Background Report Reference

AP-42 Section Number: 12.15

Background Chapter: 4

Reference Number: 17

Title: Inorganic Lead Compliance Emissions Determination of Johnson Controls, Inc., Middletown, Delaware

BCM Engineers

1988

INORGANIC LEAD COMPLIANCE EMISSIONS DETERMINATIONS

of

Process Stack, Process Vent, and Melting Pot Exhaust Stacks Servicing the North and South Oxide Mills

for

JOHNSON CONTROLS INCORPORATED
Middletown, Delaware

May 1988

BCM
Engineers, Planners and Scientists

REPORT

REPORT

FOR

INORGANIC LEAD COMPLIANCE EMISSIONS DETERMINATIONS

OF

PROCESS STACK, PROCESS VENT, AND MELTING POT EXHAUST STACKS

SERVICING THE NORTH AND SOUTH OXIDE MILLS

FOR

JOHNSON CONTROLS INCORPORATED
MIDDLETOWN, DELAWARE

APRIL 1988

BCM PROJECT NO. 00-5945-01

PREPARED BY

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1.0 EXECUTIVE SUMMARY

Johnson Controls, Inc. (Johnson Controls) operates two newly constructed lead oxide manufacturing mills at its facility in Middletown, Delaware. The two mills are referred to as the North and South Mills. Each mill consists of three separate sources: the process stack, process vent, and melting pot. Each process stack and process vent has its own baghouse for the control of particulate inorganic lead emissions, while the melting pots have no emission control system.

Johnson Controls retained BCM Eastern Inc. (BCM) to characterize the lead emissions from two oxide mills. Both the North and South Mills have associated a single-lead feed rate and three separate points of lead emissions. Emissions testing was conducted at each oxide mill on separate days. Emission determinations at each mill included simultaneous testing at the three sources with three test runs performed. EPA Reference Test Method 12 was utilized for inorganic lead emission testing. The table on the following page summarizes the actual lead emission results obtained during the testing program.

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Source	Lead Emissions	
	North Mill (lb/hr)	South Mill (lb/hr)
Process Stack	0.0045	0.0044
Process Vent	0.0009	0.0022
Melting Pot	0.0044	0.0030
Total Emissions	0.0098	0.0096

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2.0 SCOPE AND OBJECTIVES

Sampling was conducted to determine the following parameters at each exhaust:

- Gas flow - acfm and scfm
- Gas temperature - °F
- Gas moisture content - percent by volume
- Gas velocity - fpm
- Inorganic lead emissions - grain/dscf and lb/hr
- Opacity - percent

All field samples were returned to the BCM Laboratory in Norristown, Pennsylvania, for subsequent analyses.

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3.0 PROCEDURES

3.1 FIELD WORK

Field testing at the North Mill was conducted on February 9, 1988, and at the South Mill on February 18, 1988. The BCM sampling team consisted of the following personnel:

Philip C. Burg - Scientist
William J. Kesack - Engineer
Thomas Bernstiel - Scientist
Nick Charno - Technician
Chris Hewitt - Technician
Daniel Petrovay - Technician

Mr. Thomas Brossman acted as liaison between Johnson Controls and BCM, ensuring that the processes were operating normally during the testing periods.

Mr. Charles Krick and Ali Mirzakhalili of the Delaware Department of Natural Resources and Environmental Control witnessed the testing program and process operating conditions.

The following methods of sampling were employed in the test program:

- Sampling and traverse locations were determined in accordance with Method 1 of the Federal Register, Volume 42, No. 160, August 18, 1977, which is outlined in Appendix A.

- Gas flow, gas temperature, and static pressure measurements were made in accordance with Method 2 of the Federal Register, Volume 42, No. 160, August 18, 1977, which is outlined in Appendix A.

- Excess air and molecular weight determinations were made in accordance with Method 3 (with the exception that a Fyrite was used instead of an Orsat) of the Federal Register, Volume 42, No. 160, August 18, 1977, which is outlined in Appendix A.

- Moisture content sampling was conducted in accordance with Method 4 of the Federal Register, Volume 42, No. 160, August 18, 1977, which is outlined in Appendix A.

- Inorganic lead sampling was conducted in accordance with Method 12 of the Federal Register, Volume 47, No. 74, April 16, 1982, which is outlined in Appendix A.

- Opacity readings were conducted in accordance with Method 9 of the Federal Register, Volume 42, No. 160, August 18, 1977.

3.2 EQUIPMENT CALIBRATION

In accordance with the accepted procedures published by the EPA, all gas velocity measuring equipment, volume metering equipment, temperature measuring equipment, and flow rate equipment had been calibrated prior to and after the test date. Calibration data are included in Appendix D.

3.3 ANALYTICAL METHODS

All samples generated during the sampling program were analyzed at the BCM Laboratory in Norristown, Pennsylvania. An outline of the analytical methodologies is contained in Appendix B. Laboratory data are summarized in Appendix B, Table B-1. A copy of the complete laboratory report is contained at the end of Appendix B.

3.4 CALCULATIONS

All moisture content, gas flow, molecular weight, and inorganic lead emission calculations were determined using a computer. Raw data generated from the field sampling program and the results of the laboratory analyses were introduced into equations presented in Methods 2, 3, 4, and 12, of the Federal Register, Volume 42, No. 160, August 18, 1977, as amended.

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4.0 SUMMARY OF RESULTS

4.1 GAS FLOW RATE DATA

Gas flow rate data obtained by averaging results of the three test runs performed at each source are contained in Table 1. Complete gas flow rate results for each individual test run appear on the computer print-outs in Appendix B.

4.2 INORGANIC LEAD TESTING RESULTS

Inorganic lead emission results for each test run, for the North Mill and South Mill systems are contained in Tables 2 and 3, respectively. Emission concentratins of inorganic lead for both mills are contained in Table 4.

4.3 PROCESS DATA

The lead feed rates for each system were recorded as hourly lb/hr averages. The sampling times were used to determine the lead feed rates corresponding with each test. Listed in Table 5 are the average lead feed rates for each mill, as supplied by Johnson Controls.

4.4 OPACITY OBSERVATIONS

Opacity observations were conducted during the particulate testing on each source. No visible emissions were observed from any source. Visible emissions observation forms covering each period are included in Appendix A with the field data sheets.

The BCM visible emissions evaluator was EPA-certified in accordance with EPA Method 9. A copy of the Visible Emissions Evaluator certificate is included in Appendix E.

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TABLE 1

GAS FLOW RATE DATA*

Mill	Source	Gas Temperature (°F)	Moisture Content (%)	Gas Velocity (fpm)	Gas Flow (acfm)	Gas Flow (scfm)
North	Process Stack	185	1.6	4546.7	5579	4541
South	Process Stack	192	0.4	4677.1	5739	4674
North	Process Vent	78	1.3	1327.8	401	393
South	Process Vent	80	1.3	1365.2	412	402
North	Melting Pot	119	0.9	866.1	1063	968
South	Melting Pot	113	1.0	1581.7	1943	1782

*All results are averages of the three test runs

were permitted separately, one passed, one didn't, but if had been taken together, would have passed both

total scfm 12760

North - 5902

South - 6858

.0038 + 0.0060 = 0.0098

weighted average.

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TABLE 2

ACTUAL INORGANIC LEAD EMISSION RATES
NORTH MILL

Source	Inorganic Lead Emissions (lb/hr) Run No. 1	Run No. 2	Run No. 3	Average
Process Stack	0.0055	0.0045	0.0035	0.0045
Process Vent	0.0009	0.0007	0.0011	0.0009
Melting Pot	0.0033	0.0054	0.0046	0.0044
Total Emissions → lbs/Ton	0.0097 0.0081	0.0106 0.0088	0.0092 0.0077	0.0098 0.0082

Avg. Tons lead/hr
= 1.2007

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TABLE 3

ACTUAL INORGANIC LEAD EMISSION RATES
SOUTH MILL

Source	Inorganic Lead Emissions (lb/hr) Run No. 1	Run No. 2	Run No. 3	Average
Process Stack	0.0075	0.0036	0.0020	0.0044
Process Vent	0.0022	0.0027	0.0017	0.0022
Melting Pot	0.0047	0.0029	0.0014	0.0030
Total Emissions	0.0144	0.0092	0.0051	0.0096
lbs / Ton	0.0169	0.0108	0.0060	0.0112

Avg. Tons lead/hr
= 0.8539

Permitted Separately - See 114 Addendum 3

TABLE 4

INORGANIC LEAD EMISSION CONCENTRATIONS

Mill	Source	Inorganic Lead Emissions (grains/dscf) Run No. 1	Run No. 2	Run No. 3	Average
North	Process Stack	0.0001	0.0001	0.0001	0.0001
North	Process Vent	0.0003	0.0002	0.0004	0.0003
North	Melting Pot	0.0004	0.0006	0.0006	0.0005
South	Process Stack	0.0002	0.0001	0.0001	0.0001
South	Process Vent	0.0006	0.0008	0.0005	0.0006
South	Melting Pot	0.0003	0.0002	0.0001	0.0002

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TABLE 5

PROCESS DATA

North Mill		South Mill	
Time	Average Lead Feed Rate (lb/hr)	Time	Average Lead Feed Rate (lb/hr)
1200-1300	2162	1000-1100	1777
1300-1400	2352	1100-1200	1675
1400-1500	2468	1200-1300	1718
1500-1600	2906	1300-1400	1697
1600-1700	2468	1400-1500	1715
1700-1800	2505	1500-1600	1864
1800-1900	2370	1600-1700	1551
1900-2000	2538	1700-1800	1780
2000-2100	2260	1800-1900	1594
2100-2200	1984		

ave. = 2401.3 lb/hr. 1707.8889 lbs/hr.

1.20065 Tons/hr. 0.8539444 Tons/hr.

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5.0 DISCUSSION OF RESULTS

Field testing at both mills went well with few problems. All isokinetic variations and leak checks were within allowable limits. One problem encountered at the North melting pot stack caused by an obstruction resulted in two traverse points being missed. The missed points were made up by sampling longer at a previous point. Gas flow traverses conducted across the two diameters of the stack, however, show gas flow in the stack as very laminar. In addition, the source of lead emissions was 16 feet (13.7 duct diameters) downstream from the sampling ports. This would allow good mixing of the exhaust gases prior to the point of sampling. Therefore, BCM believes that the missed traverse points had no effect on the North melting pot lead emission results.

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APPENDIX A

FIELD SAMPLING PROGRAM

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APPENDIX A

FIELD SAMPLING PROGRAM

1.0 SAMPLING PROCEDURES

1.1 Test Station and Traverse Locations

The location of the sampling station and traverse points is critical to project performance. An explanation of the sampling points and stack dimensions for each source are shown in Table A-1.

1.2 Gas Flow and Gas Temperature Determinations

The gas flow rate and temperature profile at each source was measured by conducting a simultaneous velocity and temperature traverse. Gas velocity heads were measured with a standard type pitot tube that was connected to an inclined manometer. A Chromel-Alumel thermocouple connected to a potentiometer was used to determine gas temperature.

1.3 Moisture Content

Sampling methods employed the principles presented in EPA Method 4, and concurrently with lead sampling. Parameters evaluated in order to determine the gas stream's moisture content were sample gas volume, sample gas temperature, sample gas pressure, impinger moisture gain, and silica gel moisture gain. Some minor modifications were made to the Method 4 train to allow concurrent lead and moisture content sampling. These modifications did not deviate from sampling principles. Such modifications were incorporated as the substitution of a glass fiber filter for Pyrex wool as a filtering medium, and the substitution of a calibrated orifice for a rotameter as a flow metering device.

1.4 Molecular Weight Determinations

A Fyrite gas analyzer was used to determine the molecular weight of the exhaust gas at each source. The following parameters were measured in order to calculate molecular weight: volume percent carbon dioxide (CO_2), volume percent oxygen O_2, and volume percent nitrogen (N_2), determined by difference. All sources exhausted ambient air; therefore, there was no carbon monoxide present.

TABLE A-1

TEST LOCATION INFORMATION

Source	Duct ID or Dimensions (in)	Stack Diameters From Nearest Flow Disturbance Upstream	Stack Diameters From Nearest Flow Disturbance Downstream	Sample Ports	Total Sample* Points
North Process Stack	15	12	8	2	12
South Process Stack	15	12	8	2	12
North Process Vent	6.0 x 7.25	2.0	5.5	4	20
South Process Vent	6.0 x 7.25	2.5	6.7	4	20
North Melting Pot	15	2.8	13.7	2	12
South Melting Pot	15	2.8	13.7	2	12

*In accordance with EPA Method 1, amended September 30, 1983 (48 FR191)

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1.5 Inorganic Lead Sampling

All sampling procedures and sampling equipment employed were those outlined in Method 12 of the Federal Register, Volume 47, No. 74, April 16, 1982.

The nozzle size required to maintain isokinetic sampling was calculated from the results of the previously completed velocity and temperature traverses. The sampling train used a glass-lined stainless steel probe that was heated to 250 degrees Farenheit by an internal heating element. A nozzle of the calculated size was attached to the end of the probe, which was inserted into the stack. A standard type pitot tube and a Chromel-Alumel thermocouple were clamped to the in order to monitor the velocity head and the temperature at the traverse points during the sampling period. Sampled gas passed through the nozzle and probe to a glass fiber filter for the removal of the suspended particulates and inorganic lead. The filter was housed in a heated chamber with a temperature maintained at 250 degrees Farenheit. From the filter, the stack gas passed through a heated Teflon sampling line to the impinger train. The first two impingers each contained 150 ml of 0.1 N nitric acid (HNO_3). The third impinger contained no reagents and was a knockout impinger. The fourth impinger contained approximately 200 grams of coarse silica gel, which collected any moisture and/or vapors that were not captured in the preceeding impingers.

The second impinger was a 500-ml Greenburg-Smith impinger; the first, third, and fourth were 500-ml impingers of the Greenburg-Smith design, modified by replacing the tip with a 1/2-inch I.D. glass tube. It should be noted that the impinger train was monitored during the entire test period to prevent the exit gas temperature from exceeding 70 degrees Farenheit.

From the impinger train, the gas was conducted through an umbilical cord to the control console, a Model 2343 RAC Staksampler that contained the following pieces of equipment (listed in the order in which sampled gas passed through them): a main valve, a bypass valve for flow adjustment, an airtight vacuum pump, a dry gas meter, and a calibrated orifice. The orifice was equipped with pressure taps that were connected across the inclined manometer used to ensure that isokinetic conditions were being maintained. A schematic diagram of the EPA Method 12 sampling train is depicted at the end of this appendix.

The sampling train was subjected to a leak check prior to and after each sample run. The inlet of the nozzle was plugged, and the pump vacuum was held at the highest vacuum attained during the testing period. In all cases, the leakage rate was minimal, not exceeding the maximum allowable leakage rate of 0.02 cfm.

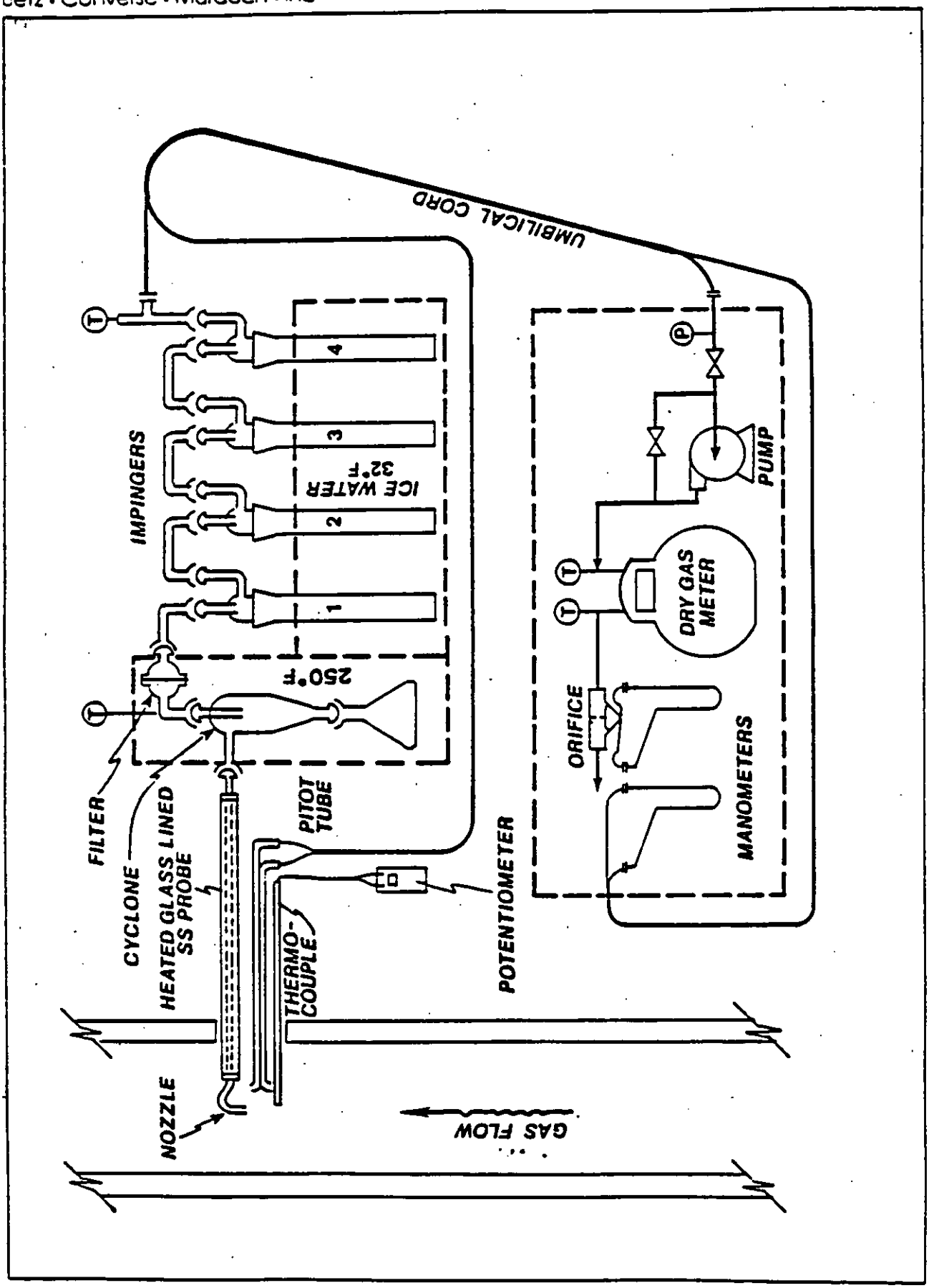
Upon completion of a test, the soiled glass fiber filter was removed from its filter holder and placed in a petri dish that was subsequently sealed. The probe nozzle and heated sample line were washed internally with 0.1 N HNO_3; the residual matter remaining in the probes and heated sample line was removed with a nylon brush attached to a polyethylene line. The front half of the glass filter holder was rinsed with 0.1 N HNO_3, and the washings obtained were added to those collected from the nozzle and probe. All washings were stored in sealed amber glass bottles for transfer to the laboratory. The silica gel used in the fourth impinger was removed and stored in a sealed sample bottle. The contents of the first, second, and third impingers were combined and measured volumetrically. The impingers were then rinsed with 0.1 N HNO_3 and added to the impinger solution.

The preceeding sampling methodologies are as outlined in EPA Method 12, with the exception that standard pitots were used instead of "S"- type pitots. Due to the relatively small duct sizes, considerable flow disturbance was created by the sampling probe when inserted into the ducts. Using standard pitots enabled velocity pressures of the stack gas to be measured approximately 6 inches upstream from the sampling probe, where flow disturbance effects caused by the probes were not as great.

The only other modification to the method was the use of a heated Teflon sample line between the heated filter and impinger train. This did not, however, deviate from general sampling procedures.

2.0 FIELD DATA SHEETS

The field data sheets for the inorganic lead testing and the opacity observations follow.



EPA METHOD 12

BCM

Plymouth Meeting
Pennsylvania 19462
Phone: (215) 825-3800
TWX: 510-660-8034

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Johnson Controls

ADDRESS:

STATE: Del | ZIP: | TELEPHONE:

SOURCE ID NUMBER: Process Stack | OBSERVATION DATE:

PROCESS: South System | OPERATING MODE:

CONTROL EQUIPMENT: | OPERATING MODE:

DESCRIBE EMISSION POINT: ~1' Diameter Circular Stack w/ common top

HEIGHT ABOVE GROUND LEVEL: ~60' | HEIGHT RELATIVE TO OBSERVER: ~12'

DISTANCE FROM OBSERVER: ~35' | DIRECTION FROM OBSERVER: E

DESCRIBE EMISSIONS:

EMISSION COLOR: | PLUME TYPE ☐ INTERMITTENT ☐ CONTINUOUS ☐ FUGITIVE ☐

WATER DROPLETS PRESENT: NO ☒ YES ☐ | IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐

AT WHAT POINT WAS OPACITY DETERMINED:

DESCRIBE BACKGROUND: Building, Sky

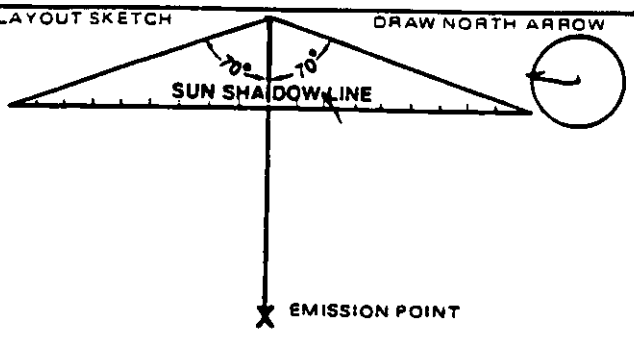
BACKGROUND COLOR: Sky, Blue | SKY CONDITIONS: 4/8 clouds

WIND SPEED: | WIND DIRECTION: out of the North

AMBIENT TEMPERATURE: 50's | RELATIVE HUMIDITY:

COMMENTS:

SOURCE LAYOUT SKETCH



OBSERVER'S SIGNATURE: | DATE: 2-18-88

VERIFIED BY:

OBSERVER'S NAME (PRINT): Christopher T. Hewitt

ORGANIZATION: BCM

CERTIFIED BY: GTA | DATE: 2/18-88

START TIME: 1024 | STOP TIME: 1124

	0	15	30	45		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
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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
25	0	0	0	0	55	0	0	0	0
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
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR FOR HIGHEST PERIOD: 0 | NUMBER OF READINGS ABOVE: 0 % WERE

RANGE OF OPACITY READINGS: 0 MINIMUM 0 MAXIMUM

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.

SIGNATURE:

TITLE: | DATE:

BCM

Plymouth Meeting
Pennsylvania 19462
Phone: (215) 825-3800
TWX: 510-660-8034

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Johnson Controls INC

ADDRESS: Middle town

STATE: Del | ZIP: | TELEPHONE:

SOURCE ID NUMBER: South System | OBSERVATION DATE: 2-18-88

PROCESS: Process stack | OPERATING MODE:

CONTROL EQUIPMENT: | OPERATING MODE:

DESCRIBE EMISSION POINT:

HEIGHT ABOVE GROUND LEVEL: | HEIGHT RELATIVE TO OBSERVER:

DISTANCE FROM OBSERVER: | DIRECTION FROM OBSERVER:

DESCRIBE EMISSIONS:

EMISSION COLOR: Clear Air | PLUME TYPE ☐ INTERMITTENT ☐ CONTINUOUS ☐ FUGITIVE ☐

WATER DROPLETS PRESENT: NO ☒ YES ☐ | IF YES, IS PLUME ATTACHED ☐ DETACHED ☐

AT WHAT POINT WAS OPACITY DETERMINED:

DESCRIBE BACKGROUND: Sky

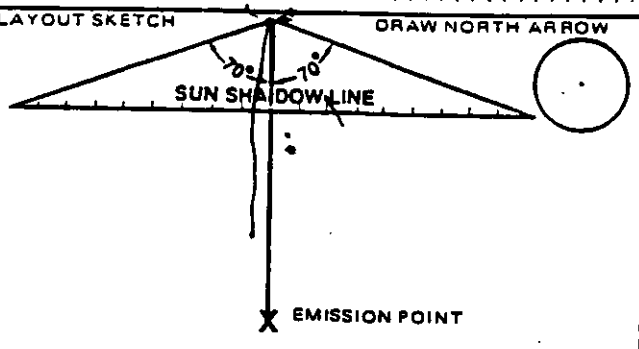
BACKGROUND COLOR: light Sky Blue | SKY CONDITIONS: Sunny High Alt clouds / blue

WIND SPEED: 3-5 | WIND DIRECTION: out of North

AMBIENT TEMPERATURE: 40s | RELATIVE HUMIDITY:

COMMENTS:

SOURCE LAYOUT SKETCH



OBSERVER'S NAME (PRINT): Christopher T. Hewitt

ORGANIZATION: BCM

CERTIFIED BY: ETA | DATE: 10-13-87

START TIME: 1622 | STOP TIME

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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
5	0	0	0	0	35	0	0	0	0
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14	0	0	0	0	44	0	0	0	0
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23	0	0	0	0	53	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
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR FOR HIGHEST PERIOD:

NUMBER OF READINGS ABOVE: % WERE

RANGE OF OPACITY READINGS: MINIMUM MAXIMUM

OBSERVER'S SIGNATURE: Chris Hewitt | DATE: 2-18-88

VERIFIED BY:

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.

