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.

2012

136

75

12/17/86

RESULTS OF THE MAY 5, 1981

PARTICULATE EMISSION MEASUREMENTS

OF THE SLUDGE INCINERATOR

LOCATED AT

THE METROPOLITAN DISTRICT COMMISSION

INCINERATOR PLANT

HARTFORD, CONNECTICUT

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1.0 Introduction

Henry Souther Laboratories was retained by The Metropolitan District Commission to perform compliance tests at their sludge incinerator located on Brainard Road, Hartford.

A source test plan was submitted in April, 1981 and accepted by the DEP. The tests were conducted on May 5, 1981 by Thomas C. Tirone, Technical Advisor for The Henry Souther Laboratories.

All data for the incinerator was monitored and recorded by MDC personell. Mr. George Miller was the Connecticut DEP engineer on site to monitor the testing.

2.0 Conclusions

The average emission rate, corrected to 12% CO_2 according to the New Source Performance Standards, Subpart E for incinerators, was 0.042 grains per dry standard cubic feet.

The DEP emission limitation for incinerators is 0.08 grains per dry standard cubic feet corrected to 12% CO_2.

3.0 Test Results and Discussion

The results of the tests of the MDC sludge incinerator for particulates are summarized in Table 3-1. The average particulate emission was 0.042 gr/dscf corrected to 12% CO_2.

During the testing period, the incinerator average feed rate was 8 tons per hour which is the normal operating condition.

Incinerator data sheets taken during testing are in Appendix A.

Inspection of the bypass damper was made during testing to insure it was positively closed.

Gas samples were taken on the inlet of the scrubber to check the percentages of combustion gasses to allow for correction due to absorption of CO_2 in the scrubber water.

Table 3-1

Summary of Particulate Test Results

of The Metropolitan District Commission

Sludge Incinerator

Test No.	Date	Sampling Time	Volumetric Flow Rate dscfm	Sample Volume dscf	% Adjusted CO_2	Isokinetic Factor %	Particulate Emissions gr/dscf @12% CO_2
1	5-5-81	08:30 - 10:50	28,090	47.22	3.60	101.2	0.056
2	5-5-81	12:30 - 14:30	33,528	61.58	3.23	106.5	0.026
3	5-5-81	14:50 - 17:15	30,186	53.29	3.22	103.3	0.043
						Average	0.042

APPENDIX A

FIELD DATA SHEETS

LAB DATA

INCINERATOR DATA

1 of 2

FIELD DATA SHEET

Name MDC	Pump No. 1	Nozzle No. & Dia. N2 .2530 in.	Nomograph C Factor 90
Location HARTFORD	Orifice No. 1	Assumed Moisture 8 %	Pitot Coefficient .84
No. #1	Ambient Temp 70 °F	Test Duration 96 min.	Orifice ΔH 1.80
Location UNIT #3 STACK	Bar Press 30.1 "Hg	Traverse Point Interval 4 min.	Test Start Time 0830
Project No.	Probe Ident. No. 1	Probe Heater Setting 240	Test End Time 1050
MA-1-5-81	Filter Ident. No. 00036/00034	Filter Temp. Setting 240	Leak Test Start 0 CFM 10 "Hg
Tirone	Duct Area 19.6 ft²	Dry Gas Meter Y 1.01	Leak Test Final 01 CFM 12 "Hg

Point	Time Min.	Velocity ΔP' in H_2O	ΔH in H_2O	T_M in °F	T_M Out °F	P_{STACK} in H_2O	T_{STACK} °F	Initial Metric Volume cu. ft.	PROBE	Cyc. Angle #	Heater Box Temp.	Temp. of Gas Leaving Condenser °F	Pump Vac. in Hg	Probe Temp. °F	O_2 Conc. %
1	40	.17=	.61	60	60	-.10	122	841.54			240	50	2	240	
2		.17=	.61	60	60		125	843.24							
3		.16=	.57	60	60		124	844.96				60			
4		.17=	.61	62	62		123	846.70			240	60	2.0	240	
5		.19=	.67	62	62		125	848.55					2.5		
6		.20=	.76	64	62		128	850.19							
7		.22=	.76	64	62		125	852.25							
8		.21=	.73	66	62		124	854.20			240	60	3.0	240	
9		.22=	.76	66	64		124	856.05					3.0		
10		.16=	.57	67	63		129	857.95							
11		.16=	.57	67	63		124	859.			240	60	2.5	240	
12	40	.21=	.73	67	63		119	861.40							
								863.30							

