EUGENE F. MOONEY
SECRETARY

AP-42 Section 11.30
Reference 11
Report Sect. 4
Reference 8

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION
BUREAU OF ENVIRONMENTAL PROTECTION
A. L. ROARK
COMMISSIONER
FRANKFORT, KENTUCKY 40601

Janaury 9, 1979

RECEIVED
Lime & Lime Products

Mr. Robert R. Lancaster, Plant Manager
Grefco, Inc.
P.O. Box 35
Florence, Kentucky 41042

ID: 079-0280-0021

Dear Mr. Lancaster:

This is to inform you the results of a review of your stack test report submitted to this Division on October 23, 1978.

On October 3, 4, and 5, 1978, compliance testing was performed on the perlite expanding furnace cyclone. These tests indicated an average particulate emission rate of 10.26 lb/hr, whereas the allowable rate, as specified by 401 KAR 3:060, Section 4 is 12.88 lb/hr. Therefore, this emission point was in compliance with the above regulation at the time of the test. A copy of the stack test evaluation report is enclosed for your review.

Sincerely,

William S. Coakley, Director
Enforcement and Surveillance Program
Division of Air Pollution Control

WSC:dh

cc: John T. Smither
Hisham M. Sa'aid
James W. Dills
Florence Regional Office
Case Preparation

pc: J. Carrick
H. Baker
P. Mehta

report

Kentucky Division of Air Pollution Control

Sampling Observation and Report Review

Grefco, Incorporated
Perlite Insulation Board Plant
Florence, Kentucky
October 17, 1978

Sampling Performed by
Grefco, Incorporated
Engineering Department
Torrence, California

Observed and Reviewed by
Kentucky Division of Air Pollution Control

Sampling Observation and Report Review

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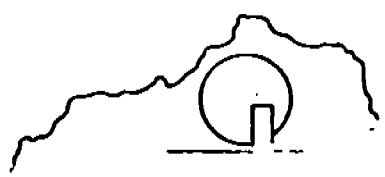


Report Certification

As observer and author I hereby certify that the sampling procedures were performed during my direct observation and general guidance and all data and conclusions in this report are authentic and accurate.

Date 12-18-78

Gerald H. Slucher

Gerald H. Slucher, Chief
Source Test Section
Division of Air Pollution Control

As observer and author I hereby certify that the facility was operated during the testing according to my instructions.

Date 12/22/78

Samuel H. Bruntz

Samuel Bruntz
Engineering & Permits Program
Division of Air Pollution Control

INTRODUCTION

On October 3, 4 and 5, 1978, Kentucky Division of Air Pollution Control personnel were present at Grefco, Incorporated, Florence, Kentucky, to observe and provide general guidance during the compliance testing of the perlite expander cyclone stack in accordance with Kentucky Air Pollution Control Regulations 401 KAR 3:060, Section 4 applicable to standards of performance for existing process operations.

Representativeness of the compliance test data was based on Methods 1, 2, 3, and 5 in the August 18, 1977 Federal Register for the sampling procedures. The baseline process conditions were set by the Kentucky Division of Air Pollution Control. All compliance test conditions and procedures were agreed upon by Grefco and the Division at a pre-test meeting prior to the compliance testing field tests.

Present during the compliance test, as shown in Figure 1, were Sam Bruntz to monitor the process operations, Chris Finley to make visible emission evaluations, and Gerald Slucher to observe sampling procedures, all with the Kentucky Division of Air Pollution Control.

The following sections of this report treat the summary of representativeness of the compliance test, facility operations, sampling and analytical procedures, and review of compliance test report.

FIELD OBSERVATION CHECKLIST

GENERAL/ADMINISTRATIVE

Plant Name GREFCO Date 10-3-78

Plant Address Florence

Source to be Tested

Plant Contact R.L. Lancaster Phone

Observers H. Hughes Affiliation KDAPC

Tom Krueth KDAPC

Chris Fenley KDAPC

Reviewed Test Protocol? ____ Comments

Reviewed Pretest Meeting Notes? ____ Comments

Reviewed Correspondence? ____ Comments

Test Team Company Name GREFCO Phone

Supervisor's Name PRAFUL MEHTA Sr Process Engineer

Other Members Don Reed Title Lab Supervisor

Table 4. OBSERVATION CHECKLIST

DAPC-110(Rev.5-27-77)

Process Description

The Grefco plant in Florence is engaged in the manufacture of fiberboard insulation. Perlite ore is shipped in by rail and pneumatically fed to a storage silo. Then, as required, ore is transferred by elevator to one of three perlite expanding furnaces. As the ore falls through the furnace, heat causes thermal expansion and the resultant expanded ore is then pneumatically blown through a series of cyclones, then mixed with a newspaper pulp and spread into a mat. The mat is fed through a series of rollers and, in the presence of a vacuum, is partially dehydrated. The mat is then blown with asphalt and baked in a drying oven. The completed mat is cut to customer specified board sizes, then shipped.

The perlite expanding furnaces are ducted to a wet cyclone which, in the past, has not been effective in reducing particulates emissions and opacity to the levels specified by regulation 401 KAR 3:060, Section 4. Grefco has therefore made modifications to the water spray system of the wet cyclone, such as the use of fresh city water rather than recycle process water and the addition of furnace shutdown mechanisms activated by items such as loss of water pressure.

The purpose of the stack test, therefore, was to determine the effectiveness of the modifications. During the test, the water spray pressure was observed to be 60 psig, and the process weight rates and allowables were as follows:

	Process Weight Rate, TPH	Allowable (3:060(4) lbs/hr.
	5.46	12.79
	5.55	12.93
	5.55	12.93
Ave.	5.52	12.88

Summary of Representativeness of Data

All facility operating conditions and sampling procedures were discussed and agreed upon at the pre-test meeting on September 12, 1978, by Grefco representatives Praful Mehta, Gary Lockhart and Bill Eilau, and Division Representatives Sam Bruntz, Samuel Murphy, Steve Brown, and John Jayne.

The sampling and recovery procedures followed the August 18, 1977, Federal Register Methods 1, 2, 3, and 5. All sampling procedures were representative of the prescribed methods.

The analysis of the sample was conducted in the laboratory at the plant. The filters were desiccated and pre-weighed and final weights measured on the analytical balance at the plant. The procedures observed were acceptable.

No visible emissions evaluation was performed, but the regional inspector, Chris Finley, did file a report on 10/3/78 stating that there were no visible emissions.

