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#06

PARTICULATE EMISSION TEST REPORT
For a Sewage Sludge Incinerator at
THE CITY OF SHELBY WASTEWATER TREATMENT PLANT
Shelby, North Carolina

Performed by the Source Testing Staff
of the
North Carolina Department
of Natural Resources & Community Development
Division of Environmental Management
Environmental Management

February 6, 1979

CONTENTS

INTRODUCTION

This report presents the results of a test performed on the exhaust of a sewage sludge incinerator at the wastewater treatment plant of the City of Shelby, North Carolina. The test was performed on February 6, 1979.

The test was performed to determine compliance with 15 NCAC 2D .0505 "Control of Particulates From Refuse Burning Equipment" (Reference 1).

G. L. Comer and R. E. Wooten, Jr. of the source testing staff performed the test. Assistance was provided by Randy Hyatt of the Asheville Regional Office.

SOURCE AND PROCESS DESCRIPTION

The City of Shelby incinerates its municipal sewage sludge with a No. 2 oil-fired fluidized bed incinerator.

The sludge is dewatered on a filter. The filter cake drops to a conveyor and is transported to the incinerator. The sludge is weighed at one point on the conveyor. The weight tally is automatically kept and displayed on a counter in the control room.

The emissions of the incinerator are controlled by scrubbing with water. Consequently, the stack exhaust is saturated with water, or nearly so.

The allowable particulate emissions from the incinerator are defined by 15 NCAC 2D .0505 "Control of Particulates From Refuse Burning Equipment" (Reference 1). See Appendix G for the computation of the allowable emissions for the three test runs.

SAMPLING AND ANALYTICAL PROCEDURE

Particulate testing and analysis of samples were performed according to procedures developed by the U.S. Environmental Protection Agency and referred to as Method 5. Sampling port locations and number of test points to be used were determined according to Method 1. Port placement and test point locations are shown in Appendix E.

The flue gas composition was determined in accordance with Method 3. A gas sample was withdrawn continuously from a point near the particulate sampling nozzle and was collected in a Tedlar bag. The gas sample was analyzed for CO_2 and O_2 with an Orsat apparatus; the balance of the sample was presumed to be N_2. The results of this analysis are reported in Appendix B.

The above named Federal Test methods appear in their original form in the December 23, 1971 Federal Register (Reference 2), with updated versions appearing in the Environment Reporter (Reference 3).

The charge rate for waste was determined from the control room weight totalizer, which was presumed accurate. The charge rate data is given in Appendix G along with the allowable emission calculations.

It should be mentioned that part of the cyclone bypass was broken during disassembly of the third collection train. Care was taken that no glass slivers ended up as sample catch, at least none were seen. Any sample on the walls of the cyclone bypass was discarded. Consequently, the reported results for run 3 may be slightly low.

During the second run, the recording of the final gas meter reading before the final leak test was overlooked. Thus, after the leak test, a second leak test was performed without the meter box controls being touched. The change in gas volume during the second leak test was subtracted from the gas meter reading at the end of the first leak test to get a close approximation to the end-of-test gas meter reading.

SUMMARY OF RESULTS

As shown on the following test summary, the particulate emissions from the City of Shelby's sludge incinerator are less than one tenth what is allowed by 15 NCAC 2D .0505.

Robert E. Wooten, Jr., P.E.
Source Test Engineer
March 20, 1979

REFERENCES

1. North Carolina Administrative Code, Title 15, Chapter 2, Subchapter 2D, Section .0505 "Control of Particulates From Refuse Burning Equipment", Environmental Management Commission, Raleigh, N.C. (February 1, 1976).

2. Federal Register, Standards of Performance for New Stationary Sources, Volume 36, Number 247, U.S. Government Printing Office, Washington, D.C. (December 23, 1971).

3. Environment Reporter, pp 121:1543 - 121:1578 updated thru April 21, 1978, The Bureau of National Affairs, Washington, D.C.

