STAPPA/ALAPCO
2:5

#136
12/17/86

79

**Compliance Test Report**
**Mattabassett District**
**Pollution Control Plant**
**Main Incinerator**
**Cromwell, Connecticut**



# ROJAC Environmental Services, Inc.

**John S. Gammie**
**Project Manager**

**ROJAC Project F86-2Ø**

**September 1986**

P.O. Box 731
West Hartford, Connecticut 06107
(203) 527-7307

TABLE OF CONTENTS

## LIST OF FIGURES



## LIST OF TABLES

## 1.Ø PURPOSE OF TEST

The Mattabassett District Pollution Control Plant retained ROJAC Environmental Services, Inc. to conduct compliance testing for particulate, lead and hydrocarbon emissions on the Main Incinerator exhaust stack at the Mattabassett District Water Pollution Control Plant. All emission tests were to comply with the requirements of the Connecticut Department of Environmental Protection (DEP).

The Source Test Plan was submitted and reviewed by the Connecticut DEP prior to the beginning of the testing program. A copy of the test plan is contained in Appendix A. Field work was observed by Mr. George Miller of the DEP. The emission tests were conducted by ROJAC on August 27, 1986 by Messrs. Leigh Gammie and John Gammie. The test program was conducted with supervision from Mr. Christian Bratina of the Mattabassett District.

All testing was performed according to EPA Methods 1 through 5.

## 2.0 SUMMARY OF RESULTS

### 2.1 Particulate Emissions

A summary of the particulate emissions from the Main Incinerator exhaust stack is shown in Table 2-1. Four test runs were performed under varying operating conditions. The average particulate concentration was 0.21 pounds per 1000 pounds of flue gas at 50 percent excess air. The results ranged from 0.141 to 0.282 lb/1000 lb dry @ 50% excess air. The particulate concentration limit to be demonstrated was 0.40 pounds per 1000 pounds of flue gas at 50 percent excess air.

### 2.2 Total Hydrocarbon Emissions

A summary of the total hydrocarbon emissions from the incinerator exhaust stack is shown in Table 2-2. The average total hydrocarbon emission rate was 2.3 pounds per hour. Three tests were performed simultaneously with the particulate tests. Quantitation of the total hydrocarbons was based upon n-hexane.

### 2.3 Total Lead Emissions

The results of the lead emissions are shown in Table 2-1. The average lead emission rate was 0.036 pounds per hour, with results ranging from 0.024 to 0.050 pounds per hour. The lead content in the flue gas was determined from the EPA Method 5 filter used during the particulate test.

### 2.4 Sludge Analysis

Prior to and during the test program sludge samples were collected. Samples were then analyzed for mercury and beryllium.

The mercury concentration was <0.002 milligrams per kilogram and the beryllium concentration was less than 1 part per million. The results of these analyses may be found in Appendix C.

TABLE 2-1

SUMMARY OF PARTICULATE AND LEAD EMISSIONS
MATTABASSETT DISTRICT COMMISSION
INCINERATOR EXHAUST
CROMWELL, CONNECTICUT

| Run Number | 1 | 2 | 3 | 4 | Average |
|---|---|---|---|---|---|
| Date | 08/27/86 | 08/27/86 | 08/27/86 | 08/27/86 | |
| Time | 1019-1122 | 1219-1321 | 1431-1536 | 1725-1829 | |
| Location | Outlet | Outlet | Outlet | Outlet | Outlet |
| Volume of Gas Sampled, (ACF) | 49.05 | 50.35 | 48.42 | 51.10 | |
| Volume of Gas Sampled, (DSCF)[1] | 46.32 | 47.06 | 45.14 | 48.02 | |
| Volumetric Flowrate, (ACFM)[2] | 13100 | 15300 | 14500 | 14900 | |
| Volumetric Flowrate, (DSCFM)[3] | 8500 | 7100 | 9600 | 9000 | |
| Percent Moisture By Volume | 25.3 | 45.0 | 23.7 | 29.8 | |
| Average Stack Temperature, ($^{o}F$) | 149 | 164 | 144 | 152 | |
| Percent Isokinetic | 105.9 | 128.4 | 91.0 | 103.3 | |
| Percent Oxygen, (Dry) | 12.1 | 10.5 | 14.6 | 12.2 | |
| Percent Carbon Dioxide, (Dry) | 6.6 | 8.0 | 5.2 | 6.6 | |
| Molecular Weight, (Stack) | 26.6 | 24.4 | 26.7 | 26.1 | |
| Total Particulate Collected, (mg)[4] | 151.3 | 359.4 | 141.6 | 286.4 | |
| Emission Rate, (Pounds/Hour) | 3.65 | 7.16 | 3.98 | 7.09 | |
| Particulate Concentration, (Grains/DSCF)[5] | 0.05 | 0.12 | 0.04 | 0.09 | 0.075 |
| Particulate Concentration, (Gr/DSCF@50%EA)[6] | 0.076 | 0.153 | 0.086 | 0.139 | 0.114 |
| Particulate Concentration, (lbs/1000 lbs dry @ 50% EA)[7] | 0.141 | 0.282 | 0.160 | 0.258 | 0.210 |
| Emission Limitation, (lbs/1000 lbs dry @ 50% EA) | | | | | 0.40 |
| Total Lead Collected, (mg) | 1.244 | 2.496 | 1.348 | 0.956 | |
| Lead Emission Rate, (lb/hr) | 0.030 | 0.050 | 0.038 | 0.024 | 0.036 |

1 Dry standard cubic feet @ 68 $^{o}F$, 29.92 inches Hg.
2 Actual cubic feet per minute.
3 Dry standard cubic feet per minute.
4 Milligrams (filter catch and acetone wash).
5 Grains per dry standard cubic feet.
6 Grains per dry standard cubic feet 50 percent excess air.
7 Pounds per 1000 pounds dry at 50 percent excess air.

TABLE 2-2

SUMMARY OF TOTAL HYDROCARBON EMISSIONS
MATTABASSETT DISTRICT COMMISSION
INCINERATOR EXHAUST
CROMWELL, CONNECTICUT

| Run Number | 1 | 2 | 3 | Average |
|---|---|---|---|---|
| Date | Ø8/27/86 | Ø8/27/86 | Ø8/27/86 | |
| Time | 1Ø19-1122 | 1219-1321 | 1431-1536 | |
| Location | Outlet | Outlet | Outlet | Outlet |
| Volumetric Flowrate, (ACFM)[1] | 131ØØ | 153ØØ | 145ØØ | |
| Volumetric Flowrate, (DSCFM)[2] | 85ØØ | 71ØØ | 96ØØ | |
| Percent Moisture By Volume | 25.3 | 45.Ø | 23.7 | |
| Average Stack Temperature, ($^{o}F$) | 149 | 164 | 144 | |
| THC Measured, (mg/l)[3] | Ø.Ø65 | Ø.Ø96 | Ø.Ø61 | |
| THC Emission Rate, (Pounds/Hour) | 2.1 | 2.6 | 2.2 | 2.3 |

1 Actual cubic feet per minute.
2 Dry standard cubic feet per minute.
3 Total hydrocarbons in milligrams per liter based on n-hexane.

## 3.0 DISCUSSION OF RESULTS

### 3.1 Particulate Tests

As previously mentioned the emission measurement tests were conducted while the incinerator and scrubber were operating at varying levels. The operating parameters were varied to determine which condition would meet the particulate compliance level. The following table will show the sludge input ranges versus the corresponding test run:

| Test Run | Sludge Input (Wet Ton/Hour) |
|---|---|
| 1 | 5.5 - 5.9 |
| 2 | 4.7 - 6.6 |
| 3 | 5.0 - 5.1 |
| 4 | 5.6 - 6.2 |

Originally, three tests were to be performed. However, during Run No. 2 a combination of process upsets with the incinerator and scrubber caused the emissions to increase substantially therefore, a fourth test was run.

The average particulate concentration, excluding Run No. 2, would be 0.19 lbs/1000 lb flue gas @ 50% excess air. As shown in Table 2-1 despite the changes in the operational parameters all four test runs met the compliance limit of 0.40 lbs/1000 lb flue gas @ 50% excess air.

### 3.2 Total Hydrocarbon Tests

Three total hydrocarbon tests were performed concurrently with the first three particulate tests. Quantitation of the total hydrocarbons was based on n-hexane. Table 2-2 summarizes the total hydrocarbon emissions. Results ranged from 2.1 to 2.6 pounds per hour with an average emission rate of 2.3 pounds per hour. A fourth test run was not performed due to a shortage in clean gas sampling bags caused by the mishap on Run No. 2.

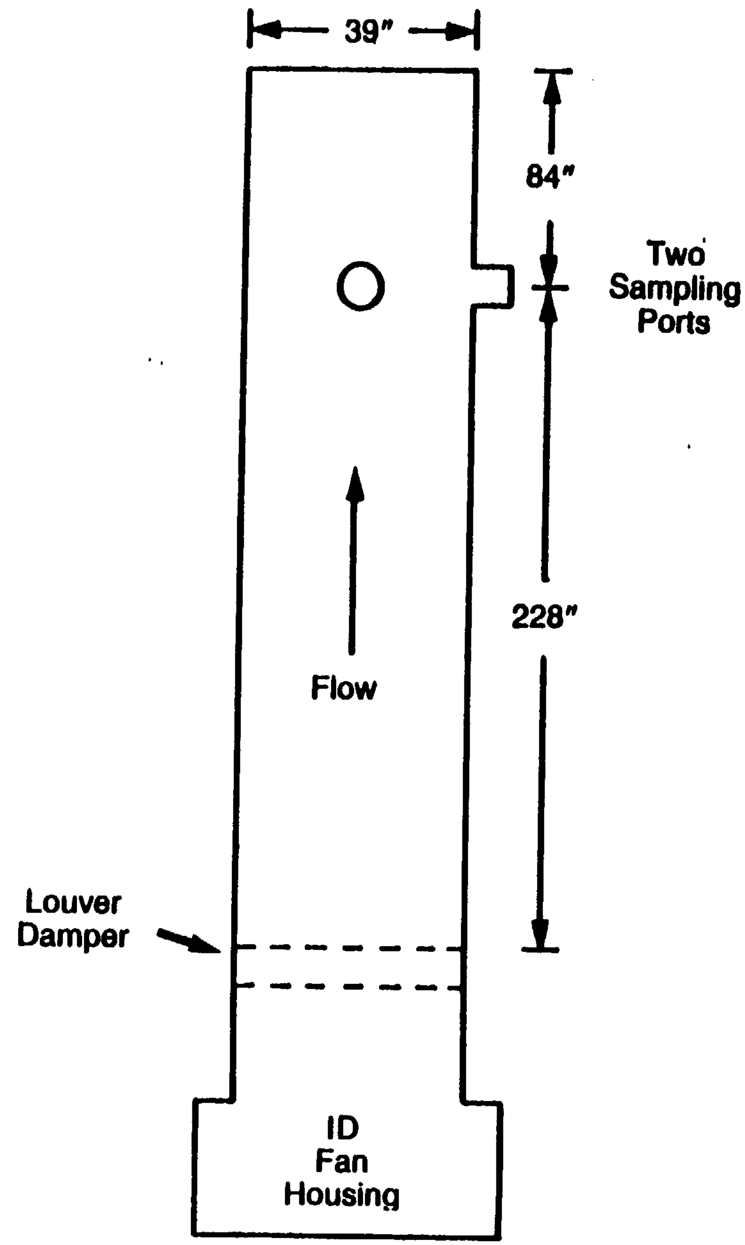
### 3.3 Lead Tests

Four lead tests were performed on the exhaust flue gases. As shown in Table 2-1 the emissions seem to be consistent. The average emission rate was Ø.Ø36 pounds per hour with a range from Ø.Ø24 to Ø.Ø5Ø pounds per hour.

## 4.Ø DESCRIPTION OF SAMPLING LOCATION

The incinerator exhaust stack sampling location was located in a 39 inch ID vertical section of steel stack. Two 3 inch sampling ports were positioned 9Ø degrees apart in a horizontal plane and were located 288 inches (5.8 duct diameters) downstream from the louver damper and 84 inches (2.1 duct diameters) upstream from the top of the stack.

This sampling location did not meet the "eight and two diameters" criteria of EPA Method 1, so 1Ø sampling points were used on each of two traverse axes, for a total of 2Ø sampling points. A schematic diagram of the outlet location along with the traverse point distances is shown in Figure 4-1. Prior to the particulate matter tests, a full 2Ø point cyclonic flow check was performed.




| Traverse Point Number | Traverse Point Location From Stack Wall (inches) |
|---|---|
| 1 | 1.0 |
| 2 | 3.2 |
| 3 | 5.7 |
| 4 | 8.8 |
| 5 | 13.3 |
| 6 | 25.6 |
| 7 | 30.2 |
| 8 | 33.3 |
| 9 | 35.8 |
| 10 | 37.9 |

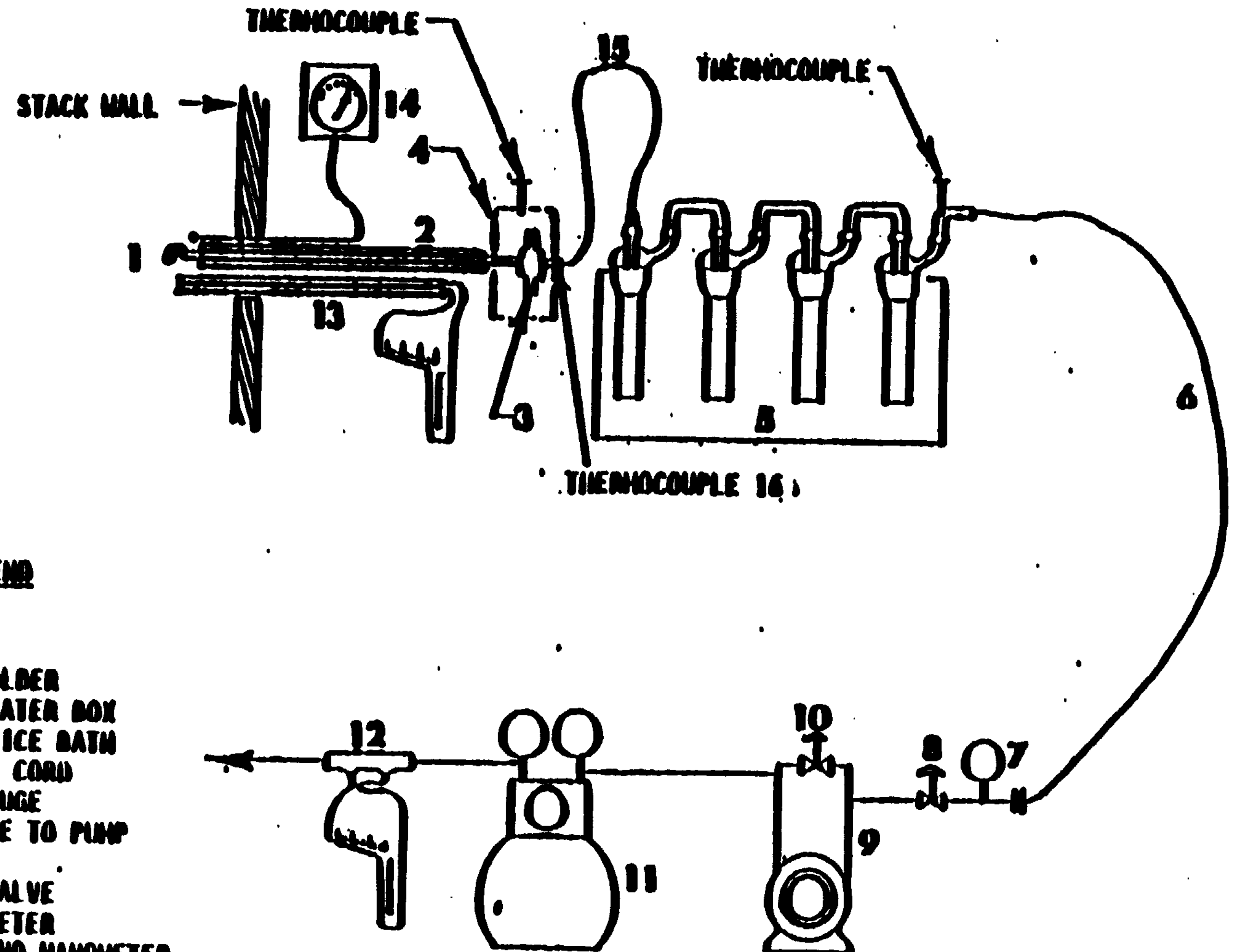
Figure 4-1
Incinerator Outlet Sampling Location
Mattabassett District
Main Incinerator
Cromwell, Connecticut

## 5.0 SAMPLING AND ANALYSIS METHODOLOGY

### 5.1 Particulate Matter Tests

Particulate sampling was accomplished by using the EPA Method 5 collection train described in Title 40, Code of Federal Regulations, Part 60. It is shown schematically in Figure 5-1 and consists of a nozzle, probe, filter, four impingers, vacuum pump, dry gas meter, and an orifice flow meter. Complete sampling train calibrations were performed before and after this compliance test program.

A nozzle (1) was attached to a glass-lined probe (2) which was heated to prevent condensation. Reeve-Angel No. 934AH fiber-glass filter paper supported in a 3 inch glass filter holder (3) was used as the collection media. The filter assembly was enclosed in a heated box (4) to maintain temperatures at 250°F. An ice bath containing four impingers (5) was attached to the back end of the filter. The first two impingers contained distilled water, the third was dry, and the fourth contained silica gel to remove any remaining moisture. Flexible tubing (6), vacuum gauge (7), needle valve (8), leakless vacuum pump (9), bypass valve (10), dry gas meter (11), calibrated orifice and inclined manometer (12) completed the sampling train. The stack velocity pressure was measured using a pitot tube and inclined manometer (13). The stack temperature was monitored by a thermocouple that was attached to the pitot and connected to a potentiometer (14). A check valve was not used in the sampling train.




LEGEND

1 - NOZZLE
2 - PROBE
3 - FILTER HOLDER
4 - FILTER HEATER BOX
5 - IMPINGER ICE BATH
6 - UMBILICAL CORD
7 - VACUUM GAUGE
8 - MAIN VALVE TO PUMP
9 - PUMP
10 - BY-PASS VALVE
11 - DRY GAS METER
12 - ORIFICE AND MANOMETER
13 - PITOT TUBE AND MANOMETER
14 - STACK TEMPERATURE READOUT
15 - FLEXIBLE TUBING
16 - THERMOCOUPLE

Figure 5-1
Modified EPA Method 5 Particulate Sampling Train

A nomograph was used to quickly determine the orifice pressure drop required for any pitot velocity pressure and stack temperature in order to maintain isokinetic sampling conditions. Sampling flow was adjusted by means of the bypass valve. Before and after each particulate test run the sampling train was leak checked.

Test data recorded is listed on the field data sheet shown in the Appendix. At the end of each test, three sample containers were used as follows:

Container #1 - Filter

Container #2 - Acetone wash of probe and front half of filter. The probe and nozzle were washed and brushed three times.

Container #3 - Silica gel from the fourth impinger.

The samples were transported to the laboratory and the following analyses performed:

Container #1 - Transferred the filter and any loose particulate matter from the sample container to a tared glass weighing dish, desiccated and dried to a constant weight. Reported results to the nearest Ø.1 mg.

Container #2 - Transferred the acetone washings to a tared beaker and evaporated to dryness at ambient temperature and pressure. Desiccated and dried to a constant weight. Reported results to the nearest Ø.1 mg.

Container #3 - Weigh silica gel to the nearest Ø.5 g. The weight of the moisture entrapped in the silica gel, along with the volume of moisture which was condensed in the impingers, was used to calculate the moisture content to the flue gas.

Prior to testing a preliminary velocity traverse, covering all sampling points, was performed to check for cyclonic flow. The pitot-nulling technique was used to determine if cyclonic flow was present, as detailed in EPA Method 1.

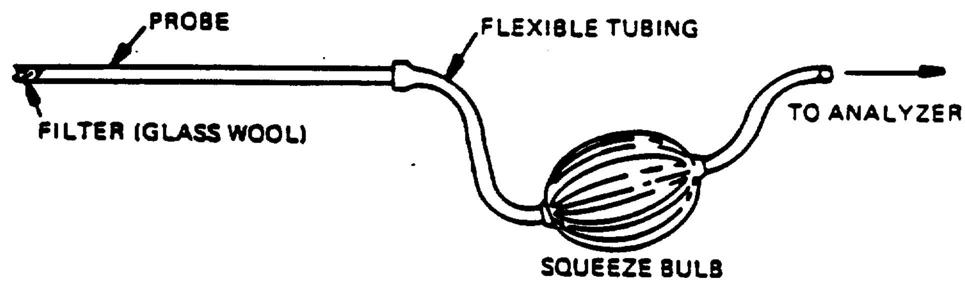
A calculator program was used to calculate mass emission rates in pounds per hour and particulate concentrations in grains per dry standard cubic feet and pounds per 1000 pounds of flue gas at 50% excess air. The program also calculates percent moisture, molecular weight of the stack gas at stack conditions, and the percentage isokinetics.

## 5.2 Exhaust Gas Analysis

The composition of the gas stream at the sampling location was analyzed for oxygen and carbon dioxide during each test run in accordance with EPA Method 3 as specified in Title 40, CFR, Part 60, Appendix A. To make an accurate assessment of the flue gas composition, redundant Orsat analyses were conducted. During each particulate test run, at least one multipoint integrated sample of flue gas was taken for Orsat analysis. The integrated gas sampling train and grab sampling train used for EPA Method 3 are shown in Figure 5-2.

## 5.3 Sludge Analysis

The collected sludge samples (as charged to the incinerator) were analyzed for mercury and beryllium. Sludge samples collected for mercury analyses were taken in accordance with EPA Method 105 and subsequently analyzed by EPA Method 7471. The beryllium analyses were performed according to EPA Method 210. 1.




GRAB SAMPLE SETUP FOR MOLECULAR WEIGHT DETERMINATION

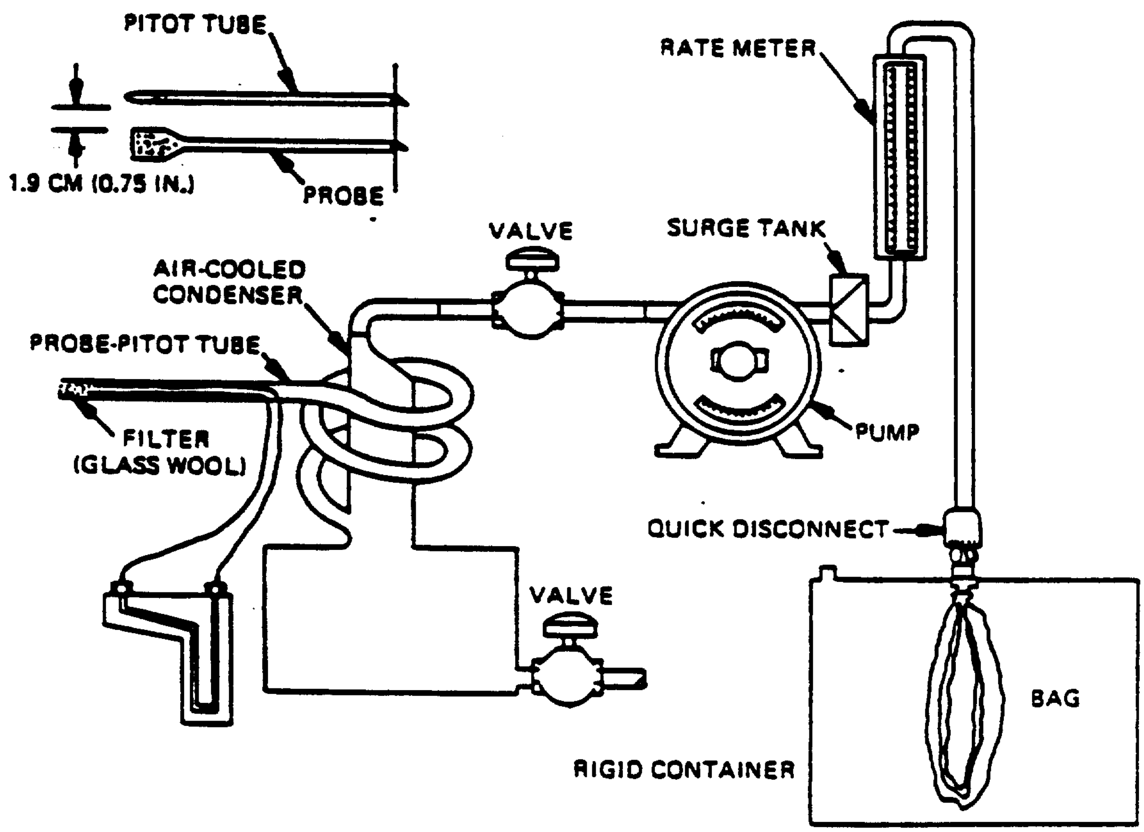



Figure 5-2
INTEGRATED SAMPLE SETUP FOR MOLECULAR WEIGHT DETERMINATION

### 5.4 Total Hydrocarbon Gas Analysis

A modified version of EPA Method 18 was used for the sampling and analysis. The modification consisted of identifying only total hydrocarbons (as n-hexane) instead of the normal specific compound identification usually performed for EPA Method 18. Sampling was performed in the same manner as the Orsat samples. Each gas sampling bag was placed in the rigid container; the air within the rigid container was then slowly evacuated. The resulting vacuum inflated the bag with the sampled flue gas. Figure shows the integrated gas sampling train.