All three test runs were observed and evaluated to have no significant biases.

Sampling and Analytical Procedures

Sampling and analytical procedures followed the August 18, 1977, Federal Register Methods 1, 2, 3, and 5.

The sample site checklist is presented in Figure 2. The sample site met the specified requirements to allow the sample to be withdrawn from the stack at 32 sample points. Very little buildup was present on the inner stack walls.

The sample train component and calibration checklist is presented in Figure 3. Calibration data was presented at the test and found to be acceptable. The meter box was calibrated by Pedco Environmental. All sample train components met guidelines set forth by EPA methods.

The sample train assembly and final preparation check list is presented in Figure 4. All train components were prepared and assembled properly. The leak rate was within the acceptable limits of each test.

The sample collection checklist is presented in Figure 5. The sample train was operated in the prescribed manner.

The sample recovery checklist is presented in Figure 6. The drying and weighing of the sample was done according to the prescribed procedures.

The sample residues and filters from the sample analysis were not requested to be shipped to the Division after the review of the compliance test report.

GENERAL/SAMPLING SITE

Stack/Duct Cross Section Dimensions 42" Equivalent Diameter _____

Material of Construction metal Corroded? no Leaks no

Internal Appearance - Corroded? ____ Caked Particulate? ✓ Thickness ____

Insulation? no Thickness — Lining? — Thickness —

Nipple? ✓ I.D. 3" Length 6" Flush with Inside Wall? _____

Straight Run Before Ports _____ Diameters 5 diam

Straight Run After Ports _____ Diameters 2 diam.

Photos Taken? _____ of what _____

Drawing of Sampling Location:

Minimum information on drawing: stack/duct dimensions, location and description of major disburbances and all minor disturbances (dampers, transmissometers, etc.), and cross sectional view showing dimensions and port locations.

Table 4. (continued). OBSERVATION CHECKLIST

DPAC-110(Rev.5-27-77)

GENERAL/SAMPLING SYSTEM

Sampling Method (e.g., EPA5) _____

Sampling Train Schematic Drawing:

Modifications to Standard Method _____

_____

Pump Type: Fibervane with In-Line Oiler X Carbon Vane X Diaphragm X

Probe Liner Material SS Heated? ✓ Entire Length? ✓

Type "S" Pitot Tube? ✓ Other _____

Pitot Tube Connected To: Inclined Manometer ___ Or Magnehelic Gauge ✓

Range 0-1" Approx. Scale Length _____ Divisions .02"

Orifice Meter Connected To: Inclined Manometer ___ Or Magnehelic Gauge ✓

Range 0-3" Approx. Scale Length _____ Divisions .1"

Meter Box Brand TOY X Sample Box Brand TOY X

Recent Calibration of Orifice Meter-Dry Gas Meter? ___ Pitot Tubes? ___

Nozzles ___ Thermometers or Thermocouples? ___ Magnehelic Gauges? ___

Numbers of Sampling Points/Traverse From Fed.Reg. ___ Number to be Used ___

Length of Sampling Time/Point Desired _____ Time to be Used _____

X - not required by regulations

Table 4 (continued). OBSERVATION CHECKLIST

PAGE_____ OF_____

TRAIN ASSEMBLY/FINAL PREPARATIONS

RUN #_____

(Use One Sheet Per Run if Necessary)

Filter Holder Clean Before Test? ✓ Filter Holder Assembled Correctly? ✓ Filter Media Type Glass Filter Clearly Identified? ✓

Filter Intact? ✓ Probe Liner Clean Before Test? ✓

Nozzle Clean? ✓ Nozzle Undamaged? ✓

Impingers Clean Before Test? ✓ Impingers Charged Correctly? ✓

Ball Joints or Screw Joints? Ball Grease used? ✓

Kind of Grease Silicone Pitot Tube Tip Undamaged? ✓

Pitot Lines Checked for Leaks?_____ Plugging?_____

Meter Box Leveled? — Pitot Manometer Zeroed? ✓

Orifice Manometer Zeroed? ✓ Probe Markings Correct? ✓

Probe Hot Along Entire Length? ✓ Filter Compartment Hot? ✓

Temperature Information Available? ✓ Impingers Iced Down? ✓

Thermometer Reading Properly? ✓ Barometric Pressure Measured?_____

If Not, What is Source of Data_____ $\Delta H_@$ From Most Recent Calibration_____ $\Delta H_@$ From Check Against Dry Gas Meter_____

Nomograph Check:

If $\Delta H_@$ = 1.80, TM = 100° F, % H_2O = 10%, P_s/P_m = 1.00, C = X (0.95)

If C = 0.95, TS = 200° F, DN = 0.375, Δp Reference = X (0.118)

Align Δp = 1.0 with ΔH = 10; @ Δp = 0.01, ΔH = X (0.1)

For Nomograph Set-Up:

Estimated Meter Temperature X °F Estimated Value of P_s/P_m X

Estimated Moisture Content X % How Estimated?_____

C Factor X Estimated Stack Temperature X °F Desired Nozzle Diameter X

Stack Thermometer Checked Against Ambient Temperature?_____

Leak Test Performed Before Start if Sampling?____ Rate____ CFM @_____

SAMPLING (Use One Sheet For Each Run if Necessary) Run #_____

Probe-Sample Box Movement Technique:

Is Nozzle Sealed When Probe is in Stack with Pump Turned Off? OK

Is Care Taken to Avoid Scraping Nipple or Stack Wall? ✓

Is an Effective Seal Made Around Probe at Port Opening? ✓

Is Probe Seal Made Without Disburbing Flow Inside Stack? ✓

Is Probe Marking System Adequate to Properly Locate Each Point? ✓

Are Nozzle and Pitot Tube Kept Parallel to Stack Wall At Each Point? ✓

If Probe is Disconnected From Filter Holder with Probe in the Stack on a Negative Pressure Source, How is Particulate Matter in the Probe Prevented From Being Sucked Back into the Stack? N/A

If Filters are Changed During a Run, Was any Particulate Lost? N/A

Meterbox Operation:

Is Data Recorded in a Permanent Manner? ✓ Are Data Sheets Complete? ✓

Average Time to Reach Isokinetic Rate at Each Point 30 sec

Is Nomograph Setting Changed When Stack Temperature Changes Significantly? —

Are Velocity Pressures (Δp) Read and Recorded Accurately? ✓

Is Leak Test Performed at Completion of Run? <.02 cfm @ 15 In Hg.

