AP42 Section:	11.25
Title:	Correspondance and related materials 1993 - 1994

HUBER CLAY

J.M. Huber Corporation
Clay Division
One Huber Road
Macon, GA 31298
912 745-4751
Fax 912 745-1116 - Marketing
Fax 912 741-1817 - R & D/Tech Services
Fax 912 742-8613 - All Others
Telex 544438

April 20, 1994

Mr. Ronald B. Myers
Emission Factors and Methodologies Section
Emission Inventory Branch
United States Environmental Protection Agency
Office of Air Quality Planning and Standards
Fax (919) 541-0684

Dear Sir,

Thank you for granting an extension in May to your deadline for comments on the Draft Chapter 8 of AP42 regarding "clay processing".

The China Clay Producer's Association, representing the six largest kaolin clay producers in the United States, is very interested in providing useful comments on this draft. Unfortunately, this spring the producer's have been very busy responding to legislative and regulatory initiatives ranging from Title V implementation to state severance tax proposals.

We therefore request additional time to pole our membership and acquire test data if appropriate. I believe we can have an initial response to you by May 20th. Does that date meet with your approval?

Regards,

J.M. Huber Corporation

Jay Hutto
Division Manager
Environmental Affairs

JWH/saw
CC: Mr. Jim Groome, China Clay Producers Association
Mr. Lee Lemke, Georgia Mining Association
Mr. Billy Veal, Thiele Kaolin,
Chairman CCPA Environmental Committee

410 North Michigan Avenue
Chicago, Illinois 60611
Phone 312-321-1515
Fax 312-321-1271

Cable Oil-Dri • Chicago, U.S.A.
Telex 910-221-5280

OIL-DRI
CORPORATION OF AMERICA

April 8, 1994

Mr. Ronald E. Myers
United States Environmental Protection Agency
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

Dear Mr. Myers:

I am writing regarding the Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, AP-42. I have reviewed and have passed on the document to others at Oil-Dri in the environmental area, and we all feel comfortable with the Reports as drafted. Therefore, while we have no comments to make regarding changes at this time, I wanted to express our appreciation for being considered in the review process. Should any other drafts come up that affect our industry in the future, please continue to forward the drafts to us for our review. Thank you very much for giving us this opportunity.

Sincerely,

OIL-DRI CORPORATION OF AMERICA

Heidi M. Jaffee

Heidi M. Jaffee

FAX (919) 541-0684

CLAY

WYO-BEN, INC.

WYO-BEN

Telefax #919-541-0684

April 8, 1994

Ronald E. Meyers
Emissions Factors and Methodologies Section
Emission Inventory Branch
US EPA
Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

Re: Review Comments For AP-42

Dear Mr. Meyers:

Thank you for the opportunity to review and comment on the draft update documents for AP-42.

5. Draft AP-42 Section 8.32

1. The inlet end dryer temperature for bentonite processing noted on page 8.32-7 is slightly in error. Most often it will be around 900°C (1650°F).

2. In the discussion of bentonite processing given on page 8.32-7 you note that the bentonite clay is screened after being dried and ground. This is incorrect. At some plants the ground clay is put through an after-grinder air classifier, however, this process is optional and only done for specialized products.

3. In the process flow diagram for bentonite on page 8.32-9, you show the ground product being passed through an air classifying/screening process which is also shown as a PM emission point. As noted in 2. this process is strictly optional and is not part of the process for most bentonite processing plants.

4. There appears to be some calculation errors in Table 8.32-4 (English Units) on page 8.32-16 as follows: Based upon the metric values given in Table 8.32-4 the filterable PM for the rotary dryer should be 280 and for the rotary dryer with ESP, 0.032. The rotary dryer PM-10 should be 19.6.

Emission Factor Documentation for AP-42, Draft 1663/3612

5. On Table 2-1, page 5, the amount of bentonite sold listed for Virginia should,

550 S. 24th Street W., Suite 201 • P.O. Box 1979 • Billings, Montana 59103 • Telephone 406-652-6351 • Telefax 406-656-0748

correctly, be listed for Wyoming. Virginia has no bentonite production.

6. Paragraph 2.2.4, page 14, should be adjusted per 1. and 2. above.

7. The flow diagram on Figure 2-5, page 17, should be adjusted per 3. above.

8. The values given for English units in Table 4-4, page 35 appear to be partially incorrect and should be adjusted as follows: Rotary dryer filterable PM minimum, 260, average, 280; Rotary dryer PM-10 minimum 18.2, maximum 22, average 19.6; Rotary dryer with ESP filterable PM maximum 0.16, average 0.032.

9. Similarly, it appears that the bentonite emission factor (English units) values for rotary dryer filterable PM and PM-10 should be 280 and 19.6, respectively.

All other information and data pertaining to the bentonite industry appears to be factual and in good order.

Sincerely,

Richard K. Brown

Richard K. Brown
Vice President, Resources

WYO-BEN 550 S. 24th Street W., Suite 201 • P.O. Box 1979 • Billings, Montana 59103 • Telephone 406-652-6351 • Telefax 406-656-0748

Source category: Clay Processing FILE: BENT_EF.WQ1 Date: 07/06/94
Plant name : Location:
Test date : 9/20-9/22/83 Ref. No.: 7
Process : Bentonite Process rate basis: production

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor kg/Mg	Emission factor lb/ton	Volumetric flow rate, DSCFM	Concen. ppm
Plant C1									
Rotary dryer	none	filt. PM	1	8,192	27	152	303		
		filt. PM	2	7,821	27	145	290		
		filt. PM	3	7,183	27	133	266		
				AVERAGE	27	143	286	RATING:	B
		filt. PM-10	1	573	27	11	21		
		filt. PM-10	2	547	27	10	20		
		filt. PM-10	3	503	27	9.3	19		
				AVERAGE	27	10	20	RATING:	B
	fabric filter	filt. PM	1	1.74	27	0.032	0.064		
		filt. PM	2	2.68	27	0.050	0.10		
		filt. PM	3	3.65	27	0.068	0.14		
				AVERAGE	27	0.050	0.10	RATING:	B
		filt. PM-10	1	1.29	27	0.024	0.048		
		filt. PM-10	2	1.98	27	0.037	0.073		
		filt. PM-10	3	2.70	27	0.050	0.10		
				AVERAGE	27	0.037	0.074	RATING:	B
Plant C3									
Rotary dryer	ESP	filt. PM	1		44				
		filt. PM	2	0.69	44	0.0078	0.016		
		filt. PM	3	1.14	56	0.010	0.020		
				AVERAGE		0.0090	0.018	RATING:	C

FILENAME: F:\SHARE\TOWP\REFR_NEW

Reference A. This report documents measurements of uncontrolled HF and SO_2 emissions from a gas-fired tunnel kiln used to manufacture refractory bricks. The test was conducted in April 1994 to demonstrate compliance with local regulations. Process rates were based on the average rate of fired brick produced.

Hydrogen fluoride emissions were measured using Method 13B, and Method 6 was used to measure SO_2 emissions. Three test runs were conducted. In addition, CO_2 concentrations were measured by Orsat and reported for the three test runs. Emission factors were developed for emissions of HF, SO_2, and CO_2 from the kiln. The emission data are rated B. The test methodology was sound, and no problems were reported. However, the report lacked adequate details to warrant a higher rating.

A. *Source Emission Tests at Corundite Refractories, Massillon, Ohio, Continuous Kiln Stack, April 29, 1994,* Custom Stack Analysis Company, Alliance, Ohio, May 1993.

CONTACT REPORT--MRI Project No. 4602-01

From: Richard Marinshaw, Environmental Engineering Department

Date of Contact: October 17, 1994

Contacted by: Telephone

Company/Agency: Canton City Health Department
420 Market Avenue North
Canton, Ohio 44702

Telephone Number: (216) 489-3385

Person(s) Contacted/Title(s)

Daniel Schiltz, Air Pollution Control Engineering Technician

CONTACT SUMMARY:

Mr. Schiltz was contacted for additional information on the emission test reports provided by the Canton City Health Department for revising the AP-42 section on ceramics manufacturing.

Mr. Schiltz provided the following information:

Stark Ceramics--September 16, 1993 Emission Test

The kiln production rate for this test was 5,482 lb/hr.

Metropolitan Ceramics--November 17-18, 1993 Emission Test

The kiln test was a gas-fired kiln producing unglazed ceramic tile. The SO_2 results should be considered invalid due to equipment problems during the test.

Newcastle Refractories--April 29, 1994 Emission Test

The kiln production rate for the test was 2,400 lb/hr. The facility manufactures refractory bricks.

Source category: Refractory manufacturing
Plant name : Newcastle Refractories
Process : refractory brick

Filename: REF_NEW1.WQ1
Location: Massillon, OH
Test date: 4/29/94

Date: 10/17/94
Ref. No.:
Process rate basis: production

Source	Type of control	Pollutant	Run No.	Test Method	Isokinetic, %	Gas volume, DSCF	Volum. flow rate, DSCFM	Mass, g	Concen., gr/DSCF	Emission rate, lb/hr	Process rate, ton/hr	Emission factor kg/Mg	Emission factor lb/ton	Rat.
Kiln No. 1 (Gas-fired Tunnel kiln)	none	HF	1	EPA13B	99.3	34.02	853	0.032	0.015	0.11	1.20	0.045	0.089	
		HF	2		96.9	36.44	946	0.037	0.016	0.13	1.20	0.054	0.11	
		HF	3		99.5	36.84	929	0.046	0.019	0.15	1.20	0.065	0.13	
									ppm	Average		0.054	0.11	B
		SO2	1	EPA 6	NA	NA	38,370	NA		0.38	1.20	0.16	0.32	
		SO2	2		NA	NA	38,659	NA		0.27	1.20	0.11	0.22	
		SO2	3		NA	NA	38,827	NA		0.27	1.20	0.11	0.22	
									%	Average		0.13	0.25	B
		CO2	1	Orsat	NA	NA	35,697	NA	12.2	29,893	1.20	12,500	24,900	
		CO2	2		NA	NA	38,284	NA	8.5	22,336	1.20	9,300	18,600	
		CO2	3		NA	NA	38,412	NA	9.5	25,048	1.20	10,500	20,900	
										Average		10,770	21,500	B

Basis for rating: - Process rates are average for kiln car processed.
Problems noted:
Other notes: - Corrected process rates provided by Canton Health Department (10/17/94).

CERAMICS
REF. 4-7 (B2)

Canton City Health Department

Division of Air Pollution Control
420 Market Avenue N. • Canton, Ohio 44702-1544
(216) 489-3385 • Fax: (216) 489-3335

Robert E. Pattison, M.P.A.
Health Commissioner

Bruce E. Blankenship
Administrator

July 21, 1994

Mr. Dave Morehart
Ohio EPA, DAPC
P.O. Box 1049
Columbus, Ohio 43266-0149

Re: Newcastle Refractories
15 76 00 0082 P011
Stack Test - Tunnel Kiln

Dear Dave:

The subject stack test was done to establish a reference base for HF and SO_2 released for modeling purposes.

The HF (.13 lb/hr) is a very low level discharge. Other tile plants have had levels of HF over twice this (.13) level.

The SO_2 at .29 lb/hr is surprising since the analytical reports of the clays they use were examined. The reports showed 8 metallic oxides as the composition of the clays used. None of the analytical reports showed the presence of sulfur or sulfur compounds. So it was a little surprising that they showed even this much (.29 lb/hr).

All brick and tile manufacturers in Stark County have been required to conduct stack tests from the curing process of their products to establish reference levels for SO_2 and HF. Future stack tests will monitor the continuity level of these gases for variation levels from their base values.

If you have any questions regarding the subject test, please contact this agency.

Sincerely,

Andy Pasko
APC Engineer

Enclosure - Appendix K

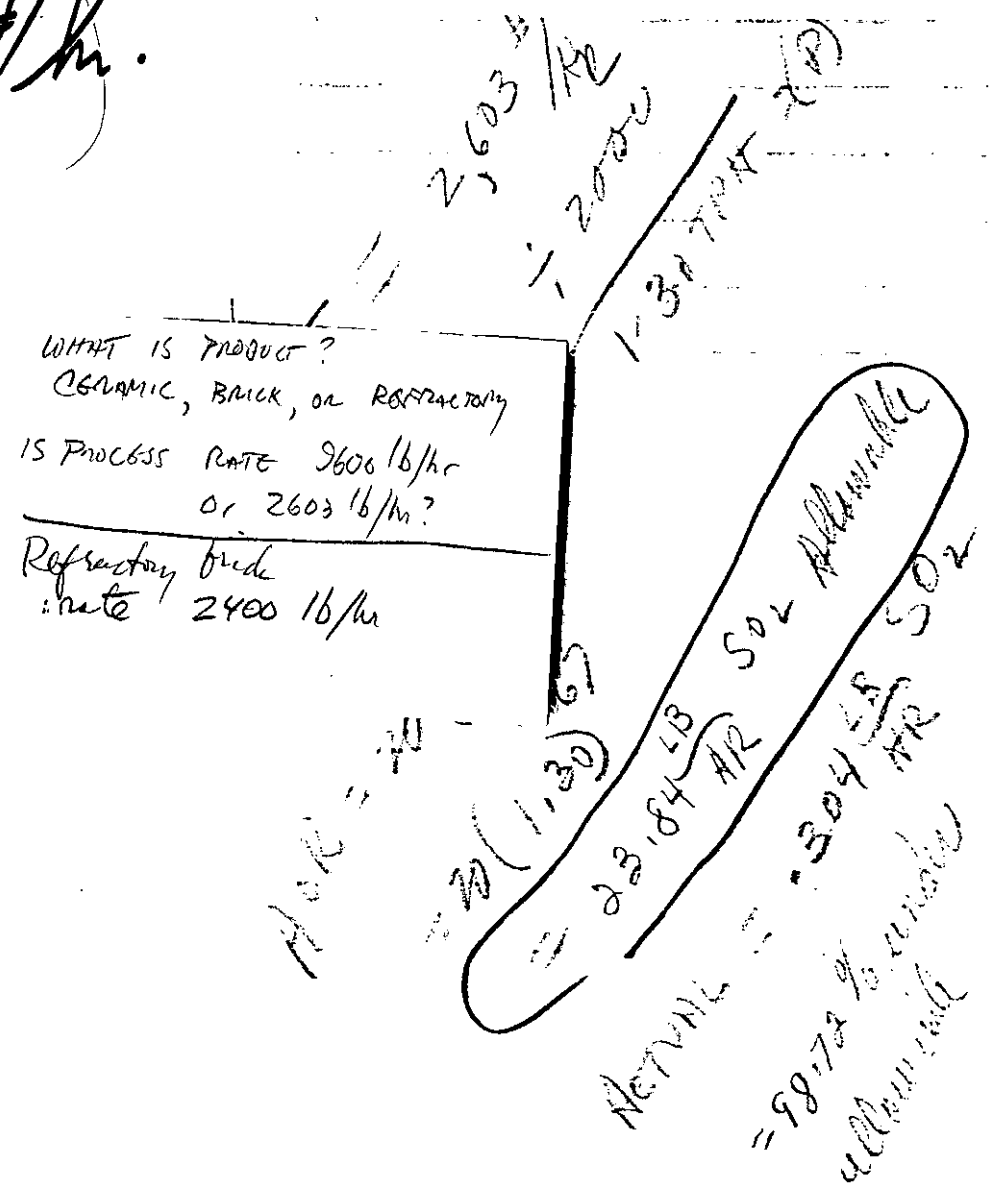
AP0721DM.MM

20,826 #/8 hrs. thru tunnel Kiln

Mike Helsacker - Foreman.

LEAK CK No. 1 = .015 #CF 5" VAC
No. 2 = .010 CF 6" "
No. 3 = .010 CF 6" "

9600 #/hr.