TEST SUMMARY - City of Shelby Sludge Incinerator

	Parameter	Run 1	Run 2	Run 3
Q_s	Stack volume flow rate, acfm	1887	1881	1987
Q_{std}	Stack volume flow rate, scfm	1648	1632	1707
%I	Percent isokinetic, %	99.3	98.3	99.5
pmr_{avg}	Emission rate, lb/hr.	0.1894	0.1459	0.1593
%EA	Percent excess air, %	43.8	29.8	45.4
	Refuse charge rate, lb/hr.	994	1145	1182
	Allowed emission rate, *lb/hr.	1.99	2.29	2.36
	Percent that emission rate is of the allowed rate, %	9.52	6.37	6.75

*Based on 15 NCAC 2D .0505

Calculation Summary

SOURCE City of Shelby Sludge Incin. Date 6 Feb 79

LOCATION Shelby, N.C.

ENTRY	RUN 1	RUN 2	RUN 3	ANSWER
Ave. ΔH (in H_2O)	[illegible]	[illegible]	[illegible]	
P_{atm} (in Hg)	29.5500	[illegible]	[illegible]	
	29.7022	29.6115	29.5581	P_m (in Hg)
P_s(gage)(in H_2O)	-0.1400	-0.1400	-0.1400	
	29.5397	29.4497	29.3897	P_s (in Hg)
T_m (^oR)	517.0000	525.0000	522.0000	
V_m (ft^3)	45.9000	45.3000	46.9100	
	46.7013	45.2499	47.0424	$V_{m_{std}}$ (ft^3)
V_{lq} (ml)	196.0000	216.0000	240.0000	
	9.2708	10.2168	11.3520	$V_{v_{std}}$ (ft^3)
	55.9721	55.4667	58.3944	V_{std} (ft^3)
	16.5632	18.4197	19.4402	%M
	0.8344	0.8158	0.8056	M_d
MW_d	30.0000	30.1900	30.0500	
	28.0124	27.9446	27.7075	M
T_s (^oR)	599.0000	601.0000	606.0000	
$\Sigma\sqrt{\Delta p}$	4.5654	4.5306	4.7430	
$n_{\Delta p}$	12.0000	12.0000	12.0000	
	0.3805	0.3776	0.3953	Ave $\sqrt{\Delta p}$
C_p	[illegible]	[illegible]	[illegible]	
	[illegible]	23.1668	[illegible]	v_s (ft/sec)
D_s (in)	[illegible]	15.7500	[illegible]	
	[illegible]	1.3530	[illegible]	A_s (ft^2)
	1887.	1881.	1987.	Q_s (ft^3/min)
	1648.	1632.	1707.	Q_{std} (ft^3/min)
W_t (gm)	0.0488	0.0378	0.0413	
	[illegible]	0.1471	0.1597	pmr_c (lb/hr)
D_n (in)	[illegible]	0.3780	0.3770	
	[illegible]	0.1122	0.1116	A_n (in^2)
θ (min)	[illegible]	60.0000	60.0000	
	[illegible]	0.1447	0.1589	pmr_a (lb/hr)
	99.3326	98.3395	99.5088	%I
	0.1894	0.1459	0.1593	pmr_{avg} (lb/hr)
%CO	0.0000	0.0000	0.0000	
$\%O_2$	6.6300	5.0000	6.7700	
$\%N_2$	[illegible]	82.5700	[illegible]	
	[illegible]	29.7646	[illegible]	%EA
F Factor				
				HI (10^6 BTU/hr.)
				pmr_u(lbs/10^6BTU)

