40	1.12	1.12	94	2.0	250	65	312	
2	2	120.34	0.50	1.40	1.40	94	2.5	250	65	318	
3	4	121.64	0.60	1.70	1.70	95	3.0	250	65	324	
4	6	123.04	0.65	1.81	1.81	95	3.0	250	65	330	
5	8	124.51	0.75	2.10	2.10	95	4.0	250	65	333	

Company CHATHAM BRICK AND TILE CO. Run # 3

Point	Clock Time	Dry Gas Meter, Cu. Ft.	Pitot Manometer (Δp) in. H_2O	Orifice Manometer (ΔH) in. H_2O Desired	Orifice Manometer (ΔH) in. H_2O Actual	Average Meter Temp. °F	Pump Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
6	10	126.18	0.85	2.35	2.35	96	4.0	250	65	333
7	12	127.83	0.75	2.10	2.10	96	4.0	250	65	329
8	14	129.60	0.60	1.70	1.70	96	3.5	250	65	326
D1	1-0	131.039	0.35	0.98	0.98	95	2.5	250	65	317
2	2	132.15	0.50	1.40	1.40	96	3.0	250	65	326
3	4	133.44	0.60	1.70	1.70	96	3.0	250	65	331
4	6	134.84	0.75	2.10	2.10	96	4.0	250	65	336
5	8	137.38	0.85	2.35	2.35	97	4.5	250	65	334
6	10	139.11	0.85	2.35	2.35	98	4.5	250	65	330
7	12	140.01	0.75	2.10	2.10	98	4.5	250	65	325
8	14	141.66	0.60	1.70	1.70	99	3.5	250	65	320
E1	1-0	143.101	0.30	0.87	0.87	96	2.0	250	65	313
2	2	144.15	0.40	1.12	1.12	97	2.0	250	65	319
3	4	145.28	0.50	1.40	1.40	97	3.0	250	65	325
4	6	146.59	0.75	2.10	2.10	98	3.5	250	65	327
5	8	148.25	0.70	1.95	1.95	99	4.0	250	65	327
6	10	149.84	0.75	2.10	2.10	99	4.0	250	65	326
7	12	151.49	0.65	1.81	1.81	100	3.5	250	65	320
8	14	152.98	0.55	1.55	1.55	100	3.0	250	65	315
	1-0	154.362								
40	80	54.259								
	diff									
	avg		.536		1.54	94				323
			(.7321)							

PARTICULATE SAMPLING CLEANUP SHEET

Plant Name CHATHAM BRICK

Sampling Location A-Side Waste Heat Stack

Reagent Box # 0210 Date Analyzed 7/25/79

Blank Calculations:	Acetone	Water
Blank Residue	1.4	
Blank Volume	200	
Concentration	.007 mg/mls	mg/mls
Volume Used	100 mls	mls
# 1 Blank Weight	0.7 mgms	mgms
Volume Used	110 mls	mls
# 2 Blank Weight	0.8 mgms	mgms
Volume Used	125 mls	mls
# 3 Blank Weight	0.9 mgms	mgms

Analysis Method: (Zero & Span Balance mg Initials)

EPA-5

Description of Sample:

light catch, black particulate

Remarks:

	1	2	3
Date of Test	7/18	7/18	7/18
Test Number	1	2	3
Moisture Collected:			
Impinger water volume	262	264	264
Tared volume	200	200	200
Captured water	62 mls	64 mls	64 mls
Silica Gel weight	240.0	240.5	238.5
Tared weight	225.0	225.0	225.0
Adsorbed water	15.0 gms	15.5 gms	13.5 gms
TOTAL MOISTURE CATCH	77.0 mls	79.5 mls	77.5 mls
Front Half Analysis: (Nozzle, probe, cyclone, filter front half)			
Filter & Particulate	515.1	498.7	520.5
Filter Tare weight	471.2	462.5	461.8
Filter Particulate	-	-	-
Rinsings or Dry Wt.	-	-	-
Particulate catch	43.9 mgms	36.2 mgms	58.7 mgms
Acetone blank	0.7	0.8	0.9
TOTAL FRONT CATCH	43.2 mgms	35.4 mgms	57.8 mgms
Back Half Analysis: (Impingers, filter back half)			
Extractables weight			
Boil Down weight			
Impingers' Catch	mgms	mgms	mgms
Water blank			
TOTAL BACK CATCH	mgms	mgms	mgms
TOTAL TRAIN CATCH	mgms	mgms	mgms

