STAPPA/ALAPCO

(#21) 10/27/86

(A8)

Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

# MARYVILLE WASTEWATER TREATMENT PLANT SEWAGE SLUDGE INCINERATOR EMISSION TEST REPORT

PREPARED FOR:

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September 7, 1984

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# PERSONNEL DATA

| | |
|---|---|
| Date of Source Test: | August 29, 1984 |
| Location of Source Test: | Maryville Wastewater Treatment Plant<br>Maryville, Tennessee |
| Person In Charge: | John Carson |
| Personnel Conducting Sampling: | Mike Mowery and John Carson |
| Personnel Conducting Laboratory Analysis: | Susan Mowery |
| Personnel Conducting Visible Emission Evaluations: | Jimmy Jones |
| Personnel Observing Test Team: | Heather Wichum |

## INTRODUCTION

On August 29, 1984, EMI CONSULTANTS, Inc. performed an EPA Method 5 source emission test at MARYVILLE UTILITIES BOARD's Wastewater Treatment Plant in Maryville, Tennessee.

The objective of this test was to determine the degree of compliance of a multiple hearth sewage sludge incinerator followed by a venturi scrubber. This facility was tested in compliance in December, 1977 with natural gas as the fuel. Modifications have been made to allow the incinerator to be fueled with waste oil. This test was conducted with waste oil as the fuel.

Conditions of the permit for this facility state that particulate emissions to the atmosphere shall not exceed 1.3 lbs per ton of dry sludge charged or 0.61 lbs per hour which ever is more stringent.

## SUMMARY OF RESULTS

Table 1 presents the results of the EPA Method 5 test conducted on MARYVILLE WASTEWATER TREATMENT PLANT's sewage sludge incineration system fueled with waste oil. The average dry sludge charge rate during testing was 0.359 tons/hr. The test results show an average grain loading of 0.012 gr/dscf and an average emission rate of .653 lbs/hr or 1.82 lbs/ton of dry sludge. The average emission rate of 1.82 lbs/ton of dry sludge is greater than the allowable emission rate of 1.3 lbs/ton of dry sludge and the average emission rate of .653 lbs/hr is greater than the allowable emission rate of 0.61 lbs/hr. This indicates that this source was not in compliance with conditions stated in the permit during this test.

## STACK TEST RESULTS

| | Test 1 | Test 2 | Test 3 | Average |
|---|---|---|---|---|
| Date | 8/29/84 | 8/29/84 | 8/29/84 | |
| Time | 9:24 - 10:30 | 11:40 - 12:45 | 1:30 - 2:55 | |
| Net Test Time (Min) | 60.000 | 60.000 | 75.000 | |
| Vol. Sampled at STP (FT3) | 47.390 | 48.898 | 60.245 | 52.17 |
| Stack Gas Temp (F) | 191.000 | 185.000 | 184.000 | 187 |
| Moisture Content (% Vol) | 5.813 | 4.860 | 5.241 | 5.30 |
| CO2 (% Vol-Dry Basis) | 3.000 | 2.300 | 2.500 | 2.60 |
| O2 (% Vol-Dry Basis) | 17.400 | 18.100 | 18.000 | 17.83 |
| Stack Velocity (FT/MIN) | 3,164.510 | 3,235.571 | 3,211.232 | 3,203.77 |
| Gas Flow Rate (ACFM) | 8,354.307 | 8,541.908 | 8,477.652 | 8,457.95 |
| Gas Flow Rate (DSCFM) | 6,237.017 | 6,501.476 | 6,436.709 | 6,391.73 |
| % Isokinetic | 98.329 | 97.332 | 96.899 | 97.52 |
| Part. Con. (GR/DSCF) | 0.014 | 0.012 | 0.010 | 0.01 |
| Part. Mass Emission Rate (lbs/hr) | 0.754 | 0.668 | 0.538 | 0.65 |
| Sewage Slude Chg. Rate (wet) | 3473 | 2846 | 2711 | 3010 |
| " " " " (dry) | 504 | 427 | 393 | 441 |
| Waste Oil Fuel Rate (GPH) | 60.8 | 60.8 | 60.8 | 60.8 |
| Total Sludge Rate (Dry) (TPH) | .392 | .352 | .331 | .359 |
| Particulate Emission Rate (lbs/ton dry sludge) | 1.92 | 1.90 | 1.63 | 1.82 |

## PROCESS DESCRIPTION

MARYVILLE WASTEWATER TREATMENT PLANT utilizes a multiple hearth incinerator to burn sludge. During testing the incinerator was fueled with waste oil. The design volume rate of sludge to be charged on a dry basis is 977 lbs/hr. A 24" Merrick Model L440DS-1 digital single idler Weightometer is used to meter sludge to the incinerator. Exhaust gases from the incinerator are scrubbed with a Sly two stage size 230 Impinjet scrubber with venturi and pre-cooler before being exhausted to the atmosphere.

## SAMPLING AND ANALYTICAL PROCEDURES

The sewage sludge incineration system at the MARYVILLE WASTEWATER TREATMENT PLANT was tested in accordance with EPA Method 5. EMI CONSULTANTS utilized a sampling train manufactured by Research Appliance Corporation, Inc. (RAC). This equipment has the approval of and meets the standards of calibration accuracy set by EPA.

The RAC stack sampler consists of three main units: the pump, control units, and sampling box. The pump is a Gast$^{R}$ lubricated fiber van rotary pump altered for leak-free operation. The pump is connected to the control unit which contains a Rockwell dry gas meter, dual manometers, dial temperatures indicators, probe and oven temperature controllers, and a calibrated orifice system designed to enable isokinetic sampling. The sampling box is connected to the control unit by means of a flexible umbilical cord, and contains the impinger case and filter oven.

The probe used was constructed of stainless steel wrapped with a heating element and incased in a 304 stainless steel tube. The heating element maintains probe temperatures above gaseous dew points to prevent condensation. The probe was rigidly mounted to the sampling box and connected directly to the

filter holder inside the sampling box oven. An "S" type pitot tube mounted to the probe was used for velocity measurements at the sampling points.

The nozzles used were constructed of stainless steel and average nozzle diameter was measured on site immediately before and after testing.

Four ball-topped impingers in an ice bath were used in this system to remove moisture from stack gas samples. The first two impingers contained 100 milliliters (ml) of deionized distilled water, the third was empty, and the fourth contained a preweighed volume of silica gel desiccant. All fittings in the system were rigid ground glass to glass or specially machined steel to prevent leakage.

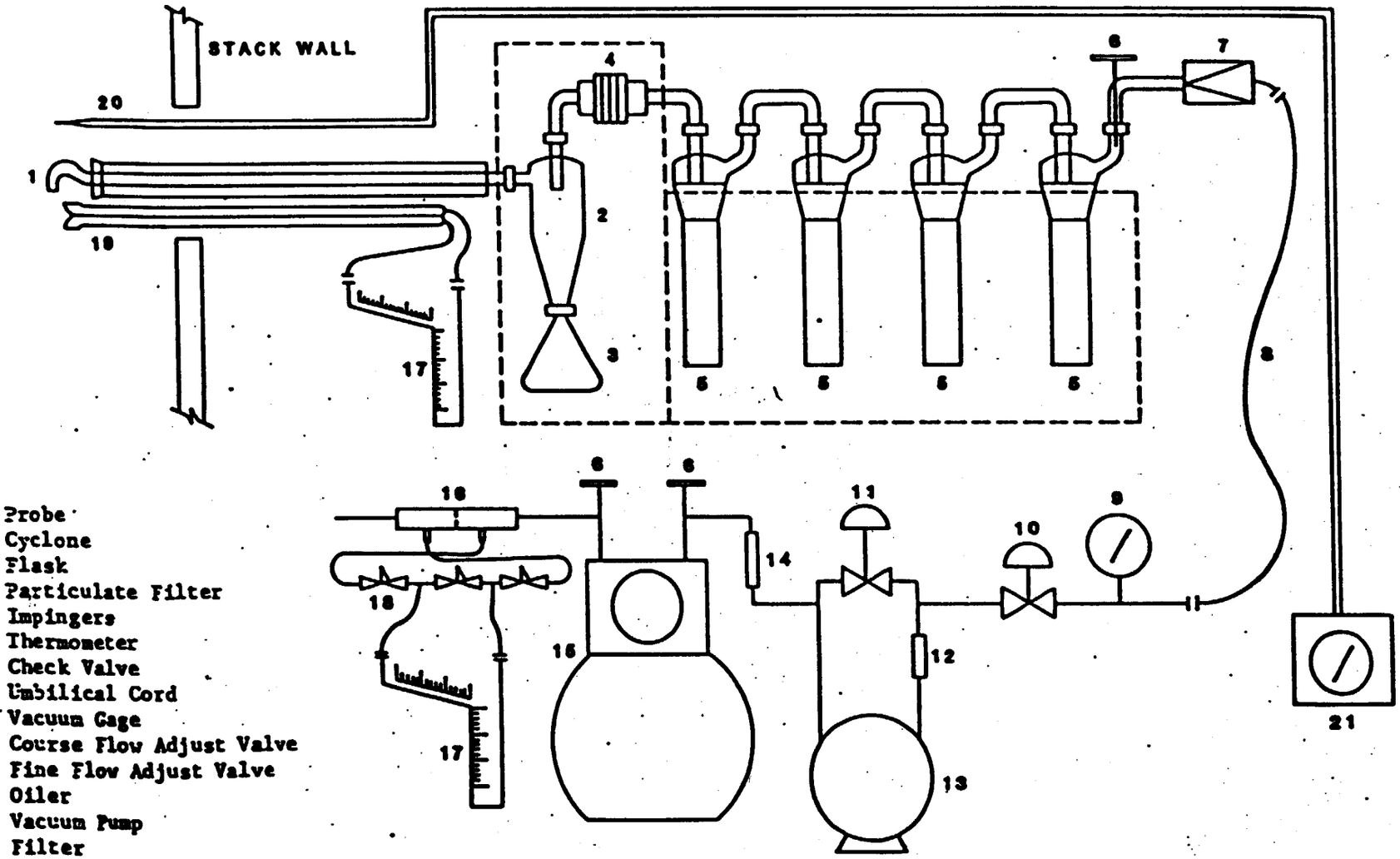
Figure 1 is a schematic of the RAC sampling train. Figure 2 is a schematic of the sampling points used for testing the scrubber.

The stack gas sample was drawn isokinetically through the nozzle, the heated probe, and into the heated filter assembly where the particulate matter was collected on a preweighed glass fiber filter. The filtered gas then passed through an umbilical cord to the dry gas meter, orifice, and pump.

Velocity pressure and temperature were monitored at each sampling point to insure that isokinetic sampling conditions were maintained. On-site leak checks were performed across the entire sampling train to insure that the system met the 0.02 cfm allowable leakage rate as specified by the EPA. This criterion was met. The pitot tube system was also checked for leaks.

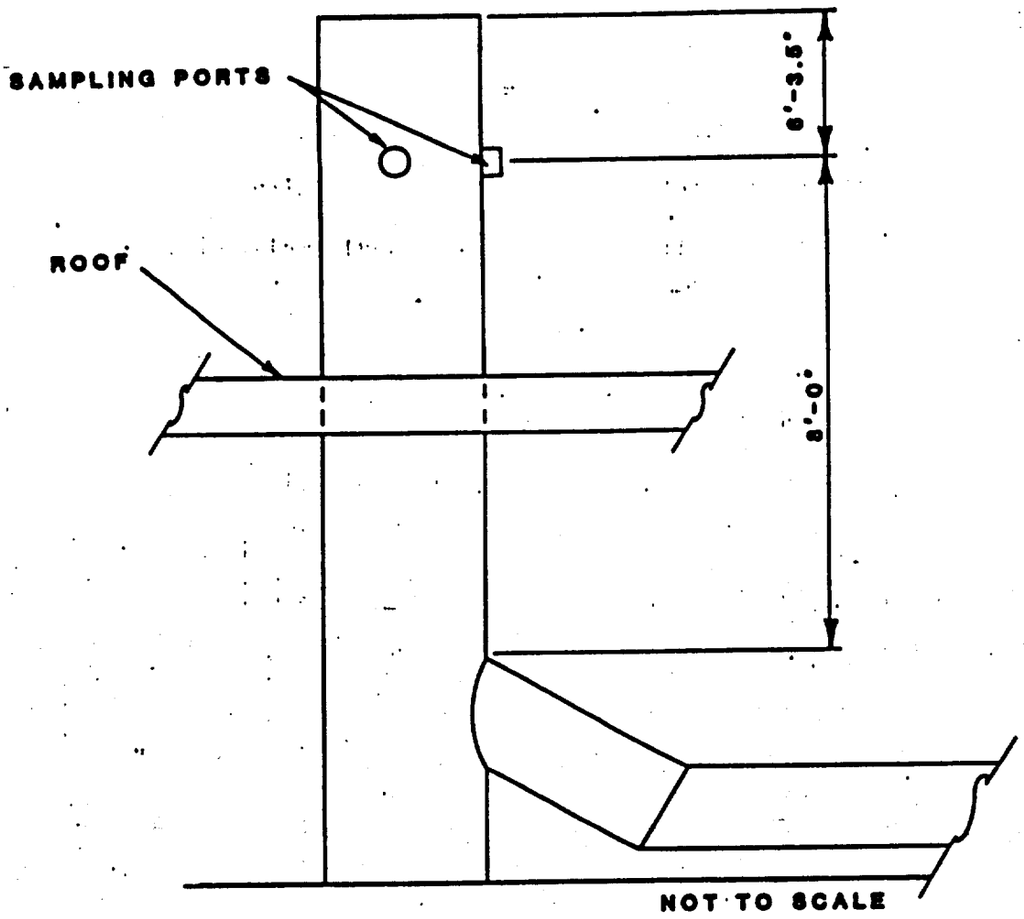
A flue gas sample was collected through a stainless steel tube mounted on the sampling probe. An integrated grab sample was collected by using a hand pump to extract a gas sample at each sampling point during testing and thereby filling one 5-liter Tedlar bag. This gas sample was then analyzed for $CO_2$ and $O_2$ using a Fisher Orsat Analyzer.

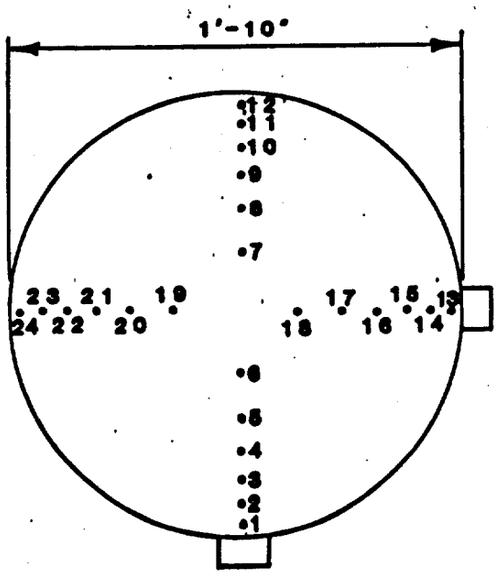
At the conclusion of each particulate test, a clean-up was conducted on the sampling train. Care was taken to insure no sample was lost and no




1 Probe
2 Cyclone
3 Flask
4 Particulate Filter
5 Impingers
6 Thermometer
7 Check Valve
8 Umbilical Cord
9 Vacuum Gage
10 Course Flow Adjust Valve
11 Fine Flow Adjust Valve
12 Oiler
13 Vacuum Pump
14 Filter
15 Dry Gas Meter
16 Orifice Tube
17 Incline Manometer
18 Solenoid Valves
19 Pitot
20 Thermocouple
21 Pyrometer

FIGURE 1. SCHEMATIC OF RAC SAMPLING TRAIN.




