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REPORT ON MEASUREMENT OF PARTICULATE EMISSIONS FROM THE SEWAGE SLUDGE INCINERATOR OF THE METROPOLITAN DISTRICT COMMISSION

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1.0 INTRODUCTION

Tests were conducted by TRC - The Research Corporation of New England at the request of the Metropolitan District Commission to determine the emission rate of particulates from the sewage sludge incinerator, stack 1. This was done to comply with an order from the State of Connecticut Department of Environmental Protection and in conformance with Section 19-508-4(c) of the Administrative Regulations for the Abatement of Air Pollution.

All particulate and orsat tests were conducted using methods and procedures described in the Federal Register, December 23, 1971 and Intent to Test Form #770039 of May 31, 1977.

2.0 SUMMARY

Three particulate sampling tests were conducted at the scrubber outlet. The results show that the incinerator is in compliance with emission limitations of .08 grains per dry standard cubic foot. The average emission was 0.020 grains per dry standard cubic foot.

2.1 Results and Discussions

Table 1 summarizes the results of the three particulate tests on the scrubber exhaust. Tables 2, 3 and 4 present the complete test results.

Detailed test data and process information are presented in Appendices A, B, and C.

TABLE 1

SUMMARY OF TEST RESULTS AT
AT HARTFORD, CONNECTICUT SLUDGE INCINERATOR

TEST #	DATE	TIME	SLUDGE FEED RATE tons/hr	CONCENTRATION grains/dscf CORRECTED TO 12% CO_2	VOLUMETRIC FLOW RATE dscfm	ISOKINETIC FACTOR, I %	VOLUME SAMPLED scf
1	7-13-77	1100	5	0.024	28,200	105.0	62.15
2	7-13-77	1430	5	0.021	26,747	98.3	55.16
3	7-14-77	0900	5	0.016	27,634	103.3	59.92

TABLE 2

METROPOLITAN DISTRICT COMMISSION
HARTFORD, CT
SLUDGE INCINERATOR

SUMMARY OF TEST DATA & RESULTS
PARTICULATE

TEST NO. 1 OUTLET
DATE/TIME 7-13-77 1100 START, 1320 FINISH

SAMPLING NOZZLE DIAMETER IN	0.250
SAMPLING TIME TOTAL MINUTES	120.
SAMPLE GAS VOLUME DSCF	62.15
AVERAGE METER TEMPERATURE	93.1
AVERAGE ORIFICE PRESSURE DROP IN H2O	0.816
DUCT AREA SQUARE FEET	19.63
AVERAGE DUCT PRESSURE IN HG	30.08
PERCENT MOISTURE IN STACK GAS	5.77
DUCT FLOW RATE ACFM	36608.
DUCT FLOW RATE SCFM	26220.
DUCT VELOCITY FPM	1865.
DUCT TEMPERATURE DEG F	199.
ALLOWABLE EMISSION RATE LBS/HR	0.01
PROBE CALIBRATION COEFFICIENT	0.830
EXCESS AIR AT SAMPLING POINT / BY VOLUME	464.1

EMISSION DATA

	GR/ ACF	GR/ DSCF	GR/ DSCF 12/ CO2	GR/ DSCF 50/ EX AIR
PARTICULATE PROBE	0.001	0.001	0.008	0.005
PARTICULATE FILTER	0.002	0.003	0.016	0.010
PARTICULATE TOTAL	0.003	0.004	0.024	0.014
ORG CONDENSIBLES	0.000	0.000	0.000	0.000
INORG CONDENSIBLES	0.000	0.000	0.000	0.000

	LBS/ HR	LBS/ 1000 LB UNCORR	LBS/ 1000 LB 12/ CO2	LBS/ 1000 LB 50/ EX AIR	LBS/ MIL BTU
PARTICULATE PROBE	0.294	0.002	0.014	0.009	0.000
PARTICULATE FILTER	0.635	0.005	0.031	0.019	0.000
PARTICULATE TOTAL	0.929	0.007	0.045	0.027	0.000
ORG CONDENSIBLES	0.000	0.000	0.000	0.000	0.000
INORG CONDENSIBLES	0.000	0.000	0.000	0.000	0.000