#1

Visible Emission Observation Form

SOURCE NAME: NEWCASTLE - CORUNDITE REF.	OBSERVATION DATE: 4-29-94	START TIME: 10:16 am	STOP TIME: 11:15
ADDRESS: 11135 CORUNDITE ST. N.W.			
CITY: MASSILLON	STATE: OHIO	ZIP: 44646	
PHONE	SOURCE ID NUMBER: 15760000082 Poll		
PROCESS EQUIPMENT: TUNNEL KILN	OPERATING MODE: ON		
CONTROL EQUIPMENT: NONE	OPERATING MODE		
DESCRIBE EMISSION POINT: KILN STACK	START	STOP	
HEIGHT ABOVE GROUND LEVEL: START 50'	STOP	HEIGHT RELATIVE TO OBSERVER: START 48	STOP
DISTANCE FROM OBSERVER: START ~100	STOP	DIRECTION FROM OBSERVER: START NW	STOP
DESCRIBE EMISSIONS: START	STOP		
EMISSION COLOR: START	STOP	PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐	
WATER DROPLETS PRESENT: NO ☑ YES ☐		IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐	
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START 1 DIA FROM STACK	STOP		
DESCRIBE BACKGROUND: START GRAY OCST SKY	STOP		
BACKGROUND COLOR: START GRAY	STOP	SKY CONDITIONS: START 100%	STOP OCST
WIND SPEED: START 1-2 MPH	STOP	WIND DIRECTION: START 5	STOP
AMBIENT TEMP: START ~60° F	STOP	WET BULB TEMP.	RH, percent

SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
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2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
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7	0	0	0	0	37	0	0	0	0
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9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
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13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
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24	0	0	0	0	54	0	0	0	0
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27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
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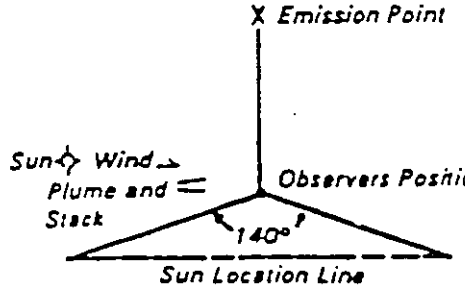
30	0	0	0	0	60	0	0	0	0

Source Layout Sketch — Draw North Arrow



AVERAGE OPACITY FOR HIGHEST PERIOD

NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS: MINIMUM — MAXIMUM

OBSERVER'S NAME (PRINT): ANDY PASKO

OBSERVER'S SIGNATURE: Andy Pasko — DATE: 4/29/94

ORGANIZATION

COMMENTS

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE

TITLE — DATE

CERTIFIED BY — DATE

VERIFIED BY — DATE

#2

Visible Emission Observation Form

SOURCE NAME: NEWCASTLE-CORUNDITE REF.	OBSERVATION DATE: 4-29-94	START TIME: 11:35	STOP TIME: 12:40
ADDRESS: 11135 CORUNDITE ST. N.W.			
CITY: MASSILLON	STATE: OHIO	ZIP: 44646	
PHONE	SOURCE ID NUMBER: P011		
PROCESS EQUIPMENT: TUNNEL KILN	OPERATING MODE: ON		
CONTROL EQUIPMENT: NONE	OPERATING MODE		
DESCRIBE EMISSION POINT: KILN STACK			
START	STOP		
HEIGHT ABOVE GROUND LEVEL: START	STOP	HEIGHT RELATIVE TO OBSERVER: START	STOP
DISTANCE FROM OBSERVER: START	STOP	DIRECTION FROM OBSERVER: START	STOP
DESCRIBE EMISSIONS: START	STOP		
EMISSION COLOR: START	STOP	PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐	
WATER DROPLETS PRESENT: NO ☐ YES ☐		IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐	
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START	STOP		
DESCRIBE BACKGROUND: START	STOP		
BACKGROUND COLOR: START	STOP	SKY CONDITIONS: START	STOP
WIND SPEED: START	STOP	WIND DIRECTION: START	STOP
AMBIENT TEMP.: START	STOP	WET BULB TEMP.	RH,percent

SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
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27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
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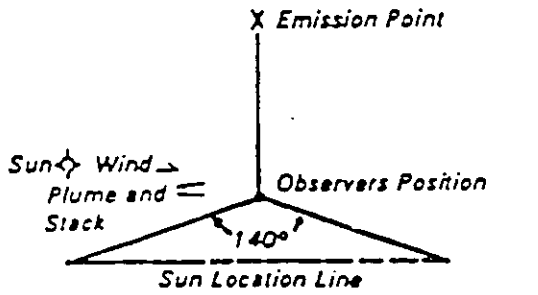
Source Layout Sketch — Draw North Arrow



AVERAGE OPACITY FOR HIGHEST PERIOD	NUMBER OF READINGS ABOVE % WERE
RANGE OF OPACITY READINGS: MINIMUM	MAXIMUM
OBSERVER'S NAME (PRINT): CINDY PASKO	
OBSERVER'S SIGNATURE: Cindy Pasko	DATE: 4/29/94
ORGANIZATION	
CERTIFIED BY	DATE
VERIFIED BY	DATE

COMMENTS

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE

TITLE — DATE

NO. 3

Visible Emission Observation Form

SOURCE NAME: NEWCASTLE-CORUNDITE REF.	OBSERVATION DATE: 4-29-94	START TIME: 1101	STOP TIME: 2:04
ADDRESS: 11135 CORUNDITE ST. N.W.			
CITY: MASSILLON	STATE: OHIO	ZIP: 44646	
PHONE	SOURCE ID NUMBER: P011		
PROCESS EQUIPMENT: TUNNEL K/N	OPERATING MODE: ON		
CONTROL EQUIPMENT: NONE	OPERATING MODE		
DESCRIBE EMISSION POINT: START K/N STACK STOP			
HEIGHT ABOVE GROUND LEVEL: START STOP	HEIGHT RELATIVE TO OBSERVER: START STOP		
DISTANCE FROM OBSERVER: START STOP	DIRECTION FROM OBSERVER: START STOP		
DESCRIBE EMISSIONS: START STOP			
EMISSION COLOR: START STOP	PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐		
WATER DROPLETS PRESENT: NO ☐ YES ☐	IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐		
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START STOP			
DESCRIBE BACKGROUND: START STOP			
BACKGROUND COLOR: START STOP	SKY CONDITIONS: START STOP		
WIND SPEED: START STOP	WIND DIRECTION: START STOP		
AMBIENT TEMP. START STOP	WET BULB TEMP.	RH.percent	

SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
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7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
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26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
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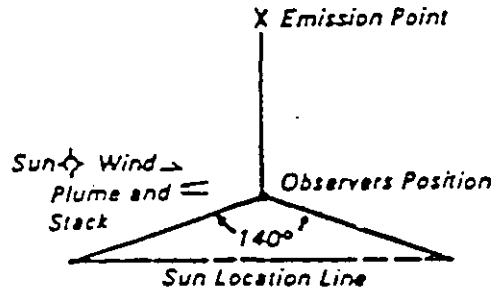
Source Layout Sketch — Draw North Arrow



AVERAGE OPACITY FOR HIGHEST PERIOD

NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS MINIMUM MAXIMUM

OBSERVER'S NAME (PRINT): ANDY PASKO

COMMENTS

OBSERVER'S SIGNATURE: Andy Pasko — DATE: 4-29-94

ORGANIZATION

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE

CERTIFIED BY — DATE

TITLE — DATE

VERIFIED BY — DATE

APPENDIX K

OEPA STACK TEST REVIEW SUMMARY FORM

APPLICATION NUMBER 1576 0000 82 P011

FACILITY NAME NEWCASTLE - CORUNDITE REFRACTORIES

SOURCE DESCRIPTION (OR SCC CODE) TUNNEL KILN - GAS FIRED

CONTROL EQUIPMENT NONE

DATE(S) OF TEST 4-29-94

FINAL TEST REPORT RECEIVED ON 7-20-94

POLLUTANT(S) TESTED SO_2, HF

TEST METHOD 6, 13B

TEST FIRM CSA

EMISSION RATES-:	HF	SO_2	HF	SO_2 **
ACTUAL (lb(s)/hr)	0.13	0.29	ALLOWABLE-- *	57.20

OPERATING RATES-:

DURING TEST-- 4.8 TONS/HR MAXIMUM-- 4.8

EMISSION FACTOR--- ----------

COMMENTS: * NO STD. TEST DONE TO ESTABLISH LEVEL FOR MODELING PURPOSES. ** ALLOWABLE BASED ON $AER = 20(P)^{.67}$ P = 4.8 TONS/HR.; ANALYSIS OF CLAYS USED SHOWS 8 METALIC OXIDES AND NO PRESENCE OF S.

I HEREBY VERIFY THAT THE INFORMATION CONTAINED WITHIN THE STACK TEST REPORT HAS BEEN REVIEWED AND IT HAS BEEN DETERMINED THAT THE TEST PROCEDURES, ANALYSES AND CALCULATIONS ARE:

(X) AN ACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

( ) AN UNACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

7-20-94
DATE OF REVIEW

REVIEWED BY

- BASED ON 3 RUN AVERAGE
-- SPECIFY APPLICABLE UNITS
--- SPECIFY ... UNITS OF MASS INPUT

NEWCASTLE REFRACTORIES, CORUNDITE DIV., KILN STACK, APRIL 29, 1994

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CSA CO., PO BOX 3750, ALLIANCE, OH 44601 PH (216)525-5119
FAX (216)525-7908

SOURCE EMISSION TESTS

AT

CORUNDITE REFRACTORIES

MASSILLON, OHIO

CONTINUOUS KILN STACK

APRIL 29, 1994

Brief of Tests

Total fluoride and sulfur dioxide emission tests were performed on the stack of the brick kiln as per EPA Federal Register methods 13B and 6 as set forth in the Appendix to Part 60, "Standards of Performance for stationary sources", Subchapter C, Chapter 1, Title 40, July 1,1991 as amended from the original Federal Register, Volume 36, No. 247, December 23, 1971.

The tunnel kiln is a continuous operation where the green product is loaded on cars that travel through the various heat zones and discharge as a finished product at the other end. The kiln is heated with natural gas with the products of combustion and the emissions from the curing process discharging to a stack via induced draft fan.

Results

The average total fluoride emission rate was 0.13 pounds per hour.

The average sulfur dioxide emission rate was 0.29 pounds per hour.

The average process weight rate was 9,600 pounds per hour.

Test Methods

A twenty four point traverse was selected for the twenty one inch diameter steel stack as per method 1. Each point was sampled for two and one half minutes for a total test time of sixty minutes. (See figure 1)

The CO_2 and O_2 analysis were conducted by an orsat flue gas analyzer from an integrated sample taken at the test ports to provide data for method 3.

Method 13B was used to determine the total fluoride quantity,

moisture determination by method 4 and gas velocity by method 2 using a Research Appliance Corp. "Stacksamplr".

The sulfur dioxide was determined by method 6 along with data acquired from method 13B.

Total Fluoride test apparatus.

A schematic of the apparatus is shown in figure 2A and 2B.

The gases were passed through a quartz lined probe and heated glass cyclone separator bypass followed by a four inch filter holder containing Watman 541 filter media. The filter backup plate was teflon coated mesh. The gases leaving the filter were cooled in a series of three impingers packed in ice. The first and third impinger were the modified Greenburg-Smith type and the second one was a standard Greenburg-Smith. The First and second impingers were filled with 100 ml of distilled water with the third one used as a dry trap. After leaving the dry trap, the gases passed through a "Drierite" column containing about 500 grams of calcium sulfate (CaS04) desicant to remove the remaining water vapor. The dry gas passed through the hose portion of the umbilical cord to a Research Appliance Corp. model 2343 "Stacksamplr" module. In the module the gas was moved through the system by a leakless air pump to a Rockwell 175-S dry test meter. The dry test meter exhausted to a calibrated orifice to measure the flow rate of the gases passing through the sampling apparatus. A type "S" pitot tube was attached to the sheath of the heated probe to measure the velocity head of the flue gases near the tip of the probe nozzle. The orifice pressure taps and the pitot tube were connected to a Dwyer dual 10 inch combination inclined well type manometer. One half of the manometer measured the orifice differential ($\triangle H$) and the other half measured the flue gas velocity head ($\triangle P$).

The temperature of the flue gas was measured by a type "K" thermocouple connected to a PyroMation digital temperature indicator.

The CO_2 and 0_2 were measured with a Burrell "Industro" Model B orsat from an integrated sample taken by withdrawing a constant flow rate of gas from the stack and injecting it into a Tedlar bag. This was done by drawing the gas through an in-stack filter via neoprene tubing to a condenser and condensate collector ahead

of a leakless diaphragm vacuum-pressure pump. The pump discharged to the rotometer and the Tedlar bag. The apparatus is equipped with valves to by-pass the rotometer and bag when clearing the sample line as shown in figure 3.

Total Fluoride Test Procedures

The probe, filter and glassware were assembled and leak tested in our lab before transporting to the job site. Three sets of equipment were used. At the job site a preliminary pitot traverse was performed to select the proper nozzle size. The nozzles were measured with an inside vernier caliper and micrometer calibrated with a one inch micrometer standard.

The first and second impingers were filled with 100 ml of distilled water and the "Drierite" columns were connected just prior to elevating the probe into position.

After leak testing the apparatus at 10 inches of mercury the probe was inserted at the first sample point to start the test.

The isokinetic sampling rates were determined using a portable desk top computer programmed to calculate the proper $\triangle H$ setting at the flue gas temperature, pressure, density and the assumed moisture along with the temperature, $\triangle P$ and an assumed $\triangle H$ of the test module. The sampling rate ($\triangle H$) can be determined in less than five seconds using this technique.

The apparatus was leak tested after the test was completed at a vacuum exceeding that encountered during the test.

The moisture content was determined from the amount of condensate collected in the impingers and the difference of the tare and gross weight of the "Drierite" desicant column. The desicant column was weighed on an Ohaus 5 Kg electroic lab balance to the nearest tenth gram. The condensate was poured into a glass graduate along with the probe, filter holder, impinger and connecting glassware wash. The total amount of sample was recorded and placed in a polyethelyne container. A blank was prepared by placing the same amount of distilled water into another container. The sample filter was placed into the sample container and the blank filter was placed into the distilled water container. The samples were transported to a nearby laboratory for total floride analysis.

The integrated gas sampler was started at the beginning of the method 13B test with about two cubic foot of gas collected in the tedlar bag at the end of the test. The sampling rate was maintained constant during the test by maintaining a constant reading on the rotometer. The orsat analysis was performed on the gases contained in the bag shortly after the test was completed.

The raw data and calculations are shown in Appendix I.

Sulfur Dioxide Test Apparatus

A schematic of the test apparatus is shown in figure 4. The gases were drawn through a stainless steel probe connected to the impinger train where it first passed through a midget bubbler containing 15 ml of 80% isopropyl alcohol. A wad of glass wool was packed in the top of the bubbler to collect any acid mist carryover. The gases then passed through two midget impingers, each containing 15 ml of 3% hydrogen peroxide solution followed by an empty midget impinger to collect the carryover from the preceeding impingers. The midget bubbler and impingers were contained in an ice bath to condense acid and water vapor. After leaving the dry trap the gases passed through a "Drierite" column containing about 500 grams of "Drierite" via rubber hose to remove the remaining water vapor. The dry gas was transmitted to the module through a "polyflow" tubing. In the module the gas was moved through the system by a leakless air pump connected to the rotometer to measure the gas flow rate and a Rockwell type "S" dry test meter to measure the gas volume. The dry test meter was equipped with a thermometer located in the top half of the gas meter to measure the temperature of the meter. The gas from the meter was discharged to the atmosphere.