SIGNATURE

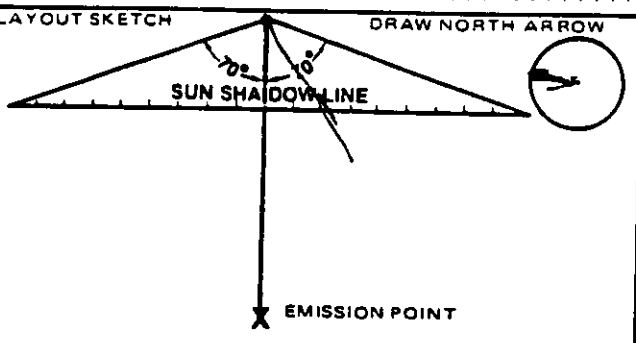
TITLE | DATE

BCM
Plymouth Meeting
Pennsylvania 19462
Phone: (215) 825-3800
TWX: 510-660-8034

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Johnson Controls
ADDRESS:
STATE: Del | ZIP: | TELEPHONE:
SOURCE ID NUMBER: South System | OBSERVATION DATE: 2-18-88
PROCESS: process Stack | OPERATING MODE:
CONTROL EQUIPMENT: | OPERATING MODE:
DESCRIBE EMISSION POINT:
HEIGHT ABOVE GROUND LEVEL: | HEIGHT RELATIVE TO OBSERVER:
DISTANCE FROM OBSERVER: | DIRECTION FROM OBSERVER:
DESCRIBE EMISSIONS:
EMISSION COLOR: | PLUME TYPE ☐ CONTINUOUS ☐ INTERMITTENT ☐ FUGITIVE ☐
WATER DROPLETS PRESENT NO ☑ YES ☐ | IF YES, IS PLUME ATTACHED ☐ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED:
DESCRIBE BACKGROUND: Sky
BACKGROUND COLOR: Sky blue | SKY CONDITIONS: HAZY
WIND SPEED: | WIND DIRECTION: NNE
AMBIENT TEMPERATURE: | RELATIVE HUMIDITY:
COMMENTS:

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S SIGNATURE: Chris Hewitt | DATE: 2-18-88
VERIFIED BY:

OBSERVER'S NAME (PRINT): CHRISTOPHER T HEWITT
ORGANIZATION: BCM
CERTIFIED BY: EA | DATE: 10-13-87

START TIME: 1337 | STOP TIME:

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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
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
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
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11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
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15	0	0	0	0	45	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
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR FOR HIGHEST PERIOD: 0
NUMBER OF READINGS ABOVE 0 % WERE
RANGE OF OPACITY READINGS: 0 MINIMUM 0 MAXIMUM

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BCM

Plymouth Meeting
Pennsylvania 19462
Phone: (215) 825-3800
TWX: 510-660-8034

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Johnson Controls Inc

ADDRESS: Middletown B

STATE: Del ~~Vent~~ | ZIP: | TELEPHONE:

SOURCE ID NUMBER: Vent | OBSERVATION DATE: 2-18-88

PROCESS: South System | OPERATING MODE:

CONTROL EQUIPMENT: | OPERATING MODE:

DESCRIBE EMISSION POINT:

HEIGHT ABOVE GROUND LEVEL: 30' | HEIGHT RELATIVE TO OBSERVER: 30'

DISTANCE FROM OBSERVER: 100' | DIRECTION FROM OBSERVER: NW

DESCRIBE EMISSIONS:

EMISSION COLOR: | PLUME TYPE ☐ INTERMITTENT ☐ CONTINUOUS ☐ FUGITIVE ☐

WATER DROPLETS PRESENT NO ☐ YES ☐ | IF YES, IS PLUME ATTACHED ☐ DETACHED ☐

AT WHAT POINT WAS OPACITY DETERMINED:

DESCRIBE BACKGROUND: Building wall

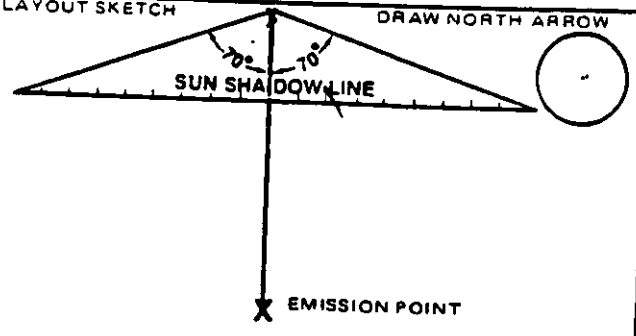
BACKGROUND COLOR: Engine | SKY CONDITIONS: Overcast

WIND SPEED: 5-10 mph variable | WIND DIRECTION: (EBJ) out of the ~~North~~

AMBIENT TEMPERATURE: 90's | RELATIVE HUMIDITY:

COMMENTS:

SOURCE LAYOUT SKETCH



OBSERVER'S NAME (PRINT): Chris Tucker T. Heintz

ORGANIZATION: BCM

CERTIFIED BY: EJT | DATE: Certified 10-5-87 ~~2-18-88~~

START TIME: 1135 | STOP TIME: 1205

	0	15	30	45		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
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
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
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23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
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
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR FOR HIGHEST PERIOD: 0 | NUMBER OF READINGS ABOVE: 0 % WERE

RANGE OF OPACITY READINGS: 0 MINIMUM | 0 MAXIMUM

OBSERVER'S SIGNATURE: | DATE:

VERIFIED BY:

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BCM
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Pennsylvania 19462
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TWX: 510-660-8034

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Johnson Controls

ADDRESS:

STATE: Del | ZIP: | TELEPHONE:

SOURCE ID NUMBER: SouthSystem | OBSERVATION DATE: 2-18-88

PROCESS: Melting Pot | OPERATING MODE:

CONTROL EQUIPMENT: | OPERATING MODE:

DESCRIBE EMISSION POINT:

HEIGHT ABOVE GROUND LEVEL: | HEIGHT RELATIVE TO OBSERVER:

DISTANCE FROM OBSERVER: | DIRECTION FROM OBSERVER:

DESCRIBE EMISSIONS:

EMISSION COLOR: | PLUME TYPE ☐ INTERMITTENT ☐ CONTINUOUS ☐ FUGITIVE ☐

WATER DROPLETS PRESENT NO ☒ YES ☐ | IF YES, IS PLUME ATTACHED ☐ DETACHED ☐

AT WHAT POINT WAS OPACITY DETERMINED:

DESCRIBE BACKGROUND: Building Side

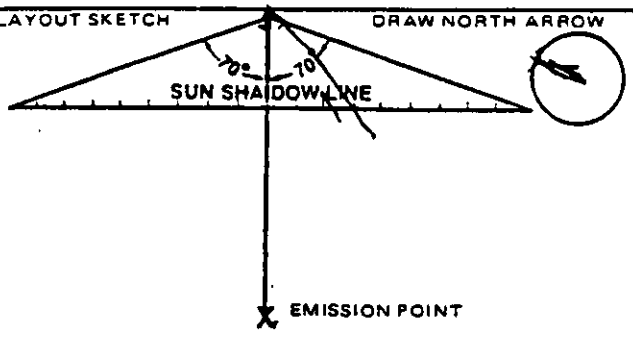
BACKGROUND COLOR: Yellow Grill | SKY CONDITIONS: HAZY

WIND SPEED: | WIND DIRECTION: out of NE

AMBIENT TEMPERATURE: 40's | RELATIVE HUMIDITY:

COMMENTS:

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S SIGNATURE: | DATE:

OBSERVER'S NAME (PRINT): Christopher - Hewitt

ORGANIZATION: BCM

CERTIFIED BY: ETA | DATE: 10-13-87

START TIME: 1337 | STOP TIME:

	0	15	30	45		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
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
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
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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
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21	0	0	0	0	51	0	0	0	0
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24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
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
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR FOR HIGHEST PERIOD: 0 | NUMBER OF READINGS ABOVE: 0 % WERE

RANGE OF OPACITY READINGS: 0 MINIMUM 0 MAXIMUM

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Phone: (215) 825-3800
TWX: 510-660-8034

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Johnson Controls

ADDRESS: Middle town

STATE: Del | ZIP: | TELEPHONE:

SOURCE ID NUMBER: South System | OBSERVATION DATE: 2-18-88

PROCESS: Melting Pot | OPERATING MODE:

CONTROL EQUIPMENT: | OPERATING MODE:

DESCRIBE EMISSION POINT:

HEIGHT ABOVE GROUND LEVEL: | HEIGHT RELATIVE TO OBSERVER:

DISTANCE FROM OBSERVER: | DIRECTION FROM OBSERVER:

DESCRIBE EMISSIONS:

EMISSION COLOR: Clear Air | PLUME TYPE ☐ INTERMITTENT ☐ CONTINUOUS ☐ FUGITIVE ☐

WATER DROPLETS PRESENT NO ☒ YES ☐ | IF YES, IS PLUME ATTACHED ☐ DETACHED ☐

AT WHAT POINT WAS OPACITY DETERMINED:

DESCRIBE BACKGROUND: Building Side

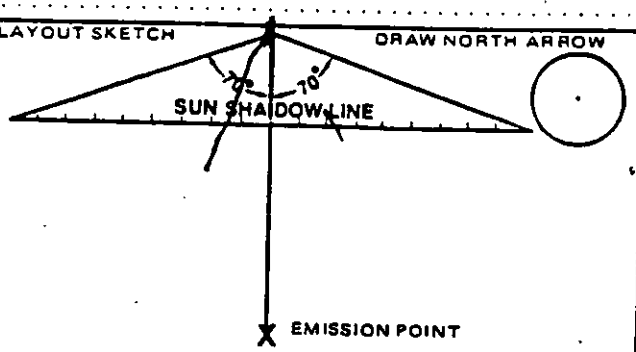
BACKGROUND COLOR: Yellowish Gold | SKY CONDITIONS: High Alt Clouds Sunny blue sky

WIND SPEED: 3-5 | WIND DIRECTION: out of North

AMBIENT TEMPERATURE: 40's | RELATIVE HUMIDITY:

COMMENTS:

SOURCE LAYOUT SKETCH



OBSERVER'S NAME (PRINT): Christopher T Hewett

ORGANIZATION: BCM

CERTIFIED BY: ETA | DATE: 10-13-87

START TIME: 1622 | STOP TIME:

	0	15	30	45		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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6	0	0	0	0	36	0	0	0	0
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
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11	0	0	0	0	41	0	0	0	0
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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
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18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
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25	0	0	0	0	55	0	0	0	0
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
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR FOR HIGHEST PERIOD: | NUMBER OF READINGS ABOVE: % WERE

RANGE OF OPACITY READINGS: MINIMUM | MAXIMUM

OBSERVER'S SIGNATURE: Chris Hewett | DATE: 2-18-88

VERIFIED BY:

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TITLE: | DATE:

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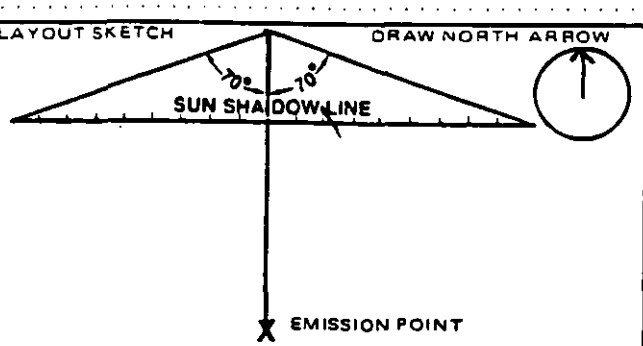
Pennsylvania 19462
Phone: (215) 825-3800
TWX: 510-660-8034

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: JOHNSON CONTROLS INC.
ADDRESS: Middle Town
STATE: Delaware | ZIP: | TELEPHONE:
SOURCE ID NUMBER: Process Vent. "Rect" | OBSERVATION DATE: 2-9-88
PROCESS: North System | OPERATING MODE: Normal
CONTROL EQUIPMENT: Baghouse | OPERATING MODE: Normal
DESCRIBE EMISSION POINT: Vent on side of Building
HEIGHT ABOVE GROUND LEVEL: 4ft. | HEIGHT RELATIVE TO OBSERVER: 4ft
DISTANCE FROM OBSERVER: 20yds | DIRECTION FROM OBSERVER: West
DESCRIBE EMISSIONS: No Emissions
EMISSION COLOR: None | PLUME TYPE: CONTINUOUS ☐ INTERMITTENT ☐ FUGITIVE ☐
WATER DROPLETS PRESENT: NO ☒ YES ☐ | IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED: Vent Exit
DESCRIBE BACKGROUND: Gold Building
BACKGROUND COLOR: Gold | SKY CONDITIONS: 100% overcast
WIND SPEED: 5 To 7 mph | WIND DIRECTION: S.W.
AMBIENT TEMPERATURE: 38° | RELATIVE HUMIDITY: 57%
COMMENTS:

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S NAME (PRINT): Daniel R. Petrovay
ORGANIZATION: BCM Eastern Inc.
CERTIFIED BY: E.T.A. | DATE: Sept. 30, 1987

START TIME: 1601 | STOP TIME: 1631

	0	15	30	45		0	15	30	45
1	0	0	0	0	31				
2	0	0	0	0	32				
3	0	0	0	0	33				
4	0	0	0	0	34				
5	0	0	0	0	35				
6	0	0	0	0	36				
7	0	0	0	0	37				
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26	0	0	0	0	56				
27	0	0	0	0	57				
28	0	0	0	0	58				
29	0	0	0	0	59				
30	0	0	0	0	60				

AVERAGE OPACITY FOR FOR HIGHEST PERIOD: 0
NUMBER OF READINGS ABOVE: 5 % WERE 0
RANGE OF OPACITY READINGS: 0% - MINIMUM | 0% - MAXIMUM

OBSERVER'S SIGNATURE: Daniel R. Petrovay | DATE: 2-9-88
VERIFIED BY:

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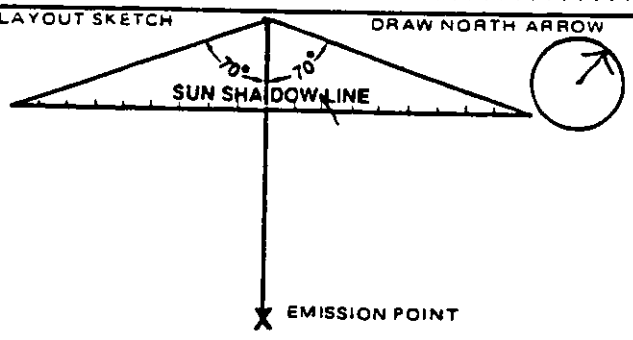
SIGNATURE
TITLE | DATE

BCM
Plymouth Meeting
Pennsylvania 19462
Phone: (215) 825-3800
TWX: 510-660-8034

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: JOHNSON CONTROLS INC.
ADDRESS: BATTERY DIVISION
MIDDLE TOWN
STATE: DELEWARE | ZIP: | TELEPHONE:
SOURCE ID NUMBER: PROCESS STACK "CIRCULAR" | OBSERVATION DATE: 2-9-88
PROCESS: P NORTH SYSTEM | OPERATING MODE: NORMAL
CONTROL EQUIPMENT: BAGHOUSE | OPERATING MODE: NORMAL
DESCRIBE EMISSION POINT: TOP OF STACK
HEIGHT ABOVE GROUND LEVEL: 12 FT. | HEIGHT RELATIVE TO OBSERVER: 7 FT.
DISTANCE FROM OBSERVER: 50 FT. | DIRECTION FROM OBSERVER: S.W.
DESCRIBE EMISSIONS: NO EMISSIONS
EMISSION COLOR: NO COLOR | PLUME TYPE ☐ CONTINUOUS ☐ INTERMITTENT ☐ FUGITIVE ☐
WATER DROPLETS PRESENT NO ☒ YES ☐ | IF YES, IS PLUME ATTACHED ☐ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED: TOP OF STACK
DESCRIBE BACKGROUND: GOLD BUILDING BEHIND STACK
BACKGROUND COLOR: GOLD | SKY CONDITIONS: 100% OVERCAST
WIND SPEED: 5 TO 7 MPH | WIND DIRECTION: S.W.
AMBIENT TEMPERATURE: 36° | RELATIVE HUMIDITY: 59%
COMMENTS:

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S NAME (PRINT): DANIEL R. PETROWAY
ORGANIZATION: BCM EASTERN INC.
CERTIFIED BY: E.T.A. 218752 CERT. NO. | DATE: SEPT. 30, 1987
START TIME: 1710 | STOP TIME: 1740

	0	15	30	45		0	15	30	45
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2	0	0	0	0	32				
3	0	0	0	0	33				
4	0	0	0	0	34				
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6	0	0	0	0	36				
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28	0	0	0	0	58				
29	0	0	0	0	59				
30	0	0	0	0	60				

AVERAGE OPACITY FOR FOR HIGHEST PERIOD: 0
NUMBER OF READINGS ABOVE: 5 % WERE 0
RANGE OF OPACITY READINGS: 0% - MINIMUM 0% - MAXIMUM

OBSERVER'S SIGNATURE: Daniel R. Petroway | DATE: 2-9-88
VERIFIED BY:

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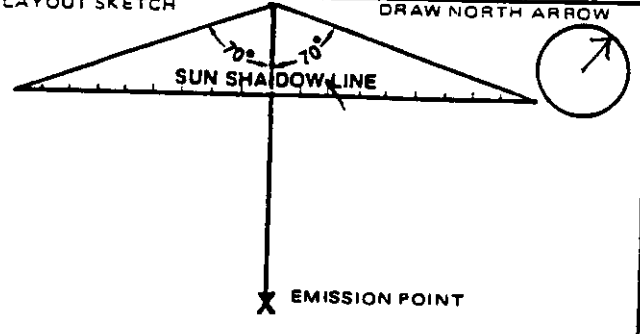
Phone: (215) 825-3800
TWX: 510-660-8034

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: JOHNSON CONTROLS INC
ADDRESS: BATTERY DIVISION
MIDDLETOWN
STATE: DELEWARE
ZIP:
TELEPHONE:
SOURCE ID NUMBER: MELTING POT VENT
OBSERVATION DATE: 2-9-88
PROCESS: LEAD MELTING North System
OPERATING MODE: NORMAL
CONTROL EQUIPMENT: BAGHOUSE
OPERATING MODE: Normal
DESCRIBE EMISSION POINT: TOP OF VENT
HEIGHT ABOVE GROUND LEVEL: 4ft.
HEIGHT RELATIVE TO OBSERVER: 5ft.
DISTANCE FROM OBSERVER: 50 ft.
DIRECTION FROM OBSERVER: S.W
DESCRIBE EMISSIONS: NO Emissions
EMISSION COLOR: No Color
PLUME TYPE: CONTINUOUS ☐ INTERMITTENT ☐ FUGITIVE ☐
WATER DROPLETS PRESENT: NO ☐ YES ☐
IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED: TOP OF VENT
DESCRIBE BACKGROUND: GOLD BUILDING behind VENT
BACKGROUND COLOR: GOLD
SKY CONDITIONS: 100% overcast
WIND SPEED: 5TO 7 mPL
WIND DIRECTION: S.W.
AMBIENT TEMPERATURE: 36O
RELATIVE HUMIDITY: 59%
COMMENTS:

SOURCE LAYOUT SKETCH



OBSERVER'S NAME (PRINT): DANIEL R. PETROWAY
ORGANIZATION: BCM EASTERN INC.
CERTIFIED BY: E.T.A 218752 CERT. NO.
DATE: SEPT. 30, 1987

START TIME: 1710 STOP TIME: 1740

	0	15	30	45		0	15	30	45
1	0	0	0	0	31				
2	0	0	0	0	32				
3	0	0	0	0	33				
4	0	0	0	0	34				
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6	0	0	0	0	36				
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9	0	0	0	0	39				
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26	0	0	0	0	56				
27	0	0	0	0	57				
28	0	0	0	0	58				
29	0	0	0	0	59				
30	0	0	0	0	60				

AVERAGE OPACITY FOR FOR HIGHEST PERIOD: 0
NUMBER OF READINGS ABOVE: 5 % WERE 0
RANGE OF OPACITY READINGS: 0% - MINIMUM 0% - MAXIMUM

OBSERVER'S SIGNATURE: Daniel R. Petroway
DATE: 2-9-88
VERIFIED BY:

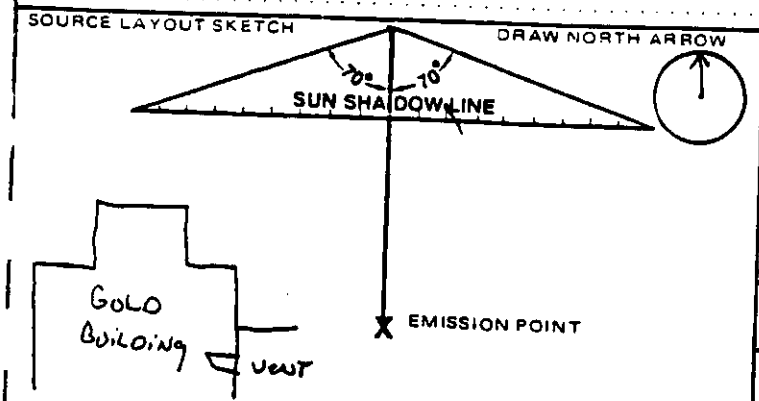
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.
SIGNATURE:
TITLE:
DATE:

BCM
Plymouth Meeting
Pennsylvania 19462
Phone: (215) 825-3800
TWX: 510-660-8034

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: JOHNSON CONTROLS INC.
ADDRESS: BATTERY DIVISION
MIDDLETOWN
STATE: DELE. | ZIP: | TELEPHONE:
SOURCE ID NUMBER: PROCESS VENT RECTANGULAR | OBSERVATION DATE: 2-9-88
PROCESS: NORTH SYSTEM | OPERATING MODE: NORMAL
CONTROL EQUIPMENT: BAGHOUSE | OPERATING MODE: NORMAL
DESCRIBE EMISSION POINT: VENT ON SIDE OF BUILDING
HEIGHT ABOVE GROUND LEVEL: 4FT | HEIGHT RELATIVE TO OBSERVER: 4FT.
DISTANCE FROM OBSERVER: 20 YDS | DIRECTION FROM OBSERVER: WEST
DESCRIBE EMISSIONS: NO EMISSIONS
EMISSION COLOR: NONE | PLUME TYPE ☐ CONTINUOUS ☐ INTERMITTENT ☐ FUGITIVE ☐
WATER DROPLETS PRESENT NO ☒ YES ☐ | IF YES, IS PLUME ATTACHED ☐ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED: VENT EXIT
DESCRIBE BACKGROUND: GOLD BUILDING
BACKGROUND COLOR: GOLD | SKY CONDITIONS: 100% OVERCAST
WIND SPEED: 5TO7 MPH | WIND DIRECTION: S.W.
AMBIENT TEMPERATURE: 36° | RELATIVE HUMIDITY: 59%
COMMENTS:

SOURCE LAYOUT SKETCH



OBSERVER'S NAME (PRINT): DANIEL R. PETROWAY
ORGANIZATION: RCM EASTERN INC.
CERTIFIED BY: E.T.A. | DATE: SEPT. 30, 1987
START TIME: 1741 | STOP TIME: 1756

	0	15	30	45		0	15	30	45
1	0	0	0	0	31				
2	0	0	0	0	32				
3	0	0	0	0	33				
4	0	0	0	0	34				
5	0	0	0	0	35				
6	0	0	0	0	36				
7	0	0	0	0	37				
8	0	0	0	0	38				
9	0	0	0	0	39				
10	0	0	0	0	40				
11	0	0	0	0	41				
12	0	0	0	0	42				
13	0	0	0	0	43				
14	0	0	0	0	44				
15	0	0	0	0	45				
16					46				
17					47				
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				
30					60				

AVERAGE OPACITY FOR FOR HIGHEST PERIOD: 0
NUMBER OF READINGS ABOVE: 5 % WERE 0
RANGE OF OPACITY READINGS: 0 % - MINIMUM | 0 % MAXIMUM

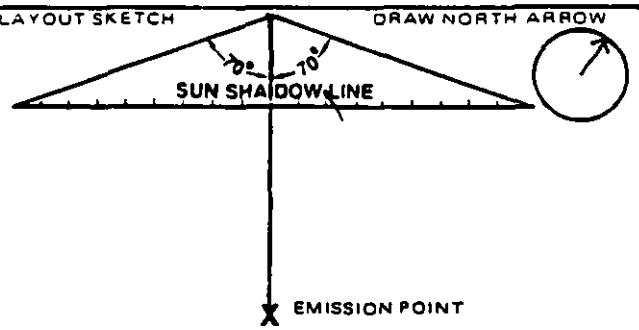
OBSERVER'S SIGNATURE: Daniel R Petroway | DATE: 2-9-88
VERIFIED BY:
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.
SIGNATURE:

DAVIS | Phone: (215) 825-3800
TWX: 510-660-8034

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: JOHNSON CONTROLS INC.
ADDRESS: MIDDLETOWN
STATE: Del. | ZIP: | TELEPHONE:
SOURCE ID NUMBER: Process STACK "Circular" | OBSERVATION DATE: 2-9-88
PROCESS: Lead Melting North System | OPERATING MODE: Normal
CONTROL EQUIPMENT: Baghouse | OPERATING MODE: Normal
DESCRIBE EMISSION POINT: TOP OF STACK
HEIGHT ABOVE GROUND LEVEL: 12 FT. | HEIGHT RELATIVE TO OBSERVER: 7 ft.
DISTANCE FROM OBSERVER: 50 ft. | DIRECTION FROM OBSERVER: S.W
DESCRIBE EMISSIONS: No Emissions
EMISSION COLOR: None | PLUME TYPE: CONTINUOUS ☐ INTERMITTENT ☐ FUGITIVE ☐
WATER DROPLETS PRESENT: NO ☒ YES ☐ | IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED:
DESCRIBE BACKGROUND: Gold Tan Building Behind Stack
BACKGROUND COLOR: Gold Building | SKY CONDITIONS: 100% overcast
WIND SPEED: 5 to 10 MPH | WIND DIRECTION: S.W
AMBIENT TEMPERATURE: 33° | RELATIVE HUMIDITY: 52%
COMMENTS: Run #1

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S NAME (PRINT): Daniel R. Petroway
ORGANIZATION: BCM Eastern Inc.
CERTIFIED BY: E.T.A. | DATE: Sept. 30, 1987

START TIME: 1413 | STOP TIME: 1500

	0	15	30	45		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
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
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				
18	0	0	0	0	48				
19	0	0	0	0	49				
20	0	0	0	0	50				
21	0	0	0	0	51				
22	0	0	0	0	52				
23	0	0	0	0	53				
24	0	0	0	0	54				
25	0	0	0	0	55				
26	0	0	0	0	56				
27	0	0	0	0	57				
28	0	0	0	0	58				
29	0	0	0	0	59				
30	0	0	0	0	60				

AVERAGE OPACITY FOR FOR HIGHEST PERIOD: 0 %
NUMBER OF READINGS ABOVE: 5 % WERE 0
RANGE OF OPACITY READINGS: 0% MINIMUM — 0% MAXIMUM

OBSERVER'S SIGNATURE: Daniel R. Petroway | DATE: 2-9-88
VERIFIED BY:

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.
SIGNATURE:
TITLE: | DATE:

BCM

Plymouth Meeting
Pennsylvania 19462
Phone: (215) 825-3800
TWX: 510-660-8034

VISIBLE EMISSION OBSERVATION FORM

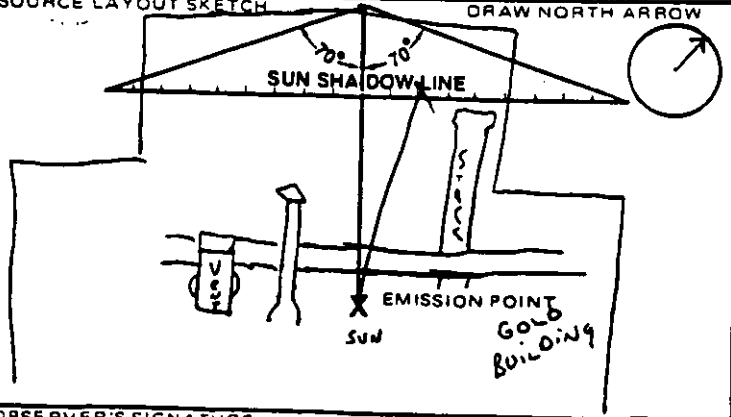
SOURCE NAME: JOHNSON CONTROLS INC.
ADDRESS: MIDDLETOWN
STATE: Del. | ZIP: | TELEPHONE:
SOURCE ID NUMBER: Process STACK "Circular"
OBSERVATION DATE: 2-9-88
PROCESS: Process STACK North System
OPERATING MODE: CONTINUOUS
CONTROL EQUIPMENT: BAGHOUSE
OPERATING MODE: NORMAL
DESCRIBE EMISSION POINT: TOP OF STACK
HEIGHT ABOVE GROUND LEVEL: 12 FT.
HEIGHT RELATIVE TO OBSERVER: 7 FT.
DISTANCE FROM OBSERVER: 50 FT.
DIRECTION FROM OBSERVER: S.W.
DESCRIBE EMISSIONS: NO EMISSIONS
EMISSION COLOR: NONE
PLUME TYPE ☐ INTERMITTENT ☐ CONTINUOUS ☐ FUGITIVE ☐
WATER DROPLETS PRESENT: NO ☒ YES ☐
IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED: TOP OF Process STACK
DESCRIBE BACKGROUND: GOLD TAN Building Behind STACK
BACKGROUND COLOR:
SKY CONDITIONS: 100% OVERCAST
WIND SPEED: 5 TO 7 MPH
WIND DIRECTION: S.E.
AMBIENT TEMPERATURE: 32°
RELATIVE HUMIDITY: 50%
COMMENTS: RUN 1