PERCENT ISOKINETIC FOR PARTICULATE TRAIN 105.0

TABLE 3

METROPOLITAN DISTRICT COMMISSION
HARTFORD, CT
SLUDGE INCINERATOR

SUMMARY OF TEST DATA & RESULTS
PARTICULATE

TEST NO. 2 OUTLET
DATE/TIME 7-13-77 1430 START, 1650 FINISH

SAMPLING NOZZLE DIAMETER IN	0.250
SAMPLING TIME TOTAL MINUTES	120.
SAMPLE GAS VOLUME DSCF	55.16
AVERAGE METER TEMPERATURE	105.7
AVERAGE ORIFICE PRESSURE DROP IN H2O	0.745
DUCT AREA SQUARE FEET	19.63
AVERAGE DUCT PRESSURE IN HG	30.08
PERCENT MOISTURE IN STACK GAS	7.08
DUCT FLOW RATE ACFM	34808.
DUCT FLOW RATE SCFM	26747.
DUCT VELOCITY FPM	1773.
DUCT TEMPERATURE DEG F	182.
ALLOWABLE EMISSION RATE LBS/HR	0.01
PROBE CALIBRATION COEFFICIENT	0.830
EXCESS AIR AT SAMPLING POINT / BY VOLUME	464.4

EMISSION DATA

	GR/ ACF	GR/ DSCF	GR/ DSCF 12/ CO2	GR/ DSCF 50/ EX AIR
PARTICULATE PROBE	0.000	0.000	0.001	0.001
PARTICULATE FILTER	0.003	0.004	0.020	0.014
PARTICULATE TOTAL	0.003	0.004	0.021	0.015
ORG CONDENSIBLES	0.000	0.000	0.000	0.000
INORG CONDENSIBLES	0.000	0.000	0.000	0.000

	LBS/ HR	LBS/ 1000 LB UNCORR	LBS/ 1000 LB 12/ CO2	LBS/ 1000 LB 50/ EX AIR	LBS/ MIL BTU
PARTICULATE PROBE	0.051	0.000	0.002	0.002	0.000
PARTICULATE FILTER	0.870	0.007	0.037	0.027	0.000
PARTICULATE TOTAL	0.922	0.007	0.039	0.029	0.000
ORG CONDENSIBLES	0.000	0.000	0.000	0.000	0.000
INORG CONDENSIBLES	0.000	0.000	0.000	0.000	0.000

PERCENT ISOKINETIC FOR PARTICULATE TRAIN 98.3

TABLE 4

METROPOLITAN DISTRICT COMMISSION
HARTFORD, CT
SLUDGE INCINERATOR

SUMMARY OF TEST DATA & RESULTS
PARTICULATE

TEST NO. 3 OUTLET
DATE/TIME 7-14-77 0900 START, 1120 FINISH

SAMPLING NOZZLE DIAMETER IN	0.250
SAMPLING TIME TOTAL MINUTES	120.
SAMPLE GAS VOLUME DSCF	59.92
AVERAGE METER TEMPERATURE	90.9
AVERAGE ORIFICE PRESSURE DROP IN H2O	0.786
DUCT AREA SQUARE FEET	19.63
AVERAGE DUCT PRESSURE IN HG	30.15
PERCENT MOISTURE IN STACK GAS	7.50
DUCT FLOW RATE ACFM	35206.
DUCT FLOW RATE SCFM	27634.
DUCT VELOCITY FPM	1794.
DUCT TEMPERATURE DEG F	167.
ALLOWABLE EMISSION RATE LBS/HR	0.01
PROBE CALIBRATION COEFFICIENT	0.830
EXCESS AIR AT SAMPLING POINT / BY VOLUME	377.4

EMISSION DATA

	GR/ ACF	GR/ DSCF	GR/ DSCF 12/ CO2	GR/ DSCF 50/ EX AIR
PARTICULATE PROBE	0.000	0.000	0.002	0.001
PARTICULATE FILTER	0.003	0.003	0.015	0.010
PARTICULATE TOTAL	0.003	0.004	0.016	0.012
ORG CONDENSIBLES	0.000	0.000	0.000	0.000
INORG CONDENSIBLES	0.000	0.000	0.000	0.000