TRAVERSE POINTS

| | |
|---|---|
| 1/13 | - 1.00 |
| 2/14 | - 1.47 |
| 3/15 | - 2.59 |
| 4/16 | - 3.89 |
| 5/17 | - 5.50 |
| 6/18 | - 7.81 |
| 7/19 | - 14.19 |
| 8/20 | - 16.50 |
| 9/21 | - 18.11 |
| 10/22 | - 19.40 |
| 11/23 | - 20.53 |
| 12/24 | - 21.00 |

FIGURE 2. SCHEMATIC OF THE STACK AND SAMPLING POINTS.

particulate matter other than the sample itself was allowed in the sample to be analyzed.

The nozzle and probe were washed with acetone, and the probe was cleaned with a teflon bore brush. The washings were placed in polyethylene sample bottles. The filter holder and impingers were transported to the lab for subsequent analysis. The filter holder and impingers were transported to the lab for subsequent analysis.

The filter was removed from the filter holder and transferred to a petri dish. The front half of the filter holder was washed with acetone and this wash added to the nozzle and probe wash. The liquid in impingers 1, 2, and 3 were measured with a graduated cylinder. The silica gel in impinger 4 was removed and weighed to the nearest 0.5 gm.

The filters were subsequently desiccated for 24 hours before weighing to a constant weight. The net weight of the captured particulate was determined to the nearest 0.10 mg.

The contents of the wash samples were transferred to tared beakers and evaporated to dryness at ambient temperature and pressure. The beakers were then desiccated for 24 hours to a constant weight. The net weight of the captured particulate was then determined to the nearest 0.10 mg.

All volumes and weights were recorded on laboratory sheets.

# EQUATIONS
# and
# NOMENCLATURE

# SAMPLE EPA METHOD 5 CALCULATIONS

CLIENT _____

TEST NO. _____

## Volume of Water Collected

$V_{wstd} = (V_{lc}) (0.0474 \frac{ft.^3}{ml})$

=

$V_{wstd}$ =

## Volume of Gas Metered, Standard Conditions

$V_{mstd} = ((17.71) (V_m) (P_b + \frac{\Delta H}{13.6}) (\gamma))/ T_m$

=

$V_{mstd}$ =

## Moisture Content

$$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$$

=

$B_{wo}$ =

## Molecular Weight of Dry Gas Stream

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

=

$M_d$ =

## Molecular Weight of Stack Gas

$M_s = M_d(1-B_{ow}) + 18(B_{wo})$

=

$M_s$ =

## Velocity of Stack Gas

$$Vs = 174\ Cp\sqrt{\overline{\Delta p}}\ \sqrt{Ts \times \frac{29.92}{Ps} \times \frac{28.96}{Ms}}$$

=

Vs =

## Total Flow of Stack Gas

Qa = As x Vs

=

Qa =

$$Qs = Qa \times \frac{530}{TsR} \times \frac{Ps}{29.92}$$

=

Qs =

Qstd = Qs (1-Bwo)

=

Qstd =

## Percent Isokinetic of Test

$$Is = \frac{Vmstd}{An\ (\theta)\ (Vs_{std})}$$

=

Is =

## Particulate Concentration

$$Cs = \frac{(15.43)\ (Mn)}{Vmstd}$$

=

Cs =

## Particulate Mass Rate

$$PMR = \frac{(Mn)\ (Qstd)\ (60)}{(Vmstd)\ (454)}$$

=

PMR =

DATA SHEETS
and
CALCULATIONS

## NOMENCLATURE

| | |
|---|---|
| An | - Cross sectional area of nozzle, square feet. |
| As | - Cross section area of stack, square feet. |
| Bwo | - Proportion by volume of water vapor in gas stream, %. |
| Ca | - Concentration of particulate matter in stack gas, Gr./Acf. |
| Cp | - Pitot tube coefficient, dimensionless. |
| Cs | - Concentration of particulate matter in stack gas, Gr./DSCF. |
| $C_{12}$ | - Emission rate corrected to 12% $CO_2$, lb/hour. |
| $\overline{\Delta H}$ | - Average pressure drop across the orifice, inches $H_2O$. |
| $\overline{\sqrt{\Delta p}}$ | - Average velocity head of stack gas, inches $H_2O$. |
| %I | - Percent of isokinetic sampling (acceptable: $90 \leq I \leq 110\%$). |
| Kp | - 85.48 ft./sec.: constant $\left[\frac{\text{lb.}}{\text{lb. mole}\ \ R}\right]^{1/2}$ |
| Md | - Dry molecular weight of stack gas, lb/lb. mole. |
| Mn | - Total amount of particulate matter collected, mg. |
| Ms | - Molecular weight of stack gas (wet basis), lb/lb. mole. |
| Pb | - Barometric pressure, inches Hg. |
| Ps | - Absolute stack gas pressure, inches Hg. |
| Pstd | - Pressure at standard conditions. |
| PMR | - Particulate mass rate, lbs/hr. |
| Qa | - Volumetric flow rate, actual conditions. |
| Qs | - Volumetric flow rate at standard conditions. |
| Qstd | - Volumetric flow rate at standard conditions, (dry basis). |
| $\overline{Tm}$ | - Average dry gas meter temperature, °R or °F. |
| $\overline{Ts}$ | - Average stack temperature, °R or °F. |
| Tstd | - Absolute temperature at standard conditions, 530°R. |

$\theta$ —Total sampling time, minutes

$V_{lc}$ —Total volume of liquid collected in impingers and silica gel, ml.

$V_m$ —Volume of gas sample through the dry gas meter (meter conditions), cubic feet.

$V_{mstd}$ —Volume of gas sample through the dry gas meter at standard conditions.

$V_{wstd}$ —Volume of water collected at 29.92" Hg. and 70° cubic feet.

$\overline{V_s}$ —Stack gas velocity, feet per minute.

$V_{Pc}$ —Vapor pressure of metered gas at condenser temperature, in. Hg.

Standard Conditions, 29.92" Hg. and 70° F.

$\gamma$ —Dry meter calibration factor.

PARAMETER SHEET

| PARAMETER | TEST 1 | TEST 2 | TEST 3 |
|---|---|---|---|
| H | 2.5450 | 2.6810 | 2.7230 |
| P | 0.8310 | 0.8540 | 0.8480 |
| PB | 29.1300 | 29.1300 | 29.1300 |
| PS | 29.1300 | 29.1300 | 29.1300 |
| TM | 558.0000 | 560.0000 | 570.0000 |
| TSR | 651.0000 | 645.0000 | 644.0000 |
| VM | 50.0300 | 51.7900 | 64.9400 |
| VMSTD | 47.3897 | 48.8983 | 60.2447 |
| VLO | 61.7000 | 52.7000 | 70.3000 |
| VWSTD | 2.9246 | 2.4980 | 3.3322 |
| BWO | 0.0581 | 0.0486 | 0.0524 |
| MD | 29.1760 | 29.0920 | 29.1200 |
| MS | 28.5264 | 28.5529 | 28.5372 |
| VS | 3,164.5100 | 3,235.5710 | 3,211.2320 |
| QA | 8,354.3070 | 8,541.9080 | 8,477.6520 |
| QSTD | 6,237.0170 | 6,501.4760 | 6,436.7090 |
| MN | 0.0433 | 0.0380 | 0.0381 |
| CS | 0.0141 | 0.0120 | 0.0098 |

| | | | |
|---|---|---|---|
| ZIS | 0.9833 | 0.9733 | 0.9690 |
| AS | 2.6400 | 2.6400 | 2.6400 |
| CP | 0.8400 | 0.8400 | 0.8400 |
| E | 60.0000 | 60.0000 | 75.0000 |
| Y | 1.0180 | 1.0180 | 1.0180 |
| AN | 0.000340 | 0.000340 | 0.000340 |
| ZCO2 | 3.0000 | 2.3000 | 2.5000 |
| ZO2 | 17.4000 | 18.1000 | 18.0000 |
| PMR | 0.7538 | 0.6683 | 0.5385 |

| Time | Cumulative Weight Scale | inches $H_2O$ | inches Hg | Cumulative Weight Scale | | |
|---|---|---|---|---|---|---|
| | | | 15 min | 30 min | 45 min | 1 |
| [illegible] | 67176 | | 701 | | | |
| [illegible] | 67877 | | 623 | 1324 | | |
| [illegible] | [illegible] | | | | | |
| [illegible] | [illegible] | | | | 1934 | |
| [illegible] | [illegible] | | | | | |
| [illegible] | [illegible] | | 764 | Test I | | |
| [illegible] | 71289 | 6.0-2.5 | | 757/1521 | | |
| [illegible] | 72[illegible] | 5.6-2.4 | | | 1045/2614 | |
| | | | | | | 1003/3637 |
| 10 [illegible] | 73405 | 6.2-2.8 | | | | |
| 10 [illegible] | 73950 | 6.2-2.8 | 551 | | | |
| 13 [illegible] | 7176[illegible] | 6.2-2.8 | | [illegible]/[illegible]7 | | |
| [illegible] | 75[illegible] | | | | 323/1280 | |
| | | | | | | 37/[illegible] |
| 11 [illegible] | 75172 | | | | | |
| [illegible] | [illegible] | | 328 | | | |
| 15 [illegible] | 75721 | | | 224/552 | | |
| [illegible] | | | | | | |
| 11 [illegible] | 76309 | | | | | |

# Test II

8-29-84

| | Wt. scale | Wt. | Inch $H_2O$ | Inch Hg |
|---|---|---|---|---|
| 11:40 a.m. | 76309 | | 4.8 | 2.4 |
| 11:55 | 76866 | 557 | 4.6 | 2.5 |
| 12:10 | 77466 | 600/1157 | 4.8 | 2.4 |
| 12:25 | 78012 | 546/1703 | 4.8 | 2.4 |
| 12:40 | 79155 | 1143/2846 | 4.8 | 2.4 |

Test III

| | | | | |
|---|---|---|---|---|
| 1:30 p.m. | 80600 | | 6.2 | 2.4 |
| 1:45 p.m. | 81100 | 500 | 5.8 | 2.4 |
| 2:00 p.m. | 81500 | 400/900 | 5.8 | 2.4 |
| 2:15 p.m. | 81868 | 368/1268 | 6.2 | 2.4 |
| 2:30 p.m. | 83132 | 1264/2532 | 5.8 | 2.4 |
| 2:45 | 83566 | 434/2966 | 5.2 | 2.4 |
| 3:00 | 84666 | 1100/4000 | 5.4 | 2.4 |

## Run #1

Oil Moisture - 28%
% Cake Solids - 14.5%
% Volatiles - 63%

## Run #2

Oil Moisture - 29%
% Cake Solids - 15%
% Volatiles - 63%

## Run #3

Oil Moisture - 31%
% Cake Solids - 14.5%
% Volatiles - 66%

Specific Gravity of Oil = 0.77

~~Density Oil =~~

Oil Usage ~~300~~ 304 gallons in 5 hrs

**EMI** CONSULTANTS

DESIGN CALCULATIONS

| DESCRIPTION | | | DATE |
|---|---|---|---|
| MARYVILLE SEWAGE SLUDGE INCINERATOR | | | 9/7/84 |
| PROJECT NO. | MADE BY MPB | CHECKED BY | SHEET NO ____ OF ____ |

SLUDGE RATES:

TEST NO.1 - (9:30-10:30) -

74,762 - 71,289 = 3473 lbs (wet)

3473 lbs/HR x .145 solids = 504 lbs/HR (DRY)

OIL - 304 GALLONS/5 HRS x .77 x 8.34 lbs/gal = 390 lbs/HR

Note- 390 lbs/HR oil sludge - All tests.

DRY OIL SLUDGE = 390 lbs/HR x .72 solids = 281 lbs/HR

∴ TOTAL DRY RATE TEST NO. 1

= 504 lbs/HR + 281 = 785 lbs/HR

= 0.3925 TPH

TEST NO.2 - Use 11:40 to 12:40

79,155 - 76,309 = 2846 lbs/HR (wet)

& 2846 lbs/HR x .15 solids = 427 lbs/HR (DRY)

OIL = 390 lbs/HR (WET)

OIL = 390 x .71 = 277 lbs/HR (DRY)

TOTAL = 277 + 427 = 704 lbs/HR (DRY)

= 0.352 TPH (DRY)

**EMI** CONSULTANTS

DESIGN CALCULATIONS

| DESCRIPTION | | | DATE |
|---|---|---|---|
| MARYVILLE SEWAGE SLUDGE INCINERATOR | | | 9/7/84 |
| PROJECT NO. | MADE BY MPB | CHECKED BY | SHEET NO 2 OF 2 |

TEST NO.3 (Use 1:30 - 3:00)

84,666 - 80600 = 4066 LBS in 1.5 HR (wet)

4066 / 1.5 = 2711 lbs/HR (wet)

OIL - 390 lbs/HR (wet)

390 lbs/HR x .69 solids = 269 lbs/HR (dry)

SEWAGE - 2711 lbs/HR x .145 (solids) = 393 lbs/HR (DRY)

TOTAL = 393 + 269 = 662 lbs/HR (Dry)

= 0.331 TPH (Dry)

## ORSAT ANALYSIS FORM

Date 8/29/84

Client MRWTP

Process Incinerator

Sample Technique Grab

Analyzed By JC

COMMENTS: Molecular wt. only

| Run # | $CO_2$ | $CO_2 + O_2$ | $CO_2 + O_2 + CO$ | $O_2$ | CO | $N_2$ (By difference) | Leak Check |
|---|---|---|---|---|---|---|---|
| 1 | 3.0 | 20.4 | | 17.4 | | | ✓ |
| | 3.0 | 20.4 | | 17.4 | | | |
| Ave | 3.0 | | | 17.4 | | 79.6 | |
| | | | | | | | |
| 2 | 2.3 | 20.4 | | 18.1 | | | |
| | 2.3 | 20.4 | | 18.1 | | | |
| Ave | 2.3 | | | 18.1 | | 79.6 | |
| | | | | | | | |
| 3 | 2.5 | 20.4 | | 17.9 | | | |
| | 2.4 | 20.4 | | 18.0 | | | |
| Ave | 2.5 | | | 18.0 | | 79.5 | ✓ |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