Class "A" burrettes and pipets were used for the titrations in the lab analysis of the contents of the impingers.

Sulfur dioxide test Procedures.

Two method 6 runs of twenty minute duration comprised one test.

A single point near the center of the stack using one of the method 5 sample ports was used for the sample location.

The sample train was leak checked using a calibrated vacuum gage. The vacuum gage was connected to the inlet of the sample train and the system was brought to a ten inch mercury vacuum and

held for one minute before starting the test. After the test was completed the system was purged for fifteen minutes at the same flow rate using a seperate vacuum pump and rotometer. After purging the system, the contents of the midget bubbler were discarded and the contents of the midget impingers along with the washings were placed in a marked polyethylene bottle. The samples were titrated at our Alliance lab as per EPA Federal Register methods using barium perclorate titrant and thorin indicator. The barium perclorate was standardized against a purchased .01 normal sulfuric acid standard using thorin indicator.

The samples and container distilled water rinse were poured into a 100 ml voumetric flask and dilluted to the mark with distilled water. A 20 ml aloquot was pipetted into a 400 ml florence flask along with 80 ml of 100% isopropanol and four drops of thorin indicator. The solution was titrated to a pink endpoint with the standardized barium perchlorate. The samples were repeted to within one tenth ml of titrant.

The SO_2 quantity was calculated as per method 6 with the dry gas volumetric flow rate (Q-CFH) from method 13B used to calculate the pounds per hour of sulfur dioxide emission. The raw data and calculations are shown in Appendix II.

Miscellaneous.

The process weight and operating chart are shown in Appendix I.

The Intent to Test Notification is shown in Appendix III.

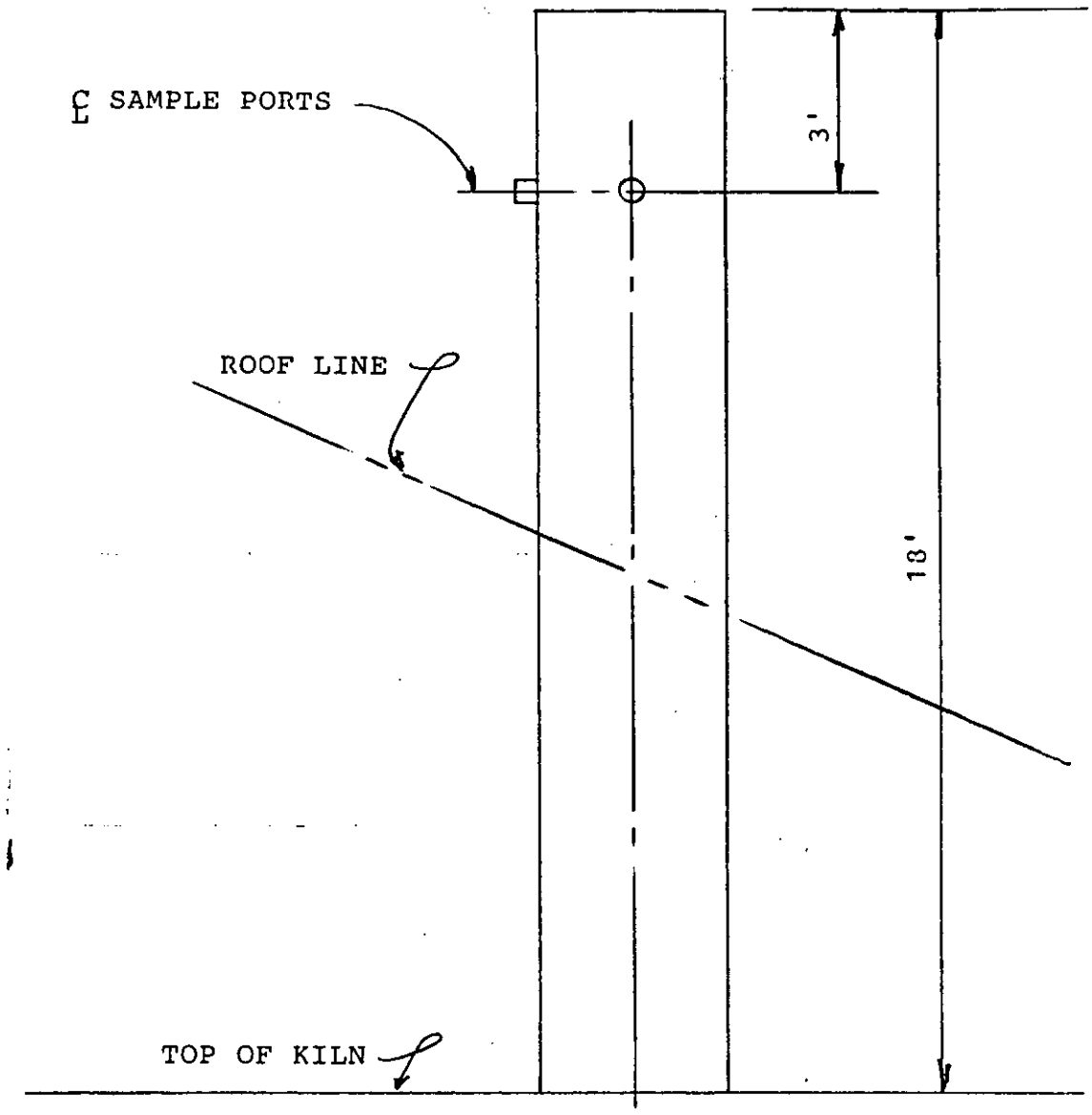
Submitted by

Ernest L. Kolm

Test	1	2	3	Avg.
Date	4/29/94	4/29/94	4/29/94	
Time	10:10/11:15	11:35/12:40	13:01/14:03	
ACID EMISSIONS				
HF Lbs/Hour	0.11	0.13	0.15	0.13
GASEOUS EMISSIONS				
SO2 Pounds/Hr	0.331	0.267	0.265	0.29
STACK GAS CONDITIONS				
Temperature - dg. F	1051.0	952.0	959.0	987.3
Static Pressure - in H2O	0.0	0.0	0.0	0.0
CO2 - %	12.2	8.5	9.5	10.1
O2 - %	7.7	11.0	10.2	9.6
H20 - %	14.8	8.0	10.9	11.2
Velocity - FPS	20.4	19.6	19.9	20.0
Stack Area - sqr. ft.	2.4	2.4	2.4	2.4
Gas Flow - ACFM	2938	2820	2872	2877
Gas Flow (DSTP) CFH	51173	56784	55711	54556
SAMPLE TRAIN CONDITIONS				
Pitot Delta P in H2O	.044	.044	.045	
Orifice Delta P in H2O	1.110	1.290	1.360	
Temp. Meter - DG. F	89	99	100	
Gas Volume - CF Dry STP	34.02	36.44	36.84	
Barometer - in Hg	29.06	29.06	29.06	
Probe Tip Dia. - In.	0.5440	0.5410	0.5420	
Isokinetic Var. - %	99.3	96.9	99.5	

NEWCASTLE REFRACTORIES, INC. (CORUNDITE)
MASSILLON, OHIO
NO.1 KILN STACK
COMPILED DATA

Table 1



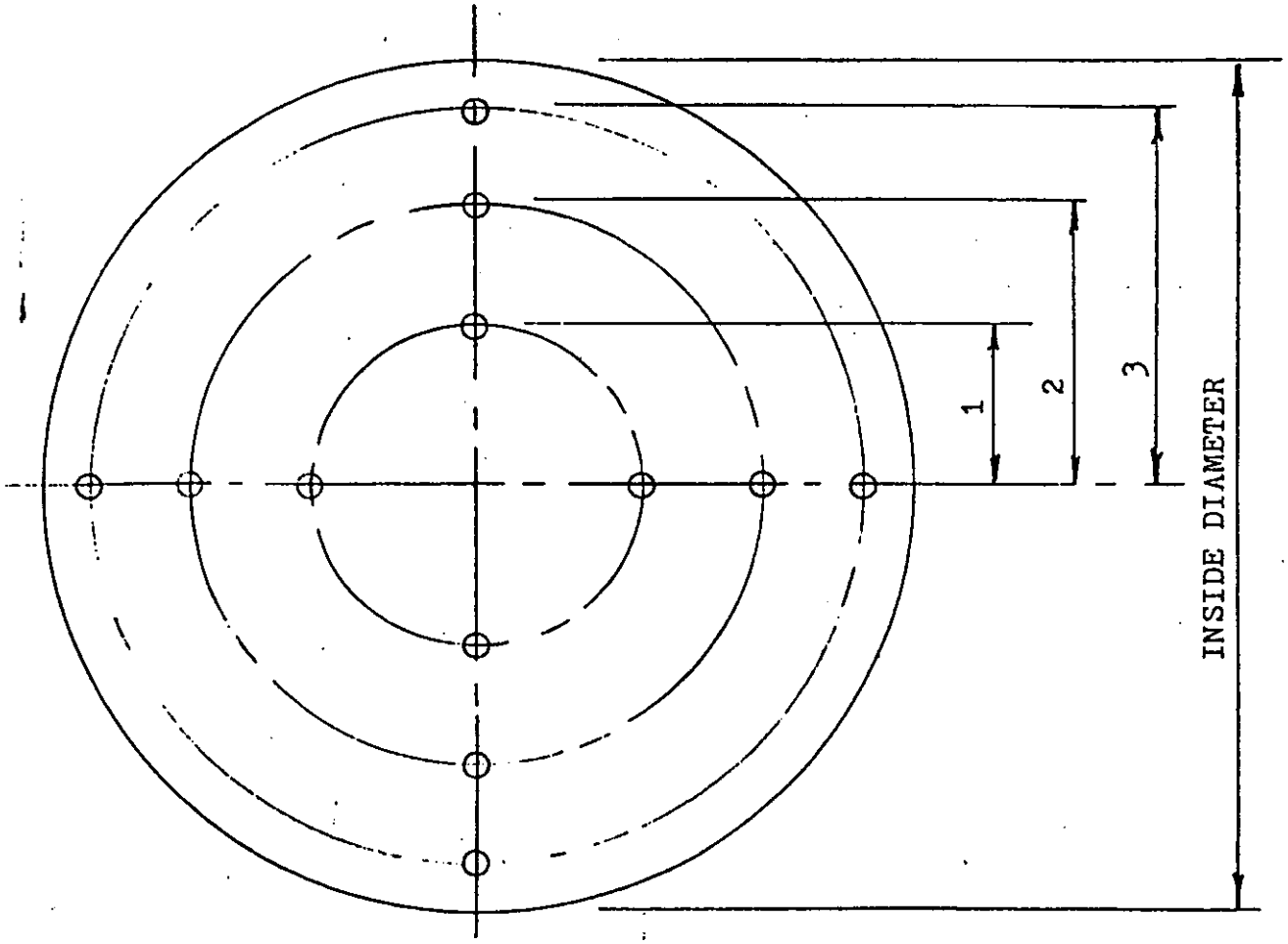
LOCATION OF SAMPLE PORTS

FIGURE 1A

Sample Points For Round Ducts

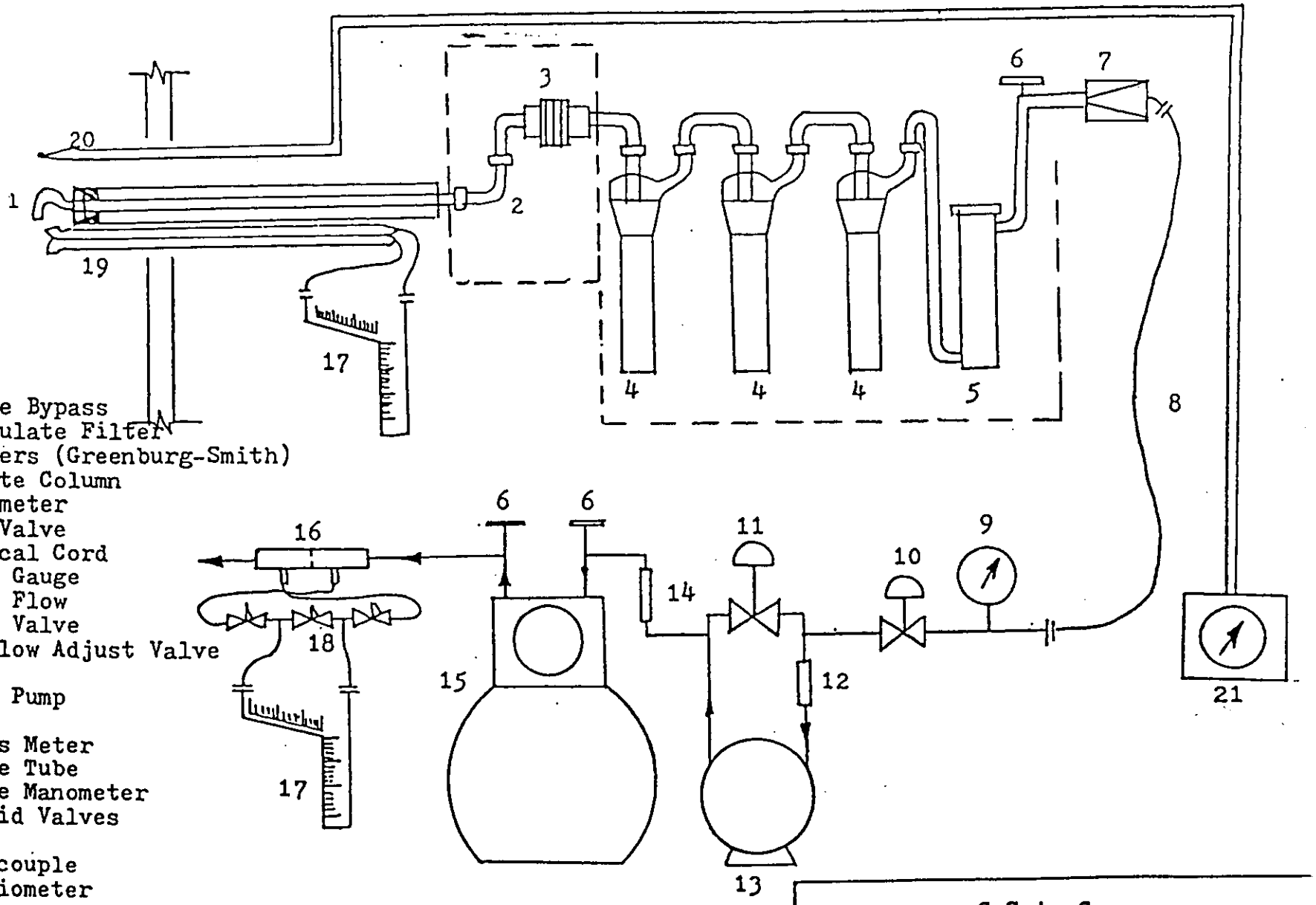
Diameter of duct in inches = 20
Area = 2.181662
Radius = 10
Total No. Of Points = 12