The analysis method for the total hydrocarbon samples was by chromatography with flame ionization detection (GC/FID). GC/FID conditions were set to maximize peak resolution. Three calibrations constituted the range of the three standards.

### 5.5 Lead Analysis

The particulate collected on the EPA Method 5 filters was analyzed for lead after the gravimetric analysis had been performed. A section from each filter was acid digested and then analyzed by atomic absorption (direct aspiration). The analyses were performed in accordance with *Methods for Chemical Analysis of Water and Waters*, EPA - 600/4-79-020, March 1979.

Appendix A

Source Test Plan

THE MATTABASSETT DISTRICT
NEW BRITAIN-BERLIN-CROMWELL
REGIONAL SEWER AUTHORITY

GREGORY ABRAHAMIAN
EXECUTIVE DIRECTOR

P.O. BOX 137
CROMWELL, CONNECTICUT 06416
203-635-5550

August 20, 1986

Mr. George T. Miller
Sr. APC Engineer
State of Connecticut
Dept. of Environmental Protection
165 Capitol Avenue
Hartford, CT 06106

Dear Mr. Miller:

This letter is in regards to the test plan for sampling emissions from a Sewage Sludge Incinerator, owned and operated by the Mattabassett District in Cromwell, Connecticut. As required by the State of Connecticut, Department of Environmental Protection, sludge should be analyzed for Mercury and Beryllium. Sludge collected by EPA Method 105 for Mercury will be analyzed using EPA Method 7471. The test protocol for Beryllium will be EPA Method 210.1. Both analyses will be conducted by an independent certified laboratory.

If you have any questions concerning this matter please contact me at (203) 635-5550.

Sincerely,

THE MATTABASSETT DISTRICT

Terri Pelletier

Terri Pelletier
Chemist

TP/lg

cc: Christian Bratina
√Mr. John S. Gammie
Rojac Environmental Services, Inc.
P.O. Box 731
West Hartford, CT 06107

# STATE OF CONNECTICUT
## DEPARTMENT OF ENVIRONMENTAL PROTECTION

August 5, 1986

Mr. John S. Gammie
Project Manager
Rojac Environmental Services, Inc.
P.O. Box 731
W. Hartford, CT 06107

Dear Mr. Gammie:

You are hereby notified that "Intent to Test" form #860037, which describes a test plan for sampling emissions from a Sewage Sludge Incinerator that is owned and operated by the Mattabassett District Commission and located in Cromwell, Connecticut, is acceptable, subject to the following conditions, and meets the test criteria required by the State of Connecticut, Department of Environmental Protection.

1. Documented calibration of the sludge weighing device must be available on the day of the test.

2. If an incinerator by-pass stack exists, complete closure must be demonstrated for the duration of the test.

3. Are grit and scum incinerated? At what time interval and how are they fed to the incinerator?

4. Particulate results are requested in pounds/1000 pounds flue gas @ 50% excess air.

5. A sludge analysis for Mercury is required. Please submit a test protocol for E.P.A. method 105.

6. A sludge analysis for Beryllium is required. Please submit a test protocol.

7. Emission testing may be conducted at various operating parameters to determine compliance at various operating levels. Particulates, hydrocarbons and lead shall be sampled at each level.

The field test will be observed by myself unless you are otherwise notified. I should be informed of progress and problems that may alter the test program. If you have any questions concerning the content or intent of this letter, do not hesitate to contact me at (203) 566-3310. Please complete the enclosed form(s) and include them in your test report.

Very truly yours,

George T. Miller

George T. Miller
Sr. APC Engineer

cc: Mr. Christian Bratina
Mattabassett District Commission
P.O. Box 137
Cromwell, CT 06416

Encl.

GTM/ja

Source Test Plan
Mattabassett District
Pollution Control Plant
Main Incinerator
Cromwell, Connecticut

# ROJAC Environmental Services, Inc.

John S. Gammie
Project Manager

ROJAC Project F86-20

July 1986

P.O. Box 731
West Hartford, Connecticut 06107
(203) 527-7307

## SOURCE TEST PLAN

Client Name: Mattabassett District<br>Water Pollution Control Plant<br>P.O. Box 137<br>Cromwell, CT 06416<br>Mr. Christian Bratina<br>(203) 635-5550

Test Location: Mattabassett District<br>Water Pollution Control Plant<br>Cromwell, Connecticut

Testing Organization: ROJAC Environmental Services, Inc.<br>P. O. Box 731<br>West Hartford, CT 06107<br>(203) 527-7303

Individual Preparing Test Plan: John S. Gammie

Source To Be Tested: Main Incinerator

Proposed Test Date: August 1986

## TABLE OF CONTENTS



## LIST OF FIGURES

## 1.Ø PURPOSE OF TEST

The purpose of this test program is to determine the particulate, lead, and hydrocarbon emissions from the Mattabassett District main incinerator located in Cromwell, Connecticut. The tests will be carried out in conformance with the State of Connecticut Department of Environmental Protection guidelines for source emission testing. The incinerator at the Mattabassett facility must comply with the following emission limitations:

Particulate Matter - Ø.Ø8 grains per dry standard cubic feet corrected to 12% $CO_2$.

Lead and Hydrocarbons - for informational purposes only.

## 2.0 SCOPE OF TEST PROGRAM

### 2.1 Particulate Tests

The particulate emissions from the incinerator outlet stack will be tested in triplicate according to EPA Methods 1-5. Particulate compliance tests will be conducted on the Main Incinerator exhaust stack. The exhaust stack requires sampling at 20 traverse points. A minimum sample volume of thirty five (35) actual cubic feet will be collected during each test. All tests will be conducted while the facility is operating at its designed capacity of 3.75 wet tons/hour.

### 2.2 Exhaust Gas Analysis

The composition of the gas stream at the sampling location will be determined. Analysis will be conducted for oxygen and carbon dioxide during each test run in accordance with EPA Method 3. During each particulate test run at least one integrated sample of flue gas will be taken for Orsat analysis.

### 2.3 Hydrocarbon Emission Tests

The hydrocarbon emissions from the incinerator will be tested in triplicate according to a modified version of EPA Method 18. A single point within the incinerator will be sampled for 3 - 60 minute periods using an EPA Method 3 indirect fill gas sampling approach, commonly called "bag-in-the-box". Teflon gas sampling bags will be used. Analysis will be performed by gas chromatography.

## 2.4 Lead Analysis

Once the gravimetric analysis has been completed, for the EPA Method 5 test results, each filter will be analyzed for lead content. Analysis will be performed by atomic absorption.

## 3.0 PROCESS DESCRIPTION

The sewage sludge incinerator at this facility is of Bartlett-Snow Pacific design. Auxiliary fire is provided by natural gas. The designed maximum firing rate is approximately 2700 cubic feet per hour. Twenty-five percent excess air is provided for the fuel combustion. Approximately fifty percent excess air is provided for the sludge incineration. The maximum furnace temperature is 1800$^{\circ}$F.

The ash exits at a temperature of approximately 400$^{\circ}$F and is removed to an ash pond.

The exhaust gases pass through a wet cyclonic scrubber before exhausting out of the stack. The exit temperature of the exhaust gases during normal operating conditions is approximately 140$^{\circ}$F. Volumetric flowrate is approximately 500,000 standard cubic feet per hour.

The operating capacity of sewage sludge to the incinerator is approximately 3 to 6 wet tons per hour. Fluctuations in the feed rate depend on the operation of the belt filter and are functions of the particular characteristics of the sludge being charged. This plant normally operates with a sludge input of approximately 3.75 wet tons per hour. Sludge is fed to the incinerator by a screw conveyor. The incinerator is stoked by rabble arms with overfire air. The incinerator utilizes six burners.

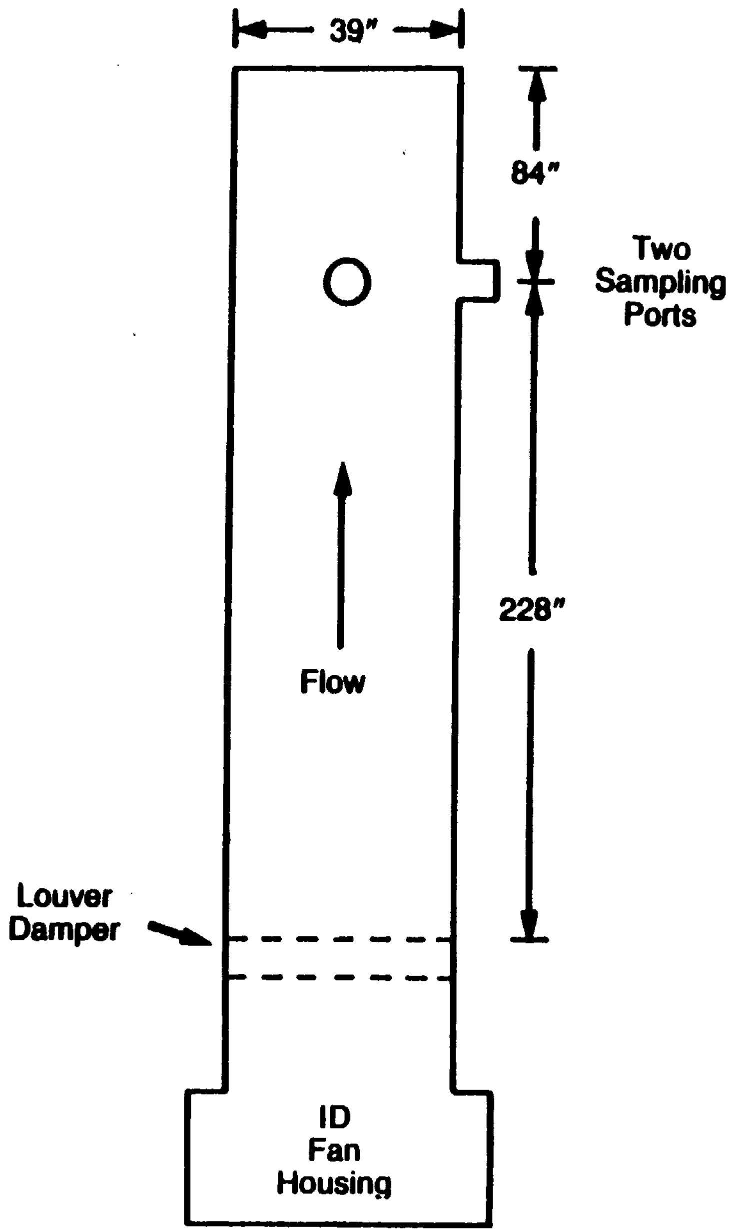
Sludge input weights will be measured using calibrated scales. Weights will be taken and recorded before, during, and after each particulate test run.

During the course of each particulate test run grab samples of sludge, charged to the incinerator, will be collected to determine the dry sludge content. Three sludge samples will be collected for total solids residue determination.

## 4.Ø DESCRIPTION OF SAMPLING LOCATION

The incinerator exhaust stack sampling location is located in a 39 inch ID vertical section of steel stack. Two 3 inch sampling ports are positioned 9Ø degrees apart in a horizontal plane and are located approximately 228 inches (5.8 duct diameters) downstream from the louver damper and approximately 84 inches (2.1 duct diameters) upstream from the top of the stack.

This sampling location did not meet the "eight and two diameters" criteria of EPA Method 1, so 1Ø sampling points will be used on each of two traverse axes, for a total of 2Ø sampling points. A schematic diagram of the outlet location along with the traverse point distances is shown in Figure 4-1. Prior to the particulate matter tests, a full 2Ø point cyclonic flow check will be performed.




| Traverse Point Number | Traverse Point Location From Stack Wall (inches) |
|---|---|
| 1 | 1.0 |
| 2 | 3.2 |
| 3 | 5.7 |
| 4 | 8.8 |
| 5 | 13.3 |
| 6 | 25.6 |
| 7 | 30.2 |
| 8 | 33.3 |
| 9 | 35.8 |
| 10 | 37.9 |

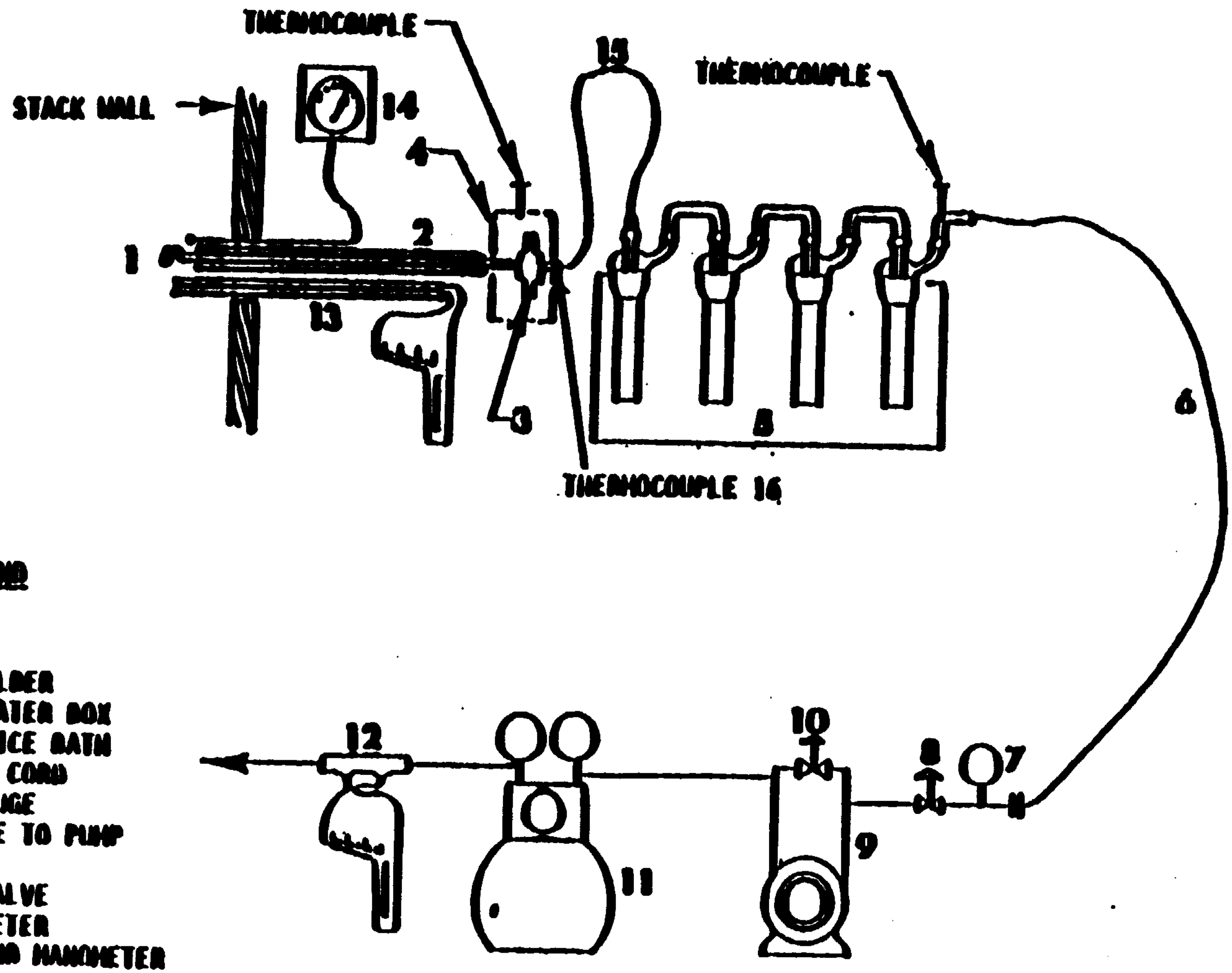
Figure 4-1
Incinerator Outlet Sampling Location
Mattabassett District
Main Incinerator
Cromwell, Connecticut

## 5.0 SAMPLING AND ANALYSIS METHODOLOGY

### 5.1 Particulate Matter Tests

Particulate sampling will be accomplished by using the EPA Method 5 collection train described in Title 40, Code of Federal Regulations, Part 60. It is shown schematically in Figure 5-1 and consists of a nozzle, probe, filter, four impingers, vacuum pump, dry gas meter, and an orifice flow meter. Complete sampling train calibrations are performed before and after every compliance test program.

A nozzle (1) is attached to a stainless steel or glass-lined probe (2) which is heated to prevent condensation. Reeve-Angel No. 934AH fiberglass filter paper supported in a 2-1/2 inch glass filter holder (3) is used as the collection media. The filter assembly is enclosed in a heated box (4) to maintain temperatures at 250$^{o}$F. An ice bath containing four impingers (5) is attached to the back end of the filter. The first two impingers contain distilled water, the third is dry, and the fourth contains silica gel to remove any remaining moisture. Flexible tubing (6), vacuum gauge (7), needle valve (8), leakless vacuum pump (9), bypass valve (10), dry gas meter (11), calibrated orifice and inclined manometer (12) complete the sampling train. The stack velocity pressure is measured using a pitot tube and inclined manometer (13). The stack temperature is monitored by a thermocouple that is attached to the pitot and connected to a potentiometer (14). A check valve is not used in the sampling train.




LEGEND

1 - NOZZLE
2 - PROBE
3 - FILTER HOLDER
4 - FILTER HEATER BOX
5 - IMPINGER ICE BATH
6 - UMBILICAL CORD
7 - VACUUM GAUGE
8 - MAIN VALVE TO PUMP
9 - PUMP
10 - BY-PASS VALVE
11 - DRY GAS METER
12 - ORIFICE AND MANOMETER
13 - PITOT TUBE AND MANOMETER
14 - STACK TEMPERATURE READOUT
15 - FLEXIBLE TUBING
16 - THERMOCOUPLE

Figure 5-1
Modified EPA Method 5 Particulate Sampling Train

A nomograph is used to quickly determine the orifice pressure drop required for any pitot velocity pressure and stack temperature in order to maintain isokinetic sampling conditions. Sampling flow is adjusted by means of the bypass valve. Before and after each particulate test run the sampling train is leak checked.

Test data to be recorded is listed on the field data sheet shown in the Appendix. At the end of each test, three sample containers will be used as follows:

Container #1 - Filter

Container #2 - Acetone wash of probe and front half of filter. The probe and nozzle are washed and brushed three times.

Container #3 - Silica gel from the fourth impinger.

The samples will be transported to the laboratory and the following analyses performed:

Container #1 - Transfer the filter and any loose particulate matter from the sample container to a tared glass weighing dish, desiccate and dry to a constant weight. Report results to the nearest 0.1 mg.

Container #2 - Transfer the acetone washings to a tared beaker and evaporated to dryness at ambient temperature and pressure. Desiccate and dry to a constant weight. Report results to the nearest 0.1 mg.

Container #3 - Weight silica gel to the nearest 0.5 mg. The weight of the moisture entrapped in the silica gel, along with the volume of moisture which is condensed in the impingers, is used to calculate the moisture content to the flue gas.

Prior to testing a preliminary velocity traverse, covering all sampling points, will be performed to check for cyclonic flow. The pitot-nulling technique will be used to determine if cyclonic flow is present, as detailed in EPA Method 1.

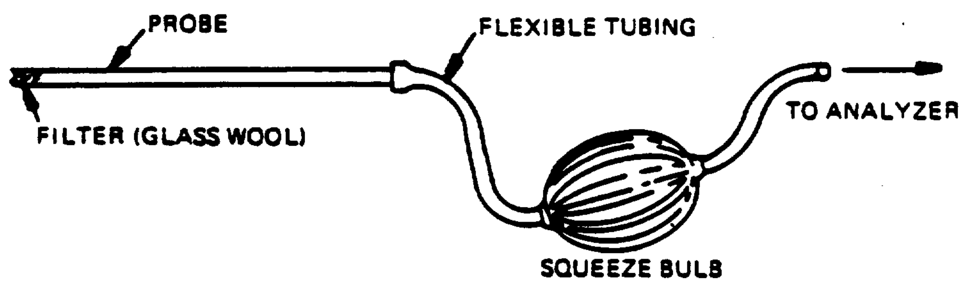
A calculator program is used to calculate mass emission rates in pounds per hour and particulate concentration in grains per dry standard cubic feet. The program also calculates percent moisture, molecular weight of the stack gas at stack conditions, and the percentage isokinetics.

### 5.2 Exhaust Gas Analysis

The composition of the gas stream at the sampling location will be analyzed for oxygen and carbon dioxide during each test run in accordance with EPA Method 3 as specified in Title 40, CFR, Part 60, Appendix A. To make an accurate assessment of the flue gas composition, redundant Orsat analyses will be conducted. During each particulate test run, at least one multipoint integrated sample of flue gas will be taken for Orsat analysis. The integrated gas sampling train and grab sampling train used for EPA Method 3 are shown in Figure 5-2.

### 5.3 Hydrocarbon Gas Analysis

A modified version of EPA Method 18 will be used for this sampling program. The modification will consist of identifying only total hydrocarbons instead of the normal specific compound identification usually performed for EPA Method 18. Sampling will be performed in the same manner as the Orsat samples. Each bag will be placed in the rigid container and slowly evacuating the




GRAB SAMPLE SETUP FOR MOLECULAR WEIGHT DETERMINATION

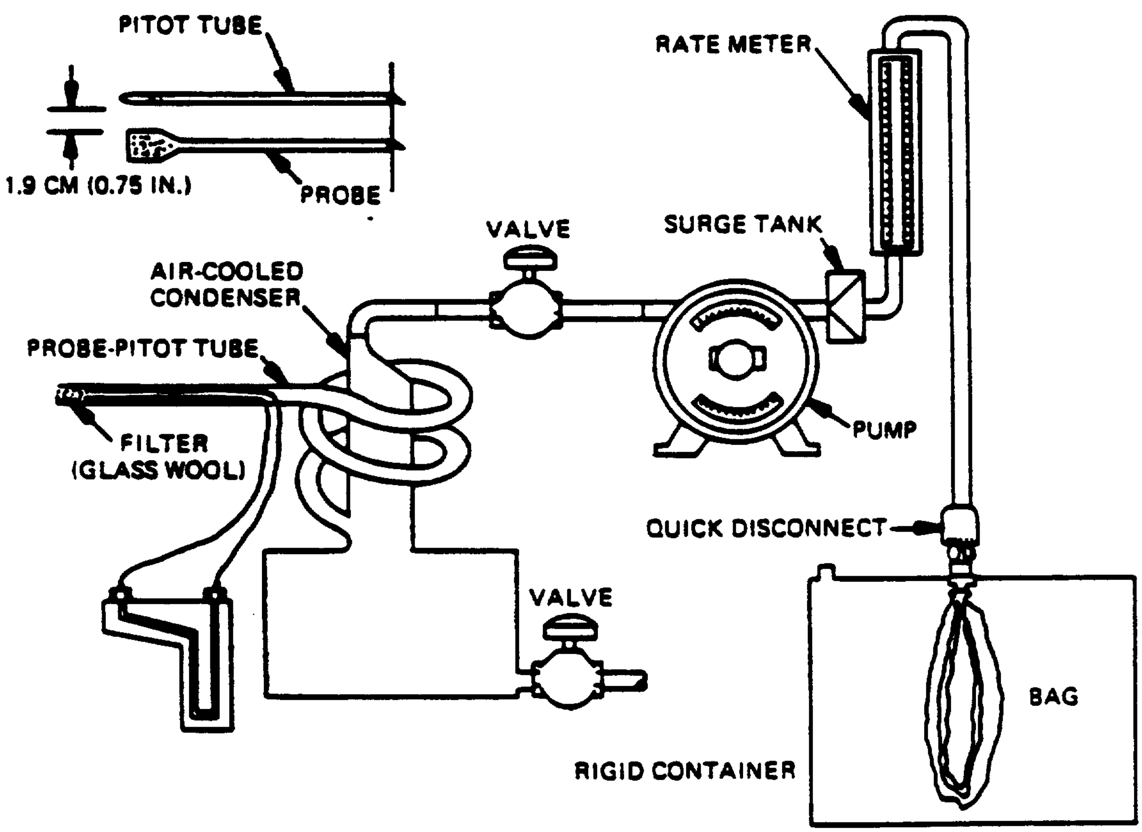



Figure 5-2
INTEGRATED SAMPLE SETUP FOR MOLECULAR WEIGHT DETERMINATION

air within the container. The resulting vacuum will inflate the bag with the sampled gas. Figure 5-2 shows the integrated gas sampling train.