ENVIRO - MEASURE, INC.
*Consulting Engineers*

3028 MAGNOLIA AVE
P. O. BOX 2511
KNOXVILLE, TN 37901-9990

# CHAIN OF CUSTODY

| CLIENT | PROJECT NUMBER | PLANT NAME |
|---|---|---|
| Maryville Utilities | | Maryville Waste Incinerato. |
| **LABORATORY** | **TYPE OF SAMPLE** | **SAMPLING LOCATION** |
| EMI | Particulate | Incinerator Stack |

| | | |
|---|---|---|
| Run No. 1 | Run No. 2 | Run No. 3 |
| Filter No. 8436 | Filter No. 8437 | Filter No. 8438 |
| Acetone No. 1 | Acetone No. 2 | Acetone No. 3 |
| Sample Recovery: | Sample Recovery: | Sample Recovery: |
| By Michael Mowery | By Michael Mowery | By Michael Mowery |
| Date 8-29-84 | Date 8-29-84 | Date 8-29-84 |
| Samples Received in Laboratory: | Samples Received in Laboratory: | Samples Received in Laboratory: |
| By Susan Mowery | By Susan Mowery | By Susan Mowery |
| Date 8/29/84 | Date 8/29/84 | Date 8/29/84 |
| Samples Handled in Laboratory: | Samples Handled in Laboratory: | Samples Handled in Laboratory: |
| By Susan Mowery | By Susan Mowery | By Susan Mowery |
| Date 8/30/84 | Date 8/30/84 | Date 8/30/84 |
| Time | Time | Time |
| Laboratory Report Received: | Laboratory Report Received: | Laboratory Report Received: |
| By Michael Mowery | By Michael Mowery | By Michael Mowery |
| Date 8-31-84 | Date 8-31-84 | Date 8-31-84 |

COMMENTS:

CLIENT Maryville Waste SOURCE Waste Incinerator

RUN NO. 1
DATE 3-29-84
OPERATORS MM/JC
METER BOX NO. 4
SAMPLE BOX NO. #1
FILTER NO. 3436
PROBE HEATER SETTING 60%

BAROMETRIC PRESSURE 29.13
STATIC PRESSURE -0-
AMBIENT TEMPERATURE 70
PROBE LENGTH 8'6"
PROBE LINER 3S
PORT LENGTH 11'9½"
PORT DIAMETER 4"

SCHEMATIC OF STACK

| TRAVERSE POINT NUMBER | SAMPLING TIME CLOCK | SAMPLING TIME SAMPLE | VELOCITY HEAD (ΔP) | √(ΔP) | ORIFICE METER (ΔH) in. H₂O ACTUAL | ORIFICE METER (ΔH) in. H₂O DESIRED | GAS SAMPLE TEMP. AT DRY GAS METER INLET (Tm) °F | GAS SAMPLE TEMP. AT DRY GAS METER OUTLET (Tm) °F | PUMP VACUUM GAUGE in. Hg | SAMPLE BOX TEMP. °F | TEMP. OF GAS LEAVING LAST IMPINGER °F | GAS SAMPLE VOLUME (Vm) | STACK TEMP. (Ts) °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9:24 | 00 | 1.05 | | 3.80 | 3.80 | 83 | 76 | 7 | 275 | 73 | 235.10 | 175 |
| 2 | | 2.5 | 1.05 | | 3.80 | 3.80 | 91 | 77 | 7 | 275 | 73 | 237.61 | 177 |
| 3 | | 5.0 | 0.98 | | 3.60 | 3.60 | 99 | 79 | 6 | 275 | 79 | 240.20 | 177 |
| 4 | | 7.5 | 0.90 | | 3.25 | 3.25 | 100 | 79 | 6 | 275 | 75 | 243.02 | 179 |
| 5 | | 10.0 | 0.75 | | 2.75 | 2.75 | 105 | 81 | 5 | 245 | 75 | 241.07 | 181 |
| 6 | | 12.5 | 0.66 | | 2.40 | 2.40 | 106 | 82 | 4 | 250 | 75 | 247.35 | 184 |
| 7 | | 15.0 | 0.56 | | 2.05 | 2.05 | 107 | 83 | 4 | 275 | 76 | 249.15 | 191 |
| 8 | | 17.5 | 0.53 | | 1.90 | 1.90 | 107 | 84 | 3.5 | 260 | 76 | 251.10 | 207 |
| 9 | | 20.0 | 0.53 | | 1.90 | 1.90 | 109 | 87 | 3.5 | 260 | 75 | 25292 | 210 |
| 10 | | 22.5 | 0.50 | | 1.80 | 1.80 | 109 | 87 | 3.5 | 265 | 75 | 254.81 | 216 |
| 11 | | 25.0 | 0.49 | | 1.75 | 1.75 | 109 | 89 | 3.0 | 245 | 72 | 256.55 | 211 |
| 12 | | 27.5 | 0.47 | | 1.70 | 1.70 | 109 | 89 | 3.0 | 230 | 72 | 258.25 | 212 |
| 13 | | 30.0 | 0.81 | | 2.95 | 2.95 | 105 | 91 | 6.0 | 240 | 73 | 259.95 | 196 |
| 14 | | 32.5 | 0.85 | | 3.10 | 3.10 | 109 | 92 | 6.0 | 230 | 64 | 262.23 | 199 |
| 15 | | 35.0 | 0.74 | | 2.70 | 2.70 | 111 | 93 | 5.5 | 240 | 64 | 264.52 | 206 |
| 16 | | 37.5 | 0.67 | | 2.45 | 2.45 | 111 | 93 | 5.5 | 230 | 65 | 266.65 | 201 |
| 17 | | 40.0 | 0.64 | | 2.30 | 2.30 | 113 | 94 | 5.0 | 240 | 66 | 268.80 | 201 |
| 18 | | 42.5 | 0.62 | | 2.25 | 2.25 | 115 | 95 | 5.0 | 230 | 66 | 271.02 | 202 |
| 19 | | 45.0 | 0.62 | | 2.25 | 2.25 | 115 | 95 | 45.0 | 235 | 66 | 272.90 | 20 |
| 20 | | 47.5 | 0.61 | | 2.45 | 2.45 | 115 | 96 | 5.0 | 275 | 68 | 275.00 | 183 |
| 21 | | 50.0 | 0.70 | | 2.55 | 2.55 | 116 | 96 | 5.0 | 270 | 68 | 276.90 | 175 |
| 22 | | 52.5 | 0.72 | | 2.60 | 2.60 | 116 | 96 | 5.5 | 250 | 67 | 278.9 | 176 |
| 23 | | 55.0 | 0.68 | | 2.50 | 2.50 | 116 | 96 | 5.5 | 230 | 67 | 281.0 | 172 |
| 24 | | 57.5 | 0.63 | | 2.30 | 2.30 | 117 | 97 | 5.0 | 250 | 68 | 283.15 | 173 |
| stop | 10:30 | 60.0 | | | | | | | | | | 285.13 | |
| TOTAL | | | 14.96 | | 61.10 | | 4720 | | | | | 50.03 | 45 |
| AVERAGE | | | 0.83 | | 2.545 | | 99.2 | | | | | | 191 |

| | |
|---|---|
| STATIC PITOT LEAK-CHECK @ 15 sec. | OK |
| IMPACT PITOT LEAK-CHECK @ 15 sec. | OK |
| TRAIN LEAK RATE @ 60 sec: | 0.0 cf @ 15 in. |
| TRAIN LEAK RATE @ 60 sec: | 0.0 cf @ 12 in. |

STACK GAS ANALYSIS

| TIME | $CO_2$ | $O_2$ | CO | $N_2$ |
|---|---|---|---|---|
| | | ORSAT | | |

NOZZLE CALIBRATION I.D. NO. ____

| PRETEST | POST-TEST |
|---|---|
| DIA. 1 | DIA. 1 |
| DIA. 2 | DIA. 2 |
| DIA. 3 | DIA. 3 |
| AVERAGE 1/4" | AVERAGE |

ENVIRO - MEASURE, INC.
3028 MAGNOLIA AVE.
P. O. BOX 2511
KNOXVILLE, TN 37901

Consultants in Air Pollution

SIGNATURE Michael Mooney
TEST TEAM LEADER

SOURCE SAMPLING EPA PARTICULATE TEST LAB DATA SHEET

COMPANY Marysville Incinerator DATE Aug. 29, 1984.

SOURCE _____ BOX NO. B RUN NO. 1

## CONDENSATION

| IMPINGER NO. | INITIAL VOL., ml | FINAL VOL., ml | NET GAIN, ml |
|---|---|---|---|
| 1. | 100 | 127 | 27 |
| 2. | 100 | 114 | 14 |
| 3. | -0- | 5 | 5 |
| 4. | 200 ,g | 215.7 ,g | 15.7 ,g |
| TOTAL | 400 | 461.7 | 61.7 |

## PARTICULATE

| COMPONENT I.D. NO. | INITIAL WT., g | FINAL WT., g | NET WT., g |
|---|---|---|---|
| PROBE WASH | 8.9556 | 8.9643 | 0.0087 |
| ACETONE BLANK | 8.6909 | 8.6909 | -0- |
| PROBE WASH (-Blank) | | | 0.0087 |
| CYCLONE | ——— | ——— | ——— |
| FILTER | 0.3165 | 0.3511 | 0.0346 |
| IMPINGERS | ——— | ——— | ——— |

| | |
|---|---|
| PARTICULATE COLLECTED (excluding impinger catch) = | 0.0433 ,g |
| PARTICULATE COLLECTED (including impinger catch) = | ——— ,g |

COMMENTS: _____

SIGNATURE OF PERSON RESPONSIBLE Susan Mowery DATE 8/29/84

CLIENT Maryville Waste SOURCE Waste Incinerator

RUN NO. 2
DATE 9-29-84
OPERATORS MM/JC
METER BOX NO. 4
SAMPLE BOX NO. 2
FILTER NO. 2437
PROBE HEATER SETTING 60%

BAROMETRIC PRESSURE 29.13
STATIC PRESSURE
AMBIENT TEMPERATURE 75
PROBE LENGTH 6'
PROBE LINER SS
PORT LENGTH 9½"
PORT DIAMETER 4"

SCHEMATIC OF STACK

Eda

| TRAVERSE POINT NUMBER | SAMPLING TIME CLOCK | SAMPLING TIME SAMPLE | VELOCITY HEAD (Δ Ps) | (√Δ Ps) | ORIFICE METER (ΔH) in. H2O ACTUAL | DESIRED | GAS SAMPLE TEMP. AT DRY GAS METER INLET (Tm in) °F | OUTLET (Tm out) °F | PUMP VACUUM GAUGE in. Hg. | SAMPLE BOX TEMP. °F | TEMP. OF GAS LEAVING LAST IMPINGER °F | GAS SAMPLE VOLUME (Vm), ft³ | STACK TEMP. (Ts) °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11:40 | 00 | 1.10 | | 4.0 | 4.0 | 89 | 86 | 6 | 250 | 66 | 285.33 | 171 |
| 2 | | 2.5 | 1.10 | | 4.0 | 4.0 | 97 | 87 | 6 | 250 | 66 | 287.95 | 170 |
| 3 | | 5.0 | 1.05 | | 3.80 | 3.80 | 103 | 87 | 6 | 245 | 65 | 290.50 | 170 |
| 4 | | 7.5 | 0.93 | | 3.35 | 3.35 | 107 | 89 | 5.5 | 250 | 66 | 293.22 | 172 |
| 5 | | 10.0 | 0.79 | | 2.85 | 2.85 | 109 | 90 | 4.5 | 270 | 67 | 295.80 | 174 |
| 6 | | 12.5 | .070 | | 2.55 | 2.55 | 110 | 91 | 4.0 | 260 | 66 | 298.80 | 179 |
| 7 | | 15.0 | .056 | | 2.05 | 2.05 | 110 | 91 | 3.5 | 250 | 67 | 300.0 | 198 |
| 8 | | 17.5 | 0.53 | | 1.90 | 1.90 | 110 | 91 | 3.5 | 245 | 67 | 302.0 | 198 |
| 9 | | 20.0 | 0.53 | | 1.90 | 1.90 | 108 | 91 | 3.5 | 255 | 67 | 303.90 | 201 |
| 10 | | 22.5 | 0.52 | | 1.85 | 1.85 | 107 | 93 | 3.0 | 260 | 67 | 305.53 | 202 |
| 11 | | 25.0 | 0.50 | | 1.80 | 1.80 | 107 | 93 | 3.0 | 260 | 67 | 307.45 | 202 |
| 12 | | 27.5 | 0.48 | | 1.75 | 1.75 | 107 | 93 | 3.0 | 265 | 67 | 309.15 | 201 |
| 13 | | 30.0 | 0.87 | | 3.15 | 3.15 | 103 | 93 | 5.5 | 270 | 68 | 310.90 | 190 |
| 14 | | 32.5 | 0.85 | | 3.10 | 3.10 | 104 | 93 | 5.5 | 275 | 63 | 313.32 | 190 |
| 15 | | 35.0 | 0.78 | | 2.80 | 2.80 | 111 | 95 | 5.0 | 270 | 63 | 315.65 | 190 |
| 16 | | 37.5 | 0.73 | | 2.65 | 2.65 | 111 | 95 | 5.0 | 265 | 63 | 317.90 | 192 |
| 17 | | 40.0 | 0.68 | | 2.50 | 2.50 | 112 | 96 | 5.0 | 260 | 64 | 320.10 | 192 |
| 18 | | 42.5 | 0.65 | | 2.35 | 2.35 | 112 | 96 | 4.5 | 260 | 64 | 322.25 | 194 |
| 19 | | 45.0 | 0.68 | | 2.50 | 2.50 | 113 | 96 | 5.0 | 265 | 64 | 324.25 | 193 |
| 20 | | 47.5 | 0.73 | | 2.65 | 2.65 | 113 | 97 | 5.0 | 260 | 64 | 326.40 | 175 |
| 21 | | 50.0 | 0.78 | | 2.80 | 2.80 | 113 | 97 | 5.5 | 265 | 66 | 328.47 | 175 |
| 22 | | 52.5 | 0.80 | | 2.90 | 2.90 | 113 | 98 | 5.5 | 265 | 66 | 330.80 | 170 |
| 23 | | 55.0 | 0.72 | | 2.60 | 2.60 | 114 | 98 | 5.5 | 270 | 66 | 332.95 | 169 |
| 24 | | 57.5 | 0.70 | | 2.55 | 2.55 | 114 | 98 | 5.0 | 270 | 66 | 335.10 | 169 |
| | 12:45 | 60.0 | | | | | | | | | | 337.12 | |
| TOTAL | | | 20.50 | | 64.35 | | 4831 | | | | | 51.79 | 4437 |
| AVERAGE | | | 0.854 | | 2.681 | | 100.64 | | | | | | 184.87 |

STATIC PITOT LEAK-CHECK @ 15 sec. OK
IMPACT PITOT LEAK-CHECK @ 15 sec. OK
TRAIN LEAK RATE @ 60 sec: 0.0 cf @ 15 in.
TRAIN LEAK RATE @ 60 sec: cf @ in.