General Comment on Sampling Techniques _____

If Orsat Analysis is Done, Was It: From Stack_____ From Integrated Bag_____

Was Bag System Leak Tested?_____ Was Orsat Leak Tested?_____ Check Against Air?_____

If Data Sheets Cannot Be Copied, Record: Approximate Stack Temperature_____°F

Nozzle Dia._____In. Volume Metered_____ACF

First 8 Δp Readings___ ___ ___ ___ ___ ___ ___ ___

Table 4 (continued). OBSERVATION CHECKLIST

SAMPLE RECOVERY

General Environment-Clean Up Area in Lab

Wash Bottles Clean? ✓ Brushes Clean? ✓ Brushes Rusty? NO

Jars Clean? ✓ Acetone Grade _____ Residue on Evap. Spec. _____

Filter Handled OK? ✓ Probe Handled OK? ✓ Impingers Handled OK? ✓

After Cleanup: Filter Holder Clean? ✓ Probe Liner Clean? ✓

Nozzle Clean? ✓ Impingers Clean? ✓ Blanks Taken? NO

Description of Collected Particulate light brown dust

Silica Gel All Pink? Run 1 YES Run 2 NO Run 3 NO

Jars Adequately Labeled? N/A Jars Sealed Tightly? N/A

Liquid Level Marked on Jars? NA Jars Locked Up? N/A

General Comments on Entire Sampling Project:

Was the Test Team Supervisor Given the Opportunity to Read Over This Checklist? --- Did He Do So? _____

Observer's Name Gareth Wanke Title Grp Supervisor Tst & Eval

Affiliation KDAPC Signature Gareth Wanke

Table 5. SAMPLE RECOVERY CHECKLIST

Review of Compliance Test Report

The compliance test report followed the reporting format required by the Division. The reporting requirement checklist is presented in Figure 7. A review of the report and all calculations showed the data presentation to be representative and accurate. Figure 8, 9, and 10 present the data and calculations as verified with a Hewlett-Packard Model 10 programmable calculator.

The emission standard is 12.88 lbs/hr. The reported emission rate is 10.26 lbs/hr.

Based on the data and the discussions in the report and this review, it does not seem that any errors occurred which would have biased the results. It is recommended that this test report be accepted.

STACK TEST REVIEW

NAME GRAFIC — TEST NO. 1

SOURCE TYPE Rotogravure Printing — RUN NO. 1

MODEL OR NAME _____ — DATE OF TEST 10-3-78

TEST PERFORMED BY GRAFIC

DATA REQUIRED		RESULTS	
T_s, Stack temperature	138.9 °F	V_{H2O}, Volume of water	10.53 cf
P_s, Stack pressure	29.97 in.Hg.	B_{wo}, Moisture of content	.11
T_m, Meter temperature	74.86 °F	V_{ne}, Volume of sample at ~~stack~~ cond.	34.47 cf
P_m, Meter pressure	29.49 in.Hg.	M_{dry}, Molecular wt dry	
M_w, Condensed water	225.5 gm	M_{wet}, Molecular wt wet	26.55
V_{DGM}, Volume of sample (meter conditions)	40.30 cf	Velocity	31.27 fps
CO_2	% 0	Isokinetic Ratio	101
O_2	% 21	gr/scf @ 12% CO_2	
CO_2	% 0		
N_2	% 79		
ΔP, Velocity head (traverse points)	.24 .13 in.H_2O	Lb/Hr	9.6
C_p, Pitot tube coeff.		Lb/mm BTU	
90 min x 60			
θ, Sampling time	90 min ~~sec.~~		
A_n, area of nozzle D= D^2 x 0.005454	.00373409 ft^2		
Weight of collected pollutant	2290 ~~mg~~ gm	REQUESTED BY	
CO_2, Waste only	%	REVIEWED BY	
		DATE	
A_s, Area of stack D= ft $\frac{D2}{4}\pi$	9.62 ft^2	RECOMMENDATION	
Boiler Heat Capacity	mmBTU/Hr.		

REMARKS

ENTER
TS=X
TN=Y
ENTER
PS=X
PM=Y
ENTER
ML=X
MM=Y
ENTER
CO2=X
O2=Y
ENTER
CO=X
N2=Y
ENTER
DEL P
AVG DEL P
0.492050

ENTER
CP=X
THETA=Y
ENTER
AN=X
MN=Y
ENTER
AS=X
VMSTD
39.870754

VWSTD
10.682700

BWO
0.211394

MS
28.548464

MS
31.272929

ISOKIN
101.092105

CONC
LBS/FT3
0.02

ENTER

STACK TEST REVIEW

NAME KREFCO

TEST NO.

SOURCE TYPE Rotary Cyclone

RUN NO. 2

MODEL OR NAME

DATE OF TEST 10-4-78

TEST PERFORMED BY KREFCO

DATA REQUIRED		RESULTS
T_s, Stack temperature	128.75 °F	V_{H_2O}, Volume of water 32.25 cf
P_s, Stack pressure	29.94 in.Hg.	B_{wo}, Moisture of content 2.21
T_m, Meter temperature	76.8 °F	V_{ne}, Volume of sample at ~~stack~~ cond. 82.825 cf
P_m, Meter pressure	30.08 in.Hg.	M_{dry}, Molecular wt dry
M_w, Condensed water	469.5 gm	M_{wet}, Molecular wt wet 28.5
V_{DGM}, Volume of sample (meter conditions)	63.46 cf	Velocity 30.18 fps
CO_2	% 0	Isokinetic Ratio 101.3
O_2	% 21	gr/scf @ 12% CO_2
CO_2	% 0	
N_2	% 79	
ΔP, Velocity head 2.25 .71 in.H_2O (traverse points)		Lb/Hr 11.25
C_p, Pitot tube coeff. .857		Lb/mm BTU
____min x 60		
Θ, Sampling time 90 min ~~sec.~~		
A_n, area of nozzle D= " ~~0.0004~~ ft^2		
D^2 x 0.005454 .00717		
Weight of collected pollutant 5.751 mg ~~gm~~		REQUESTED BY
CO_2, Waste only ____ %		REVIEWED BY
		DATE
A_s, Area of stack D= ft $\frac{D2}{4}$ π 9.62 ft^2		RECOMMENDATION
Boiler Heat Capacity mmBTU/Hr.		