The analysis method for total hydrocarbons will be gas chromatography with flame ionization detection (GC/FID). GC conditions will be set to maximize peak resolution. Three calibration standards will be prepared which will "box-in" the expected stack gas concentrations. High, low, and middle concentrations will constitute the range of the three standards.

## 5.4 Lead Analysis

The particulate collected on the EPA Method 5 filters will be analyzed for lead after the gravimetric analysis has been performed. A section from each filter will be acid digested and then analyzed by atomic absorption (direct aspiration). The analyses will be performed in accordance with Methods for Chemical Analysis of Water and Waters, EPA - 600/4-79-020, March 1979.

## 6.0 QUALITY ASSURANCE

The project manager will be responsible for implementation of the quality assurance program as applied to this project.

### 6.1 Sampling Quality Assurance

Generally, our implementation of quality assurance procedures for source measurement programs is designed so that the work is done:

1. by competent, trained individuals experienced in the specific methodologies being used;
2. using properly calibrated equipment; and
3. using approved procedures for sample handling and documentation.

ROJAC's measurement devices, pitot tubes, dry gas meters, thermocouples, and portable gas analyzers are uniquely identified and calibrated with documented procedures and acceptance criteria before and after each field effort. Records of all calibration data are maintained in ROJAC files.

Data are recorded on standard forms. Bound field notebooks are used to record observations and miscellaneous elements affecting data, calculations, or evaluation. Chain of custody forms are used to keep track of samples, all of which are uniquely identified. A sample chain of custody form is included in the Appendix.

Prior to each test, ROJAC will provide the official compliance test observer with the following:

1. Filter numbers and tare weights of all filters available for the test.

2. The results of a solvent blank run of the solvent to be used during the test.

3. Calibrations of all pitot tubes, dry gas meters, orifice meters, sampling nozzles, and thermocouples which will be used during the test. All calibrations will be performed within 4 months prior to the test date.

Specific details of ROJAC's QA program for stationary air pollution sources may be found in Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III (EPA-600/4-7027b).

6.2 Analytical Quality Control

Laboratory analysis of collected field samples is provided by Henry Souther Laboratories, Bloomfield, Connecticut. Henry Souther Laboratories, an accredited State of Connecticut laboratories, maintains a vigorous quality assurance program for all samples analyzed in the laboratory. This program is based on the general guidelines given in Handbook for Analytical Quality Control in Water and Wastewater Laboratories. (EPA 600/4-79-019; March 1979). This program suggests guidelines in the areas of:

*Laboratory services
*Instrument selection
*Glassware
*Reagents
*Solvents
*Gases
*Analytical performance
*Data handling and reporting
*Laboratory safety

In addition, Henry Souther Laboratories routinely receives and analyzes quality control samples from the Federal EPA and/or State Department of Health (Connecticut). Results of these audits are available. This ROJAC/Henry Souther Laboratories implemented quality assurance program thus provided for the confident sampling and analysis of all sources. Samples of all field data sheets, calibration forms, and chain of custody forms are contained in the appendix of this report.

## I SOURCE INFORMATION

Name Mattabassett District
No./St. P.O. Box 137
City Cromwell, CT 06416

Person or Persons Responsible for tests
Name Mr. Christian Brating
Telephone 635-5550

## II TESTER INFORMATION

Name ROJAC Environmental
Address P.O. Box 731
WH, CT 06107

Person or Persons Responsible for Tests
Name John Gammie
Telephone 527-7307

Signature ______
Person Responsible for Tests
Date ______

Proposed Test Date August 1986

## III. IDENTIFY EQUIPMENT AND STACK TO BE TESTED

______

______

CONN. REGISTRATION OR PERMIT NO. 043-0012-0032-01

## IV. Gas Stream Sampling Information. Identify all gas stream components to be sampled.

| Component | Sampling Duration: minutes per point | Sampling Duration: total test time | Number of tests (Minimum of 3) | Expected Concentrations | Brief description of the test method to be used for each pollutant |
|---|---|---|---|---|---|
| 1. Particulate | 3 | 60 | 3 | < 0.08 grains / DSCF @ 12% $CO_2$ | EPA Methods 1-5 |
| 2. Lead | | 60 | 3 | To be determined | EPA method 5 filter analyzed by AA |
| 3. Hydrocarbons | | 60 | 3 | To be determined | Modified EPA method 18 |
| 4. | | | | | |
| 5. | | | | | |

## V. Stack Information:

1. Approx. gas temp. 140 °F
2. Approx. gas flow 10,000 A.C.F.M.
3. Approx. percent moisture 17 % (percent by volume)

## VI. Is equipment or process to be tested:

1. Presently under State Order? Yes X No ___ Order No. ______
2. Been issued a Notice of Violation? Yes X No ___ Notice No. ______
3. applying for a permit to construct ___? operate ___?
4. testing to comply with 100 ton source test reg? Yes ___ No ___
5. testing to prove compliance Yes X No ___
6. other (specify) ______

## VII. Identification of documents requested on attached sheets

VIII______ X______ XII______ XIV______
IX______ XI______ XIII______

## Appendix B

## Test Data Summaries

I.T.T. # 860037

Test Report Data Form #1-5

Process Information: SEWAGE SLUDGE INCINERATORS

I. Results

| | TEST NUMBER 1 | 2 | 3 | | | 4 |
|---|---|---|---|---|---|---|
| 1. Particulates (lb/1000 lb) 250% E.A | 0.141 | 0.287 | 0.160 | Avg. | .210 | 0.2 |
| ($gr/SCF$ @ 12% $CO_2$) | .0916 | .1768 | ~~.147~~ 0.0923 | Avg. | .1368 | .16 |

.04 x 12% / 5.2%

II. Description

1. Maximum Feed Rate (lb/hr) 3750
2. Normal Feed Rate 2500
3. Method of Feeding Screw Conveyor
4. Method of Stoking Rabble Arms
5. Fuel:

maximum firing rate (gal/hr, CFH) 2700

type - ultimate and proximate analysis Natural Gas as Fuel

6. Dampers:

method of activation Lower Induced Air Fan Discharge

III. Operating Parameters During Test

1. Actual Burner Firing Rate (gal/hr, CFH) 1.7 E6
2. Material Incinerated:

% moisture 70

feed rate (lb/hr) 5000

incineration outlet temperature (s) (°F) 700-900

IV. Normal Operating Times

1. Hrs/Day 24/7
2. Days/Week 5
3. Weeks/Month 4
4. Shut Down Period (If Applicable) 4wks/yr

ANY ADDITIONAL INFORMATION AVAILABLE:

THIS FORM MUST BE COMPLETED AND INCLUDED IN FINAL REPORT.

FE #415

I.T.T. # 860037

Test Report Data Form #1-7

I. Test Data
(Particulate - E.P.A. Method 5)

| | TEST NUMBER 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1. Volume Water Collected (ML): | | | | |
| impingers | 315 | 805 | 295 | 420 |
| silica gel | 18.3 | 15.6 | 3.7 | 14.6 |
| 2. Meter Volume (Actual Cubic Feet) | 49.05 | 50.35 | 48.42 | 51.10 |
| 3. Avg. Meter Temperature (°F) | 101 | 107 | 108 | 104 |
| 4. Stack Pressure - Absolute (IN. HG) | -0.0118 | -0.0118 | -0.0110 | -0.010 |
| 5. Avg. Orifice Press. Drop (IN. $H_2O$) | 2.26 | 2.40 | 2.09 | 2.44 |
| 6. Pitot Coefficient | .84 | .84 | .84 | .84 |
| 7. Stack Area ($Ft^2$) | 8.3 | 8.3 | 8.3 | 8.3 |
| 8. Nozzle Diameter (IN.) | .362 | .362 | .362 | .362 |
| 9. Avg. Stack Temp. (°F) | 149 | 164 | 144 | 152 |
| 10. Atmospheric Press. (IN. HG) | 29.78 | 29.78 | 29.78 | 29.78 |
| 11. Total Test Time (Min.) | 60 | 60 | 60 | 60 |
| 12. Heat Input (MBTU/HR) | NA | NA | NA | NA |
| 13. Total Particulate Collected (MG) | 151.3 | 359.4 | 141.6 | 286.4 |
| 15. Avg. Velocity Press. Drop (IN. $H_2O$) | .4193 | .4633 | .4642 | .4707 |
| II. ORSAT Analysis: | | | | |
| per cent $CO_2$ | 6.6 | 8.0 | 5.2 | 6.6 |
| per cent $O_2$ | 12.1 | 10.5 | 14.6 | 12.2 |
| per cent CO | 0 | 0 | 0 | 0 |
| III. Moisture Content (Per Cent $H_2O$) | 25.3 | 45.0 | 23.7 | 29.8 |

I.T.T. # 860037

Test Report Data Form #2-5

Control Equipment Information: SCRUBBER

I. Description

1. Scrubber Type (e.g. cyclone, orifice, mechanical, venturi, packed tower) — Cyclonic
2. Maximum Gas Volume Capacity (CFM) — 28,000
3. Scrubber Diameter (Ft) — 7.6
4. Manufacturer — Aircetron
5. Model Number — N/A

II. Operating Parameters

1. Inlet Gas Temperature (°F) — 250
2. Outlet Gas Temperature (°F) — 150
3. Gas Pressure Drop Across Unit ($In.\ H_2O$) — 3 1/2"
4. Outlet Gas Flow Rate (CFM) — 28000
5. Fan Horsepower — 40
6. Liquid Flow Rate (GPM) — 80
7. Injection Pressure (PSI) — 120

III. For Packed Tower Scrubbers:

1. Type of Packing — NA
2. Packing Depth (Ft) — NA
3. Per Cent Free Volume of Packing — NA
4. Packing Surface Area ($Ft^2$) — NA

ANY ADDITIONAL INFORMATION AVAILABLE:

THIS FORM MUST BE COMPLETED AND INCLUDED IN FINAL TEST REPORT.

## PARTICULATE TEST DATA SUMMARY

TEST RUN: 1
LOCATION: Incinerator Outlet
FIRM: Mattabassett W.W.T.P

TIME: 1019-1122
DATE: 8-27-86
PROJECT NO.: F86-20

### INPUTS

| | | |
|---|---|---|
| PBAR | BARAMETRIC PRESSURE, (in. Hg) | 29.78 |
| AS | STACK AREA, ($Ft^2$) | 8.3 |
| DN | NOZZLE DIAMETER, (in.) | .362 |
| TIME TOT | TOTAL SAMPLING TIME, (min.) | 60 |
| Y | CALIBRATION FACTOR | 1.0025 |
| CP | PITOT COEFICIENT | 0.84 |
| DELTA P1/2 | AVG. SQ. RT. VELOCITY HEAD, (in. $H_2O$) | .4193 |
| DELTA H | AVG. ORIFICE PRESSURE DROP (in. $H_2O$) | 2.26 |
| TM | AVERAGE METER TEMPERATURE (°F) | 101 |
| P STK | AVERAGE STACK PRESSURE, (in. $H_2O$) | -0.16 |
| T STK | AVERAGE STACK TEMPERATURE, (°F) | 149 |
| VM | ACTUAL METER VOLUME, ($Ft^3$) | 49.05 |
| VI | TOTAL $H_2O$ VAPOR COLLECTED, (ml) | 333.3 |
| $CO_2$ | % $CO_2$ IN STACK GAS, (DRY) | 6.6 |
| $O_2$ | % $O_2$ IN STACK GAS, (DRY) | 12.1 |
| CO | % CO IN STACK GAS, (DRY) | 0 |
| $N_2$ | % $N_2$ IN STACK GAS, (DRY) | 81.3 |
| MN | TOTAL PARTICULATE CATCH, (mg) | 151.3 |
| HF | % HYDROGEN IN FUEL | NA |
| CF | % CARBON IN FUEL | |
| SF | % SULFUR IN FUEL | |
| NF | % NITROGEN IN FUEL | |
| OF | % OXYGEN IN FUEL | |
| GCV | GROSS CALIFORIC VOLUME, (BTU/lb) | |

### OUTPUTS

| | | |
|---|---|---|
| VM STD | METER VOLUME STANDARD CONDITIONS ($Ft^3$) | 46.32 |
| $H_2O$ | PERCENT MOISTURE IN STACK GAS | 25.3 |
| MS | MOLECULAR WEIGHT OF STACK GAS (WET) | 26.6 |
| EA | PERCENT OF EXCESS AIR | 129.2 |
| VS | AVERAGE VELOCITY OF STACK GAS, (FPM) | 1583.7 |
| Q | ACTUAL STACK GAS FLOWRATE, (ACFM) | 13145 |
| QSTD | STACK GAS FLOWRATE AT STP, (DSCFM) | 8470.3 |
| I | % ISOKINETIC, (NOZZLE VEL./STACK/VEL.) | 105.9 |
| C | ACTUAL PARTICULATE CONC., (GRAINS/ACF) | .03 |
| CS | PARTICULATE CONCENTRATION, (GR/DSCF) | .05 |
| ER | PARTICULATE EMISSION RATE, (lb/hr) | 3.65 |
| $CS12CO_2$ | PARTICULATE CONCTRATION, (GR/DSCF @ 12% $CO_2$) | .0716 |
| FD | F FACTOR, (DSCF/MMBTU) | NA |
| E | PARTICULATE EMISSIONS, (lbs/MMBTU) | NA |
| | Particulate Concentration, (lbs/1000 lbs dry @ 50 EA) | 0.141 |

PARTICULATE TEST DATA SUMMARY

TEST RUN 2
LOCATION Incinerator Outlet
FIRM Mattabassett W.W.T.P.

TIME 1219-1321
DATE 8-22-86
PROJECT NO. F86-20

INPUTS

| | | |
|---|---|---|
| PBAR | BARAMETRIC PRESSURE, (in. Hg) | 29.78 |
| AS | STACK AREA, ($Ft^2$) | 8.3 |
| DN | NOZZLE DIAMETER, (in.) | .362 |
| TIME TOT | TOTAL SAMPLING TIME, (min.) | 60 |
| Y | CALIBRATION FACTOR | 1.0025 |
| CP | PITOT COEFICIENT | .84 |
| DELTA P1/2 | AVG. SQ. RT. VELOCITY HEAD, (in. $H_2O$) | .4633 |
| DELTA H | AVG. ORIFICE PRESSURE DROP (in. $H_2O$) | 2.40 |
| TM | AVERAGE METER TEMPERATURE (°F) | 107 |
| P STK | AVERAGE STACK PRESSURE, (in. $H_2O$) | -0.16 |
| T STK | AVERAGE STACK TEMPERATURE, (°F) | 164 |
| VM | ACTUAL METER VOLUME, ($Ft^3$) | 50.35 |
| VI | TOTAL $H_2O$ VAPOR COLLECTED, (ml) | 820.6 |
| $CO_2$ | % $CO_2$ IN STACK GAS, (DRY) | 8.0 |
| $O_2$ | % $O_2$ IN STACK GAS, (DRY) | 10.5 |
| CO | % CO IN STACK GAS, (DRY) | 0 |
| $N_2$ | % $N_2$ IN STACK GAS, (DRY) | 81.5 |
| MN | TOTAL PARTICULATE CATCH, (mg) | 351.4 |
| HF | % HYDROGEN IN FUEL | NA |
| CF | % CARBON IN FUEL | |
| SF | % SULFUR IN FUEL | |
| NF | % NITROGEN IN FUEL | |
| OF | % OXYGEN IN FUEL | |
| GCV | GROSS CALIFORIC VOLUME, (BTU/lb) | |

OUTPUTS

| | | |
|---|---|---|
| VM STD | METER VOLUME STANDARD CONDITIONS ($Ft^3$) | 47.06 |
| $H_2O$ | PERCENT MOISTURE IN STACK GAS | 45.0 |
| MS | MOLECULAR WEIGHT OF STACK GAS (WET) | 24.4 |
| EA | PERCENT OF EXCESS AIR | 95.3 |
| VS | AVERAGE VELOCITY OF STACK GAS, (FPM) | 1849.2 |
| Q | ACTUAL STACK GAS FLOWRATE, (ACFM) | 15348.6 |
| QSTD | STACK GAS FLOWRATE AT STP, (DSCFM) | 7096.8 |
| I | % ISOKINETIC, (NOZZLE VEL./STACK/VEL.) | 128.4 |
| C | ACTUAL PARTICULATE CONC., (GRAINS/ACF) | .05 |
| CS | PARTICULATE CONCENTRATION, (GR/DSCF) | .1178 |
| ER | PARTICULATE EMISSION RATE, (lb/hr) | 7.16 |
| CS12$CO_2$ | PARTICULATE CONCTRATION, (GR/DSCF @ 12% $CO_2$) | .1768 |
| FD | F FACTOR, (DSCF/MMBTU) | NA |
| E | PARTICULATE EMISSIONS, (lbs/MMBTU) | NA |
| | Particulate Concentration, (lbs/1000 lbs dry @ 50 EA) | 0.282 |

## PARTICULATE TEST DATA SUMMARY

TEST RUN: 3
LOCATION: Incinerator Outlet
FIRM: Mattabassett W.W.T.P.

TIME: 1431-1536
DATE: 8-27-86
PROJECT NO.: F86 20

**INPUTS**

| | | |
|---|---|---|
| PBAR | BAROMETRIC PRESSURE, (in. Hg) | 29.78 |
| AS | STACK AREA, ($Ft^2$) | 8.3 |
| DN | NOZZLE DIAMETER, (in.) | .362 |
| TIME TOT | TOTAL SAMPLING TIME, (min.) | 60 |
| Y | CALIBRATION FACTOR | 1.0025 |
| CP | PITOT COEFICIENT | .84 |
| DELTA P1/2 | AVG. SQ. RT. VELOCITY HEAD, (in. $H_2O$) | .4642 |
| DELTA H | AVG. ORIFICE PRESSURE DROP (in. $H_2O$) | 2.09 |
| TM | AVERAGE METER TEMPERATURE (°F) | 108 |
| P STK | AVERAGE STACK PRESSURE, (in. $H_2O$) | -0.15 |
| T STK | AVERAGE STACK TEMPERATURE, (°F) | 144 |
| VM | ACTUAL METER VOLUME, ($Ft^3$) | 48.42 |
| VI | TOTAL $H_2O$ VAPOR COLLECTED, (ml) | 298.7 |
| $CO_2$ | % $CO_2$ IN STACK GAS, (DRY) | 5.2 |
| $O_2$ | % $O_2$ IN STACK GAS, (DRY) | 14.6 |
| CO | % CO IN STACK GAS, (DRY) | 0 |
| $N_2$ | % $N_2$ IN STACK GAS, (DRY) | 80.2 |
| MN | TOTAL PARTICULATE CATCH, (mg) | 141.6 |
| HF | % HYDROGEN IN FUEL | NA |
| CF | % CARBON IN FUEL | |
| SF | % SULFUR IN FUEL | |
| NF | % NITROGEN IN FUEL | |
| OF | % OXYGEN IN FUEL | |
| GCV | GROSS CALIFORIC VOLUME, (BTU/lb) | |

**OUTPUTS**

| | | |
|---|---|---|
| VM STD | METER VOLUME STANDARD CONDITIONS ($Ft^3$) | 45.14 |
| $H_2O$ | PERCENT MOISTURE IN STACK GAS | 23.7 |
| MS | MOLECULAR WEIGHT OF STACK GAS (WET) | 26.7 |
| EA | PERCENT OF EXCESS AIR | 222.1 |
| VS | AVERAGE VELOCITY OF STACK GAS, (FPM) | 1743.3 |
| Q | ACTUAL STACK GAS FLOWRATE, (ACFM) | 14470.0 |
| QSTD | STACK GAS FLOWRATE AT STP, (DSCFM) | 9596.6 |
| I | % ISOKINETIC, (NOZZLE VEL./STACK/VEL.) | 91.0 |
| C | ACTUAL PARTICULATE CONC., (GRAINS/ACF) | .03 |
| CS | PARTICULATE CONCENTRATION, (GR/DSCF) | .04 |
| ER | PARTICULATE EMISSION RATE, (lb/hr) | 3.98 |
| CS12$CO_2$ | PARTICULATE CONCTRATION, (GR/DSCF @ 12% $CO_2$) | .1117 |
| FD | F FACTOR, (DSCF/MMBTU) | N/A |
| E | PARTICULATE EMISSIONS, (lbs/MMBTU) | N/A |

Particulate Concentration, (lbs/1000 lbs dry @ 50% EA) 0.160

## PARTICULATE TEST DATA SUMMARY

TEST RUN 4
LOCATION Incinerator Outlet
FIRM Mattabassett W.W.T.P.