Wash RW Cleaning Patch —

Collected 45cc

ORSAT Measurements

	Time	CO_2	O_2	CO	N_2
1					
2					
3					

ORSAT Bag Sample Triplicate Analysis

CO_2	O_2	CO	N_2

2 of 2

FIELD DATA SHEETS

Name MOC	Pump No. 1	Nozzle No. & Dia. 11-2 .2530 in.	Nomograph C Factor .190
Location HARTFORD	Orifice No. 1	Assumed Moisture 8 %	Pitot Coefficient .84
No. 21	Ambient Temp 62 °F	Test Duration 96 min.	Orifice $\Delta H_@$ 1.80
Sampling Location #3 OUT	Bar Press 30.1 "Hg	Traverse Point Interval 4.0 min.	Test Start Time 08:30
Project No.	Probe Ident. No. 1	Probe Heater Setting 240 °F	Test End Time 10:50
Date 5-5-81	Filter Ident. No. 00036/00034	Filter Temp. Setting 240	Leak Test Start 0 CFM@ 10 "Hg
Tester T. BONE	Duct Area 19.6 ft²	Dry Gas Meter Y 1.01	Leak Test Final 01 CFM@ 12 "Hg

Point	Time Min.	Velocity ΔP in H_2O	ΔH in H_2O	T_M in °F	T_M Out °F	P_{STACK} in H_2O	T_{STACK} °F	Initial Metric Volume cu. ft.	Probe	Cyc. Angle #	Heater Box Temp.	Temp. of Gas Leaving Condenser °F	Pump Vac. in Hg	Probe Temp. °F	O_2 Conc. %
1	40	.25	.88	64	62	-.10	124	86330			240	60	3.5	240	
2		.28	.97	66	63		125	86540					6.5		
3		.30	1.05	68	64		134	86745			240		2.5	240	
4		.31	1.09	68	64		135	86955					3.0		
5		.27	.93	68	66		152	87184			240	60	3.0	240	
6		.16	.56	72	67		155	87405							
7		.24	.83	73	68		146	87580					3.0		
8		.25	.88	74	68		137	87780							
9		.25	.88	74	70		135	87985			240	60	3.0	240	
10		.23	.79	74	70		135	88215							
11		.23	.79	78	70		135	88410			240	60	3.0	240	
12		.23	.79	78	70		134	88590							
								88780							

* Changed filter ran leak test ok

Probe Wash [illegible] Sampling Patch

[illegible] Filtered 45CC

[illegible] Condition Clean

ORSAT Measurements

Time	CO_2	O_2	CO	N_2
1				
2				
3				

ORSAT Bag Sample Triplicate Analysis

CO_2	O_2	CO	N_2	
5.2	13.6		81.2	IN (BEFORE SCRUBBER)
3.4	[illegible]		[illegible]	OUT (STACK)

1 of 2

FIELD DATA SHEETS

Name MDC
Location HARTFORD
No. #2
Ing Location STACK #3
Project No.
5/5/81
TIRONE

Pump No. 1
Orifice No. 1
Ambient Temp 70 °F
Bar Press 30.1 "Hg
Probe Ident. No. 1
Filter Ident. No. 00035/
Duct Area 19.6 ft²

Nozzle No. & Dia. N-2 .2530 in.
Assumed Moisture 8/6 %
Test Duration 96 min.
Traverse Point Interval 4.0 min.
Probe Heater Setting 240 amps
Filter Temp. Setting 240
Dry Gas Meter Y 1.01

Nomograph C Factor .90/.94*
Pitot Coefficient .84
Orifice ΔH Tm 1.80
Test Start Time 12:30
Test End Time
Leak Test Start .002 CFM 10 "Hg
Leak Test Final .005 CFM 15 "Hg

Point	Time Min.	Velocity ΔP in H_2O	ΔH in H_2O	T_M in °F	T_M Out °F	P_{STACK} in H_2O	T_{STACK} °F	Initial Metric Volume cu. ft.	PROBE	Cyc. Angle °	Heater Box Temp.	Temp. of Gas Leaving Condenser °F	Pump Vac. in Hg	Probe Temp. °F	O_2 Conc. %
1	4.0	25=	.86	68	68	-.10	126	888.36			240	58	2.0	240	
2		30=	1.09	70	68		127	890.							
3		30=	1.09	72	70		128	892.90					3.5		
4		32=	1.15	76	70		129	895.06			240	60	3.5	240	
5		32=	1.15	78	70		131	897.55					4.0		
6		32=	1.20	80	72		132	900.15							
7		32=	1.20	82	72		133	902.55							
8		34=	1.27	86	74		134	904.98			240	62	4.0	240	
9		35=	1.30	88	76		136	907.45							
10		32=	1.20	88	76		136	910.08			240	62	4.5	240	
11		34=	1.27	88	76		135	912.56							
12		30=	1.10	89	76		135	915.20			240	62	4.5	240	