REMARKS

ENFORCEMENT AND SURVEILLANCE

ENTER
TS=X
TM=Y
ENTER
PS=X
PM=Y
ENTER
VL=X
VM=Y
ENTER
CO2=X
O2=Y
ENTER
CO=X
N2=Y
ENTER
DEL P
AVG Γ DEL P
0.475048

ENTER
CP=X
THETA=Y
ENTER
AN=X
MN=Y
ENTER
AS=X
VMSTD
82.825157

VWSTD
22.254300

BWO
0.211765

MS
26.544240

VS
30.180925

ISOKIN
101.341623

CONC
LBS/FT3
0.000015
EMISSIONS
LBS/HR
11.253???

STACK TEST REVIEW

NAME GREFCO

TEST NO.

SOURCE TYPE Pulp Expander

RUN NO. 3

MODEL OR NAME

DATE OF TEST 10-5-78

TEST PERFORMED BY GREFCO

DATA REQUIRED		RESULTS	
T_s, Stack temperature	138.44 °F	V_{H2O}, Volume of water	23.01 cf
P_s, Stack pressure	30.000 in.Hg.	B_{wo}, Moisture of content	.211
T_m, Meter temperature	75.23 °F	V_{ne}, Volume of sample at ~~stack~~ cond.	86.65 cf
P_m, Meter pressure	30.09 in.Hg.	M_{dry}, Molecular wt dry	
M_w, Condensed water	485.5 gm	M_{wet}, Molecular wt wet	26.55
V_{DGM}, Volume of sample (meter conditions)	46.46 cf	Velocity	30.6 fps
CO_2	% 0	Isokinetic Ratio	103.7
O_2	% 21	gr/scf @ 12% CO_2	
CO_2	% 0		
N_2	% 79		
ΔP, Velocity head (traverse points)	.232188 in.H_2O	Lb/Hr	9.97
C_p, Pitot tube coeff.	.857	Lb/mm BTU	
____ min x 60			
θ, Sampling time	90 min ~~sec~~		
A_n, area of nozzle D= " D^2 x 0.005454	~~.003549~~ .003717 ft^2		
Weight of collected pollutant	521.1 mg ~~gm~~	REQUESTED BY	
CO_2, Waste only	%	REVIEWED BY	
		DATE	
A_s, Area of stack D= ft $\frac{D2}{4}$ π	9.62 ft^2	RECOMMENDATION	
Boiler Heat Capacity	mmBTU/Hr.		

REMARKS

ENFORCEMENT AND SURVEILLANCE

ENTER
TS→X
TM→Y
ENTER
PS→X
PM→Y
ENTER
VL→X
VM→Y
ENTER
CO2→X
O2→Y
ENTER
CO→X
N2→Y
ENTER
DEL P
AVG P DEL P
0.401859

ENTER
CP→X
THETA→Y
ENTER
AN→X
MW→Y
ENTER
AS→X
VMSTD
86.054023

VWSTD
20.013700

BWO
0.210997

MS
28.85[illegible]

VO
30.595655

ISOKIN
103.673131

CONC
LBS/FT3
[illegible]

EMISS

GREFCO, INC.
ENGINEERING DEPARTMENT
TORRANCE, CALIFORNIA

Project No.: 384-FL

STACK EMISSION MEASUREMENT AT GREFCO's PERMALITE INSULATION BOARD PLANT FLORENCE, KENTUCKY

A report prepared for Kentucky Division of
Air Pollution Control, Frankfort, Kentucky

October 17, 1978

Prepared and submitted by:
P. A. Mehta, Sr. Process Engineer

TABLE OF CONTENTS

INTRODUCTION

Three sets of particulate emission measurements were made on the perlite expanders cyclone stack at the Florence plant during the week of October 2, 1978. These tests were conducted to demonstrate to the Kentucky Division of Air Pollution control that the particulate emissions from the perlite expander stack are within the allowable rate as set forth in the most recent Kentucky Air Pollution control regulations, Section 401-KAR 3:060, Standards of Performance for Existing Source, Section 5, Table 3, Page 16-17.

Representatives of the Kentucky Division of Air Pollution Control, Messers Gerald H. Slucher, Chief, Source Test Section; and Samuel Bruntz, Environmental Engineer were present to witness the first test on October 3. Mr. Chris Finley, Divisional Air Pollution Control Inspector joined the later part of the test on October 3. Mr. Slucher was present during the next two tests conducted on October 4 and 5, 1978. Florence Plant Quality Control Laboratory Supervisor, Mr. Donald Black assisted the writer in successfully conducting the tests.

During the last labor day weekend, a new, larger furnace exhauster was installed to replace two smaller blowers. Water is introduced through eight nozzles, equally divided before and after the blower to control and maintain stack emissions within allowable limits. Introduction of fresh water ahead of blower did not pose any mechanical or operational problems. Each of the eight sprays is equipped with a flow switch connected to an alarm. Decrease in the water pressure or in the water flow from a set point will activate the alarm, and also will shut off the perlite feed to the furnaces, and subsequently the plant operation.

The tests were conducted under normal plant operation, and in accordance with the

EPA Method 5, outlined in the Federal Register, Vol. 42, No. 160, August 18, 1977; Pages 41776-41782.

RESULTS AND CONCLUSIONS

Results of the three tests are summarized below. Detailed summary of the results are attached to this report.

Test No.	I	II	III	Average
Date	Oct.3, 78	Oct.4, 78	Oct.5, 78	
Process Weight - TPA	5.46	5.55	5.55	5.52
Allowable Emissions(lbs/Hr)*	12.785	12.926	12.926	12.879
Actual Emissions(lbs/Hr)	9.387	10.930	9.693	10.00
Air Flow - Actual CFM	17,990	17,225	17,556	17,590
Isokinetic Variations - %	96.4	97.8	99.4	98.4

* The allowable emissions are based on the Formula:

$E = 4.10 \times P^{0.67}$

E = Emissions (lbs/Hr)
P = Process Weight -(Tons/Hr)

Results of each test indicate that the emissions from the expanders cyclone stack are within the allowable limits and hence in compliance with the Kentucky State Air Pollution Regulations, 401-KAR, 3:060.

Mr. Chris Finley's Inspection Report is also attached. His findings indicate that there were no visible emissions from the stack.