(1)- 4.082483
(2)- 7.071068
(3)- 9.128709



SAMPLE POINT LOCATION

FIGURE 1B

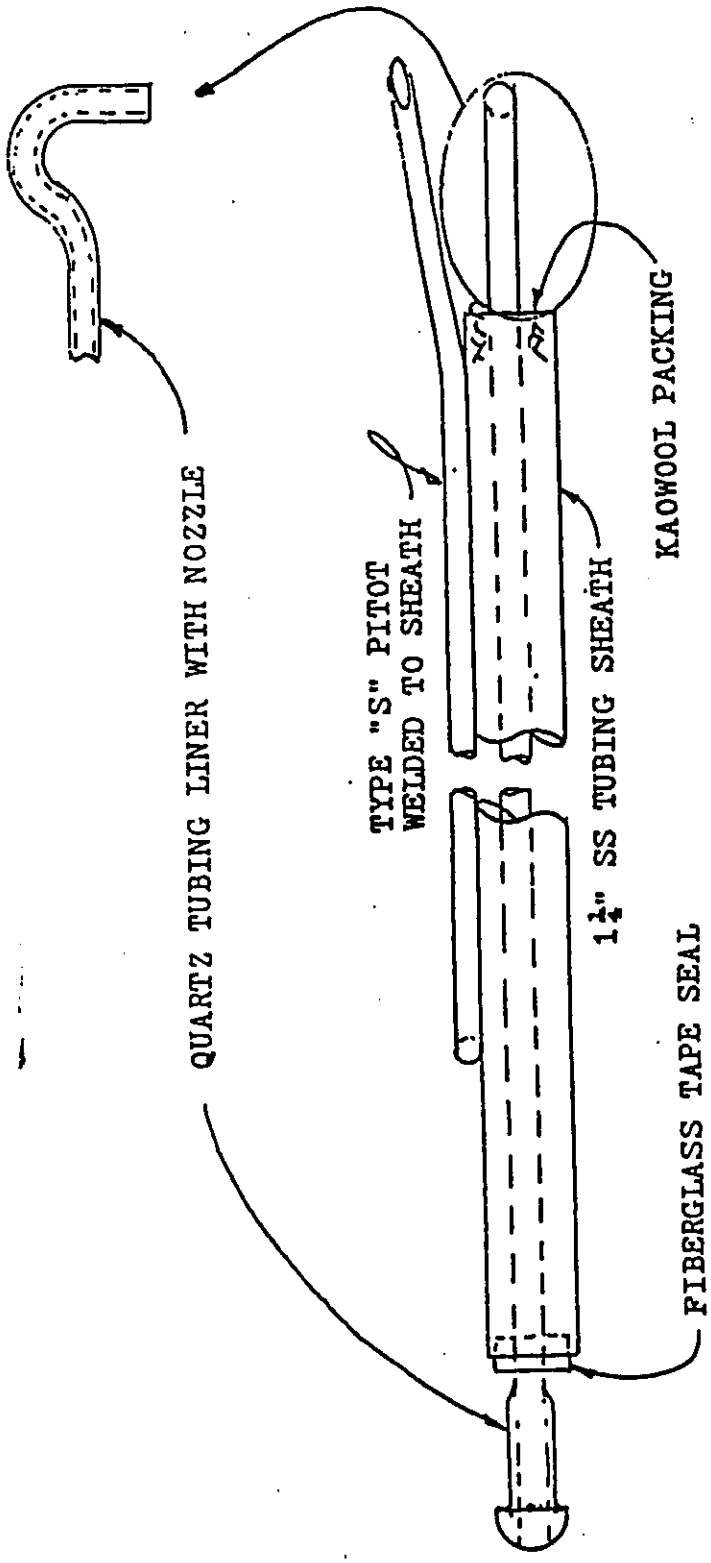


1) Probe
2) Cyclone Bypass
3) Particulate Filter
4) Impingers (Greenburg-Smith)
5) Drierite Column
6) Thermometer
7) Check Valve
8) Umbilical Cord
9) Vacuum Gauge
10) Course Flow Adjust Valve
11) Fine Flow Adjust Valve
12) Oiler
13) Vacuum Pump
14) Filter
15) Dry Gas Meter
16) Orifice Tube
17) Incline Manometer
18) Solenoid Valves
19) Pitot
20) Thermocouple
21) Potentiometer

C.S.A. Co.
MODIFICATION OF R.A.C. SAMPLE TR
USING DRIERITE COLUMN IN PLACE O
IMPINGER DESICANT

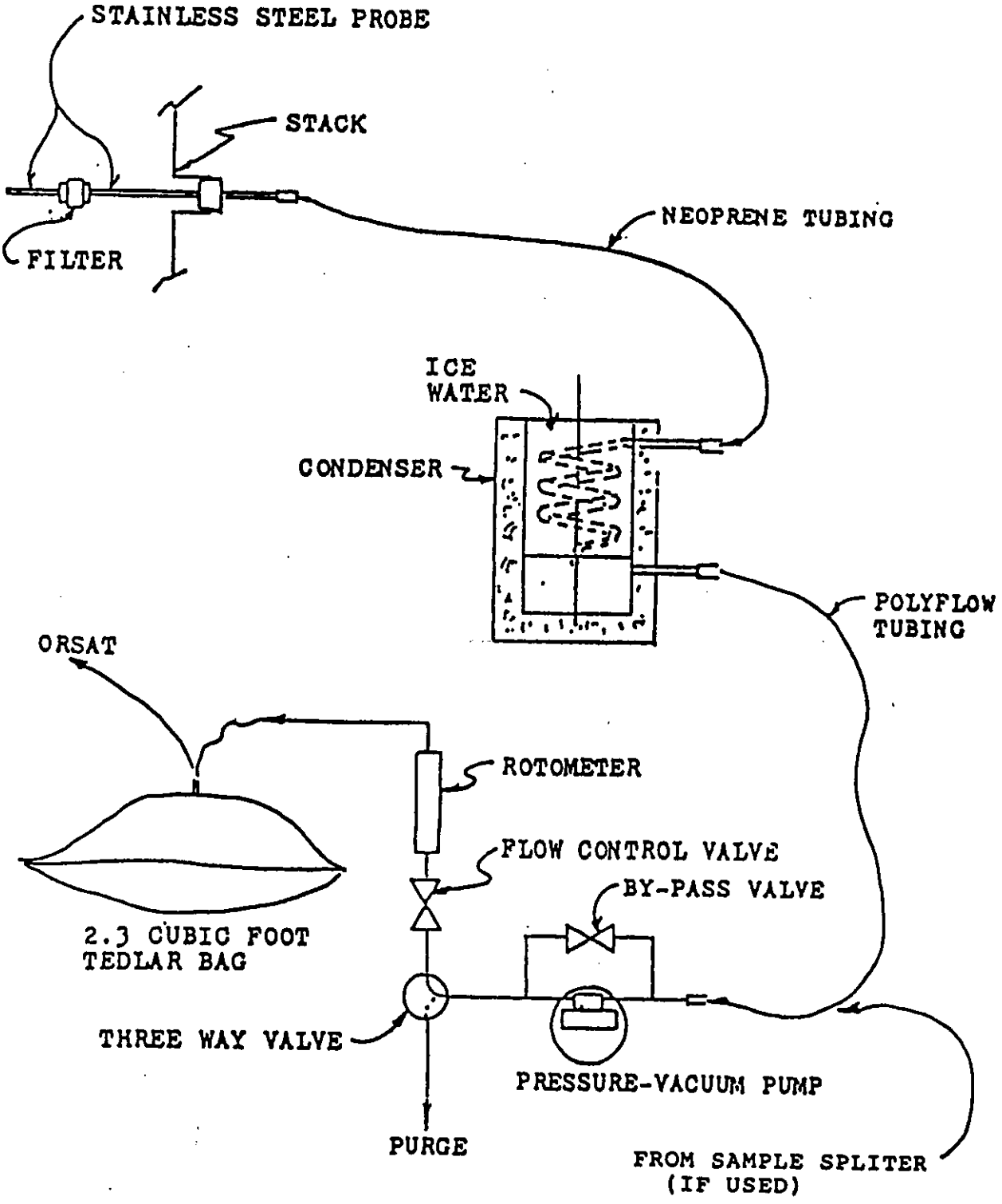
DATE 8-3-76 BY D.E.K.

Figure 2A



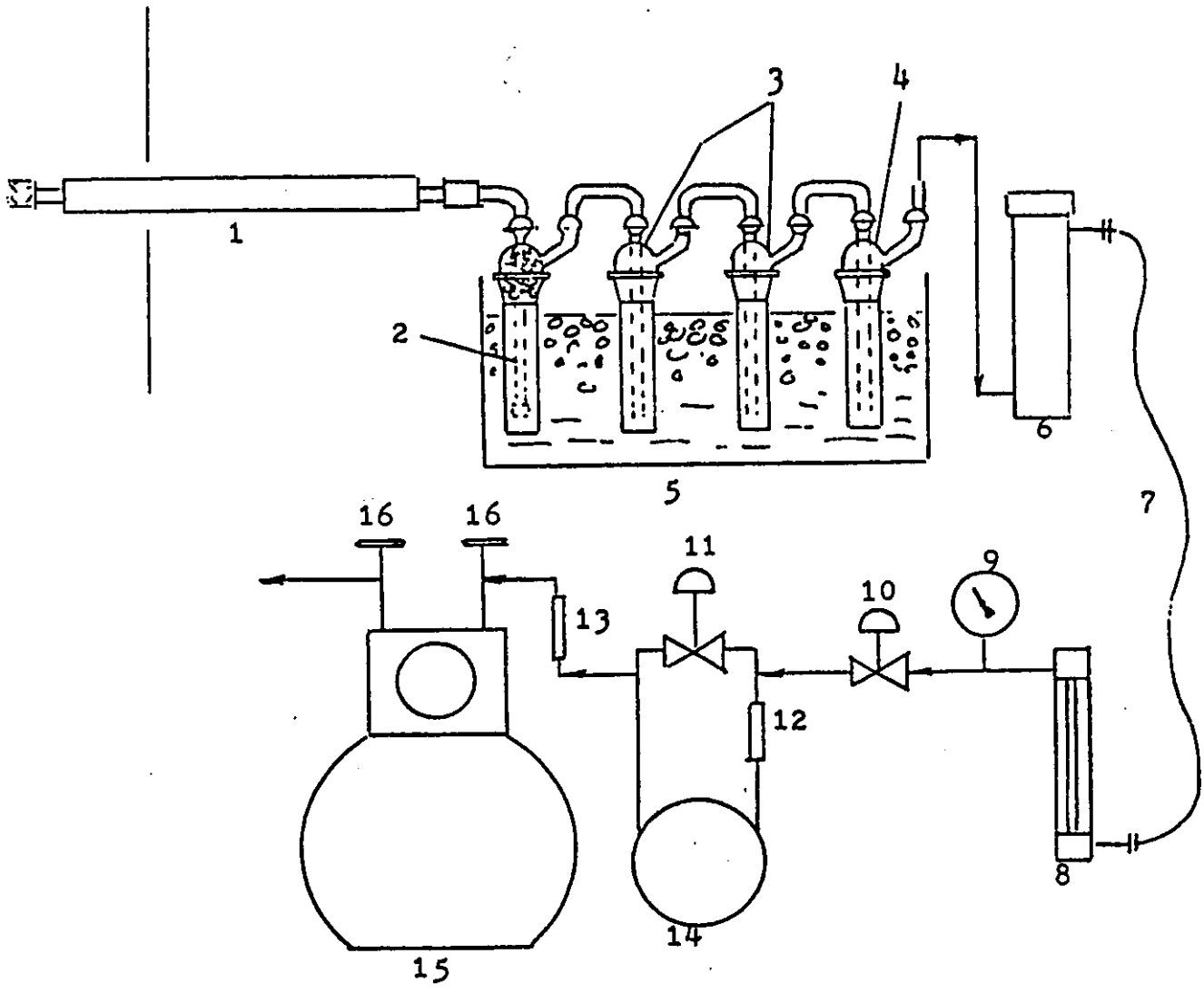
HIGH TEMPERATURE QUARTZ LINED PROBE

FIGURE 2B



INTEGRATED SAMPLER
METHOD 3

FIGURE 3



1) HEATED PYREX LINED PROBE. END PACKED WITH QUARTZ WOOL
2) MIDGET BUBBLER. TOP PAKED WITH GLASS WOOL
3) MIDGET IMPINGERS. EACH FILLED WITH 15 ml OF H_2O_2 (3%)
4) MIDGET IMPINGER. DRY TRAP
5) ICE BATH
6) DRIERITE COLUMN. FILLED WITH CALCIUM SULFATE DESICANT
7) UMBILICAL CORD
8) ROTAMETER
9) VACUUM GAGE
10) VALVE FOR COARSE FLOW ADJUSTMENT
11) VALVE FOR FINE FLOW ADJUSTMENT
12) OILER
13) OIL FILTER
14) VACUUM PUMP
15) DRY GAS TEST METER
16) THERMOMETER

E.P.A. METHOD 6 SO_2 SAMPLING TRAIN

FIGURE 4

APPENDIX I

COMPUTER NOMENCLATURE FOR TOTAL FLUORIDE EMISSIONS

METHOD 13A OR 13B

SYMBOL	DESCRIPTION	UNITS
Vm	Meter volume	Cubic feet
Pb	Barometer	Inches mercury
ΔH	Orifice differemtial	Inches water
T_m	Meter temperature	Degrees fahrenheit
T_s	Stack temperature	Degrees fahrenheit
P_g	Stack static pressure	Inches water
Cp	Pitot coeficient	Dimentionless
ΔP	Average square root of ΔP	Inches water
CO_2	Carbon dioxide	Percent
O_2	Oxygen	Percent
CO	Carbon monoxide	Percent
N_2	Ntitrogen	Percent
Md	Molecular weight dry gas	Lb/Lb-mol
Ms	Molecular weight wet basis	Lb/Lb-mol
Vl_c	Volume of condensate collected	Milliliter
As	Cross-sectional area of stack	Square feet
Mn	Weight of fluorde	Milligram
θ	Test time	Minutes
Dn	Diameter of nozzle	Inches
An	Area of nozzle	Square inches
Vm_{std}	Meter volume @ dry standard temp & press	Cubic feet
Vw_{std}	Meter volume @ wet standard temp & press	Cubic feet
Bw_o	Moisture in gas	Percent
Vs	Gas velocity in stack	Feet/second
Qa	Actual stack gas flow	Cubic feet/minute
Qs	Stack gas flow (dry STD)	Cubic feet/hour
Cs	Fluoride concentration	Pound/f^3 @ dry STD
L	Fluoride emission rate	Pounds per hour

TOTAL FLUORIDE CALCULATIONS
METHOD 13A OR 13B

DRY GAS VOLUME (standard conditions), f^3

$Vm_{std} = (17.71)\ V_m\ (P_b + (P_m/13.6))/(T_m + 460)$

VOLUME OF WATER (standard conditions), f^3

$Vw_{std} = (.0474\ f^3/ml)(Vl_c)$

MOISTURE CONTENT (proportion by volume)