TIME 1725-1829
DATE 8-27-86
PROJECT NO. F86-20

### INPUTS

| | | |
|---|---|---|
| PBAR | BARAMETRIC PRESSURE, (in. Hg) | 29.78 |
| AS | STACK AREA, ($Ft^2$) | 8.3 |
| DN | NOZZLE DIAMETER, (in.) | .362 |
| TIME TOT | TOTAL SAMPLING TIME, (min.) | 60 |
| Y | CALIBRATION FACTOR | 1.0025 |
| CP | PITOT COEFICIENT | .84 |
| DELTA P1/2 | AVG. SQ. RT. VELOCITY HEAD, (in. $H_2O$) | .4707 |
| DELTA H | AVG. ORIFICE PRESSURE DROP (in. $H_2O$) | 2.44 |
| TM | AVERAGE METER TEMPERATURE (°F) | 104 |
| P STK | AVERAGE STACK PRESSURE, (in. $H_2O$) | -0.14 |
| T STK | AVERAGE STACK TEMPERATURE, (°F) | 152 |
| VM | ACTUAL METER VOLUME, ($Ft^3$) | 51.10 |
| VI | TOTAL $H_2O$ VAPOR COLLECTED, (ml) | 434.6 |
| $CO_2$ | % $CO_2$ IN STACK GAS, (DRY) | 6.6 |
| $O_2$ | % $O_2$ IN STACK GAS, (DRY) | 12.2 |
| CO | % CO IN STACK GAS, (DRY) | 0 |
| $N_2$ | % $N_2$ IN STACK GAS, (DRY) | 81.2 |
| MN | TOTAL PARTICULATE CATCH, (mg) | 286.4 |
| HF | % HYDROGEN IN FUEL | NA |
| CF | % CARBON IN FUEL | |
| SF | % SULFUR IN FUEL | |
| NF | % NITROGEN IN FUEL | |
| OF | % OXYGEN IN FUEL | |
| GCV | GROSS CALIFORIC VOLUME, (BTU/lb) | |

### OUTPUTS

| | | |
|---|---|---|
| VM STD | METER VOLUME STANDARD CONDITIONS ($Ft^3$) | 48.02 |
| $H_2O$ | PERCENT MOISTURE IN STACK GAS | 29.87 |
| MS | MOLECULAR WEIGHT OF STACK GAS (WET) | 26.1 |
| EA | PERCENT OF EXCESS AIR | 132.0 |
| VS | AVERAGE VELOCITY OF STACK GAS, (FPM) | 1800.0 |
| Q | ACTUAL STACK GAS FLOWRATE, (ACFM) | 14940 |
| QSTD | STACK GAS FLOWRATE AT STP, (DSCFM) | 8993.9 |
| I | % ISOKINETIC, (NOZZLE VEL./STACK/VEL.) | 103.3 |
| C | ACTUAL PARTICULATE CONC., (GRAINS/ACF) | .05 |
| CS | PARTICULATE CONCENTRATION, (GR/DSCF) | .09 |
| ER | PARTICULATE EMISSION RATE, (lb/hr) | 7.09 |
| $CS12CO_2$ | PARTICULATE CONCTRATION, (GR/DSCF @ 12% $CO_2$) | .1673 |
| FD | F FACTOR, (DSCF/MMBTU) | NA |
| E | PARTICULATE EMISSIONS, (lbs/MMBTU) | NA |
| | Particulate Concentration, (lbs/1000 lbs dry @ 50% EA) | 0.258 |

# PARTICULATE TEST DATA SUMMARY

TEST RUN 1- Lead
LOCATION Incinerator Outlet
FIRM mattabassett

TIME 1019- 1122
DATE 8/27/86
PROJECT NO. F86-20

## INPUTS

| | | |
|---|---|---|
| PBAR | BARAMETRIC PRESSURE, (in. Hg) | 29.78 |
| AS | STACK AREA, ($Ft^2$) | 8.3 |
| DN | NOZZLE DIAMETER, (in.) | 0.362 |
| TIME TOT | TOTAL SAMPLING TIME, (min.) | 60 |
| Y | CALIBRATION FACTOR | 1.0025 |
| CP | PITOT COEFICIENT | 0.84 |
| DELTA P1/2 | AVG. SQ. RT. VELOCITY HEAD, (in. $H_2O$) | 0.4193 |
| DELTA H | AVG. ORIFICE PRESSURE DROP (in. $H_2O$) | 2.26 |
| TM | AVERAGE METER TEMPERATURE (°F) | 101 |
| P STK | AVERAGE STACK PRESSURE, (in. $H_2O$) | -0.16 |
| T STK | AVERAGE STACK TEMPERATURE, (°F) | 149 |
| VM | ACTUAL METER VOLUME, ($Ft^3$) | 49.05 |
| VI | TOTAL $H_2O$ VAPOR COLLECTED, (ml) | 333.3 |
| $CO_2$ | % $CO_2$ IN STACK GAS, (DRY) | 6.6 |
| $O_2$ | % $O_2$ IN STACK GAS, (DRY) | 12.1 |
| CO | % CO IN STACK GAS, (DRY) | 0 |
| $N_2$ | % $N_2$ IN STACK GAS, (DRY) | 81.3 |
| MN | TOTAL PARTICULATE CATCH, (mg) | 1.044 |
| HF | % HYDROGEN IN FUEL | NA |
| CF | % CARBON IN FUEL | |
| SF | % SULFUR IN FUEL | |
| NF | % NITROGEN IN FUEL | |
| OF | % OXYGEN IN FUEL | |
| GCV | GROSS CALIFORIC VOLUME, (BTU/lb) | |

## OUTPUTS

| | | |
|---|---|---|
| VM STD | METER VOLUME STANDARD CONDITIONS ($Ft^3$) | 46.32 |
| $H_2O$ | PERCENT MOISTURE IN STACK GAS | 25.30 |
| MS | MOLECULAR WEIGHT OF STACK GAS (WET) | 26.62 |
| EA | PERCENT OF EXCESS AIR | 129.2 |
| VS | AVERAGE VELOCITY OF STACK GAS, (FPM) | 1583.7 |
| Q | ACTUAL STACK GAS FLOWRATE, (ACFM) | 13145 |
| QSTD | STACK GAS FLOWRATE AT STP, (DSCFM) | 8470.3 |
| I | % ISOKINETIC, (NOZZLE VEL./STACK/VEL.) | 105.9 |
| C | ACTUAL PARTICULATE CONC., (GRAINS/ACF) | .0002 |
| CS | PARTICULATE CONCENTRATION, (GR/DSCF) | .0004 |
| ER | PARTICULATE EMISSION RATE, (lb/hr) | .0300 |
| $CS12CO_2$ | PARTICULATE CONCTRATION, (GR/DSCF @ 12% $CO_2$) | .0007 |
| FD | F FACTOR, (DSCF/MMBTU) | NA |
| E | PARTICULATE EMISSIONS, (lbs/MMBTU) | NA |

PARTICULATE TEST DATA SUMMARY

TEST RUN 2 - Lead
LOCATION Incinerator Outlet
FIRM Mattabassett

TIME 1219- 1321
DATE 8/27/86
PROJECT NO. F86-20

**INPUTS**

| | | |
|---|---|---|
| PBAR | BARAMETRIC PRESSURE, (in. Hg) | 29.78 |
| AS | STACK AREA, ($Ft^2$) | 8.3 |
| DN | NOZZLE DIAMETER, (in.) | 0.362 |
| TIME TOT | TOTAL SAMPLING TIME, (min.) | 60 |
| Y | CALIBRATION FACTOR | 1.0025 |
| CP | PITOT COEFICIENT | 0.84 |
| DELTA P1/2 | AVG. SQ. RT. VELOCITY HEAD, (in. $H_2O$) | 0.4633 |
| DELTA H | AVG. ORIFICE PRESSURE DROP (in. $H_2O$) | 2.40 |
| TM | AVERAGE METER TEMPERATURE (°F) | 107 |
| P STK | AVERAGE STACK PRESSURE, (in. $H_2O$) | -0.16 |
| T STK | AVERAGE STACK TEMPERATURE, (°F) | 164 |
| VM | ACTUAL METER VOLUME, ($Ft^3$) | 50.35 |
| VI | TOTAL $H_2O$ VAPOR COLLECTED, (ml) | 820.6 |
| $CO_2$ | % $CO_2$ IN STACK GAS, (DRY) | 8.0 |
| $O_2$ | % $O_2$ IN STACK GAS, (DRY) | 10.5 |
| CO | % CO IN STACK GAS, (DRY) | 0 |
| $N_2$ | % $N_2$ IN STACK GAS, (DRY) | 81.5 |
| MN | TOTAL PARTICULATE CATCH, (mg) | 2.476 |
| HF | % HYDROGEN IN FUEL | NA |
| CF | % CARBON IN FUEL | |
| SF | % SULFUR IN FUEL | |
| NF | % NITROGEN IN FUEL | |
| OF | % OXYGEN IN FUEL | |
| GCV | GROSS CALIFORIC VOLUME, (BTU/lb) | |

**OUTPUTS**

| | | |
|---|---|---|
| VM STD | METER VOLUME STANDARD CONDITIONS ($Ft^3$) | 47.06 |
| $H_2O$ | PERCENT MOISTURE IN STACK GAS | 45.07 |
| MS | MOLECULAR WEIGHT OF STACK GAS (WET) | 24.42 |
| EA | PERCENT OF EXCESS AIR | 95.31 |
| VS | AVERAGE VELOCITY OF STACK GAS, (FPM) | 1649.2 |
| Q | ACTUAL STACK GAS FLOWRATE, (ACFM) | 15348 |
| QSTD | STACK GAS FLOWRATE AT STP, (DSCFM) | 7096.8 |
| I | % ISOKINETIC, (NOZZLE VEL./STACK/VEL.) | 128.4 |
| C | ACTUAL PARTICULATE CONC., (GRAINS/ACF) | .0003 |
| CS | PARTICULATE CONCENTRATION, (GR/DSCF) | .0008 |
| ER | PARTICULATE EMISSION RATE, (lb/hr) | .0497 |
| $CS12CO_2$ | PARTICULATE CONCTRATION, (GR/DSCF @ 12% $CO_2$) | .0012 |
| FD | F FACTOR, (DSCF/MMBTU) | NA |
| E | PARTICULATE EMISSIONS, (lbs/MMBTU) | NA |

# PARTICULATE TEST DATA SUMMARY

TEST RUN 3 - Lead
LOCATION Incinerator Outlet
FIRM Mattabassett

TIME 1431- 1536
DATE 8/27/86
PROJECT NO. F86-20

## INPUTS

| | | |
|---|---|---|
| PBAR | BAROMETRIC PRESSURE, (in. Hg) | 29.78 |
| AS | STACK AREA, ($Ft^2$) | 8.3 |
| DN | NOZZLE DIAMETER, (in.) | 0.362 |
| TIME TOT | TOTAL SAMPLING TIME, (min.) | 60 |
| Y | CALIBRATION FACTOR | 1.0025 |
| CP | PITOT COEFICIENT | 0.84 |
| DELTA P1/2 | AVG. SQ. RT. VELOCITY HEAD, (in. $H_2O$) | 0.4642 |
| DELTA H | AVG. ORIFICE PRESSURE DROP (in. $H_2O$) | 2.09 |
| TM | AVERAGE METER TEMPERATURE (°F) | 108 |
| P STK | AVERAGE STACK PRESSURE, (in. $H_2O$) | -0.15 |
| T STK | AVERAGE STACK TEMPERATURE, (°F) | 144 |
| VM | ACTUAL METER VOLUME, ($Ft^3$) | 48.42 |
| VI | TOTAL $H_2O$ VAPOR COLLECTED, (ml) | 298.7 |
| $CO_2$ | % $CO_2$ IN STACK GAS, (DRY) | 5.2 |
| $O_2$ | % $O_2$ IN STACK GAS, (DRY) | 14.6 |
| CO | % CO IN STACK GAS, (DRY) | 0 |
| $N_2$ | % $N_2$ IN STACK GAS, (DRY) | 80.2 |
| MN | TOTAL PARTICULATE CATCH, (mg) | 1.348 |
| HF | % HYDROGEN IN FUEL | NA |
| CF | % CARBON IN FUEL | |
| SF | % SULFUR IN FUEL | |
| NF | % NITROGEN IN FUEL | |
| OF | % OXYGEN IN FUEL | |
| GCV | GROSS CALIFORIC VOLUME, (BTU/lb) | |

## OUTPUTS

| | | |
|---|---|---|
| VM STD | METER VOLUME STANDARD CONDITIONS ($Ft^3$) | 45.14 |
| $H_2O$ | PERCENT MOISTURE IN STACK GAS | 23.74 |
| MS | MOLECULAR WEIGHT OF STACK GAS (WET) | 26.70 |
| EA | PERCENT OF EXCESS AIR | 222.1 |
| VS | AVERAGE VELOCITY OF STACK GAS, (FPM) | 1743.3 |
| Q | ACTUAL STACK GAS FLOWRATE, (ACFM) | 14470 |
| QSTD | STACK GAS FLOWRATE AT STP, (DSCFM) | 9596.6 |
| I | % ISOKINETIC, (NOZZLE VEL./STACK/VEL.) | 91.0 |
| C | ACTUAL PARTICULATE CONC., (GRAINS/ACF) | .0003 |
| CS | PARTICULATE CONCENTRATION, (GR/DSCF) | .0004 |
| ER | PARTICULATE EMISSION RATE, (lb/hr) | .0378 |
| CS12CO2 | PARTICULATE CONCTRATION, (GR/DSCF @ 12% $CO_2$) | .0010 |
| FD | F FACTOR, (DSCF/MMBTU) | NA |
| E | PARTICULATE EMISSIONS, (lbs/MMBTU) | NA |

## PARTICULATE TEST DATA SUMMARY

TEST RUN 4- Lead
LOCATION Incinerator Outlet
FIRM Mattabassett

TIME 1725 - 1829
DATE 8/27/86
PROJECT NO. F86-20

### INPUTS

| | | |
|---|---|---|
| PBAR | BARAMETRIC PRESSURE, (in. Hg) | 29.78 |
| AS | STACK AREA, ($Ft^2$) | 8.3 |
| DN | NOZZLE DIAMETER, (in.) | 0.362 |
| TIME TOT | TOTAL SAMPLING TIME, (min.) | 60 |
| Y | CALIBRATION FACTOR | 1.0025 |
| CP | PITOT COEFICIENT | 0.84 |
| DELTA P1/2 | AVG. SQ. RT. VELOCITY HEAD, (in. $H_2O$) | 0.4707 |
| DELTA H | AVG. ORIFICE PRESSURE DROP (in. $H_2O$) | 2.44 |
| TM | AVERAGE METER TEMPERATURE (°F) | 104 |
| P STK | AVERAGE STACK PRESSURE, (in. $H_2O$) | -0.14 |
| T STK | AVERAGE STACK TEMPERATURE, (°F) | 152 |
| VM | ACTUAL METER VOLUME, ($Ft^3$) | 51.10 |
| VI | TOTAL $H_2O$ VAPOR COLLECTED, (ml) | 434.6 |
| $CO_2$ | % $CO_2$ IN STACK GAS, (DRY) | 6.6 |
| $O_2$ | % $O_2$ IN STACK GAS, (DRY) | 12.2 |
| CO | % CO IN STACK GAS, (DRY) | 0 |
| $N_2$ | % $N_2$ IN STACK GAS, (DRY) | 81.2 |
| MN | TOTAL PARTICULATE CATCH, (mg) | 0.956 |
| HF | % HYDROGEN IN FUEL | NA |
| CF | % CARBON IN FUEL | |
| SF | % SULFUR IN FUEL | |
| NF | % NITROGEN IN FUEL | |
| OF | % OXYGEN IN FUEL | |
| GCV | GROSS CALIFORIC VOLUME, (BTU/lb) | |

### OUTPUTS

| | | |
|---|---|---|
| VM STD | METER VOLUME STANDARD CONDITIONS ($Ft^3$) | 48.02 |
| $H_2O$ | PERCENT MOISTURE IN STACK GAS | 29.87 |
| MS | MOLECULAR WEIGHT OF STACK GAS (WET) | 26.09 |
| EA | PERCENT OF EXCESS AIR | 132.0 |
| VS | AVERAGE VELOCITY OF STACK GAS, (FPM) | 1800.0 |
| Q | ACTUAL STACK GAS FLOWRATE, (ACFM) | 14940 |
| QSTD | STACK GAS FLOWRATE AT STP, (DSCFM) | 8993.9 |
| I | % ISOKINETIC, (NOZZLE VEL./STACK/VEL.) | 103.3 |
| C | ACTUAL PARTICULATE CONC., (GRAINS/ACF) | .0001 |
| CS | PARTICULATE CONCENTRATION, (GR/DSCF) | .0003 |
| ER | PARTICULATE EMISSION RATE, (lb/hr) | .0236 |
| $CS12CO_2$ | PARTICULATE CONCTRATION, (GR/DSCF @ 12% $CO_2$) | .0005 |
| FD | F FACTOR, (DSCF/MMBTU) | NA |
| E | PARTICULATE EMISSIONS, (lbs/MMBTU) | NA |

Appendix C

Laboratory Analysis Data

ROJAC Environmental Services, Inc.
P.O. Box 731
West Hartford, Connecticut 06107
(203) 527-7307

**SUBMITTAL FOR LABORATORY ANALYSES**

TO: HENRY SOUTHER LABS

FROM: ROJAC Environmental Services, Inc.

Date: 8-28 86 Project No.: F86-20

| Sample Type | Sample ID | Analysis |
|---|---|---|
| Filter 1 | 51x | Weighing method 5 |
| " 2 | 52x | |
| " 3 | 53x | |
| " 4 | 67x | |
| Probe & Nozzle Rinse | PW-1 | |
| " " " | PW-2 | |
| " " " | PW-3 | |
| " " " | PW-4 | |

Thank You,

JOHN S. GAMMIE
Print Name

ROJAC Environmental Services, Inc.

P.O. Box 731
West Hartford, Connecticut 06107
(203) 527-7307

**SUBMITTAL FOR LABORATORY ANALYSES**

TO: THE HARTFORD LAB

FROM: ROJAC Environmental Services, Inc.

Date: 8-27-86 Project No.: F86-30

| Sample Type | Sample ID | Analysis |
|---|---|---|
| TEDLAR BAGS | Run 1 THC-1 | TOTAL HYDRO CARBONS |
| " " | Run 2 THC-2 | " |
| " " | Run 3 THC-3 | " |

Thank You,

JOHN S GAMMIE
Print Name

**ROJAC** Environmental Services, Inc.

P.O. Box 731
West Hartford, Connecticut 06107
(203) 527-7307

## SUBMITTAL FOR LABORATORY ANALYSES

TO: THE HARTFORD

FROM: ROJAC Environmental Services, Inc.

Date: 9/4/86

Project No.: F86-70

| Sample Type | Sample ID | Analysis |
|---|---|---|
| Filter | S1 x | Lead Analysis |
| | S2 x | |
| | S3 x | |
| | 67 x | |

Thank You,

JOHN S. GAMMIE
Print Name

THE HARTFORD INSURANCE GROUP-ENVIRONMENTAL SCIENCES LABORATORY

ACCOUNT ROJAC

SUBMITTOR J. Gammie

DATE REPORTED 9-3-86

LABORATORY R# 6525

ANALYST P. L. Murray

ANALYTICAL METHOD Gas Chromatography

| SAMPLE I.D. | | Total Hydrocarbons mg/l | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.065 | | | | | | | |
| 2 | | 0.096 | | | | | | | |
| 3 | | 0.061 | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

NOTES: Quantitation is based on n-hexane.

# THE MATTABASSETT DISTRICT

## METER CALIBRATION

Meter: Sludge Weigh Scale  Date: 8-19-86  Personnel: Grant Bergeron

Flume Width: N/A  Hb: N/A  Pat DeStefano

| Minutes | Time | Totalizer Reading | Chart Reading | Flume Depth | Distance to water | Depth of Flow | Calculated Flow |
|---|---|---|---|---|---|---|---|
| 0 | | 989042 | | | | | |
| 5 | | | | | | | |
| 10 | | | | | | | |
| 15 | | | | | | | |
| 20 | | | | | | | |
| 25 | | | | | | | |
| 30 | | 989350 | | | | | |
| | Diff. | Diff. | Avg. | | | | Avg. |
| | 30 | 308 | | | | | 317.5 |

| | Average Flow | % Error |
|---|---|---|
| Calculated Flow | 6.35 T/hr | |
| Totalizer Flow | 6.16 T/hr | - 3.0% |
| Chart Flow | | |
| Submergence (Hb/Ha) | | |

1 ) Measure the Flume width at the waist.

2 ) Measure the Flume Depth from top to bottom.

3 ) At Minute 0, note the Time, Totalizer Reading, Chart Reading, and Distance to water. Repeat every five minutes.

4 ) Find the Difference between the start and finish Time and Totalizer Reading.

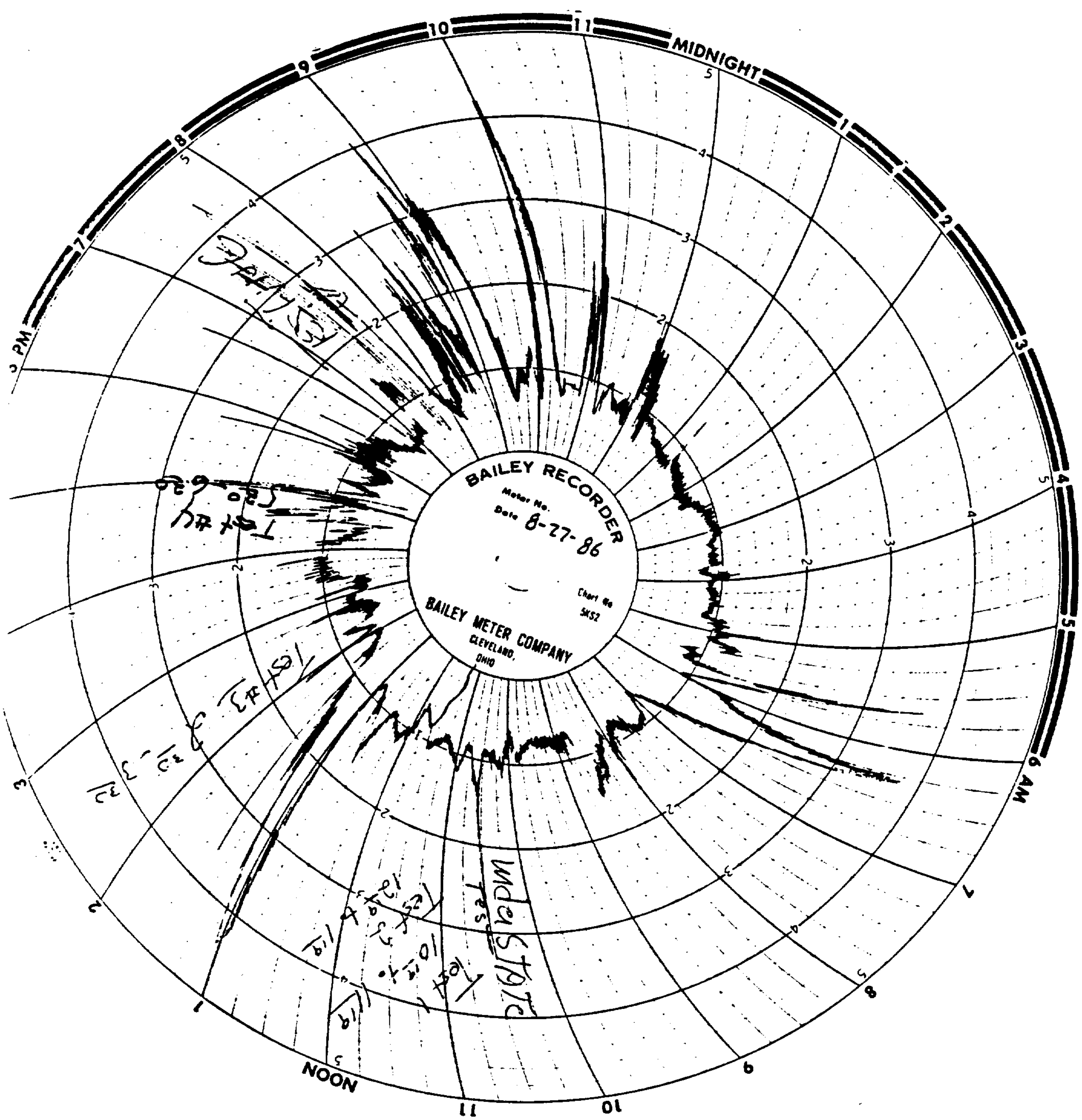
5 ) To find the Depth of Flow, subtract the Distance to water from the Flume Depth.

6 ) Using the Parshall Flume tables, find the Calculated Flows.

7 ) Find the Totalizer Flow be dividing the Totalizer Reading Difference by the Time Difference.

8 ) Find the % Error by subtracting the Calculated Flow, and dividing by the Calculated Flow. Note whether + or -.

9 ) Divide $H_b$ by the Depth of Flow (Ha) to find the Submergence.