CUSTODY SHEET FOR REAGENT BOX # 0210

Date of Makeup 6/22/79 Individual Water Tare Volume 200 mls

Initials mcg Individual Silica Gel Tare Weight 225 gms

Locked? ✓

Plant Name CHATHAM BRICK

Sampling Location A-SIDE Waste Heat Stack

Box/Test Number	Date Used	Initials	Locked?	Date Cleanup	S. Gel Spent?	Initials	Locked?
1	7-18	JN	✓	7-18	½	FJP	✓
2	"	"	✓	"	½	FJP	✓
3	"	"	✓	"	½	FJP	✓

	Date	Initials	Locked?
Transferred to Lab	7-20	FJP	✓
Received in Lab	7-20	mcg	✓

Zero & Span Balance Initials mcg

Sampling Method: Method 5

Filter #	Tare Weight (mgms)	Used on Test
3947	.4712	1
3944	.4618	3
3945	.4625	2

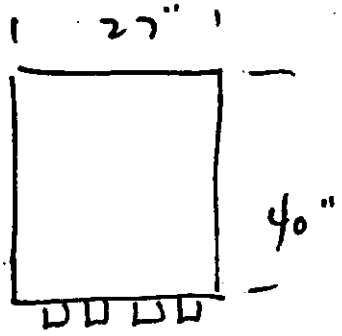
ENTROPY ENVIRONMENTALISTS, INC

SPECIALISTS IN SOURCE SAMPLING

APPENDIX B-2

PRELIMINARY FIELD DATA

Stack Geometry



Plant Name CHATHAM BRICK & TILE CO

Plant Location SANFORD, N.C.

Sampling Location DRIER OUTLET STACK

Date(s) 7/17 - 19/79

A. Dist. from inside of far wall to outside of near wall: 40 inches

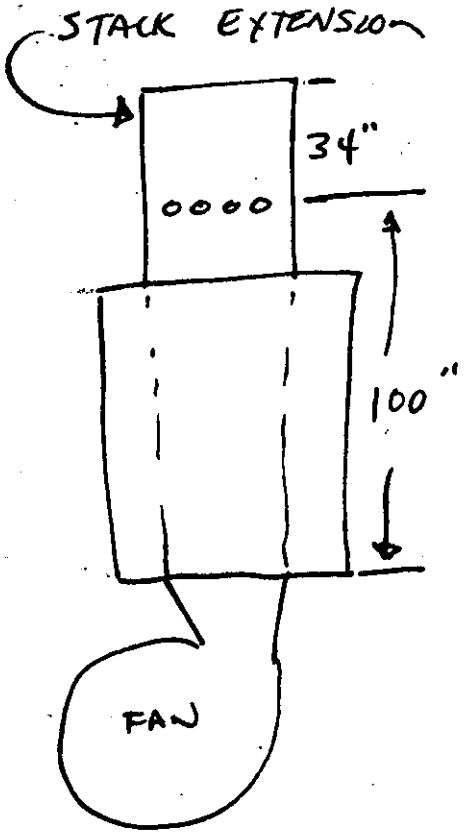
B. Wall thickness: Neg. inches

Inside diameter of stack (A-B): — inches

Stack Area: 1080 square inches

Comments: 4 ports / 9 points per port

Sketch of stack cross section showing sampling ports.



Sketch of stack dimensions and location of sampling ports.

Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	1/18	2 1/4	↑
2	3/18	6 1/2	
3	5/18	11	
4	7/18	15	
5	9/18	20	
6	11/18	24 1/2	
7	13/18	28 3/4	SAME
8	15/18	33 1/4	
9	17/18	37 3/4	↓

PARTICULATE FIELD DATA

Company/Location Chatham Brick Sanford, N.C

Sampling Location: Dryer Outlet Stack

Date 7/18 Test Participants CW, CG

Bar. Press.,in. Hg 29.77 Meter Box # N-3

Static Press.,in. H_2O -.20 ΔH@ 1.85

Ambient Temp,°F 81 C Factor 1.00

Est. Moisture,% 7 Temp. Device T/C-1

Run # 4

Start: 09:20

Finish: 10:43

Filter # 3814 Tare Wt. .4615

Sample Box # Red @ Heat Setting Hi

Probe # S-1 @ Heat Setting 5

Nozzle # 506 with Dia., inches .252

Pitot Leak Tests: Before ✓ After ___

Sampling Train Leak Test (from nozzle)