*moist check 6%

Cleaning Patch
H_2O Collected

ORSAT Measurements

Time	CO_2	O_2	CO	N_2

ORSAT Bag Sample Triplicate Analysis

CO_2	O_2	CO	N_2

2 of 2

FIELD DATA SHEETS

m Name MDC	Pump No. 1	Nozzle No. & Dia. W-2 2530 in.	Nomograph C Factor .94 / .98 *
nt Location HARTFORD	Orifice No. 1	Assumed Moisture 6 %	Pitot Coefficient .84
t No. #2	Ambient Temp 72 °F	Test Duration 96 min.	Orifice ΔH_A 1.80
pling Location STACK #3 OUT	Bar Press 30.1 "Hg	Traverse Point Interval 4 min.	Test Start Time 12:30
Project No.	Probe Ident. No. 1	Probe Heater Setting 240 amps	Test End Time 14:30
5-5-81	Filter Ident. No. 00035	Filter Temp. Setting 240	Leak Test Start 002 Chk 10 "Hg
ter TIRONE	Duct Area 19.6 ft²	Dry Gas Meter Y 1.01	Leak Test Final 005 Chk 15 "Hg

Point	Time Min.	Velocity ΔP in H_2O	ΔH in H_2O	T_M in °F	T_M Out °F	P_{STACK} in H_2O	T_{STACK} °F	Initial Metric Volume cu. ft.	PROBE	Cyc. Angle #	Heater Box Temp.	Temp. of Gas Leaving Condenser °F	Pump Vac. in Hg	Probe Temp. °F	O_2 Conc. %
1	40	25=	.93	82	76	-.10	132	917.62			240	60	4.0	240	
2		27=	1.00	84	76		134	919.75							
3		30=	1.13	86	78		134	922.09							
4		30=	1.13	86	78		134	924.48							
5		32=	1.20	88	80		132	926.88			240	62	5.0	240	
6		32=	1.22	96	84		134	929.85							
7		37=	1.40	96	86		132	932.10					6.0		
8		37=	1.40	96	87		132	934.75							
9		38=	1.43	94	82		130	937.50							
10		40=	1.51	94	82		127	940.18			240	64	6.5	240	
11		40=	1.51	95	83		125	943.00							
12		38=	1.43	96	84		125	945.75							
								949.18							

* Chk Nomo meter Temp up

3.9.12
61.82

be Wash PW-2 Cleaning Patch —

ice Gal [redacted] H_2O Collected 47

[redacted] Condition Kuhl

ORSAT Measurements

	Time	CO_2	O_2	CO	N_2
1					
2					
3					

ORSAT Bag Sample Triplicate Analysis

CO_2	O_2	CO	N_2	
5.4	13.7	–	80.9	IN
3.0	[illegible]	–	80.8	OUT

FIELD DATA SHEETS

Name MDC
Location HARTFORD
No. STACK #3 OUT
Log Location STACK OUT
Project No.
54-5-81
TIRONE

Pump No. 1
Orifice No. 1
Ambient Temp 75 °F
Bar Press 30.1 "Hg
Probe Ident. No. 1
Filter Ident. No. 00030/00032
Duct Area 19.6 ft²

Nozzle No. & Dia. N-2 2530 in.
Assumed Moisture 6 %
Test Duration 96 min.
Traverse Point Interval 4 min.
Probe Heater Setting 240 amps
Filter Temp. Setting 240
Dry Gas Meter Y 1.01

Nomograph C Factor .98
Pitot Coefficient .84
Orifice ΔH Δ in. 180
Test Start Time 14:50
Test End Time 17:15
Leak Test Start .003 CFM 15 "Hg
Leak Test Final .005 CFM 15 "Hg

Point	Time Min.	Velocity ΔP in H_2O	ΔH in H_2O	T_M in °F	T_M Out °F	P_{STACK} in H_2O	T_{STACK} °F	Initial Metric Volume cu. ft.	PROBE	Cyc. Angle °	Heater Box Temp.	Temp. of Gas Leaving Condenser °F	Pump Vac. in Hg	Probe Temp. °F	O_2 Conc. %
1	4.0	26-	.98	94	84	-.1	131	949.42			240	64	3.0	240	
2		24-	.92	96	84		136	951.70							
3		28-	1.05	98	86		135	953.85							
4		28-	1.05	98	86		139	955.75			240	64	4.0	240	
5		30-	1.15	96	85		141	958.38							
6		30-	1.15	96	85		142	960.98							
7		33-	1.27	96	85		142	963.33							
8		35	1.32	98	86		142	965.88			240	65	5.5	240	
9		30-	1.15	98	86		143	968.65							
10		28-	1.05	98	86		142	971.10							
11		28-	1.05	100	88		142	972.93							
12		26-	.98	94	82		136	975.45			240	65	5.5	240	