STACK GAS ANALYSIS

| TIME | CO2 | O2 | CO | N2 |
|---|---|---|---|---|
| | | ORSAT | | |
| | | | | |
| | | | | |

NOZZLE CALIBRATION I.D. NO.

| PRETEST | POST-TEST |
|---|---|
| DIA. 1 | DIA. 1 |
| DIA. 2 | DIA. 2 |
| DIA. 3 | DIA. 3 |
| AVERAGE 1/4" | AVERAGE |

ENVIRO - MEASURE, INC.
3028 MAGNOLIA AVE.
P. O. BOX 2511
KNOXVILLE, TN 37901

EMI Consultants in Air Pollution

SIGNATURE Michael Mason
TEST TEAM LEADER

SOURCE SAMPLING EPA PARTICULATE TEST LAB DATA SHEET

COMPANY Maryville Incinerator DATE Aug. 29, 1984

SOURCE J BOX NO. C RUN NO. 2

## CONDENSATION

| IMPINGER NO. | INITIAL VOL., ml | FINAL VOL., ml | NET GAIN, ml |
|---|---|---|---|
| 1. | 100 | 128 | 28 |
| 2. | 100 | 110 | 10 |
| 3. | -0- | 2 | 2 |
| 4. | 200 ,g | 212.7 ,g | 12.7 ,g |
| TOTAL | 400 | 452.7 | 52.7 |

## PARTICULATE

| COMPONENT I.D. NO. | INITIAL WT., g | FINAL WT., g | NET WT., g |
|---|---|---|---|
| PROBE WASH | 8.9569 | 8.9624 | 0.0055 |
| ACETONE BLANK | 8.6909 | 8.6909 | -0- |
| PROBE WASH (-Blank) | | | 0.0055 |
| CYCLONE | | | |
| FILTER | 0.3155 | 0.3480 | 0.0325 |
| IMPINGERS | | | |

| | |
|---|---|
| PARTICULATE COLLECTED (excluding impinger catch) = | 0.0380 ,g |
| PARTICULATE COLLECTED (including impinger catch) = | ,g |

COMMENTS:

SIGNATURE OF PERSON RESPONSIBLE Susan Mowery DATE 8/29/84

CLIENT Maryville Waste SOURCE Waste Incinerator

RUN NO. 3
DATE 8-29-84
OPERATORS mm/JC
METER BOX NO. 4
SAMPLE BOX NO. 3
FILTER NO.
PROBE HEATER SETTING 600

BAROMETRIC PRESSURE 29.13
STATIC PRESSURE
AMBIENT TEMPERATURE 80°
PROBE LENGTH 6'
PROBE LINER SS
PORT LENGTH 9½"
PORT DIAMETER 4"

SCHEMATIC OF STACK

| TRAVERSE POINT NUMBER | SAMPLING TIME CLOCK | SAMPLING TIME SAMPLE | VELOCITY HEAD (Δ Ps) | VELOCITY HEAD (√Δ Ps) | ORIFICE METER (ΔH) in. H2O ACTUAL | ORIFICE METER (ΔH) in. H2O DESIRED | GAS SAMPLE TEMP. AT DRY GAS METER INLET (Tm in) °F | GAS SAMPLE TEMP. AT DRY GAS METER OUTLET (Tm out) °F | PUMP VACUUM GAUGE in. Hg | SAMPLE BOX TEMP. °F | TEMP. OF GAS LEAVING LAST IMPINGER °F | GAS SAMPLE VOLUME (Vm), ft.³ | STACK TEMP. (Ts) °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1:30 | 00 | 1.10 | | 4.0 | 4.0 | 92 | 91 | 5 | 230 | 72 | 337.31 | 170 |
| 2 | | 2.5 | 1.10 | | 4.0 | 4.0 | 94 | 91 | 5 | 245 | 72 | 339.85 | 169 |
| 3 | | 5.0 | 1.05 | | 3.80 | 3.80 | 109 | 93 | 5 | 250 | 71 | 342.31 | 170 |
| 4 | | 7.5 | 0.92 | | 3.30 | 3.30 | 115 | 94 | 4.5 | 260 | 70 | 345.12 | 173 |
| 5 | | 10.0 | 0.75 | | 2.75 | 2.75 | 116 | 94 | 4.0 | 270 | 70 | 347.65 | 176 |
| 6 | | 12.5 | 0.68 | | 2.45 | 2.45 | 118 | 95 | 3.5 | 265 | 70 | 349.62 | 180 |
| 7 | | 15.0 | 0.61 | | 2.25 | 2.25 | 118 | 95 | 3.0 | 260 | 70 | 351.70 | 182 |
| 8 | | 17.5 | 0.57 | | 2.10 | 2.10 | 119 | 96 | 2.5 | 250 | 69 | 353.77 | 197 |
| 9 | | 20.0 | 0.53 | | 1.90 | 1.90 | 119 | 97 | 2.5 | 245 | 69 | 355.70 | 198 |
| 10 | | 22.5 | 0.51 | | 1.85 | 1.85 | 119 | 98 | 2.5 | 255 | 70 | 357.55 | 198 |
| 11 | | 25.0 | 0.48 | | 1.75 | 1.75 | 118 | 101 | 2.5 | 250 | 70 | 359.35 | 197 |
| 12 | | 27.5 | 0.48 | | 1.75 | 1.75 | 118 | 101 | 2.5 | 255 | 71 | 361.20 | 198 |
| 13 | | 30.0 | 0.86 | | 3.15 | 3.15 | 115 | 100 | 2.5 | 260 | 70 | 362.84 | 189 |
| 14 | | 32.5 | 0.87 | | 3.20 | 3.20 | 117 | 100 | 2.5 | 270 | 68 | 365.42 | 188 |
| 15 | | 35.0 | 0.77 | | 2.80 | 2.80 | 119 | 101 | 2.0 | 280 | 67 | 367.8 | 191 |
| 16 | | 37.5 | 0.73 | | 2.65 | 2.65 | 121 | 105 | 2.0 | 275 | 68 | 369.75 | 193 |
| 17 | | 40.0 | 0.65 | | 2.40 | 2.40 | 125 | 105 | 2.0 | 260 | 69 | 371.95 | 192 |
| 18 | | 42.5 | 0.63 | | 2.30 | 2.30 | 126 | 105 | 2.0 | 260 | 69 | 374.25 | 195 |
| 19 | | 45.0 | 0.65 | | 2.35 | 2.35 | 127 | 105 | 2.0 | 270 | 69 | 376.20 | 192 |
| 20 | | 47.5 | 0.70 | | 2.55 | 2.55 | 128 | 106 | 2.0 | 265 | 70 | 378.10 | 175 |
| 21 | | 50.0 | 0.75 | | 2.70 | 2.70 | 128 | 106 | 2.0 | 270 | 70 | 380.2 | 173 |
| 22 | | 52.5 | 0.80 | | 2.90 | 2.90 | 128 | 107 | 2.0 | 265 | 70 | 382.4 | 175 |
| 23 | | 55.0 | 0.78 | | 2.80 | 2.80 | 128 | 107 | 2.0 | 260 | 70 | 384.5 | 171 |
| 24 | 1:33 / 40 | 57.5 | 0.73 | | 2.65 | 2.65 | 127 | 107 | 2.0 | 250 | 71 | 386.65 | 171 |
| stop | 2:13 | 60.0 | 0.94 | .84a | 3.45 | 3.45 | 114 | 106 | 5.0 | 250 | 70 | 388.76 | 190 |
| | 15 | 2.5 | 0.83 | | 3.05 | 3.05 | 117 | 107 | 5.0 | 240 | 70 | 390.75 | 188 |
| | 17 | 5.0 | 0.73 | | 2.65 | 2.65 | 123 | 107 | 4.5 | 255 | 70 | 393.45 | 190 |
| | 19 | 7.5 | 0.66 | | 2.40 | 2.40 | 124 | 108 | 4.0 | 260 | 69 | 395.70 | 189 |
| | 21 | 10.0 | 0.82 | | 3.0 | 3.0 | 125 | 108 | 4.5 | 265 | 69 | 398.0 | 175 |
| | 23 | 12.5 | 0.78 | | 2.8 | 2.8 | 126 | 108 | 4.0 | 270 | 70 | 400.15 | 168 |
| TOTAL | 2:55 | 15.0 | 20.968 | | 61.7 | | 6666 | | | | | 402.25 | 9413 |
| AVERAGE | | | 0.852 | | 2.723 | | 110.26 | | | | | 64.94 | 182.87 |

| | |
|---|---|
| STATIC PITOT LEAK-CHECK @ 15 sec. | OK |
| IMPACT PITOT LEAK-CHECK @ 15 sec. | OK |
| TRAIN LEAK RATE @ 60 sec: | 0.0 cf @ 15 in. |
| TRAIN LEAK RATE @ 60 sec: | cf @ in. |

STACK GAS ANALYSIS

| TIME | CO2 | O2 | CO | N2 |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

NOZZLE CALIBRATION I.D. NO.

| PRETEST | POST-TEST |
|---|---|
| DIA. 1 | DIA. 1 |
| DIA. 2 | DIA. 2 |
| DIA. 3 | DIA. 3 |
| AVERAGE ¼" | AVERAGE |

ENVIRO - MEASURE, INC.
3028 MAGNOLIA AVE.
P. O. BOX 2511
KNOXVILLE, TN 37901

EMI Consultants in Air Pollution

SIGNATURE Michael Mowry
TEST TEAM LEADER

# SOURCE SAMPLING EPA PARTICULATE TEST LAB DATA SHEET

COMPANY Marysville Incinerator DATE Aug. 29, 1984

SOURCE ~~J~~ BOX NO. D RUN NO. 3

## CONDENSATION

| IMPINGER NO. | INITIAL VOL., ml | FINAL VOL., ml | NET GAIN, ml |
|---|---|---|---|
| 1. | 100 | 140 | 40 |
| 2. | 100 | 111 | 11 |
| 3. | -0- | 5 | 5 |
| 4. | 200 ,g | 214.3 ,g | 14.3 ,g |
| TOTAL | 400 | 470.3 | 70.3 |

## PARTICULATE

| COMPONENT I.D. NO. | INITIAL WT., g | FINAL WT., g | NET WT., g |
|---|---|---|---|
| PROBE WASH | 0.7758 | 0.7795 | 0.0037 |
| ACETONE BLANK | 0.6909 | 0.6909 | -0- |
| PROBE WASH (-Blank) | | | 0.0037 |
| CYCLONE | | | |
| FILTER | 0.3156 | 0.3500 | 0.0344 |
| IMPINGERS | | | |

| | |
|---|---|
| PARTICULATE COLLECTED (excluding impinger catch) = | 0.0381 ,g |
| PARTICULATE COLLECTED (including impinger catch) = | ,g |

COMMENTS:

SIGNATURE OF PERSON RESPONSIBLE Susan Mowry DATE 8/29/84

## SAMPLE CALCULATIONS–TEST 1

### VOLUME OF WATER COLLECTED

VWSTD = (VLO)(0.0474)
VWSTD = 61.7 * .0474
VWSTD = 2.92458

### VOLUME OF GAS METERED, STANDARD CONDITIONS

VMSTD = ((17.71)(VM)(PB + H / 13.6)(Y)) / TM
VMSTD = ( 17.71 * 50.03 * ( 29.13 + 2.545 / 13.6 ) * 1.018 ) / 558
VMSTD = 47.38972

### MOISTURE CONTENT

BWO = VWSTD / (VMSTD + VWSTD)
BWO = 2.92458 / 47.38972 + 2.92458
BWO = 5.812623E-02

### MOLECULAR WEIGHT OF DRY GAS STREAM

MD = (0.44)(%CO2) + (.32)(%O2) + (0.28)(%CO + %N2)
MD = .44 * 3 + .32 * 17.4 + .28 *( 0 + 79.6 )
MD = 29.176

### MOLECULAR WEIGHT OF STACK GAS

MS = MD(1 - BWO) + 18(BWO)
MS = 29.176 *( 1 - 5.812623E-02 ) + 18 * 5.812623E-02
MS = 28.52638

### VELOCITY OF STACK GAS

VS = 174 * CP * P * SQR (TS * (29.92 / PS) * (28.96 / MS))
VS = 174 * .84 * .831 *SQR( 651 *( 29.92 / 29.13 )*( 28.96 / 28.52638 ))
VS = 3164.51

### TOTAL FLOW OF STACK GAS

QA = AS * VS
QA = 2.64 * 3164.51
QA = 8354.307
QS = QA * (530 / TSR) * (PS / 29.92)
QS = 8354.307 * ( 530 / 651 )*( 29.13 / 29.92 )
QS = 6621.924
QSTD = QS(1 - BWO)
QSTD = 6621.924 ( 1 - 5.812623E-02 )
QSTD = 6237.017

PARTICULATE CONCENTRATION

CS = (15.43)(MN) / VMSTD
CS = ( 15.43 * .0433 ) / 47.38972
CS = .0140984

PARTICULATE MASS RATE

PMR = (MN)(QSTD)(60) / (VMSTD)(453.6)
PMR = ( .0433 * 6237.017 * 60 ) / ( 47.38972 * 453.6 )
PMR = .7538048

PERCENT ISOKINETIC OF TEST

IS = VMSTD / (AN * E * VSSTD)
IS = 47.38972 / ( .00034 * 60 * 2362.506 )
IS = .9832886

SAMPLE CALCULATIONS-TEST 2

VOLUME OF WATER COLLECTED

VWSTD = (VLO)(0.0474)
VWSTD = 52.7 * .0474
VWSTD = 2.49798

VOLUME OF GAS METERED, STANDARD CONDITIONS

VMSTD = ((17.71)(VM)(PB + H / 13.6)(Y)) / TM
VMSTD = ( 17.71 * 51.79 * ( 29.13 + 2.681 / 13.6 ) * 1.018 ) / 560
VMSTD = 48.89831

MOISTURE CONTENT

BWO = VWSTD / (VMSTD + VWSTD)
BWO = 2.49798 / 48.89831 + 2.49798
BWO = 4.860235E-02

MOLECULAR WEIGHT OF DRY GAS STREAM

MD = (0.44)(%CO2) + (.32)(%O2) + (0.28)(%CO + %N2)
MD = .44 * 2.3 + .32 * 18.1 + .28 *( 0 + 79.6 )
MD = 29.092

MOLECULAR WEIGHT OF STACK GAS

MS = MD(1 - BWO) + 18(BWO)
MS = 29.092 *( 1 - 4.860235E-02 ) + 18 * 4.860235E-02
MS = 28.5529

VELOCITY OF STACK GAS

VS = 174 * CP * P * SQR (TS * (29.92 / PS) * (28.96 / MS))
VS = 174 * .84 * .854 *SQR( 645 *( 29.92 / 29.13 )*( 28.96 / 28.5529 ))
VS = 3235.571

TOTAL FLOW OF STACK GAS

QA = AS * VS
QA = 2.64 * 3235.571
QA = 8541.908
QS = QA * (530 / TSR) * (PS / 29.92)
QS = 8541.908 * ( 530 / 645 )*( 29.13 / 29.92 )
QS = 6833.605
QSTD = QS(1 - BWO)
QSTD = 6833.605 ( 1 - 4.860235E-02 )
QSTD = 6501.476