Before @ ≥ 15 in. Hg = 0.000 cfm

After @ 7 in. Hg = 0.000 cfm

Avg. Δp .47 at ΔH of 1.84

Point	Clock Time	Dry Gas Meter, Cu. Ft.	Pitot Manometer (Δp) in. H_2O	Orifice Manometer (ΔH) in. H_2O Desired	Orifice Manometer (ΔH) in. H_2O Actual	Average Meter Temp. °F	Pump Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp. °F	Stack Temp. °F	
A-1	0	269.894	.23	.91	.91	87	3	250	75	109	
2	2	271.28	.42	1.65	1.65	88	5	250	75	124	
3	4	272.72	.45	1.78	1.78	89	5	250	73	125	
4	6	274.18	.48	1.90	1.90	90	5	250	70	125	
5	8	275.70	.52	2.0	2.0	90	5	250	70	125	
6	10	277.29	.68	2.68	2.68	91	6	250	70	125	
7	12	279.05	.65	2.55	2.55	91	7	250	70	126	
8	14	280.83	.62	2.45	2.45	93	7	250	70	126	
9	16	282.59	.62	2.45	2.45	94	7	250	70	126	
B-1	18/0	284.39	.27	1.06	1.06	95	4	245	70	123	
2	2	285.69	.42	1.65	1.65	95	5	245	73	126	
3	4	286.96	.50	1.98	1.98	95	6	244	75	127	
4	6	288.47	.50	1.78	1.98	95	6	240	75	126	
5	8	290.02	.51	2.0	2.0	95	6	240	75	126	
6	10	291.60	.55	2.15	2.15	95	6	240	75	123	
7	12	293.24	.57	2.21	2.21	95	6	240	75	123	
8	14	294.90	.60	2.35	2.35	95	6	240	75	123	
9	16	296.60	.65	2.53	2.53	95	7	240	75	123	
C-1	18/0	298.43	.33	1.30	1.30	95	5	238	73	117	
2	2	299.74	.38	1.42	1.42	95	5	235	73	121	
3	4	300.99	.35	1.40	1.40	95	5	235	73	123	

Company Chatham Brick Run # 4

Point	Clock Time	Dry Gas Meter, Cu. Ft.	Pitot Manometer (Δp) in. H_2O	Orifice Manometer (ΔH) in. H_2O Desired	Orifice Manometer (ΔH) in. H_2O Actual	Average Meter Temp. °F	Pump Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
4	6	302.34	.40	1.58	1.58	95	5	235	73	124
5	8	303.71	.41	1.60	1.60	95	5	235	73	124
6	10	305.10	.43	1.70	1.70	95	5	235	73	124
7	12	306.54	.46	1.82	1.82	95	5	235	73	125
8	14	308.00	.53	2.05	2.05	96	5	235	73	125
9	16	309.65	.57	2.25	2.25	96	5	235	73	125
0-1	18/0	310.43	.22	.86	.86	97	4	240	74	121
2	2	312.55	.36	1.42	1.42	98	5	240	75	122
3	4	313.78	.32	1.29	1.29	98	5	240	75	126
4	6	315.08	.32	1.29	1.29	98	5	240	75	126
5	8	316.35	.34	1.35	1.35	99	5	240	75	126
6	10	317.65	.41	1.60	1.60	99	5	240	75	126
7	12	319.08	.41	1.60	1.60	99	5	240	75	126
8	14	320.43	.43	1.70	1.70	100	5	240	75	126
9	16	321.83	.49	1.94	1.94	100	5	240	75	126
	18/OFF	323.338								
		53.444								
			.499		1.79	95				124
			(.7065)							

PARTICULATE FIELD DATA

Company/Location Chatham Brick Siler City, N.C.
Sampling Location: Dryer Outlet Stack
Date 7/18 Test Participants CW, CG
Bar. Press., in. Hg 29.77 Meter Box # W-3
Static Press., in. H_2O .24 ΔH@ 1.85
Ambient Temp, °F 92 C Factor 1.05
Est. Moisture, % 7 Temp. Device T/C-1