BAILEY RECORDER
Meter No.
Date 8-27-86
Chart No
5K52
BAILEY METER COMPANY
CLEVELAND, OHIO
MIDNIGHT
NOON
6 AM

# INCINERATOR DAILY RECORD

Date 8-27-86

| | HEARTHS #1 | #2 | #3 | #4 | #5 | #6 | #7 | | SCALE 6935 | TONS PER HOUR | | B | List any and all changes or adjustments on the Incinerator. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 MID | 700 | 790 | 1370 | 1720 | 480 | 280 | 150 | Inc Gas Meter 45938 | 007250 | 3.15 | Belt PLI | - | |
| 1 AM | 640 | 790 | 1220 | 1660 | 430 | | | Scrubber Exhaust = 140 | 7650 | 4.00 | T: 26 B: 38 | - | |
| 2 | 720 | 870 | 1310 | 1740 | 460 | 270 | | Cool Air Exhaust = 270 | 8120 | 4.70 | Polymer 96 | - | |
| 3 | 720 | 880 | 1350 | 1750 | 490 | | | Scrubber Inlet = 180 | 8570 | 4.50 | Lbs/DT= 8.2 | - | |
| 4 | 710 | 970 | 1330 | 1750 | 520 | 270 | 180 | Scrubber Pressure= 60 | 9080 | 5.10 | Density=32.5 | - | |
| 5 | 700 | 820 | [illegible] | 1520 | 510 | | | Return Air Valve = 100% | 9580 | 5.00 | Wet Tons=36.05 | - | |
| 6 | 700 | 870 | 1120 | 1360 | 970 | 510 | | Center Shaft RPM = .9 | 0070 | 4.90 | Dry Tons=11.7 | 5 | #5(W) on 5:30 |
| 7 | 750 | 880 | 1280 | 1520 | 720 | | | | 0540 | 4.70 | Inc Gas= 4 | - | #5(W) off 6:30 |
| 8 | 735 | 880 | 1415 | 1620 | 630 | 300 | 115 | Inc Gas Meter 45942 | 1000 | 4.60 | Belt PLI | - | |
| 9 | 660 | 810 | 1115 | 1575 | 630 | | | Scrubber Exhaust = 150 | 1430 | 4.30 | T:32 B:36 | 5 | [illegible] |
| 10 | 660 | 785 | 1190 | 1490 | 750 | 215 | | Cool Air Exhaust = 395 | 1975 | 5.45 | Polymer 96 | 5 | |
| 11 | 680 | 800 | 1065 | 1260 | 775 | | | Scrubber Inlet = 180 | 2565 | 5.90 | Lbs/DT= 7.3 | 5 | |
| NOON | 690 | 800 | 1070 | 1220 | 710 | 490 | 210 | Scrubber Pressure= 60 | 3220 | 6.55 | Density=31.6 | 5 | |
| 1 | 710 | 820 | 1080 | 1190 | 1270 | | | Return Air Valve 100% | 3690 | 4.70 | Wet Tons=41.6 | 5 | #5W off |
| 2 | 820 | 920 | 1380 | 1635 | 920 | 560 | | Center Shaft RPM = .6 | 4190 | 5.00 | Dry Tons=13.1 | - | |
| 3 | [illegible] | 860 | [illegible] | [illegible] | [illegible] | | | | 4700 | 5.10 | Inc Gas= 11 | - | |
| 4 | 600 | 580 | 760 | 1300 | 520 | 340 | 180 | Inc Gas Meter [illegible] | 5270 | 5.75 | Belt PLI | 5 | |
| 5 | 706 | [illegible] | [illegible] | 1230 | 1580 | | | Scrubber Exhaust = 160 | 5835 | 5.60 | T:26 B: 32 | 5 | |
| 6 | 700 | 800 | 1340 | 1580 | 1600 | 1240 | | Cool Air Exhaust = [illegible] | 6450 | 6.15 | Polymer 96 | - | |
| 7 | 700 | 810 | 1100 | 1400 | 1360 | | | Scrubber Inlet = 160 | 7015 | 5.65 | Lbs/DT= 7.[illegible] | 5 | |
| 8 | 780 | 950 | 1340 | 1680 | 1580 | 1140 | 800 | Scrubber Pressure= 80 | 7550 | 5.35 | Density= 30 | - | |
| 9 | 840 | 980 | 1540 | [illegible] | [illegible] | | | Return Air Valve = 50 | 8030 | 4.80 | Wet Tons=[illegible] | - | |
| 10 | 700 | 720 | 1100 | 1400 | 1000 | 1041 | | Center Shaft RPM = 1.2 | 8545 | 5.15 | Dry Tons=12.8 | - | |
| 11 PM | 840 | [illegible] | [illegible] | 1780 | 960 | | | | 9465 | 4.10 | Inc Gas= 10 | - | |

Total Inc Gas 25 Inc Gas/Dry Ton .6 Daily Average Density 31.3 Total Wet Tons 120.3 Total Dry Tons 37.6

Appendix F

Equipment Calibration Data

FIELD DATA SHEET

Firm Name: Mattebassett
Plant Location: Cromwell
Test Number: 2
Sampling Location: Incinerator Outlet
Project No.: E86-36
Date: 8/27/86
Tester: JJG/LAG

Orifice No.: 1758
Ambient Temp.: 78 °F
Bar. Press.: 29.78 "Hg
Probe Ident. No.: 401
Filter Ident. No.: 52X
Duct Area: 8.3 ft²
0.6428

Nozzle No. & Dia.: 0.362 in.
Assumed Moisture: 24 %
Test Duration: 60 min.
Traverse Point Interval: 3 min.
Probe Heater Setting: 250 °F
Filter Temp. Setting: 250 °F
Dry Gas Meter Y: 1.0025

Nomograph C Factor: 0.60
Pitot Coefficient: 0.84
Orifice ΔH$_A$: 1.78
Test Start Time: 1219
Test Final Time: 1321
Leak Test Start: 0.— CFM@ 10 "Hg
Leak Test Final: 0.00 CFM@ 10 "Hg

| Port | Point | Time Min. | Velocity ΔP in $H_2O$ | ΔH in $H_2O$ | $T_M$ in °F | $T_M$ out °F | $P_{Stack}$ in $H_2O$ | $T_{Stack}$ °F | Gas Sample Volume cu. ft. | PROBE | Cyc. Angle β | Heater Box Temp. | Temp. of Gas Leaving Condenser °F | Pump Vac. in Hg | Probe Temp. °F | $O_2$ % | $CO_2$ % | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 30 | .024 | 267 | 120 | 103 | | 161 | 90391 | | | 222 | <65 | 223 | 8 | | | 06 |
| | 6 | | .022 | 240 | 122 | 104 | | 165 | 90655 | | | 290 | | 7 | 217 | | | 09 |
| | 7 | | .018 | 201 | 122 | 104 | | 169 | 90895 | | | 282 | | 7 | 235 | | | 12 |
| | 8 | | .015 | 201 | 122 | 105 | | 169 | 91101 | | | 292 | | 7 | 233 | | | 15 |
| | 9 | | .019 | 212 | 122 | 106 | | 168 | 91344 | | | 285 | | 8 | 225 | | | 18 |
| | 10 | | .018 | 201 | 122 | 106 | | 167 | 91545 | | | 289 | | | 237 | | | 21 |
| | | | | | | | | | 5035 | | | | | | | | | |
| Average | | | Σ√ΔP 04633 | 240 | 107 | | | 164 | | | | | | | | | | |

$H_2O$ Collected: 805 ml
SG Condition:
SG Weight: 15.6 gm
Total Volume Collected: 820.6 ml

Orsat Bag Sample Triplicate Analysis, %

| $CO_2$ | $O_2$ | CO | $N_2$ |
|---|---|---|---|
| 8.0 | 10.5 | | |
| 7.9 | 10.7 | | |
| 8.0 | 10.5 | | |

3'
250
127
252
90
26
805

COMMENTS:

FIELD DATA S

| | |
|---|---|
| Firm Name | Mattabassett |
| Plant Location | Cromwell |
| Test Number | 3 |
| Sampling Location | Incinerator outlet |
| Project No. | F86-20 |
| Date | 8/27/86 |
| Tester | LAG/DJG |
| Orifice No. | 1758 |
| Ambient Temp. | 76 °F |
| Bar. Press. | 29.78 "Hg |
| Probe Ident. No. | 401 |
| Filter Ident. No. | 53X |
| Duct Area | 8.3 ft² |
| Nozzle No. & Dia. | 0.362 in. |
| Assumed Moisture | 30 % |
| Test Duration | 60 min. |
| Traverse Point Interval | 3 min. |
| Probe Heater Setting | 250 °F |
| Filter Temp. Setting | 250 °F |
| Dry Gas Meter Y | 1.0085 |
| Nomograph C Factor | 0.60 |
| Pitot Coefficient | 0.84 |
| Orifice ΔH@ | 1.78 |
| Test Start Time | 1431 |
| Test Final Time | 1536 |
| Leak Test Start | 0.00 CFM 10 "Hg |
| Leak Test Final | 0.00 CFM 11 "Hg |

0.6435

1 of 2

| Port | Point | Time Min. | Velocity ΔP in $H_2O$ | ΔH in $H_2O$ | $T_M$ in °F | $T_M$ out °F | $P_{Stack}$ in $H_2O$ | $T_{Stack}$ °F | Gas Sample Volume cu. ft. | PROBE | Cyc. Angle ° | Heater Box Temp. | Temp. of Gas Leaving Condenser °F | Pump Vac. in Hg | Probe Temp. °F | $O_2$ % | $CO_2$ % | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | 31 |
| | | | | | | | | | 917.82 | | | 294 | <65 | 4.5 | 228 | | | 34 |
| | 1 | 30 | [illegible] | 200 | 96 | 93 | | 142 | 919.63 | | | 286 | | 4.5 | 232 | | | 37 |
| | 2 | | .021 | 200 | 100 | 95 | | 143 | 922.86 | | | 291 | | 4.5 | 224 | | | 40 |
| | 3 | | .022 | 210 | 106 | 96 | | 145 | 925.07 | | | 269 | | 5 | 220 | | | 43 |
| | 4 | | .024 | 232 | 110 | 97 | | 146 | 927.44 | | | 287 | | 6 | 220 | | | 46 |
| | 5 | | .025 | 240 | 112 | 98 | -0.15 | 148 | 930.70 | | | 291 | | 6 | 228 | | | 49 |
| | 6 | | .025 | 240 | 115 | 99 | | 149 | 933.18 | | | 283 | | 6 | 228 | | | 52 |
| | 7 | | .021 | 200 | 116 | 100 | | 149 | 935.35 | | | 284 | | 7 | 238 | | | 55 |
| | 8 | | .025 | 240 | 116 | 100 | | 150 | 938.11 | | | 286 | | 6 | 240 | | | 58 |
| | 9 | | .017 | 168 | 118 | 101 | | 149 | 940.57 | | | 296 | | 5 | 238 | | | 01/46 |
| | 10 | | .015 | 149 | 118 | 102 | | 148 | 942.07 | | | 288 | | 5 | 244 | | | 09 |
| | 1 | | .024 | 232 | 113 | 102 | | 144 | 944.23 | | | 282 | | 7 | 240 | | | 12 |
| | 2 | | .025 | 240 | 114 | 102 | | 144 | 947.50 | | | 296 | | 6.5 | 225 | | | 15 |
| | 3 | | .023 | 220 | 116 | 103 | | 143 | 950.00 | | | 295 | | 6.5 | 231 | | | 18 |
| | 4 | | .025 | 240 | 116 | 103 | | 142 | 952.20 | | | | | | | | | |
| Average | | | $\Sigma\sqrt{\Delta P}$ | | | | | | | | | | | | | | | |

$H_2O$ Collected ______ ml

SG Condition ______

SG Weight ______ gm

Total Volume Collected ______ ml

Orsat Bag Sample Triplicate Analysis, %

| $CO_2$ | $O_2$ | CO | $N_2$ |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

COMMENTS:

FIELD DATA S

Firm Name Mattabassett
Plant Location Cromwell
Test Number 3
Sampling Location Incinerator Outlet
Project No. F86-20
Date 8/27/86
Tester LAG/JSG

Orifice No. 1758
Ambient Temp. 76 °F
Bar. Press. 29.78 "Hg
Probe Ident. No. 401
Filter Ident. No. 53X
Duct Area 8.3 ft²

0.6436

Nozzle No. & Dia. 0.362 in.
Assumed Moisture 30 %
Test Duration 60 min.
Traverse Point Interval 3 min.
Probe Heater Setting 250 °F
Filter Temp. Setting 250 °F
Dry Gas Meter Y 1.0025

Nomograph C Factor 0.60
Pitot Coefficient 0.84
Orifice ΔH@ 1.78
Test Start Time 1431
Test Final Time 1536
Leak Test Start 0.00 CFM 10 "Hg
Leak Test Final 0.00 CFM 11 "Hg

2 of 2

| Port | Point | Time Min. | Velocity ΔP in $H_2O$ | ΔH in $H_2O$ | $T_M$ in °F | $T_M$ out °F | $P_{Stack}$ in $H_2O$ | $T_{Stack}$ °F | Gas Sample Volume cu. ft. | PROBE | Cyc. Angle ° | Heater Box Temp. | Temp. of Gas Leaving Condenser °F | Pump Vac. in Hg | Probe Temp. °F | $O_2$ % | $CO_2$ % | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | 21 |
| | 5 | 5 | 025 | 240 | 119 | 104 | | 143 | 95486 | | | 268 | <65 | 8 | 226 | | | |
| | 6 | | 024 | 232 | 120 | 105 | | 142 | 95774 | | | 273 | | 7 | 230 | | | 24 |
| | 7 | | 023 | 220 | 121 | 105 | | 139 | 95999 | | | 258 | | 7 | 235 | | | 27 |
| | 8 | | 018 | 176 | 121 | 106 | | 138 | 96213 | | | 265 | | 6 | 231 | | | 30 |
| | 9 | | 016 | 156 | 121 | 106 | | 138 | 96461 | | | 261 | | 6 | 231 | | | 33 |
| | 10 | | 015 | 149 | 118 | 105 | | 139 | 96624 | | | 279 | | 6 | 232 | | | 36 |
| | | | | | | | | | 4842 | | | | | | | | | |
| Average | | | Σ-√ΔP 04642 | 209 | | 108 | | 144 | | | | | | | | | | |

$H_2O$ Collected 295 ml
SG Condition
SG Weight 3.7 gm
Total Volume Collected 298.7 ml

Orsat Bag Sample Triplicate Analysis, %

| $CO_2$ | $O_2$ | ~~CO~~ | $N_2$ |
|---|---|---|---|
| 5.2 | ~~[illegible]~~ | 14.6 | |
| 5.2 | ~~[illegible]~~ | 14.5 | |
| 5.2 | | 14.6 | |

250
135
110
~~495~~ 495
200
895

COMMENTS:

FIELD DATA S

Firm Name mcHbassett
Plant Location Cromwell
Test Number 4
Sampling Location Incinerator Outlet
Project No. F86-20
Date 8/27/86
Tester ____

Orifice No. 1758
Ambient Temp. 76 °F
Bar. Press. 29.78 "Hg
Probe Ident. No. 401
Filter Ident. No. 67X
Duct Area 8.3 ft²

Nozzle No. & Dia. 0.362 in.
Assumed Moisture 24 %
Test Duration 60 min.
Traverse Point Interval 3 min.
Probe Heater Setting 250 °F
Filter Temp. Setting 250 °F
Dry Gas Meter Y 1.0025

Nomograph C Factor 0.70
Pitot Coefficient 0.84
Orifice ΔH@ 1.78
Test Start Time 1725
Test Final Time 1829
Leak Test Start 0.01 CFM@ 10 "Hg
Leak Test Final 0.005 CFM@ 11 "Hg

1 of 2

| Port | Point | Time Min. | Velocity ΔP in $H_2O$ | ΔH in $H_2O$ | $T_M$ in °F | $T_M$ out °F | $P_{Stack}$ in $H_2O$ | $T_{Stack}$ °F | Gas Sample Volume cu. ft. 967.95 | PROBE | Cyc. Angle ∅ | Heater Box Temp. | Temp. of Gas Leaving Condenser °F | Pump Vac. in Hg | Probe Temp. °F | $O_2$ % | $CO_2$ % | 25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 30 | 019 | 210 | 96 | 87 | | 153 | 96903 | | | 261 | <65 | 5 | 231 | | | 28 |
| | 2 | | 019 | 210 | 96 | 88 | | 152 | 97183 | | | 270 | | 5 | 229 | | | 31 |
| | 3 | | 020 | 220 | 98 | 89 | -.014 | 153 | 97440 | | | 264 | | 5 | 221 | | | 34 |
| | 4 | | 025 | 273 | 104 | 90 | | 151 | 97730 | | | 262 | | 6 | 224 | | | 37 |
| | 5 | | 025 | 273 | 108 | 92 | | 151 | 98036 | | | 267 | | 7 | 225 | | | 40 |
| | 6 | | 025 | 273 | 111 | 93 | | 152 | 98249 | | | 259 | | 7 | 230 | | | 43 |
| | 7 | | 023 | 250 | 113 | 94 | | 151 | 98601 | | | 270 | | 6 | 235 | | | 46 |
| | 8 | | 023 | 250 | 114 | 95 | | 151 | 98849 | | | 265 | | 6 | 237 | | | 49 |
| | 9 | | 020 | 221 | 115 | 96 | | 151 | 99081 | | | 266 | | 6 | 241 | | | 52 |
| | 10 | | 015 | 169 | 115 | 97 | | 151 | 99251 | | | 268 | | 5 | 241 | | | 55/58 |
| | 1 | | 022 | 239 | 107 | 98 | | 153 | 99539 | | | 271 | | 6 | 242 | | | 02 |
| | 2 | | 023 | 250 | 113 | 99 | | 153 | 99773 | | | 272 | | 7 | 234 | | | 05 |
| | 3 | | 024 | 265 | 115 | 100 | | 153 | 100061 | | | 271 | | 8 | 221 | | | 08 |
| | 4 | | 024 | 265 | 116 | 100 | | 152 | 100361 | | | 272 | | 8 | 221 | | | 11 |
| Average | | | Σ√ΔP | | | | | | | | | | | | | | | |

$H_2O$ Collected ____ ml
SG Condition ____
SG Weight ____ gm
Total Volume Collected ____ ml

Orsat Bag Sample Triplicate Analysis, %

| $CO_2$ | $O_2$ | CO | $N_2$ |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

COMMENTS: ____

# FIELD DATA Sheet

Firm Name Mattabassett
Plant Location Cromwell
Test Number 4
Sampling Location Incinerator Outlet
Project No. F86-20
Date 8/27/86
Tester JSG/LAG

Orifice No. 1758
Ambient Temp. 76 °F
Bar. Press. 29.78 "Hg
Probe Ident. No. 401
Filter Ident. No. 67X
Duct Area 8.3 ft²
0.6462

Nozzle No. & Dia. 0.362 in.
Assumed Moisture 24 %
Test Duration 60 min.
Traverse Point Interval 3 min.
Probe Heater Setting 250 °F
Filter Temp. Setting 250 °F
Dry Gas Meter Y 1.0025

Nomograph C Factor 0.70
Pitot Coefficient 0.84
Orifice $\Delta H_A$ 1.78
Test Start Time 1725
Test Final Time 1827
Leak Test Start 0.01 CFM@ 10 "Hg
Leak Test Final 0.005 CFM@ 11 "Hg

2 of 2

| Port | Point | Time Min. | Velocity ΔP in $H_2O$ | ΔH in $H_2O$ | $T_M$ in °F | $T_M$ out °F | $P_{Stack}$ in $H_2O$ | $T_{Stack}$ °F | Gas Sample Volume cu. ft. | PROBE | Cyc. Angle ° | Heater Box Temp. | Temp. of Gas Leaving Condenser °F | Pump Vac. in Hg | Probe Temp. °F | $O_2$ % | $CO_2$ % | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 30 | .018 | .200 | 118 | 101 | | 152 | 1006.11 | | | 269 | <65 | 6 | 229 | | | 14 |
| | 6 | | .024 | .265 | 118 | 102 | | 154 | 1008.70 | | | 269 | | 8 | 245 | | | 17 |
| | 7 | | .024 | .265 | 119 | 102 | | 152 | 1010.53 | | | 269 | | 8 | 247 | | | 20 |
| | 8 | | .024 | .265 | 119 | 103 | | 153 | 1013.70 | | | 270 | | 8 | 244 | | | 23 |
| | 9 | | .024 | .265 | 119 | 103 | | 153 | 1016.26 | | | 271 | | 8 | 242 | | | 26 |
| | 10 | | .024 | .265 | 121 | 103 | | 152 | 1019.05 | | | 270 | | 9 | 244 | | | 29 |
| | | | | | | | | | 51.10 | | | | | | | | | |
| Average | | | $\Sigma\sqrt{\Delta P}$ 0.4701 | .244 | 104 | | | 152 | | | | | | | | | | |

$H_2O$ Collected 420 ml
SG Condition
SG Weight 14.6 gm
Total Volume Collected 434.6 ml

Orsat Bag Sample Triplicate Analysis, %

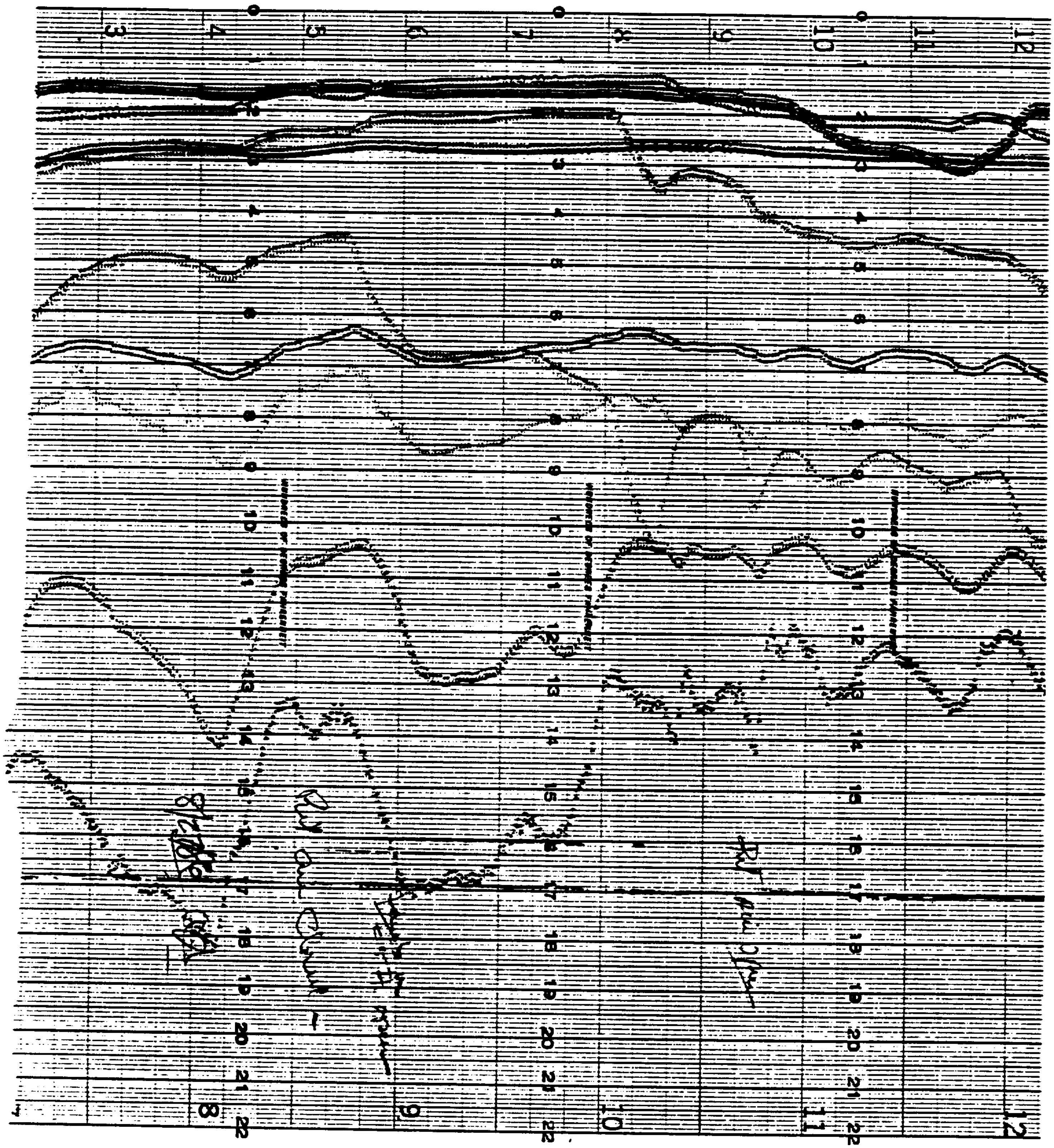
| $CO_2$ | $O_2$ | [illegible] | $N_2$ |
|---|---|---|---|
| 6.6 | [illegible] | 12.1 | |
| 6.7 | [illegible] | 12.2 | |
| 6.6 | [illegible] | 12.2 | |

250
250
120
620
.200

COMMENTS:

# Appendix E

## Incinerator No. 1 Operational Data



TYPE K THERMOCOUPLE

PRINTED IN U.S.A. HONEYWELL FORT WASHINGTON, PA.