OBSERVER'S NAME (PRINT): DANIEL PETROWAY
ORGANIZATION: BCM EASTERN INC.
CERTIFIED BY: E.T.A. 218752 CERT. | DATE: SEPT. 30, 1987
START TIME: 1213 | STOP TIME: 1313

	0	15	30	45		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
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
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
25	0	0	0	0	55	0	0	0	0
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
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR FOR HIGHEST PERIOD: 0%
NUMBER OF READINGS ABOVE: 5 % WERE 0
RANGE OF OPACITY READINGS: 0% MINIMUM | 0% MAXIMUM

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S SIGNATURE: Daniel R. Petroway | DATE: 2-9-88
VERIFIED BY:
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.
SIGNATURE:

PLANT Johnson Controls

DATE 2/18/88

SAMPLING LOCATION Melting Pot (South System)

SAMPLE TYPE Mthd 12, lead

RUN NUMBER Three OPERATOR PCB

BAROMETRIC PRESSURE 30.16 STATIC PRESSURE -1.3

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) 0 mL + 8.2 gel

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER

THERMOCOUPLE NUMBER

PROBE NUMBER TYPE

NOZZLE NUMBER I.D. .320

METER BOX NUMBER 125 $\Delta H_@$

PITOT NUMBER C_p .99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE 100

C FACTOR 1.5 REFERENCE Δp 1.25

READ AND RECORD ALL DATA EVERY 5 MINUTES

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			
	00	1623	793.592									
A-6	05	1628	797.6	.14	2.10	2.10	116	91	77	10	250	45
5	10	1633	801.8	.15	2.25	2.25	116	103	79	10	219	45
4	15	1638	806	.16	2.40	2.40	114	95	76	7	216	45
3	20	1643	810.5	.15	2.25	2.25	108	116	86	11	230	46
2	25	1648	814.5	.13	1.95	1.95	115	119	88	11	236	46
1	30	1653	818.285	.12	1.80	1.80	110	120	91	10	240	46
			stop test, change parts.									
	30	1702	818.285									
B-6	35	1707	822.1	.12	1.80	1.80	113	98	91	8	247	46
5	40	1712	826.2	.14	2.10	2.10	113	111	90	10	255	48
4	45	1718	830.5	.15	2.25	2.25	111	116	91	11	254	49
3	50	1722	834.5	.14	2.10	2.10	114	119	93	10	255	50
2	55	1727	838.9	.15	2.25	2.25	114	120	94	11	253	50
1	60	1732	843.145	.14	2.10	2.10	113	122	95	9	252	
			backflush at 15 "Hg = .005 cfm									
			V_m = 49.553	$\overline{\sqrt{\Delta p}}$ = .375	$\overline{\Delta H}$ = 2.113		$\overline{T_s}$ = 113.1	$\overline{T_M}$ = 99.2				

PLANT Johnson Controls

DATE 2-18-84

SAMPLING LOCATION Melting Pot (South System)

SAMPLE TYPE Lead, Method 12

RUN NUMBER 2 OPERATOR PCB

BAROMETRIC PRESSURE 30.16 STATIC PRESSURE -1.3

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) 0 ml + 12.4 gel

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER

THERMOCOUPLE NUMBER

PROBE NUMBER TYPE

NOZZLE NUMBER I.D. 0.320

METER BOX NUMBER 25 $\Delta H_@$

PITOT NUMBER ~~1.25~~ C_p

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE 100

C FACTOR 1.5 REFERENCE Δp 1.25

READ AND RECORD ALL DATA EVERY 5 MINUTES

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			
	00	1340	741.490									
B-6	05	1345	745.5	.14	2.10	2.10	118	73	70	8	226	60
5	10	1350	749.7	.15	2.25	2.25	116	91	71	9	235	60
4	15	1355	754.0	.16	2.40	2.40	111	106	75	9	241	58
3	20	1400	758.4	.15	2.25	2.25	113	109	77	9	241	58
2	25	1405	762.5	.17	2.60	2.60	107	114	32	9	244	60
1	30	1410	766.955	.16	2.40	2.40	114	116	85	9	246	62
			Stop test	change ports								
	30	1422	766.955									
A-6	35	1427	770	.14	2.10	2.10	115	91	85	8	259	59
5	40	1432	775.4	.16	2.40	2.40	118	106	85	9	258	60
4	45	1437	779.0	.17	2.60	2.60	111	113	87	9	255	60
3	50	1442	784.1	.14	2.10	2.10	112	116	89	8	257	62
2	55	1447	789	.15	2.25	2.25	111	117	90	9	257	64
1	60	1452	792.662	.15	2.25	2.25	105	119	93	9	256	64
				leak check at .15" 14_g = .0025 cfm								
			V_m = 51.172	$\overline{\sqrt{\Delta p}}$ = .391	$\overline{\Delta H}$ = 2.308		$\overline{T_s}$ = 112.6	$\overline{T_M}$ = 94.2				

PLANT Johnson Controls

DATE 2/18/88

SAMPLING LOCATION Melting Pot (South System)

SAMPLE TYPE Mthd 12, lead

RUN NUMBER one OPERATOR RCB

BAROMETRIC PRESSURE 30.20 STATIC PRESSURE -1.4

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) - 0 ml H_2O + 10.2 g gel

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER

THERMOCOUPLE NUMBER

PROBE NUMBER TYPE

NOZZLE NUMBER I.D. .320

METER BOX NUMBER 125 $\Delta H_@$

PITOT NUMBER C_p

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE 100

C FACTOR 1.55 REFERENCE Δp 1.25

READ AND RECORD ALL DATA EVERY 5 MINUTES

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			
	00	1017	689.625									
A-6	05	1022	693.8	.15	2.25	2.25	108	73	65	9	249	58
5	10	1027	698.0	.16	2.40	2.40	110	93	67	9	242	60
4	15	1032	702.3	.16	2.40	2.40	113	105	72	9	233	60
3	20	1037	706.7	.15	2.25	2.25	111	111	75	9	228	60
2	25	1042	711.0	.13	2.00	2.00	110	112	79	8	226	64
1	30	1047	714.330	.10	1.50	1.50	108	116	83	7	226	64
				stop test, change ports								
	30	1102	714.330									
B-6	35	1107	718	.15	2.25	2.25	107	88	81	9	232	62
5	40	1112	723	.15	2.25	2.25	116	103	81	9	230	62
4	45	1117	727.1	.15	2.25	2.25	116	111	83	9	229	64
3	50	1122	731	.17	2.60	2.60	113	117	86	10	227	64
2	55	1127	736.0	.16	2.40	2.40	116	120	88	10	226	64
1	60	1132	740.130	.14	2.10	2.10	115	121	90	8	225	66
				leak check at 20" Hg = .005 cfm								
			Vm = 50.505	$\overline{\sqrt{\Delta p}}$ = .383	$\overline{\Delta H}$ = 2.221		$\overline{T_s}$ = 1119	$\overline{T_m}$ = 92.7				

PLANT Johnson Control DATE 2-18-88 RUN NUMBER 3 Process Vent (South System)

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			
	45 / 1710	874.414									
D-1	49 / 1719	876.7	0.10	1.55	1.55	82	109	95	5	250	49
D-2	51 / 1722	879.0	0.11	1.7	1.7	82	111	95	5	250	49
D-3	54 / 1725	881.4	0.12	1.85	1.85	82	112	96	5	250	49
D-4	57 / 1728	883.7	0.12	1.95	1.85	82	113	96	5	250	49
D-5	60 / 1731	885.958	0.11	1.70	1.70	82	113	97	5	250	50
	Leak check = 0.015 @ 8 in Hg										
		V_m = 45.905	$\overline{\sqrt{\Delta P}}$ = .331	$\overline{\Delta H}$ = 1.700		$\overline{T_s}$ = 81.9	$\overline{T_{m\,in}}$ =	98.4			

PLANT Johnson Controls

DATE 2-18

SAMPLING LOCATION Process Vent (South System)

SAMPLE TYPE Lead Method 12

RUN NUMBER 3 OPERATOR WJK

BAROMETRIC PRESSURE 30.19 STATIC PRESSURE +0.32

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) -5ml H_2O +12.9 gel

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER Omega HH-51

THERMOCOUPLE NUMBER 3

PROBE NUMBER 3-1 TYPE glass

NOZZLE NUMBER I.D. 8.322

METER BOX NUMBER 4 $\Delta H_@$ 1.72

PITOT NUMBER 3-Std C_p 0.99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE 100

C FACTOR 1.4 REFERENCE Δp 0.12

READ AND RECORD ALL DATA EVERY _____ MINUTES

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			
	00	1625	840.053									
A-1	03	1628	842.6	0.11	1.70	1.70	81	82	82	5	240	38
A-2	06	1631	844.7	0.11	1.70	1.70	81	89	83	5	250	44
A-3	09	1634	847.1	0.11	1.70	1.70	82	94	84	5	250	42
A-4	12	1637	849.2	0.10	1.55	1.55	82	100	85	5	250	43
A-5	15	1640	851.417	0.10	1.55	1.55	82	104	86	5	250	44
	15	1642	851.417									
B-1	18	1645	853.6	0.10	1.55	1.55	82	103	87	5	250	45
B-2	21	1648	856.0	0.11	1.7	1.7	82	107	88	5	250	46
B-3	24	1651	858.2	0.11	1.7	1.7	82	109	89	5	250	46
B-4	27	1654	860.5	0.10	1.55	1.55	82	110	90	5	250	47
B-5	30	1657	862.768	0.11	1.7	1.7	82	112	91	5	250	48
	30	1659	862.768									
C-1	33	1702	865.1	0.12	1.85	1.85	82	108	92	5	250	48
C-2	36	1705	867.4	0.11	1.7	1.7	82	110	93	5	250	48
C-3	39	1708	869.9	0.11	1.7	1.7	82	111	93	5	250	48
C-4	42	1711	872.0	0.12	1.85	1.85	82	113	94	5	250	48
C-5	45	1714	874.414	0.12	1.85	1.85	82	114	95	5	250	48

PLANT Johnson Controls DATE 2-18-88 RUN NUMBER 2 Process Vent (South System)

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			
	45	1428	827.922									
A-1	48	1431	830.2	0.11	1.70	1.70	82	107	92	5	250	65
A-2	51	1434	832.5	0.11	1.70	1.70	82	109	93	5	250	65
A-3	54	1437	834.7	0.10	1.55	1.55	82	111	93	5	250	66
A-4	57	1440	837.0	0.10	1.55	1.55	82	113	94	5	250	66
A-5	60	1443	839.250	0.11	1.7	1.7	82	113	95	5	250	66
	Leak check =		cfm	@11	in Hg							
			V_m = 46.720	$\overline{\sqrt{\Delta p}}$ = .342	$\overline{\Delta H}$ = 1.82		$\overline{T_s}$ = 81.4	$\overline{T_m}$ =	93.7			

PLANT Johnson Controls

DATE 2-18-98

SAMPLING LOCATION Lead Method 12

SAMPLE TYPE Process Vent (South System)

RUN NUMBER 2 OPERATOR WJK

BAROMETRIC PRESSURE 30.16 STATIC PRESSURE +0.33

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) +0 + 11.5 gel

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER Omega HH-57

THERMOCOUPLE NUMBER 3

PROBE NUMBER 3-1 TYPE glass

NOZZLE NUMBER I.D. 0.322

METER BOX NUMBER 4 $\Delta H_@$ 1.72

PITOT NUMBER std C_p 0.99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE 100

C FACTOR 1.4 REFERENCE Δp 0.12

READ AND RECORD ALL DATA EVERY 3 MINUTES

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			
	00	1357	792.530									
D-1	03	1340	795.1	0.15	2.35	2.35	80	76	76	7	250	50
D-2	06	1343	797.8	0.15	2.35	2.35	79	80	77	7	250	52
D-3	09	1346	800.2	0.14	2.15	2.15	80	87	77	7	250	50
D-4	12	1349	802.7	0.15	2.35	2.35	81	93	79	7	250	50
D-5	15	1352	805.148	0.13	2.0	2.0	81	96	79	7	250	50
	17	1354	805.148									
C-1	18	1357	807.6	0.13	2.0	2.0	81	97	81	7	250	60
C-2	21	1400	809.8	0.12	1.85	1.85	81	101	82	7	250	59
C-3	24	1403	812.1	0.11	1.70	1.70	81	103	83	7	250	58
C-4	27	1406	814.4	0.11	1.70	1.70	82	105	85	7	250	60
C-5	30	1409	816.656	0.11	1.70	1.70	82	106	85	7	250	60
	30	1410	816.656									
B-1	33	1413	819.0	0.11	1.70	1.70	82	103	87	5	250	66
B-2	36	1416	821.3	0.10	1.55	1.55	82	105	88	5	250	60
B-3	39	1419	823.4	0.10	1.55	1.55	82	108	89	5	250	60
B-4	42	1422	825.7	0.10	1.55	1.55	82	109	90	5	250	60
B-5	45	1425	827.922	0.11	1.70	1.70	82	111	91	6	250	60

PLANT Johnson Controls DATE 2·18·88 RUN NUMBER 1 - Process Vent (South System)

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr CLOCK) / SAMPLING TIME, min		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			
	45	1103	780.831									
D·1	48	1106	783.0	0.09	1.40	1.40	76	103	88	5	250	60
D·2	51	1109	785.2	0.11	1.7	1.70	77	106	88	5	250	63
D·3	54	1112	787.6	0.13	2.0	2.0	78	107	89	6	250	63
D·4	57	1115	790.1	0.13	2.0	2.0	78	110	89	6	250	63
D·5	60	1118	792.305	0.10	1.55	1.55	79	111	89	6	250	65
	Leak check = .011 cfm @ 8 in Hg											
			V_m = 47.089	$\overline{\sqrt{\Delta p}}$ = .349	$\overline{\Delta H}$ = 1.89		$\overline{T_s}$ = 75.9	$\overline{T_M}$ = 84.5				

PLANT Johnson Controls

DATE 2-18-88

SAMPLING LOCATION Process Vent (South System)

SAMPLE TYPE Lead Method 12

RUN NUMBER 1 OPERATOR WJK

BAROMETRIC PRESSURE 30.20 STATIC PRESSURE +0.36

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) +5 mls + 14.9 gel

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER Omega HH-51

THERMOCOUPLE NUMBER 3

PROBE NUMBER 31 TYPE

NOZZLE NUMBER I.D. 0.322

METER BOX NUMBER 4 $\Delta H_@$ 1.72

PITOT NUMBER Std C_p 0.99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE 100

C FACTOR 1.4 REFERENCE Δp 0.12

READ AND RECORD ALL DATA EVERY 3 MINUTES

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			
	00 / 1009	745.216									
A-1	03 / 1012	747.8	0.15	2.35	2.35	73	70	70	7	250	50
A-2	06 / 1015	750.2	0.13	2.0	2.0	73	77	71	6	250	46
A-3	09 / 1018	752.6	0.13	2.0	2.0	74	83	71	6	250	46
A-4	12 / 1021	754.8	0.12	1.85	1.85	74	90	73	6	250	46
A-5	15 / 1024	757.042	0.11	1.70	1.70	75	94	73	6	250	57
	15 / 1027	757.042									
B-1	18 / 1030	759.5	0.13	2.0	2.0	75	88	76	7	250	57
B-2	21 / 1033	761.8	0.12	1.85	1.85	76	96	77	6	250	60
B-3	24 / 1036	764.1	0.11	1.70	1.70	76	98	79	6	250	60
B-4	27 / 1039	766.5	0.13	2.0	2.0	76	100	79	7	250	67
B-5	30 / 1042	768.810	0.12	1.95	1.95	76	104	81	6	250	68
	30 / 1045	768.810									
C-1	33 / 1048	771.6	0.14	2.15	2.15	76	99	83	7	250	60
C-2	36 / 1051	773.8	0.13	2.0	2.0	76	103	84	6	250	60
C-3	39 / 1054	776.2	0.13	2.0	2.0	77	105	85	6	250	60
C-4	42 / 1057	778.7	0.12	1.85	1.95	77	107	88	6	250	60
C-5	45 / 1100	780.931	0.12	1.85	1.95	77	109	87	6	250	60

PLANT Johnson Controls

DATE 2/18/88

SAMPLING LOCATION Process Stack (South System)

SAMPLE TYPE Mthd 12, lead

RUN NUMBER Three OPERATOR RCB

BAROMETRIC PRESSURE 30.16 STATIC PRESSURE +.28

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) -5 ml H_2O + 8.4 gel

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER

THERMOCOUPLE NUMBER

PROBE NUMBER TYPE

NOZZLE NUMBER I.D. .199

METER BOX NUMBER 285 $\Delta H_@$

PITOT NUMBER C_p .99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%)

ASSUMED METER TEMPERATURE

C FACTOR 1.55 REFERENCE Δp 0.85

READ AND RECORD ALL DATA EVERY 5 MINUTES

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			
	00 / 1625	940.412									
A-6	05 / 1630	944.5	1.10	2.20	2.20	180	81	76	7	275	45
5	10 / 1635	949.0	1.20	2.60	2.60	180	103	77	8	258	45
4	15 / 1640	953.4	1.20	2.60	2.60	179	112	80	8	260	45
3	20 / 1645	957.9	1.20	2.60	2.60	179	117	84	8	263	47
2	25 / 1650	962.4	1.20	2.60	2.60	178	120	87	8	267	48
1	30 / 1655	966.545	1.00	2.20	2.20	182	122	89	8	268	48
		stop test, change ports									
	30 / 1704	966.545									
B-6	35 / 1709	971.1	1.00	2.20	2.20	181	106	92	7	280	46
5	40 / 1714	975.2	1.20	2.60	2.60	177	122	93	7	255	47
4	45 / 1719	979.5	1.10	2.40	2.40	178	123	95	7	271	48
3	50 / 1724	983.9	1.10	2.40	2.40	178	124	96	7	251	50
2	55 / 1729	988.3	1.20	2.60	2.60	178	125	97	7	269	52
1	60 / 1734	992.650	1.10	2.40	2.40	178	125	98	7	270	52
			leak check at 18" H_g = .015 cfm								
		V_m = 52.238	$\overline{\sqrt{\Delta p}}$ = 1.064	$\overline{\Delta H}$ = 2.450		$\overline{T_s}$ = 179	$\overline{T_m}$ = 101.8				

PLANT Johnson Controls

DATE 2-19-93

SAMPLING LOCATION Process Stack South System

SAMPLE TYPE Lead, Method 12

RUN NUMBER 2 OPERATOR PCB

BAROMETRIC PRESSURE 30.16 STATIC PRESSURE -.13

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) - 10 ml + 15.5

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER

THERMOCOUPLE NUMBER

PROBE NUMBER TYPE

NOZZLE NUMBER I.D. .199

METER BOX NUMBER 285 $\Delta H_@$

PITOT NUMBER C_p .99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE 100

C FACTOR 1.55 REFERENCE Δp .085 / .426 @ T_s 230°

@ T_s 140

READ AND RECORD ALL DATA EVERY 5 MINUTES

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			
	00	1342	888.379									
B-6	05	1347	892.8	1.10	2.35	2.35	153	85	77	6	250	52
5	10	1352	897.1	1.20	2.60	2.60	183	108	78	6	246	52
4	15	1357	901.7	1.20	2.60	2.60	202	115	82	6	256	52
3	20	1402	906.2	1.20	2.60	2.60	214	118	85	6	268	52
2	25	1407	910.7	1.10	2.40	2.40	223	121	88	6	270	52
1	30	1412	914.646	.95	2.05	2.05	235	122	91	5	266	54
			slop test	change	parts							
	30	1424	914.646									
A-6	35	1429	918.6	.93	2.00	2.00	236	90	88	5	277	54
5	40	1434	923.1	1.20	2.60	2.60	246	112	88	6	274	54
4	45	1439	927.8	1.20	2.60	2.60	248	119	90	6	273	56
3	50	1444	932.8	1.20	2.60	2.60	246	121	91	6	247	58
2	55	1449	938.2	1.20	2.60	2.60	244	122	93	5	244	58
1	60	1454	940.124	1.00	2.00	2.00	242	121	94	5	255	60
				leak	check	at	15 "H_2O	= .01 cfm				
			V_m = 51.475	$\overline{\sqrt{\Delta p}}$ = 1.059	$\overline{\Delta H}$ = 2.419		$\overline{T_s}$ = 222.7	$\overline{T_m}$ = 100				

PLANT Johnson Controls

DATE 2/18/88

SAMPLING LOCATION Process Stack, South System

SAMPLE TYPE Mthd 12, lead

RUN NUMBER One OPERATOR PCB

BAROMETRIC PRESSURE 30.20 STATIC PRESSURE +.26

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) -10 ml +14.0 gel

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER

THERMOCOUPLE NUMBER

PROBE NUMBER TYPE

NOZZLE NUMBER I.D. .199

METER BOX NUMBER 235 $\Delta H_@$

PITOT NUMBER C_p .94

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE 190

C FACTOR 1.55 REFERENCE Δp .85

READ AND RECORD ALL DATA EVERY 5 MINUTES

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			
	00	1019	831.702									
A-6	05	1024	836.0	.95	2.05	2.05	173	69	66	7	202	48
5	10	1029	840.2	1.2	2.60	2.60	174	94	67	9	250	48
4	15	1034	844.7	1.2	2.60	2.60	173	104	70	9	260	52
3	20	1039	849.0	1.2	2.60	2.60	172	111	74	9	267	54
2	25	1044	853.6	1.2	2.60	2.60	173	116	79	9	203	56
1	30	1049	858.105	1.2	2.60	2.60	169	118	82	9	234	58
	30	1104	358.105									
B-6	35	1109	862.3	1.05	2.25	2.25	172	87	81	8	270	50
5	40	1114	866.7	1.20	2.60	2.60	173	101	81	10	230	50
4	45	1119	871.2	1.20	2.60	2.60	173	113	82	10	249	52
3	50	1124	875.7	1.20	2.60	2.60	173	118	85	10	267	54
2	55	1129	880.1	1.20	2.60	2.60	174	120	88	10	270	56
1	60	1134	834.228	.93	2.00	2.00	174	121	90		219	58
				back check		cal 18	"Hg = .01 cfm					
			V_m = 52.526	$\overline{\sqrt{\Delta p}}$ = 1.069	$\overline{\Delta H}$ = 2.475		$\overline{T_s}$ = 172.8	$\overline{T_m}$ = 92.6				

Betz • Converse • Murdoch • Inc. BCM

NOMOGRAPH DATA

PLANT Johnson Controls

DATE 2/17/88

SAMPLING LOCATION Melting Pot (South System)

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.25 1.82
AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F	$T_{m_{avg.}}$	100
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	2
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	Cp =.99
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	130
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	.04
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	.14
C FACTOR	1.5	
CALCULATED NOZZLE DIAMETER, in.		
ACTUAL NOZZLE DIAMETER, in.	.374	.320
REFERENCE Δp, in. H_2O	.07	1.25

D_N = .322, .318 .322 = .320

Betz • Converse • Murdoch • Inc. BCM

NOMOGRAPH DATA

PLANT Johnson Controls

DATE 2/17/88

SAMPLING LOCATION Process Vent (Rectangular) South System

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	Box 4 1.72
AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F	$T_{m_{avg.}}$	100
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	2
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	Cp = .99
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	85
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	.13
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	
C FACTOR	1.4	
CALCULATED NOZZLE DIAMETER, in.		
ACTUAL NOZZLE DIAMETER, in.	.322	
REFERENCE Δp, in. H_2O	.12	

Betz • Converse • Murdoch • Inc. BCM

NOMOGRAPH DATA

PLANT Johnson Controls

DATE 2/17/88

SAMPLING LOCATION Process Stack (Circular)
South System

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	285 1.38
AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F	$T_{m_{avg.}}$	100
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	2
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	Cp =.99
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	190
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	1.34
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	2.2
C FACTOR	1.55	
CALCULATED NOZZLE DIAMETER, in.		
ACTUAL NOZZLE DIAMETER, in.	.199	
REFERENCE Δp, in. H_2O	.85	

PLANT Johnson Controls
DATE 2/9/88
SAMPLING LOCATION Melting Pot, North
SAMPLE TYPE Mthd 12
RUN NUMBER Three OPERATOR RCB
BAROMETRIC PRESSURE 30.25 STATIC PRESSURE -1.5
FILTER NUMBER(S)
GEL NUMBER(S)
THIMBLE NUMBER PLATE NUMBER
H_2O PICKUP (ml) +0ml H_2O, 7.0g (gel)

BCM
FIELD DATA SHEET

ORSAT:
CO_2
O_2
CO

PYROMETER NUMBER
THERMOCOUPLE NUMBER
PROBE NUMBER TYPE Glass
NOZZLE NUMBER I.D. .374
METER BOX NUMBER 285 $\Delta H_@$
PITOT NUMBER C_p .99
SAMPLE BOX NUMBER(S)
ASSUMED MOISTURE (%) 2
ASSUMED METER TEMPERATURE
C FACTOR 1.55 REFERENCE Δp .065

READ AND RECORD ALL DATA EVERY 5 MINUTES

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			
	00	2008	792.727									
A-6	05	2013	795.9	.04	1.16	1.15	125	84	68	5	232	48
5	10	2018	798.9	.04	1.15	1.15	126	90	68	5	230	48
4	15	2023	802.0	.04	1.15	1.15	121	98	71	6	232	48
3	20	2028	805.1	.04	1.15	1.15	119	104	74	6	240	52
3	25	2033	808.2	.04/.04	1.15	1.15	118	107	77	6	245	55
3	30	2038	811.285	.04/.04	1.15	1.15	119	109	79	6	252	56
	30	2045	811.285									
B 6	35	2050	814.7	.05	1.40	1.40	112	84	81	6	264	56
5	40	2055	818.1	.05	1.40	1.40	112	103	80	6	264	56
4	45	2100	821.0	.04	1.15	1.15	116	107	81	5	265	56
3	50	2105	824.2	.04	1.15	1.15	111	107	82	5	266	58
2	55	2110	827.4	.04	1.15	1.15	116	108	84	6	267	58
1	60	2115	830.351	.04	1.15	1.15	116	110	85	6	269	60
			leak check at 12" Hg		= .008 cfm							
	@ = 60		V_m = 37.624	$\overline{\sqrt{\Delta p}}$ = .204	$\overline{\Delta H}$ = 1.192		T_s = 118	T_m = 89				

PLANT Johnson Controls

DATE 2/9/88

SAMPLING LOCATION Melting Pot North

SAMPLE TYPE Mthd 12

RUN NUMBER Tutor OPERATOR PCB

BAROMETRIC PRESSURE 30.27 STATIC PRESSURE -1.5

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) 6.0(gel) + .0 ml H_2O

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER

THERMOCOUPLE NUMBER

PROBE NUMBER TYPE Glass

NOZZLE NUMBER I.D. .374

METER BOX NUMBER 285 $\Delta H_@$

PITOT NUMBER C_p .99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE

C FACTOR 1.55 REFERENCE Δp .065

READ AND RECORD ALL DATA EVERY 5 MINUTES

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			
	00	1720	753.323									
B 6	05	1735	756.4	.04	1.15	1.15	120	71	68	4	270	63
5	10	1740	759.6	.05	1.40	1.40	118	90	69	5	267	65
4	15	1745	763.0	.05	1.40	1.40	115	100	71	5	262	65
3	20	1750	766.3	.05	1.40	1.40	112	105	74	5	258	66
2	25	1755	769.5	.04	1.15	1.15	117	108	77	5	257	64
1	30	1800	772.556	.04	1.15	1.15	118	109	80	5	255	64
	30	1810	772.556									
A 6	35	1815	775.	.04	1.15	1.15	118	98	84	5	259	58
5	40	1820	779.2	.05	1.40	1.40	118	114	86	6	260	60
4	45	1825	782.3	.04	1.15	1.15	116	114	87	5	255	60
3	50	1830	785.4	.04	1.15	1.15	119	113	88	6	254	62
3	55	1835	788.6	.04/.04	1.15	1.15	121	113	89	6	253	62
3	60	1840	791.905	.05/.05	1.40	1.40	120	114	90	6	253	62
			leak check at 17 "Hg				= .005 cfm					
	θ = 60		V_m: 38.582	$\sqrt{\Delta p}$ = .210	$\overline{\Delta H}$ = 1.254		T_s = 118	T_m = 92				

PLANT Johnson Controls

DATE 2/9/88

SAMPLING LOCATION Melting Pot, North

SAMPLE TYPE Mthd 12

RUN NUMBER One OPERATOR PCB

BAROMETRIC PRESSURE 30.32 STATIC PRESSURE -1.5

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) - 5 ml H_2O + 17.1 g (sol.)