Run # 5
Start: 11:19
Finish: 12:57

Filter # 3848 Tare Wt. ~~.4715~~ .4715

Sample Box # Rock @ Heat Setting 5
Probe # 5-1 @ Heat Setting 5
Nozzle # 506 with Dia., inches .252
Pitot Leak Tests: Before ✓ After ✓
Sampling Train Leak Test (from nozzle)
Before @ ≥ 15 in. Hg = 0.005 cfm
After @ 6 in. Hg = 0.001 cfm
Avg. Δp .46 at ΔH of 1.84

Point	Clock Time	Dry Gas Meter, Cu. Ft.	Pitot Manometer (Δp) in. H_2O	Orifice Manometer (ΔH) in. H_2O Desired	Orifice Manometer (ΔH) in. H_2O Actual	Average Meter Temp. °F	Pump Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
A-1	0	323.698	.24	.96	.96	96	3	235	75	110
2	2	324.87	.38	1.52	1.52	97	4	235	75	120
3	4	326.01	.43	1.72	1.72	97	4	235	75	125
4	6	327.37	.57	2.20	2.20	97	5	235	73	126
5	8	328.98	.57	2.20	2.20	98	5	235	70	126
6	10	330.66	.60	2.40	2.40	98	5	235	70	125
7	12	332.37	.57	2.20	2.20	99	6	235	70	125
8	14	334.07	.57	2.20	2.20	99	6	235	70	124
9	16	335.70	.45	1.80	1.80	99	5	240	70	110
B-1	18/0	337.23	.31	1.25	1.25	99	5	240	70	115
2	2	338.48	.39	1.55	1.55	99	5	240	70	129
3	4	339.83	.46	1.85	1.85	99	5	240	70	127
4	6	341.30	.46	1.85	1.85	99	5	240	70	127
5	8	342.80	.49	1.98	1.98	99	5	240	70	127
6	10	344.36	.55	2.20	2.20	100	5	240	70	127
7	12	346.00	.53	2.11	2.11	100	5	241	70	127
8	14	347.67	.58	2.30	2.30	100	5	243	70	124
9	16	349.36	.60	2.40	2.40	100	5	243	70	124
C-1	18/0	351.16	.32	1.21	1.21	100	4	245	70	109
2	2	352.30	.39	1.55	1.55	100	5	243	70	121
3	4	353.63	.35	1.40	1.40	100	5	240	70	125

Company Chetlain Brick Run 5

Point	Clock Time	Dry Gas Meter, Cu. Ft.	Pitot Manometer (Δp) in. H_2O	Orifice Manometer (ΔH) in. H_2O Desired	Orifice Manometer (ΔH) in. H_2O Actual	Average Meter Temp. °F	Pump Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
4	6	354.95	.38	1.52	1.52	100	5	240	70	125
5	8	356.32	.41	1.65	1.65	100	5	240	70	125
6	10	357.76	.43	1.72	1.72	100	5	238	71	125
7	12	359.19	.47	1.90	1.90	100	5	237	72	125
8	14	360.70	.52	2.10	2.10	100	5	235	74	125
9	16	362.33	.57	2.30	2.30	100	5	235	75	125
0-1	18/0	364.01	.22	.88	.88	100	4	235	75	122
2	2	365.05	.30	1.20	1.20	100	5	235	75	125
3	4	366.25	.34	1.35	1.38	100	5	235	75	125
4	6	367.54	.32	1.20	1.20	100	5	235	75	126
5	8	368.79	.37	1.50	1.50	100	5	239	77	125
6	10	370.13	.37	1.50	1.50	100	5	241	77	125
7	12	371.50	.37	1.50	1.50	101	5	244	77	125
8	14	372.86	.38	1.52	1.52	101	5	245	77	125
9	16	374.24	.43	1.72	1.72	102	5	245	77	126
	18/OFF	375.784								
		52.086								
			.429		2.31	99				124
			(.6553)							

PARTICULATE FIELD DATA

Company/Location Chatham Brick, Sanford, N.C.

Sampling Location: Dryer Outlet Stack

Date 7/18 Test Participants CW, CG

Bar. Press., in. Hg _____ Meter Box # NN3

Static Press., in. H_2O .29+ $\Delta H_@$ 1.85

Ambient Temp, °F 80 C Factor 1.05

Est. Moisture, % 2 Temp. Device T/C-1

Run # 6

Start: 11:34

Finish: 12:54

Filter #	Tare Wt.
3946	.4679

Sample Box # Red @ Heat Setting 5

Probe # 5-1 @ Heat Setting 5

Nozzle # 506 with Dia., inches .252

Pitot Leak Tests: Before ✓ After ✓

Sampling Train Leak Test (from nozzle)