CHART NO. [illegible]

11 AM to 4 pm

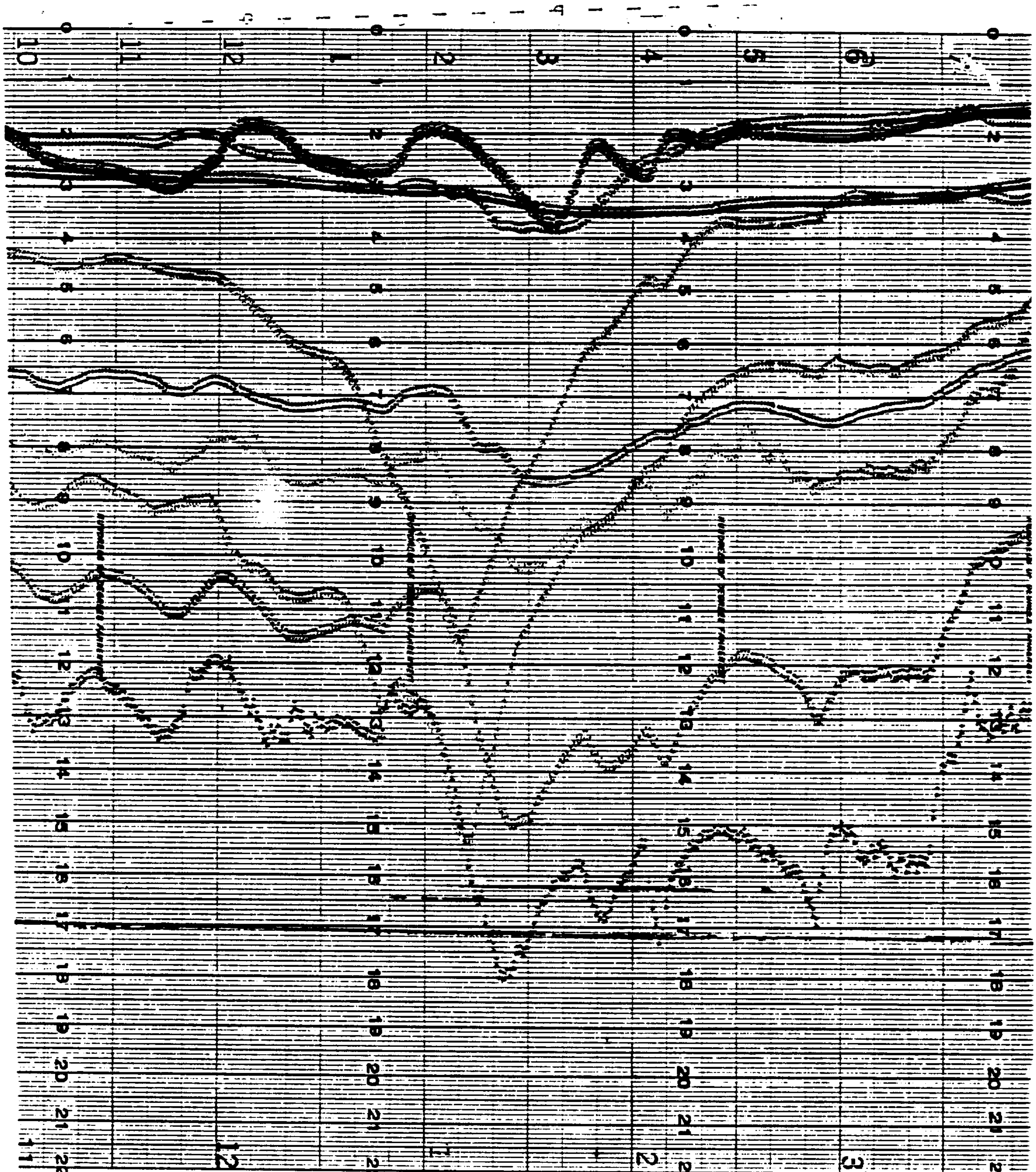
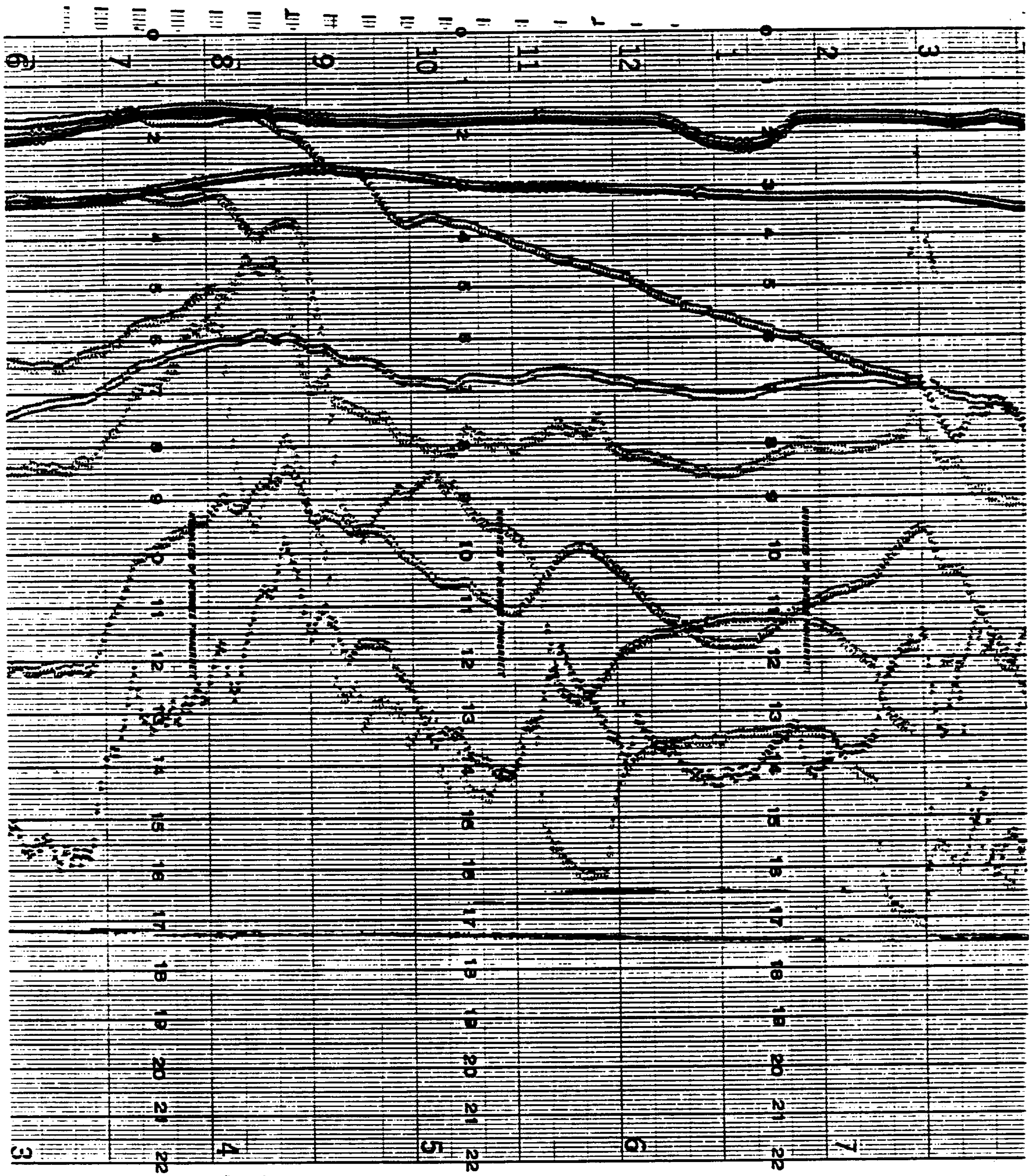


CHART NO. [illegible]    TYPE K THERMOCOUPLE    PRINTED IN U.S.A. HONEY



3 PM to 8 PM

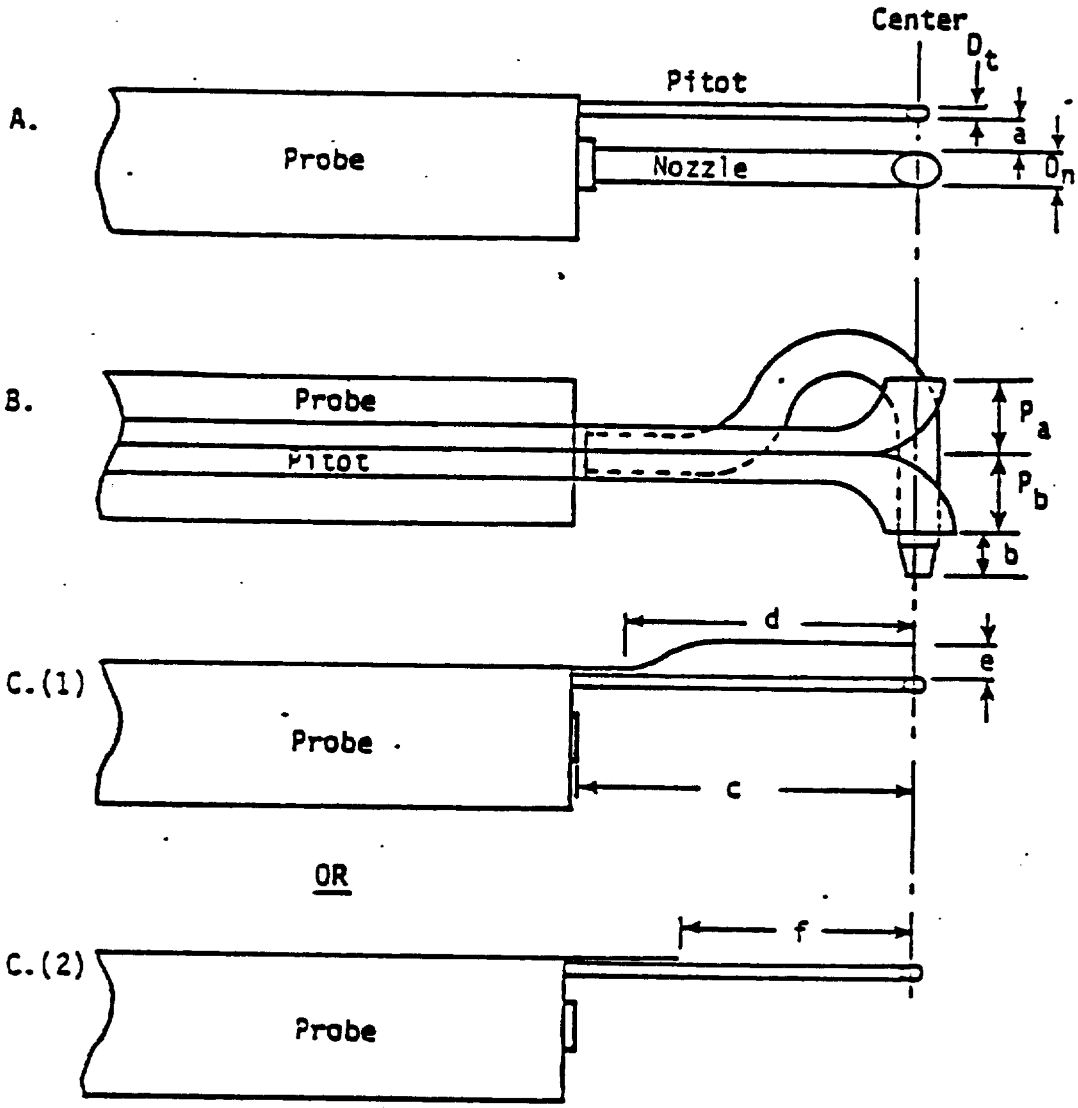
PRINTED IN U.S.A. HONEYWELL FORT WASHINGTON, PA. CHART NO. [illegible]

## S-TYPE PITOT GEOMETRIC CALIBRATION
## PART 1 - PROBE CONFIGURATION

Probe Identification 401 Pitot Identification 401

Technical Specialist JSL

Date 7-11-86




$D_t$ 0.385

$D_n$ 0.500

a 0.510

1.235 { $P_a$ 0.6175, $P_b$ 0.6175 }

b 0.603

c ______

d ______

e ______

OR

c ______

f 2.116

### Specifications (EPA Method 2)

| | | |
|---|---|---|
| $D_t$ = 3/16" to 3/8" | $c \geq 3"$ | $P_a = P_b$ |
| $D_n$ = 1/2" | $d \geq 3"$ | |
| $a \geq 3/4"$ | $e \geq 3/4"$ | $1.05\ D_t \leq P \leq 1.50\ D_t$ |
| $b \geq 0$ | $f \geq 2"$ | |

If these specifications are met, proceed with Part 2 Pitot alignment.

# S-TYPE PITOT GEOMETRIC CALIBRATION
## PART 2 - PITOT ALIGNMENT

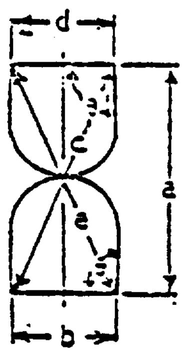
Probe Identification 401 Pitot Identification 401

Technical Specialist JSL

Date 8-11-86

A.

Transverse Tube Axis



a 1.235

b 0.388

c 1.280

d 0.385

e 1.354

$\theta$ 87.7°

$\theta'$ 80.3

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \theta$$

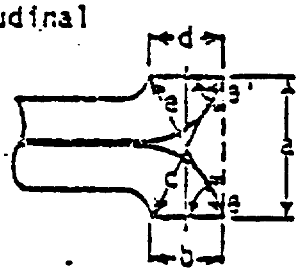
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \theta'$$

($80^\circ < \theta < 100^\circ$)

($80^\circ < \theta' < 100^\circ$)

B.

Longitudinal Tube Axis



a 1.235

b 0.485

c 1.305

d 0.501

e 1.340

$\theta$ 87.3°

$\theta'$ 86.6

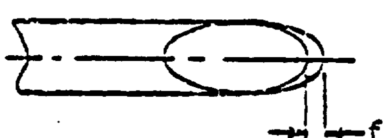
$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \theta$$

$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \theta'$$

($85^\circ < \theta < 95^\circ$)

($85^\circ < \theta' < 95^\circ$)

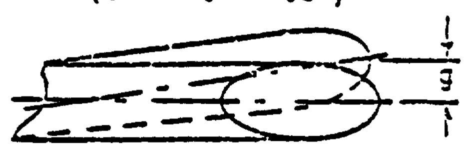
C.



f 0.000

(f < 1/8")

D.



g 0.000

(g < 1/32")

NOTE: values in parentheses are EPA Method 2 specifications.

## PROBE THERMOCOUPLE CALIBRATION

| | | Tolerances |
|---|---|---|
| Expected Stack Temperature ($T_s$) | ______ °R | |
| Mercury Thermometer ($T_{ref}$) | ______ °R | ($T_s \pm 10\%$) |
| Thermocouple Readout | ______ °R | ($T_{ref} \pm 1.5\%$) |

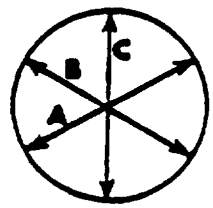
Probe Identification ______

Technician ______ Date ______

# NOZZLE CALIBRATION DATA SHEET

BOX

NOZZLE SET NO. 1 DATE 2 AUGUST 86 TECHNICIAN JSG




| NOZZLE NO. | DIAMETER* | A | B | C | AVERAGE** |
|---|---|---|---|---|---|
| 1/8" 1-1 | 0.180 | 0.179 | 0.181 | 0.180 | 0.180 |
| 1/4" 1-2 | 0.245 | 0.245 | 0.247 | 0.245 | 0.245 |
| 3/8" 1-3 | 0.362 | 0.361 | 0.360 | 0.364 | 0.362 |
| 1/2" 1-4 | 0.497 | 0.499 | 0.496 | 0.495 | 0.497 |
| 1-5 | 0.397 | 0.398 | 0.396 | 0.398 | 0.397 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

* Measure to nearest .001"

** Three measurements must be within .004" of each other

# METHOD 5 MODULE CALIBRATION

DATE 8-25-86 ORIFICE/MODULE NO. S 1758 NAME JSG

BAROMETRIC PRESSURE Pb 30.00 in Hg STANDARD METER 570415

| MODULE ORIFICE SETTING ΔH (in. $H_2O$) | STANDARD METER Volume $V_s$ ($ft^3$) | Factor $Y_s$ | Temperature $t_s$ (°F) | Pressure ΔPs (in. $H_2O$) | MODULE METER Volume $V_m$ ($ft^3$) | Temperatures tmi (°F) | tmo (°F) | Time θ (min) | Y | ΔHa (in. $H_2O$) | Module Flowrate Q (SCFM) | OF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5 | 5.000 | 1.000 | 74 | -0.5 | 5.136 | 93 | 84.5 | 12.40 | 1.0004 | 1.69 | | |
| 1.0 | 5.004 | 1.000 | 74 | -0.5 | 5.170 | 95 | 87.5 | 8.93 | .9982 | 1.74 | | |
| 1.5 | 10.000 | 1.000 | 74 | -0.5 | 10.323 | 96 | 88 | 14.86 | 1.0044 | 1.81 | | |
| 2.0 | 10.007 | 1.000 | 74 | -0.8 | 10.350 | 100.5 | 90 | 13.03 | 1.0071 | 1.83 | | |
| 3.0 | 10.005 | 1.000 | 74 | -1.0 | 10.401 | 103 | 92 | 10.68 | 1.0013 | 1.84 | | |
| | | | | | | | | | | | | |
| | | | | | | | | AVERAGE | 1.0025 | 1.78 | | |

CHECK:

FOR CHECK, USE THE AVERAGE ΔHa FOR ΔH

$$Y = \frac{V_s \left(P_b + \frac{Ps}{13.6}\right)(Tm + 460)\ Ys}{Vm \left(P_b + \frac{\Delta H}{13.6}\right)(t_s + 460)}$$

$$\Delta Ha = \left[\frac{(0.0317)\ \Delta H}{Pb\ (tm + 460)}\right]\left[\frac{(ts + 460)\ \theta}{Vs\ Ys}\right]^2$$

$$Q = Y\ (17.64)\ Vm \left[\frac{Pb + \frac{\Delta H}{13.6}}{(tm + 460)\ \theta}\right]$$

$$OF = \text{orifice factor} = \left[\frac{(tm + 460)\ \Delta H}{Pb}\right]^{1/2}$$

Correlation Line Equation
Q = m (OF) + b

Q = ______ OF + ______

ACCEPTANCE CRITERIA:

Each Y must be 1.00 ± 0.01
Average ΔHa must be 1.84 ± 0.25
Each ΔHa must be within 0.15 of the average ΔHa

TC Readout Calibrated with Constant Voltage Source ______ °F
tmi ______ °F tmo ______ °F Reference Thermometer ______ °F
Module Leak Check ✓
Heater Box Love Control OK ✓ Probe Heater Low Control ✓
Module Cleaned ✓ Pitot tube manometer leak check ✓

Calibrated and Checked by JSG Date 8-25-86
Reviewed by ______ Date ______

5/3/83

METHOD 5 MODULE CALIBRATION

DATE 9-11-86 ORIFICE/MODULE NO. S 1758 NAME JSG

BAROMETRIC PRESSURE Pb 29.92 in Hg STANDARD METER 570415

| MODULE ORIFICE SETTING ΔH (in. $H_2O$) | STANDARD METER | | | | MODULE METER | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Volume $V_s$ ($ft^3$) | Factor $Y_s$ | Temperature $t_s$ (°F) | Pressure ΔPs (in. $H_2O$) | Volume Vm ($ft^3$) | Temperatures tmi (°F) | tmo (°F) | Time θ (min) | Y | ΔHa (in. $H_2O$) | Module Flowrate Q (SCFM) | OF |
| 0.5 | 5.002 | 1.000 | 76 | -0.5 | 5.085 | 87.3 | 84.3 | 12.31 | 1.0035 | 1.68 | | |
| 1.0 | 5.000 | 1.000 | 76 | -0.5 | 5.085 | 91 | 84 | 8.86 | 1.0044 | 1.75 | | |
| 1.5 | 10.001 | 1.000 | 76 | -0.7 | 10.177 | 94.5 | 84.5 | 14.83 | 1.0075 | 1.82 | | |
| 2.0 | 10.005 | 1.000 | 76 | -1.0 | 10.180 | 96.5 | 85.5 | 12.88 | 1.0100 | 1.81 | | |
| 3.0 | 10.003 | 1.000 | 76 | -1.5 | 10.157 | 91.5 | 84 | 10.56 | 1.0064 | 1.85 | | |
| | | | | | | | | | | | | |
| | | | | | | | | AVERAGE: | 1.0064 | 1.78 | | |

CHECK:

FOR CHECK, USE THE AVERAGE ΔHa FOR ΔH

$$Y = \frac{V_s \left(P_b + \frac{Ps}{13.6}\right)(Tm + 460)\ Ys}{Vm \left(P_b + \frac{\Delta H}{13.6}\right)(t_s + 460)}$$

$$\Delta Ha = \left[\frac{(0.0317)\ \Delta H}{Pb\ (tm + 460)}\right]\left[\frac{(ts + 460)\ \theta}{Vs\ Ys}\right]^2$$

$$Q = Y\ (17.64)\ Vm \left[\frac{Pb + \frac{\Delta H}{13.6}}{(tm + 460)\ \theta}\right]$$

$$OF = \text{orifice factor} = \left[\frac{(tm + 460)\ \Delta H}{Pb}\right]^{1/2}$$

Correlation Line Equation

Q = m (OF) + b

Q = ______ OF + ______

ACCEPTANCE CRITERIA:

Each Y must be 1.00 ± 0.01
Average ΔHa must be 1.84 ± 0.25
Each ΔHa must be within 0.15 of the average ΔHa

TC Readout Calibrated with Constant Voltage Source ______
tmi ______ °F tmo ______ °F Reference Thermometer ______ °F
Module Leak Check 0.0
Heater Box Love Control OK ✓ Probe Heater Low Control ✓
Module Cleaned ✓ Pitot tube manometer leak check ✓

Calibrated and Checked by JSG Date 9-11-86
Reviewed by LAG Date 9/11/86

5/3/83

# ANALYTICAL DATA

PLANT Mattabassett District

DATE 8-27-86

SAMPLING LOCATION Incinerator Outlet

SAMPLE TYPE Method 5

RUN NUMBER 1

SAMPLE BOX NUMBER

CLEAN-UP MAN JSG

COMMENTS:

## FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER Filter 1 — 100.7 mg

FILTER NUMBER I.w. → .6428

S/X F.w .7435

CONTAINER PW-1 — 50.6 mg

FRONT HALF SUBTOTAL 151.3 mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

ETHER-CHLOROFORM EXTRACTION ______ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

BACK HALF SUBTOTAL ______ mg

**TOTAL WEIGHT** ______ mg

## MOISTURE

IMPINGERS
- FINAL VOLUME ______ ml
- INITIAL VOLUME ______ ml
- NET VOLUME ______ ml

SILICA GEL
- FINAL WEIGHT ______ g ______ g ______ g
- INITIAL WEIGHT ______ g ______ g ______ g
- NET WEIGHT ______ g ______ g ______ g

TOTAL MOISTURE ______ g

EPA (Dur) 231
4/72

# ANALYTICAL DATA

PLANT Mattabassett District

DATE 8-27-86

SAMPLING LOCATION : Incinerator Outlet

SAMPLE TYPE Method 5

RUN NUMBER 2

SAMPLE BOX NUMBER

CLEAN-UP MAN JSG

COMMENTS:

## FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER Filter 2 256.2 mg

FILTER NUMBER 52x T.W. → .6438 F.W. .2562

CONTAINER PW-2 103.2 mg

FRONT HALF SUBTOTAL 359.4 mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

ETHER-CHLOROFORM EXTRACTION ______ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

BACK HALF SUBTOTAL ______ mg

TOTAL WEIGHT ______ mg

## MOISTURE

IMPINGERS

FINAL VOLUME ______ ml

INITIAL VOLUME ______ ml

NET VOLUME ______ ml

SILICA GEL

FINAL WEIGHT ______ g ______ g ______ g

INITIAL WEIGHT ______ g ______ g ______ g

NET WEIGHT ______ g ______ g ______ g

TOTAL MOISTURE ______ g

EPA (Dur) 231
4/72

# ANALYTICAL DATA

PLANT Mattabassett District

DATE 8-27-86

SAMPLING LOCATION Incinerator Outlet

SAMPLE TYPE Method 5

RUN NUMBER 3

SAMPLE BOX NUMBER

CLEAN-UP MAN JSG

COMMENTS:

## FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER Filter 3 86.6 mg

FILTER NUMBER T.W. — 2.6436

53x F.W.