PARTICULATE CONCENTRATION

CS = (15.43)(MN) / VMSTD
CS = ( 15.43 * .038 ) / 48.89831
CS = 1.199101E-02

PARTICULATE MASS RATE

PMR = (MN)(QSTD)(60) / (VMSTD)(453.6)
PMR = ( .038 * 6501.476 * 60 ) / ( 48.89831 * 453.6 )
PMR = .668313

PERCENT ISOKINETIC OF TEST

IS = VMSTD / (AN * E * VSSTD)
IS = 48.89831 / ( .00034 * 60 * 2462.68 )
IS = .9733201

## SAMPLE CALCULATIONS–TEST 3

### VOLUME OF WATER COLLECTED

VWSTD = (VLO)(0.0474)
VWSTD = 70.3 * .0474
VWSTD = 3.33222

### VOLUME OF GAS METERED, STANDARD CONDITIONS

VMSTD = ((17.71)(VM)(PB + H / 13.6)(Y)) / TM
VMSTD = ( 17.71 * 64.94 * ( 29.13 + 2.723 / 13.6 ) * 1.018 ) / 570
VMSTD = 60.24474

### MOISTURE CONTENT

BWO = VWSTD / (VMSTD + VWSTD)
BWO = 3.33222 / 60.24474 + 3.33222
BWO = 5.241239E-02

### MOLECULAR WEIGHT OF DRY GAS STREAM

MD = (0.44)(%CO2) + (.32)(%O2) + (0.28)(%CO + %N2)
MD = .44 * 2.5 + .32 * 18 + .28 *( 0 + 79.5 )
MD = 29.12

### MOLECULAR WEIGHT OF STACK GAS

MS = MD(1 - BWO) + 18(BWO)
MS = 29.12 *( 1 - 5.241239E-02 ) + 18 * 5.241239E-02
MS = 28.53717

### VELOCITY OF STACK GAS

VS = 174 * CP * P * SQR (TS * (29.92 / PS) * (28.96 / MS))
VS = 174 * .84 * .848 *SQR( 644 *( 29.92 / 29.13 )*( 28.96 / 28.53717 ))
VS = 3211.232

### TOTAL FLOW OF STACK GAS

QA = AS * VS
QA = 2.64 * 3211.232
QA = 8477.652
QS = QA * (530 / TSR) * (PS / 29.92)
QS = 8477.652 * ( 530 / 644 )*( 29.13 / 29.92 )
QS = 6792.732
QSTD = QS(1 - BWO)
QSTD = 6792.732 ( 1 - 5.241239E-02 )
QSTD = 6436.709

PARTICULATE CONCENTRATION

CS = (15.43)(MN) / VMSTD
CS = ( 15.43 * .0381 ) / 60.24474
CS = 9.758247E-03

PARTICULATE MASS RATE

PMR = (MN)(QSTD)(60) / (VMSTD)(453.6)
PMR = ( .0381 * 6436.709 * 60 ) / ( 60.24474 * 453.6 )
PMR = .5384532

PERCENT ISOKINETIC OF TEST

IS = VMSTD / (AN * E * VSSTD)
IS = 60.24474 / ( .00034 * 75 * 2438.147 )
IS = .9689895

8 Item #2 – Sept. 11 Correspondence

IT CORPORATION

# IT ANALYTICAL SERVICES

5815 Middlebrook Pike • Knoxville, Tennessee 37921 • 615-588-6401

## CERTIFICATE OF ANALYSIS

TO: Maryville Utilities
ATTN: Jimmy Burchfield
P. O. Box 667
Maryville, TN 37801

DATE REPORTED: September 18, 1984
PROJECT CODE: MUB 18534
ORDER NUMBER: 5655

Sample Description: One (1) oil sample and one (1) sludge sample received August 30, 1984

Concentration units are µg/gram (ppm)

| | Maryville Waste Oil Composite | Maryville Filter Cake Sludge Composite 8/29/84 |
|---|---|---|
| Lead | 10. | 23. |
| Mercury | <0.1 | 0.8 |

Sworn to and subscribed before me this 18th
day of September, 1984
My commission expires January 16, 1988

Notary Public

Approved by Alice K. Moore
Laboratory Manager
Title

Accredited by the American Association for Laboratory Accreditation in the chemical field of testing, as listed in the current AALA Directory of Accredited Laboratories

COMPLIANCE

**TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT**

**OFFICE CORRESPONDENCE**

| FROM | TO | DATE |
|---|---|---|
| | JWS | JWS 9/7 9-7-84 |
| | KEC | |
| | | |

DATE: September 7, 1984

TO: Company File

FROM: Heather Whitlow

SUBJECT: Stack Sampling at Maryville Utilities Board (05-0116-01-A3) NSPS

On August 29, 1984 the Maryville Utilities Board sewage sludge incinerator at Louisville, Tennessee was stack tested to measure particulate emissions. Condition number 7 of Construction Permit 992673I requires this sampling.

The source testing was performed by Enviro-Measure Inc. Carl Koontz, Jimmy Jones and I attended the sampling.

The sewage sludge incinerator is a Nichols multiple hearth unit. The plant burns waste rolling oil obtained from Alcoa.

The control device is a wet scrubber with a venturi throat followed by impingement plates. A new fan with capacity of 5500 acfm has replaced the existing fan to increase air flow velocity. The pressure drop across the venturi throat has been increased to approximately 34.3 inches of water (2.5 inches of Mercury). The pressure drop across the system was measured at an average of 5.6 inches of water. The emergency stack was closed during testing and all emissions were vented through the scrubbers and out the main stack.

During the testing period, sewage sludge with an average of 14.7% cake solids, 29.3% moisture and 64% volatiles was burned. The oil usage rate was 1 gal/min. The following parameters were monitored during testing by an employee of the Maryville Utilities Board.

| FROM | DATE |
|---|---|
| | |

10

1. Fuel burn rate
2. sewage sludge input rate
3. pressure drop across venturi throat
4. pressure drop across scrubber system
5. Hearth temperatures for each of 5 hearths
6. Moisture content, solids content and volatile content of representative samples during testing

The recordings are to be included in the test report. Also to be included are an analysis of the sewage sludge for mercury and lead content and an analysis of the waste oil for mercury and lead.

The process weight rate dropped significantly for a 10 minute period during the 3rd test run resulting in a 33% reduction in process weight rate for the testing period. The test was extended 15 minutes during which time the process input rate was increased resulting an acceptable input rate over the testing period.

ckh 5/3

PH-0001
SR 3/77

Tennessee Division of Air Pollution Control

INTERNAL REVIEW
METHOD 5 PARTICULATE TEST
SECTION I
(Review by Source Sampling)

A. GENERAL

1. Company MARYVILLE UTIL. BOARD Ref. No. 05-0116-01
2. Plant Contact JOHN CARSON Phone _____
3. Source(s) tested SEWAGE SLUDGE INCINERATOR
4. Type Control Device VENTURI SCRUBBER
5. Source Test Performed By ENVIRO-MEASURE
   Person In Charge of Test MIKE MOWERY
   Address KNOXVILLE, TN Phone _____
6. Date(s) Test(s) Actually Performed AUGUST 29, 1984
7. Test Observer CARL KOONTZ Process Observer HEATHER WHITLOW
8. Final Test Report Received: Date 9/21/84
9. Preliminary Review: By K.E. COOER Date 9/25/84
10. Requested Information: Item(s) _____
    Date _____ Phone _____ Letter _____ Other _____
    Received: Date _____

B. EVALUATION

1. Observers Evaluation/Waiver Letter Included
   Yes ✓ No _____
2. Field Test Accepted Yes ✓ No _____
3. Visible Emissions Read Yes ✓ No _____
   If yes, V.E. Observer JIMMY JONES
   copy in report ✓ copy attached _____
4. Calibration Data: Acceptable ✓ Unacceptable _____

5. Sampling Points

Sketch showing upstream/downstream distance from nearest flow disturbances. Yes ✓ No ____

Number of Points Required 24 Number of Points Used 24

* RW #3 used 30 PT

If Different, was Deviation Authorized? Yes ____ No ____

By ____ Date ____

Method: Letter ____ Observer ____

6. Calculations Correct Yes ✓ No ____.

If no, did Acceptability of Test Change? Yes ____ No ____

Person Checking Calculations Katherine E. Corder

(Complete calculation Sheet Appendix A and attach to this Report.

One set for each stack tested.)

7. Summary of Results

corrected to 12% CO2

| | % Isokinetic | Concentration | Mass Rate |
|---|---|---|---|
| Run 1 | 98.21 | 0.0565 | 0.7542 |
| Run 2 | 97.05 | 0.0628 | 0.6698 |
| Run 3 | 95.44 | 0.0469 | 0.5463 |
| Avg. | 96.90 % | 0.0554 gr/dscf | 0.6568 lb/hr |

8. Acceptable Method 5 Test Yes ✓ No ____

9. If Method 5 Test unacceptable, Give Details Below:

Source Sampling Evaluation
By: Katherine E. Corder
Date: 9/25/84

Approved By Section Chief
By: Jerel W. Stewart
Date: 9/26/84

Date Letter Sent ____

INTERNAL REVIEW

SECTION II

(Review by Engineering Program)

A. GENERAL

1. Company _____ Ref. No. _____

2. Process Observer _____ Test Date(s) _____

B. PROCESS INFORMATION

| | Run 1 | Run 2 | Run 3 | Avg. |
|---|---|---|---|---|
| 1. Allowable Emissions (#/hr) (#/MBTU) (#/100#) | | | | |
| 2. Process Weight | | | | |
| 3. Operating Rate Test Conditions (#/hr) (MBTU) | | | | |
| a. Design Rate | | | | |
| b. Percent of Design Rate | | | | |
| c. Acceptable Operating Rate | | | | |

C. STATEMENT OF INSPECTION PARAMETERS:

D. PERMIT CONDITIONS:

Company MARYVILLE UTILITIES BOARD Source SEWAGE SLUDGE INCIN. Date 8/29/84

| Store | 1 | 2 | 3 |
|---|---|---|---|
| 2 | 50.03 | 51.79 | 64.94 |
| 3 | 191 / 651 | 185 / 645 | 184 / 644 |
| 4 | 0.831 | 0.854 | 0.860 |
| 5 | 2.546 | 2.681 | 2.723 |
| 6 | 98 / 558 | 101 / 561 | 110 / 570 |
| 7 | 3.0 | 2.3 | 2.5 |
| 8 | 17.4 | 18.1 | 18.0 |
| 9 | 79.6 | 79.6 | 79.5 |
| 0 | 0.01 | 0.01 | 0.01 |
| I | 1.018 | 1.018 | 1.018 |
| B | 61.7 | 52.7 | 70.3 |
| C | 0.84 | 0.84 | 0.84 |
| f P> <S | | | |
| 0 | 60 | 60 | 75 |

1. Volume sampled $V_m$ ; $ft^3$.
2. Average stack temperature, $T_S$; $^oF/^oR$
3. Average $\overline{\sqrt{\Delta P}}$; in water
4. Average $\overline{\Delta H}$; in. water
5. Average temperature of meter, $T_m$; $^oF/^oR$
6. Per cent $CO_2$
7. Per cent $O_2$
8. Per cent $N_2$ + per cent CO
9. Stack gauge pressure in. $H_2O$, $P_S'$
10. Meter correction factor MCF
11. Volume liquid collected $V_{wc}$; ml
12. Pitot coefficient $C_p$
13. Total time in minutes $\theta_1$

f P> <S

COMMAND

| | | | |
|---|---|---|---|
| C | 29.13 | 29.13 | 29.13 |
| D | 2.64 | 2.64 | 2.64 |
| E | 0.2496 | 0.2496 | 0.2496 |

f P> <S

| | | | |
|---|---|---|---|
| STORE D | | | |
| COMMAND A | 0.0433 | 0.0380 | 0.0381 |

14. $P_{bar}$ (Barometric pressure); in. Hg
15. $A_s$ (area of stack); $ft^2$
16. $D_n$ (nozzle diameter); in.

ENTER CARD TWO

17. W (fuel burning); $10^6$ BTU
18. $M_n$ (part. catch); grams

Source Sampling Calculation

BY Katherine E. Corder

Approved By Section Chief

BY Jerold W. Stewart

Company: MARYVILLE UTILITIES BOARD Test Date(s): 8/29/84

Source: SEWAGE SLUDGE INCINERATOR

| | Stored | 1 | 2 | 3 | Avg. |
|---|---|---|---|---|---|
| 1. Volume of water vapor (68°F, 29.92 "Hg), ft³<br>$V_{w\ gas} = 0.04707 \times V_{wc}$<br>($V_{wc}$ = water catch of impinger; ml) | 1 | 2.9042 | 2.4806 | 3.3090 | 2.8979 |
| 2. Moisture in stack gas<br>$\%M = \frac{100 \times V_{w\ gas}}{V_{mstd} + V_{w\ gas}}$ | 2 | 5.7961 | 4.8545 | 5.2262 | 5.2923 |
| 3. Mole fraction of dry gas<br>$M_d = \frac{100 - \%M}{100}$ | 3 | 0.9420 | 0.9515 | 0.9477 | 0.9471 |
| 4. Molecular weight of dry stack gas<br>$MW_d = (\%CO_2 \times \frac{44}{100}) + (\%O_2 \times \frac{32}{100}) + (\%N_2 + \%CO)(28/100)$ | 4 | 29.18 | 29.09 | 29.12 | 29.13 |
| 5. Volume of dry gas sampled at standard conditions (68°F, 29.92 in. Hg): ft³<br>$V_{mstd} = (17.64)(\frac{V_m}{T_m - 460})(P_{Bar} + \frac{\Delta H}{13.6})(MCF)$<br>MCF = Meter Correction Factor | 5 | 47.2025 | 48.6182 | 60.0066 | 51.9424 |
| 6. Molecular Weight of stack gas<br>$MW = (MW_d)(M_d) + 18(1-M_d)$ | 6 | 28.53 | 28.55 | 28.54 | 28.54 |
| 7. Stack Pressure ($P_s$):<br>$P_s = P_{Bar} \pm \frac{P_s'}{13.6}$<br>$P_s$ = Absolute Pressure in Stack; in. Hg.<br>$P_s'$ = Stack gauge pressure, in. $H_2O$ | 7 | 29.13 | 29.13 | 29.13 | 29.13 |
| 8. Stack velocity (stack conditions); ft/min.<br>$V_s = (85.49)(C_p)(Avg.\sqrt{\Delta P})\sqrt{\frac{T_s + 460}{(P_s)(MW)}} \times 60$ | 8 | 3,169.01 | 3,240.24 | 3,246.32 | 3,223.52 |