4

DIVISION OF AIR POLLUTION

INSPECTION REPORT

REFERS TO COMPLAINT NO. _ _ _ -- _ _ _ FILE NO. 0190280 _ _ _ _

DATE 10/3/78 TIME am pm to am pm INSPECTION TYPE: S SI (CS) F E C

A. GENERAL:

FACILITY NAME GREFCO Phone _ _ _ (area code)

Location 7125 INDUSTRIAL RD _ _ _ -- _ _ _ _

FLORENCE KY

PERSON CONTACTED DON BLACK Title LAB SUPVR

WEATHER SHOWERS TERRAIN CONDITIONS INDUSTRIAL PARK

B. EQUIPMENT & PROCESS DESCRIPTION

INSULATION BOARD MANUFACTURE

COMPANY'S OWN STACK TEST TEAM

C. CONTROL EQUIPMENT

WET CYCLONE

ALARM SYSTEM

CCYCLONE USED IN PROCESS)

D. FINDINGS

STACK TEST - PARTICULATES

4 TONS/HR OUTPUT → 12 LBS/HR ALLOWABLE EMISSIONS

NO VISIBLE EMISSIONS - STEAM ONLY

REGULATIONS VIOLATED:

E. RECOMMENDED CORRECTIVE ACTION:

2 ADDITIONAL TESTS SCHEDULED FOR 10/4/78

LBS/MIN - PROCESS RATE; 1% = 1 LB.

INVESTIGATOR'S SIGNATURE Title

I hereby acknowledge receipt of a copy of this report and do further acknowledge that I have been apprised of the discrepancies and alleged violations noted during the inspection.

SIGNED Title

F. OFFICE USE ONLY

CC: J. Carrick
J. Lockard
T. Baker
P. Mehta

LOG NO. _ _ _ -- _ _ _

DAP-90

DIVISION OF AIR POLLUTION

INSPECTION REPORT

REFERS TO COMPLAINT NO. ___ ___ ___ -- ___ ___ ___ FILE NO. 0 7 9 0 2 8 0 ___ ___ ___

DATE 10/3/78 TIME am pm to am pm INSPECTION TYPE: S SI (CS) F E C

A. GENERAL:

FACILITY NAME GREFCO Phone ___ ___ ___ (area code)

Location 7125 INDUSTRIAL RD ___ ___ ___ -- ___ ___ ___ ___

FLORENCE KY

PERSON CONTACTED DON BLACK Title LAB SUPVR

WEATHER SHOWERS TERRAIN CONDITIONS INDUSTRIAL PARK

B. EQUIPMENT & PROCESS DESCRIPTION

INSULATION BOARD MANUFACTURE

COMPANY'S OWN STACK TEST TEAM

C. CONTROL EQUIPMENT

WET CYCLONE

ALARM SYSTEM

(CYCLONE USED IN PROCESS)

D. FINDINGS

STACK TEST - PARTICULATES

4 TONS/HR OUTPUT → 12 LBS/HR ALLOWABLE EMISSIONS

NO VISIBLE EMISSIONS - STEAM ONLY

REGULATIONS VIOLATED:

E. RECOMMENDED CORRECTIVE ACTION:

2 ADDITIONAL TESTS SCHEDULED FOR 10/4/78

LBS/MIN - PROCESS RATE; 1% = 1 LB.

INVESTIGATOR'S SIGNATURE [illegible] *Title* [illegible]

I hereby acknowledge receipt of a copy of this report and do further acknowledge that I have been apprised of the discrepancies and alleged violations noted during the inspection.

SIGNED Don Black *Title* Lab Supervisor

F. OFFICE USE ONLY

[illegible] > DIVISION REPS

[illegible]

CC: J. Carcich
J. Lockard
H. Baker
P. Mehta

LOG NO. ___ ___ ___ -- ___ ___ ___

DAP-90

PLANT: FLORENCE "PSRI" BOARD PLANT STACK TESTED: PERLITE EXPANDER CYCLONE (WET) STACK

SUMMARY OF DATA AND RESULTS

		1	2	3	Average
TEST NUMBER					
DATE		Oct. 3,'78	Oct.4,'78	Oct.5,'78	
GAS COMPOSITION CO_2	%	5.2	5.0	4.7	5.0
O_2	%	14.5	14.8	15.2	14.8
N_2	%	80.3	80.3	80.1	80.2
A_n Nozzle Area	Ft^2	0.0003342	0.0007167	0.0007167	-----
A_s Stack Area	Ft^2	9.62	9.62	9.62	9.62
ACFM Air Volume @ Stack Cond.	CF^3/Min.	17,990	17,225	17,556	17,590
C Particulate Conc.	Grain/SCF*	0.08724	0.10597	0.0922	0.09514
dH Pressure Drop Across Orifice	"w.c.	0.284	1.300	1.330	0.971
D_n Nozzle Diameter	In.	0.2475	0.3625	0.3625	------
D_s Stack Diameter	In.	42	42	42	42
E Emission Rate	lbs/hr.	9.387	10.930	9.693	10.00
F_w Mole Fraction Water		0.208	0.208	0.208	0.208
I Isokinetic	%	96.74	97.83	99.40	98.0
M_d Molecular Wt.-Dry	lb/lb mole	29.41	29.39	29.36	29.39
M_s Molecular Wt.-Wet	lb/lb mole	27.038	27.019	26.997	27.02
$\sqrt{P}$ Pitot Reading Sq. Average	"w.c.	0.4943	0.4735	0.4823	0.4834
P_b Barometric Pressure	" Hg	29.96	29.99	29.98	29.98
P_s Stack Pressure Absolute	" Hg	29.97	30.00	29.99	29.99
SCFM (wet) °F & 29.92"Hg	SCF/Min.				
SCFM (dry) 68 °F & 29.92"Hg	FT^3/Min.	12,554	12,033	12,263	12,283
SG Specific Gravity (stack conditions)					
T_m Gas Temp. @ Meter **	°R	530**	530**	530**	530**
T_s Stack gas temp.	°R	600	600	600	600
V_{ic} Condensate	Gms.	225.5	469.5	485.5	393.5
V_m Dry Gas Sampled	Ft^3	40.58	84.04	87.07	69.56
V_s Average Stack Gas Velocity	Ft/Sec.	31.17	29.84	30.42	30.48
V_s " " " "	Ft/Min.	1870	1790	1825	1829
Wt Sample Weight	Grams	0.2290	0.5781	0.5211	0.4427
θ Sampling Time	Minutes	96	96	96	96
K Pitot Coefficient		0.857	0.857	0.857	0.857
Process Weight Rate	lbs./Hr.	10,920	11,100	11,100	11,040
Allowable Emission Rate	lbs./Hr.	12.785	12.926	12.926	12.879
Actual Emission Rate	lbs./Hr.	9.387	10.930	9.693	10.00

** Gas Meter Compensated @ 70°F

* Dry SCF @ 68 °F & 29.92" Hg

EQUIPMENT & TEST PROCEDURE

Western Precipitation Division/Joy Manufacturing Co. (Los Angeles, California) Emission Parameter Analyzer (EPA II) was used for sampling the stack. This EPA sampling train is essentially the same as the one recommended and shown on Page 41777 of Federal Register, Vol. 42, No. 160, August 18, 1977.