CONTAINER PW-3 55.0 mg

FRONT HALF SUBTOTAL 141.6 mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ mg

ETHER-CHLOROFORM EXTRACTION ______ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ mg

BACK HALF SUBTOTAL ______ mg

TOTAL WEIGHT ______ mg

## MOISTURE

IMPINGERS

FINAL VOLUME ______ ml

INITIAL VOLUME ______ ml

NET VOLUME ______ ml

SILICA GEL

FINAL WEIGHT ______ g ______ g ______ g

INITIAL WEIGHT ______ g ______ g ______ g

NET WEIGHT ______ g ______ g ______ g

TOTAL MOISTURE ______ g

EPA (Dur) 231
4/72

Appendix G

Orsat Analysis Validation Forms

# ANALYTICAL DATA

PLANT Mattabassett District

DATE 8-27-86

SAMPLING LOCATION Incinerator Outlet

SAMPLE TYPE Method 5

RUN NUMBER 4

SAMPLE BOX NUMBER

CLEAN-UP MAN JSG

COMMENTS:

## FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER Filter 4 — 101.0 mg

FILTER NUMBER 67X

| | | |
|---|---|---|
| FILTER NUMBER | T.W. | .6462 |
| 67X | F.W. | .1010 |
| | | |

CONTAINER Pw-4 — 185.4 mg

FRONT HALF SUBTOTAL 286.4 mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

ETHER-CHLOROFORM EXTRACTION ______ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

BACK HALF SUBTOTAL ______ mg

**TOTAL WEIGHT ______ mg**

## MOISTURE

IMPINGERS

FINAL VOLUME ______ ml

INITIAL VOLUME ______ ml

NET VOLUME ______ ml

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | g | g | g |
| INITIAL WEIGHT | g | g | g |
| NET WEIGHT | g | g | g |

TOTAL MOISTURE ______ g

EPA (Dur) 231
4/72

EPA METHOD 3
ORSAT EQUIPMENT CHECK, MOLECULAR WEIGHT
DETERMINATION, AND ANALYSIS VALIDATION

FIRM Mattabassett District

TEST NUMBER 1

SAMPLING TIME (24-hr CLOCK) 1019 - 1122

SAMPLING LOCATION Main Incinerator Exhaust

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) ______

SAMPLE MOISTURE CONTENT 20 %

AMBIENT TEMPERATURE 70

TESTER/DATE JSG

An ORSAT analysis of boiler exhaust gases is considered valid if the $F_o$ calculated from the ORSAT analysis is within ±5% of the $F_o$ calculated from fuel analysis. If fuel analysis data is not available, the $F_o$ calculated from the ORSAT analysis must be within ±5% of the average published $F_o$ for a given fuel as follows:

| FUEL | AVE. $F_o$ | ±5% ACCEPTANCE LIMITS |
|---|---|---|
| Anthracite | 1.070 | 1.016 - 1.124 |
| Bituminous | 1.140 | 1.083 - 1.197 |
| Lignite | 1.076 | 1.022 - 1.130 |
| Oil | 1.346 | 1.279 - 1.413 |
| Natural Gas | 1.749 | 1.662 - 1.836 |
| Propane | 1.510 | 1.434 - 1.586 |
| Butane | 1.479 | 1.405 - 1.553 |
| Wood | 1.050 | 0.9975- 1.102 |
| Bark | 1.056 | 1.003 - 1.109 |

## PRE-TEST ORSAT EQUIPMENT CHECK

ORSAT CHECK: PRE-TEST LEAK CHECK: INITIAL 4.8 ml 0 min.
ACCEPTANCE LIMIT: LEAK < 0.2 ml/5 min. FINAL 4.8 ml 5 min.
PRE-TEST AMBIENT $O_2$ = 20.8 %; ACCEPTANCE LIMITS OF $O_2$ = 20.6 - 21.2%

## MOLECULAR WEIGHT DETERMINATION

| GAS \ RUN | 1 ACTUAL READING (ml) | 1 % | 2 ACTUAL READING (ml) | 2 % | 3 ACTUAL READING (ml) | 3 % | AVERAGE % | MULTIPLIER | CONTRIBUTION TO DRY MOLECULAR WEIGHT OF STACK GAS $M_{di}$ lb/lb-mole |
|---|---|---|---|---|---|---|---|---|---|
| $CO_2$ | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 44/100 | |
| $O_2$ | 18.7 | 12.1 | 18.7 | 12.1 | 18.7 | 12.1 | 12.1 | 32/100 | |
| CO | | | | | | | | 28/100 | |
| $N_2$ | | 81.3 | | 81.3 | | 81.3 | 81.3 | 28/100 | |

$$M_w = \frac{M_d (100 - \% H_2O) + 18 (\% H_2O)}{100} = \_\_\_\_\_\_$$

$$M_d = \sum M_{di} = \_\_\_\_\_\_$$

FOR F-FACTOR CALCULATIONS ALL ORSAT ANALYSES MUST BE RUN IN TRIPLICATE AND MUST AGREE WITH EACH OTHER TO WITHIN 0.3% BY VOLUME

## POST-TEST ORSAT EQUIPMENT CHECK

ORSAT CHECK: POST-TEST LEAK CHECK: INITIAL ____ ml 0 min.
ACCEPTANCE LIMIT: LEAK < 0.2 ml/5 min. FINAL ____ ml 5 min.
POST-TEST AMBIENT $O_2$ = ____ %; ACCEPTANCE LIMITS OF $O_2$ = 20.6 - 21.2%

## ORSAT ANALYSIS VALIDATION

Average Published $F_o$ = ______

Fuel Analysis $F_o = \frac{20.9 (1.53 \%C + 3.64 \%H + 0.57 \%S + 0.14 \%N - 0.46 \%O)}{0.321 \%C (100)} =$ ______

ORSAT Analysis $F_o^* = \frac{20.9 - \% O_2}{\% CO_2} =$ ______, Acceptance Limits are shown above.

*Assuming CO concentration is neglible (< 1000 ppm)

EPA METHOD 3
ORSAT EQUIPMENT CHECK, MOLECULAR WEIGHT
DETERMINATION, AND ANALYSIS VALIDATION

FIRM Mattabassett District

TEST NUMBER 2

SAMPLING TIME (24-hr CLOCK) 1219 - 1321

SAMPLING LOCATION Main Incinerator Exhaust

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) ______

SAMPLE MOISTURE CONTENT 20 %

AMBIENT TEMPERATURE 70

TESTER/DATE JJG

An ORSAT analysis of boiler exhaust gases is considered valid if the $F_o$ calculated from the ORSAT analysis is within ±5% of the $F_o$ calculated from fuel analysis. If fuel analysis data is not available, the $F_o$ calculated from the ORSAT analysis must be within ±5% of the average published $F_o$ for a given fuel as follows:

| FUEL | AVE. $F_o$ | ±5% ACCEPTANCE LIMITS |
|---|---|---|
| Anthracite | 1.070 | 1.016 - 1.124 |
| Bituminous | 1.140 | 1.083 - 1.197 |
| Lignite | 1.076 | 1.022 - 1.130 |
| Oil | 1.346 | 1.279 - 1.413 |
| Natural Gas | 1.749 | 1.662 - 1.836 |
| Propane | 1.510 | 1.434 - 1.586 |
| Butane | 1.479 | 1.405 - 1.553 |
| Wood | 1.050 | 0.9975- 1.102 |
| Bark | 1.056 | 1.003 - 1.109 |

PRE-TEST ORSAT EQUIPMENT CHECK

ORSAT CHECK: PRE-TEST LEAK CHECK: INITIAL _____ ml 0 min.
ACCEPTANCE LIMIT: LEAK < 0.2 ml/5 min. FINAL _____ ml 5 min.
PRE-TEST AMBIENT $O_2$ = _____%; ACCEPTANCE LIMITS OF $O_2$ = 20.6 - 21.2%

MOLECULAR WEIGHT DETERMINATION

| GAS \ RUN | 1 | | 2 | | 3 | | AVERAGE % | MULTIPLIER | CONTRIBUTION TO DRY MOLECULAR WEIGHT OF STACK GAS $M_{di}$ lb/lb-mole |
|---|---|---|---|---|---|---|---|---|---|
| | ACTUAL READING (ml) | % | ACTUAL READING (ml) | % | ACTUAL READING (ml) | % | | | |
| $CO_2$ | 8.0 | 8.0 | 7.7 | 7.9 | 8.0 | 8.0 | 8.0 | 44/100 | |
| $O_2$ | 18.5 | 10.5 | 18.6 | 10.7 | 18.5 | 10.5 | 10.5 | 32/100 | |
| CO | | | | | | | | 28/100 | |
| $N_2$ | | 81.5 | | 81.4 | | 81.5 | 81.5 | 28/100 | |

$$M_w = \frac{M_d\,(100 - \%\,H_2O) + 18\,(\%\,H_2O)}{100} = \_\_\_\_\_\_ \qquad M_d = \sum M_{di} = \_\_\_\_\_\_$$

FOR F-FACTOR CALCULATIONS ALL ORSAT ANALYSES MUST BE RUN IN TRIPLICATE AND MUST AGREE WITH EACH OTHER TO WITHIN 0.3% BY VOLUME

POST-TEST ORSAT EQUIPMENT CHECK

ORSAT CHECK: POST-TEST LEAK CHECK: INITIAL _____ ml 0 min.
ACCEPTANCE LIMIT: LEAK < 0.2 ml/5 min. FINAL _____ ml 5 min.
POST-TEST AMBIENT $O_2$ = _____%; ACCEPTANCE LIMITS OF $O_2$ = 20.6 - 21.2%

ORSAT ANALYSIS VALIDATION

Average Published $F_o$ = ______

Fuel Analysis $F_o = \frac{20.9\,(1.53\,\%C + 3.64\,\%H + 0.57\,\%S + 0.14\,\%N - 0.46\,\%O)}{0.321\,\%C\,(100)} = \_\_\_\_\_\_$

ORSAT Analysis $F_o^* = \frac{20.9 - \%\,O_2}{\%\,CO_2} = \_\_\_\_\_\_$, Acceptance Limits are shown above.

*Assuming CO concentration is neglible (< 1000 ppm)

EPA METHOD 3
ORSAT EQUIPMENT CHECK, MOLECULAR WEIGHT
DETERMINATION, AND ANALYSIS VALIDATION

FIRM Mattabassett District

TEST NUMBER 3

SAMPLING TIME (24-hr CLOCK) 1431 - 1536

SAMPLING LOCATION Main Incinerator Exhaust

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) ______

SAMPLE MOISTURE CONTENT 20 %

AMBIENT TEMPERATURE 70

TESTER/DATE JDG

An ORSAT analysis of boiler exhaust gases is considered valid if the $F_o$ calculated from the ORSAT analysis is within ±5% of the $F_o$ calculated from fuel analysis. If fuel analysis data is not available, the $F_o$ calculated from the ORSAT analysis must be within ±5% of the average published $F_o$ for a given fuel as follows:

| FUEL | AVE. $F_o$ | ±5% ACCEPTANCE LIMITS |
|---|---|---|
| Anthracite | 1.070 | 1.016 - 1.124 |
| Bituminous | 1.140 | 1.083 - 1.197 |
| Lignite | 1.076 | 1.022 - 1.130 |
| Oil | 1.346 | 1.279 - 1.413 |
| Natural Gas | 1.749 | 1.662 - 1.836 |
| Propane | 1.510 | 1.434 - 1.586 |
| Butane | 1.479 | 1.405 - 1.553 |
| Wood | 1.050 | 0.9975- 1.102 |
| Bark | 1.056 | 1.003 - 1.109 |

## PRE-TEST ORSAT EQUIPMENT CHECK

ORSAT CHECK: PRE-TEST LEAK CHECK: INITIAL ____ ml 0 min.
ACCEPTANCE LIMIT: LEAK < 0.2 ml/5 min. FINAL ____ ml 5 min.
PRE-TEST AMBIENT $O_2$ = ____%; ACCEPTANCE LIMITS OF $O_2$ = 20.6 - 21.2%

## MOLECULAR WEIGHT DETERMINATION

| GAS \ RUN | 1 ACTUAL READING (ml) | 1 % | 2 ACTUAL READING (ml) | 2 % | 3 ACTUAL READING (ml) | 3 % | AVERAGE % | MULTIPLIER | CONTRIBUTION TO DRY MOLECULAR WEIGHT OF STACK GAS $M_{di}$ lb/lb-mole |
|---|---|---|---|---|---|---|---|---|---|
| $CO_2$ | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 44/100 | |
| $O_2$ | 19.8 | 14.6 | 19.7 | 14.5 | 19.8 | 14.6 | 14.6 | 32/100 | |
| CO | | | | | | | | 28/100 | |
| $N_2$ | | 80.2 | | 80.3 | | 80.2 | 80.2 | 28/100 | |

$M_w = \frac{M_d (100 - \% H_2O) + 18 (\% H_2O)}{100}$ = ______ $M_d = \sum M_{di}$ = ______

FOR F-FACTOR CALCULATIONS ALL ORSAT ANALYSES MUST BE RUN IN TRIPLICATE AND MUST AGREE WITH EACH OTHER TO WITHIN 0.3% BY VOLUME

## POST-TEST ORSAT EQUIPMENT CHECK

ORSAT CHECK: POST-TEST LEAK CHECK: INITIAL ____ ml 0 min.
ACCEPTANCE LIMIT: LEAK < 0.2 ml/5 min. FINAL ____ ml 5 min.
POST-TEST AMBIENT $O_2$ = ____%; ACCEPTANCE LIMITS OF $O_2$ = 20.6 - 21.2%

## ORSAT ANALYSIS VALIDATION

Average Published $F_o$ = ______

Fuel Analysis $F_o$ = $\frac{20.9 (1.53 \%C + 3.64 \%H + 0.57 \%S + 0.14 \%N - 0.46 \%O)}{0.321 \%C (100)}$ = ______

ORSAT Analysis $F_o^*$ = $\frac{20.9 - \% O_2}{\% CO_2}$ = ______. Acceptance Limits are shown above.

*Assuming CO concentration is negligible (< 1000 ppm)

EPA METHOD 3
ORSAT EQUIPMENT CHECK, MOLECULAR WEIGHT DETERMINATION, AND ANALYSIS VALIDATION

FIRM Mattabassett District

TEST NUMBER 4

SAMPLING TIME (24-hr CLOCK) 1725 - 1829

SAMPLING LOCATION Incinerator Outlet

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS)

SAMPLE MOISTURE CONTENT 20 %

AMBIENT TEMPERATURE 70

TESTER/DATE LAG

An ORSAT analysis of boiler exhaust gases is considered valid if the $F_o$ calculated from the ORSAT analysis is within ±5% of the $F_o$ calculated from fuel analysis. If fuel analysis data is not available, the $F_o$ calculated from the ORSAT analysis must be within ±5% of the average published $F_o$ for a given fuel as follows:

| FUEL | AVE. $F_o$ | ±5% ACCEPTANCE LIMITS |
|---|---|---|
| Anthracite | 1.070 | 1.016 - 1.124 |
| Bituminous | 1.140 | 1.083 - 1.197 |
| Lignite | 1.076 | 1.022 - 1.130 |
| Oil | 1.346 | 1.279 - 1.413 |
| Natural Gas | 1.749 | 1.662 - 1.836 |
| Propane | 1.510 | 1.434 - 1.586 |
| Butane | 1.479 | 1.405 - 1.553 |
| Wood | 1.050 | 0.9975- 1.102 |
| Bark | 1.056 | 1.003 - 1.109 |

PRE-TEST ORSAT EQUIPMENT CHECK

ORSAT CHECK: PRE-TEST LEAK CHECK: INITIAL ____ ml 0 min.
ACCEPTANCE LIMIT: LEAK < 0.2 ml/5 min. FINAL ____ ml 5 min.
PRE-TEST AMBIENT $O_2$ = ____%; ACCEPTANCE LIMITS OF $O_2$ = 20.6 - 21.2%

MOLECULAR WEIGHT DETERMINATION

| GAS \ RUN | 1 ACTUAL READING (ml) | 1 % | 2 ACTUAL READING (ml) | 2 % | 3 ACTUAL READING (ml) | 3 % | AVERAGE % | MULTIPLIER | CONTRIBUTION TO DRY MOLECULAR WEIGHT OF STACK GAS $M_{di}$ lb/lb-mole |
|---|---|---|---|---|---|---|---|---|---|
| $CO_2$ | 6.6 | 6.6 | 6.7 | 6.7 | 6.6 | 6.6 | 6.6 | 44/100 | |
| $O_2$ | 18.7 | 12.1 | 18.9 | 12.2 | 18.8 | 12.2 | 12.2 | 32/100 | |
| CO | | | | | | | | 28/100 | |
| $N_2$ | | 81.3 | | 81.1 | | 81.2 | 81.2 | 28/100 | |

$$M_w = \frac{M_d\ (100 - \%\ H_2O) + 18\ (\%\ H_2O)}{100} = \_\_\_\_$$

$$M_d = \sum M_{di} = \_\_\_\_$$

FOR F-FACTOR CALCULATIONS ALL ORSAT ANALYSES MUST BE RUN IN TRIPLICATE AND MUST AGREE WITH EACH OTHER TO WITHIN 0.3% BY VOLUME

POST-TEST ORSAT EQUIPMENT CHECK

ORSAT CHECK: POST-TEST LEAK CHECK: INITIAL 6.2 ml 0 min.
ACCEPTANCE LIMIT: LEAK < 0.2 ml/5 min. FINAL 6.2 ml 5 min.
POST-TEST AMBIENT $O_2$ = 20.8%; ACCEPTANCE LIMITS OF $O_2$ = 20.6 - 21.2%

ORSAT ANALYSIS VALIDATION

Average Published $F_o$ = ____

Fuel Analysis $F_o$ = $\frac{20.9\ (1.53\ \%C + 3.64\ \%H + 0.57\ \%S + 0.14\ \%N - 0.46\ \%O)}{0.321\ \%C\ (100)}$ = ____

ORSAT Analysis $F_o^*$ = $\frac{20.9 - \%\ O_2}{\%\ CO_2}$ = ____, Acceptance Limits are shown above.

*Assuming CO concentration is neglible (< 1000 ppm)

# Appendix H

## Example Calculations

# EMISSION CALCULATION SYMBOLS

TEST No. 1

La - Allowable leak rate, cfm

$Vm_{total}$ - Total meter sample volume, $ft^3$

$T_{total}$ - Total sampling time, min

$L_p$ - Final leak rate of sampling train, cfm

$Vmc_{total}$ - Total volume sampled corrected for excessive leakage, $ft^3$

Y - Dry gas meter calibration factor, dimensionless

$T_{std}$ - Standard temperature, $^oF$

$Tm_{avg.}$ - Average dry gas meter temperature, $^oF$

$P_{bar}$ - Barometric pressure, "Hg

$\Delta H_{avg.}$ - Average orifice pressure drop, "$H_2O$

$P_{std}$ - Standard pressure, "Hg

$V_I$ - Volume of liquid collected in impingers, ml

$V_{SG}$ - Volume of liquid collected in silica gel, grams

$M_S$ - Molecular weight of stack gas, lb/lb-mole

$\%CO_2$ - Percent $CO_2$ by volume (dry basis), %

%CO - Percent CO by volume (dry basis), %

$\%N_2$ - Percent $N_2$ by volume (dry basis), %

$\%O_2$ - Percent $O_2$ by volume (dry basis), %

$D_{st}$ - Average duct gas density, $lbs/ft^3$

$Ps_{avg}$ - Average duct static pressure, "$H_2O$

$Ts_{avg}$ - Average duct temperature, $^oF$

EA - Excess air, %

$V_s$ - Average duct velocity, ft/min

$C_p$ - Pitot tube coefficient, dimensionless

$(\sqrt{\Delta P})avg$ - Average square root of velocity head, $\sqrt{"H_2O}$

$A_s$ - Cross-sectional area of duct, $ft^2$

EMISSION CALCULATION SYMBOLS (cont'd)

Q - Duct volumetric flow rate, acfm

$Q_{std}$ - Duct volumetric flow rate, corrected to dry standard conditions, dscfm

$D_n$ - Nozzle diameter, inches

F - F factor, DSCF/MM BTU

%H - Percent by weight of hydrogen in fuel

%C - Percent by weight of carbon in fuel

%S - Percent by weight of sulfur in fuel

%N - Percent by weight of nitrogen in fuel

%O - Percent by weight of oxygen in fuel

GCV - Gross calorific value of fuel, BTU/lb.

C - Actual particulate concentration, grains/acf

$C_s$ - Particulate concentration, grains/dscf

ER - Particulate emission rate, lbs/hr

E - Particulate emissions, lbs/MM BTU

$C_s$ @ 12% $CO_2$ - Particulate concentration, grains/dscf @ 12% $CO_2$

$C_s$ @ 50% EA - Particulate concentration, grains/dscf @ 50% EA

$C_{Lb}$ - Particulate concentration, lbs/1000 duct gas

$C_{Lb}$ @ 12% $CO_2$ - Particulate concentration, lbs/1000 lbs @ 12% $CO_2$

$C_{Lb}$ @ 50% EA - Particulate concentration, lbs/1000 lbs @ 50% EA

$M_n$ - Total particulate collected, mg

1. Allowable Leak Rate

$$La = 0.02 \text{ cfm or } 0.04 \frac{V_m \text{ total}}{T \text{ total}} \quad \text{which ever is less.}$$

$$\frac{0.04\ V_m \text{ total}}{T_{total}} = \frac{0.04 \times \qquad}{\qquad}$$

La = cfm

2. Correction for Excessive Leak Rate

Lp = cfm

if Lp > La use $V_{mc}$ total in place of $V_m$ total in all subsequent equations.

$$V_{mc \text{ total}} = V_{m \text{ total}} - (Lp - La)\ T_{total}$$

$$V_{mc \text{ total}} = \qquad -( \quad - \quad ) \quad = \qquad ft^3$$

3. Volume of Sample Measured by Dry Gas Meter, Corrected to Standard Conditions

$$V_{m \text{ total (std)}} = V_{m \text{ total}}\ Y \left(\frac{T_{std} + 460}{T_{m\ avg} + 460}\right) \left[\frac{P_{bar} + \frac{\Delta H\ avg}{13.6}}{P_{std}}\right]$$

$$V_{m \text{ total (std)}} = 49.05 \times 1.0025 \left(\frac{68 + 460}{101 + 460}\right) \left[\frac{29.78 + \frac{2.26}{13.6}}{29.92}\right]$$

$V_m$ total (std) = 46.32 dscf

4. Moisture Content of Duct Gas

$$\%\ H_2O = \frac{0.04707\ (V_I + V_{SG})}{V_{m \text{ total (std)}} + 0.04707\ (V_I + V_{SG})} \times 100$$

$$\%\ H_2O = \frac{0.04707\ (333.3 + \quad)}{46.32 + 0.04707\ (333.3 + \quad)} \times 100$$

% $H_2O$ = 25.3 %

5. Molecular Weight of Stack Gas

$$Ms = \left[(0.44 \times \%\ CO_2)+(0.28 \times \%\ CO)+(0.28 \times \%\ N_2)+(0.32 \times \%\ O_2)\right]\left(1-\frac{\%\ H_2O}{100}\right)+ 0.18\ (\%\ H_2O)$$

$$Ms = \left[(0.44 \times 6.6)+(0.28 \times 0)+(0.28 \times 81.3)+(0.32 \times 12.1)\right]\left(1-\frac{25.3}{100}\right)+ 0.18\ (25.3)$$

$$Ms = 26.6 \text{ lb/lb-mole}$$

6. Average Duct Gas Density

$$D_{st} = 0.0458 \times Ms \left(\frac{P_{bar} + \frac{Ps\ avg}{13.6}}{T_{s\ avg} + 460}\right)$$

$$D_{st} = 0.0458 \times \left(\frac{\quad + \frac{\quad}{13.6}}{\quad + 460}\right)$$

$$D_{st} = NA \text{ lbs/ft}^3$$

7. Excess Air

$$EA = 100 \left[\frac{\%\ O_2 - 0.5\ \%\ CO}{0.264\ \%\ N_2 - (\%\ O_2 - 0.5\%\ CO)}\right]$$

$$EA = 100 \left[\frac{12.1 - 0.5 \times 0}{0.264 \times 81.3 - (12.1 - 0.5 \times 0)}\right]$$

$$EA = 129\ \%$$

8. Average Duct Velocity

$$V_s = 5129.4\ C_p\ (\sqrt{\Delta P})avg \sqrt{\frac{T_{s\ avg} + 460}{\left(P_{bar} + \frac{P_{s\ avg}}{13.6}\right) Ms}}$$

$$V_s = 5129.4 \times 0.84 \times 0.4193 \sqrt{\frac{149 + 460}{\left(29.78 + \frac{-0.16}{13.6}\right) 26.6}}$$

$$V_s = 1583 \text{ ft/min}$$

9. Duct Volumetric Flow Rate

$$Q = V_s \times A_s$$

$$Q = 1583.7 \times 8.3$$

$$Q = 13145 \text{ acfm}$$

10. Duct Volumetric Flow Rate, Corrected to Dry Standard Conditions

$$Q_{std} = Q\left(1 - \frac{\% H_2O}{100}\right)\left(\frac{T_{std} + 460}{T_{s\ avg} + 460}\right)\left(\frac{P_{bar} + \frac{P_{s\ avg}}{13.6}}{P_{std}}\right)$$

$$Q_{std} = 13145 \left(1 - \frac{25.3}{100}\right)\left(\frac{68 + 460}{149 + 460}\right)\left(\frac{29.78 + \overline{13.6}}{29.92}\right)$$

$Q_{std}$ = dscfm

11. Isokinetic Factor

$$I = \frac{5.67\ (T_{s\ avg} + 460)(V_{m\ std})}{\left(P_{bar} + \frac{P_{s\ avg}}{13.6}\right) V_s \times T_{total} \left(1 - \frac{\% H_2O}{100}\right)\left(\frac{(Dn)^2 \times 0.7854}{144}\right)}$$

$$I = \frac{5.67\ (149 + 460)(46.32)}{\left(29.78 + \frac{.4193}{13.6}\right) 1583 \times 60 \left(1 - \frac{25.3}{100}\right)\left(\frac{(.362)^2 \times 0.7854}{144}\right)}$$

$I$ = 105.9 %

12. F - Factor

$$F = \frac{10^6(3.64\%\ H + 1.53\%\ C + 0.57\%\ S + 0.14\%\ N - 0.46\%\ O)}{GCV}$$

$$F = \frac{10^6(3.64 \times \quad +1.53 \times \quad +0.57 \times \quad +0.14 \times \quad -0.46 \times \quad )}{}$$

F = NA DSCF/MM BTU

13. Actual Particulate Concentration

$$C = \frac{0.01543 \times Mn}{Vm_{std}} \frac{(T_{std} + 460)}{T_{s\,avg} + 460} \frac{\left(P_{bar} + \frac{P_{s\,avg}}{13.6}\right)}{P_{std}} \left(1 - \frac{\%H_2O}{100}\right)$$

$$C = \frac{0.01543 \times 151.3}{46.32} \frac{(68 + 460)}{(149 + 460)} \frac{\left(28.78 + \frac{4193}{13.6}\right)}{(29.92)} \left(1 - \frac{25.3}{100}\right)$$

$C = 0.03$ grains/acf

14. Particulate Concentration, Corrected to Dry Standard Conditions

$$C_s = 0.01543 \times \frac{Mn}{V_{m\,std}}$$

$$C_s = 0.01543 \times \frac{151.3}{46.32}$$

$C_s = 0.05$ grains/dscf

15. Particulate Emission Rate

$$ER = 0.008571 \times C_s \times Q_{std}$$

$$ER = 0.008571 \times 0.05 \times 8470$$

$ER = 3.6$ lbs/hr.