Company MARYVILLE UTILITIES BOARD Test Date(s) 8/29/84

Source SEWAGE SLUDGE INCINERATOR

| | | Stored | 1 | 2 | 3 | Avg. |
|---|---|---|---|---|---|---|
| 9. | Stack gas volume (68°F, 29.92 "Hg), SCFM<br>$Q_s$ std = $\frac{(17.64)\ (V_s)\ (A_s)\ (M_d)\ (P_s)}{(T_s + 460)}$<br>($A_s$ = area of the stack; $ft^2$) | 9 | 6,221.09 | 6,484.26 | 6,511.03 | 6,405.[illegible] |
| 10. | Percent isokinetic<br>%I = $\frac{(1039)\ (T_s + 460)\ (V_{mstd})}{(V_s)\ (\Theta_1)\ (P_s)\ (M_d)\ (Dn)^2}$<br>($D_n$ = Nozzle diameter; in.) | D | 98.21 | 97.05 | 95.44 | 96.90 |
| 11. | Percent excess air at sampling point<br>%EA = $\frac{100\ (\%O_2)}{0.264\ (\%N_2) - \%O_2}$ | I | | | | |
| 12. | Total Particulate catch, $M_n$; grams | A | 0.0433 | 0.0380 | 0.0381 | 0.039[illegible] |
| 13. | Particulate concentration, C; grains/dscf<br>C = 15.4 $M_n/V_{mstd}$ | C | 0.0141 | 0.0120 | 0.0098 | 0.012[illegible] |
| 14. | Mass Rate of emission, A; lb/hr<br>A = $\frac{(Q_s std)\ (60)\ (M_n)}{(V_{mstd})\ (454)}$ | B | 0.7542 | 0.6698 | 0.5463 | 0.6568 |
| 15. | Emission per million BTU, E; lb/$10^6$ BTU<br>E = $\frac{A}{W}$ (fuel burning) | E | | | | |
| 16. | Concentration corrected to 12% $CO_2$, c12; grains/dscf<br>c12 = $\frac{12c}{\%CO_2}$<br>c12 is the concentration of particulate matter corrected to twelve (12) percent $CO_2$<br>c is the concentration of particulate matter | 0 | 0.0565 | 0.0628 | 0.0469 | 0.0554 |

**Note:** If CO is present in the flue gas, percent excess air is to be calculated using the following formula.

$$\%EA = \frac{\%O_2 - 0.5\%\ CO}{0.264\ \%N_2 - (\%O_2 - 0.5\%\ CO)} \times 100$$

DC/dgw 1-33

MARYVILLE UTILITIES BOARD
SEWAGE SLUDGE INCINERATOR
RUN # 1
8/29/84

| | |
|---|---|
| 50.0300 | ST02 |
| 651.0000 | ST03 |
| 0.8310 | ST04 |
| 2.5450 | ST05 |
| 556.0000 | ST06 |
| 3.0000 | ST07 |
| 17.4000 | ST08 |
| 79.6000 | ST09 |
| 0.0100 | ST00 |
| 1.0100 | ST01 |
| 61.7000 | ST0B |
| 0.8400 | ST0C |
| | P#3 |
| 60.0000 | ST0D |
| | P#5 |
| 29.1300 | GSBC |
| 2.6400 | GSBD |
| 0.2496 | GSBE |

| | |
|---|---|
| 60.0000 | 0 |
| 2.9042 | 1 |
| 5.7561 | 2 |
| 0.9420 | 3 |
| 29.1760 | 4 |
| 47.1025 | 5 |
| 28.5282 | 6 |
| 29.1307 | 7 |
| 3169.0145 | 8 |
| 6221.0864 | 9 |
| 29.1300 | A |
| 61.7000 | B |
| 0.8400 | C |
| 98.2147 | D |
| 325076.1654 | E |
| 5.5630 | I |

| | |
|---|---|
| | P#3 |
| 0.0433 | GSBH |

| | |
|---|---|
| 0.9565 | 0 |
| 481.4077 | 1 |
| 50.0300 | 2 |
| 651.0000 | 3 |
| 3.5144 | 4 |
| 2.5450 | 5 |
| 556.0000 | 6 |
| 3.0000 | 7 |
| 17.4000 | 8 |
| 79.6000 | 9 |
| 0.0433 | A |
| 0.7542 | B |
| 0.0141 | C |
| 98.2147 | D |
| 0.0077 | E |
| 1740.0000 | I |

MARYVILLE UTILITIES BOARD
SEWAGE SLUDGE INCINERATOR
RUN # 2
8/29/84

| | |
|---|---|
| 51.7500 | ST02 |
| 645.0000 | ST03 |
| 0.8540 | ST04 |
| 2.6810 | ST05 |
| 561.0000 | ST06 |
| 2.3000 | ST07 |
| 18.1000 | ST08 |
| 79.6000 | ST09 |
| 0.0100 | ST00 |
| 1.0100 | ST01 |
| 52.7000 | ST0B |
| 0.8400 | ST0C |
| | P#3 |
| 60.0000 | ST0D |
| | P#5 |
| 29.1300 | GSBC |
| 2.6400 | GSBD |
| 0.2496 | GSBE |

| | |
|---|---|
| 60.0000 | 0 |
| 2.4806 | 1 |
| 4.8545 | 2 |
| 0.9515 | 3 |
| 29.0920 | 4 |
| 48.6183 | 5 |
| 28.5535 | 6 |
| 29.1307 | 7 |
| 3240.2453 | 8 |
| 6484.2537 | 9 |
| 29.1300 | A |
| 52.7000 | B |
| 0.8400 | C |
| 97.0546 | D |
| 335705.1604 | E |
| 5.7920 | I |

| | |
|---|---|
| | P#3 |
| 0.0380 | GSBH |

| | |
|---|---|
| 0.0626 | 0 |
| 621.0541 | 1 |
| 51.7500 | 2 |
| 645.0000 | 3 |
| 3.9144 | 4 |
| 2.6810 | 5 |
| 561.0000 | 6 |
| 2.3000 | 7 |
| 18.1000 | 8 |
| 79.6000 | 9 |
| 0.0380 | A |
| 0.6696 | B |
| 0.0120 | C |
| 97.0546 | D |
| 0.0059 | E |
| 1810.0000 | I |

MARYVILLE UTILITIES BOARD
SEWAGE SLUDGE INCINERATOR
RUN #3
8/29/84

| | |
|---|---|
| 54.5400 | ST02 |
| 644.0000 | ST03 |
| 0.8600 | ST04 |
| 2.7230 | ST05 |
| 570.0000 | ST06 |
| 2.5000 | ST07 |
| 18.0000 | ST08 |
| 79.5000 | ST09 |
| 0.0100 | ST00 |
| 1.0100 | ST01 |
| 70.3000 | ST0B |
| 0.8400 | ST0C |
| | P#3 |
| 75.0000 | ST0D |
| | P#5 |
| 29.1300 | GSBC |
| 2.6400 | GSBD |
| 0.2496 | GSBE |

| | |
|---|---|
| 75.0000 | 0 |
| 3.3090 | 1 |
| 5.2262 | 2 |
| 0.9477 | 3 |
| 29.1200 | 4 |
| 60.0066 | 5 |
| 28.5388 | 6 |
| 29.1307 | 7 |
| 3261.3194 | 8 |
| 6511.0282 | 9 |
| 29.1300 | A |
| 70.3000 | B |
| 0.8400 | C |
| 95.4371 | D |
| 420710.5078 | E |
| 5.7600 | I |

| | |
|---|---|
| | P#3 |
| 0.0361 | GSBH |

| | |
|---|---|
| 0.0463 | 0 |
| 602.4056 | 1 |
| 54.5400 | 2 |
| 644.0000 | 3 |
| 2.9660 | 4 |
| 2.7230 | 5 |
| 570.0000 | 6 |
| 2.5000 | 7 |
| 18.0000 | 8 |
| 79.5000 | 9 |
| 0.0361 | A |
| 0.5463 | B |
| 0.0096 | C |
| 95.4371 | D |
| 0.0057 | E |
| 1800.0000 | I |

INTERNAL REVIEW

SECTION II

(Review by Engineering Program)

A. GENERAL

1. Company Maryville Utilities Board Ref. No. 05-0116-01

2. Process Observer Heather Whitlow. Test Date(s) 8/29/84

B. PROCESS INFORMATION

| | Run 1 | Run 2 | Run 3 | Avg. |
|---|---|---|---|---|
| 1. Allowable Emissions (#/hr) (#/MBTU) (#/100#) | | | | 1.30#/TON Sludge |
| 2. Process Weight | 503.6#/HR Dry Sludge | 426.9#/HR Dry Sludge | 393.1#/HR Dry Sludge | 441.2#/HR Dry Sludge |
| 3. Operating Rate Test Conditions (#/hr) (MBTU) | | | | |
| a. Design Rate | | | | 957#/HR Dry Sludge |
| b. Percent of Design Rate | 52.6 | 44.6 | 41.1 | 46.1 |
| c. Acceptable Operating Rate | ✓ | ✓ | ✓ | ✓ |

C. STATEMENT OF INSPECTION PARAMETERS:

D. PERMIT CONDITIONS:

11-1-84 HMW

MUB-05-116-01 Sewage Sludge Incinerator - source test

Calculations

Test 1 9:24 - 10:30 (66 min)

sludge: 3473 lbs (wet) 9:30 - 10:30 actual weight

3473 x .145 (% solids) = 503.6 #/hr dry sludge

oil: $\frac{(304 \text{ gal.}/5 \text{ hours})}{5} \times (8.35 \#/\text{gal}) \times (.77) = 390.9 \#/\text{hr oil}$

(390.9 #/hr x) (0.00998) = 3.90 # non-volatile/hr - oil

| 4 analyses | % non-volatile solids | |
|---|---|---|
| | 0.71 | 1/21/83 |
| | 0.88 | 3/4/83 |
| | 1.19 | 5/27/83 |
| | 1.21 | 12/6/83 |
| | 0.998 | |

Total solids (w/ oil)

503.6 + 3.90 = 507.50 #/hr = 0.254 TON/HR

Particulate emission rate

0.754 #/hr or $(0.754 \#/\text{hr})\left(\frac{\text{HR}}{0.254 \text{ TON}}\right) =$ 2.97 # / TON dry sludge

Solids w/o oil

503.6 = 0.252 TON/HR

.754 #/hr or $(.754 \#/\text{hr})\left(\frac{\text{HR}}{0.252 \text{ TON}}\right) =$ 2.99 #/TON Dry Sludge

Test 2 (11:40 Am - 12:40 Pm)

Sludge: 2846 #/hr (wet)

(2846) x (.15) solids = 426.9 #/hr dry sludge

oil : (390.9 #/hr)(.00998) avg non volatile solids = 3.90 #/hr

Total solids (w/ oil)

426.9 + 3.90 = 430.8 #/hr = 0.215 TON/HR

Particulate emission rate

.668 #/hr or (.668 #/hr)(HR / 0.215 TON) = 3.10 # / Dry TON Sludge

Solids w/o oil

426.9 #/hr = 0.213 TON

emission rate

.668 #/hr or (.668 #/hr)(HR / .213 TON) = 3.14 # / Dry TON Sludge

Test 3: 1:30 – 2:55 (use 1:30 – 3:00 data)

sludge: $\frac{4066\ \#}{1.5\ HR} = 2710.7\ \#/Hr$

$(2710.7)\ \#/hr \times (.145)$ solids $= 393.1\ \#/hr$

oil: 3.90 # non-volatile/hr-oil

~~Total Solids (w/ oil)~~

$393.1 + 3.90 = 397.0\ \#/Hr = 0.199\ TON$

emission rate

.538 #/hr or $(.538\ \#/hr)\left(\frac{HR}{0.199\ TON}\right) = 2.71\ \#/TON$ Dry Sludge

Solids (w/o oil)

$393.1\ \#/HR = 0.197\ TON$

.538 #/hr or $(.538\ \#/hr)\left(\frac{HR}{0.197\ TON}\right) = 2.73\ \#/TON$ Dry Sludge

3 Test Average

441.2 #/hr Dry sludge
3.90 #/hr non volatile solids – oil

Total Solids (w/ oil)

441.2 + 3.90 = 445.1 #/hr = 0.222 TON/HR

emissions (Avg):

0.653 #/hr or $(.653\ \#/hr)\left(\frac{HR}{.222\ TON}\right) = 2.94\ \#/\text{Dry TON Sewage}$

Solids (w/o oil)

441.2 #/hr = 0.221 TON/HR

Emissions:

0.653 #/hr or $(.653\ \#/hr)\left(\frac{HR}{.221\ TON}\right) = 2.96\ \#/\text{Dry TON Sewage}$

~~co. file~~
KEC

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
555648912

**TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT**
Bureau of Environment
T.E.R.R.A. BUILDING
150 NINTH AVENUE, NORTH
NASHVILLE, TENNESSEE 37203

December 20, 1984

Mr. T. Rex Ogle
Maryville Utilities Board
Division of Water and Sewerage
400 West Broadway, Box 667
Maryville, TN 37801

Reference Number: 05-0116-01-A3

NOTICE OF VIOLATION

Dear Mr. Ogle:

The Tennessee Division of Air Pollution Control has received the particulate source test report submitted by Maryville Utilities Board for the sewerage sludge incinerator located at Maryville, Tennessee. This source test was conducted on August 29, 1984 by Enviro-Measure, Inc.

The source test report has been reviewed by the Compliance Monitoring Section. The sampling data appears to be in order, and the report is acceptable to the section.

The operational parameters presented in the source test report have been reviewed by the Air Resources Program.

The process input rate for the three test runs was determined to be an average of 441 pounds/hour dry sludge. The average emissions of particulates during the testing was measured at 0.657 pounds/hour. This corresponds to an emission rate of 2.98 pounds of particulates per ton of dry sludge input. The allowable emission standard for NSPS sewage sludge incinerators as specified in rule 1200-3-16-.15-2(a) and condition 1c of construction permit 99273I is 1.30 pounds/ton dry sludge input. The measured particulate emission rate does not satisfy the allowable emission rate, therefore, this source is out of compliance. This letter is a formal notice of violation.

Please complete and return to this office two copies of the enclosed form APC-19, Proposed Schedule of Corrective Action for the sewage sludge incinerator within 45 days of the receipt of this letter. Please be sure to indicate the method to be used to achieve compliance, and the time required to come into compliance.

This matter has been forwarded to this Division's Enforcement Program for consideration.

If you have any questions concerning the review of the sampling data or concerning source sampling in general, please contact Mr. Stewart at (615) 741-7941. If you have any questions concerning the review of the operational parameters or the compliance status of the source, please contact Mr. Stephens at (615) 741-3931.

Sincerely,

Harold E. Hodges

Harold E. Hodges, P.E.
Technical Secretary
Tennessee Air Pollution Control Board

shb

cc: D. W. Weeter

Enclosure

Item #5

# KENWILL, INC.

2268

MINERAL EXPLORATION • MINING CONSULTAN
LABORATORY SERVICES (COAL/WATER/GEOLOGI
505 E. BROADWAY • MARYVILLE, TENN. 37801
615/984-6100

Mr. Don Thompson
Maryville Utilities Board
P.O. Box 667
Maryville, TN 37801

Date received: 8/27/82

cc: Mr. D. W. Weeter

Sample Identification: Maryville Treatment Plant Ash.