NOMENCLATURE

A_n (in^2), Cross sectional area of nozzle

A_s (in^2), Cross sectional area of stack

A_s' (ft^2), Cross sectional area of stack

C_p Pitot tube calibration coefficient

%EA Percent Excess Air

F (scfd/10^6 BTU), F factor

ΔH (in H_2O), Average orifice meter reading

HI (10^6 BTU/hr), Heat Input Rate

%I Percent Isokineticity

M (lb/lb mole), Molecular Weight of wet gas

%M Percent Moisture

M_d Mole fraction of dry gas

MW_d (lb/lb mole) Molecular weight of dry gas

$n_{\Delta p}$ Number of Δp readings

P_{atm} (in Hg), Local atmospheric pressure

P_m (in Hg), Absolute pressure in dry gas meter

P_s (in Hg), Absolute stack pressure

$P_{s(gage)}$ (in H_2O), Measured static stack pressure

P_{std} (29.92 in Hg), Standard pressure

pmr_a (lb/hr), Pollutant mass rate based on ratio of areas

pmr_{avg} (lb/hr), Average pollutant mass rate

pmr_c (lb/hr), Pollutant mass rate based on concentration

pmr_u (lb/10^6 BTU), Specific emission rate

Δp (in H_2O), Velocity pressure

Q_s (ft^3/min), Actual stack volume flow rate

Q_{std} (ft^3/min), Stack volume flow rate at standard conditions

T_m (^{o}R), Average dry gas meter temperature

T_s (^{o}R), Average stack temperature

T_{std} (530 ^{o}R), Standard temperature

V_{lq} (ml), Liquid volume

V_m (ft^3), Sample volume measured by dry gas meter

$V_{m_{std}}$ (ft^3), Sample volume at standard conditions

V_{std} (ft^3), Total sample volume at standard conditions

$V_{v_{std}}$ (ft^3), Volume of water vapor collected, corrected to standard conditions

v_s (ft/sec), Stack velocity

W_t (gm), Total weight of particulate collected

θ (min), Duration of test

EQUATIONS

1. Absolute Pressure in Dry Gas Meter - P_m (in. Hg.)

$$P_m = P_{atm} + \frac{\Delta H}{13.6}$$

2. Absolute Stack Pressure - P_s (in. Hg.)

$$P_s = P_{atm} + \frac{P_{s(gage)}}{13.6}$$

3. Sample Volume at Standard Conditions - $V_{m_{std}}$ (ft^3)

$$V_{m_{std}} = V_m \frac{T_{std}}{T_m} \frac{P_m}{P_{std}}$$

4. Volume of Water Vapor Collected, Corrected to Standard Conditions - $V_{v_{std}}$ (ft^3)

$$V_{v_{std}} = K_2 V_{lq} \frac{T_{std}}{P_{std}} \qquad K_2 = 0.00267 \text{ (units conversion)}$$

5. Total Sample Volume at Standard Conditions - V_{std} (ft^3)

$$V_{std} = V_{m_{std}} + V_{v_{std}}$$

6. Percent Moisture in Stack Gas - %M

$$\%M = \frac{V_{v_{std}}}{V_{std}} \times 100$$

7. Mole Fraction of Dry Gas - M_d

$$M_d = \frac{100 - \%M}{100}$$

8. Molecular Weight of Wet Gas - M (lb/lb mole)

$$M = (MW_d \times M_d) + 18(1 - M_d)$$

9. Stack Velocity - v_s (ft/sec)

$$v_s = K_p C_p \sqrt{\frac{T_s}{P_s M}} \frac{\Sigma\sqrt{\Delta p}}{n_{\Delta p}}$$

K_p = 85.48 (units conversion factor)

10. Stack Volume Flow Rate - Q_s (ft^3/min)

$$Q_s = K_1 v_s A_s' \qquad K_1 = 60 \text{ (units conversion)}$$

11. Stack Volume Flow Rate at Standard Conditions - Q_{std} (ft^3/min)

$$Q_{std} = \frac{T_{std}}{P_{std}} \frac{P_s}{T_s} Q_s$$

12. Pollutant Mass Rate Based on Particulate Concentration - pmr_c (lb/hr)

$$pmr_c = K_3 \frac{W_t Q_{std}}{V_{std}} \qquad K_3 = 0.1323 \text{ (units conversion)}$$