BCM FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER

THERMOCOUPLE NUMBER

PROBE NUMBER TYPE Glass

NOZZLE NUMBER I.D. .374

METER BOX NUMBER 285 $\Delta H_@$

PITOT NUMBER C_p .99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE

C FACTOR 1.55 REFERENCE Δp .065

READ AND RECORD ALL DATA EVERY 5 MINUTES

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			
	00	1213	711.706									
A 6	05	1218	714	.04	1.15	1.15	126	72	67	4	273	50
5	10	1223	718.0	.05	1.40	1.40	128	86	68	5	225	50
4	15	1228	721.0	.04	1.15	1.15	121	97	70	5	254	50
3	20	1233	725	.05	1.40	1.40	118	103	73	5	261	55
4	25	1238	727.5	.04/.04	1.15	1.15	117	107	76	5	263	62
5	30	1243	730.755	.05/.04	1.45	1.45	122	110	80	5	263	64
			leak check		at 15" Hg		OK.					
	30	1328	733.510									
B 6	35	1333	736.9	.05	1.40	1.40	124	79	77	5	274	54
5	40	1338	740.2	.05	1.40	1.40	120	105	78	5	271	50
4	45	1343	743.5	.05	1.40	1.40	119	108	79	5	270	52
3	50	1348	746.6	.04	1.15	1.15	117	111	81	5	268	54
2	55	1353	749.8	.04	1.15	1.15	124	113	83	5	230	56
1	60	1358	752.972	.04	1.15	1.15	123	115	85	5	246	60
			leak check at		16"	= .017 cfm						
	0 - 60		Vm = 38.511	$\sqrt{\Delta P}$ = .212	ΔH = 1.279		T_s = 122		Tm = 88			

North

PLANT Johnson Co DATE 2-9-88 RUN NUMBER Process Vent - Run No 3

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			
	~~45~~ 2101	731.927									
A-1	48 2104	734.2	0.09	1.4	1.4	77	99	85	7	250	68
A-2	51 2107	736.3	0.09	1.4	1.4	77	104	87	7	240	68
A-3	54 2110	738.4	0.08	1.25	1.25	77	105	87	7	235	68
A-4	57 2113	740.4	0.09	1.4	1.4	78	106	88	7	250	68
A-5	60 2116	742.794	0.11	1.7	1.7	78	108	88	8	250	68
	Leak Check	= 0.020 cfm	@ 14	in Hg							
	θ = 60	V_m = 43.169	$\sqrt{\Delta P}$ = .306	$\overline{\Delta H}$ = 1.475		T_s = 78	T_m = 90°				

PLANT Johnson Controls

DATE 2-9-89

SAMPLING LOCATION Process Vent, North

SAMPLE TYPE Lead Method 12

RUN NUMBER 3 OPERATOR WJK NJC

BAROMETRIC PRESSURE 30.26 STATIC PRESSURE +.28

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) +2 mL (H_2O) + 11.3 g (gel)

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER Omega HH51

THERMOCOUPLE NUMBER

PROBE NUMBER 3-1 TYPE glass

NOZZLE NUMBER I.D. 0.322

METER BOX NUMBER 4 $\Delta H_@$ 1.72

PITOT NUMBER 3-Std C_p 0.99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE 100

C FACTOR 1.45 REFERENCE Δp 0.119

READ AND RECORD ALL DATA EVERY 3 MINUTES

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			
	00 1955	699.618									
A-1	03 1958	702.1	0.09	1.4	1.40	78	78	77	7	250	68
A-2	06 2001	704.1	0.09	1.4	1.40	78	95	78	7	250	68
A-3	09 2004	706.2	0.08	1.25	1.25	79	92	78	7	250	66
A-4	12 2007	708.1	0.07	1.05	1.05	78	94	79	7	250	66
A-5	15 2010	710.134	0.09	1.40	1.40	78	97	80	7	250	66
	15										
B-1	18	710.141	.10	1.55	1.55	78	87	80°	7	230	68
B-2	21	712.450	.08	1.25	1.25	78	94	82°	7	260	68
B-3	24	715.000	.07	1.05	1.05	78	97	81°	6	240	68
B-4	27	716.500	.08	1.25	1.25	78	98	82	6	240	68
B-5	30 2036	719.000	.11	1.70	1.70	78	101	83	7	240	68
		720.500									
C	30 2043	720.500				78	93	83	7	260	68
C-1	33 2046	722.80	0.11	1.70	1.70	↓	↓	↓	↓	↓	↓
C-2	36 2049	725.420	.110	1.70	1.70	78	98	85	7	260	68
C-3	39 2052	727.000	.100	1.55	1.55	77	102	85	7	260	68
C-4	42 2055	729.780	.120	1.85	1.85	77	105	85	8	260	68
C-5	45 2058	731.927	0.120	1.85	1.85	77	106	85	8	240	68

North

PLANT Johnson Cnt DATE 2-9-88 RUN NUMBER Process Vent - Run 2

TRAVERSE POINT NUMBER	SAMPLING TIME, min / CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft³	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			
	45 / 1820	691.727									
A-1	48 / 1823	690.1	0.11	1.70	1.70	78	103	88	9.0	250	68
A-2	51 / 1826	692.6	0.10	1.55	1.55	78	106	90	8.0	250	68
A-3	54 / 1829	694.55	0.10	1.55	1.55	78	108	90	8	250	68
A-4	57 / 1832	697.1	0.10	1.55	1.55	78	110	90	8	250	68
A-5	60 / 1835	699.222	0.13	2.00	2.00	78	111	90	10	250	68
	Leak check = 0.008 cfm @ 15 in Hg										
		V_m = 47.613	$\sqrt{\Delta p}$ = .346	$\overline{\Delta H}$ = 1.875		T_s = 79°	T_m = 93°				

PLANT Johnson Controls

DATE 2-9.88

SAMPLING LOCATION Lead Method 12, North

SAMPLE TYPE Process Vent

RUN NUMBER 2 OPERATOR WJK

BAROMETRIC PRESSURE 30.27 STATIC PRESSURE +0.36

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) +7.4g (gel) +2.0ml H_2O

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER Omega HH51

THERMOCOUPLE NUMBER

PROBE NUMBER 3-1 TYPE Glass

NOZZLE NUMBER I.D. 0.322

METER BOX NUMBER 4 $\Delta H_@$ 1.72

PITOT NUMBER 3-S Hd C_p 0.99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE 100

C FACTOR 1.45 REFERENCE Δp 0.119

READ AND RECORD ALL DATA EVERY 3 MINUTES

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			
	00 / 1725	651.609									
A-1	03 / 1728	654.0	0.12	1.85	1.85	79	76	76	10	250	68
D-2	06 / 1731	656.7	0.14	2.20	2.20	80	81	77	12	250	70
D-3	09 / 1734	659.0	0.16	2.50	2.50	80	89	79	13	250	70
D-4	12 / 1737	662.0	0.14	2.20	2.20	80	96	79	11	250	70
D-5	15 / 1740	664.135	0.15	2.35	2.35	80	101	79			
	15 / 1743	664.135									
C-1	18 / 1746	667.1	0.15	2.35	2.35	78	95	80	12	250	70
C-2	21 / 1749	669.3	0.10	1.55	1.55	78	103	81	9	250	70
C-3	24 / 1752	671.4	0.09	1.40	1.40	79	104	82	8	255	72
C-4	27 / 1755	673.7	0.12	1.85	1.85	79	105	83	9	255	72
C-5	30 / 1758	676.199	0.14	2.20	2.20	79	109	85	12	255	71
	30 / 1802	676.199									
B-1	33 / 1805	678.8	0.14	2.20	2.20	79	101	85	11	250	72
B-2	36 / 1808	681.1	0.10	1.55	1.55	79	108	86	9	250	72
B-3	39 / 1811	683.1	0.09	1.40	1.40	80	109	87	8	250	69
B-4	42 / 1814	685.3	0.10	1.55	1.55	79	110	89	9	250	68
B-5	45 / 1817	687.727	0.13	2.00	2.00	79	111	88	10	250	68

North

PLANT Johnson Cnt DATE 2-9-88 RUN NUMBER Process Vent-No. 1

TRAVERSE POINT NUMBER	SAMPLING TIME, min / CLOCK TIME (24 hr CLOCK)		GAS METER READING (V_m), ft³	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			
	45	1311	639.711									
D-1	48	1314	642.4	0.12	1.85	1.85	77	101	89	10	250	70
D-2	51	1317	644.2	0.09	1.40	1.40	77	112	91	10	250	70
D-3	54	1320	647.2	0.13	2.0	2.0	78	113	91	11	250	70
D-4	57	1323	649.0	0.12	1.85	1.85	78	116	92	11	250	70
D-5	60	1326	651.298	0.11	1.70	1.70	78	117	92	10	250	70
	Leak check = 0.014 cfm @ 15 in Hg											
	θ = 60		V_m = 46.760	$\sqrt{\Delta P}$ = .345	ΔH = 1.85		T_s = 78	T_m = 91.5				

PLANT Johnson Controls

DATE 2-9-88

SAMPLING LOCATION Process Vent, North

SAMPLE TYPE Lead Method 12

RUN NUMBER 1 OPERATOR WJK

BAROMETRIC PRESSURE 30.32 STATIC PRESSURE +0.33

FILTER NUMBER(S)

GEL NUMBER(S) +112.4 grams

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) +5.4 mls

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER Omega HHS1

THERMOCOUPLE NUMBER

PROBE NUMBER 3-1 TYPE glass

NOZZLE NUMBER I.D. 0.322

METER BOX NUMBER 4 $\Delta H_@$ 1.72

PITOT NUMBER 3 std C_p 0.99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%) 2

ASSUMED METER TEMPERATURE 100

C FACTOR 1.45 REFERENCE Δp 0.119

READ AND RECORD ALL DATA EVERY 3 MINUTES

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			
	00	1215	604.538									
A-1	03	1218	606.8	0.13	2.0	2.0	80	70	70	11	250	69
A-2	06	1221	609.0	0.11	1.7	1.7	76	76	71	9	250	68
A-3	09	1224	611.5	0.10	1.55	1.55	80	79	71	9	250	68
A-4	12	1227	613.5	0.12	1.85	1.85	80	85	72	10	250	69
A-5	15	1230	616.027	0.15	2.35	2.35	77	91	73	13	250	68
	15	1235	616.027									
B-1	18	1238	619.1	0.16	2.50	2.50	77	92	75	14	250	68
B-2	21	1241	621.1	0.12	1.85	1.85	77	102	77	10	250	68
B-3	24	1244	623.2	0.11	1.70	1.70	77	105	79	10	250	68
B-4	27	1247	625.6	0.12	1.85	1.85	77	107	80	10	250	68
B-5	30	1250	628.123	0.15	2.35	2.35	77	108	81	12	250	68
	30	1253	628.123	0.13	2.0	2.0	78	103	85			70
C-1	33	1256	631.1	↓	↓	↓	↓	↓	↓	11	250	69
C-2	36	1259	633.3	0.10	1.55	1.55	78	110	85	9	251	69
C-3	39	1302	635.5	0.10	1.55	1.55	78	111	86	9	250	70
C-4	42	1305	637.8	0.11	1.70	1.70	78	112	88	10	250	70
C-5	45	1308	639.711	0.12	1.85	1.85	78	113	89	10	250	70

PLANT Johnson Controls

DATE 2/9/88

SAMPLING LOCATION Process Stack, North

SAMPLE TYPE Mthd 12

RUN NUMBER 3 OPERATOR PCB

BAROMETRIC PRESSURE 30.25 STATIC PRESSURE -.54

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) ~~12~~ ml (H_2O) + ~~NOG~~ g (gel)
+10 8.7

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER

THERMOCOUPLE NUMBER

PROBE NUMBER TYPE

NOZZLE NUMBER I.D. .199

METER BOX NUMBER 125 $\Delta H_@$

PITOT NUMBER C_p .99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%)

ASSUMED METER TEMPERATURE

C FACTOR REFERENCE Δp

READ AND RECORD ALL DATA EVERY _____ MINUTES

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			
	00	2010	637.514									
A-6	05	2015	641.4	.95	1.85	1.85	188	68	66	5	230	45
5	10	2020	645.3	1.05	2.00	2.00	187	84	67	5	236	36
4	15	2025	649.1	1.05	2.00	2.00	187	95	70	5	238	39
3	20	2030	653.5	1.20	2.40	2.40	187	101	73	6	222	42
2	25	2035	657.9	1.10	2.15	2.15	186	105	76	6	225	45
1	30	2040	661.567	1.00	1.95	1.95	186	108	79	5	226	46
	30	2047	661.567									
B 6	35	2052	665.7	1.10	2.15	2.15	183	82	79	5	234	54
5	40	2057	670.1	1.20	2.40	2.40	184	98	79	6	235	45
4	45	2102	674.2	1.15	2.20	2.20	186	103	81	6	237	48
3	50	2107	678.5	1.15	2.20	2.20	185	105	82	6	238	50
2	55	2112	682	1.20	2.40	2.40	185	108	84	6	240	51
1	60	2117	686.828	1.00	1.95	1.95	185	109	85	5	240	53
				leak	check	at	10" Hg	.01	cfm			
	0 = 60		Vm = 49.314	$\overline{\sqrt{\Delta p}}$ = 1.046	$\overline{\Delta H}$ =	2.137	Ts = 186	Tm = 87				

PLANT Johnson Controls

DATE 2/9/87

SAMPLING LOCATION Process Stack, North

SAMPLE TYPE Mthd 12

RUN NUMBER Two OPERATOR PCB

BAROMETRIC PRESSURE 30.27 STATIC PRESSURE -.54

FILTER NUMBER(S)

GEL NUMBER(S)

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) 8.5 g (gel). + 18ml H_2O

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER

THERMOCOUPLE NUMBER

PROBE NUMBER TYPE

NOZZLE NUMBER I.D. .312 . 199

METER BOX NUMBER 125 $\Delta H_@$

PITOT NUMBER C_p .99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%)

ASSUMED METER TEMPERATURE

C FACTOR REFERENCE Δp

READ AND RECORD ALL DATA EVERY 5 MINUTES

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			
	00	1732	587.855									
B6	05	1737	591.9	1.05	2.00	2.00	189	69	67	5	230	58
5	10	1742	596.1	1.20	2.40	2.40	188	85	68	6	230	40
4	15	1747	600.1	1.10	2.15	2.15	184	97	71	6	237	42
3	20	1752	604.2	1.10	2.15	2.15	185	101	73	6	239	44
2	25	1757	608.6	1.20	2.40	2.40	185	106	77	6	241	45
1	30	1802	612.500	1.00	1.95	1.95	185	108	82	5	242	45
	30	1812	612.500									
A 6	35	1817	617	1.00	1.95	1.95	189	87	80	5	246	54
5	40	1822	620.8	1.20	2.40	2.40	186	100	81	6	246	45
4	45	1827	625.	1.10	2.15	2.15	186	106	82	5	246	48
3	50	1832	629.2	1.10	2.15	2.15	186	108	84	6	247	48
2	55	1837	633.0	1.05	2.00	2.00	185	110	85	6	246	50
1	60	1842	636.920	.95	1.85	1.85	187	110	87	5	246	50
			leak check at		15" H_g	= .018 cfm						
	θ = 60		V_m = 49.065	$\sqrt{\Delta p}$ = 1.042	ΔH =	2.129	T_s = 186	T_m = 88.5				

PLANT Johnson Controls North System

DATE 2/9/88

SAMPLING LOCATION Process Stack (Circular)

SAMPLE TYPE Mthd 12, Lead

RUN NUMBER 1 OPERATOR PCB

BAROMETRIC PRESSURE 30.32 STATIC PRESSURE -.54

FILTER NUMBER(S)

GEL NUMBER(S) +9.8 mL

THIMBLE NUMBER PLATE NUMBER

H_2O PICKUP (ml) +2.0 ml H_2O.

BCM

FIELD DATA SHEET

ORSAT:

CO_2

O_2

CO

PYROMETER NUMBER

THERMOCOUPLE NUMBER

PROBE NUMBER TYPE

NOZZLE NUMBER I.D. .199

METER BOX NUMBER 125 $\Delta H_@$

PITOT NUMBER C_p .99

SAMPLE BOX NUMBER(S)

ASSUMED MOISTURE (%)

ASSUMED METER TEMPERATURE

C FACTOR REFERENCE Δp

READ AND RECORD ALL DATA EVERY 5 MINUTES

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			
	00	1215	539.758									
A-6	05	1220	543.5	.92	1.80	1.80	181	67	64	2	240	53
5	10	1225	547.6	1.10	2.15	2.15	181	88	65	2	236	40
4	15	1230	551.2	1.10	2.15	2.15	182	94	69	4	240	45
3	20	1235	555.2	1.15	2.25	2.25	184	99	71	5	241	50
2	25	1240	559	1.05	2.00	2.00	182	103	75	5	241	55
1	30	1245	562.787	.93	1.80	1.80	174	105	78	5	241	58
				leak check @ 15" Hg OK								
	30	1330	562.909									
B 6	35	1335	566.5	.96	1.90	1.90	185	75	70	2	244	57
5	40	1340	570	1.05	2.00	2.00	185	89	71	2	244	53
4	45	1345	574.5	1.15	2.20	2.20	185	95	72	3	244	55
3	50	1350	578.7	1.10	2.15	2.15	186	100	75	3	244	54
2	55	1355	583	1.10	2.15	2.15	188	103	77	3	245	56
1	60	1400	586.742	1.05	2.00	2.00	186	106	80	3	245	57
				leak check at 7" Hg = .004 cfm								
	Θ = 60		V_m = 46.364	$\sqrt{\Delta p}$ = 1.026	ΔH = 2.046		T_s = 183	T_m = 83				

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NOMOGRAPH DATA

PLANT Johnson Controls

DATE 2/8/88

SAMPLING LOCATION Melting Pot, North System

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	Box 285 1.84
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	105
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	2
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	Cp=.84
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	130
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	.08
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	.10
C FACTOR		1.1
CALCULATED NOZZLE DIAMETER, in.		.39
ACTUAL NOZZLE DIAMETER, in.		.374
REFERENCE Δp, in. H_2O		.09

$C_p = .99$

.05

.08

1.55 (C_p=.99

.065 (C_p=.9

Dn = .312, .315, .320

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NOMOGRAPH DATA

PLANT Johnson Controls

DATE 2/8/88

SAMPLING LOCATION Process Vent (Rectangular)

North System

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	Box #4 1.72
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	100
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	2
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	30.44
STATIC PRESSURE IN STACK, in. Hg	C_p	.99
($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	30.40
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1.0
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	86
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	.13
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	.16
C FACTOR		1.0 using .84 C_p
CALCULATED NOZZLE DIAMETER, in.		.32
ACTUAL NOZZLE DIAMETER, in.		.322
REFERENCE Δp, in. H_2O		.16 using .34

-.54" H2O

1.45 using .99 C_p

1.15 using .99

Nozzle set No. 4

D_N = .322, .323, .320 = .322

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NOMOGRAPH DATA

PLANT Johnson Control

DATE 2/8/88

SAMPLING LOCATION Process Stack (circular)

North

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	Box 125 1.74	
AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F	$T_{m_{avg.}}$	105	
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	2	
BAROMETRIC PRESSURE AT METER, in. Hg	P_m		
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in. H_2O)	P_s	Cp=.84	Cp = .99
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m		
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	190	
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	1.84	1.11
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	2.2	1.2
C FACTOR	1.03		1.45 (Cp=.99)
CALCULATED NOZZLE DIAMETER, in.	.325		.19
ACTUAL NOZZLE DIAMETER, in.	.312		.199
REFERENCE Δp, in. H_2O	.22		.95 (Cp=.99)

D_N = .311, .311, .314 = .312

.198 .200 .200 = .199

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VELOCITY DETERMINATIONS

Client: Johnson Controls

Location: Melting Pot, North

Date: 2/9/88

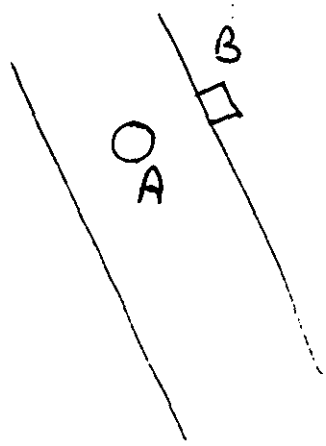
Stack Pressure: − 1.5

Barometric Pressure: _____

Pitot Factor: _____

Engineer: _____

Sample Port Location:



Pitot/Temperature Readings

Point No.	Distance (Inches)	Port A		Port B		Port A		Port B		Port__	
		ΔP	T	ΔP	T	ΔP	T	ΔP	T	ΔP	T
1		.05		.06		.04		.05			
2		.07	131	.06		.04		.06			
3		.06		.07	126	.04		.06			
4		.09		.09		.05		.06			
5		.10	128°	.10		.04		.08			
6		.10		.10		.04		.05			
		"	"								
		S	Pitot			Std. Pitot					
TOTAL		130									
AVG.		.08				.051					

Cp = .84
Ts = 130
Ps = 30.33
ms = 28.84
Vs = 1000.9

Qs = 1228 (5.92)

Ts = 130
Ps = 30.33
ms = 28.84
Vs = 941.8

Cp = .99
Qs = 1156

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VELOCITY DETERMINATIONS

Client: Johnson Controls

Location: Process Vent, North

Date: 2/8/88

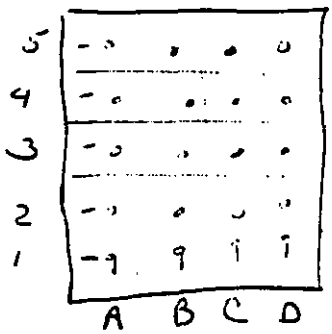
Stack Pressure: _____

Barometric Pressure: _____

Pitot Factor: .99

Engineer: _____

Sample Port Location:



Pitot/Temperature Readings

Point No.	Distance (Inches)	Port A		Port B		Port C		Port D		Port __	
		ΔP	T	ΔP	T	ΔP	T	ΔP	T	ΔP	T
1		.14	66	.15	61	.15	60	.14	61		
2		.11	66	.12	61	.13	60	.16	61		
3		.09	64	.11	60	.12	60	.10	60		
4		.10	64	.11	60	.12	60	.12	60		
5		.14	62	.14	60	.15	60	.15	61		
TOTAL											
AVG.		.127	61								

607.6

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VELOCITY DETERMINATIONS

Client: Johnson Controls

Location: Process Stack (circular)

Date: 2/3/88

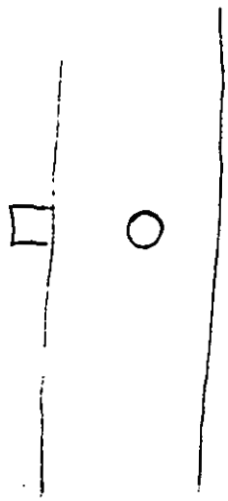
Stack Pressure: -.54

Barometric Pressure: 30.44

Pitot Factor: .99 / .84

Engineer: PCB

Sample Port Location:



Pitot/Temperature Readings

Point No.	Distance (Inches)	Port A		Port B		Port B		Port A		Port	
		ΔP	T	ΔP	T	ΔP	T	ΔP	T	ΔP	T
		Standard Pitot				"S" pitot					
1		1.1		1.1		1.2		1.5			
2		1.2		1.2		1.6		1.3			
3		1.1		1.2		1.9		1.9	180°		
4		1.1		1.1		2.0		2.1	187°		
5		1.1		1.2		2.1	191	2.2			
6		.95		1.0		2.2		2.1	190°		
TOTAL											
AVG.		1.11						1.84			

$T_s = 190$
$P_s = 30.40$
$m_s = 28.84$
$v_s = 4607$
$Q_s = 5653$

$T_s = 190$
$P_s = 30.40$
$m_s = 28.84$
$Q_s = 5317$ ACFM

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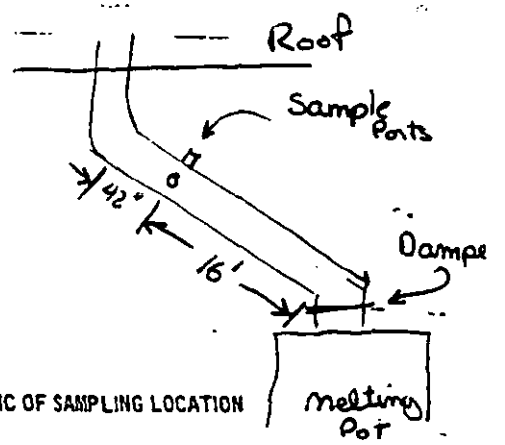
TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Johnson Controls
DATE 2/9/88
SAMPLING LOCATION Melting Pot North & South
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE. (DISTANCE A) 18"
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE. (DISTANCE B) 3"
STACK I.D.. (DISTANCE A - DISTANCE B) 15"
NEAREST UPSTREAM DISTURBANCE
NEAREST DOWNSTREAM DISTURBANCE
CALCULATOR



SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1.8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	4.4	15"	1.0	3"	4.0
2	14.6		2.2		5.2
3	29.6		4.4		7.4
4	70.4		10.6		13.6
5	85.4		12.3		12.8
6	95.6		14.0		17.0