Before @ ≥ 15 in. Hg ~~0.005~~ cfm 0.002

After @ 4 in. Hg = 0.003 cfm

Avg. Δp .47 at ΔH of 1.84

Point	Clock Time	Dry Gas Meter, Cu. Ft.	Pitot Manometer (Δp) in. H_2O	Orifice Manometer (ΔH) in. H_2O Desired	Orifice Manometer (ΔH) in. H_2O Actual	Average Meter Temp. °F	Pump Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp. °F	Stack Temp. °F	
A-1	0	377.540	.25	.98	.98	86	2	215	70	112	
2	2	378.66	.40	1.56	1.56	86	2	217	70	116	
3	4	380.04	.52	2.0	2.0	87	2	220	70	117	
4	6	381.66	.55	2.15	2.15	89	3	220	68	117	
5	8	383.31	.57	2.20	2.20	89	4	220	66	116	
6	10	385.00	.62	2.40	2.40	90	4	220	65	116	
7	12	386.71	.52	2.0	2.0	90	4	222	64	116	
8	14	388.32	.52	2.0	2.0	90	4	222	64	116	
9	16	389.97	.42	1.65	1.65	90	4	222	64	116	
B-1	18/0	391.47	.32	1.27	1.27	90	3	220	65	107	
2	2	392.62	.40	1.58	1.58	90	3	220	67	115	
3	4	393.98	.43	1.69	1.69	90	4	220	66	119	
4	6	395.41	.45	1.78	1.78	90	4	220	65	119	
5	8	396.88	.57	2.20	2.20	90	4	220	65	119	
6	10	398.53	.63	2.45	2.45	90	4	220	65	119	
7	12	400.26	.68	2.65	2.65	90	4	220	65	118	
8	14	402.04	.68	2.65	2.65	91	4	220	66	118	
9	16	403.84	.50	1.95	1.95	91	4	220	66	118	
C-10	18/0	405.42	.30	1.18	1.18	92	3	220	66	104	
2	2	406.64	.32	1.27	1.27	92	3	220	66	112	
3	4	407.90	.36	1.42	1.42	92	3	220	66	115	

Company Chatham Brick

Run # 6

Point	Clock Time	Dry Gas Meter, Cu. Ft.	Pitot Manometer (Δp) in. H_2O	Orifice Manometer (ΔH) in. H_2O Desired	Orifice Manometer (ΔH) in. H_2O Actual	Average Meter Temp. °F	Pump Vacuum in. Hg Gauge	Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
4	6	408.12	.38	1.49	1.49	92	4	220	66	115
5	8	410.53	.40	1.56	1.56	93	4	220	68	116
6	10	411.92	.44	1.70	1.70	93	4	220	69	116
7	12	413.37	.48	1.89	1.89	93	4	220	70	117
8	14	414.88	.55	2.15	2.15	93	4	220	70	117
9	16	416.53	.60	2.32	2.32	93	4	220	71	117
D-1	18/OFF	418.22	.20	.79	.79	93	2	225	71	109
2	2	419.22	.30	1.18	1.18	93	2	228	71	118
3	4	420.39	.32	1.27	1.27	93	2	230	71	117
4	6	421.66	.35	1.39	1.39	93	3	231	71	117
5	8	422.96	.33	1.30	1.30	93	3	232	72	117
6	10	424.25	.35	1.39	1.39	93	3	235	72	116
7	12	425.57	.38	1.49	1.49	93	3	235	72	116
8	14	426.92	.42	1.65	1.65	93	3	235	72	115
9	16	428.34	.48	1.89	1.89	93	3	235	72	117
	18/OFF									
	DIFF	50.8								
	Avg		.436 (.4602)		1.74	91				116

PARTICULATE SAMPLING CLEANUP SHEET

Plant Name CHATHAM BRICK
Sampling Location B-Side Dryer Outlet Stack
Reagent Box # 0203 Date Analyzed 7/25/79

Blank Calculations:	Acetone	Water
Blank Residue	1.4	
Blank Volume	200	
Concentration	.007 mg/mls	mg/mls
Volume Used	200 mls	mls
# 4 Blank Weight	1.4 mgms	mgms
Volume Used	175 mls	mls
# 5 Blank Weight	1.2 mgms	mgms
Volume Used	100 mls	mls
# 6 Blank Weight	0.7 mgms	mgms