13. Pollutant Mass Rate Based on the Ratio of the Cross Sectional Area of the Stack and the Sampling Nozzle - pmr_a (lb/hr)

$$pmr_a = K_3 \frac{W_t A_s}{\theta A_n} \qquad K_3 = 0.1323 \text{ (units conversion)}$$

14. Percent Isokineticity - %I

$$\%I = \frac{pmr_a}{pmr_c} \times 100$$

15. Average Pollutant Mass Rate - pmr_{avg} (lb/hr)

$$pmr_{avg} = \frac{pmr_a + pmr_c}{2}$$

16. Percent Excess Air - %EA

$$\%EA = \frac{\%O_2 - .5(\%CO)}{.264(\%N_2) - \%O_2 + .5(\%CO)} \quad (100)$$

17. Heat Input Rate - HI (10^6 BTU/hr)

$$HI = \frac{60 \; Q_{std} \; M_d}{F(100 + \%EA)} \quad (100)$$

18. Specific Emission Rate - pmr_u (lb/10^6 BTU)

$$pmr_u = \frac{pmr_{avg}}{HI}$$

DRY MOLECULAR WEIGHT DETERMINATION

PLANT City of Shelby
DATE 8 Feb 79 (Samples taken 6 Feb 79)
SAMPLING LOCATION Stack of sludge Incinerator
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Integrated
ANALYTICAL METHOD Orsat
AMBIENT TEMPERATURE 70°F
OPERATOR

COMMENTS:

Run 1 Lung 4 REW

Time	read	%	read	%	read	%	Average Volume	Multiplier	Molecular Weight M_d
$\%CO_2$	10.9	10.9	10.8	10.8	10.9	10.9	10.87	.44	4.78
$\%O_2$	7.5	6.6	6.5	6.7	7.5	6.6	6.62	.32	2.12
$\%N_2$	~~82.5~~	82.5		82.5		82.5	82.5	.28	23.10
									30.00

Run 2 Lung 5 GC

Time	read	%	read	%	read	%			
$\%CO_2$	12.5	12.5	12.4	12.4	12.4	12.4	12.43	.44	5.47
$\%O_2$	5.5	5.0	5.3	4.9	7.5	5.1	5.00	.32	1.60
$\%N_2$		82.5		82.7		82.5	82.57	.28	23.12
									30.19

Run 3 Lung 6 REW

Time	read	%	read	%	read	%			
$\%CO_2$	11.1	11.1	11.1	11.1	11.1	11.1	11.10	.44	4.88
$\%O_2$	7.9	6.5	7.8	6.7	7.9	6.8	6.77	.32	2.17
$\%N_2$		82.1		82.2		82.1	82.13	.28	23.00
									30.05

APPENDIX C

ANALYTICAL DATA

Lab No. 0707

3-6-79

Plant City of Shelby

Run Number 1 Date 2/6/79

Location Shelby N.C

FILTER WEIGHTS				TOTALS
Filter Number	55603			
Final Weight (g)				*
Tare Weight (g)	.4069			.4069

WASHINGS				TOTALS
Beaker Number	8			
Volume (Acetone)	200			200
Final Weight (g)	183.7520			183.7520
Tare Weight (g)	183.2956			183.2956

ACETONE BLANK

Lot Number Fisher 775109

Beaker Number B

Volume (ml) 300

Final Weight (g) 182.0239

Tare Weight (g) 182.0229

Blank Residue (g) .0010 of Image

TOTAL PARTICULATE CATCH

Filter Final Weight *

+ Washings, Final Weight 183.7520

- Filter Tare .4069

- Beaker Tare (Washings) 183.2956

- Corrected Blank .0007

= Total Particulate (g) .0488

BLANK CORRECTION =

$$\frac{(\text{Vol. Washings})}{(\text{Vol. Blank})} \times (\text{Blank Residue})$$

$$\frac{(200)}{(300)} \times (.0010) = .0007$$

IMPINGERS (1, 2, 3)

Final Volume (ml) 374

Initial Volume (200 ml) 200

Water Collected (ml) 174

SILICA GEL

Final Weight (g) 222.2

Initial Weight (g) 200

Moisture Collected (g) 22.2

Total Water Collected (ml) 196.2

*These blocks will be blank if filter is weighed together with the washings.