90.9 139.3

Cash _____ Cleaning Patch _____
Cal _____ H_2O Collected _____

ORSAT Measurements

Time	CO_2	O_2	CO	N_2

ORSAT Bag Sample Triplicate Analysis

CO_2	O_2	CO	N_2

[illegible] DATA SHEETS

Name MDC
Location HARTFORD
No. #3
Ing Location STACK OUT
Project No. #3
5-5-81
TIRONE

Pump No. 1
Orifice No. 1
Ambient Temp 75 °F
Bar Press 30.1 "Hg
Probe Ident. No. 1
Filter Ident. No. 00030/00032
Duct Area 19.6 ft²

Nozzle No. & Dia. N-2, 2530 in.
Assumed Moisture 6 %
Test Duration 96 min.
Traverse Point Interval 4.0 min.
Probe Heater Setting 240
Filter Temp. Setting 240
Dry Gas Meter Y 1.01

Nomograph C Factor 98
Pitot Coefficient .84
Orifice ΔH in 1.80
Test Start Time 14:50
Test End Time
Leak Test Start .003 CFM 15 "Hg
Leak Test Final .005 CFM 15 "Hg

Point	Time Min.	Velocity ΔP in H_2O	ΔH in H_2O	T_M in °F	T_M Out °F	P_{STACK} in H_2O	T_{STACK} °F	Initial Metric Volume cu. ft.	PROBE	Cyc. Angle #	Heater Box Temp.	Temp. of Gas Leaving Condenser °F	Pump Vac. in Hg	Probe Temp. °F	O_2 Conc. %
1	40	20	.77	90	86	-.10	127	977.70			240	67	45	240	
2		24	.92	92	86		125	979.70							
3		22	.83	94	88		126	982.05					5.0		
4		26	1.00	96	88		127	984.10					2.0		
5		26	1.00	96	88		126	986.28			240	68	2.0	240	
6		22 *	.83	98	88		131	988.65							
7		20	.76	96	85		130	990.73							
8		20	.76	98	86		128	992.78			240	68	2.0	240	
9		20	.76	98	86		131	994.85							
10		20	.76	98	86		131	996.88							
11		20	.76	98	86		130	998.90			240	68	2.0	240	
12		20	.76	98	86		130	1000.92							
								1003.02							

* changed FILTER/LEAK OK

Wash PW-3 Cleaning Patch —
Gel SG-3 H_2O Collected 39
Gel [illegible] H_2O Condition Cloudy

ORSAT Measurements

	Time	CO_2	O_2	CO	N_2
1					
2					
3					

ORSAT Bag Sample Triplicate Analysis

CO_2	O_2	CO	N_2	
5.4	13.3			IN
3.2	16.4		80.4	OUT

REPORTED BY
SHIFT 1 Bret SHIFT 2 _____ SHIFT 3 M Carter

INCINERATOR OPERATION

DAY OF WEEK Tues
DATE 5-5 19 81

	TEMPERATURES (°F) 6 POINT						EQUIPMENT STATUS CHECK															REMARKS
TIME	FUR. OUT	SCR IN	SCR OUT	I.D. FAN IN	B.P. STACK	C.S. OUT	BOT. BRG.	FUR. DR.	SHAFT C.A.F.	SL. BUR. BLOW	OIL PUMPS	A.B. BLOW	ASH PUMPS	SSW PUMP	GAS PRES	~~GAS~~ SCR	TOP BRG.	I.D. FAN	SL. COM. A.F.	SCREW CONV.	BELT CONV.	
8 AM	[illegible]	[illegible]	70	90	55	270	✓	✓	✓	✓	-		✓	-	✓	✓	✓	✓	-	✓	6	
9	680	160	70	90	50	255	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	-	✓	6	
10	750	160	70	100	50	260	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	-	✓	6	
11	910	150	70	100	55	340	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	-	✓	6	
NOON	[illegible]	[illegible]	[illegible]	70	60	[illegible]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
1	910	160	80	100	60	[illegible]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	6	
2	[illegible]	[illegible]	75	[illegible]	60	310	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	6	
3	950	160	75	100	65	320	✓	✓	✓	✓	✓	-	✓	-	✓	✓	✓	✓	-	✓	6	
4																						
5																						
6	920	160	75	95	80	300	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	-	-	✓	6	
7	710	160	75	75	80	265	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	6	
8	675	155	65	75	80	260	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	-	✓	✓	6	
9	645	150	65	75	80	255	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	6	
10	645	160	80	85	65	265	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	✓	✓	6	
11	800	160	90	105	65	300	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	✓	✓	6	
MID-NIGHT	700	150	80	90	60	260	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	-	✓	[illegible]	
1	720	150	80	90	60	280	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	-	✓	5	
2	1000	170	90	110	60	310	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	-	✓	5	
3	790	160	90	110	60	300	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	-	✓	5	
4	640	160	70	80	60	250	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	-	✓	5	
5	690	160	80	90	60	260	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	-	✓	5	
6	1030	140	80	90	60	350	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	-	✓	5	
7	820	160	80	90	60	360	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	-	✓	5	