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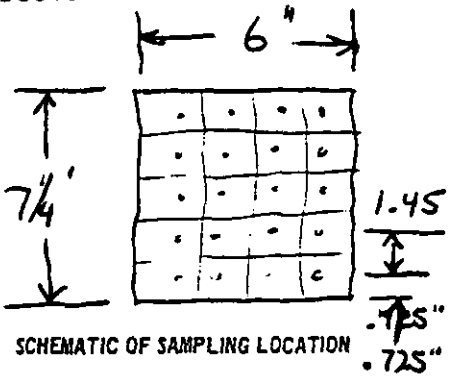
TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Johnson Controls
DATE 2/9/88
SAMPLING LOCATION Process Vent North + South
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE. (DISTANCE A) _____
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE. (DISTANCE B) _____
STACK I.D., (DISTANCE A - DISTANCE B) _____
NEAREST UPSTREAM DISTURBANCE _____
NEAREST DOWNSTREAM DISTURBANCE _____
CALCULATOR _____



SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	0.7~~5~~				
2	~~1.45~~ 2.2				
3	3.6				
4	5.1				
5	6.5				
1	0.75				
2	2.2				
3	3.7				
4	5.25				

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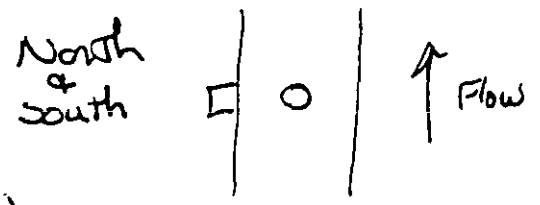
TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Johnson Controls
DATE 2/9/88
SAMPLING LOCATION Process Stack (Circular)
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE A) 18"
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE B) 3"
STACK I.D., (DISTANCE A - DISTANCE B) 15"
NEAREST UPSTREAM DISTURBANCE ≥ 90" (6 duct dias.)
NEAREST DOWNSTREAM DISTURBANCE 12' (9.6 duct dias.)
CALCULATOR



SCHEMATIC OF SAMPLING LOCATION

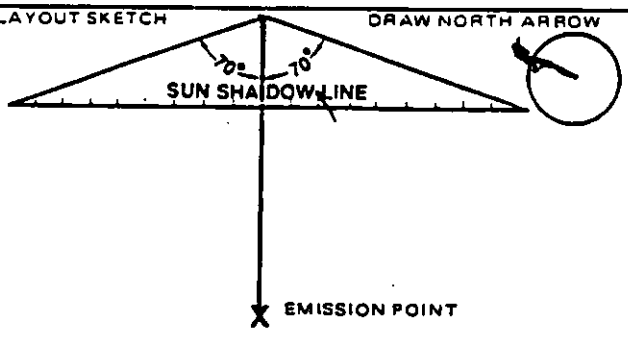
TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	4.4	15	1.0	3	4.0
2	14.6		2.2		5.2
3	29.6		4.4		7.4
4	70.4		10.6		13.6
5	85.4		12.8		12.8
6	95.6		14.0		17.0

BCM
Plymouth Meeting
Pennsylvania 19462
Phone: (215) 825-3800
TWX: 510-660-6034

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Johnson Controls
ADDRESS:
STATE: Del | ZIP: | TELEPHONE:
SOURCE ID NUMBER: South System | OBSERVATION DATE: 2-18-88
PROCESS: Melting Pot | OPERATING MODE:
CONTROL EQUIPMENT: | OPERATING MODE:
DESCRIBE EMISSION POINT: 2' Diameter Stack w/fan w/cowling
HEIGHT ABOVE GROUND LEVEL: ~55' | HEIGHT RELATIVE TO OBSERVER: ~2'
DISTANCE FROM OBSERVER: ~25' | DIRECTION FROM OBSERVER: NE
DESCRIBE EMISSIONS:
EMISSION COLOR: | PLUME TYPE ☐ INTERMITTENT ☐ CONTINUOUS ☐ FUGITIVE ☐
WATER DROPLETS PRESENT NO ☐ YES ☐ | IF YES, IS PLUME ATTACHED ☐ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED:
DESCRIBE BACKGROUND: Building Side
BACKGROUND COLOR: Yellowish gold | SKY CONDITIONS: High Clouds
WIND SPEED: | WIND DIRECTION: out of the North
AMBIENT TEMPERATURE: 50's | RELATIVE HUMIDITY:
COMMENTS:

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S NAME (PRINT): Christopher T. Hewitt
ORGANIZATION: BCM
CERTIFIED BY: ETA | DATE: 2-18-88
START TIME: 1024 | STOP TIME: 1124

	0	15	30	45		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
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
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
25	0	0	0	0	55	0	0	0	0
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
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR FOR HIGHEST PERIOD: 0
NUMBER OF READINGS ABOVE: 0 % WERE
RANGE OF OPACITY READINGS: 0 MINIMUM | 0 MAXIMUM

OBSERVER'S SIGNATURE: [signature] | DATE: 2-18-88
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.
SIGNATURE:
VERIFIED BY: | TITLE: | DATE:

BCM

APPENDIX B

LABORATORY ANALYSIS AND DATA EVALUATION

BCM

APPENDIX B

LABORATORY ANALYSIS AND DATA EVALUATION

1.0 ANALYTICAL METHODS

All samples generated during the test program were analyzed by BCM personnel at the BCM Laboratory in Norristown, Pennsylvania. The following paragraphs describe the analytical methods employed.

1.1 Inorganic Lead Samples

For each sample run, the glass fiber filter was cut into strips and combined with the probe wash and impinger solution following volume determinations. Care was taken to assure complete transferral of all samples so as not to bias the analysis. The combined sample was then extracted for lead, as specified in EPA Method 12, and analyzed by atomic absorption spectroscopy following spectrophotometer calibration. Mandatory checks for matrix effects on the lead results were performed on one sample from each source using the Method of Additions to detect any sensitivity of the atomic absorption analysis to the chemical compositions and to the physical properties of the sample. Results of all Method of Additions analyses show less than 3 percent of variability caused by matrix effects. This is below the 5 percent allowable variation.

Both filter and nitric acid blanks were analyzed to determine a blank value to be used as a correction factor. The laboratory results are summarized in Table B-1. The complete laboratory report is presented in this appendix following the test result calculations. The report includes results of audit samples, field samples, blanks and matrix effects results. Also included are the spectrophotometer calibrations and spectrophotometer results of all samples.

1.2 Moisture Content

Silica gel had been tare-weighted prior to its use. Upon completion of a test run, the silica gel was reweighted. The entire weight gain was considered due to water vapor. The total volume of the impinger solutions, minus the original volume of nitric acid in the impingers, plus the volume of moisture and/or vapors collected by the silica gel, equaled the total moisture gain of the sampling train. This volume was used to calculate percent moisture by volume. The laboratory results of the moisture analyses appear concurrently with the results of the inorganic lead testing program in Table B-1.

BCM

2.0 COMPUTER INPUT SHEET

The reduced data calculated from the field data sheets were combined with the laboratory results on the computer input data sheet to facilitate programming. The computer input data sheets follow Table B-1.

3.0 CALCULATIONS

The equations used to calculate test program results follow the computer input sheets.

4.0 TEST RESULTS

The complete results of the computer analysis and data reduction of the input data generated from the sampling program follow the calculations.

BCM

TABLE B-1

LEAD LABORATORY INORGANIC RESULTS

Oxide Mill	Source	Run No.	Total Pb in Sample (ug)	Moisture Grain (ml) Gel	Impingers	Total
North	Melting Pot	1	948	12.1	-5	7.1
North	Melting Pot	2	1,540	6.0	0	6.0
North	Melting Pot	3	1,330	7.0	0	7.0
South	Melting Pot	1	973	10.2	0	10.2
South	Melting Pot	2	604	12.4	0	12.4
South	Melting Pot	3	289	8.2	0	8.2
North	Process Stack	1	431	9.8	2	11.8
North	Process Stack	2	356	8.5	10	18.5
North	Process Stack	3	279	8.7	10	18.7
South	Process Stack	1	604	14.0	-10	4.0
South	Process Stack	2	293	15.5	-10	5.5
South	Process Stack	3	163	8.4	-5	3.4
North	Process Vent	1	772	10.4	5.4	15.8
North	Process Vent	2	634	7.4	2	9.4
North	Process Vent	3	998	11.3	2	13.3
South	Process Vent	1	1,840	14.9	5	19.9
South	Process Vent	2	2,320	11.5	0	11.5
South	Process Vent	3	1,440	12.9	-5	7.9

EQUATIONS FOR PARTICULATE, MOISTURE, AND FLOW CALCULATIONS

(BASED ON STANDARD CONDITIONS OF 68°F AND 29.92"Hg)

1. $V_{w(std)} = 0.0471\ V_{wc}$

2. $V_{m(std)} = 17.64\ V_m \dfrac{P_{bar} + .07355\ \Delta H}{T_m + 460}\ \gamma$

3. $B_{wo} = \dfrac{V_{w(std)}}{V_{m(std)} + V_{w(std)}}$

4. $M_d = 0.44(\%CO_2) + 0.28(\%CO) + 0.32(\%O_2) + 0.28(\%N_2)$

5. $M_s = M_d\ (1 - B_{wo}) + 18\ B_{wo}$

6. $EA = \dfrac{(\%O_2) - 0.5(\%CO)}{0.264(\%N_2) - (\%O_2) + 0.5(\%CO)}\ 100$

7. $V_s = (85.49)(60)(C_p)\sqrt{\Delta P}\sqrt{\dfrac{T_s + 460}{(P_s)(M_s)}}$

8. $Q_s = \dfrac{(V_s)(A_s)}{144}$

9. $Q_{s(std)} = Q_s(1 - B_{wo})\ 17.64\ \dfrac{P_s}{T_s + 460}$

10. $C'_s = 0.0154\ \dfrac{W_t}{V_{m(std)}}$

11. $C'_w = 0.0154\ \dfrac{W_t}{V_{m(std)} + V_{w(std)}}$

12. $C'_c = \dfrac{12\ C'_s}{\%CO_2}$

13. $C'_a = W_w\ \dfrac{(T_s + 460)(29.92)}{(528)(P_s)}$

14. $E = 0.00857\ Q_{s(std)}\ C'_s$

15. $A_n = \dfrac{(\pi)(D_n)^2}{(144)(4)}$

16. $I = \dfrac{(60)(1.667)(T_s + 460)(0.00267\ V_{wc} + V_{m(std)}/17.64)}{(\Theta)(V_s)(P_s)(A_n)}$

LEGEND

A_n	=	Area of nozzle, ft^2
A_s	=	Area of stack, in^2
B_{wo}	=	Moisture content of gas stream, dimensionless
C_p	=	Pitot correction factor, dimensionless
C'_a	=	Particulate concentration (stack conditions), gr/ft^3
C'_c	=	Particulate concentration at 12% CO_2 (dry), gr/dscf
C'_s	=	Particulate concentration (dry), gr/dscf
C'_w	=	Particulate concentration (wet), gr/scf
D_n	=	Diameter of nozzle, in.
E	=	Particulate emission rate, lb/hr
EA	=	Excess air, percent
ΔH	=	Orifice pressure drop, in. H_2O
I	=	Isokinetic ratio, percent
M_d	=	Dry molecular weight of stack gas, lb/lb-mole
M_s	=	Molecular weight of stack gas, lb/lb-mole
P_{bar}	=	Barometric pressure, in. Hg
P_s	=	Stack pressure (absolute), in. Hg
$\sqrt{\Delta P}$	=	Average of square roots of pitot pressure differential, in. H_2O
Q_s	=	Stack gas flow, acfm
$Q_{s(std)}$	=	Stack gas flow, scfm
T_m	=	Average dry gas meter temperarure, ^oF
T_s	=	Average stack temperature, ^oF
V_m	=	Dry sample volume (meter conditions), ft^3
$V_{m(std)}$	=	Dry sample volume (standard conditions), ft^3

V_s = Stack velocity, ft/min

V_{wc} = Volume of liquid collected in impingers and silica gel, ml

$V_{w(std)}$ = Volume of liquid collected, ft^3

W_t = Total weight of particulates collected, mg

Θ = Duration of test, min.

1	Heading	North System, Process Stack								
2	Number of tests	3	Sampled 2/9/88							
3	Test type ("EPA","PA","F",or "H2S")	"EPA"	"EPA"	"EPA"						
4	Test identification (ID's in qoutes)	"1"	"2"	"3"	2					
5	Stack area, in^2	176.7	176.7	176.7						
6	Stack temperature, ^oF	183	186	186						
7	Sample volume, ft^3	46.869	49.085	49.314						
8	Meter temperature, ^oF	83	89	87						
9	Orifice (ΔH), in. H_2O	2.046	2.129	2.187						
10	Nozzle diameter, in	.199	.199	.199						
11	Duration of test, min.	60	60	60						
12	Volume of CO_2, %	0	0	0						
13	Volume of CO, %	0	0	0						
14	Volume of O_2, %	21	21	21						
15	Static pressure, in. H_2O	-.54	-.54	-.54						
16	Barometric pressure, in. Hg	30.32	30.27	30.25						
17	Pitot correction factor	.99	.99	.99						
18	Traverse (Avg $\sqrt{\Delta p}$), in. H_2O	1.026	1.042	1.046						
19	Volume H_2O collected, ml	11.8	18.5	18.7						
20	Weight collected, mg	.431	.356	.279						
21	Volume titrant, SO_3, ml	—	—	—						
22	Volume titrant, SO_2, ml	—	—	—						
23	Normality titrant, SO_3	—	—	—						
24	Normality titrant, SO_2	—	—	—						
25	Meter calibration factor # 125 →	1.00	1.00	1.00						
26	Avg. Cosine of angle	1	1	1						
27	Post leak check rate, CFM	0	0	0						
28	Leak check rate no. 1, CFM	0	0	0						
29	Leak check time no. 1, min.	0	0	0						

Job Number 5945-01

File Name South Stk, Usw

1	Heading	South System, Process Vent								
2	Number of tests	3	Sampled 2/9/88							
3	Test type ("EPA","PA","F",or "H2S")	"EPA"	"EPA"	"EPA"						
4	Test identification (ID's in qoutes)	"1"	"2"	"3"						
5	Stack area, in^2	43.5	43.5	43.5						
6	Stack temperature, ^oF	78	79	78						
7	Sample volume, ft^3	46.760	42.613	43.169						
8	Meter temperature, ^oF	92	93	90						
9	Orifice (ΔH), in. H_2O	1.857	1.875	1.475						
10	Nozzle diameter, in ✓	.322	.322	.322						
11	Duration of test, min.	60	60	60						
12	Volume of CO_2, %	0	0	0						
13	Volume of CO, %	0	0	0						
14	Volume of O_2, %	21	21	21						
15	Static pressure, in. H_2O	+.33	+.36	+.28						
16	Barometric pressure, in. Hg	30.32	30.27	30.25						
17	Pitot correction factor	.99	.99	.99						
18	Traverse (Avg $\sqrt{\Delta p}$), in. H_2O	.345	.346	.306						
19	Volume H_2O collected, ml	15.8	14.4	19.3						
20	Weight collected, mg	.7712	.634	.998						
21	Volume titrant, SO_3, ml	0	0	0						
22	Volume titrant, SO_2, ml	0	0	0						
23	Normality titrant, SO_3	0	0	0						
24	Normality titrant, SO_2	0	0	0						
25	Meter calibration factor #4 →	1.00	1.00	1.00						
26	Avg. Cosine of angle	1	1	1						
27	Post leak check rate, CFM	0	0	0						
28	Leak check rate no. 1, CFM	0	0	0						
29	Leak check time no. 1, min.	0	0	0						

Job Number 8945-01

File Name SouthVnt, Unu

1	Heading	North System Melting Pot								
2	Number of tests	3	Sampled 2/9/88							
3	Test type ("EPA","PA","F",or "H2S")	"EPA"	"EPA"	"EPA"						
4	Test identification (ID's in qoutes)	"1"	"2"	"3"						
5	Stack area, in^2	176.7	176.7	176.7						
6	Stack temperature, ^oF	122	118	118						
7	Sample volume, ft^3	38.511	38.582	37.624						
8	Meter temperature, ^oF	88	92	89						
9	Orifice (ΔH), in. H_2O	1.279	1.254	1.192						
10	Nozzle diameter, in	.374	.374	.374						
11	Duration of test, min.	60	60	60						
12	Volume of CO_2, %	0	0	0						
13	Volume of CO, %	0	0	0						
14	Volume of O_2, %	21	21	21						
15	Static pressure, in. H_2O	-1.5	-1.5	-1.5						
16	Barometric pressure, in. Hg	30.32	30.27	30.25						
17	Pitot correction factor	.99	.99	.99						
18	Traverse (Avg:$\sqrt{\Delta p}$), in. H_2O	.212	.210	.204						
19	Volume H_2O collected, ml	7.1	6.0	7.0						
20	Weight collected, mg	.948	1.540	1.330						
21	Volume titrant, SO_3, ml	0	0	0						
22	Volume titrant, SO_2, ml	0	0	0						
23	Normality titrant, SO_3	0	0	0						
24	Normality titrant, SO_2	0	0	0						
25	Meter calibration factor #285	.98	.98	1.98						
26	Avg. Cosine of angle	1	1	1						
27	Post leak check rate, CFM	0	0	0						
28	Leak check rate no. 1, CFM	0	0	0						
29	Leak check time no. 1, min.	0	0	0						

Job Number 5945-01

File Name SouthPot, UNN

1	Heading	South System Process Stack								
2	Number of tests	3	Sampled 2/18/88							
3	Test type ("EPA","PA","F",or "H2S")	"EPA"	"EPA"	"EPA"						
4	Test identification (ID's in qoutes)	"1"	"2"	"3"						
5	Stack area, in^2	176.7	176.7	176.7						
6	Stack temperature, ^oF	173	223	179						
7	Sample volume, ft^3	52.526	51.475	52.238						
8	Meter temperature, ^oF	93	100	102						
9	Orifice (ΔH), in. H_2O	2.475	2.417	2.450						
10	Nozzle diameter, in	.199	.199	.199						
11	Duration of test, min.	60	60	60						
12	Volume of CO_2, %	0	0	0						
13	Volume of CO, %	0	0	0						
14	Volume of O_2, %	21	21	21						
15	Static pressure, in. H_2O	+.26	+.13	+.28						
16	Barometric pressure, in. Hg	30.20	30.16	30.16						
17	Pitot correction factor	.99	.99	.99						
18	Traverse (Avg $\sqrt{\Delta p}$), in. H_2O	1.069	1.059	1.069						
19	Volume H_2O collected, ml	14.0	+5.5	+3.4						
20	Weight collected, mg	.604	.293	.163						
21	Volume titrant, SO_3, ml	0	0	0						
22	Volume titrant, SO_2, ml	0	0	0						
23	Normality titrant, SO_3	0	0	0						
24	Normality titrant, SO_2	0	0	0						
25	Meter calibration factor	1.00	1.00	1.00						
26	Avg. Cosine of angle	1	1	1						
27	Post leak check rate, CFM	0	0	0						
28	Leak check rate no. 1, CFM	0	0	0						
29	Leak check time no. 1, min.	0	0	0						

#285

Job Number 5945-01

File Name ! Stk, UNN

1	Heading	South System, Process Vent							
2	Number of tests	3	Sampled 2/18/88						
3	Test type ("EPA","PA","F",or "H2S")	"EPA"	"EPA"	"EPA"					
4	Test identification (ID's in qoutes)	"1"	"2"	"3"					
5	Stack area, in^2	43.5	43.5	43.5					
6	Stack temperature, ^oF	76	81	82					
7	Sample volume, ft^3	47.089	46.720	45.905					
8	Meter temperature, ^oF	89	94	98					
9	Orifice (ΔH), in. H_2O	1.89	1.82	1.700					
10	Nozzle diameter, in	.322	.322	.322					
11	Duration of test, min.	60	60	60					
12	Volume of CO_2, %	0	0	0					
13	Volume of CO, %	0	0	0					
14	Volume of O_2, %	21	21	21					
15	Static pressure, in. H_2O	+.36	+.33	+.32					
16	Barometric pressure, in. Hg	30.20	30.16	30.16					
17	Pitot correction factor	.99	.99	.99					
18	Traverse (Avg $\sqrt{\Delta p}$), in. H_2O	.349	.342	.331					
19	Volume H_2O collected, ml	19.9	11.5	7.9					
20	Weight collected, mg	1840	2.320	1.440					
21	Volume titrant, SO_3, ml	0	0	0					
22	Volume titrant, SO_2, ml	0	0	0					
23	Normality titrant, SO_3	0	0	0					
24	Normality titrant, SO_2	0	0	0					
25	Meter calibration factor	1.00	1.00	1.00					
26	Avg. Cosine of angle	1	1	1					
27	Post leak check rate, CFM	0	0	0					
28	Leak check rate no. 1, CFM	0	0	0					
29	Leak check time no. 1, min.	0	0	0					

Job Number 5945-01

File Name UNT, UNN

1	Heading	South System, Melting Pot								
2	Number of tests	3	Sampled 2/18/88							
3	Test type ("EPA","PA","F",or "H2S")	"EPA"	"EPA"	"EPA"						
4	Test identification (ID's in qoutes)	"1"	"2"	"3"						
5	Stack area, in^2	176.7	176.7	176.7						
6	Stack temperature, ^oF	112	113	113						
7	Sample volume, ft^3	50.305	51.172	49.553						
8	Meter temperature, ^oF	93	94	99						
9	Orifice (ΔH), in. H_2O	2.221	2.308	2.113						
10	Nozzle diameter, in	.320	.320	.320						
11	Duration of test, min.	60	60	60						
12	Volume of CO_2, %	0	0	0						
13	Volume of CO, %	0	0	0						
14	Volume of O_2, %	21	21	21						
15	Static pressure, in. H_2O	-1.4	-1.3	-1.3						
16	Barometric pressure, in. Hg	30.20	30.16	30.16						
17	Pitot correction factor	.99	.99	.99						
18	Traverse (Avg:$\sqrt{\Delta p}$), in. H_2O	.383	.391	.325						
19	Volume H_2O collected, ml	10.2	12.4	8.2						
20	Weight collected, mg	.973	.604	.289						
21	Volume titrant, SO_3, ml	0	0	0						
22	Volume titrant, SO_2, ml	0	0	0						
23	Normality titrant, SO_3	0	0	0						
24	Normality titrant, SO_2	0	0	0						
25	Meter calibration factor	1.00	1.00	1.00						
26	Avg. Cosine of angle	1	1	1						
27	Post leak check rate, CFM	0	0	0						
28	Leak check rate no. 1, CFM	0	0	0						
29	Leak check time no. 1, min.	0	0	0						

#125

Job Number 5945-01

File Name Pot, UNN

NORTH SYSTEM-PROCESS STACK (CIRCULAR)

PARAMETERS:		1	2	3
AREA OF BREECHING	(SQ FT)	1.23	1.23	1.23
SAMPLE VOLUME	(DSCF)	46.389	47.968	48.357
MOISTURE	(%)	1.2	1.8	1.8
MOLECULAR WEIGHT	(LB/LB-MOLE)	28.71	28.65	28.65
GAS TEMPERATURE	(F)	183.0	186.0	186.0
GAS VELOCITY	(FT/MIN)	4480.7	4570.1	4589.2
GAS VOLUME	(DRY SCFM)	4513.3	4546.7	4562.5
GAS VOLUME	(ACFM)	5498.2	5607.9	5631.4
PARTICULATE EMISSIONS:				
CONCENTRATION	(GRAINS/DSCF)	.0001	.0001	.0001
CONC. @ STK COND.	(GRAINS/CF)	.0001	.0001	.0001
EMISSION RATE	(LB/HR)	.0055	.0045	.0035
ORSAT ANALYSIS:				
CARBON DIOXIDE	(VOL %)	.0	.0	.0
CARBON MONOXIDE	(VOL %)	.0	.0	.0
OXYGEN	(VOL %)	21.0	21.0	21.0
NITROGEN	(VOL %)	79.0	79.0	79.0
EXCESS AIR	(%)	-14583.2	-14583.2	-14583.2
ISOKINETICS	(%)	97.3	99.9	100.3

NORTH SYSTEM-PROCESS VENT (RECTANGULAR)

PARAMETERS:		1	2	3
AREA OF BREECHING	(SQ FT)	.30	.30	.30
SAMPLE VOLUME	(DSCF)	45.511	46.183	42.033
MOISTURE	(%)	1.6	.9	1.5
MOLECULAR WEIGHT	(LB/LB-MOLE)	28.67	28.74	28.68
GAS TEMPERATURE	(F)	78.0	79.0	78.0
GAS VELOCITY	(FT/MIN)	1377.8	1382.5	1223.2
GAS VOLUME	(DRY SCFM)	407.4	410.1	361.4
GAS VOLUME	(ACFM)	416.2	417.6	369.5
PARTICULATE EMISSIONS:				
CONCENTRATION	(GRAINS/DSCF)	.0003	.0002	.0004
CONC @ STK COND.	(GRAINS/CF)	.0003	.0002	.0004
EMISSION RATE	(LB/HR)	.0009	.0007	.0011
ORSAT ANALYSIS:				
CARBON DIOXIDE	(VOL %)	.0	.0	.0
CARBON MONOXIDE	(VOL %)	.0	.0	.0
OXYGEN	(VOL %)	21.0	21.0	21.0
NITROGEN	(VOL %)	79.0	79.0	79.0
EXCESS AIR	(%)	-14583.2	-14583.2	-14583.2
ISOKINETICS	(%)	99.4	100.2	103.5

NORTH SYSTEM-MELTING POT

PARAMETERS:		1	2	3
AREA OF BREECHING	(SQ FT)	1.23	1.23	1.23
SAMPLE VOLUME	(DSCF)	36.949	36.686	35.942
MOISTURE	(%)	.9	.8	.9
MOLECULAR WEIGHT	(LB/LB-MOLE)	28.74	28.76	28.74
GAS TEMPERATURE	(F)	122.0	118.0	118.0
GAS VELOCITY	(FT/MIN)	881.4	870.6	846.2
GAS VOLUME	(DRY SCFM)	981.4	975.8	946.4
GAS VOLUME	(ACFM)	1081.5	1068.2	1038.4
PARTICULATE EMISSIONS:				
CONCENTRATION	(GRAINS/DSCF)	.0004	.0006	.0006
CONC. @ STK COND.	(GRAINS/CF)	.0004	.0006	.0005
EMISSION RATE	(LB/HR)	.0033	.0054	.0046
ORSAT ANALYSIS:				
CARBON DIOXIDE	(VOL %)	.0	.0	.0
CARBON MONOXIDE	(VOL %)	.0	.0	.0
OXYGEN	(VOL %)	21.0	21.0	21.0
NITROGEN	(VOL %)	79.0	79.0	79.0
EXCESS AIR	(%)	-14583.2	-14583.2	-14583.2
ISOKINETICS	(%)	100.9	100.8	101.8

SOUTH SYSTEM-PROCESS STACK (CIRCULAR)