Test procedure, equipment, and data sheet to be used were discussed and agreed upon in the meeting held on September 12, 1978 with the Grefco personnel and the members of the Kentucky Division of Air Pollution Control at Frankfort, Kentucky.

The dry gas meter was caliberated against wet test meter before and after the testing by an independent testing laboratory. The dry gas meter was within the tolerance. Their results are attached in the appendix. Each sampling nozzle was accurately measured to the nearest 0.001 inch and the S-type pitot tube was caliberated and its coefficient was determined.

Prior to each test, the equipment was tested for leaks and it was maintained below 0.02 CFM at about 15-20 inches of Hg vacuum. Nominal 0.25" diameter was used for the first test, and later was changed to 3/8" diameter nozzle at the request of Mr. Slucher.

Carbon dioxide and oxygen in the flue gases were determined with the Fyrites. Reagent grade acetone was used for washing sampling nozzle, probe, and particulate contaminated glasswares. All weight, other than that of silica gel were recorded to the nearest 0.1 milligram. The weight of silica gel was recorded to the nearest 0.5 gram. The condensate from each impinger was measured to the nearest 1 ml.

All samplings were done isokinetically. Prior to each test, a complete velocity traverse were taken using caliberated S-type pitot tube. Both, velocity traverse points and particulate traverse points were determined from figure 1-1 of Federal Register, Vol. 42, No. 160, Aug. 18, 1977, Page 41756. A sketch (DWG. NO. FL 384-A-29) showing sampling points location and a sketch (DWG. NO. FL 384-A-26) showing sampling port location are attached.

DISCUSSION:

This report covers the results of three tests conducted on the expander cyclone stack during the Florence Board Plant normal operation.

Water was introduced before and after the furnace exhauster to reduce stack emissions. This technique has been in use to reduce particulate emissions at several Grefco plants and they are in compliance with their respective state air pollution codes.

Several tests taken at the Florence Board Plant since the larger blower installation, including the three tests discussed in this report have indicated that the emissions from the perlite expander stack are lower by about 25% than allowable rate.

It is the writers opinion that excess of water before the blower may show high emissions in a stack test because excess water may cause free droplets, containing particulates to escape through the stack. However, as long as the stack gases are not supersaturated, the emissions from the stack will be lower than allowable rate.

It should be noted that the formula used in calculating the emission rates are the same as given in the Federal Register, Pg. 41776-41782 except the nomenclature and the formats are different.

A P P E N D I X

DATA, CALCULATIONS, AND RESULTS

PRELIMINARY VELOCITY TRAVERSE

PLANT GREFCO, INC.
DATE Oct. 3, 78
LOCATION Florence, KY
STACK I.D. 42"
BAROMETRIC PRESSURE, in. Hg 29.98"
STACK GAUGE PRESSURE, in. H_2O +0.01"
OPERATORS P.A. Mehta & D. Black

RUN NO. 1

Dryer Side

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in.H_2O	STACK TEMPERATURE (T_s), °F
1	0.13	140
2	0.16	
3	0.18	
4	0.19	
5	0.19	
6	0.175	
7	0.17	
8	0.18	
9	0.25	
10	0.27	
11	0.29	
12	0.32	
13	0.37	
14	0.36	
15	0.36	
16	0.33	
AVERAGE		

AVERAGE $\sqrt{p}$ = 0.48826

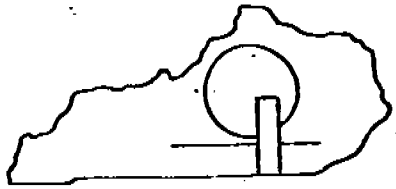
SCHEMATIC OF TRAVERSE POINT LAYOUT

Expander Side

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in.H_2O	STACK TEMPERATURE (T_s), °F
1	0.17	140
2	0.23	
3	0.24	
4	0.28	
5	0.24	
6	0.24	
7	0.25	
8	0.23	
9	0.21	
10	0.23	
11	0.25	
12	0.25	
13	0.30	
14	0.32	
15	0.32	
16	0.27	
AVERAGE		

Ave $\sqrt{p}$ = 0.50043

AVERAGE $\sqrt{\Delta p}$ = 0.49434"



FIELD DATA

Test #1

PLANT Greco - Florence, Ky
DATE 10-3-78
SAMPLING LOCATION EXP CYC
SAMPLE TYPE Particulate
RUN NUMBER 1
OPERATOR PAM E.D. BLOCK
AMBIENT TEMPERATURE 60°F
BAROMETRIC PRESSURE 29.98
STATIC PRESSURE, (P_g) +0.02"
FILTER NUMBER(s) A

PROBE LENGTH AND TYPE 4' - S.S.
NOZZLE I.D. 0.2475
ASSUMED MOISTURE 21%
SAMPLE BOX NUMBER -
METER BOX NUMBER -
METER AH@ ____
C FACTOR 1.1
PROBE HEATER SETTING @ 250°F
HEATER BOX SETTING 250°F
REFERENCE Δp ____