## CERTIFICATE OF ANALYSIS

Below are the results of the sample we received from you on 8/27/82 requesting the EP Toxicity Test. Analysis of the sample was carried out in accordance with the methods outlined in 40 CFR 261, Appendix II. The detailed procedure employed was that given in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846; U. S. Environmental Protection Agency, Office of Solid Waste, D.C. 20460.

| | Concentration in Extract, mg/l |
|---|---|
| Arsenic, As | 0.226 |
| Barium, Ba | <0.50 |
| Cadmium, Cd | <0.025 |
| Chromium, Cr | <0.05 |
| Copper, Cu | <0.05 |
| Mercury, Hg | <0.0005 |
| Selenium, Se | <0.0025 |
| Silver, Ag | <0.05 |
| Lead, Pb | 0.11 |
| Nickel, Ni | 0.14 |
| Zinc , Zn | 0.187 |
| Manganese, Mn | 1.97 |
| Iron, Fe | 0.12 |
| Magnesium, Mg | 72.50 |

Kenwill, Inc.

Wm. D. Carter, III

7753

# KENWILL, INC.

MINERAL EXPLORATION • ENGINEERIN
LABORATORY SERVICES (COAL/WATER/GEOLOGI
505 EAST BROADWAY • MARYVILLE, TENNESSEE 378
615/977-1200

January 20, 1984

Maryville Utilities Board
P.O. Box 667
Maryville, TN 37801

Attn: Mr. Don Thompson

Received 12/5/83

Sample I.D. Ash from incinerated sludge

## CERTIFICATE OF ANALYSIS

| | |
|---|---|
| pH Paste | 8.0 |
| % Total Solids | 98.9 |
| Volatile Solids (% of Total Solids) | 0.22 |
| Potassium | 0.60% |
| Copper | 0.046% |
| Zinc | 0.095% |
| Lead | 0.034% |
| Nickel | 0.005% |
| Cadmium | <0.0007% |
| Chromium, hexvalent | <0.00001% |
| Nitrate Nitrogen | 0.00094% |
| Nitrite Nitrogen | 0.000047% |
| Organic Nitrogen | <0.01% |
| Phosphorus | 8.13 % |

* mg/l = % x 10,000

Kenwill, Inc.

Wm. D. Carter, III

E. W. Kuemmerle, Jr., Ph.D.
For Vice President, Laboratory Division

Item 06

TABLE IV-1

| | |
|---|---|
| **Influent Analysis** | |
| Tetrachloroethylene | 0.030 mg/l |
| Trichloroethylene | 0.100 mg/l |
| Bis (2-ethylhexyl) Phthalate | 0.036 mg/l |
| Mercury | 0.0004 mg/l |
| Nickel | 1.11 mg/l |
| Zinc | 0.13 mg/l |
| Phenols | 0.036 mg/l |
| **Effluent Analysis** | |
| Methylene Chloride | 0.011 mg/l |
| Bis (2-ethylhexyl) Phthalate | 0.014 mg/l |
| Mercury | 0.0003 mg/l |
| Zinc | 0.080 mg/l |
| **Sludge Analysis** | |
| Methylene Chloride | 0.011 mg/l |
| Toluene | 0.140 mg/l |
| 1,2-Trans-Dichloroethylene | 0.160 mg/l |
| Phenol | 0.044 mg/l |
| Cadmium (total) | 0.12 mg/l |
| Chromium (total) | 16.8 mg/l |
| Copper (total) | 7.05 mg/l |
| Lead (total) | 4.3 mg/l |
| Mercury (total) | 0.108 mg/l |
| Nickel (total) | 2.7 mg/l |
| Silver (total) | 0.39 mg/l |
| Zinc (total) | 21.3 mg/l |
| Cyanide (total) | 0.035 mg/l |
| Phenols (total) | 1.55 mg/l |

All of the remaining priority pollutants were either not present in the samples or were present in amounts lower than the detection limits established by EPA for the priority pollutants as promulgated in the December 3, 1979 Federal Register.

Dhw #7

4887

**KENWILL, INC.**

MINERAL EXPLORATION • MINING CONSULTAN
LABORATORY SERVICES (COAL/WATER/GEOLOGI
505 E. BROADWAY • MARYVILLE, TENN. 37801
615/984-6100

February 7, 1983

Aluminum Company of America
P.O. Box 9158
Alcoa, TN 37701

Received 1/21/83

Attn: Mr. Paul Martinez

Sample I.D. Sludge to MUB, 11/5/82 100 ml, 11/11/82 100 ml, 11/17/82 100 ml, 11/24/82 100 ml, 12/2/82 100 ml, 12/8/82 100 ml, 12/15/82 100 ml, 12/15/82 100 ml, 12/22/82 100 ml, 1/5/83 100 ml

# CERTIFICATE OF ANALYSIS

All results reported as mg/l unless otherwise noted.

| | |
|---|---|
| BTU per Lb. | 12124 |
| % Sulfur | 0.19 |
| % Water | 33.6 |
| % Total Solids | 0.71 |
| % Non-Volatile Solids | 0.26 |
| % of +300 Mesh Particles | 0.04 |
| Viscosity | 153 cps @ 21.5°C |
| Al | 867 |
| Cd | 0.15 |
| Mn | 22.2 |
| Pb | 12.0 |
| Zn | 0.43 |

Kenwill, Inc.

Wm. F. Curtis III

E. W. Kuemmerle, Jr., Ph.D.

Item #7

5314

# KENWILL, INC.

MINERAL EXPLORATION • ENGINEERIN
LABORATORY SERVICES (COAL/WATER/GEOLOGI
505 EAST BROADWAY • MARYVILLE, TENNESSEE 378
615/977-1200

June 2, 1983

Aluminum Company of America
P.O. Box 9158
Alcoa, TN 37701

Attn: Mr. Paul Martinez

Received 3/4/83

Sample I.D. in-MUB Sludge, 1-10-83 100 ml, 1-12-83 100 ml, 1-20-83 100 ml, 1-25-83 100 ml, 1-26-83 100 ml, 1-28-83 100 ml, 2-11-83 100 ml, 2-16-83 100 ml, 2-23-83 100 ml, 3-2-83 100 ml

## CERTIFICATE OF ANALYSIS

All results are reported as mg/l unless otherwise noted.

| | |
|---|---|
| BTU per Lb. | 11541 |
| % Sulfur | 0.30 |
| % Water | 37.0 |
| % Total Solids | 0.91 |
| % Non-volatile Solids | 0.88 |
| % of +300 Mesh Particles | 0.16 |
| Viscosity | 150.5 cps @ 72.5°F. |
| Al | 1840 |
| Cd | 0.17 |
| Mn | 11.1 |
| Pb | 8.8 |
| Zn | 16.4 |

Kenwill, Inc.

Wm. K. Carter, III

for E. W. Kuemmerle, Jr., Ph.D.
Vice President, Laboratory Division

Item #7

**KENWILL, INC.**
6278

MINERAL EXPLORATION • MINING CONSULTANTS
LABORATORY SERVICES (COAL/WATER/GEOLOGIC)
505 E. BROADWAY • MARYVILLE, TENN. 37801
615/977-1200

July 29, 1983

Aluminum Company of America
P.O. Box 9158
Alcoa, TN 37701

Attn: Mr. Paul Martinez

Received: 5/27/83

**Sample Description** MUB, Composite Sludge #5 nl
Paul Martinez

**Date Taken & Time** 100ml- 3/15/83, 100ml-3/17/83, 100ml-3/23/83,100ml-3/30/83
100ml- 4/8/83, 100ml-4/13/83, 100ml-4/20/83,100ml-4/27/83
100ml- 5/4/83, 100ml-5/11/83, 100ml-5/19/83

# CERTIFICATE OF ANALYSIS

(All results are reported as mg/l unless otherwise noted.)

| | |
|---|---|
| BTU per lb | 12,429 |
| % Sulfur | 0.14 |
| % Water | 32.0 |
| % Total Solids | 1.24 |
| % Non-Volatile Solids | 1.19 |
| % of + 300 Mesh Particles | 0.031 |
| Viscosity | 96.5 cps @ 74.8° |
| Aluminum | 2012 |
| Cadmium | 0.15 |
| Manganese | 8.98 |
| Lead | 6.75 |
| Zinc | 12.4 |

KENWILL, INC.

Wm. J. Carter, III

for E. W. Kuenmerle, Jr., Ph.D.
Vice President, Laboratory Division

Item #7

7746

# KENWILL, INC.

MINERAL EXPLORATION • ENGINEE
LABORATORY SERVICES (COAL/WATER/GEOLC
505 EAST BROADWAY • MARYVILLE, TENNESSEE
615/977-1200

January 3, 1984

Aluminum Company of America
P.O. Box 9158
Alcoa, TN 37701

Received 12/6/83

Attn: Mr. Paul Martinez

Sample I.D. MUB Sludge, 100 ml, 8/17/83, 100 ml, 8/31/83, 100 ml, 9/14/83, 100 ml, 9/
100 ml, 9/30/83, 100 ml, 10/6/83, 100 ml, 10/12/83, 100 ml, 10/19/83,
100 ml, 11/15/83, 100 ml, 11/22/83

## CERTIFICATE OF ANALYSIS

| | |
|---|---|
| BTU per lb. | 13158 |
| % Sulfur | 0.26 |
| % Water | 28.3 |
| % Total Solids | 2.34 |
| % Non-Volatile Solids | 1.21 |
| % of +300 mesh particles | 0.028 |
| Viscosity | 114 cps @ 72.0°F. |
| Al, mg/l | 2514 |
| Cd, mg/l | 0.28 |
| Mn, mg/l | 11.8 |
| Pb, mg/l | 9.2 |
| Zn, mg/l | 14.2 |

Kenwill, Inc.

William L. Carter III

E. W. Kuemmerle, Jr., Ph.D.
for Vice President, Laboratory Division

Item 3

# Stewart Laboratories, Inc.

5815 MIDDLEBROOK PIKE KNOXVILLE, TENNESSEE 37921

## CERTIFICATE OF ANALYSIS

TO: Aluminum Company of America
ATTN: Mr. Steve Myers
North Plant
Alcoa, TN 37701

DATE REPORTED: May 20, 1982
CODE: AAC 14688
ORDER No.: AT59005480

Sample Description: Three (3) oil samples received May 11, 1982

Concentration units are µg/gram (ppm)

| | Aroclor 1016, 1232, 1242 and/or 1248 | Aroclor 1254 | Aroclor 1260 | Total Aroclors |
|---|---|---|---|---|
| North Lagoon East Side | <4. | <7.** | <4. | <7. ± 0.4 |
| North Lagoon West Side | <4. | <6.** | <4. | <6. ± 0.3 |
| North Lagoon Bottom - oil phase | <4. | <4. | <4. | <4. ± 0.2 |

** See Attachment

Sworn to and subscribed before me this 20th day of May, 1982

Janice F. Atwell
NOTARY PUBLIC

STEWART LABORATORIES, INC.

R. L

# Stewart Laboratories, Inc.

5815 MIDDLEBROOK PIKE KNOXVILLE, TENNESSEE 37921

## CERTIFICATE OF ANALYSIS

TO: Aluminum Company of America
ATTN: Mr. Steve Myers
North Plant
Alcoa, TN 37701

DATE REPORTED: May 20, 1982
CODE: AAC 14688
ORDER No.: AT59005480

Sample Description: One (1) water sample and one (1) sediment sample received May 11, 1982

Concentration units are µg/liter (ppb) for water and µg/gram (ppm) for sediment

| | Aroclor 1242 and/or 1016 | Aroclor 1254 | Aroclor 1260 | Total Aroclors |
|---|---|---|---|---|
| 1982 May 11, Water from Waste Oil Facility | <0.3** | <0.3 | <0.3 | <0.3 |
| North Lagoon Bottom - sediment phase | <0.03 | <0.1** | <0.06 | <0.1 |

** See Attachment

Sworn to and subscribed before me this 20th day of May, 1982

NOTARY PUBLIC

My commission expires December 14, 1983

STEWART LABORATORIES, INC.

By

Item #7

# KENWILL, INC.

2537

MINERAL EXPLORATION • MINING CONSULTANTS
LABORATORY SERVICES (COAL/WATER/GEOLOGIC)
505 E. BROADWAY • MARYVILLE, TENN. 37801
615/977-1200

October 1, 1982

Maryville Utilities Board
P.O. Box 667
Maryville, TN 37801

Attn: Mr. Don Thompson

| | |
|---|---|
| Sample Description | Waste Oil |
| Date Taken & Time | 9/28/82 |

## CERTIFICATE OF ANALYSIS

(All results are reported as mg/l unless otherwise noted.)

| | |
|---|---|
| Mercury | <0.05 ppm |

KENWILL, INC.

E. W. Kuemmerle, Jr., Ph.D.

TENNESSEE AIR POLLUTION CONTROL DIVISION
SOURCE SAMPLING SECTION
Source Sampling Observation Report Sheet (Particulates)

Company Marysville Waste Incinerator Ref. No. _____
Source I.D. Waste Incinerator
Test Conducted by Enviro-Measure, INC.
Person in Charge of Test John Carson
Observer Carl Kopf
Run Number Observed I and II

Date 8/29/84 Time Test Observed 7:30 AM – 1:30 PM

THIS REPORT SHEET IS AN EVALUATION OF SAMPLING PROCEDURES CONDUCTED AT THE ABOVE MENTIONED SITE. THIS EVALUATION COVERS ONLY GENERAL ITEMS OBVIOUS TO THE OBSERVER. THIS DOES NOT IN ANY WAY IMPLY THAT ALL TEST PROCEDURES ARE ACCURATE OR THAT THE TEST REPORT WILL BE ACCEPTED BY THE TAPCD. EVEN THOUGH THE FIELD PROCEDURE MAY BE ACCEPTABLE, INFORMATION PRESENTED IN THE TEST REPORT MAY RENDER THE ENTIRE TEST UNACCEPTABLE. THIS REPORT APPLIES ONLY TO THE TESTS ACTUALLY OBSERVED BY THE TAPCD OBSERVER.