PARAMETERS:		1	2	3
AREA OF BREECHING	(SQ FT)	1.23	1.23	1.23
SAMPLE VOLUME	(DSCF)	50.905	49.191	49.747
MOISTURE	(%)	.4	.5	.3
MOLECULAR WEIGHT	(LB/LB-MOLE)	28.80	28.78	28.81
GAS TEMPERATURE	(F)	173.0	223.0	179.0
GAS VELOCITY	(FT/MIN)	4629.6	4769.3	4632.3
GAS VOLUME	(DRY SCFM)	4766.4	4536.2	4720.6
GAS VOLUME	(ACFM)	5680.9	5852.3	5684.2
PARTICULATE EMISSIONS:				
CONCENTRATION	(GRAINS/DSCF)	.0002	.0001	.0001
CONC. @ STK COND.	(GRAINS/CF)	.0002	.0001	.0000
EMISSION RATE	(LB/HR)	.0075	.0036	.0020
ORSAT ANALYSIS:				
CARBON DIOXIDE	(VOL %)	.0	.0	.0
CARBON MONOXIDE	(VOL %)	.0	.0	.0
OXYGEN	(VOL %)	21.0	21.0	21.0
NITROGEN	(VOL %)	79.0	79.0	79.0
EXCESS AIR	(%)	-14583.2	-14583.2	-14583.2
ISOKINETICS	(%)	101.1	102.6	99.7

SOUTH SYSTEM-PROCESS VENT (RECTANGULAR)

PARAMETERS:		1.	2	3
AREA OF BREECHING	(SQ FT)	.30	.30	.30
SAMPLE VOLUME	(DSCF)	45.904	45.066	43.949
MOISTURE	(%)	2.0	1.2	.8
MOLECULAR WEIGHT	(LB/LB-MOLE)	28.62	28.71	28.75
GAS TEMPERATURE	(°F)	76.0	81.0	82.0
GAS VELOCITY	(FT/MIN)	1394.9	1372.2	1328.4
GAS VOLUME	(DRY SCFM)	410.8	403.1	390.9
GAS VOLUME	(ACFM)	421.4	414.5	401.3
PARTICULATE EMISSIONS:				
CONCENTRATION	(GRAINS/DSCF)	.0006	.0008	.0005
CONC. @ STK COND.	(GRAINS/CF)	.0006	.0008	.0005
EMISSION RATE	(LB/HR)	.0022	.0027	.0017
ORSAT ANALYSIS:				
CARBON DIOXIDE	(VOL %)	.0	.0	.0
CARBON MONOXIDE	(VOL %)	.0	.0	.0
OXYGEN	(VOL %)	21.0	21.0	21.0
NITROGEN	(VOL %)	79.0	79.0	79.0
EXCESS AIR	(%)	-14583.2	-14583.2	-14583.2
ISOKINETICS	(%)	99.4	99.5	100.1

SOUTH SYSTEM-MELTING POT

PARAMETERS:		1	2	3
AREA OF BREECHING	(SQ FT)	1.23	1.23	1.23
SAMPLE VOLUME	(DSCF)	48.917	49.418	47.404
MOISTURE	(%)	1.0	1.2	.8
MOLECULAR WEIGHT	(LB/LB-MOLE)	28.73	28.71	28.75
GAS TEMPERATURE	(°F)	112.0	113.0	113.0
GAS VELOCITY	(FT/MIN)	1581.7	1617.7	1550.4
GAS VOLUME	(DRY SCFM)	1784.0	1815.8	1746.6
GAS VOLUME	(ACFM)	1940.9	1985.0	1902.5
PARTICULATE EMISSIONS:				
CONCENTRATION	(GRAINS/DSCF)	.0003	.0002	.0001
CONC. @ STK COND.	(GRAINS/CF)	.0003	.0002	.0001
EMISSION RATE	(LB/HR)	.0047	.0029	.0014
ORSAT ANALYSIS:				
CARBON DIOXIDE	(VOL %)	.0	.0	.0
CARBON MONOXIDE	(VOL %)	.0	.0	.0
OXYGEN	(VOL %)	21.0	21.0	21.0
NITROGEN	(VOL %)	79.0	79.0	79.0
EXCESS AIR	(%)	-14583.2	-14583.2	-14583.2
ISOKINETICS	(%)	100.4	99.6	99.4

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PLYMOUTH MEETING, PA 19462
215-825-3800

FINAL REPORT
This is a final report.
The results have been checked and authorized for release.

CLIENT

JOHNSON CONTROLS
ATT: PHILIP BURG
BCM MALL
00-5945-01

Date : 03/02/88
BCM # : - -
P.O.# :
Order# : 19785

BCM Number : 803899
Location : EPA AUDIT
Client ID : 52

Date Sampled : 02/09/88
Date Received : 02/11/88

Test Description	Results	Units	Test Method
Metal Digestion	2/18/88	M/D/Y	EPA - METALS
Lead	392	ug	EPA # 6010

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CLIENT

JOHNSON CONTROLS
ATT: PHILIP BURG
BCM MALL
OO-5945-01

Date : 03/02/88
BCM # : - -
P.O.# :
Order# : 19785

BCM Number : 803900
Location : EPA AUDIT
Client ID : 98

Date Sampled : 02/09/88
Date Received : 02/11/88

Test Description	Results	Units	Test Method
Metal Digestion	2/18/88	M/D/Y	EPA - METALS
Lead	831	ug	EPA # 6010

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CLIENT

JOHNSON CONTROLS
ATT: PHILIP BURG
BCM MALL
OO-5945-01

Date : 03/02/88
BCM # : - -
P.O.# :
Order# : 19785

BCM Number : 803901
Location : MELTING POT, North System
Client ID : #1

Date Sampled : 02/09/88
Date Received : 02/11/88

Test Description	Results	Units	Test Method
Metal Digestion	2/18/88	M/D/Y	EPA - METALS
Lead	948	ug	EPA # 6010
Sample Volume	844	ml	

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JOHNSON CONTROLS
ATT: PHILIP BURG
BCM MALL
00-5945-01

Date : 03/02/88
BCM # : - -
P.O.# :
Order# : 19785

BCM Number : 803902
Location : MELTING POT North System
Client ID : #2

Date Sampled : 02/09/88
Date Received : 02/11/88

Test Description	Results	Units	Test Method
Metal Digestion	2/18/88	M/D/Y	EPA - METALS
Lead	1540	ug	EPA # 6010
Sample Volume	758	ml	

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ATT: PHILIP BURG
BCM MALL
OO-5945-01

Date : 03/02/88
BCM # : - -
P.O.# :
Order# : 19785

BCM Number : 803903
Location : MELTING POT North System
Client ID : #3

Date Sampled : 02/09/88
Date Received : 02/11/88

Test Description	Results	Units	Test Method
Metal Digestion	2/18/88	M/D/Y	EPA - METALS
Lead	1330	ug	EPA @ 6010
Sample Volume	722	ml	

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ATT: PHILIP BURG
BCM MALL
00-5945-01

Date : 03/02/88
BCM # : - -
P.O.# :
Order# : 19785

BCM Number : 803904
Location : PROCESS VENT North System
Client ID : #1

Date Sampled : 02/09/88
Date Received : 02/11/88

Test Description	Results	Units	Test Method
Metal Digestion	2/18/88	M/D/Y	EPA - METALS
Lead	772	ug	EPA # 6010
Sample Volume	608	ml	

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ATT: PHILIP BURG
BCM MALL
00-5945-01

Date : 03/02/88
BCM # : - -
P.O.# :
Order# : 19785

BCM Number : 803905
Location : PROCESS VENT North System
Client ID : #2

Date Sampled : 02/09/88
Date Received : 02/11/88

Test Description	Results	Units	Test Method
Metal Digestion	2/18/88	M/D/Y	EPA - METALS
Lead	634	ug	EPA # 6010
Sample Volume	695	ml	

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ATT: PHILIP BURG
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00-5945-01

Date : 03/02/88
BCM # : - -
P.O.# :
Order# : 19785

BCM Number : 803906
Location : PROCESS VENT North System
Client ID : #3

Date Sampled : 02/09/88
Date Received : 02/11/88

Test Description	Results	Units	Test Method
Metal Digestion	2/18/88	M/D/Y	EPA - METALS
Lead	998	ug	EPA @ 6010
Sample Volume	722	ml	

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ATT: PHILIP BURG
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00-5945-01

Date : 03/02/88
BCM # : - -
P.O.# :
Order# : 19785

BCM Number : 803907
Location : PROCESS STACK North System
Client ID : #1

Date Sampled : 02/09/88
Date Received : 02/11/88

Test Description	Results	Units	Test Method
Metal Digestion	2/18/88	M/D/Y	EPA - METALS
Lead	431	ug	EPA # 6010
Sample Volume	800	ml	

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ATT: PHILIP BURG
BCM MALL
00-5945-01

Date : 03/02/88
BCM # : - -
P.O.# :
Order# : 19785

BCM Number : 803908
Location : PROCESS STACK North System
Client ID : #2

Date Sampled : 02/09/88
Date Received : 02/11/88

Test Description	Results	Units	Test Method
Metal Digestion	2/18/88	M/D/Y	EPA - METALS
Lead	356	ug	EPA # 6010
Sample Volume	630	ml	

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ATT: PHILIP BURG
BCM MALL
00-5945-01

Date : 03/02/88
BCM # : - -
P.O.# :
Order# : 19785

BCM Number : 803909
Location : PROCESS STACK North System
Client ID : #3

Date Sampled : 02/09/88
Date Received : 02/11/88

Test Description	Results	Units	Test Method
Metal Digestion	2/18/88	M/D/Y	EPA - METALS
Lead	279	ug	EPA # 6010
Sample Volume	729	ml	

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JOHNSON CONTROLS
ATT: PHILIP BURG
BCM MALL
OO-5945-01

Date : 03/02/88
BCM # : - -
P.O.# :
Order# : 19785

BCM Number : 803909
Location : PROCESS STACK
Client ID : #3

Date Sampled : 02/09/88
Date Received : 02/11/88

Test Description	Results	Units	Test Method

End of Report

Certified by : _____

BCM Eastern Laboratory Director

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ATT: PHILIP BURG
BCM MALL
00-5945-01

Date : 03/15/88
BCM # : 00-5945-01
P.O.# :
Order# : 19968

BCM Number : 804970
Location : MELTING POT
Client ID : SOUTH SYS.#1

Date Sampled : 02/19/88
Date Received : 02/19/88

Test Description	Results	Units	Test Method
Metal Digestion	2/26/88	M/D/Y	EPA - METALS
Lead	973	ug	EPA # 6010
Sample Volume	609	ml	

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ATT: PHILIP BURG
BCM MALL
00-5945-01

Date : 03/15/88
BCM # : 00-5945-01
P.O.# :
Order# : 19968

BCM Number : 804971
Location : MELTING POT
Client ID : SOUTH SYS.#2

Date Sampled : 02/19/88
Date Received : 02/19/88

Test Description	Results	Units	Test Method
Metal Digestion	2/26/88	M/D/Y	EPA - METALS
Lead	604	ug	EPA # 6010
Sample Volume	660	ml	

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ATT: PHILIP BURG
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00-5945-01

Date : 03/15/88
BCM # : 00-5945-01
P.O.# :
Order# : 19968

BCM Number : 804972
Location : MELTING POT
Client ID : SOUTH SYS #3

Date Sampled : 02/19/88
Date Received : 02/19/88

Test Description	Results	Units	Test Method
Metal Digestion	2/26/88	M/D/Y	EPA - METALS
Lead	289	ug	EPA # 6010
Sample Volume	680	ml	

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[redacted] CLIENT

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ATT: PHILIP BURG
BCM MALL
00-5945-01

Date : 03/15/88
BCM # : 00-5945-01
P.O.# :
Order# : 19968

BCM Number : 804973
Location : PROCESS VENT
Client ID : SOUTH SYS #1

Date Sampled : 02/19/88
Date Received : 02/19/88

Test Description	Results	Units	Test Method
Metal Digestion	2/26/88	M/D/Y	EPA - METALS
Lead	1840	ug	EPA # 6010
Sample Volume	626	ml	

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00-5945-01

Date : 03/15/88
BCM # : 00-5945-01
P.O.# :
Order# : 19968

BCM Number : 804974
Location : PROCESS VENT
Client ID : SOUTH SYS #2

Date Sampled : 02/19/88
Date Received : 02/19/88

Test Description	Results	Units	Test Method
Metal Digestion	2/26/88	M/D/Y	EPA - METALS
Lead	2320	ug	EPA # 6010
Sample Volume	654	ml	

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00-5945-01

Date : 03/15/88
BCM # : 00-5945-01
P.O.# :
Order# : 19968

BCM Number : 804975
Location : PROCESS VENT
Client ID : SOUTH SYS#3

Date Sampled : 02/19/88
Date Received : 02/19/88

Test Description	Results	Units	Test Method
Metal Digestion	2/26/88	M/D/Y	EPA - METALS
Lead	1440	ug	EPA # 6010
Sample Volume	641	ml	

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BCM MALL
00-5945-01

Date : 03/15/88
BCM # : 00-5945-01
P.O.# :
Order# : 19968

BCM Number : 804976
Location : PROCESS STACK
Client ID : SOUTH SYS #1

Date Sampled : 02/19/88
Date Received : 02/19/88

Test Description	Results	Units	Test Method
Metal Digestion	2/26/88	M/D/Y	EPA - METALS
Lead	604	ug	EPA # 6010
Sample Volume	589	ml	

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JOHNSON CONTROLS
ATT: PHILIP BURG
BCM MALL
00-5945-01

Date : 03/15/88
BCM # : 00-5945-01
P.O.# :
Order# : 19968

BCM Number : 804977
Location : PROCESS STACK
Client ID : SOUTH SYS #2

Date Sampled : 02/19/88
Date Received : 02/19/88

Test Description	Results	Units	Test Method
Metal Digestion	2/26/88	M/D/Y	EPA - METALS
Lead	293	ug	EPA # 6010
Sample Volume	543	ml	

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JOHNSON CONTROLS
ATT: PHILIP BURG
BCM MALL
00-5945-01

Date : 03/15/88
BCM # : 00-5945-01
P.O.# :
Order# : 19968

BCM Number : 804978
Location : PROCESS STACK
Client ID : SOUTH SYS #3

Date Sampled : 02/19/88
Date Received : 02/19/88

Test Description	Results	Units	Test Method
Metal Digestion	2/26/88	M/D/Y	EPA - METALS
Lead	163	ug	EPA # 6010
Sample Volume	668	ml	

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JOHNSON CONTROLS
ATT: PHILIP BURG
BCM MALL
00-5945-01

Date : 03/15/88
BCM # : 00-5945-01
P.O.# :
Order# : 19968

BCM Number : 804978
Location : PROCESS STACK
Client ID : SOUTH SYS #3

Date Sampled : 02/19/88
Date Received : 02/19/88

Test Description	Results	Units	Test Method

End of Report

Certified by : _____

BCM Eastern Laboratory Director

Run Auto Mode 88/03/07 13:29

Method Name: Replicates: 2 Read Delay: 40
int Format: Mean Values Only ID Name: Pb Data Name: Mar 07-2
marks:

Pb216.9

Element Name Pb216.9 Gain 767

Standard 1
Pb216.9 AV 98820 SD 1342.4 CV 1.3 CONC 20.000 mg/l

Standard 2
Pb216.9 AV 50070 SD 216.4 CV 0.4 CONC 10.000 mg/l

Standard 3
Pb216.9 AV 22455 SD 12.5 CV 0.0 CONC 4.000 mg/l

Standard 4
Pb216.9 AV 7481 SD 174.6 CV 2.3 CONC 1.000 mg/l

Standard 5
Pb216.9 AV 4522 SD 537.4 CV 11.8 CONC 0.200 mg/l

Blank
Pb216.9 AV 3985 SD 408.7 CV 10.2 CONC 0.000 mg/l

Element Name Pb216.9 Correlation Coefficent 0.9998

Standard 1
Pb216.9 AV 18.486 mg/l SD 0.2337 CV 1.2

ICP INTER SOL'N
Pb216.9 AV 1.534 mg/l SD 0.0312 CV 2.0

B 3-3
Pb216.9 AV 0.029 mg/l SD 0.1310 CV 441.4

304970
Pb216.9 AV 9.733 mg/l 973 SD 0.2093 CV 2.1

304970 SA – South melting Pot Rwl
Pb216.9 AV 14.561 mg/l 1456 SD 0.1643 CV 1.1 S %R 97.8
SA = 999 %dev 2.63

304971
Pb216.9 AV 6.041 mg/l 604 SD 0.0354 CV 0.5

304972
Pb216.9 AV 2.885 mg/l 289 SD 0.0097 CV 0.3

304973
Pb216.9 AV 18.397 mg/l 1840 SD 0.0064 CV 0.0

804973 SA – South Process Vent, Rwl
Pb216.9 22.603 mg/l over Calib.

Pb216.9 22.519 mg/l Over Calib.

Pb216.9 AV 22.561 mg/l SD 0.0585 CV 0.2

804974

Pb216.9 22.097 mg/l Over Calib.

Pb216.9 22.551 mg/l Over Calib. See below

Pb216.9 AV 22.324 mg/l SD 0.3209 CV 1.4

804975

Pb216.9 AV 14.401 mg/l 1440 SD 0.3745 CV 2.6

804976

Pb216.9 AV 6.035 mg/l 604 SD 0.0958 CV 1.5

804976 SA — South Process Stock Run1

Pb216.9 AV 10.949 mg/l 1090 SD 0.1992 CV 1.8

SA 621 Rdev 2.77

804977

Pb216.9 AV 2.930 mg/l 293 SD 0.0475 CV 1.6

804978

Pb216.9 AV 1.630 mg/l 163 SD 0.1031 CV 6.3

806294 mg/kg

Pb216.9 AV 19.775 mg/l 198 SD 0.7601 CV 3.8

Standard 3

Pb216.9 AV 4.376 mg/l SD 0.0923 CV 2.1

Blank

Pb216.9 AV 0.015 mg/l SD 0.0694 CV 439.6

ICP INTER SOL'N

Pb216.9 AV 1.501 mg/l SD 0.0780 CV 5.2

Ac 3/7/91

804973 SA/5

Pb216.9 AV 4.738 mg/l 23.60 SD 0.0241 CV 0.5

SA 1770 Rdev 3.87

804974/5

Pb216.9 AV 4.633 mg/l 23.2 SD 0.0392 CV 0.8

2320

BCM

№ 1176

Pb

Data file MAR 27-2

PREP BLK = Nose rinse < .200 mg/L

All Samples in 100 ml Volume

804470 $\frac{9.73\ mg}{L} \times \frac{1\ L}{1000\ ml} \times 100\ ml \times \frac{1000\ ug}{mg} = 973\ ug$

STD Add $\frac{1460\ mg}{L} \times \frac{1}{100\ ml} \times 100\ ml \times \frac{1000\ ug}{mg} = 1460$

$C_x = \frac{973\ ug \times .05\ ml \times 100000\ mg}{(1460\ ug - 973\ ug)(5\ ml)} = 999\ ug$

$\%RPD = \frac{999\ ug - 973\ ug}{\left(\frac{999+973}{2}\right)} \times 100 = 2.63$

804471

$\frac{6.04\ mg}{L} \times \frac{1000\ ug}{mg} \times \frac{1\ L}{1000 ml} \times 100 ml = 604\ ug$

804472

$\frac{2.89\ mg}{L} \times \frac{1\ L}{1000 ml} \times \frac{1000 ug}{mg} \times 100 ml = 289\ ug$

804473

$\frac{18.4\ mg}{L} \times \frac{1\ L}{1000 ml} \times \frac{1000\ ug}{mg} \times 100 ml = 1840\ ug$

STD Add 1/5 dil $\frac{4.74\ mg}{L} \times \frac{1\ L}{1000 ml} \times \frac{1000\ ug}{mg} \times 100 ml \times 5 = 2360$

$C_x = \frac{1840\ ug \times .05\ ml \times 100000\ mg}{(2360\ ug - 1840\ ug)(5\ ml)} = 1770\ ug$

$\%RPD = \frac{1840 - 1770}{\left(\frac{1840+1772}{2}\right)} \times 100 = 3.87$

Duplicate 3 1/2 ...

CONT NEXT Pg

BCM

№ 1177

Pb Cont

80-4774 (1.5 solution)

$$\frac{2.63\ mg}{L} \times \frac{1000\ ug}{mg} \times \frac{L}{1000\ ml} \times 100\ ml \times 5 = 2320\ ug$$

804775

$$144\ \frac{mg}{L} \times \frac{L}{1000\ ml} \times \frac{1000\ ug}{mg} \times 10\ ml = 1440\ ug$$

804776

$$6.04\ mg/L \times \frac{L}{1000\ ml} \times \frac{1000\ ug}{mg} \times 100\ ml = 604\ ug$$

STD Addl

$$10.1\ \frac{mg}{L} \times \frac{L}{1000\ ml} \times \frac{1000\ ug}{mg} \times 10\ ml = 1010\ ug$$

$$C_x = \frac{604\ ug \times 105\ ml \times 1000\ ug}{(1010 - 604\ ug) \times 10} = 621\ ug$$

$$\%\ RPD = \frac{621 - 604}{\left(\frac{621 + 604}{2}\right)} \times 100 = 2.77$$

804777

$$2.93\ \frac{mg}{L} \times \frac{L}{1000\ ml} \times \frac{1000\ ug}{mg} \times 100\ ml = 293\ ug$$

804778

$$1.63\ mg/L \times \frac{L}{1000\ ml} \times \frac{1000\ ug}{mg} \times 100\ ml = 163\ ug$$

Curt Fullerton 3/8/88

Laryn J Hazel 3-9-88

Run Auto Mode 88/02/22 07:48

Method Name: Replicates: 2 Read Delay: 50
Print Format: Mean Values Only ID Name: Pb Air Data Name: Feb 22-1
Remarks:

Pb216.9

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units mg/L
not mg/kg

Element Name Pb216.9 Gain 752

Standard 1
Pb216.9 AV 121034 SD 1289.8 CV 1.0 CONC 20.000 mg/kg

Standard 2
Pb216.9 AV 62384 SD 158.3 CV 0.2 CONC 10.000 mg/kg

Standard 3
Pb216.9 AV 26541 SD 74.4 CV 0.2 CONC 4.000 mg/kg

Standard 4
Pb216.9 AV 8827 SD 238.2 CV 2.6 CONC 1.000 mg/kg

Standard 5
Pb216.9 AV 4305 SD 430.6 CV 10.0 CONC 0.200 mg/kg

Blank
Pb216.9 AV 2640 SD 24.0 CV 0.9 CONC 0.000 mg/kg

Element Name Pb216.9 Correlation Coefficent 0.9999

Results in ug

Standard 1
Pb216.9 AV 20.774 mg/kg SD 0.3253 CV 1.5

CP INTER SOL'N
Pb216.9 AV 0.972 mg/kg SD 0.0071 CV 0.7

I 2-18
Pb216.9 AV -0.022 mg/kg SD 0.0040 CV 17.9

~~IC~~
~~Pb216.9 AV 5.695 mg/kg SD 0.1996 CV 3.5~~ WRONG SAMP! See At End

IC
Pb216.9 AV 9.708 mg/kg SD 0.1843 CV 1.8

803899 (115ml)
Pb216.9 AV 3.268 mg/kg SD 0.1021 CV 3.1

803899 (115ml)
Pb216.9 AV 3.185 mg/kg SD 0.0405 CV 1.2 > 392

803900
Pb216.9 AV 8.005 mg/kg SD 0.1255 CV 1.5

803900
Pb216.9 AV 8.118 mg/kg SD 0.2500 CV 3.0 > 831

803901
Pb216.9 AV 9.478 ~~mg/kg~~ 948 SD 0.2809 CV 2.9

803901 SA North Melting Pot, Run 1
5 Pb216.9 AV 14.442 ~~mg/kg~~ 1444 SD 0.0055 CV 0.0
by SA 956 0.86% der

803902
Pb216.9 AV 15.365 mg/kg 1540 SD 0.0437 CV 0.2

803903
Pb216.9 AV 13.317 mg/kg 1330 SD 0.2212 CV 1.6

Standard 3
Pb216.9 AV 4.520 mg/kg SD 0.0933 CV 2.0

Blank
Pb216.9 AV 0.041 mg/kg SD 0.0646 CV 155.5

803904
Pb216.9 AV 7.721 mg/kg 772 SD 0.0097 CV 0.1

803904 SA North Process Vent, Run 1
Pb216.9 AV 12.625 mg/kg 1260 SD 0.0574 CV 0.4
by SA 791 2.43% der

803905
Pb216.9 AV 6.341 mg/kg 634 SD 0.1541 CV 2.4

803906
Pb216.9 AV 9.984 mg/kg 998 SD 0.0941 CV 0.9

803907
Pb216.9 AV 4.306 mg/kg 431 SD 0.1882 CV 4.3

803907 SA North Process Stack, Run 1
Pb216.9 AV 9.162 mg/kg 916 SD 0.2251 CV 2.4
by SA 444 2.97% der

803908
Pb216.9 AV 3.558 mg/kg 356 SD 0.0428 CV 1.2

803909
Pb216.9 AV 2.793 mg/kg 279 SD 0.0408 CV 1.4

Standard 3
Pb216.9 AV 4.372 mg/kg SD 0.1111 CV 2.5

Blank
Pb216.9 AV -0.038 mg/kg SD 0.0353 CV 91.1

ICP INTER SOL'N
Pb216.9 AV 1.007 mg/kg SD 0.0368 CV 3.6

QC apg
Pb216.9 AV 2.749 mg/kg SD 0.0024 CV 0.0
TV 2.9 2.75

BCM

№ 1181

EPA Pb study

QC:

QC2		9.71 mg	10.0	97.1

QC 3999 (100 ml Final Volume)

Aliquot

$\frac{3.27\ mg}{L} \times \frac{3.23\ mg}{L} \times \frac{L}{1000\ ml} \times 115\ ml \times \frac{1000\ ug}{mg} \div 371\ ug = 394 = 399$

QC 2500 (100 ml Final Volume)

Col Vol

$\frac{8.01\ mg}{8.12\ L} \times \frac{8.07\ mg}{L} \times \frac{L}{1000} \times 100\ ml \times \frac{1000\ ug}{mg} = 807\ ug \div 971 = 831\ ug$

BCM

№ 1182

Pb

Date file Feb 22-4

Dup Blank <0.200 ug/L

All samples 100.00 ml Final Volume

803901 9.48 mg/L x 1000 ug/mg x L/1000 ml x 100 ml = 948 ug

803901 spike (dup) ... ...