REMARKS: 089516 089521 089525
089512 089516 089521
40,000 50,000 40,000

H-12a

INCINERATOR NO. III

REPORTED BY

SHIFT 1 Bret

SHIFT 2

SHIFT 3 Carter

HARTFORD WATER POLLUTION CONTROL PLANT
DAILY REPORT "A"
INCINERATOR OPERATION

DAY OF WEEK Tues

DATE 5-5 19 81

TIME	SLUDGE FEED METER	% HIGH	% M.	TEMPERATURES (°F) 11 POINT H-1	H-2	H-3	H-4	H-5	H-6	H-7	H-8	H-9	H-10	H-11	MISC (IN. WATER) F.D.	S.D.	C.A. S.P.	BURNERS IN USE H-5	H-7	H-9	H-11	REMARKS
8 AM	62.5	10.5		800	870	1040	1060	1340	[illegible]	[illegible]	830	390	[illegible]	100	1.7	6	0	–	2	1	–	
9	71.0	8.5		820	790	1160	1040	1400	1500	[illegible]	1170	550	240	120	4	4.5	0	–	2	2	–	
10	79.5	8.5		870	820	1170	1200	1400	1450	[illegible]	[illegible]	710	240	90	4	4.5	0	–	2	2	–	
11	86.[illegible]	7.0		960	1010	1210	1270	1395	[illegible]	[illegible]	[illegible]	890	270	90	4	8	0	–	2	1	–	
NOON	[illegible]	[illegible]		[illegible]	950	1060	[illegible]	[illegible]	[illegible]	[illegible]	770	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	–	2	1	–	
1	100.5	7.0		[illegible]	970	[illegible]	1340	[illegible]	1370	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.1	8	0	–	2	1	–	
2	107.5	7.0		[illegible]	[illegible]	[illegible]	1170	1150	[illegible]	[illegible]	1190	810	270	90	3.1	8	0	–	2	1	–	
3	115.0	7.5		1010	1060	1170	1340	1410	1470	1180	910	860	230	90	3.2	7.5	0	–	1	1	–	
4	121.3	6.3																				
5	129.2	8.9																				
6	135.9	6.7		970	985	980	1140	1425	1445	1175	970	580	325	510	2.2	7.5	0	–	2	1	–	
7	144.0	8.1		760	825	970	1040	1440	1440	1135	755	715	270	125	2.0	6.5	0	–	3	1	–	
8	153.6	9.6		745	785	950	990	1460	1490	1195	1045	970	345	120	2.0	6.5	0	–	1	1	–	
9	163.0	10.6		740	770	935	780	1350	1360	1460	1530	1215	525	120	2.0	6.5	0	–	2	2		
10	172.3	9.3		720	765	940	975	1375	1370	1640	1650	1350	660	135	4.2	5.5	0	–	3	2	–	
11	180.0	8.7		850	900	1250	1165	1550	1505	1360	1260	1040	460	135	4.2	6.0	0	–	2	2	–	
10-NIGH	9.5	9.5		760	790	970	1000	1480	1510	1160	810	800	240	80	2.4	2.0	–	–	2	1	–	
1	18.5	9.0		790	840	1000	1040	1420	1370	1220	1180	1000	360	100	3.2	7.5	–	–	3	1	–	
2	25.7	7.2		1020	1140	1460	1490	1620	1620	1200	1120	860	310	100	1.8	6.0	–	–	1	1	–	
3	33.0	8.7		820	870	1040	1090	1390	1440	1270	860	410	270	110	1.8	6.0	–	–	1	–	–	
4	42.2	9.2		690	730	870	930	1260	1440	1300	1040	530	260	100	1.8	6.0	–	–	2	1	–	
5	50.4	8.2		760	790	970	1040	1520	1570	1360	1340	760	490	130	1.8	6.0	–	–	3	–	–	
6	55.5	5.1		1140	1260	1400	1400	1480	1440	1110	920	560	310	110	1.6	6.0	–	–	3	1	–	
7	62.0	7.5		880	880	1110	1200	1270	1420	1160	880	500	290	110	1.8	6.0	–	–	3	1	–	Added 4 Tons Default Dewatering
AM	62.5	10.5																				

POUNDS TO INCINERATOR

TOTAL RUNNING TIME

FUEL	GAS (CCF) METER	OIL (GALS) OIL IN	OIL OUT
FINISH			
START			

LAB DATA

Test No.	Filter Weight Mg.	Probe Wash	Total
1	44.9	6.9	51.8
2	19.8	10.4	30.2
3	33.7	6.5	40.2