10-23-75 WOGR

APPENDIX C

ANALYTICAL DATA

Lab No. 0708

3-6-79 GPB ✓ JB

Plant City of Shelby

Run Number 2 Date 2/6/79

Location Shelby N.C.

FILTER WEIGHTS				TOTALS
Filter Number	55604			
Final Weight (g)				*
Tare Weight (g)	.3950			.3950

WASHINGS				TOTALS
Beaker Number	BMF6			
Volume (Acetone)	150			150
Final Weight (g)	168.0597			168.0597
Tare Weight (g)	167.6264			167.6264

ACETONE BLANK

Lot Number Fisher T75109

Beaker Number

Volume (ml) As on

Final Weight (g) #707 OK Mwgt

Tare Weight (g)

Blank Residue (g)

TOTAL PARTICULATE CATCH

Filter Final Weight *	
+ Washings, Final Weight	168.0597
- Filter Tare	.3950
- Beaker Tare (Washings)	167.6264
- Corrected Blank	.0005
= Total Particulate (g)	.0378

BLANK CORRECTION =

$$\frac{(\text{Vol. Washings})}{(\text{Vol. Blank})} \times (\text{Blank Residue})$$

$$\frac{(150)}{(300)} \times (.0010) = .0005$$

IMPINGERS (1, 2, 3)		SILICA GEL	
Final Volume (ml)	397	Final Weight (g)	218.8
Initial Volume (200 ml)	200	Initial Weight (g)	200
Water Collected (ml)	197	Moisture Collected (g)	18.8

Total Water Collected (ml) 215.8

*These blocks will be blank if filter is weighed together with the washings.

10-23-75 WOGR

ANALYTICAL DATA

Lab No. 0709

3-6-79

Plant City of Shelby

Run Number 3 Date 2/6/79

Location Shelby, N.C.

FILTER WEIGHTS				TOTALS
Filter Number	55605			
Final Weight (g)				*
Tare Weight (g)	.4033			.4033

WASHINGS				TOTALS
Beaker Number	AG			
Volume (Acetone)	100			100
Final Weight (g)	175.0689			175.0689
Tare Weight (g)	174.6240			174.6240

ACETONE BLANK Fisher

Lot Number 775109

Beaker Number ↑

Volume (ml) As on

Final Weight (g) #707 or larger

Tare Weight (g) ↓

Blank Residue (g)

TOTAL PARTICULATE CATCH

Filter Final Weight *	
+ Washings, Final Weight	175.0689
- Filter Tare	.4033
- Beaker Tare (Washings)	174.6240
- Corrected Blank	.0003
= Total Particulate (g)	.0413

BLANK CORRECTION =

$$\frac{(\text{Vol. Washings})}{(\text{Vol. Blank})} \times (\text{Blank Residue})$$

$$\frac{(100)}{(300)} \times (.0010) = .0003$$

IMPINGERS (1, 2, 3)		SILICA GEL	
Final Volume (ml)	418	Final Weight (g)	221.8
Initial Volume (200 ml)	200	Initial Weight (g)	200.0
Water Collected (ml)	218	Moisture Collected (g)	21.8

Total Water Collected (ml) 239.8

*These blocks will be blank if filter is weighed together with the washings.