$Bw_o = (Vw_{std})/(Vm_{std} + Vw_{std})$

MOLECULAR WEIGHT OF GAS (drySTP) lb/lb-mol

$Md = .44(\%CO_2) + .32(\%O_2) + .28(\%N_2 + \%CO).$

MOLECULAR WEIGHT OF GAS (wet basis) lb/lb-mol

$Ms = Md(1 - Bw_o) + .18(Bw_o)$

GAS VELOCITY ft/sec

$Vs = 85.48C_p\ \ P\ \ Ts_a\ /(Ps_a)(Ms)$

GAS VOLUMETRIC FLOW RATE actual f^3/min

$Qm = 60(Vs)(As)$

GAS VOLUMETRIC FLOW RATE (dry std) f^3/hr

$Qs = 3600(1 - Bw_o)(Vs)(As)(530/Ts_a)(Ps_a/29.92)$

FLUORIDE(F) EMISSION (dry std) lb/f^3

$CS = (0.002205)(mg\ F)/(Vm_{std})$

FLUORIDE EMISSION LB/HR

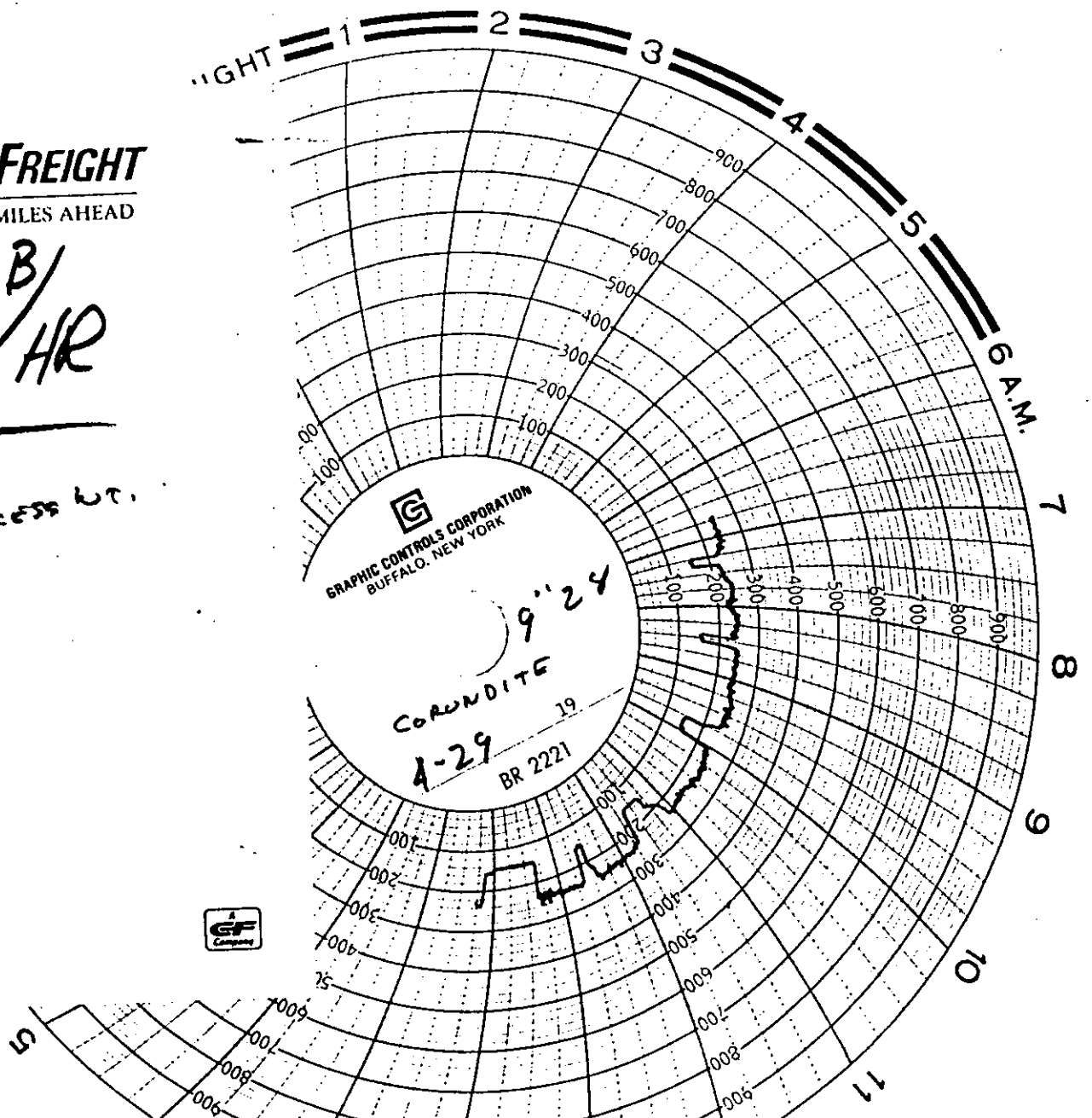
$L = (Qs)(CS)$

CF MOTORFREIGHT

WE PUT YOU MILES AHEAD

9600 LB/HR

CORUNDITE PROCESS WT.



78008-57 (7/91)

AMERICAN ANALYTICAL LABORATORIES, INC.

INDUSTRIAL HYGIENE AND ENVIRONMENTAL SCIENCES

840 S. MAIN STREET
AKRON, OHIO 44311-1516
(216) 535-1300

WORK ORDER #: 94-05-098

SAMPLES RECEIVED: 05/05/94
ANALYSIS REPORTED: 05/19/94

REPORT ISSUED TO:

Ernie Kolm
CSA Company
Custom Stack Analysis
P.O. BOX 3750
Alliance, Ohio 44601

WORK ID: Flouride Analysis
FACILITY: Corundite

SAMPLED BY: Client
SAMPLE TYPE: Water

SAMPLE ANALYSIS REPORT

SAMPLE ID / AAL LAB #	PARAMETER(S)	RESULT(S)	UNITS	METHOD(S)
#1 9405098-01	DESCRIPTION: 444.5 ml.			
	Total Flouride Emmissions	35.4	mg/Sample	EPA 13B
	35.4 - 4.77 = 30.63 mg F			
#1 Blank 9405098-02	DESCRIPTION: 444.5 ml.			
	Total Flouride Emmissions	4.77	mg/Sample	EPA 13B
#2 9405098-03	DESCRIPTION: 411.9 ml.			
	Total Flouride Emmissions	42.4	mg/Sample	EPA 13B
	42.4 - 6.86 = 35.54 mg F			
#2 Blank 9405098-04	DESCRIPTION: 411.9 ml.			
	Total Flouride Emmissions	6.86	mg/Sample	EPA 13B
#3 9405098-05	DESCRIPTION: 461.3 ml.			
	Total Flouride Emmissions	47.9	mg/Sample	EPA 13B
	47.9 - 3.80 = 44.1 mg F			

30.16

METHOD 13

CSA CO. DATA SHEET (~~METHOD 5~~)

TEST NO. 1 PLANT NEW CASTLE REFRACTORIES (CORUNDITE) DATE 4/28/94

LOCATION KILN STACK BY EAK CT

BAROMETER (P_B) 29.06 AMBIENT TEMP 64 ASSUMED MOISTURE "Y" 1.001

MOUDULE NO. 2031 PROBE NO. 1-Q FILTER NO. HEATER NO. 3 NOZZLE DIA. .544

TEST POINT	METER VOLUME (Vm)	METER TEMP (Tm) IN	METER TEMP (Tm) OUT	COND TEMP °F	FILTER HEATER TEMP°F	STACK TEMP °F (Ts)	STACK PRESS. (Ps)	VACUUM "Hg	ORIFICE "H_2O (ΔH) (Pm)	VEL HEAD (ΔP)	TIME
1	270.1	76	76	64	240	1028	0	3-	.92	.04	10:10
1	272.9	80	76	64	240	1115		3-	.92	.04	15
2	275.6	85	77	60	240	1125		3-	1.1	.05	20
3	278.6	88	78	62	240	1110		3-	1.1	.05	25
4	282.5	94	80	62	240	1105		3-	1.4	.06	30
5	285.5	94	83	62	240	1090		3-	1.2	.05	35
6	288.6	94	84	62	240	1050		3-	1.1	.045	40
1	288.6	92	85	62	240	1025		3-	1.2	.045	45
1	291.7	96	86	62	240	1015		3-	1.2	.045	50
2	294.8	97	87	62	240	1010		3-	1.2	.045	55
3	298.1	101	90	64	240	1100		3-	1.2	.045	11:00
4	301.1	102	90	64	240	995		3-	1.3	.045	05
5	303.7	103	92	64	240	985		3-	.84	.030	10
6	306.5	103	93	66	240	965		3-	.87	.030	15
(Vm)	36.4	93.2	84.1								
AVERAGE		89		****	******	1,051	0	MAX 3	1.11	.044	60 MINUTES

INTEGRATED GAS SAMPLE 107				AVG	N_2 = 80.11
CO_2				12.2	
O_2				7.7	
CO					

CONDENSATE COLLECTED	FINAL	INITIAL	TOTAL
DRIERITE	962.2	949.6	12.6
IMPINGER	313.1	200	113.1

FILTER WT	PROBE WASH WT	IMPINGER CATCH FLOURIDE	GRAND TOTAL 125.7
GROSS		30.63 mg x 1.053 =	LEAK RATE @ 5 "Hg = <.02
TARE N/A		32.25 mg HF	STACK AREA (As) 2.4 ft²
NET			AVG SQ RT ΔP .2102

TOTAL PARTICULAT WT (Mn) ——— Mg

HYDROFLUORIC ACID EMISSION TEST

DATA INPUT

Pb,In Hg	Barometer	29.06
VM,ft3	Meter Volume	36.4
ΔH,In H2O	Orifice Differential	1.11
PG,In H2O	Stack Static Pressure	0
Tm,F	Meter Temperture	89
Ts,F	Stack Temperture	1051
CP	Pitot Coefficient	.84
$\sqrt{\Delta P}$,In H2O	Average Square Root Of Delta P	.2102
% CO2	Carbon Dioxide	12.2
% O2	Oxygen	7.7
% N	Nitrogen	80.1
VCL,Ml	Volume Of Condensate	125.7
0,Min	Test Time	60
MN,Mg	Total HF Catch Weight	32.25

RESULTS

Pma,In Hg	Absolute Meter Pressure	29.14
PSA,In Hg	Absolute Stack Pressure	29.06
MD	Molecular Weight Dry Gas	30.26
MS	Molecular Weight @ Stack Conditions	28.44
VMSTP,ft3	VM Standard Temp.& Press. Dry	34.02
VWSTP,ft3	VM Standard Temp.& Press. Wet	5.92
BWO,%	Moisture	14.81
L,#/Hr	Emission Rate	0.11
I.%	Isokeinetic Variation	99.29

NEWCASTLE REFRACTORIES (CORUNDITE)
MASSILLON OH
NO 1 KILN STACK
4/29/94
TEST 1

CSA CO. DATA SHEET (METHOD 13)

TEST NO. 2 PLANT Newcastle Refractories (Corundite) DATE 4/29/94

LOCATION No 1 Kiln Stack BY GT

BAROMETER (P_B) 29.06 AMBIENT TEMP ASSUMED MOISTURE "Y" 1.001

MOUDULE NO. 2031 PROBE NO. 2 FILTER NO. HEATER NO. 5 NOZZLE DIA. .541

TEST POINT	METER VOLUME (Vm)	METER TEMP (Tm) IN	METER TEMP (Tm) OUT	COND TEMP °F	FILTER HEATER TEMP°F	STACK TEMP °F(Ts)	STACK PRESS. (Ps)	VACUUM "Hg	ORIFICE "H_2O (ΔH)(Pm)	VEL HEAD (ΔP)	TIME
1	306.7	94	93	66	240	955	0	3−	1.2	~~.04~~	11:35
1	309.5	96	93	64	240	950		3−	1.2	.04	40
2	313.2	100	93	64	240	960		3−	1.2	.04	45
3	319.2	102	94	62	240	965		4	1.5	.05	50
4	314.6	104	94	62	240	968		5−	1.8	.06	55
5	323.	105	95	62	240	968		4−	1.3	.045	12:00
6	326.3	105	95	62	240	968		3−	1.0	.035	05
1	326.3	100	94	62	240	957		3−	1.0	~~.035~~	12:10
1	329.5	104	95	64	240	955		3−	1.0	.035	15
2	333.1	105	95	62	240	941		4	1.5	.050	20
3	336.7	106	96	62	240	935		5−	1.8	.060	25
4	340.2	106	98	62	240	938		4−	1.3	.045	30
5	343.3	106	98	62	240	932		4	1.2	.040	35
6	346.4	106	98	62	240	933		3+	1.1	.035	40
(Vm)	39.7	102.8	95.1								
AVERAGE		99		****	******	952	0	MAX 5	1.29	.044	60 MINUTES

INTEGRATED GAS SAMPLE 111 — AVG — N_2= 80.5

				AVG
CO_2				8.5
O_2 (11.0)				11.0
CO				

CONDENSATE COLLECTED

	FINAL	INITIAL	TOTAL
DRIERITE	942.6	930.4	12.2
IMPINGER	254.7	200	54.7
GRAND TOTAL			66.9

FILTER WT	PROBE WASH WT	IMPINGER CATCH Flouride	
GROSS		35.54 mg F⁻ x 1.053 =	LEAK RATE @ 6 "Hg= <.02
TARE	NA	37.42 mg HF	STACK AREA (As) 2.4 ft²
NET			AVG SQ RT ΔP .2102

TOTAL PARTICULAT WT (Mn) ⟶ Mg

HYDROFLUORIC ACID EMISSION TEST

DATA INPUT

Pb,In Hg	Barometer	29.06
VM,ft3	Meter Volume	39.7
ΔH,In H2O	Orifice Differential	1.29
PG,In H20	Stack Static Pressure	0
Tm,F	Meter Temperture	99
Ts,F	Stack Temperture	952
CP	Pitot Coefficient	.84
$\sqrt{\Delta P}$,In H20	Average Square Root Of Delta P	.2102
% CO2	Carbon Dioxide	8.5
% O2	Oxygen	11.0
% N	Nitrogen	80.5
VCL,Ml	Volume Of Condensate	66.9
0,Min	Test Time	60
MN,Mg	Total HF Catch Weight	37.42

RESULTS

Pma,In Hg	Absolute Meter Pressure	29.15
PSA,In Hg	Absolute Stack Pressure	29.06
MD	Molecular Weight Dry Gas	29.80
MS	Molecular Weight @ Stack Conditions	28.86
VMSTP,ft3	VM Standard Temp.& Press. Dry	36.44
VWSTP,ft3	VM Standard Temp.& Press. Wet	3.15
BWO,%	Moisture	7.95
L,#/Hr	Emission Rate	0.13
I.%	Isokeinetic Variation	96.91

NEWCASTLE REFRACTORIES (CORUNDITE)
MASSILLON OH
NO 1 KILN STACK
4/29/94
TEST 2

CSA CO. DATA SHEET (METHOD 13)

TEST NO. 3 PLANT NEWCASTLE REFRACTORIES (CORUNDITE) DATE 4/29/91

LOCATION NO 1 KILN STACK BY MK CT

BAROMETER (P_B) 29.06 AMBIENT TEMP ASSUMED MOISTURE "Y" 1.001

MOUDULE NO. 2031 PROBE NO. 39 FILTER NO. HEATER NO. NOZZLE DIA. .542

TEST POINT	METER VOLUME (Vm)	METER TEMP (Tm) IN	METER TEMP (Tm) OUT	COND TEMP °F	FILTER HEATER TEMP°F	STACK TEMP °F (Ts)	STACK PRESS. (Ps)	VACUUM "Hg	ORIFICE "H_2O (ΔH) (Pm)	VEL HEAD (ΔP)	TIME
1	346.6	96	94	64	240	935	0	4-	1.5	.05	13:01
1	350.1	97	95	64	240	946		4-	1.5	.05	06
2	353.4	102	95	62	240	969		4+	1.7	.055	11
3	357.2	104	95	62	240	955		4+	1.7	.055	16
4	360.8	105	95	60	240	958		4+	1.7	.055	21
5	363.7	105	95	58	240	954		3-	1.0	.035	26
6	366.6	103	93	56	240	955		3-	.91	.030	31
1	366.6	100	95	58	240	959		3-	.91	.030	33
1	369.3	104	97	60	240	959		3-	.91	.030	38
2	373.2	106	98	64	240	956		4-	1.2	.040	43
3	376.6	108	98	64	240	957		5	1.8	.060	48
4	379.7	108	98	64	240	958		4+	1.5	.050	53
5	383.1	108	100	64	240	959		4-	1.2	.040	58
6	386.8	108	100	64	240	982		4+	1.5	.050	14:03
1											
(Vm) 40.2		104	96.4								
AVERAGE		100		****	******	959	0	MAX 5	1.36	.045	60 MINUTES

INTEGRATED GAS SAMPLE 109				AVG	N_2 = 80.3
CO_2				9.5	
O_2				10.2	
CO					

CONDENSATE COLLECTED

	FINAL	INITIAL	TOTAL
DRIERITE	998.4	987.0	11.4
IMPINGER	284.3	200	84.3
GRAND TOTAL			95.7

FILTER WT	PROBE WASH WT	IMPINGER CATCH FLOURIDE
GROSS		440 mg F^- x 1.053 =
TARE		46.44 mg HF
NET		

LEAK RATE @ 6 "Hg = <.02

STACK AREA (As) 2.4 ft²

AVG SQ RT ΔP .2127

TOTAL PARTICULAT WT (Mn) ——— Mg

HYDROFLUORIC ACID EMISSION TEST

DATA INPUT

Pb,In Hg	Barometer	29.06
VM,ft3	Meter Volume	40.2
ΔH,In H2O	Orifice Differential	1.36
PG,In H20	Stack Static Pressure	0
Tm,F	Meter Temperture	100
Ts,F	Stack Temperture	959
CP	Pitot Coefficient	.84
$\sqrt{\Delta P}$,In H20	Average Square Root Of Delta P	.2127
% CO2	Carbon Dioxide	9.5
% O2	Oxygen	10.2
% N	Nitrogen	80.3
VCL,Ml	Volume Of Condensate	95.7
0,Min	Test Time	60
MN,Mg	Total HF Catch Weight	46.44

RESULTS

Pma,In Hg	Absolute Meter Pressure	29.16
PSA,In Hg	Absolute Stack Pressure	29.06
MD	Molecular Weight Dry Gas	29.93
MS	Molecular Weight @ Stack Conditions	28.63
VMSTP,ft3	VM Standard Temp.& Press. Dry	36.84
VWSTP,ft3	VM Standard Temp.& Press. Wet	4.50
BWO,%	Moisture	10.90
L,#/Hr	Emission Rate	0.15
I.%	Isokeinetic Variation	99.47

NEWCASTLE REFRACTORIES (CORUNDITE)
MASSILLON OH
NO 1 KILN STACK
4/29/94
TEST 3

APPENDIX II

CSA CO.