SCHMATIC OF TRAVERSE POINT LAYOUT
READ AND RECORD ALL DATA 3 MINUTES

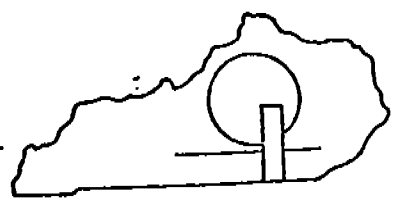
Probe = 250 ± 10

10:25 AM

TRAVERSE POINT NUMBER	SAMPLING Time, min / CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m) ft^3	VELOCITY HEAD (Δp_g), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET (Tm_{in}), °F	DRY GAS METER TEMPERATURE OUTLET (Tm_{out}), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE °F
		2950.0				1	4	6		3	5
1	0	2950	0.16	0.17	0.17	120	65	70	1.5	245	11[illegible]
2	3	295[illegible]1.05	0.21	0.23	0.23	140	60	75	1.5	275	160
3	6	2952.27	0.21	0.23	0.23	140	60	75	1.5	275	170
4	9	2953.46	0.17	0.19	0.19	140	60	75	1.5	275	160
5	12	2954.48	0.17	0.19	0.19	140	60	75	1.5	265	180
6	15	2955.51	0.17	0.19	0.19	140	60	80	1.5	[illegible]	180
7	18	2956.55	0.19	0.21	0.21	140	60	80	2.0	255	180
8	21	2957.71	0.19	0.21	0.21	140	60	85	2.0	255	180
9	24	2958.86	0.22	0.24	0.25	140	60	90	3.0	245	185
10	27	2960.09	0.25	0.275	0.27	140	60	90	3.0	245	185
11	30	2961.39	0.26	0.286	0.287	140	60	95	3.0	245	190
12	33	2962.65	0.30	0.33	0.35	140	60	95	3.5	[illegible]	190
13	36	2964.11	0.32	0.35	0.35	140	60	95	3.5	250	195
14	39	2965.55	0.36	0.396	0.40	140	60	100	[illegible]	255	200
15	42	2967.10	0.37	0.41	0.41	140	60	100	[illegible]	260	205
16	45	2969.18	0.40	0.441	0.45	140	65	100	4.0	260	205
	END 48	2970.23									
			Ave	ΔH =	.274						
			$\sqrt{H}$	0.4911		140°F					

COMMENTS:

2970.23 - 2950 = 20.23 CFM



FIELD DATA

Page No. ____ of ____ Pages

PLANT Florence - Grefco
DATE 10-2-96
SAMPLING LOCATION Exit Pipe Stack
SAMPLE TYPE Particulate
RUN NUMBER 1
OPERATOR P.A. & D.L. BLACK
AMBIENT TEMPERATURE ____
BAROMETRIC PRESSURE 29.96
STATIC PRESSURE, (P_g) +0.02"
FILTER NUMBER(s) A

PROBE LENGTH AND TYPE 4' S-S
NOZZLE I.D. 0.2475"
ASSUMED MOISTURE 21%
SAMPLE BOX NUMBER =
METER BOX NUMBER =
METER AH@ =
C FACTOR 1.1
PROBE HEATER SETTING ____
HEATER BOX SETTING ____
REFERENCE Δp ____

Test #1

SCHMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA 3 MINUTES

Probe: 250 ± 10

TRAVERSE POINT NUMBER	SAMPLING Time, min / CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m) ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE °F
				DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F			
						1	4	6		3	5
1	0	2970.23									
1	0	2970.23	0.08	0.10	0.10	125	70	100	1.0	260	160
2	3	2970.94	0.12	0.13	0.13	140	70	100	1.0	[illegible]	165
3	6	2971.79	0.12	0.13	0.13	140	70	100	1.0	265	170
4	9	2972.68	0.12	0.13	0.13	140	65	100	—	260	175
5	12	2973.58	0.12	0.13	0.13	140	65	100	1.0	260	165
6	15	2974.52	0.13	0.14	0.14	140	65	100	—	260	170
7	18	2975.48	0.13	0.14	0.14	140	65	100	1.5	260	200
8	21	2976.42	0.15	0.185	0.17	140	65	100	1.5	260	200
9	24	2977.42	0.30	0.33	0.33	140	60	100	2.5	255	170
10	27	2978.76	0.36	0.396	0.40	140	60	100	3.5	255	195
11	30	2980.35	0.41	0.45	0.45	140	55	100	4.0	255	195
12	33	2981.92	0.42	0.46	0.46	140	55	100	4.0	255	200
13	36	2983.55	0.44	0.484	0.50	140	55	105	4.0	255	200
14	39	2985.26	0.44	0.485	0.50	140	55	100	4.0	250	195
15	42	2986.90	0.45	0.495	0.50	140	60	105	4.0	250	195
16	45	2988.59	0.46	0.506	0.50	140	60	105	4.0	250	195
	END @ 48	2990.30									
					.294						
		AVG TH	0.4930								

COMMENTS:

Total Volume = 2990.30 − 2950 = 40.3

Corrected Vol = 40.3 × 1.007 = 40.58

PARTICULATE ANALYSIS

LABORATORY DATA SHEET

TEST #1

FACILITY GREFCO, INC.
LOCATION FLORENCE, KY
DATE

SAMPLE ID NUMBER A
TEST TEAM P.A. Mehta & D. Black
ANALYST P.A. Mehta.

FRONT HALF

FILTER TARE WT. A

WEIGHING NO. 1 0.7832 g.
WEIGHING NO. 2 0.7831 g.
WEIGHING NO. 3 0.7834 g.

FILTER FINAL WT.

WEIGHING NO. 1 0.9404 g.
WEIGHING NO. 2 0.9401 g.
WEIGHING NO. 3 0.9403 g.

FILTER NET WT.

FINAL WT. 0.9403 g.
TARE WT. 0.7834 g.
NET WT. 0.1569 g.

BEAKER TARE WT. A

WEIGHING NO. 1 50.4682 g.
WEIGHING NO. 2 50.4680 g.
WEIGHING NO. 3 50.4683 g.

BEAKER FINAL WT.

WEIGHING NO. 1 50.5406 g.
WEIGHING NO. 2 50.5404 g.
WEIGHING NO. 3 50.5404 g.

FRONT WASHINGS NET WT.

FINAL WT. 50.5404 g.
TARE WT. 50.4683 g.
NET WT. 0.0721 g.

VOLUME OF WASHINGS 95 ml.

FILTER NET WT. 0.1569 g.
WASHINGS NET WT. 0.0721 g.

FRONT HALF SUBTOTAL 0.2290 g.

BACK HALF

BEAKER TARE WT.

WEIGHING NO. 1 _____ g.
WEIGHING NO. 2 _____ g.
WEIGHING NO. 3 _____ g.

BEAKER FINAL WT.

WEIGHING NO. 1 _____ g.
WEIGHING NO. 2 _____ g.
WEIGHING NO. 3 _____ g.

BACK WASHINGS NET WT.

FINAL WT. _____ g
TARE WT. _____ g
NET WT. _____ g

VOLUME OF WASHINGS _____ ml.

BACK HALF SUBTOTAL _____ g.

TOTAL PARTICULATE _____ g.

ACETONE BLANK

BEAKER TARE WT.

WEIGHING NO. 1 _____ g.
WEIGHING NO. 2 _____ g.
WEIGHING NO. 3 _____ g.