10-23-75 WOGR

AIR QUALITY SECTION

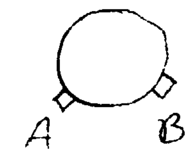
SOURCE SAMPLING FIELD DATA

Plant [illegible]
Date 6 Feb '79
Location Sludge Incinerator
Sample Type particulate
Run Number 1
Operator REW
Sample Box No. 1
Meter Box No. 2

Meter $\Delta H_@$ 1.87
C Factor 120 - .89, 130 - .82, 140 - .75, 150 - .68, 160 - .56 (Varies)
Probe Type pyrex
Probe Length 3'/4' [illegible]
Probe Tip Dia., In. .376
Probe Heater Setting max
Heater Box Setting max
Assumed Moisture % saturated

Ambient Temperature 32°F
Barometric Pressure, In. Hg. 29.55
Static Pressure (P_s), -.14
Stack Dimension(s) 15.75 in. dia.
Distance: Disturbance to port 24 ft
Distance: Port to exit 13 ft
Leak Rate .001 cfm@ 15 in. Hg
Filter number(s) 55603

Remarks:



process 1000 lb in 65 min. ... [illegible]

Exit leak rate .000 cfm @ 10 in Hg

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	% CO_2 (Fyrite)
A 1	0	1:00 PM	706.273	.10		1.25	[illegible]		[illegible]	[illegible]	200	40	12.5
2	5		709.28	.11		1.25	155		42	3	205	41	12.5
3	10		712.26	.16		1.7	160		46	5	215	44	12.5
4	15		715.67	.21		2.6	150		50	7	220	62	12.5
5	20		719.52	.22		2.7	150		52	7	220	91	13.5
6	25		724.29	.17		2.3	140		56	6	225	71	14.0
6	30		728.498										
B 1	30		728.498	.07		1.0	135		60	3	225	60	11.0
2	35		731.25	.10		1.5	130		62	4	225	55	10.5
3	40		734.48	.13		1.9	135		64	5	225	50	10.0
4	45		738.14	.17		2.8	125		66	6	225	48	7.5
5	50		742.64	.18		3.1	120		70	7	225	49	7.0
6	55		747.6	.16		2.7	115		72	6	225	50	7.0
6	60	2:04 PM	752.194										

V_m = 45.90 $\overline{\sqrt{\Delta p}}$ = .3803 $\overline{\Delta H}$ = 2.07 $\overline{T_s}$ = 139°F, 599°R $\overline{T_m}$ = 57°F, 517°R $\overline{\%CO_2}$ = 10.9

AQ-44
12-15-72 6-2-76 WOGR

AIR QUALITY SECTION

SOURCE SAMPLING FIELD DATA

Plant City of Shelby

Date 6 Feb

Location Sludge Incinerator

Sample Type particulate

Run Number 2

Operator REW

Sample Box No. 2

Meter Box No. 2

Meter $\Delta H_@$ 1.847

C Factor 120-.89 130-.82 140-.75 150-.68 160-.56

Probe Type

Probe Length 3'/4' long

Probe Tip Dia., In. .328

Probe Heater Setting

Heater Box Setting

Assumed Moisture % saturated

Ambient Temperature 32°F

Barometric Pressure, In. Hg.

Static Pressure (P_s), -.14

Stack Dimension(s) 15.75 in Dia

Distance: Disturbance to port

Distance: Port to exit

Leak Rate .001 cfm@ 15 in Hg

Filter number(s) 55

Remarks:

TRAVERSE POINT NUMBER	SAMPLING TIME, min / CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	% CO_2 (Fyrite)
1	2:55	752.595	.09		.6	130		56	3	152	39	13
2		755.44	.09		1.2	140			3	190	36	13
3	10	758.50	.14		2.0	140		58	4	195	37	12.5
4	15	761.93	.15		2.7	145			5	200	38	13.0
5	20	766.24	.20		2.8	140		64	6	210	39	11.0
6	25	770.78	.20		2.7	141				210	—	12.5
	30	775.292										
1	30	775.292	.07		.88	150		68	3	210	63	13.0
		777.9	.09		1.3	135		68	3	210	55	12.0
	40	780.71	.14		2.0	140		70	4	215	50	12
	45	784.61	.19		2.7	140		70	5	210	47	12.5
	50	788.96	.21		2.9	140		72	6	210	45	11.5
		793.61	.21		2.7	151		72	6	210	45	12.0
		798.224										
		-.594										