EPA METHOD 6 (SULFUR DIOXIDE) DATA AND CALCULATION SHEET

TEST NO 1A PLANT COLUMBITE DATE 4/29/94

LOCATION NO 1 KILN STACK BY EAK CT

Vm	Tm	ROTOMETER	TIME
169.180	70	4	10:13
169.408	72		18
169.636	72		21
169.864	73		28
170.092	74		37
			20 min
Vm .91	avg 72		

Pb 29.06

$Vm_{std} = K_1\ Y(Vm)(Pb)/(Tm)$

Vm_{std} = 17.64 (1.004)(.912)(29.06)/(460 + 72) = .882

	1st TITRATION	2nd TITRATION	3rd TITRATION	AVERAGE	V_b TITRATION
Vt	2.3	2.2	2.3	2.3	.1

$Cso_2 = K_2(Vt - Vb)(N)(Vsoln)/(Vm_{std})(Va)$

$= 70.61X10^{-6}(2.3 - .1)(.0096)(100)/(.882)(20)$

$= 8.454 \times 10^{-6}$ lb/f^{3}DSTP

SO_2 PPM = $(Cso_2)(6.037 \times 10^{-6})$ = _____

SO_2 LB/HR = (Cso_2)(50,971 f^3/Hr DSTP*) = 0.431

SO_2 LB/mmBTU = SO_2 LB/HR / mmBTU/HR = _____

*FROM METHOD 5 CALCULATION "Q"

Cso_2 = Concentration of sulfur dioxide - lb/dry standard cubic foot
N = Normality of barium perchlorate titrant
Pb = Barometric pressure - inches Hg
Tm = Temperature of meter - °F
Va = Volume of sample aloquot - ml
Vm = Volume of gas at meter temperature and pressure - f^3
Vm_{std} = Vm corrected to standard temperature and pressure - f^3
Vsoln = Total volune of sample solution - ml
Vb = Volume of titrant used for blank - ml
Y = dry gas meter calibration factor - dimensionless
K_1 = 17.64
K_2 = 7.061 X 10^{-5}

CSA CO.

EPA METHOD 6 (SULFUR DIOXIDE) DATA AND CALCULATION SHEET

TEST NO 1B PLANT CORUNDITE DATE 4/29/94

LOCATION NO 1 KILN STACK BY CLK CT

Vm	Tm	ROTOMETER	TIME
170.092	74	3	10:53
170.268	74		10:58
170.444	74		11:03
170.619	74		11:08
170.795	75		11:13
Vm .703	avg 74		

Pb 29.06

$Vm_{std} = K_1\ Y(Vm)(Pb)/(Tm)$

Vm_{std} = 17.64 (1.004)(.703)(29.06)/(460 + 74) = .678

	1st TITRATION	2nd TITRATION	3rd TITRATION	AVERAGE	V_b TITRATION
Vt	1.4	1.4		1.4	.1

$Cso_2 = K_2(Vt - Vb)(N)(Vsoln)/(Vm_{std})(Va)$

$= 70.61X10^{-6}(1.4 - .1)(.0096)(200)/(.678)(20)$

$= 6.499 \times 10^{-6}$ lb/f^{3}DSTP

SO_2 PPM = $(Cso_2)(6.037 \times 10^{-6})$ = _____

SO_2 LB/HR = (Cso_2)(50,971 f^3/Hr DSTP*) = 0.331

SO_2 LB/mmBTU = SO_2 LB/HR / mmBTU/HR = _____

*FROM METHOD 5 CALCULATION "Q"

FROM 1A, 0.431
1B, 0.331
2) .762 = 0.381 #/HR AVG

Cso_2 = Concentration of sulfur dioxide - lb/dry standard cubic foot
N = Normality of barium perchlorate titrant
Pb = Barometric pressure - inches Hg
Tm = Temperature of meter - °F
Va = Volume of sample aloquot - ml
Vm = Volume of gas at meter temperature and pressure - f^3
Vm_{std} = Vm corrected to standard temperature and pressure - f^3
Vsoln = Total volune of sample solution - ml
Vb = Volume of titrant used for blank - ml
Y = dry gas meter calibration factor - dimensionless
K_1 = 17.64
K_2 = 7.061 X 10-#5

CSA CO.

EPA METHOD 6 (SULFUR DIOXIDE) DATA AND CALCULATION SHEET

TEST NO 2A PLANT CORUNDITE DATE 4/29/94

LOCATION NO 1 KILN STACK BY EOK GT

Vm	Tm	ROTOMETER	TIME
171,028	74	3.7	11:17
171,267	74		22
171,508	74		27
171,744	75		32
171,982	75		37
			20 min
Vm .954	avg 74		

Pb 29.06

$Vm_{std} = K_1 Y(Vm)(Pb)/(Tm)$

Vm_{std} = 17.64 (1.004)(.954)(29.06)/(460 + 74) = .919

	1st TITRATION	2nd TITRATION	3rd TITRATION	AVERAGE	Vb TITRATION
Vt	1.0	1.0		1.0	.1

$Cso_2 = K_2(Vt - Vb)(N)(Vsoln)/(Vm_{std})(Va)$

= $70.61X10^{-6}$(1.0 - .1)(.0096)(100)/(.919)(20)

= 3.319×10^{-6} lb/f^3DSTP

SO_2 PPM = $(Cso_2)(6.037 \times 10^{-6})$ = _____

SO_2 LB/HR = (Cso_2)(56,785 f^3/Hr DSTP*) = 0.188

SO_2 LB/mmBTU = SO_2 LB/HR / mmBTU/HR = _____

*FROM METHOD 5 CALCULATION "Q"

Cso_2 = Concentration of sulfur dioxide - lb/dry standard cubic foot
N = Normality of barium perchlorate titrant
Pb = Barometric pressure - inches Hg
Tm = Temperature of meter - °F
Va = Volume of sample aloquot - ml
Vm = Volume of gas at meter temperature and pressure - f^3
Vm_{std} = Vm corrected to standard temperature and pressure - f^3
Vsoln = Total volune of sample solution - ml
Vb = Volume of titrant used for blank - ml
Y = dry gas meter calibration factor - dimensionless
K_1 = 17.64
K_2 = 7.061×10^{-5}

CSA CO.

EPA METHOD 6 (SULFUR DIOXIDE) DATA AND CALCULATION SHEET

TEST NO 2B PLANT CORUNDITE DATE 4/29/94

LOCATION NO 1 KILN STACK BY [illegible]

Vm	Tm	ROTOMETER	TIME
171,984	75	3.7	12:11
172,185	75		16
172,389	75		21
172,591	75		26
172.794	76		31
			20 MIN
Vm .812	avg 75		

Pb 29.06

$Vm_{std} = K_1\ Y(Vm)(Pb)/(Tm)$

Vm_{std} = 17.64 (1.004)(.812)(29.06)/(460 + 75) = 0.781

	1st TITRATION	2nd TITRATION	3rd TITRATION	AVERAGE	V_b TITRATION
Vt	1.1	1.1		1.1	0.1

$Cso_2 = K_2(Vt - Vb)(N)(Vsoln)/(Vm_{std})(Va)$

$= 70.61X10^{-6}$(1.1 - .1)(.0098)(100)/(.781)(20)

$= 4.340 \times 10^{-6}$ lb/f^{3}DSTP

SO_2 PPM = $(Cso_2)(6.037 \times 10^{-6})$ = _____

SO_2 LB/HR = (Cso_2)(56,785 f^3/Hr DSTP*) = 0.246

SO_2 LB/mmBTU = SO_2 LB/HR / mmBTU/HR = _____

*FROM METHOD 5 CALCULATION "Q"

FROM 2A, 0.188 #/HR

2B, 0.246

2)434 = 0.267 #/HR AVG

Cso_2 = Concentration of sulfur dioxide - lb/dry standard cubic foot
N = Normality of barium perchlorate titrant
Pb = Barometric pressure - inches Hg
Tm = Temperature of meter - °F
Va = Volume of sample aloquot - ml
Vm = Volume of gas at meter temperature and pressure - f^3
Vm_{std} = Vm corrected to standard temperature and pressure - f^3
Vsoln = Total volune of sample solution - ml
Vb = Volume of titrant used for blank - ml
Y = dry gas meter calibration factor - dimensionless
K_1 = 17.64
K_2 = 7.061 X 10^{-5}

CSA CO.

EPA METHOD 6 (SULFUR DIOXIDE) DATA AND CALCULATION SHEET

TEST NO 3A PLANT CORUNDITE DATE 4/29/94

LOCATION NO1 KILN STACK BY ERK GT

Vm	Tm	ROTOMETER	TIME
172,799	76	3.7	13:03
173,000	76		09
173,201	76		13
173,411	76		18
173,617	77		23
			20 min
Vm .823	avg 76		

Pb 29.06

$Vm_{std} = K_1 Y(Vm)(Pb)/(Tm)$

Vm_{std} = 17.64 (1.004)(.823)(29.06)/(460 + 76) = 0.790

	1st TITRATION	2nd TITRATION	3rd TITRATION	AVERAGE	V_b TITRATION
Vt	1.2	1.2		1.2	.1

$Cso_2 = K_2(Vt - Vb)(N)(Vsoln)/(Vm_{std})(Va)$

= $70.61X10^{-6}$(1.2 - .1)(.0096)(100)/(.790)(20)

= 4.719×10^{-6} lb/f^3DSTP

SO_2 PPM = $(Cso_2)(6.037 \times 10^{-6})$ = _____

SO_2 LB/HR = (Cso_2)(55,711 f^3/Hr DSTP*) = 0.263

SO_2 LB/mmBTU = SO_2 LB/HR / mmBTU/HR = _____

*FROM METHOD 5 CALCULATION "Q"

Cso_2 = Concentration of sulfur dioxide - lb/dry standard cubic foot
N = Normality of barium perchlorate titrant
Pb = Barometric pressure - inches Hg
Tm = Temperature of meter - °F
Va = Volume of sample aloquot - ml
Vm = Volume of gas at meter temperature and pressure - f^3
Vm_{std} = Vm corrected to standard temperature and pressure - f^3
Vsoln = Total volune of sample solution - ml
Vb = Volume of titrant used for blank - ml
Y = dry gas meter calibration factor - dimensionless
K_1 = 17.64
K_2 = 7.061 X 10^{-5}

CSA CO.

EPA METHOD 6 (SULFUR DIOXIDE) DATA AND CALCULATION SHEET

TEST NO 3B PLANT COLUMBITE DATE 4/29/94

LOCATION #01 KILN STACK BY LAKOT

Vm	Tm	ROTOMETER	TIME
173.617	76	3.7	13:39
173.837	77		44
174.058	77		49
174.278	77		54
174.498	78		59
			20 min
Vm .881	avg 77		

Pb 29.06

$Vm_{std} = K_1\ Y(Vm)(Pb)/(Tm)$

Vm_{std} = 17.64 (1.004)(.881)(29.06)/(460 + 77) = .844

	1st TITRATION	2nd TITRATION	3rd TITRATION	AVERAGE	V_b TITRATION
Vt	1.3	1.3		1.3	.1

$Cso_2 = K_2(Vt - Vb)(N)(Vsoln)/(Vm_{std})(Va)$

$= 70.61X10^{-6}(1.3 - .1)(.0096)(100)/(.844)(20)$

$= 4.819 \times 10^{-6}$ lb/f^{3}DSTP

SO_2 PPM = $(Cso_2)(6.037 \times 10^{-6})$ = _____

SO_2 LB/HR = $(Cso_2)($ 55,711 f^3/Hr DSTP*) = .268

SO_2 LB/mmBTU = SO_2 LB/HR / mmBTU/HR = _____

*FROM METHOD 5 CALCULATION "Q"

FROM 3A, 0.263 + 0.268 = .531 / 2 = AVG 0.265 #/HR

Cso_2 = Concentration of sulfur dioxide - lb/dry standard cubic foot
N = Normality of barium perchlorate titrant
Pb = Barometric pressure - inches Hg
Tm = Temperature of meter - ^oF
Va = Volume of sample aloquot - ml
Vm = Volume of gas at meter temperature and pressure - f^3
Vm_{std} = Vm corrected to standard temperature and pressure - f^3
Vsoln = Total volune of sample solution - ml
Vb = Volume of titrant used for blank - ml
Y = dry gas meter calibration factor - dimensionless
K_1 = 17.64
K_2 = 7.061 X 10^{-6} 5

APPENDIX III

Agency Use Only
Date Received _____
No. Assigned _____
Premise No. _____

INTENT TO TEST NOTIFICATION

Proposed Test Date 4/29/94
Pre-Test Meeting Desired? Yes / / No /X/

A. Facility Information

Name NEW CASTLE REFRACTORIES (CORUNDITE) Address CORUNDITE STREET MASSILON OH 44648

Contact Person THOMAS L. MATTOX Telephone Number (216) 833-4173

B. Testing Firm Information

Name CSA CO Address 24385 CENTER ROAD, ALLIANCE, OH 44601

Contact Person ERNIE KOLM Telephone Number (216) 525-5119

C. Source Sampling Information: Identify all sources and pollutants to be sampled.

Source	Control Equipment	Monitoring Equipment	Pollutant to be Tested	EPA Test Method	Filter Box Temperature	Number of Sampling Points	Total Time for Test Run	Number of Sampling Runs
CONTINUOUS BRICK KILN	—	—	FLOURIDE	13B	250	24	60 MIN	3
			SO2	6	—	2	20 MIN	6

Any modifications to USEPA Reference Method(s)? Yes /X/ No [redacted]; If yes explain ONE PIECE QUARTZ PROBE IN PLACE OF STD. GLASS OR PYREX DUE TO HIGH TEMP OF FLUE GAS 1600°F+. SEE ENCLOSED SKETCH.