APPENDIX B

CALIBRATION DATA

METHOD #5 MODULE CALIBRATION

DATE 04/28/81 ORIFICE NO TT-1 NAME Gammie

BAROMETRIC PRESSURE PB = 29.83 IN HG

Orifice Manometer Setting ΔH, (In. Water)	Gas Volume Wet Test Meter V_w (ft^3)	Gas Volume Dry Gas Meter V_d (ft^3)	Temperature: Meter t_w, (°F)	Temperature: Inlet t_{di}, (°F)	Temperature: Outlet t_{do}, (°F)	Time θ (min.)	γ	ΔH@
0.5	5	4.954	80	78	75	12.18	1.01	1.71
1.0	5	4.917	80	80	78	8.81	1.01	1.78
1.5	10							
2.0	10	9.901	80	80	78	12.72	1.00	1.86
3.0	10	9.773	80	80	78	10.35	1.01	1.85
4.0	10							
						Average	1.01	1.80

$$\gamma = \frac{(V_w)(P_b)(t_d + 460)}{(V_d)\left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$$

Tolerance = 1.00 ± 0.01

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

Tolerance of average ΔH@ : 1.84 ± 0.25

Each individual ΔH@ must be within ± 0.15 of average

TC Readout Calibrated With Constant Voltage Source NA

Dry Gas Meter Thermocouples t_{di} 78 °F t_{do} 78 °F vs. Mercury Thermometer t_{ref} 78 °F

Heater Box Love Control NA Probe Heater Love Control NA

Module Cleaned _____

Metropolitan District Commission

Sludge Incinerator

No.	Nozzle Calibrations - Inches
N-1	0.1900
N-2	0.2530
N-3	0.3780
N-4	0.5050

Pre-Test Filter Weights

No.	Wgt. grams
00036	0.1920
00035	0.1940
00034	0.1913
00032	0.1894
00030	0.1926

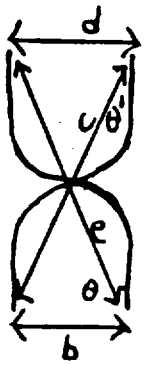
Pitot Calibration Data

MDC Sludge

Incinerator

P-1 PC 4/20/81

A. Transverse Tube Axis



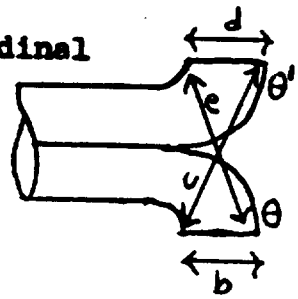
a. 1.247
b. .379
c. 1.291
d. .381
e. 1.291
θ 88°
θ¹ 88°

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

$$\frac{a^2 + d^2 - e^2}{2\ ad} = \cos\theta^1$$

$(80^\circ < \theta < 100)$
$(80^\circ < \theta^1 < 100)$

B. Longitudinal Tube Axis



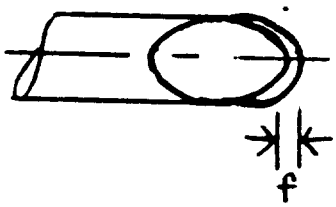
a. 1.239
b. .585
c. 1.354
d. .584
e. 1.380
θ 88.0°
θ¹ 91.0°

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

$$\frac{a^2 + d^2 - e^2}{2\ ad} = \cos\theta^1$$

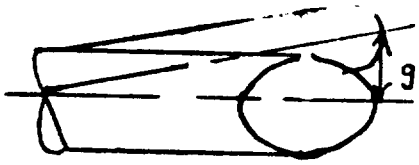
$(85 < \theta < 95)$
$(85 < \theta^1 < 95)$

C.



f. < 1/8"

(f < 1/8")



g. < 1/32"

(g < 1/32")

( ) Standard - EPA Method 2

APPENDIX C

SAMPLE CALCULATIONS

Test # 1

1. **Allowable Leak Rate**

$$La = 0.02 \text{ cfm or } 0.04 \frac{V_{m\ total}}{T_{total}} \quad \text{which ever is less.}$$

$$\frac{0.04\ V_{m\ total}}{T_{total}} = \frac{0.04\ x}{\quad}$$

$$La = N/A \text{ cfm}$$

2. **Correction for Excessive Leak Rate**

$$Lp = \quad \text{cfm}$$

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

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

$$V_{mc\ total} = N/A \quad -(\quad - \quad) \quad = \quad ft^3$$

---

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

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

$$V_{m\ total\ (std)} = 46.26 \times .01 \left(\frac{68 + 460}{66 + 460}\right) \left[\frac{30.1 + \frac{0.72}{13.6}}{29.92}\right]$$