144.4 mg/L x 1000 ug/mg x L/1000 ml x 100 = 1444 ug

$C_x = \frac{1443 ... \times 1000 ... }{(1000 ug - 944 ug) \times ... ml} = 956$ ug

% RPD $\frac{956 - 948}{\left(\frac{956 + 948}{2}\right)} \times 100 = 0.86$ %

803902

15.4 mg/L x 1000 ug/mg x 1 L/1000 ml x 100 = 1540 ug

803903 13.3 mg/L x 1000 ug/mg x 1 L/1000 ml x 100 = 1330 ug

[signature]

[signature]

BCM

P5 cont

№ 1301183

803904 $\frac{7.72\ mg}{L} \times \frac{1000\ ug}{mg} \times \frac{L}{1000\ ml} \times 100\ ml = 772\ ug$

803906 STANDARD Addition $\frac{12.6\ mg}{L} \times \frac{1000\ ug}{mg} \times \frac{L}{1000\ ml} \times 100\ ml = 1260\ ug$

$$C_x = \frac{772\ mg \times .05\ ml \times 100000\ ug}{(1260\ ug - 772\ ug) \times 10\ ml} = 791\ ug$$

$$\%RPD = \frac{791 - 772}{\left(\frac{791 + 772}{2}\right)} = 2.43$$

803905 $\frac{6.34\ mg}{L} \times \frac{1000\ ug}{mg} \times \frac{L}{1000\ ml} \times 100 = 634\ ug$

803906 $\frac{5.98\ mg}{L} \times \frac{1000\ ug}{mg} \times \frac{1\ L}{1000\ ml} \times 100 = 598\ ug$

803907 ~~Hold~~ $\frac{4.31\ mg}{L} \times \frac{1000\ ug}{mg} \times \frac{L}{1000\ ml} \times 100\ ml = 431\ ug$

803907 STANDARD Addition $\frac{9.16\ mg}{L} \times \frac{1000\ ug}{mg} \times \frac{L}{1000\ ml} \times 100\ ml = 916\ ug$

$$C_x = \frac{431\ mg \times .05\ ml \times 100000\ ug}{(916\ mg - 431\ mg) \times 10} = 444\ ug$$

$$\%RPD = \left(\frac{444 - 431}{\left(\frac{444 + 431}{2}\right)}\right) = 2.97$$

803908 $3.56\ \frac{mg}{L} \times \frac{1000\ ug}{mg} \times \frac{L}{1000\ ml} \times 100\ ml = 356\ ug$

803909 $2.79\ \frac{mg}{L} \times 1000\ \frac{ug}{mg} \times \frac{L}{1000\ ml} \times 100\ ml = 279\ ug$

beaker with a watch glass and heat gently. The warm acid will soon dissolve the membrane.

Increase the temperature of the hot plate and digest the material. When the acid has nearly evaporated, cool the beaker and watch glass and add another 3 mL of conc. HNO_3. Cover and continue heating until the digestion is complete, generally indicated by a light colored digestate. Evaporate to near dryness (2 mL), cool, add 10 mL HCl (1+1) and 15 mL deionized, distilled water per 100 mL dilution and warm the beaker gently for 15 min. to dissolve any precipitated or residue material. Allow to cool, wash down the watch glass and beaker walls with deionized distilled water and filter the sample to remove insoluble material that could clog the nebulizer. (See Note 4.) Adjust the volume based on the expected concentrations of elements present. This volume will vary depending on the elements to be determined (See Note 6). The sample is now ready for analysis. Concentrations so determined shall be reported as "suspended."

NOTE 4: In place of filtering, the sample after diluting and mixing may be centrifuged or allowed to settle by gravity overnight to remove insoluble material.

9.3 For the determination of total elements, choose a measured, volume of the well mixed acid preserved sample appropriate for the expected level of elements and transfer to a Griffin beaker. (See Note 5.) Add 3 mL of conc. HNO_3. Place the beaker on a hot plate and evaporate to near dryness cautiously, making certain that the sample does not boil and that no area of the bottom of the beaker is allowed to go dry. Cool the beaker and add another 5 mL portion of conc. HNO_3. Cover the beaker with a watch glass and return to the hot plate. Increase the temperature of the hot plate so that a gentle reflux action occurs. Continue heating, adding additional acid as necessary, until the digestion is complete (generally indicated when the digestate is light in color or does not change in appearance with continued refluxing.) Again, evaporate to near dryness and cool the beaker. Add 10 mL of 1+1 HCl and 15 mL of deionized, distilled water per 100 mL of final solution and warm the beaker gently for 15 min. to dissolve any precipitate or residue resulting from evaporation. Allow to cool, wash down the beaker walls and watch glass with deionized distilled water and filter the sample to remove insoluble material that could clog the nebulizer. (See Note 4.) Adjust the sample to a predetermined volume based on the expected concentrations of elements present. The sample is now ready for analysis (See Note 6). Concentrations so determined shall be reported as "total."

NOTE 5: If low determinations of boron are critical, quartz glassware should be use.

NOTE 6: If the sample analysis solution has a different acid concentration from that given in 9.4, but does not introduce a physical interference or affect the analytical result, the same calibration standards may be used.

9.4 For the determination of total recoverable elements, choose a measured volume of a well mixed, acid preserved sample appropriate for the expected level of elements and transfer to a Griffin beaker. (See Note 5.) Add 2 mL of (1+1) HNO_3 and 10 mL of (1+1) HCl to the sample and heat on a steam bath or hot plate until the volume has been reduced to near 25 mL making certain the sample does not boil. After this treatment, cool the sample and filter to remove insoluble material that could clog the nebulizer. (See Note 4.) Adjust the volume to 100 mL and mix. The sample is now ready for analysis. Concentrations so determined shall be reported as "total."

10. Procedure

10.1 Set up instrument with proper operating parameters established in 6.2. The instrument must be allowed to become thermally stable before beginning. This usually requires at least 30 min. of operation prior to calibration.

10.2 Initiate appropriate operating configuration of computer.

10.3 Profile and calibrate instrument according to instrument manufacturer's recommended procedures, using the typical mixed calibration standard solutions described in 7.4. Flush the system with the calibration blank (7.5.1) between each standard. (See Note 7.) (The use of the average intensity of multiple exposures for both standardization and sample analysis has been found to reduce random error.)

NOTE 7: For boron concentrations greater than 500 µg/L extended flush times of 1 to 2 min. may be required.

10.4 Before beginning the sample run, reanalyze the highest mixed calibration standard as if it were a sample. Concentration values obtained should not deviate from the actual values by more than ± 5 percent (or the established control limits whichever is lower). If they do, follow the recommendations of the instrument manufacturer to correct for this condition.

10.5 Begin the sample run flushing the system with the calibration blank solution (7.5.1) between each sample. (See Note 7.) Analyze the instrument check standard (7.6.1) and the calibration blank (7.5.1) each 10 samples.

10.6 If it has been found that method of standard addition are required, the following procedure is recommended.

10.6.1 The standard addition technique (14.2) involves preparing new standards in the sample matrix by adding known amounts of standard to one or more aliquots of the processed sample solution. This technique compensates for a sample constituent that enhances or depresses the analyte signal thus producing a different slope from that of the calibration standards. It will not correct for additive interference which causes a baseline shift. The simplest version of this technique is the single-addition method. The procedure is as follows. Two identical aliquots of the sample solution, each of volume V_x, are taken. To the first (labeled A) is added a small volume V_s of a standard analyte solution of concentration c_s. To the second (labeled B) is added the same volume V_s of the solvent. The analytical signals of A and B are measured and corrected for nonanalyte signals. The unknown sample concentration c_x is calculated:

$$c_x = \frac{S_B V_S c_S}{(S_A - S_B) V_x}$$

where S_A and S_B are the analytical signals (corrected for the blank) of solutions A and B, respectively. V_S and c_S should be chosen so that S_A is roughly twice S_B on the average. It is best if V_S is made much less than V_x, and thus c_S is much greater than c_x, to avoid excess dilution of the sample matrix. If a separation or concentration step is used, the additions are best made first and carried through the entire procedure. For the results from this technique to be valid, the following limitations must be taken into consideration:

1. The analytical curve must be linear.
2. The chemical form of the analyte added must respond the same as the analyte in the sample.

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APPENDIX C

PERTINENT REGULATIONS

§ 60.341 Definitions.

As used in this subpart, all terms not defined herein shall have the same meaning given them in the Act and in subpart A of this part.

(a) "Lime manufacturing plant" includes any plant which produces a lime product from limestone by calcination. Hydration of the lime product is also considered to be part of the source.

(b) "Lime product" means the product of the calcination process including, but not limited to, calcitic lime, dolomitic lime, and dead-burned dolomite.

(c) "Rotary lime kiln" means a unit with an inclined rotating drum which is used to produce a lime product from limestone by calcination.

(d) "Lime hydrator" means a unit used to produce hydrated lime product.

§ 60.342 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere:

(1) From any rotary lime kiln any gases which:

(i) Contain particulate matter in excess of 0.15 kilogram per megagram of limestone feed (0.30 lb/ton).

(ii) Exhibit 10 percent opacity or greater.

(2) From any lime hydrator any gases which contain particulate matter in excess of 0.075 kilogram per megagram of lime feed (0.15 lb/ton).

§ 60.343 Monitoring of emissions and operations.

(a) The owner or operator subject to the provisions of this subpart shall install, calibrate, maintain, and operate a continuous monitoring system, except as provided in paragraph (b) of this section, to monitor and record the opacity of a representative portion of the gases discharged into the atmosphere from any rotary lime kiln. The span of this system shall be set at 40 percent opacity.

(b) The owner or operator or any rotary lime kiln using a wet scrubbing emission control device subject to the provisions of this subpart shall not be required to monitor the opacity of the gases discharged as required in paragraph (a) of this section, but shall install, calibrate, maintain, and operate the following continuous monitoring devices:

(1) A monitoring device for the continuous measurement of the pressure loss of the gas stream through the scrubber. The monitoring device must be accurate within ±250 pascals (one inch of water).

(2) A monitoring device for continuous measurement of the scrubbing liquid supply pressure to the control device. The monitoring device must be accurate within ±5 percent of the design scrubbing liquid supply pressure.

(c) The owner or operator of any lime hydrator using a wet scrubbing emission control device subject to the provisions of this subpart shall install, calibrate, maintain, and operate the following continuous monitoring devices:

(1) A monitoring device for the continuous measuring of the scrubbing liquid flow rate. The monitoring device must be accurate within ±5 percent of design scrubbing liquid flow rate.

(2) A monitoring device for the continuous measurement of the electric current, in amperes, used by the scrubber. The monitoring device must be accurate within ±10 percent over its normal operating range.

(d) For the purpose of conducting a performance test under § 60.8, the owner or operator or any lime manufacturing plant subject to the provisions of this subpart shall install, calibrate, maintain, and operate a device for measuring the mass rate of limestone feed to any affected rotary lime kiln and the mass rate of lime feed to any affected lime hydrator. The measuring device used must be accurate to within ±5 percent of the mass rate over its operating range.

(e) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as all six-minute periods during which the average opacity of the plume from any lime kiln subject to paragraph (a) of this subpart is 10 percent or greater.

§ 60.344 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided under § 60.8(b), shall be used to determine compliance with § 60.322(a) as follows:

(1) Method 5 for the measurement of particulate matter,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate,

(4) Method 3 for gas analysis,

(5) Method 4 for stack gas moisture, and

(6) Method 9 for visible emissions.

(b) For Method 5, the sampling tome for each run shall be at least 60 minutes and the sampling rate shall be at least 0.85 std m^3/h, dry basis (0.53 dscf/min), except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) Because of the high moisture content (40 to 85 percent by volume) of the exhaust gases from hydrators, the Method 5 sample train may be modified to include a calibrated orifice immediately following the sample nozzle when testing lime hydrators. In this configuration, the sampling rate necessary for maintaining isokinetic conditions can be directly related to exhaust gas velocity without a correction for moisture content. Extra care should be exercised when cleaning the sample train with the orifice in this position following the test runs.

Subpart KK—Standards of Performance for Lead-Acid Battery Manufacturing Plants

[Subpart KK added by 47 FR 16573, April 16, 1982]

§ 60.370 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to the affected facilities listed in paragraph (b) of this section at any lead-acid battery manufacturing plant that produces or has the design capacity to produce in one day (24 hours) batteries containing an amount of lead equal to or greater than 5.9 Mg (6.5 tons).

(b) The provisions of this subpart are applicable to the following affected facilities used in the manufacture of lead-acid storage batteries:

(1) Grid casting facility.

(2) Paste mixing facility.

(3) Three-process operation facility.

(4) Lead oxide manufacturing facility.

(5) Lead reclamation facility.

(6) Other lead-emitting operations.

(c) Any facility under paragraph (b) of this section the construction or modification of which is commenced after January 14, 1980, is subject to the requirements of this subpart.

§ 60.371 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Grid casting facility" means the facility which includes all lead melting pots and machines used for casting the grid used in battery manufacturing.

(b) "Lead-acid battery manufacturing plant" means any plant that produces a storage battery using lead and lead compounds for the plates and sulfuric acid for the electrolyte.

(c) "Lead oxide manufacturing facility" means a facility that produces lead oxide from lead, including product recovery.

(d) "Lead reclamation facility" means the facility that remelts lead scrap and casts it into lead ingots for use in the battery manufacturing process, and which is not a furnace affected under Subpart L of this part.

(e) "Other lead-emitting operation" means any lead-acid battery manufacturing plant operation from which lead emissions are collected and ducted to the atmosphere and which is not part of a grid casting, lead oxide manufacturing, lead reclamation, paste mixing, or three-process operation facility, or a furnace affected under Subpart L of this part.

(f) "Paste mixing facility" means the facility including lead oxide storage, conveying, weighing, metering, and charging operations; paste blending, handling, and cooling operations; and plate pasting, takeoff, cooling, and drying operations.

(g) "Three-process operation facility" means the facility including those processes involved with plate stacking, burning or strap casting, and assembly of elements into the battery case.

§ 60.372 Standards for lead.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere:

(1) From any grid casting facility any gases that contain lead in excess of 0.40 milligram of lead per dry standard cubic meter of exhaust (0.000176 gr/dscf).

(2) From any paste mixing facility any gases that contain in excess of 1.00 milligram of lead per dry standard cubic meter of exhaust (0.00044 gr/dscf).

(3) From any three-process operation facility any gases that contain in excess of 1.00 milligram of lead per dry standard cubic meter of exhaust (0.00044 gr/dscf).

(4) From any lead oxide manufacturing facility any gases that contain in excess of 5.0 milligrams of lead per kilogram of lead feed (0.010 lb/ton).

(5) From any lead reclamation facility any gases that contain in excess of 4.50 milligrams of lead per dry standard cubic meter of exhaust (0.00198 gr/dscf).

(6) From any other lead-emitting operation any gases that contain in excess of 1.00 milligram per dry standard cubic meter of exhaust (0.00044 gr/dscf).

(7) From any affected facility other than a lead reclamation facility any gases with greater than 0 percent opacity (measured according to Method 9 and rounded to the nearest whole percentage).

(8) From any lead reclamation facility any gases with greater than 5 percent opacity (measured according to Method 9 and rounded to the nearest whole percentage).

(b) When two or more facilities at the same plant (except the lead oxide manufacturing facility) are ducted to a common control device, an equivalent standard for the total exhaust from the commonly controlled facilities shall be determined as follows:

$$S_e = \sum_{a=1}^{N} S_a(Q_{sd_a}/Q_{sd_T})$$

Where:

S_e = is the equivalent standard for the total exhaust stream.

S_a = is the actual standard for each exhaust stream ducted to the control device.

N = is the total number of exhaust streams ducted to the control device.

Q_{sd_a} = is the dry standard volumetric flow rate of the effluent gas stream from each facility ducted to the control device.

Q_{sd_T} = is the total dry standard volumetric flow rate of all effluent gas streams ducted to the control device.

§ 60.373 Monitoring of emissions and operations.

The owner or operator of any lead-acid battery manufacturing facility subject to the provisions of this subpart and controlled by a scrubbing system(s) shall install, calibrate, maintain, and operate a monitoring device(s) that measures and records the pressure drop across the scrubbing system(s) at least once every 15 minutes. The monitoring device shall have an accuracy of ±5 percent over its operating range.

[Sec. 114 of the Clean Air Act as amended (42 U.S.C. 7414)]

§ 60.374 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided under § 60.8(b), shall be used to determine compliance according to § 60.8 as follows:

(1) Method 12 for the measurement of lead concentrations,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 4 for stack gas moisture.

(b) For Method 12, the sampling time for each run shall be at least 60 minutes and the sampling rate shall be at least 0.85 dscm/h (0.53 dscf/min), except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) When different operations in a three-process operation facility are ducted to separate control devices, the lead emission concentration from the facility shall be determined using the equation:

$$C_{m_T} = \sum_{a=1}^{N} (C_{m_a} Q_{sd_a}/Q_{sd_T})$$

Where:

C_{m_T} = is the facility emission concentration for the entire facility.

N = is the number of control devices to which separate operations in the facility are ducted.

C_{m_a} = is the emission concentration from each control device.

Q_{sd_a} = is the dry standards volumetric flow rate of the effluent gas stream from each control device.

Q_{sd_T} = is the total dry standard volumetric flow rate from all of the control devices.

(d) For lead oxide manufacturing facilities, the average lead feed rate to a facility, expressed in kilograms per hour, shall be determined for each test run as follows:

(1) Calculate the total amount of lead charged to the facility during the run by multiplying the number of lead pigs (ingots) charged during the run by the average mass of a pig in kilograms or by another suitable method.

(2) Divide the total amount of lead charged to the facility during the run by the duration of the run in hours.

(e) Lead emissions from lead oxide manufacturing facilities, expressed in milligrams per kilogram of lead charged, shall be determined using the following equation:

$$E_m = C_m Q_{sd}/F$$

Where:

E_m = is the lead emission rate from the facility in milligrams per kilogram of lead charged.

C_m = is the concentration of lead in the exhaust stream in milligrams per dry standard cubic meter as determined according to paragraph (a)(1) of this section.

Q_{sd} = is the dry standard volumetric flow rate in dry standard cubic meters per hour as determined according to paragraph (a)(3) of this section.

F = is the lead feed rate to the facility in kilograms per hour as determined according to paragraph (d) of this section.

[Sec. 114 of the Clean Air Act as amended (42 U.S.C. 7414)]

Subpart MM—Standards of Performance for Automobile and Light Duty Truck Surface Coating Operations

[Subpart MM added by 45 FR 85415, December 24, 1980]

§ 60.390 Applicability and designation of affected facility.

(a) The provisions of this subpart apply to the following affected facilities in an automobile or light-duty truck assembly plant: each prime coat

[Sec. 60.390(a)]

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APPENDIX D

EQUIPMENT CALIBRATION

1.0 PITOT CALIBRATION

The pitot tubes were calibrated by measuring the velocity head in a duct with both an "S" type pitot and a standard pitot with a known coefficient. This was done at several different velocities. The pitot tube coefficient can be calculated as follows:

$$C_{p(test)} = C_{p(std)} \sqrt{\frac{\Delta P_{std}}{\Delta P_{test}}}$$

Where:

$C_{p(test)}$ = Pitot tube coefficient of "S" type pitot

$C_{p(std)}$ = Pitot tube coefficient of standard pitot

ΔP_{test} = Velocity head measured by "S" type pitot

ΔP_{std} = Velocity head measured by standard pitot

Coefficients were determined for each leg of the "S" type pitot. No C_p may deviate more than ± 0.01 from the average C_p, and the difference between the average C_p for each leg must be ≤ 0.01.

2.0 DRY GAS METER AND ORIFICE METER

The dry gas meter and orific were calibrated using a wet test meter. Gases were moved through the dry gas meter at orifice pressure differentials (ΔH's) of 0.5, 1.0, and 2.0 inches of water. With the information obtained, γ, the ratio of accuracy of wet test meter to dry test meter; and $\Delta H_@$, the orifice pressure

differential that gives 0.75 cfm of air at 68°F and 29.92 inches of mercury, were calculated. The γ has a tolerance of 1.00 ±0.01 and the $\Delta H_@$ has a tolerance of 1.84 +0.26 -0.24. The γ and $\Delta H_@$ are determined as follows:

$$\gamma = \frac{V_w P_b \ (t_d + 460)}{V_d [P_b + .07353 (\Delta H)] (t_w + 460)}$$

$$\Delta H_@ = \frac{0.0317 \ (\Delta H)}{P_b \ (t_d + 460)} \left(\frac{(T_w + 460) \ \theta}{V_w} \right)^2$$

Where:

ΔH = Orifice pressure differential, in H_2O

P_b = Barometric pressure, in Hg

t_d = Average temperature of dry gas meter, °F

t_w = Average temperature of wet test meter, °F

θ = Duration of test, min.

V_d = Dry gas meter volume, ft^3

V_w = Wet test meter volume, ft^3

3.0 POTENTIOMETER CALIBRATION

The Thermo - Electron potentiometers were calibrated by using a known voltage source as an input to the potentiometer.

4.0 PROBE CALIBRATION

The probes were calibrated by measuring the outlet temperatures at various variable transformer settings while passing air through at approximately 0.75 cubic feet per minute.

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METER BOX CALIBRATION SHEET

Date 2/5/88 Box No. 4 Inspector PCB

Pump OK Oil OK Wick OK Pump Serial No. 1073

Manometers OK Knobs OK Oil OK Tubing OK

Quick Connects NA Vacuum Gage OK Valves OK

Dry Gas Meter OK Volume 604 ft^3 Serial No. JA631035

Thermometers OK In 66 °F Out 66 °F Ambient 65 °F

Amphenol OK Lights OK Switches OK Variac OK

Leak Check - Max. Vacuum 28.0 in. Hg Leak Rate .002 CFM

Remarks cleaned pump & inlet piping, reduced stroke, 1 notch

Man. Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d	Time θ
0.5	5.004	5.075	63.5	75.5	66.7	71.1	13.00
1.0	5.002	5.128	63.5	85.3	68.8	77.1	8.88
2.0	10.002	10.323	63.5	97.0	72.8	84.9	13.25

Tolerances: $1.6 \leq \Delta H_@ \leq 2.1$ $0.99 \leq \gamma \leq 1.01$

$\Delta H_@ =$	$\frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_w+460)(\theta)}{(CF_w)}\right]^2$	$\gamma =$	$\frac{(CF_w)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_w+460)}$
1.85	$\frac{(0.0317)(0.5)}{(30.01)(66.7+460)}\left[\frac{(63.5+460)(13.00)}{(5.004)}\right]^2$	0.999	$\frac{(5.004)(30.01)(71.1+460)}{(5.075)(30.01+0.0368)(63.5+460)}$
1.72	$\frac{(0.0317)(1.0)}{(30.01)(68.8+460)}\left[\frac{(63.5+460)(8.88)}{(5.002)}\right]^2$	0.999	$\frac{(5.002)(30.01)(77.1+460)}{(5.128)(30.01+0.0737)(63.5+460)}$
1.91	$\frac{(0.0317)(2.0)}{(30.01)(72.8+460)}\left[\frac{(63.5+460)(13.25)}{(10.002)}\right]^2$	1.004	$\frac{(10.002)(30.01)(84.9+460)}{(10.323)(30.01+0.147)(63.5+460)}$

BCM

METER BOX CALIBRATION SHEET

Date 2/3/88 Box No. 125 Inspector RCB, NC

Pump OK Oil OK Wick OK Pump Serial No. 1084

Manometers OK Knobs OK Oil OK Tubing OK

Quick Connects OK Vacuum Gage OK Valves No

Dry Gas Meter OK Volume 536.7 ft^3 Serial No. _____

Thermometers OK In 67 °F Out _____ °F Ambient _____ °F

Amphenol OK Lights OK Switches OK Variac NA

Leak Check - Max. Vacuum 27 in. Hg Leak Rate <.001 CFM

Remarks No solenoids, keep in operate position

Man. Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d	Time θ
0.5	5.002	5.163	65.8	106.3	83.3	95.3	12.58
1.0	5.002	5.114	65.7	103.8	77.5	82.4	8.98
2.0	10.590	10.990	65.8	116.2	86.8	89.6	13.87

Tolerances: $1.6 \leq \Delta H_@ \leq 2.1$ $0.99 \leq \gamma \leq 1.01$

$\Delta H_@ =$	$\frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_w+460)(\theta)}{(CF_w)}\right]^2$	$\gamma =$	$\frac{(CF_w)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_w+460)}$
1.69	$\frac{(0.0317)(0.5)}{(30.161)(83.3+460)}\left[\frac{(65.8+460)(12.58)}{(5.002)}\right]^2$	1.022	$\frac{(5.002)(30.161)(95.3+460)}{(5.163)(30.161+0.0368)(65.8+460)}$
1.74	$\frac{(0.0317)(1.0)}{(30.161)(77.5+460)}\left[\frac{(65.7+460)(8.98)}{(5.002)}\right]^2$	1.007	$\frac{(5.002)(30.161)(82.4+460)}{(5.114)(30.161+0.0737)(65.7+460)}$
1.82	$\frac{(0.0317)(2.0)}{(30.161)(86.8+460)}\left[\frac{(65.8+460)(13.87)}{(10.590)}\right]^2$	1.002	$\frac{(10.590)(30.161)(89.6+460)}{(10.990)(30.161+0.147)(65.8+460)}$

BCM

Post

METER BOX CALIBRATION SHEET

CBP 29.95

ΔH = 2.0

Vac = 14" Hg

Date 5/11/88 Box No. 4 Inspector NC

Pump _____ Oil _____ Wick _____ Pump Serial No. _____

Manometers _____ Knobs _____ Oil _____ Tubing _____

Quick Connects _____ Vacuum Gage _____ Valves _____

Dry Gas Meter _____ Volume _____ ft^3 Serial No. _____

Thermometers _____ In _____ °F Out _____ °F Ambient _____ °F

Amphenol _____ Lights _____ Switches _____ Variac _____

Leak Check - Max. Vacuum _____ in. Hg Leak Rate _____ CFM

Remarks OK, leak check of metering system OK, No leakage observed.