V_m = 45.30 $\overline{\Delta H}$ = 2.06 $\overline{T}$ = 141°F $\overline{T_m}$ = 65°F

AIR QUALITY SECTION

SOURCE SAMPLING FIELD DATA

Plant [illegible] Meter ΔH@ 1.817 (120-.89 140-.75 160-.56)

Date 6 Feb 77 C Factor (130-.82 150-.68)

Location [illegible] Probe Type pyrex

Sample Type [illegible] Probe Length 3 1/4' [illegible]

Run Number [illegible] Probe Tip Dia., In. .377

Operator [illegible] Probe Heater Setting [illegible]

Sample Box No. [illegible] Heater Box Setting [illegible]

Meter Box No. 2 Assumed Moisture % [illegible]

Ambient Temperature 35

Barometric Pressure, In. Hg. 29.40

Static Pressure (P_s), -.14

Stack Dimension(s) 15.75 inside

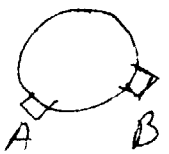
Distance: Disturbance to port 24 ft

Distance: Port to exit 13 ft

Leak Rate .001 cfm@ 16 in Hg

Filter number(s) 556.05

Remarks:



Lung 6

End leak check .000 cfm @ 10 in Hg

TRAVERSE POINT NUMBER	SAMPLING TIME, min / CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m) ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	% CO_2 (Fyrite)
				DESIRED	ACTUAL		INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F				
1	0 4.42	795.613	.11		1.4	150		54	3	160	30	11
2	[illegible]	801.83	.12		1.6	150		54	4	200	35	12
3	10	805.14	.14		2.0	140		56	5	220	36	12
4	15	808.29	.14		2.7	140		58	6	225	40	11 1/2
5	20	813.17	.21		3.0	140		60	7	230	60	12
6	25	817.56	.15		2.0	150		64	5	240	71	13
6	30	822.002										
1	30	822.002	.075		.94	150		64	3	235	50	13
2	35	826.67	.16		1.1	140		64	4	240	50	11
3	40	832.24	.14		1.9	145		66	5	240	50	11 1/2
4	45	837.34	.22		2.8	150		68	7	240	50	13 1/2
5	50	843.13	.26		3.0	155		70	8	240	53	12
6	55	849.90	.11		2.7	140		70	5	240	66	12 1/2
6	60	855.523										

$\overline{V_m}$ = 46.91 $\overline{\Delta H}$ = 2.15 $\overline{T_s}$ = 146°F 606°R $\overline{T_m}$ = 62°F 522°R %CO_2 = 12.1

Preliminary Field Data

18.5
15.75
2.75

Plant City of Shelby Wastewater Treat.