Sampling Location(s): Inlet / / Outlet /X/ Simultaneous / / Will cyclonic flow check(s) be conducted? Yes / / No /X/

Fuel Sampling: Coal - Proximate / / Ultimate / / Other (specify) _____

Emission Rate to be calculated using: F-Factor / / Ultimate Coal Analysis / / Other (specify) _____

Are concurrent Method 9 readings to be performed? Yes /X/ No / /

D. Sample Train Calibration: All affected measuring and metering equipment should be calibrated within 60 days of the scheduled testing.

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Plant CORUNDITE Date 4/29/94

Location MASSILLON OH Starting time 9:30 A

Plant process CONTINUOUS BAICK KILN

For sample port and sample point locations, see sketch(s)

Calibration sheet(s) are attached.

GENERAL DETERMINATION OF TOTAL FLOURIDE APPARATUS SAME AS METHOD 5.

The sample train is a Research Appliance Corp. model 2043 using a PYREX lined probe heated to 250 °F. The filter media is WATMAN NO 1 enclosed in pyrex holders heated to 250 °F.

The impingers contain;

1st DISTILLED WATER 4th _____

2nd DISTILLED WATER 5th _____

3rd EMTY 6th _____

A drierite column containing Drierite® (calcium sulfate) is used for final moisture removal in the impinger train.

The contents of the inpingers will be used for moisture determination and FLOURIDE.

The front half glassware will be washed using ~~acetone~~ and brush or DISTILLED WATER.

The back half will be washed using DISTILLED WATER.

The test and analytical procedures are as per latest Federal Register or local requirement.

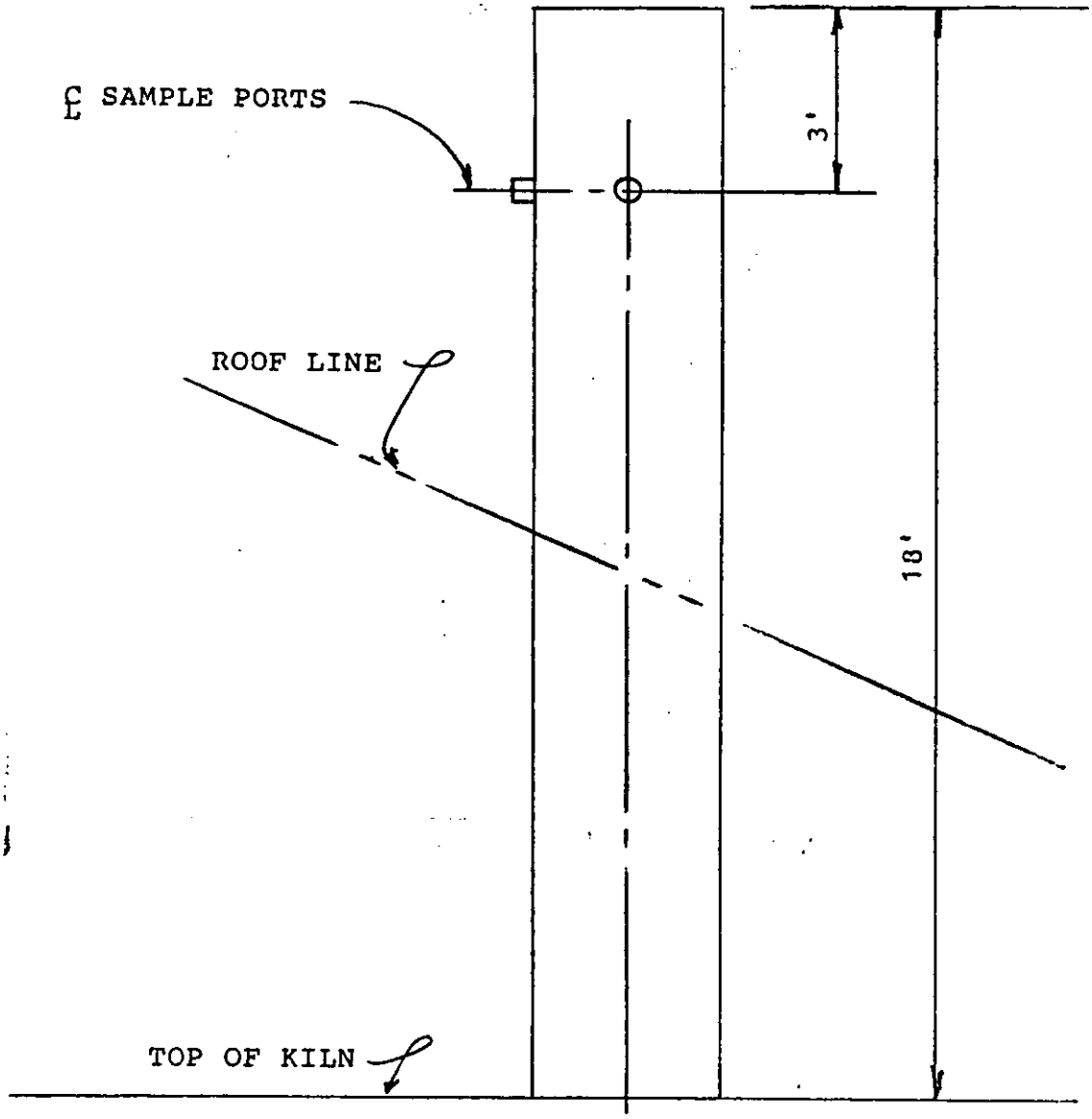
~~CO measurement by method 10 10A~~ using the MSA Lira 3000. See sketch.

CO_2 and O_2 measurement by orsat from an integrated sample. See sketch.

Other: PROBE WASH, FILTER HOLDER WASH, FILTER, BACK HALF WATER, IMPINGERS & CONNECTING GLASS WARE RINSED WITH D.W. AND PLACED IN CONTAINER NO 1. DW BLANK IN CONTAINER 2. ALL SAMPLES < 900 ml. ANALYTICAL ANALYSIS BY THE SPECIFIC ION ELECTRODE METHOD 13B, FOR FLOURIDE.

SO2 AS PER METHOD 6. TWO 20 MIN RUNS PER TEST. ANALYSIS BY BARIUM PERCHLORATE TITRATION. SEE ENCLOSED SKETCH.

CSA CO., PO BOX 3750, ALLIANCE, OH 44601-3750 PH(216)525-5119 FAX 525-7908



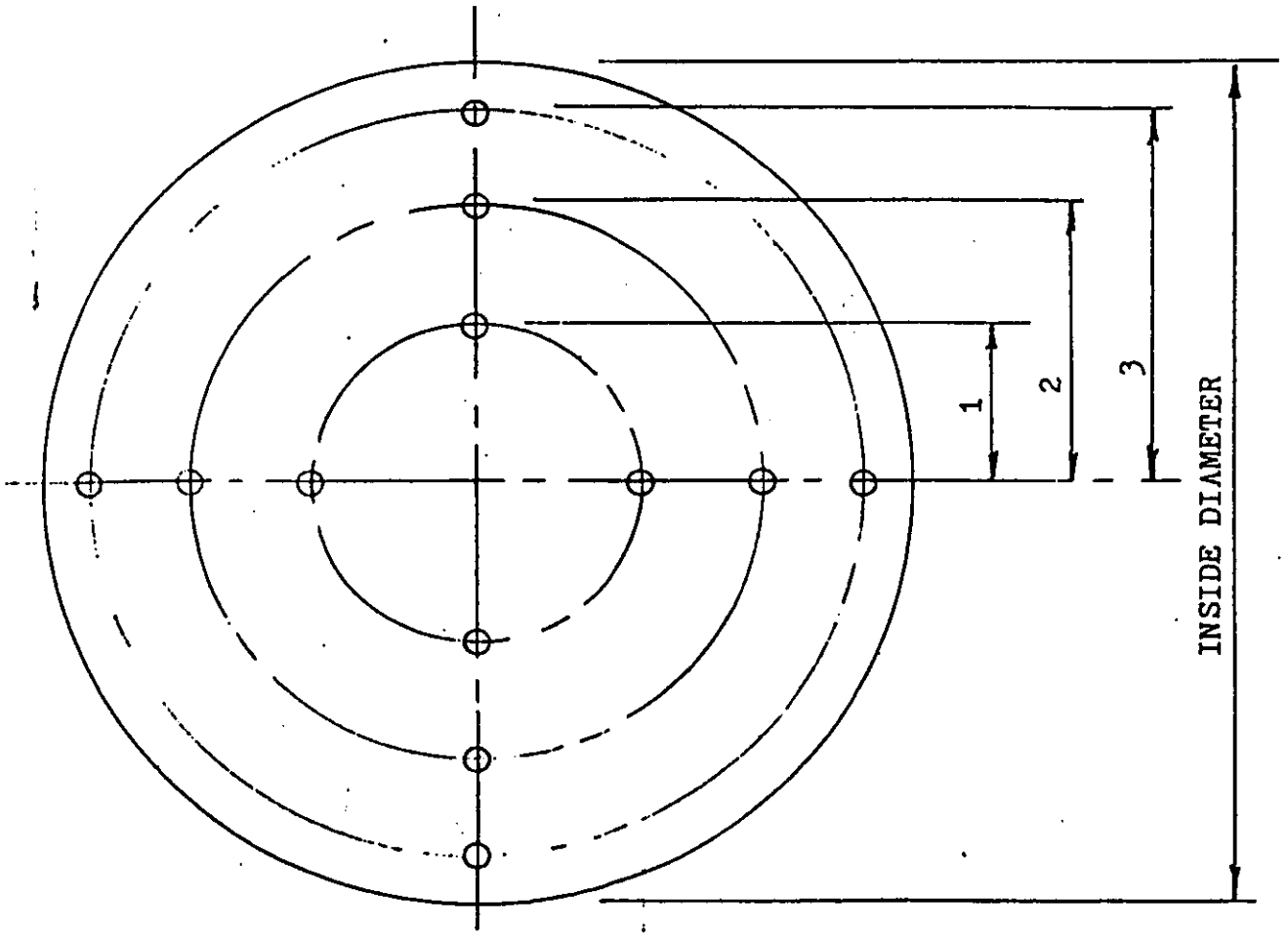
LOCATION OF SAMPLE PORTS

FIGURE 1A

Sample Points For Round Ducts

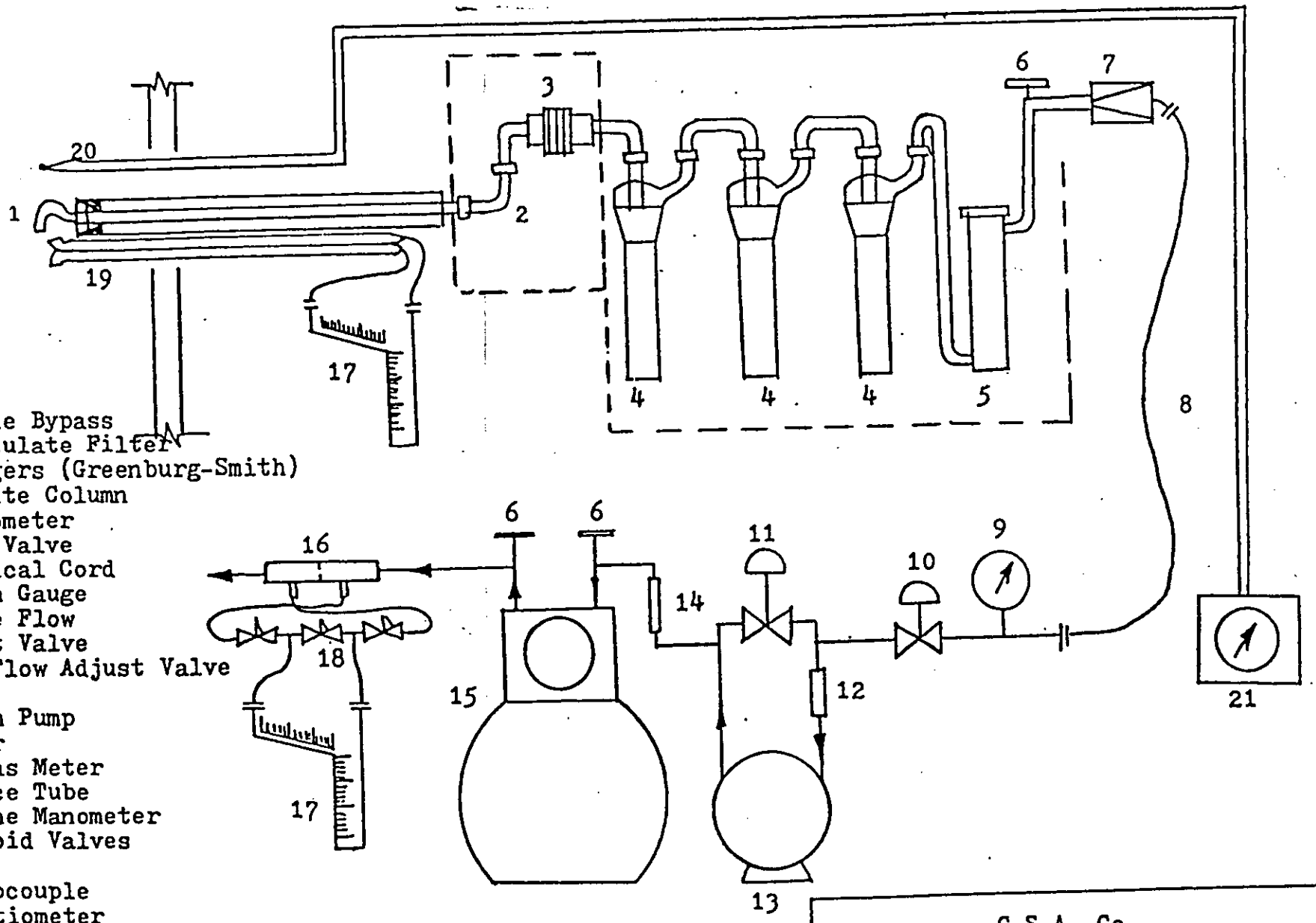
Diameter of duct in inches = 20
Area = 2.181662
Radius = 10
Total No. Of Points = 12