$$V_{m\ total\ (std)} = 47.22 \text{ dscf}$$

4. **Moisture Content of Duct Gas**

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

$$\% H_2O = \frac{0.04707\ (75 + 14)}{47.22 + 0.04707\ (75 + 14)} \times 100$$

$$\% H_2O = 5.6 \ \%$$

5. Molecular Weight of Stack Gas

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

$$M_s = \left[(0.44 \times 3.4)+(0.28 \times 0)+(0.28 \times 30.6)+(0.32 \times 16.0)\right]\left(1 - \frac{5.6}{100}\right) + 0.18\ (.056)$$

$$M_s = 27.84 \text{ lb/lb-mole}$$

6. Average Duct Gas Density

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

$$D_{st} = 0.0458 \times 27.84 \left(\frac{30.1 + \frac{-.10}{13.6}}{130.8 + 460}\right)$$

$$D_{st} = 0.064 \text{ lbs/ft}^3$$

7. Excess Air

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

$$EA = 100 \left[\frac{16 - 0.5 \times 0}{0.264 \times 30.6 - (16 - 0.5 \times 0)}\right]$$

$$EA = 303.0\ \%$$

8. Average Duct Velocity

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

$$V_s = 5129.4 \times .84 \times .466 \sqrt{\frac{130.8 + 460}{\left(30.1 + \frac{-.10}{13.6}\right) 27.84}}$$

$$V_s = 1626.0 \text{ ft/min}$$

9. Duct Volumetric Flow Rate

$$Q = V_s \times A_s$$

$$Q = 1686.2 \times 19.6$$

$$Q = 33{,}108.5 \text{ acfm}$$

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

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

$$Q_{std} = 33{,}108.5 \left(1 - \frac{5.6}{100}\right) \left(\frac{68 + 460}{130.8 + 460}\right) \left(\frac{391 + \frac{-.10}{13.6}}{29.92}\right)$$

$$Q_{std} = 28{,}090.8 \text{ dscfm}$$

11. Isokinetic Factor

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

$$I = \frac{5.67\ (130.8 + 460)(47.32)}{\left(391 + \frac{-.10}{13.6}\right) 1686.2 \times 96 \left(1 - \frac{5.6}{100}\right)\left(\frac{(25.3)^2 \times 0.7854}{144}\right)}$$

$$I = 101.2\ \%$$

12. F - Factor

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

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

$$F = N/A \text{ DSCF/MM BTU}$$

13. Actual Particulate Concentration

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

$$C = \frac{0.01543 \times \quad (68 + 460)}{(\quad + 460)} \frac{\left(\quad + \frac{\quad}{13.6}\right)}{(29.92)} \left(1 - \frac{\quad}{100}\right)$$

C = N/A grains/acf

14. Particulate Concentration, Corrected to Dry Standard Conditions

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

$$C_s = 0.01543 \times \frac{5.8}{1792}$$

C_s = 0.017 grains/dscf

15. Particulate Emission Rate

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

$$ER = 0.008571 \times \quad \times$$

ER = N/A lbs/hr.

16. Particulate Emission

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

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

E = N/A lbs/MM BTU

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

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

$$C_s\ @\ 12\%\ CO_2 = \frac{12}{3.6} \times 0.017$$

C_s @ 12% CO_2 = 0.056 grains/dscf @ 12% CO_2

Calculation of Adjusted CO_2 Values

$$(\% CO_2)\ adj. = (\% CO_2)_{di} \left[\frac{(100 + \%EA_i)}{(100 + \%EA_o)}\right]$$

Where:

$(\%CO_2)_{adj}$ is the adjusted outlet CO_2 percentage

$(\%CO_2)_{di}$ is the percentage of CO_2 measured before the scrubber, dry basis

$(\%EA)_i$ is the percentage of excess air at the inlet

$(\%EA)_o$ is the percentage of excess air at the outlet

and:

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

$$\%N_2 = 100 - \%O_2 - \%CO - \%CO_2$$

Where:

$\%O_2$, $\%CO$, and $\%CO_2$ are the percent oxygen, carbon monoxide, and carbon monoxide, and carbon dioxide by volume (dry basis) respectively.

and:

$$C_{12} = \frac{12\ c}{(\%\ CO_2)\ adj.}$$

Where:

C_{12} is the concentration of particulate matter corrected to 12 percent CO_2

C is the concentration of particulate matter as measured by Method 5

$$C = \frac{(\text{mg particulate})\ (15.43\ \text{grains/gram})\ \left(\frac{1g}{10^3 mg}\right)}{\text{Sample Volume (DSCF)}}$$

The above equations, taken from the New Source Performance Standards, Subpart E - Standards of Performance for Incinerators, detail the calculation procedure for incinerator emissions. Table F-1 presents the raw orsat data used to calculate the % excess air at the inlet and outlet of the scrubber.