Man. Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d	Time θ
2.0	11.802	11.875	67.5	99.2	73.1	86.15	15.03
2.0	11.777	11.952	67.5	101.0	76.0	88.5	15.04
2.0	11.710	12.005	67.5	102.5	76.3	89.4	15.03

Tolerances: $1.6 \leq \Delta H_@ \leq 2.1$ $\quad 0.99 \leq \gamma \leq 1.01$

$\Delta H_@ =$	$\frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_w+460)(\theta)}{(CF_w)}\right]^2$	$\gamma =$	$\frac{(CF_w)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_w+460)}$
	$\frac{(0.0317)(0.5)}{(\_\_\_\_)(\_\_\_+460)}\left[\frac{(\_\_\_+460)(\_\_\_\_)}{(\_\_\_\_)}\right]^2$	1.027	$\frac{(11.802)(29.95)(86.15+460)}{(11.875)(29.95+0.0368)(67.5+460)}$ (546.15; 29.9868; 527.5)
	$\frac{(0.0317)(1.0)}{(\_\_\_\_)(\_\_\_+460)}\left[\frac{(\_\_\_+460)(\_\_\_\_)}{(\_\_\_\_)}\right]^2$	1.022	$\frac{(11.777)(29.95)(88.5+460)}{(11.952)(29.95+0.0737)(67.5+460)}$ (548.5; 30.0237; 527.5)
	$\frac{(0.0317)(2.0)}{(\_\_\_\_)(\_\_\_+460)}\left[\frac{(\_\_\_+460)(\_\_\_\_)}{(\_\_\_\_)}\right]^2$	1.013	$\frac{(11.710)(29.95)(89.4+460)}{(12.005)(29.95+0.147)(67.5+460)}$ (549.4; 30.097; 527.5)

(1.05 95)

1.000

1.021

BCM

METER BOX CALIBRATION SHEET

Date 2-4-88 Box No. 285 Inspector NC

Pump OK Oil OK Wick OK Pump Serial No. 0385

Manometers OK Knobs OK Oil OK Tubing OK

Quick Connects ✓ Vacuum Gage ✓ Valves ✓

Dry Gas Meter OK Volume _____ ft^3 Serial No. _____

Thermometers _____ In _____ °F Out _____ °F Ambient _____ °F

Amphenol _____ Lights _____ Switches _____ Variac _____

Leak Check Max. Vacuum _____ in. Hg Leak Rate _____ CFM

Remarks _____

Man. Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d	Time θ
0.5	5.000	5.315	66.0	101.3	81.0	82.76	12.72
1.0	5.256	5.525	66.0	101.8	81.2	83.0	9.63
2.0	10.002	10.505	65.8	114.3	30.0	97.2	13.03

Tolerances: $1.6 \le \Delta H_@ \le 2.1$ $\quad 0.99 \le \gamma \le 1.01$

$$\Delta H_@ = \frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_w+460)(\theta)}{(CF_w)}\right]^2 \qquad \gamma = \frac{(CF_w)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_w+460)}$$

$\Delta H_@$ =	γ =
1.79 $\quad \frac{(0.0317)(0.5)}{(29.59)(80+460)}\left[\frac{(66.0+460)(12.72)}{(5.000)}\right]^2$	.970 $\quad \frac{(5.000)(29.59)(82.8+460)}{(5.315)(29.59+0.0368)(66.0+460)}$
1.84 $\quad \frac{(0.0317)(1.0)}{(29.59)(81.2+460)}\left[\frac{(66.0+460)(9.63)}{(5.256)}\right]^2$	.980 $\quad \frac{(5.256)(29.59)(83.0+460)}{(5.525)(29.59+0.0737)(66.0+460)}$
1.88 $\quad \frac{(0.0317)(2.0)}{(29.59)(30.0+460)}\left[\frac{(65.8+460)(13.03)}{(10.002)}\right]^2$	1.004 $\quad \frac{(10.002)(29.59)(97.2+460)}{(10.505)(29.59+0.147)(65.8+460)}$

BCM

Post

METER BOX CALIBRATION SHEET

ΔH = 1.2
Vac = 6" Hg
BP = 30.18

Date 5/12/88 Box No. 285 Inspector NC

Pump _____ Oil _____ Wick _____ Pump Serial No. _____

Manometers _____ Knobs _____ Oil _____ Tubing _____

Quick Connects _____ Vacuum Gage _____ Valves _____

Dry Gas Meter _____ Volume _____ ft^3 Serial No. _____

Thermometers _____ In _____ °F Out _____ °F Ambient _____ °F

Amphenol _____ Lights _____ Switches _____ Variac _____

Leak Check - Max. Vacuum _____ in. Hg Leak Rate _____ CFM

Remarks LEAK CHECK OF METERING SYSTEM OK

Man. Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d	Time θ
1.2	8.891	8.983	67	96	74	85.0	15.04
1.2	7.604	7.702	67	100	81.4	90.7	15.00
1.2	9.417	9.668	67.5	105.8	89.8	97.8	16.04

Tolerances: $1.6 \leq \Delta H_@ \leq 2.1$ $\quad 0.99 \leq \gamma \leq 1.01$

$$\Delta H_@ = \frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_w+460)(\theta)}{(CF_w)}\right]^2 \qquad \gamma = \frac{(CF_w)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_w+460)}$$

$$\frac{(0.0317)(0.5)}{(\quad)(\quad+460)}\left[\frac{(\quad+460)(\quad)}{(\quad)}\right]^2$$

$$\gamma = \frac{(8.891)(30.18)(85.0+460)}{(8.983)(30.18+0.0368)(67+460)} \quad 545 \quad 30.2168 \quad 527 \quad 1.022$$

$$\frac{(0.0317)(1.0)}{(\quad)(\quad+460)}\left[\frac{(\quad+460)(\quad)}{(\quad)}\right]^2$$

$$\gamma = \frac{(7.604)(30.18)(90.7+460)}{(7.702)(30.18+0.0737)(67+460)} \quad 550.7 \quad 30.2537 \quad 527 \quad 1.029$$

$$\frac{(0.0317)(2.0)}{(\quad)(\quad+460)}\left[\frac{(\quad+460)(\quad)}{(\quad)}\right]^2$$

$$\gamma = \frac{(9.417)(30.18)(97.8+460)}{(9.668)(30.18+0.147)(67.5+460)} \quad 557.8 \quad 30.327 \quad 527.5 \quad 1.025$$

1.025

BCM

Post

METER BOX CALIBRATION SHEET

$\Delta H = 2.0$

CBP: 29.95

Vacuum = 11 "Hg

Date 5/11/98 Box No. 125 Inspector NC

Pump _____ Oil _____ Wick _____ Pump Serial No. _____

Manometers _____ Knobs _____ Oil _____ Tubing _____

Quick Connects _____ Vacuum Gage _____ Valves _____

Dry Gas Meter _____ Volume _____ ft^3 Serial No. _____

Thermometers _____ In _____ °F Out _____ °F Ambient _____ °F

Amphenol _____ Lights _____ Switches _____ Variac _____

Leak Check - Max. Vacuum _____ in. Hg Leak Rate _____ CFM

Remarks leak check of metering system Good, no leakage observed

Man. Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d	Time θ
2.0	11.897	11.92	67.5	112	81	96.5	15.00
2.0	11.570	11.643	68	109	83.5	96.25	15.00
2.0	11.553	11.748	68	110.83	87.5	99.17	15.00

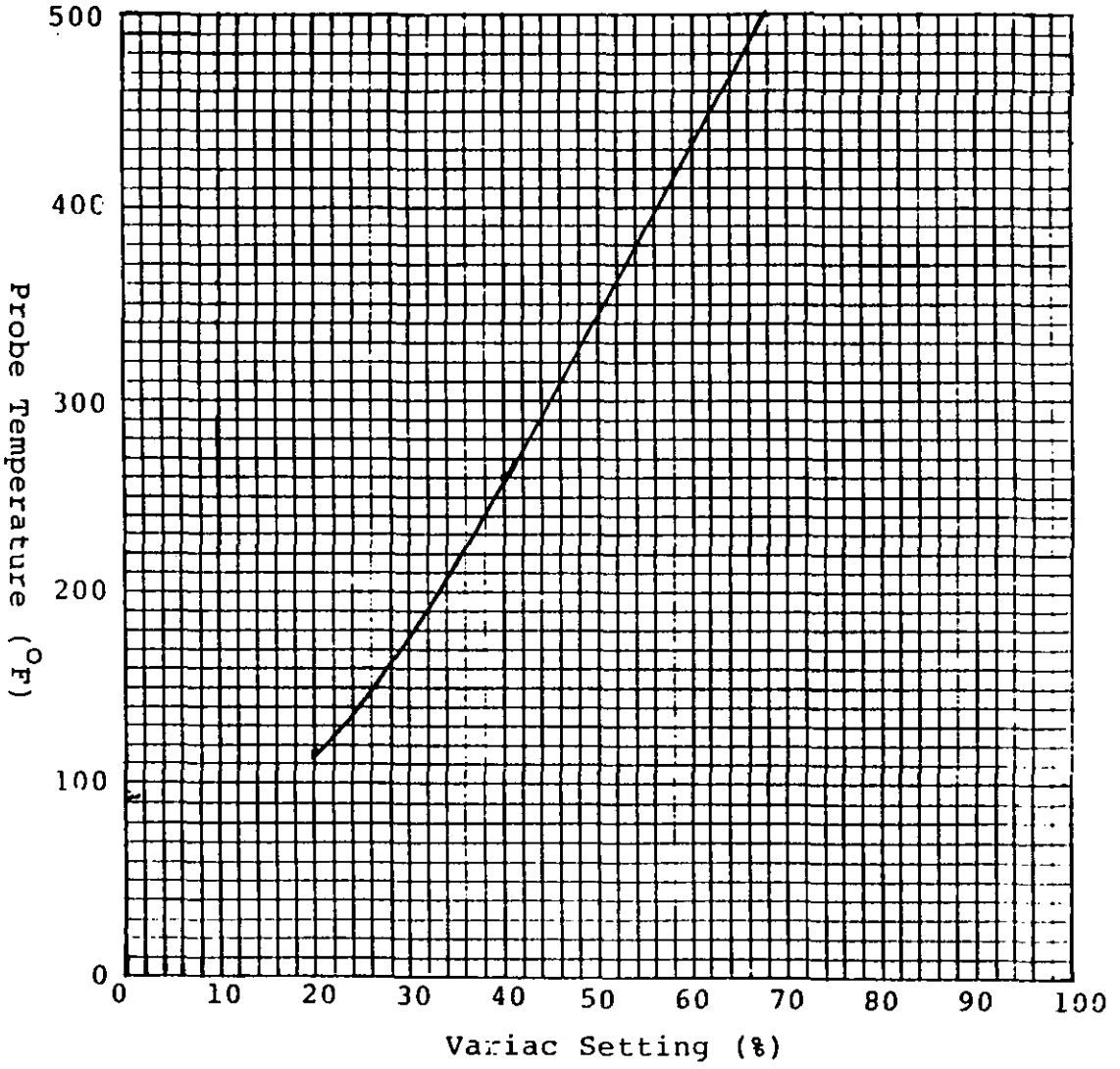
Tolerances: $1.6 \leq \Delta H_@ \leq 2.1$ $0.99 \leq \gamma \leq 1.01$

$\Delta H_@ =$	$\frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_w+460)(\theta)}{(CF_w)}\right]^2$	$\gamma =$	$\frac{(CF_w)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_w+460)}$
	$\frac{(0.0317)(0.5)}{(\quad)(\quad+460)}\left[\frac{(\quad+460)(\quad)}{(\quad)}\right]^2$	1.051	$\frac{(11.897)(29.95)(96.5+460)}{(11.92)(\underset{29.9868}{29.95}+0.0368)(\underset{527.5}{67.5}+460)}$ (556.5)
	$\frac{(0.0317)(1.0)}{(\quad)(\quad+460)}\left[\frac{(\quad+460)(\quad)}{(\quad)}\right]^2$	1.044	$\frac{(11.570)(29.95)(96.25+460)}{(11.643)(\underset{30.0237}{\quad}+0.0737)(\underset{528}{68}+460)}$ (556.25)
	$\frac{(0.0317)(2.0)}{(\quad)(\quad+460)}\left[\frac{(\quad+460)(\quad)}{(\quad)}\right]^2$	1.036	$\frac{(11.553)(29.95)(99.17+460)}{(11.748)(\underset{30.097}{\quad}+0.147)(\underset{528}{68}+460)}$ (559.17)

$\gamma_a \geq 1.044$

PROBE CALIBRATION

Probe No. 3-1 Date 1/9/82 Inspector [signature]



Flow at 0.75 CFM
(Meter box at $H_@$)

15 minutes warm up
at each variac setting

Temperature read at
outlet of probe

DO NOT LET TEMPERATURE
GO ABOVE 500°F

Variac (%)	Temp. (°F)
20	116
40	260
60	434
80	
100	

BCM

Post

METER BOX CALIBRATION SHEET

10" vac

2.5 = ΔH

CBP = 30.18

Date 5/12/88 Box No. 285 Inspector NC

Pump _____ Oil _____ Wick _____ Pump Serial No. _____

Manometers _____ Knobs _____ Oil _____ Tubing _____

Quick Connects _____ Vacuum Gage _____ Valves _____

Dry Gas Meter _____ Volume _____ ft^3 Serial No. _____

Thermometers _____ In _____ °F Out _____ °F Ambient _____ °F

Amphenol _____ Lights _____ Switches _____ Variac _____

Leak Check - Max. Vacuum _____ in. Hg Leak Rate _____ CFM

Remarks LEAK CHECK OF METERING SYSTEM good; NO LEAKAGE

Man. Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d	Time θ
2.5	12.767	12.967	67	95	69.5	82.3	15.03
2.5	12.755	13.144	67	103.3	79.7	91.5	15.04
2.5	12.806	12.994	67	101.5	76.0	88.75	15.03

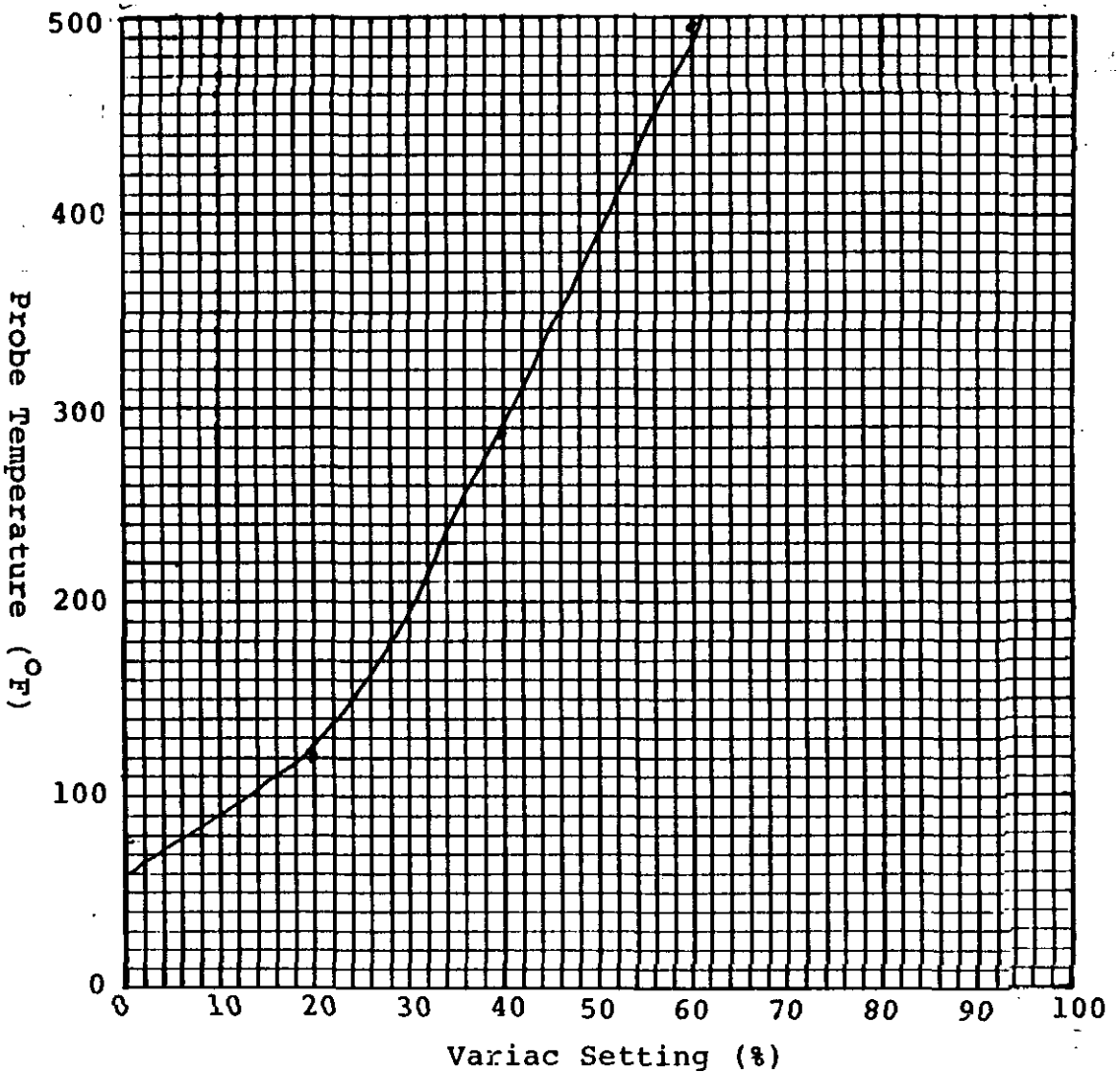
Tolerances: $1.6 \leq \Delta H_@ \leq 2.1$ $\qquad 0.99 \leq \gamma \leq 1.01$

$\Delta H_@ =$	$\frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_w+460)(\theta)}{(CF_w)}\right]^2$	$\gamma =$	$\frac{(CF_w)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_w+460)}$
	$\frac{(0.0317)(0.5)}{(\_\_\_\_)(\_\_\_+460)}\left[\frac{(\_\_\_+460)(\_\_\_\_)}{(\_\_\_\_)}\right]^2$	1.011	$\frac{(12.767)(30.18)(82.3+460)}{(12.967)(\frac{30.18}{30.2168}+0.0368)(\frac{67+460}{527})}$ (542.3)
	$\frac{(0.0317)(1.0)}{(\_\_\_\_)(\_\_\_+460)}\left[\frac{(\_\_\_+460)(\_\_\_\_)}{(\_\_\_\_)}\right]^2$	1.013	$\frac{(12.755)(30.18)(91.5+460)}{(13.144)(\frac{30.18}{30.2537}+0.0737)(\frac{67+460}{527})}$ (551.5)
	$\frac{(0.0317)(2.0)}{(\_\_\_\_)(\_\_\_+460)}\left[\frac{(\_\_\_+460)(\_\_\_\_)}{(\_\_\_\_)}\right]^2$	1.026	$\frac{(12.806)(30.18)(88.75+460)}{(12.994)(\frac{30.18}{30.327}+0.147)(\frac{67+460}{527})}$ (548.75)

1.015

PROBE CALIBRATION

Probe No. 3-4 Date 1/9/87 Inspector CTH



Flow at 0.75 CFM
(Meter box at $H_@$)

15 minutes warm up
at each variac setting

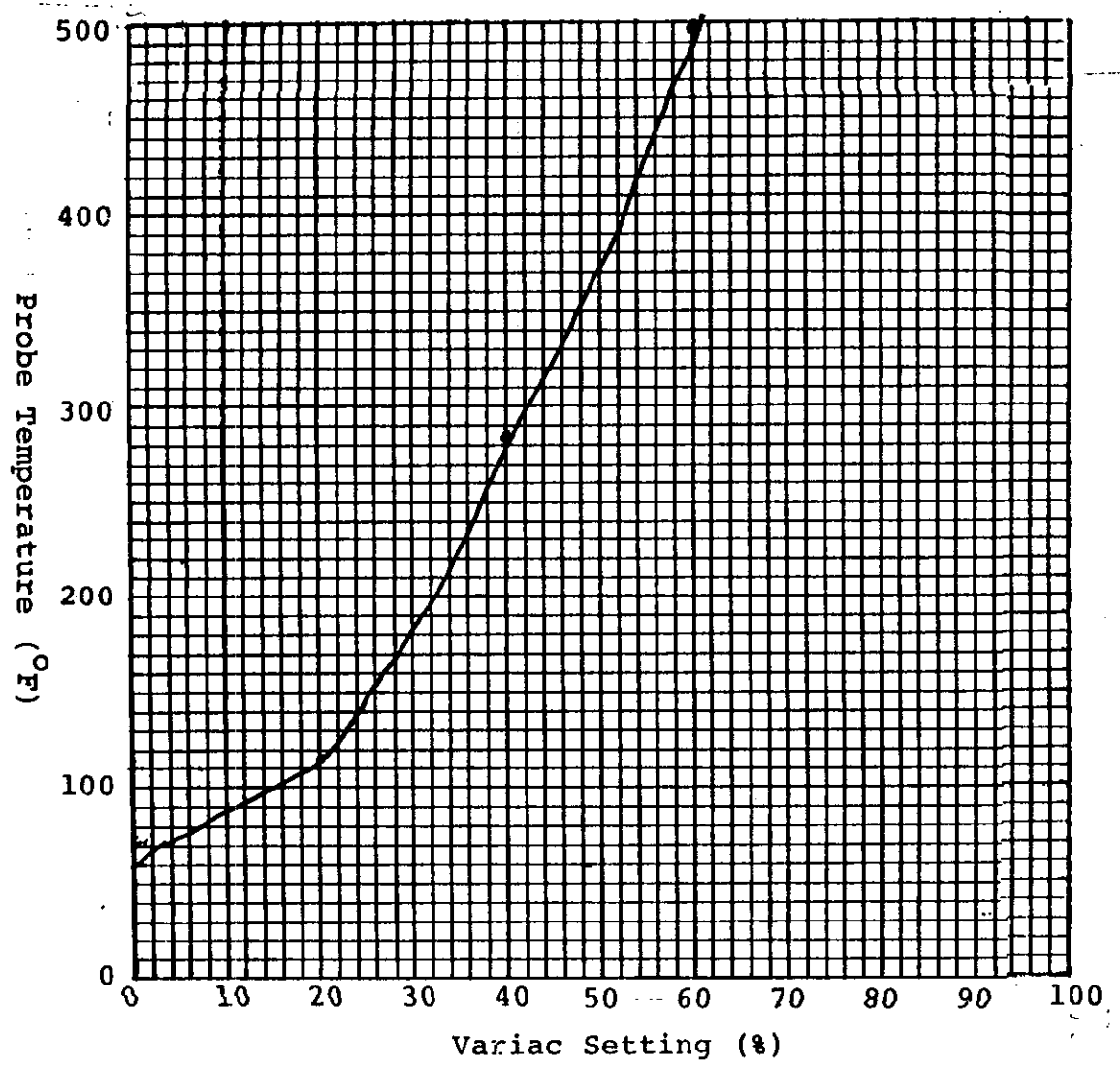
Temperature read at
outlet of probe

DO NOT LET TEMPERATURE
GO ABOVE 500°F

Variac (%)	Temp. (°F)
20	120
40	289
60	499
80	
100	

PROBE CALIBRATION

Probe No. 3-3 Date 1-9-87 Inspector C.T.H.



Flow at 0.75 CFM
(Meter box at $H_@$)

15 minutes warm up
at each variac setting

Temperature read at
outlet of probe

DO NOT LET TEMPERATURE
GO ABOVE 500°F

Variac (%)	Temp. (°F)
20	116
40	288
60	499
80	
100	

NOZZLE DIAMETER CALIBRATION SHEET

Set No. 2"-1 Date 2/8/88 Inspector P. Burg

Nominal Size	Micrometer Readings				Comments
	1	2	3	Ave.	
0.125					
0.1875	.198	.200	.200	.199	Used at N&S Process Stacks
0.250					
0.3125					
0.375					
0.500					

NOZZLE DIAMETER CALIBRATION SHEET

Set No. 2"-2 Date 2/17/88 Inspector P. Burg

Nominal Size	Micrometer Readings				Comments
	1	2	3	Ave.	
0.125					
0.1875					
0.250					
0.3125	.322	.316	.322	.320	Used at S Melting Pot
0.375					
0.500					

NOZZLE DIAMETER CALIBRATION SHEET

Set No. 2"-2 Date 2/3/88 Inspector P. Burg

Nominal Size	Micrometer Readings				Comments
	1	2	3	Ave.	
0.125					
0.1875					
0.250					
0.3125					
0.375	.374	.373	.375	.374	Used at N Melting Pot
0.500					

NOZZLE DIAMETER CALIBRATION SHEET

Set No. #4 Date 2/3/88 Inspector P. Burg

Nominal Size	Micrometer Readings				Comments
	1	2	3	Ave.	
0.125					
0.1875					
0.250					
0.3125	.322	.323	.320	.322	Used at N&S Process Vent
0.375					
0.500					

BCM

COMPUTATION SHEET

Sheet Number _____ of _____
Date 5-13-98
J. O. Number __ - _____ - __
Computed by NC
Checked by _____

Name of Client JOHNSON CONTROLS
Project
Description THERMOCOUPLE/PYROMETER VERIFICATION

	Ts	Ts
30X4 Process Vent		
OMEGA PYROMETER	79°F	
MERCURY STANDARD	79°F	
30X125 Melting Pot		
INDICATED	110°F	173°F
MERCURY STANDARD	110°F	184°F
BOX 285 Process Stack		
INDICATED	115°F	182°F
MERCURY STANDARD	115°F	180°F

Date	Ambient Temperature (°F)	Hg Barometer Reading Actual	Hg Barometer Reading Corrected	Aneroid Barometer Reading	Comments
5/11/88	68°	30.07	29.95	29.82	Adjusted to 29.95

TEMPERAT[illegible] CORRECTION TABLE — Table I — English System

To reduce the reading of the barometer to standard temperature

Temperature in degrees F.	Observed Reading of the Barometer in Inches											
	20"	21"	22"	23"	24"	25"	26"	27"	28"	29"	30"	31"
	ALL CORRECTIONS SUBTRACTIVE											
60°	0.057	0.060	0.062	0.065	0.068	0.071	0.074	0.077	0.080	0.082	0.085	0.088
62	.060	.063	.066	.069	.073	.076	.079	.082	.085	.088	.091	.094
64	.064	.067	.070	.074	.077	.080	.083	.086	.090	.093	.096	.099
66	.068	.071	.074	.078	.081	.085	.088	.091	.095	.098	.101	.105
68	.071	.075	.078	.082	.085	.089	.093	.098	.100	.103	.107	.110
70	.075	.079	.082	.086	.090	.094	.097	.101	.105	.109	.113	.116
72	.079	.082	.086	.090	.094	.098	.102	.106	.110	.114	.118	.122
74	.082	.086	.090	.094	.098	.103	.107	.111	.115	.119	.123	.127
76	.086	.090	.094	.098	.103	.107	.111	.116	.120	.124	.128	.133
78	.089	.094	.098	.103	.107	.112	.116	.120	.125	.129	.134	.138
80	.093	.097	.102	.107	.111	.116	.121	.125	.130	.135	.139	.144
82	.096	.101	.106	.111	.116	.121	.125	.130	.135	.140	.145	.149
84	.100	.105	.110	.115	.120	.125	.130	.135	.140	.145	.150	.155
86	.104	.109	.114	.119	.124	.130	.135	.140	.145	.150	.155	.161
88	.107	.113	.118	.123	.129	.134	.139	.145	.150	.155	.161	.166
90	.111	.116	.122	.127	.133	.138	.144	.150	.155	.161	.166	.172
92	.114	.120	.126	.132	.137	.143	.149	.154	.160	.166	.172	.177
94	.118	.124	.130	.136	.142	.147	.153	.159	.165	.171	.177	.183
96	.122	.128	.134	.140	.146	.152	.158	.164	.170	.176	.182	.188
98	.125	.131	.138	.144	.150	.156	.163	.169	.175	.181	.188	.194
100	.129	.135	.142	.148	.154	.161	.167	.174	.180	.187	.193	.200

CORRECTION FOR LATITUDE

B.P 28" — 0.012 .014

" 29"150" — 0.013 .016

[illegible]

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Chris Hewitt

met the specifications of Federal Reference Method 9 and qualified as a visible emissions evaluator. Maximum deviation on white and black smoke did not exceed 7.5% opacity and no single error exceeding 15% opacity was incurred during the certification test conducted by Eastern Technical Associates of Raleigh, North Carolina. This certificate is valid for six months from date of issue.

Thomas H Rose
President

218895
Certificate Number

Willis S Lee
Vice President

Allentown
Location

David Savage
Program Manager

October 14, 1981
Date of Issue

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Daniel R Strong

met the specifications of Federal Reference Method 9 and qualified as a visible emissions evaluator. Maximum deviation on white and black smoke did not exceed 7.5% opacity and no single error exceeding 10% opacity was incurred during the certification test conducted by Eastern Technical Associates of Raleigh, North Carolina. This certificate is valid for six months from date of issue.

Thomas H Rose
President

218754
Certificate Number

Willis S Lee
Vice President

Pittsburgh
Location

David Savage
Program Manager

September 30, 1987
Date of Issue