16. Particulate Emission

$$E = 0.0001429\ C_s \times F \left(\frac{20.9}{20.9 - \%O_2}\right)$$

$$E = 0.0001429 \times \quad \times \left(\frac{20.9}{20.9 - \quad}\right)$$

$E =$ NA lbs/MM BTU

17. Particulate Concentration Corrected to Dry Standard Conditions and 12% $CO_2$

$$C_s\ @\ 12\%\ CO_2 = \frac{12}{\%\ CO_2} \times C_s$$

$$C_s\ @\ 12\%\ CO_2 = \frac{12}{6.6} \times 0.05$$

$C_s$ @ 12% $CO_2$ = 0.09 grains/dscf @ 12% $CO_2$

18. Particulate Concentration Corrected to Dry Standard Conditions and 50% Excess Air

$$C_s \text{ @ } 50\% \text{ EA} = \frac{\% \text{ EA} + 100}{150} \times C_s$$

$$C_s \text{ @ } 50\% \text{ EA} = \frac{129.2 + 100}{150} \times .05$$

$C_s$ @ 50% EA = 0.07 grains/dscf @ 50% EA

19. Particulate Concentration Based on Duct Gas Weight

$$C_{Lb} = 0.1429 \times \frac{C}{D_{st\ avg}}$$

$$C_{Lb} = 0.1429 \times \underline{\qquad\qquad}$$

$C_{Lb}$ = NA lbs/1000 lbs duct gas (uncorrected)

20. Particulate Concentration Based on Duct Gas Weight Corrected to 12% $CO_2$

$$C_{Lb} \text{ @ } 12\% \ CO_2 = \frac{C_s \text{ @ } 12\% \ CO_2 \times 0.104 \ (T_{std} + 460)}{(0.44 \times \% \ CO_2) + (0.28(\% \ CO + \% N_2)) + (0.32 \times \% O_2)}$$

$$C_{Lb} \text{ @ } 12\% \ CO_2 = \frac{\qquad \times 0.104 \ (528)}{(0.44 \times \qquad) + (0.28( \qquad + \qquad)) + (0.32 \times \qquad)}$$

$C_{Lb}$ @ 12% $CO_2$ = NA lbs/1000 lbs dry corrected to 12% $CO_2$

21. Particulate Concentration Based on Duct Gas Weight Corrected to 50% Excess Air

$$C_{Lb} \text{ @ } 50\% \text{ EA} = \frac{C_s \text{ @ } 50\% \text{ EA} \times 0.104 \ (T_{std} + 460)}{(0.44 \times \% CO_2) + (0.28(\% CO + \% N_2)) + (0.32 \times \% O_2)}$$

$$C_{Lb} \text{ @ } 50\% \text{ EA} = \frac{0.07 \times 0.104 \ (528)}{(0.44 \times 6.6) + (0.28(0 + 81.3)) + (0.32 \times 12.1)}$$

$C_{Lb}$ @ 50% EA = 0.141 lbs/1000 lbs dry @ 50% EA

## Total Hydrocarbon Emissions

### Test No. 1

$$\frac{0.065\ mg}{l} \times \frac{28.32\ l}{1\ ft^3} \times \frac{1\ lb}{453.6\ g} \times \frac{1\ g}{1000\ mg}$$

$$= 4.06\ E^{-6}\ lb / dscf$$

$$\frac{4.06E{-6}\ lb}{dscf} \times \frac{8470\ dscf}{min.} \times \frac{60\ min}{hr}$$

= 2.1 pounds total hydrocarbon / hour

### Test No. 2

$$\frac{0.096\ mg}{l} \times \frac{28.32\ l}{ft^3} \times \frac{1\ lb}{453.6\ g} \times \frac{1\ g}{1000\ mg}$$

$$= 6.0\ E^{-6}\ lb / dscf$$

$$\frac{6.0\ E{-6}\ lb}{dscf} \times 7097\ \frac{dscf}{min.} \times 60\ \frac{min}{hr}$$

= 2.6 pounds total hydrocarbon / hour

# Total Hydrocarbon Emissions

Test No. 3

$$0.061 \frac{mg}{\ell} \times \frac{28.32\ \ell}{1\ ft^3} \times \frac{1\ lb}{453.6\ g} \times \frac{1\ g}{1000\ mg}$$

$= 3.8\ E^{-6}\ lb/dscf$

$$\frac{3.8E-6\ lb}{dscf} \times 9597 \frac{dscf}{min} \times 60 \frac{min}{hr}$$

$= 2.2$ pounds total hydrocarbon / hour

THE HARTFORD INSURANCE GROUP-ENVIRONMENTAL SCIENCES LABORATORY

ACCOUNT ROJAC

SUBMITTOR John Gammie

DATE REPORTED 9-16-86

LABORATORY R# 6538

ANALYST Cyndy Adams

ANALYTICAL METHOD Atomic Absorption Spectrometry

| SAMPLE I.D. | Air Volume | Lead MILLIGRAMS | $MG/M^3$ | MILLIGRAMS | $MG/M^3$ | MILLIGRAMS | $MG/M^3$ | MILLIGRAMS | $MG/M^3$ |
|---|---|---|---|---|---|---|---|---|---|
| 51X | | 1.244 | | | | | | | |
| 52X | | 2.496 | | | | | | | |
| 53X | | 1.348 | | | | | | | |
| 67X | | 0.956 | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

NOTES:

A. RICHARD LOMBARDI, P.E.
PRESIDENT
THOMAS D. LEE
DIRECTOR
FREDERICK O. A. ALMQUIST, P.E.
SANITARY ENGINEER
H. F. SACHS
BACTERIOLOGIST
J. LAIRD NEWELL, P.E.
CONSULTANT

# THE NEWLANDS SANITARY LABORATORY

HENRY SOUTHER LABORATORIES, PROPRIETOR
SANITARY, CHEMICAL AND BACTERIOLOGICAL INVESTIGATIONS
24 TOBEY ROAD
BLOOMFIELD, CONNECTICUT 06002
TEL. (203) 242-6291

WATER SUPPLY AND PURIFICATION
SEWAGE & INDUSTRIAL WASTE DISPOSAL
DESIGN-SUPERVISION-VALUATION
CHEMICAL & BIOLOGICAL LABORATORIES
AIR POLLUTION STUDIES

August 29, 1986

ROJAC Environmental Services, Inc.
P.O. BOx 731
West Hartford, Conn. 06107

Attn: Mr. Leigh A. Gammie

Gentlemen:

We have the following to report on the sample submtited to this laboratory on August 28, 1986.

| | |
|---|---|
| Sample No. | 1523H6 |
| Mark | Project #F86-20 |
| **Particulate Matter:** | |
| Filters | |
| #1 - 51X | 0.1007 grams |
| #2 - 52X | 0.2562 grams |
| #3 - 53X | 0.0866 grams |
| #4 - 67X | 0.1010 grams |
| **Condensibles:** | |
| Probe & Nozzle Rinse | |
| PW-1 | 0.0506 grams |
| PW-2 | 0.1032 grams |
| PW-3 | 0.0550 grams |
| PW-4 | 0.1854 grams |

Very truly yours,

THE NEWLANDS SANITARY LABORATORY

Thomas D. Lee

Thomas D. Lee
Laboratory Director

TDL/cas

ENVIRONMENTAL
SCIENCE
CORPORATION

P.O. BOX 616
50 WALNUT STREET • MIDDLETOWN, CONN. 06457
TELEPHONE: 347-6961

# Laboratory Report

LAB. REPORT NO.
C - 2154

State Certification No. PH-0476

CLIENT

Terrie Pelletier
Mattabassett District
P.O. Box 137
Cromwell, CT 06416

DATE September 5, 1986

CLIENT PHONE NO. 635-5550

S. CIAL INSTRUCTIONS:

P.O.#9034

| SAMPLE DESCRIPTION | TEST | RESULTS |
|---|---|---|
| | | mg/kg |
| 18,000 Tank 11:00 - 7:00 | Mercury | < 0.002 |
| 18,000 Tank 7:00 - 3:00 8-27-86 | Mercury | < 0.002 |
| 18,000 Tank 3:00 - 11:00 8-28-86 | Mercury | < 0.002 |

R' IARKS:

9-16-86
received

September 12, 1986
DATE REPORTED

Thomas F. McGloin
LABORATORY DIRECTOR

ENVIRONMENTAL
LABORATORIES

..ATER AND AIR ANALYSIS

OSHA, DEP, EPA
COMPLIANCE TESTING

August 4, 1986

Ms. Terri Pelletier
Mattabassett
P.O. Box 137
Cromwell, CT 06416

RE: Lab. No. 066312-003
P.O. NO. 8891
Inv. No. 11680

Dear Ms. Pelletier:

The following is a report of analysis performed on samples received June 26. 1986:

| | 6-20-86 Sludge Good Quality | 6-25-86 Sludge Bad Quality |
|---|---|---|
| Beryllium (ppm) | <1 | - - - - - |
| Mercury | <0.1 | - - - - - |
| MBAS | 417 | 173 |
| Coliform. Total | 6-25-86 46/100ml | 6-26-86 33/100ml |

| | 6-20-86 Good Quality Sludge | 6-20-86 Good Quality Filtrate | 6-25-86 Bad Quality Sludge | 6-25-86 Bad Quality Filtrate |
|---|---|---|---|---|
| Chloride (mgl) | 113 | 113 | 135 | 90 |
| Oil & Grease | 16 | 610 | 7.4 | 430 |

If you have any questions, please contact us.

Very truly yours,

Stephen J. Franco

Stephen J. Franco
Laboratory Director

SJF/br

GRISWOLD & FUSS
ENVIRONMENTAL LABORATORIES, INC.
360 East Center St. Manchester, Conn. 06040 Tel. (203) 646-5628

Appendix D

Field Data Sheets

FIEL... IA SI

Firm Name McHabassett
Plant Location Caswell
Test Number 1
Sampling Location Incinerator Outlet
Project No.
Date 8/27/86
Tester JXG/KAG

Orifice No. 1758
Ambient Temp. 75 °F
Bar. Press. 29.78 "Hg
Probe Ident. No. 401
Filter Ident. No. 51X
Duct Area 8.3 ft²

Nozzle No. & Dia. 0.362 in.
Assumed Moisture 18 %
Test Duration 60 min.
Traverse Point Interval 3 min.
Probe Heater Setting 282 °F
Filter Temp. Setting 250 °F
Dry Gas Meter Y 1.0025

Nomograph C Factor 0.77
Pitot Coefficient 0.84
Orifice ΔH@ 1.78
Test Start Time 1019
Test Final Time 1122
Leak Test Start 0.00 CFM 15 "Hg
Leak Test Final 0.01 CFM 11 "Hg

1 of 2

| Port | Point | Time Min. | Velocity ΔP in $H_2O$ | ΔH in $H_2O$ | $T_M$ in °F | $T_M$ out °F | $P_{Stack}$ in $H_2O$ | $T_{Stack}$ °F | Gas Sample Volume cu. ft. | PROBE | Cyc. Angle ø | Heater Box Temp. | Temp. of Gas Leaving Condenser °F | Pump Vac. in Hg | Probe Temp. °F | $O_2$ % | $CO_2$ % | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 814.80 | | | | | | | | | 1019 |
| 1 | 1 | 3 | .022 | .268 | 84 | 76 | | 147 | 817.18 | | | 238 | <65 | 5 | 234 | | | 22 |
| | 2 | | .023 | .280 | 85 | 76 | | 146 | 821.00 | | | 243 | | 6 | 226 | | | 25 |
| | 3 | | .018 | .223 | 92 | 79 | | 143 | 823.11 | | | 255 | | 5.5 | 224 | | | 28 |
| | 4 | | .024 | .296 | 95 | 80 | -.015 | 145 | 825.42 | | | 259 | | 8 | 222 | | | 31 |
| | 5 | | .020 | .249 | 100 | 82 | | 145 | 828.56 | | | 258 | | 7 | 221 | | | 34 |
| | 6 | | .012 | .151 | 102 | 84 | | 146 | 830.82 | | | 246 | | 2 | 202 | | | 37 |
| | 7 | | .004 | .0505 | 102 | 85 | | 148 | 831.68 | | | 261 | | 2 | 227 | | | 40 |
| | 8 | | .004 | .0505 | 102 | 85 | | 149 | 833.05 | | | 260 | | 3 | 227 | | | 43 |
| | 9 | | .014 | .178 | 102 | 86 | | 153 | 835.10 | | | 249 | | 5 | 217 | | | 46 |
| | 10 | | .018 | .223 | 102 | 90 | | 149 | 837.28 | | | 271 | | 7 | 226 | | | 49/51 |
| 2 | 1 | | .023 | .280 | 106 | 92 | | 149 | 840.61 | | | 267 | | 8 | 223 | | | 55 |
| | 2 | | .024 | .296 | 110 | 93 | | 146 | 843.17 | | | 262 | | 8 | 216 | | | 58 |
| | 3 | | .024 | .296 | 112 | 95 | | 148 | 845.83 | | | 255 | | 8.5 | 220 | | | 01 |
| | 4 | | .024 | .296 | 116 | 96 | | 152 | 847.06 | | | 244 | | | 224 | | | 04 |
| Average | | | $\Sigma\sqrt{\Delta P}$ | | | | | | | | | | | | | | | |

~~33~~
~~35~~

$H_2O$ Collected ______ ml
SG Condition ______
SG Weight ______ gm
Total Volume Collected ______ ml

Orsat Bag Sample Triplicate Analysis, %

| $CO_2$ | $O_2$ | CO | $N_2$ |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

COMMENTS:

FIELD DATA SHEET

| | |
|---|---|
| Firm Name | Mattabassett |
| Plant Location | Cromwell |
| Test Number | 1 |
| Sampling Location | Incinerator Outlet |
| Project No. | F86-20 |
| Date | 8/27/86 |
| Tester | JSG/LAG |

| | |
|---|---|
| Orifice No. | 1758 |
| Ambient Temp. | 75 °F |
| Bar. Press. | 29.78 "Hg |
| Probe Ident. No. | 401 |
| Filter Ident. No. | 51X |
| Duct Area | 8.3 ft² |

0.6428

| | |
|---|---|
| Nozzle No. & Dia. | 0.362 in. |
| Assumed Moisture | 18 % |
| Test Duration | 60 min. |
| Traverse Point Interval | 3 min. |
| Probe Heater Setting | 250 °F |
| Filter Temp. Setting | 250 °F |
| Dry Gas Meter Y | 1.0025 |

| | |
|---|---|
| Nomograph C Factor | 0.77 |
| Pitot Coefficient | 0.84 |
| Orifice ΔH@ | 1.78 |
| Test Start Time | 1019 |
| Test Final Time | 1122 |
| Leak Test Start | 0.00 CFM @ 10 "Hg |
| Leak Test Final | 0.01 CFM @ 11 "Hg |

2 of 2

| Port | Point | Time Min. (3-5) | Velocity ΔP in $H_2O$ (6-10) | ΔH in $H_2O$ (12-15) | $T_M$ in °F (18-20) | $T_M$ out °F (23-25) | $P_{Stack}$ in $H_2O$ (26-30) | $T_{Stack}$ °F (32-35) | Gas Sample Volume cu. ft. (40-45) | PROBE (50) | Cyc. Angle ° (52-53) | Heater Box Temp. | Temp. of Gas Leaving Condenser °F | Pump Vac. in Hg | Probe Temp. °F | $O_2$ % | $CO_2$ % | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 30 | 015 | 189 | 118 | 98 | | 156 | 85163 | | | 257 | 265 | 6 | 215 | | | 07 |
| | 6 | | 024 | 296 | 118 | 99 | | 155 | 85411 | | | 226 | | 9 | 218 | | | 10 |
| | 7 | | 023 | 280 | 120 | 100 | | 152 | 85736 | | | 266 | | 9 | 218 | | | 13 |
| | 8 | | 021 | 257 | 120 | 101 | | 150 | 85952 | | | 253 | | 6 | 215 | | | 16 |
| | 9 | | 019 | 237 | 120 | 102 | | 148 | 86204 | | | 256 | | 6 | 218 | | | 19 |
| | 10 | | 011 | 137 | 120 | 103 | | 147 | 86385 | | | 254 | | 5 | 218 | | | 20 |
| | | | | | | | | | 4905 | | | | | | | | | |
| Average | | | $\Sigma\sqrt{\Delta P}$ 04193 | 226 | 101 | | | 149 | | | | | | | | | | |

| | |
|---|---|
| $H_2O$ Collected | 315 ml |
| SG Condition | Moist |
| SG Weight | 18.3 gm |
| Total Volume Collected | 333.3 ml |

Orsat Bag Sample
Triplicate Analysis, %

| $CO_2$ | $O_2$ | CO | $N_2$ |
|---|---|---|---|
| 6.6 | ~~10.7~~ | 10.1 | |
| 6.6 | ~~10.7~~ | 10.1 | |
| 6.6 | ~~10.7~~ | 10.1 | |

250
165
100
515
200
315

COMMENTS:

**FIELD DATA S**

Firm Name Mattebassett
Plant Location Cromwell
Test Number 2
Sampling Location Incinerator Outlet
Project No. FE6:20
Date 8/27/86
Tester JSG/LKG

Orifice No. 1758
Ambient Temp. 78 °F
Bar. Press. 29.78 "Hg
Probe Ident. No. 401
Filter Ident. No. 52X
Duct Area 8.3 ft²

Nozzle No. & Dia. 0.362 in.
Assumed Moisture 24 %
Test Duration 60 min.
Traverse Point Interval 3 min.
Probe Heater Setting 250 °F
Filter Temp. Setting 250 °F
Dry Gas Meter Y 1.0025

Nomograph C Factor 0.68
Pitot Coefficient 0.84
Orifice $\Delta H_A$ 1.76
Test Start Time 1219
Test Final Time 1321
Leak Test Start 0.00 CFM@ 10 "Hg
Leak Test Final 0.00 CFM@ 10 "Hg

1 of 2

| Port | Point | Time Min. | Velocity $\Delta P$ in $H_2O$ | $\Delta H$ in $H_2O$ | $T_M$ in °F | $T_M$ out °F | $P_{Stack}$ in $H_2O$ | $T_{Stack}$ °F | Gas Sample Volume cu. ft. 865.10 | PROBE | Cyc. Angle ∅ | Heater Box Temp. | Temp. of Gas Leaving Condenser °F | Pump Vac. in Hg | Probe Temp. °F | $O_2$ % | $CO_2$ % | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 30 | .024 | 2.67 | 94 | 93 | | 165 | 868.49 | | | 256 | 265 | 6 | 228 | | | 19 |
| | 2 | | .024 | 2.67 | 100 | 93 | | 165 | 870.51 | | | 265 | | 6 | 218 | | | 22 |
| | 3 | | .024 | 2.67 | 103 | 93 | -0.16 | 164 | 873.55 | | | 254 | | 7 | 217 | | | 25 |
| | 4 | | .024 | 2.67 | 108 | 94 | | 162 | 876.92 | | | 258 | | 7 | 213 | | | 28 |
| | 5 | | .025 | 2.75 | 111 | 95 | | 161 | 879.32 | | | 290 | | 7 | 211 | | | 31 |
| | 6 | | .020 | 2.22 | 113 | 95 | | 163 | 881.55 | | | 288 | | 6 | 217 | | | 34 |
| | 7 | | .024 | 2.67 | 114 | 97 | | 164 | 884.34 | | | 283 | | 7 | 218 | | | 37 |
| | 8 | | .022 | 2.40 | 116 | 98 | | 166 | 886.55 | | | 293 | | 7 | 221 | | | 40 |
| | 9 | | .019 | 2.13 | 116 | 98 | | 165 | 888.87 | | | 287 | | 6 | 223 | | | 43 |
| | 10 | | .013 | 1.48 | 116 | 99 | | 164 | 890.63 | | | 289 | | 5 | 228 | | | 46 |
| | 1 | | .020 | 2.22 | 116 | 99 | | 159 | 893.51 | | | 286 | | 7 | 234 | | | 49/51 |
| | 2 | | .026 | 2.89 | 118 | 100 | | 158 | [illegible]4 | | | 284 | | 8 | 236 | | | 54 |
| | 3 | | .024 | 2.67 | 118 | 102 | | 158 | 898.36 | | | 281 | | 8 | 230 | | | 57 |
| | 4 | | .024 | 2.67 | 120 | 103 | | 158 | 899 | | | 280 | | 7 | 221 | | | 00 |
| Average | | | $\Sigma\sqrt{\Delta P}$ | | | | | | | | | | | | | | | 03 |

$H_2O$ Collected ________ ml
SG Condition ________
SG Weight ________ gm
Total Volume Collected ________ ml

Orsat Bag Sample Triplicate Analysis, %

| $CO_2$ | $O_2$ | CO | $N_2$ |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

COMMENTS: ________