Analysis Method: (Zero & Span Balance mcg Initials)
EPA-5

Description of Sample:
light catch, white particulate

Remarks:

Date of Test	7/18	7/18	7/19
Test Number	4	5	6
Moisture Collected:			
Impinger water volume	234	254	246
Tared volume	200	200	200
Captured water	34 mls	54 mls	46 mls
Silica Gel weight	240.5	238.0	238.0
Tared weight	225.0	225.0	225.0
Adsorbed water	15.5 gms	13.0 gms	13.0 gms
TOTAL MOISTURE CATCH	49.5 mls	67.0 mls	59.0 mls
Front Half Analysis: (Nozzle, probe, cyclone, filter front half)			
Filter & Particulate	482.0	482.3	480.6
Filter Tare weight	461.5	471.5	467.9
Filter Particulate	-	-	-
Rinsings or Dry Wt.	-	-	-
Particulate catch	20.5 mgms	10.8 mgms	12.7 mgms
Acetone blank	1.4	1.2	0.7
TOTAL FRONT CATCH	19.1 mgms	9.6 mgms	12.0 mgms
Back Half Analysis: (Impingers, filter back half)			
Extractables weight			
Boil Down weight			
Impingers' Catch	mgms	mgms	mgms
Water blank			
TOTAL BACK CATCH	mgms	mgms	mgms
TOTAL TRAIN CATCH	mgms	mgms	mgms

ENTROPY ENVIRONMENTALISTS, INC
SPECIALISTS IN SOURCE SAMPLING

CUSTODY SHEET FOR REAGENT BOX # 0203

Date of Makeup 6/22/79 Individual Water Tare Volume 200 mls

Initials MEG Individual Silica Gel Tare Weight 225 gms

Locked? ✓

Plant Name Chatham Brick

Sampling Location B-Side Dryer Outlet Stack

Box/Test Number	Date Used	Initials	Locked?	Date Cleanup	S. Gel Spent?	Initials	Locked?
0203/4	7/18/79	C.G.	✓	7/20	80%	CW	✓
5	7/18	C.W.	✓	7/20	20%	CW	✓
6	7/19	CW	✓	7/20	70%	CW	✓

	Date	Initials	Locked?
Transferred to Lab	7/20	CW	✓
Received in Lab	7/20	MEG	✓

Zero & Span Balance Initials MEG

Sampling Method: EPA-5

Remarks:

Filter #	Tare Weight (mgms)	Used on Test
3814	.4615	4
3848	.4715	5
3946	.4679	6

ENTROPY ENVIRONMENTALISTS, INC ..... SPECIALISTS IN SOURCE SAMPLING

APPENDIX C

TEST PARTICIPANTS

FRANK J. PHOENIX	PROJECT DIRECTOR
CHRIS M. WRENN	SAMPLING TEAM LEADER
W. CHRIS GOODALL	ENGINEERING TECHNICIAN
JOHN T. NASH	ENGINEERING TECHNICIAN
DONALD J. DEITZ	ENGINEERING TECHNICIAN

APPENDIX D

APPENDIX E

CALIBRATIONS

GENERAL

All measuring equipment Entropy uses is initially calibrated before use. Equipment which can change calibration is both checked upon return from each field use and is also periodically recalibrated in full. When an instrument is found out of calibration, it is so noted in the report and appropriate adjustments are made to the final results. The equipment is then repaired and recalibrated or retired as needed. Specific equipment is handled as follows:

PITOT TUBE

All pitot tubes used by Entropy, whether separate or attached to a sampling probe, are constructed in-house or by Nutech Corporation. Prior to their initial usage, they are calibrated using EPA geometry standards. In general, if a type "S" pitot tube is assembled correctly, and positioned properly in relation to the probe nozzle, it will have an average Cp of 0.84. As long as it is not damaged, it should not change its calibration. The recalibration schedule for pitot tubes is related to the physical condition and usage of the pitot tube, not a fixed time schedule. Each pitot tube is inspected upon return to the laboratory from each field use.

DRY GAS METER AND ORIFICE METER

All Entropy meter boxes are calibrated upon purchase and at least once every six months against a secondary test meter (one calibrated against a wet test meter) according to their usage history. Basic procedures are outlined in the EPA Publication No. APTD-0576. The only differences are in the choice of flow rates used and the volumes metered at each flow rate. After each field use, quick checks are performed to insure ΔH@ changes of less than 5%. These checks compare the orifice against the dry gas meter. If greater than 5% changes occur, recalibration and repair are instituted.