BEAKER FINAL WT.

WEIGHING NO. 1 _____ g.
WEIGHING NO. 2 _____ g.
WEIGHING NO. 3 _____ g.

VOLUME OF ACETONE BLANK _____ ml.

TOTAL PARTICULATE _____ g.
BLANK CORRECTION _____ g.

CORRECTED TOTAL PARTICULATE _____

MOISTURE

IMPINGERS

FINAL VOLUME 416 g.
INITIAL VOLUME 200 g.
NET VOLUME 216 g.

SILICA GEL

FINAL WEIGHT 259.5 g.
INITIAL WEIGHT 250.0 g.
NET WEIGHT 9.5 g.

TOTAL MOISTURE 225.5 g.

SAMPLING DATA

Date: 10-3-78 Plant: Florence, KY Location: Exp. Cyc. Stack Test no: 1

MOLECULAR WEIGHT:

COMPONENT	1	2	3	Ave.	Mol. Wt.	Mole Frac.
Carbon Dioxide %	5.5	5.0	5.0	5.2	.44	2.288
Oxygen %	14.5	14.5	14.5	14.5	.32	4.640
Carbon Monoxide %	-	-	-	-	.28	-
Nitrogen %	80.0	80.5	80.5	80.3	.28	22.484

Average Molecular Weight - M_d = 29.412 lb.Mol

MOLECULAR WEIGHT OF STACK GASES:

$$M_s = M_d (1-F_w) + 18 \times F_w$$

$$= 29.412 (1 - 0.20805) + 18 \times 0.20805 = 27.038$$

ANALYTICAL DATA:

A. Weight of the particulate collected

Container	Final Weight - Gms	Tare - Gms.	Weight Gained - Gms.
=			

Total Weight - Grams:

B. Weight of Liquid Water Collected:

Container	Final	Initial	Difference
Impinger no.1	255 ml.	100 ml.	155 ml.
Impinger no.2	157 ml.	100 ml.	57 ml.
Impinger no.3	4 ml.	0 ml.	4 ml.
Silica Gel -	259.5 Gms.	250 Gms.	9.5 Gms.

Assuming density of water = 1 gm/cc, Total Weight: 225.5 Grams.

CALCULATIONS

TEST #1

PLANT: Florence, KY STACK Exp. cyc. stack DATE: 10-3-78

METER: V_m = 40.58 Ft^3. P_m = 29.98 in.Hg T_m = 530 ^oR*

STACK: P_b = 29.96 in.Hg P_s = 29.96 in. Hg T_s = 600 ^oR

SAMPLE: θ = 96 Min. Wt = 0.2290 Grams Vic= 225.5 Ml.

M_s= 27.038 A_s = 9.62 Ft^2. A_n = 3.342×10^{-4} Ft^2

F_w FRACTIONAL MOISTURE CONTENT OF THE STACK GAS:-

$$\frac{\frac{Vic}{8164.8}}{\frac{Vic}{8164.8} + \frac{0.0458\ V_m \times P_m}{T_m}}$$

where $P_m = P_{bar} + dH/13.6$

$= 29.98 + \frac{0.284}{13.6}$

$$= \frac{\frac{225.5}{8164.8}}{\frac{225.5}{8164.8} + \frac{0.0458 \times 40.58 \times 29.98}{530}}$$

= 0.20805 Fractional Moisture Conaent

V_s AVERAGE STACK GAS VELOCITY:-

$$85.48 \times (K \times \sqrt{\Delta P_{ave.}}) \times \left(\frac{T_s}{P_s \times M_s}\right)^{1/2}$$

$$= 85.48 \times 0.857 \times 0.494314 \times \left[\frac{600}{29.96 \times 27.038}\right]^{1/2}$$

= 31.167 AVERAGE VELOCITY FEET/SEC. V

ACFM EXHAUST GAS VOLUME @ STACK CONDITIONS:-

$$60 \times V_s \times A_s$$

$= 60 \times 31.167 \times 9.62$

17,990 STACK GAS VOLUME CFM AC

PLANT: Florence, KY. STACK: Expander Cyclone DATE: 10-3-78

$V_{scfm\ (dry)}$ EXHAUST GAS VOLUME @ STANDARD CONDITIONS (68°F & 29.92" Hg) - DRY:-

$$= \frac{ACFM \times (1 - F_w) \times T_{std} \times P_s}{29.92 \times T_s}$$

$$= 17,990 \times (1 - 0.20805) \times \frac{528 \times 29.96}{29.92 \times 600}$$

$$= 12,554$$ SCFM STACK GAS VOLUME - DRY

$V_{m\text{-}std}$ DRY GAS VOLUME SAMPLED @ STANDARD CONDITIONS:-

$$= 0.00006306 \times V_m \times P_m \times T_{std}$$

$$= 0.00006306 \times 40.58 \times 29.98 \times 528$$

$$= 40.507$$ SCF-DRY GAS VOLUME SAMPLED

C_s GRAIN LOADING - GRAINS PER STANDARD CUBIC FEET DRY:-

$$= \frac{15.4321 \times Wt}{V_{m\text{-}std}}$$

$$= \frac{15.4321 \times 0.2290}{40.507}$$

$$= 0.08724$$ GRAINS PER STANDARD FT^3 DRY -

E PARTICULATE EMISSION RATE - POUNDS PER HOUR:-

$$= 0.008571 \times C_s \times V_{scfm\text{-}dry}$$

$$= 0.008571 \times 0.08724 \times 12,554$$

$$= 9.387$$ lb/hr. EMISSION RATE - E

CALCULATIONS

PLANT: Florence, KY STACK: Expander Cyclone DATE: 10-3-78

I ISOKINETIC SAMPLING VARIATION:-

$$= \frac{1.667 \times T_s}{\theta \times V_s \times P_s \times A_n} \times \left[(0.00267 \times Vic) + \frac{(V_m \times P_m)}{T_m}\right]$$

$$= \frac{1.667 \times 600}{96 \times 31.167 \times 29.96 \times 3.342 \times 10^{-4}} \times \left[(0.00267 \times 225.5) + \frac{(40.58 \times 29.98)}{530}\right]$$

= 96.74 PERCENT ISOKINETIC VARIATIC

P PROCESS WEIGHT RATE: 10,920 POUNDS PER HOUR

	ALLOWABLE	ACTUAL
GRAIN LOADINGS - C_s		
EMISSION - Lbs/Hr. - E	12.785	9.387