(1)- 4.082483
(2)- 7.071068
(3)- 9.128709



SAMPLE POINT LOCATION

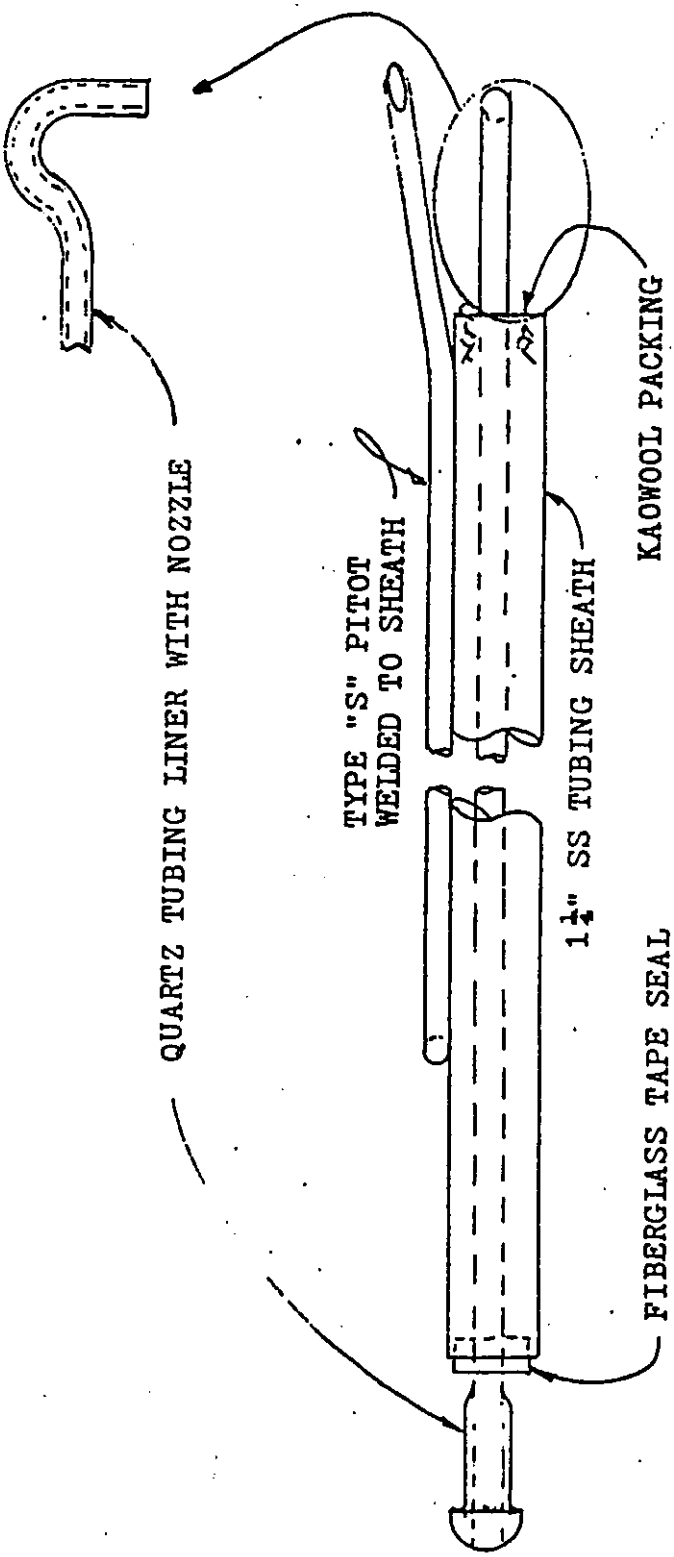
FIGURE 1B



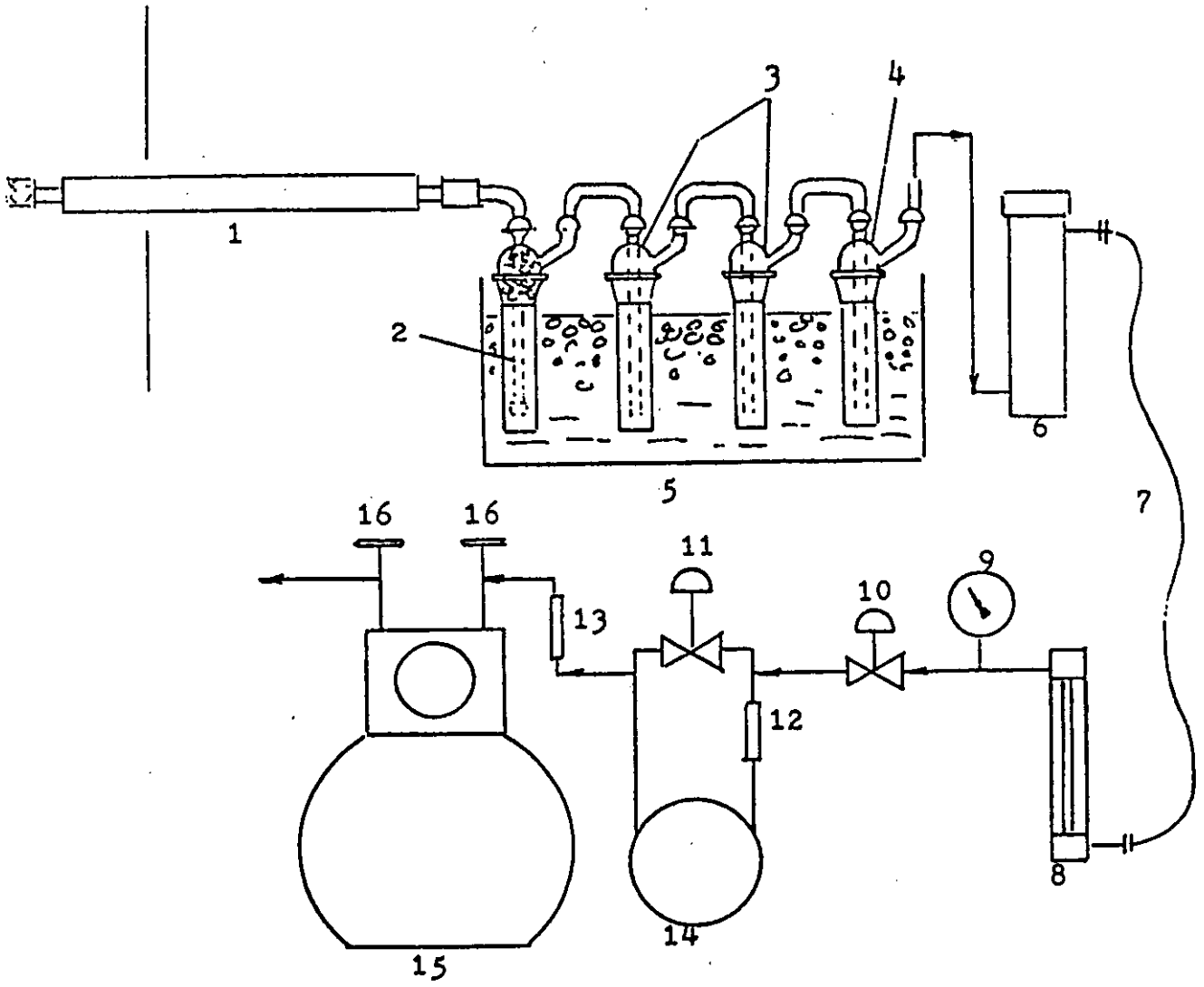
1) Probe
2) Cyclone Bypass
3) Particulate Filter
4) Impingers (Greenburg-Smith)
5) Drierite Column
6) Thermometer
7) Check Valve
8) Umbilical Cord
9) Vacuum Gauge
10) Course Flow Adjust Valve
11) Fine Flow Adjust Valve
12) Oiler
13) Vacuum Pump
14) Filter
15) Dry Gas Meter
16) Orifice Tube
17) Incline Manometer
18) Solenoid Valves
19) Pitot
20) Thermocouple
21) Potentiometer

C.S.A. Co.
MODIFICATION OF R.A.C. SAMPLE TRA
USING DRIERITE COLUMN IN PLACE OF
IMPINGER DESICANT

Figure 2



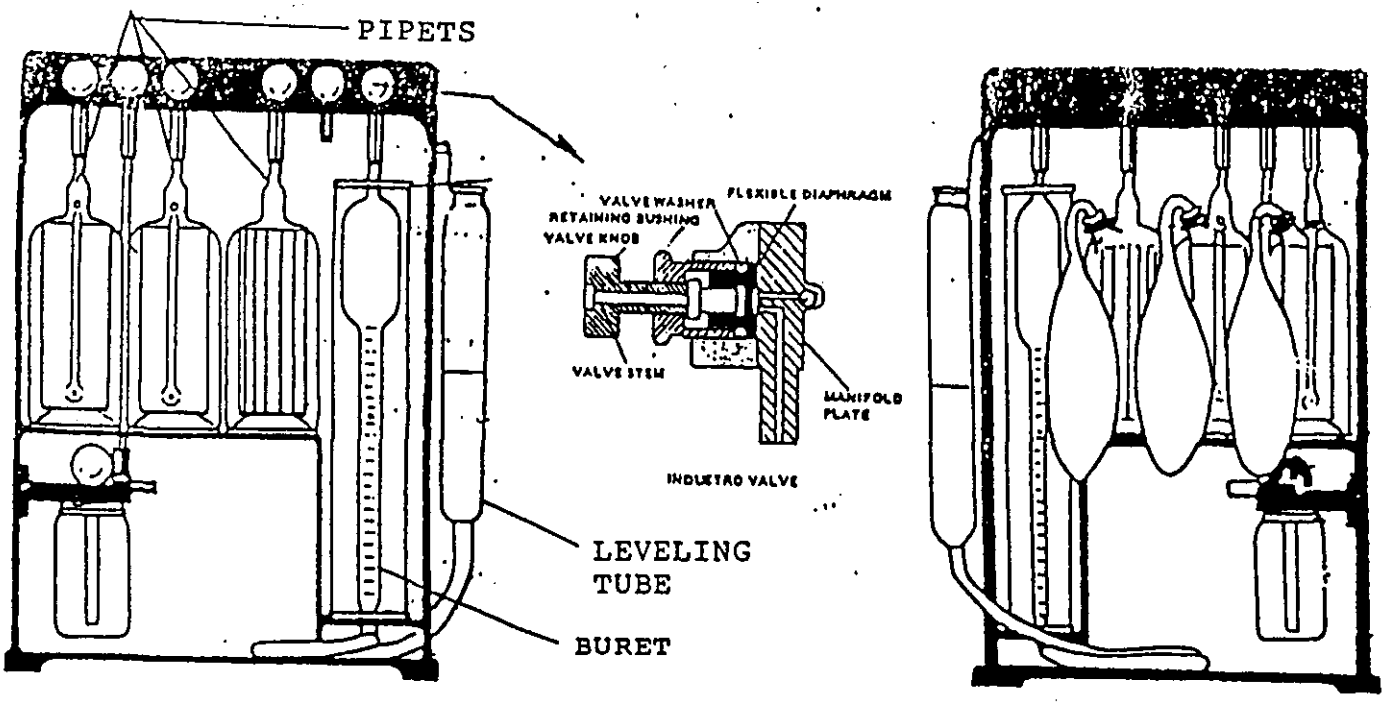
HIGH TEMPERATURE QUARTZ LINED PROBE



1) HEATED PYREX LINED PROBE. END PACKED WITH QUARTZ WOOL
2) MIDGET BUBBLER. TOP PAKED WITH GLASS WOOL
3) MIDGET IMPINGERS. EACH FILLED WITH 15 ml OF H_2O_2 (3%)
4) MIDGET IMPINGER. DRY TRAP
5) ICE BATH
6) DRIERITE COLUMN. FILLED WITH CALCIUM SULFATE DESICANT
7) UMBILICAL CORD
8) ROTAMETER
9) VACUUM GAGE
10) VALVE FOR COARSE FLOW ADJUSTMENT
11) VALVE FOR FINE FLOW ADJUSTMENT
12) OILER
13) OIL FILTER
14) VACUUM PUMP
15) DRY GAS TEST METER
16) THERMOMETER

E.P.A. METHOD 6 SO_2 SAMPLING TRAIN

FIGURE 4



LEAK CHECKING

1) THE LEVEL OF THE SOLUTION IN THE PIPET WILL NOT BE MANTAINED AT ITS PROPER LEVEL IF THER IS A LEAK BETWEEN THE PIPET AND THE MANIFOLD VAVE OR IN THE MANIFOLD VALVE.

2) THE BURET SOLUTION IS SET TO ZERO WITH THE LEVELING TUBE. The LEVELING TUBE IS RAISED TO ABOUT TWENTY INCHES FOR TWO MINUTES TO APPLY PRESSURE TO THE MANIFOLD, VALVES AND REMAINING PART OF THE SYSTEM. THE LEVELING TUBE IS RETURNED TO ITS ORIGINAL ZERO POSITION. IF THER IS A LEAK, THE BURET SOLUTION WILL BE ABOVE THE ZERO MARK. IT WILL BE ON THE ZERO MARK IF THER ARE NO LEAKS.

THE LEAK CHECK IS PERFORMED BEFORE EACH GAS ANALYSIS OR SERIES OF ANALYSIS.

THE SOLUTIONS ARE PURCHASED FROM BURRELL CORP. THEY ARE IN THREE OUNCE BOTTLES THAT ARE THE PROPER SIZE FOR FILLING THE PIPET.
"DISORBENT" IS USED IN THE CONTACT PIPET FOR CO_2.
"OXORBENT" IS USED IN THE FIRST AUOTO-BUBBLER PIPET FOR O_2.
"COSORBENT IS USED IN THE SECOND AUTO-BUBBLER PIPET FOR CO.

THE BURREL MODEL B "INDUSTRO" ORSAT GAS ANALYZER

C.S.A. Co.
STACKSAMPLR CALIBRATION SHEET

Customer _____ Order No. _____
Date 3/23/94 Serial No. 2031 RAC Order No. _____

Pump CLEAN Pump Oil CHG Clean Quick Disconnects YES
Manometers OK Dry Test Meter OK Thermometers SEE BELOW
Lights OK Electrical Check OK Variac OK
Vacuum Gauge OK Leak Check @ 27''Hg Vacuum NO LEAKS
Remarks PRESSURE CHECK @ 8.5" H2O - NO LEAKS

Barometer (Pb) 28.93

K	N	DH	CFw	CFd	Tw	ITd	OTd	TD	t	ΔH	Y
.0158	.0368	0.5	5	5.05	71	82	74	78	12.80	1.890	1.002
.0317	.0737	1.0	5	5.07	71	83	77	80	9.10	1.906	1.000
.0634	.1470	2.0	10	10.20	71	87	83	85	12.90	1.894	1.001
.1268	.2490	4.0	10	10.18	71	88	85	86	9.15	1.898	1.001
.1902	.4310	6.0	10	10.18	71	89	87	88	7.45	1.881	0.999
.2536	.5880	8.0	10	10.15	71	91	88	90	6.52	1.917	1.000

Tolerances H=1.6-1.84-2.1 , Y=0.99-1.00-1.01

AVG ΔH = 1.897
AVG Y = 1.0005
SAY 1.001

$H=(K/(Pb(OTd+460)))*(((Tw+460)t)/CFw)^2$

Y=(CFw Pb (Td avg.+460))/(CFd (Pb+N) (Tw+460))

DH= Orifice pressure drop - in. H_2O
CFw= Volume wet test meter - f^3
CFd= Volume dry test meter - f^3
Tw= Temp. wet test meter
ITd= Inlet temperature dry test meter
OTd= Outlet temperature dry test meter
Td avg.= Average temperature dry test meter
t= Time - minutes
Pb=Barometer press.

DIAL THERMOMETER CALIBRATION		ICE WATER	BOILING WATER
Precision Lab Thermometer		33	211
Meter Thermometers		ITd 34 OTd 33	ITd 210 OTd 211
Impinger Outlet Thermometer	(1)	34	211
	(2)	33	211

STACK DIGITAL TEMPERATURE INDICATORS
NBS TRACABLE FROM FACTORY. 2 UNITS CALIBRATED AGAINST EACH OTHER(PyroMation) ALL THERMOCOUPLES ARE CALIBRATED BY OVEN FROM 100 TO 500°F AGAINST A CMS LAB THERMOMETER (No. 227-934). ANY THERMOCOUPLE THAT IS MORE THAN 2°F FROM STANDARD IS DISCARDED.

3/30/94
BK

SO_2 Apparatus Calibration

Dry Test Meter End	Dry Test Meter Start	V_D	T_D	Wet Test Meter V_W	Wet Test Meter T_W	Rotometer CFH	Time min
29.451	28,666	.785	79	.766	67	3	20
30.762	29,699	1,163	87	1,117	67	4	20
32.788	31,355	1,553	88	1,488	67	5	20

$$\text{or } V_{cw} = V_D m V_w \frac{(P_B - V_P)(530)}{(29.92)(T_m)} \qquad P_A = 29.07 - .67 = 28,4 \qquad V_c = V514.94 / T_m$$

V_{cD} @ STP (DRY)	V_{cw} @ STP (DRY)	V_{cD} / V_{cw} = Y	Rotometer
.750	.748	1,003	3
1,095	1,091	1,004	4
1,460	1,454	1,004	5

AVG Y = 1,004

C. S. A. Co.
24385 Center Road
P. O. Box 3750
ALLIANCE, OH 44601