NOZZLES

Each nozzle is calibrated upon purchase, and thereafter whenever it becomes apparent that the nozzle has become damaged. Each nozzle is inspected upon return to laboratory from each field use. The diameter is measured on four different axes, with the high and low readings differing by no more than 0.004 inches as a tolerance.

TEMPERATURE MEASURING INSTRUMENTS

After each field use, the thermocouples or thermometers are calibrated against an ASTM precision mercury-in-glass thermometer across a wide range of temperatures. If the initial

reading is not within ± 1.5% of the absolute temperature reading of the standard thermometer, the instrument is adjusted until it is in the acceptable range.

MAGNEHELIC GAUGES

After each field use, each magnehelic gauge is calibrated against an inclined manometer at three different settings (low, medium, high) over the range of the individual gauges. If the readings differ more than ± 5% from the manometer readings, the magnehelics are recalibrated.

BAROMETER

After each field use, each barometer is checked against a mercury barometer.

Date 7-6-79 Box N-3 P_B 29.82 Initials M.C.

ORIFICE SETTING	TEST METER VOLUME	ROOM TEMP °F	TIME MINUTES	ΔH@	BOX METER VOLUME	BOX METER TEMP	γ
0.3	2	72°	6.48	1.74	2.0150	84°	1.014
0.5	3	74°	7.43	1.73	3.014	76°	.996
0.7	3	74°	6.4	1.80	3.017	78°	1.000
1.0	3	72°	5.48	1.86	3.020	84°	.997
1.5	5	74°	7.41	1.86	5.02	78°	.999
2.0	5	74°	6.43	1.85	5.04	83°	.997
4.0	5	74°	4.68	1.95	5.074	84°	.992
6.0	5	72°	3.87	1.98	5.028	84°	1.002

$$\Delta H@ = \frac{(0.0317)\Delta H}{P_B(T_{Box} + 460)} \left(\frac{(T_{Room} + 460)\theta}{V_{Test\ Meter}} \right)^2$$

$$\gamma = \frac{V_{Test}\ (P_B)(T_{Box} + 460)}{V_{Box}\left(P_B + \frac{\Delta H}{13.6}\right)(T_{Room} + 460)}$$

$\Delta H_{@}$ 1.85 $\gamma = 1.000$

Date 7-3-79 Box N-4 P_B 29.54 Initials MH

ORIFICE SETTING	TEST METER VOLUME	ROOM TEMP °F	TIME MINUTES	ΔH@	BOX METER VOLUME	BOX METER TEMP	Y
0.3	2	73°	6.60	1.85	2.008	78°	1.005
0.5	3	74°	7.70	1.87	3.030	80°	1.000
0.7	3	73°	6.35	1.79	2.962	74°	1.013
1.0	3	74°	5.40	1.86	3.029	82°	1.003
1.5	5	74°	7.53	1.92	5.043	82°	1.003
2.0	5	73°	6.52	1.93	5.067	76°	0.987
4.0	5	74°	4.55	1.87	5.002	83°	1.006
6.0	5	74°	3.73	1.88	4.984	84°	1.007

$$\Delta H@ = \frac{(0.0317)\Delta H}{P_B(T_{Box} + 460)} \left(\frac{(T_{Room} + 460)\theta}{V_{Test\ Meter}} \right)^2$$

$\Delta H@ = 1.87$

$$\gamma = \frac{V_{Test}\ (P_B)(T_{Box} + 460)}{V_{Box}\left(P_B + \frac{\Delta H}{13.6}\right)(T_{Room} + 460)}$$

$\gamma = 1.003$

NOZZLE CALIBRATION DATA

NOZZLE # 505

DATE	INITIALS	DIAMETER, in. 1	2	3	4	AVERAGE
7-15-77	WN	.250	.247	.250	.248	.249
12-13-78	JLE	.252	.252	.252	.250	.252
3-26-79	MH	.251	.250	.254	.252	.252
6/29/79	C.G.	.246	.249	.247	.247	.247

NOZZLE CALIBRATION DATA

NOZZLE # 506

DATE	INITIALS	DIAMETER, in. 1	2	3	4	AVERAGE
7-15-77	CWN	.254	.254	.254	.254	.254
12-13-78	JLE	.253	.252	.255	.255	.254
3-26-79	MH	.253	.250	.253	.252	.252