Adjusted CO_2 Level for Test No. 1

$$\% \text{ EA In} = \frac{100 \times 13.6}{0.264\ (81.2) - 13.6} = 173.6$$

$$\% \text{ EA Out} = \frac{100 \times 16.0}{0.264\ (80.6) - 16} = 303\ \%$$

$$\% \ CO_2 \text{ Adj.} = 5.2 \times \frac{(100 + 173.6)}{(100 + 303}$$

$$\% \ CO_2 \text{ Adj.} = 3.6$$

Test No. 1

	CO_2	O_2	N_2
Inlet	5.2	13.6	81.2
Outlet	3.4	16.0	80.6

APPENDIX D

DEP DATA FORMS

[illegible] # 810012

Test Report Data Form #1-5

Process Information: SEWAGE SLUDGE INCINERATORS

I. Results

	TEST NUMBER 1	2	3	
1. Particulates (lb/1000 lb)	—	—	—	Avg. N/A
(gr/SCF @ 12% CO_2)	0.056	0.026	0.043	Avg. 0.042

II. Description

1. Maximum Feed Rate (lb/hr) 7.4 TONS/HL
2. Normal Feed Rate 7 TONS/HL
3. Method of Feeding Belt and Screw Conveyor
4. Method of Stoking Rabbing
5. Fuel:

   maximum firing rate (gal/hr, CFH) _____

   type - ultimate and proximate analysis Natural Gas

6. Dampers:

   method of activation Automatic

   location Suction Side - Induced Draft Fan

III. Operating Parameters During Test

1. Actual Burner Firing Rate (gal/hr, CFH) 7,500 CFH
2. Material Incinerated:

   % moisture 21%

   feed rate (lb/hr) 7.4 TONS/HL

   incineration outlet temperature (s) (°F) [illegible]

IV. Normal Operating Times

1. Hrs/Day 24
2. Days/Week [illegible]
3. Weeks/Month 4
4. Shut Down Period (If Applicable) [illegible]

ANY ADDITIONAL INFORMATION AVAILABLE:

THIS FORM MUST BE COMPLETED AND INCLUDED IN FINAL REPORT

I.T.T. # 810012

Test Report Data Form #2-5

Control Equipment Information: SCRUBBER

I. Description

1. Scrubber Type (e.g. cyclone, orifice, mechanical, venturi, packed tower) — Impingement Tray
2. Maximum Gas Volume Capacity (CFM) — 53,000 ACFM
3. Scrubber Diameter (Ft) — 10'
4. Manufacturer — CEA
5. Model Number — 2030

II. Operating Parameters

1. Inlet Gas Temperature (°F) — 155°F
2. Outlet Gas Temperature (°F) — 75°F
3. Gas Pressure Drop Across Unit (In. H_2O) — 6"
4. Outlet Gas Flow Rate (CFM) — 30,000 ACFM
5. Fan Horsepower — 100
6. Liquid Flow Rate (GPM) — 1000 GPM
7. Injection Pressure (PSI) — 10 PSI

III. For Packed Tower Scrubbers:

1. Type of Packing — N/A
2. Packing Depth (Ft) — ↓
3. Per Cent Free Volume of Packing — ↓
4. Packing Surface Area (Ft^2) — ↓

ANY ADDITIONAL INFORMATION AVAILABLE:

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

I.T.T. # 81C012

Test Report Data Form #1-7

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

		TEST NUMBER 1	2	3
1.	Volume Water Collected (ML):			
	impingers	45	47	39
	silica gel	14	15	17
2.	Meter Volume (Actual Cubic Feet)	46.26	61.82 ← 60.82	53.6
3.	Avg. Meter Temperature (°F)	66	88.1	90.8
4.	Stack Pressure - Absolute (IN. HG)	30.09	30.09	30.09
5.	Avg. Orifice Press. Drop (IN. H_2O)	.72	1.21	.92
6.	Pitot Coefficient	.84	.84	.84
7.	Stack Area (Ft^2)	19.6	19.6	19.6
8.	Nozzle Diameter (IN.)	.253	.253	.253
9.	Avg. Stack Temp. (°F)	130.8	131.4	133.9
10.	Atmospheric Press. (IN. HG)	30.1	30.1	30.1
11.	Total Test Time (Min.)	96	96	96
12.	Heat Input (MBTU/HR)	N/A	N/A	N/A
13.	Total Particulate Collected (MG)	57.8	30.2	46.2
14.	Avg. Stack Temperature (°F)	130.8	131.4	133.9
15.	Avg. Velocity Press. Drop (IN. H_2O)	.217	.311	.25
II.	ORSAT Analysis:			
	per cent CO_2	3.4	3.0	3.2
	per cent O_2	16.0	16.2	16.4
	per cent CO	—	—	—
III.	Moisture Content (Per Cent H_2O)	5.6	4.5	4.7