**PRELIMINARY DETERMINATIONS**

| | |
|---|---|
| Sampling Location | ✓ |
| Number of sample points | 24 |
| Velocity traverse | ✓ |
| Method of moisture determination | ✓ |

**SAMPLING**

| | |
|---|---|
| Leak check: pretest (specify ____) | |
| post test (specify 4.02) | ✓ |
| Probe tip orientation | ✓ |
| Filter heated to minimum temp. | ✓ |
| Time sampled each point | ✓ 2½ MIN. |
| Accurately monitored train temps. | ✓ |
| Initial readings recorded | ✓ |
| Readings recorded if train shut down | ✓ |
| Final readings recorded | ✓ |
| Gas analysis (specify orsat) | ✓ |

**PROCESS INFORMATION**

Engineer Present (Name Heather Wickman)

Pretest Agreement yes

**SAMPLING TRAIN**

| | |
|---|---|
| Basic Construction | ____ |
| Probe Design | ____ |
| Nozzle Condition | ____ |
| Pitot Condition | ____ |
| Filter | ____ |
| Correct amt. $H_2O$ and Silica Gel in impingers | ____ |

**TRAIN BREAK-DOWN**

| | |
|---|---|
| Probe moved so as to not lose material | ____ |
| Probe washed and brushed | ____ |
| Acceptable container to store washings | ____ |
| Reagent grade acetone used | ____ |
| Blank of solutions taken | ____ |
| Train re-set acceptably | ____ |

**CALIBRATION DATA**

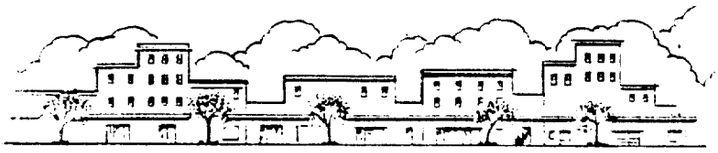
Proper calibration data available at site ____

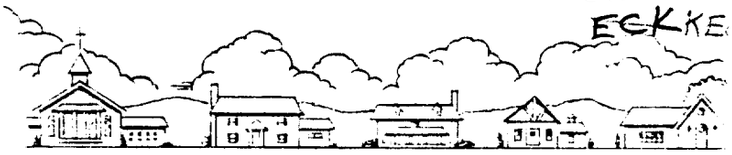
Observer Carl Kopf Team Leader Michael Mowry

Original to observer; copy to team leader (to be submitted with test report)

PH-0463

APC 8/79






# MARYVILLE UTILITIES BOARD

(615) 984-7900

400 West Broadway • P.O. Box 667 • Maryville, Tennessee 37801 Division of Water and Sewerage


RECEIVED
DATE 8-14-84
CO. NO.
I.D. A 1 2 3 4 5 6
B 1 2 3 4 5
CS
OTHER

August 9, 1984

Mr. Gerald Stewart
Tenn. Dept. of Public Health
Air Pollution Control Division
T.E.R.R.A. Building
150 Ninth Ave., North
Nashville, TN 37203

Re: MWWTP - Sludge Incinerator Air
Pollution Control Compliance Schedule

Dear Mr. Stewart:

This letter is to confirm the telephone conversation you had with our consultant, Mr. Dennis Weeter on August 8, 1984, regarding our schedule for testing the emissions on our Wastewater Plant Sludge Incinerator.

Mr. Weeter informed you that we plan to conduct this test on August 29, 1984, which you indicated was acceptable with your office. We propose to use EMI Consultants out of Knoxville to perform these tests.

Should you have any questions, please call me at 615-984-7900.

Sincerely,

MARYVILLE UTILITIES BOARD

T. Rex Ogle

T. Rex Ogle
Water/Wastewater
Operations Supervisor

TRO/vjc

cc: Mr. Jim Haynes
Mr. Victor Malichis
Mr. John Carson
Mr. Robert Young - MWWTP
Mr. Dennis Weeter

# MARYVILLE REGIONAL WASTEWATER TREATMENT PLANT

## DAILY INCINERATOR LOG

SHIFT OPERATORS: 1ST. YMA-MS 2ND. DH-Law-JB-CW 3RD. DATE: 8-28-84

Item 4

| TIME | SLUDGE WT. METER | SLUDGE WT. LBS/HR | TEMPERATURES Pt. 1 H-1 | Pt. 2 H-2 | Pt. 3 H-3 | Pt. 4 H-4 | Pt. 5 H-5 | Pt. 6 H-6 | Pt. 7 Cool. Air. | Pt. 8 Scrub. Inlet | Pt. 9 Scrub. Outlet | INSTRUMENTATION Draft | % $O_2$ | Scrub. Diff. | Scrub. $H_2O$ | Oil in Top Brg. | Oil in Bot. Brg. | Oil in I.D. Brg. | BURNERS IN USE H-2 1 | H-2 2 | H-3 1 | H-3 2 | H-4 1 | H-4 2 | H-5 1 | H-5 2 | FUEL USED METER INITIAL | METER FINAL | AMOUNT USED | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MID-NIGHT | 16064 | 2505 | 710 | 1240 | 1340 | 1140 | 1500 | 1660 | 380 | 160 | 150 | -.05 | OFF | OFF | OFF | 1/4" | 1/4 | 1/4 | | | | | | | | 7765 | | | |
| 1 | 48569 | 2742 | 720 | 1180 | 1340 | 1560 | 1280 | 1600 | 380 | 160 | 150 | -.09 | | | | | | | | | | | | | | | | | CLEANED BURNERS |
| 2 | 51311 | 2945 | 740 | 1000 | 1100 | 1580 | 1440 | 1610 | 360 | 150 | 150 | -.10 | | | | | | | | | | | | | | | | | |
| 3 | 54256 | 2686 | 730 | 930 | 1060 | 1540 | 1430 | 1610 | 340 | 150 | 150 | -.10 | | | | | | | | | | | | | | | | | |
| 4 | 56942 | 2489 | 720 | 940 | 1010 | 1540 | 1420 | 1620 | 330 | 150 | 150 | -.10 | | | | | | | | | | | | | | | | | |
| 5 | 59431 | 2393 | 740 | 970 | 1060 | 1580 | 1500 | 1660 | 340 | 150 | 150 | -.12 | | | 260 | | | 1/4 | | | | | | | | | | | 5AM Started d.o. & scrubber |
| 6 | 61774 | 2223 | 710 | 1030 | 1130 | 1600 | 1540 | 1650 | 340 | 100 | 140 | -.09 | | | | | | | | | | | | | | | | | |
| 7 | 63997 | 3179 | 700 | 1060 | 1150 | 1620 | 1420 | 1630 | 380 | 110 | 150 | -.06 | | | | | | | | | | | | | | | | | |
| 8 | 67176 | 2592 | 630 | 990 | 1080 | 1610 | 1320 | 1600 | 340 | 90 | 130 | -.15 | | | | | | | | | | | | | | | | | |
| 9 | 69768 | 3637 | 660 | 1030 | 1130 | 1610 | 1460 | 1620 | 350 | 90 | 140 | -.06 | | | | | | | | | | | | | | | | | |
| 10 | 73405 | 1767 | 630 | 980 | 1060 | 1630 | 1480 | 1610 | 360 | 90 | 150 | -.08 | | | | | | | | | | | | | | | | | |
| 11 | 75172 | 1789 | 610 | 980 | 1060 | 1460 | 1390 | 1600 | 330 | 110 | 160 | -.13 | | | | | | | | | | | | | | | | | |
| NOON | 76961 | 3146 | 610 | 990 | 1060 | 1570 | 1320 | 1580 | 330 | 110 | 160 | -.15 | | | | | | | | | | | | | | | | | |
| 1 | 80187 | 1393 | 580 | 960 | 1040 | 1530 | 1320 | 1560 | 330 | 110 | 160 | -.13 | | | | | | | | | | | | | | | | | |
| 2 | 81500 | 3166 | 590 | 960 | 1030 | 1510 | 1330 | 1560 | 330 | 110 | 160 | -.14 | | | | | | | | | | | | | | | | | |
| 3 | 82466 | | 566 | 940 | 1000 | 1500 | 1340 | 1560 | 330 | 110 | 160 | -.14 | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TOTAL POUNDS OF SLUDGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

TOTAL AMOUNT OF FUEL USED (GAS) (PROPANE)

RT. 4 BOX 283
LOUISVILLE, TN 37777
615/970-2313

DENNIS WEETER ASSOCIATES

CONSULTING ENGINEERS

September 11, 1984

Attn: Ms. Heather Whitlow
Compliance Monitoring Section
Air Pollution Control Division - TDPH
Terra Building
150 Ninth Ave., North
Nashville, TN 37203

Re: Maryville Utilities Board, Municipal Sewage Incinerator, Reference No. 05-0116-01; Test of 8/29/84.

Dear Ms. Whitlow:

Please find enclosed the following nine (9) items with regard to the MUB incinerator, the ALCOA waste oil sludge, and the air test of 8/29/84:

1. Two (2) copies of an emission test report prepared by EMI.

2. One (1) copy of a lab report indicating values of lead and mercury on the waste oil and the sewage sludge (both composite taken on 8/29/84.

3. Table 1 which summarizes sludge and oil loadings and moisture characteristics.

4. Four (4) pages of handwritten notes and a daily log from 8/29/84.

5. Two (2) data sheets (8/27/82 & 12/5/83) giving analyses of incinerator ash. Note that the waste oil project came on line in April 1982. Note, also that ash is regulated by TDPH - Div. Solid Waste.

6. One (1) page analysis indicating a 1980 sewage sludge analysis for priority pollutants.

7. Four (4) pages (1/20/83; 3/4/83; 5/27/83; 12/6/83) of analyses of the composites of ALCOA waste oil as delivered to MUB. This indicates the parameters which have limits relative to the contract between MUB and ALCOA.

8. Two (2) pages of analyses relative to PCB's. No analyses have been performed relative to dioxins which would not be produced in the treatment and handling process. Given a third party is not involved, indiscriminate contamination is not likely. For your background, this waste oil sludge is produced at ALCOA where dirty rolling oils are treated with alum and sulfuric acid and three phases result. Clean oil is reused. Water is discharged for waste treatment. The sludge is sent to MUB.

9. One (1) copy of results of a lab analysis on 9/28/82 for Hg in the waste oil. This was the day we earlier had tested the incinerator.

You will notice that the incinerator exceeded the standard of 1.3#/ton on the day of the test by emitting 1.82#/ton. A concern to us is that we had conducted several test runs, using a high volume sampler, where our emissions were 1.0#/ton. It is the opinion of EMI that the filters contained a fine powder (50% of weight), a few large particulates (25% of weight), and condensed hydrocarbons (25% of weight). It is our intention to file a new compliance schedule and prepare to modify the venturi to increase pressure drop, increase quench section efficiency, install an air filter on the warm air duct, and improve sludge dewatering. We have in the past year, reduced emissions from 11#/ton to 1.8#/ton. We know, because of past experience, that we can operate this incinerator within standards.

Should you need further information, please contact us.

Sincerely yours,

D. W. Weeter, PhD., PE

DWW/jet

Enclosures as Described

cc: Rex Ogle (with enclosures)
Robin Hetzel (with enclosures)
John Carson (without enclosures)
Jim Haynes (without enclosures)
Wm. Stroud (without enclosures), ALCOA

~~Item~~
~~Test~~ #3

MUB Air Test
APCD #05-0116-01
08/29/84

TABLE 1

| Run # | Time | Sludge Cake % Solids | Sludge Cake % Volatile | Oil Sludge % $H_2O$ | Sludge Wt. Total For Run [lbs/hr(wet)] | Venturi $\Delta P$ in Hg | Tray $\Delta P$ in $H_2$ |
|---|---|---|---|---|---|---|---|
| 1 | 9:15 AM | 14.5 | 63 | 28 | 3637 | 2.5 | 6.0 |
| | 10:15 AM | | | | [3637] | 2.8 | 5.6 |
| 2 | 11:40 AM | 15 | 63 | 29 | 2846 | 2.4 | 4.8 |
| | 12:40 PM | | | | [2846] | 2.4 | 4.8 |
| 3 | 1:45 PM | 14.5 | 66 | 31 | 4000 | 2.4 | 5.8 |
| | 3:00 PM | | | | [3200] | 2.4 | 5.4 |

NOTES:
1. Specific Gravity of Oil = 0.77
2. Oil Used was 304 gallons in 5 hours (60.8 gallons/hr. - 390.5#/hr.)
3. Run #3 was extended to 75 minutes due to mechanical failure of sludge drying belt.

Item 4

8/29/84
MUB

| Oil Tank Depth | Time | Cumulative Weight Scale | inches $H_2O$ | inches Hg | Cumulative Weight Scale 15 min | 30 min | 45 min | 1 h |
|---|---|---|---|---|---|---|---|---|
| | 8 am | 67176 | | 701 | | | | |
| | 8:15 | 67877 | | 623 | | 1324 | | |
| | 8:30 | 68500 | | | | | | |
| | 8:45 | 69110 | | | | | 1934 | |
| | 9am | 69768 | | | | | | 259 |
| | 9:15 | 70532 | | 764 | | | | |
| 5ft 2 inch | 9:30 | 71289 (1st Test Reading) | 6.0-2.5 | | | 757/1521 | | |
| | 9:45 | 72382 | 5.6-2.4 | | | | 1093/2614 | |
| | | | | | | | | 1023/3637 |
| | 10a.m. | 73405 | 6.2-2.8 | | | | | |
| | 10:15 | 73956 | 6.2-2.8 | 551 | | | | |
| 5ft 1 3/4 in. | 10:30 | 74762 | 6.2-2.8 | | | 806/1357 | | |
| | 10:45 | 75085 | | | | | 323/1680 | |
| | | | | | | | | 87/176 |
| | 11a.m | 75172 | | | | | | |
| | 11:15 | 75500 | | 328 | | | | |
| 5ft 1 1/4 in. | 11:30 | 75724 | | | | 224/552 | | |
| | 11:45 | | | | | | | |
| | 11:48 | 76309 | | | | | | |

Item 4

# Test II

8-29-84

| 0:1 Tank depth | | wt. scale | wt. | Inches $H_2O$ | Inches Hg |
|---|---|---|---|---|---|
| 5 ft 1¼ inch. | 11:40 a.m. | 76309 | | 4.8 | 2.4 |
| | 11:55 | 76866 | 557 | 4.6 | 2.5 |
| | 12:10 | 77466 | 600/1157 | 4.8 | 2.4 |
| | 12:25 | 78012 | 546/1703 | 4.8 | 2.4 |
| 5 ft 1 inch | 12:40 | 79155 | 1143/2846 | 4.8 | 2.4 |

## Test III

| | | | | | | |
|---|---|---|---|---|---|---|
| 5 ft ½ inch | 1:30 | p.m. | 80600 | | 6.2 | 2.4 |
| | 1:45 | p.m. | 81100 | 500 | 5.8 | 2.4 |
| | 2:00 | p.m. | 81500 | 400/900 | 5.8 | 2.4 |
| | 2:15 | p.m. | 81868 | 368/1268 | 6.2 | 2.4 |
| 5 ft 0 | 2:30 | p.m. | 83132 | 1264/2532 | 5.8 | 2.4 |
| 4 ft 11 9/10 ↓ | 2:45 | | 83566 | 434/2966 | 5.2 | 2.4 |
| | 3:00 | | 84666 | 1100/4000 | 5.4 | 2.4 |

Item 4

Run #1

Oil moisture - 28%

% CAKE SOLIDS - 14.5%

% VOLATILES - 63%

Run #2

Oil Moisture - 29%

% CAKE SOLIDS - 15%

% Volatiles - 63%

Run #3

Oil Moisture - 31%

% CAKE SOLIDS - 14.5%

% VOLATILES - 66%

Specific Gravity of Oil = 0.77

~~Density of Oil =~~