Date Feb. 6 1979

Port Location STACK

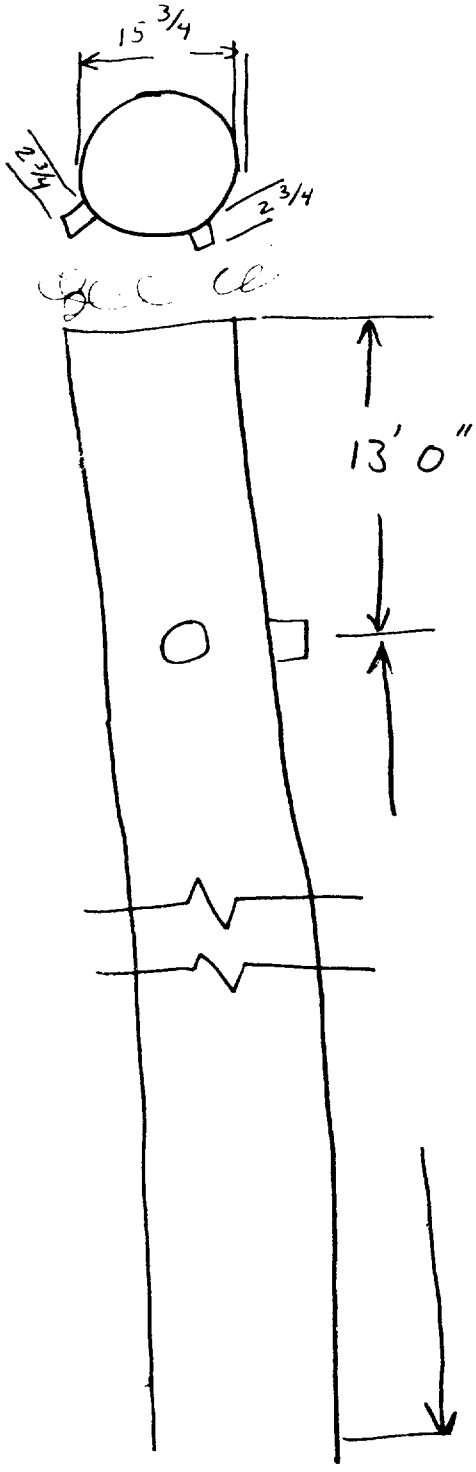
Nearest Disturbance:

Before Port ~~>8'~~ 24 ft

After Port >20 13'-0"

Duct Diameter 15 3/4" 1,313 ft

Nipple 2.75"



Sketch of stack or duct showing location of sampling ports

Point Number		% of Diameter	Distance From Near Wall
A	1	6.7	
	2	25.0	
	3	75.0	
	4	93.3	
B	5		
	6		
	7		
	8		
A & B	1	4.4	.06 ft → .08 ft
	2	14.7	.19 ft
	3	29.5	.39 ft
	4	70.5	.93 ft
	5	85.3	1.12 ft
	6	93.3	1.25 ft → 1.23 ft

NOMOGRAPH DATA

PLANT City of Shelby Wastewater Treatment

DATE 6 Feb 79

SAMPLING LOCATION Sludge Incinerator

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.847
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	60
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	Saturated
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.55
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	-.14
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	138
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	.115
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	.120
C FACTOR		120 - .89, 130 .82, 140 - .75, 150 - .68, 160 - .56
CALCULATED NOZZLE DIAMETER, in.		
ACTUAL NOZZLE DIAMETER, in.		.376
REFERENCE Δp, in. H_2O		

Preliminary Traverse

Point	Δp	T_s
A 1	.06	135
2	.105	140
3	.135	140
4	.19	135
5	.120	140
6	.118	140

$\overline{\Delta p} = .15$

$\overline{T_s} = 138$

EPA (Dur) 234 WOGR
4/72

01/12/87
per Don Rhow
City of Shelby
WW Trt. Plant
- weighed
off vac. filter
∴ dry

APPENDIX G

SLUDGE CHARGE RATE AND ALLOWABLE EMISSIONS

		Weight totalizer	Time
Run 1	End	2591920 lb	2:10 pm
	Begin	2590843 lb	1:05 pm
	Total	1077 lb	1 hr. 5 min.
Run 2	End	2594168 lb	4:05 pm
	Begin	2592928 lb	3:00 pm
	Total	1240 lb	1 hr. 5 min.
Run 3	End	2596321 lb	5:48 pm
	Begin	2595041 lb	4:43 pm
	Total	1280 lb	1 hr. 5 min.

Run 1

$$E = (.002)\left(\frac{1077\ lb}{65\ min} \times \frac{60\ min.}{1\ hr.}\right) = (.002)(994\ \frac{lb}{hr.})$$

E = 1.99 lb/hr

Run 2 E = 2.29 lb/hr

Run 3 E = 2.36 lb/hr