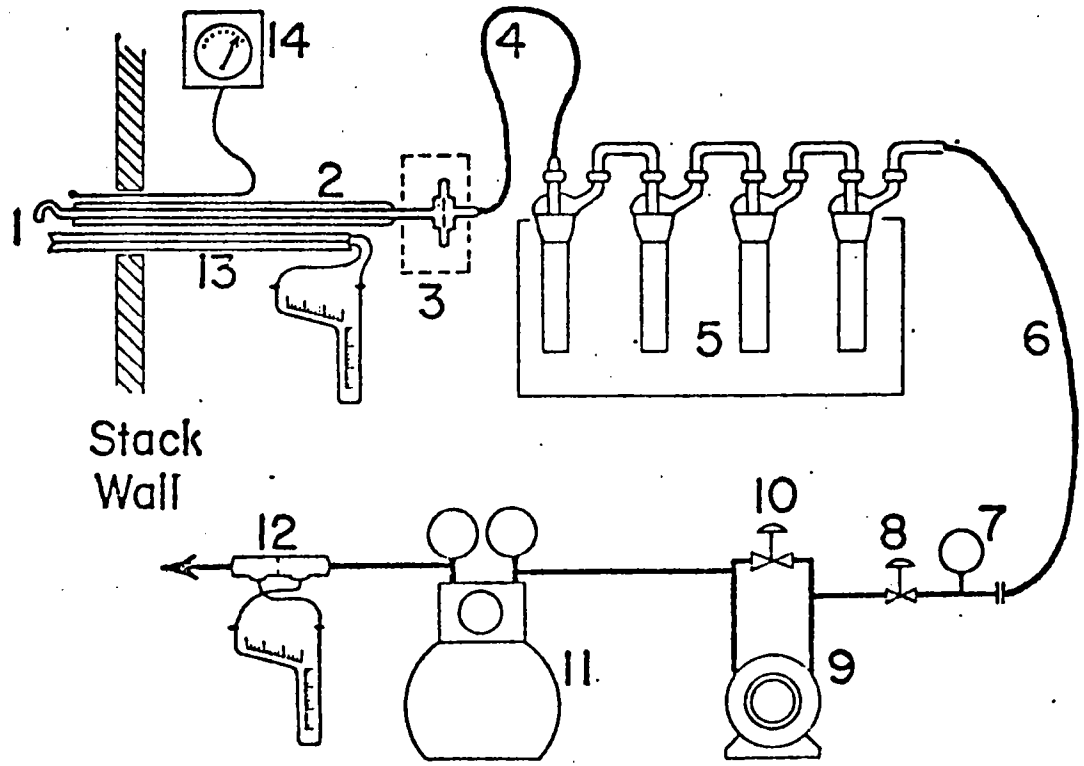
	LBS/ HR	LBS/ 1000 LB UNCORR	LBS/ 1000 LB 12/ CO2	LBS/ 1000 LB 50/ EX AIR	LBS/ MIL BTU
PARTICULATE PROBE	0.097	0.001	0.003	0.002	0.000
PARTICULATE FILTER	0.779	0.006	0.028	0.020	0.000
PARTICULATE TOTAL	0.876	0.007	0.031	0.022	0.000
ORG CONDENSIBLES	0.000	0.000	0.000	0.000	0.000
INORG CONDENSIBLES	0.000	0.000	0.000	0.000	0.000

PERCENT ISOKINETIC FOR PARTICULATE TRAIN 103.3

3.0 SAMPLING AND ANALYSIS PROCEDURES

3.1 Particulate Sampling and Analysis

Particulate sampling was accomplished by using modified EPA collection train. It is shown schematically in Figure 1 and consists of a nozzle, probe, filter, four impingers, vacuum pump, dry gas meter, and an orifice flow meter. The nozzle (1) is stainless steel and is of a button-hook shape. It is connected to a 5/8" glass-lined probe (2) that is wrapped with nichrome heating wire and jacketed. This prevents condensation of the sampled gas. Following the probe, the gas stream impacts on a glass fiber filter supported on a coarse fritted-glass disc in a glass filter holder. Gelman Type A filter paper is used. Enclosing the whole filter assembly is a heated box (3) to maintain temperatures about 250°F. Again, condensation is prevented. An ice bath containing four impingers (5) is attached to the back end of the filter via a flexible umbilical cord (4). All condensible material in the sample stream is collected here. The first two impingers contain distilled water, the third is dry and the fourth contains silica gel to remove any remaining moisture. Leaving the fourth impinger the sample stream flows through flexible tubing (6), a vacuum gauge (7), needle valve (8), a leakless vacuum pump (9) in parallel with a by-pass valve (10) and a dry gas meter (11). A calibrated orifice and inclined manometer (12) complete the sampling train. The stack velocity pressure is measured using a pitot tube and inclined manometer (13) and stack temperature is monitored by a thermocouple attached to the pitot and connected to a potentiometer (14). A nomograph rapidly determines the orifice pressure drop required for any pitot velocity pressure and stack temperature in order to maintain isokinetic sampling conditions. Sampling flow is adjusted by means of the by-pass valve.



Modified EPA Particulate Sampling Train

December 23, 1971 Federal Register

Figure 1

Test data recorded included test time, sampling duration at each traverse point, pitot pressure, stack temperature, meter volume, meter inlet-outlet temperature and orifice pressure drop. At the end of each test three sample containers were used as follows:

Container #1 - filter

Container #2 - acetone wash of probe and front half of filter. Tared gun patches were used to loosen particles adhering to the inside of the probe.

Container #3 - silica gel from the fourth impinger.

The samples were transported to TRC's laboratory and the following analyses were performed.

Container #1 Transfer the filter and any loose particulate matter from the sample container to a tared glass weighing dish, desiccate and dry to a constant weight. Report results to nearest 0.5 mg.

Container #2 Transfer the acetone washings to a tared beaker and evaporate to dryness at ambient temperature and pressure. Desiccate and dry to a constant weight. Report results to nearest 0.5 mg.

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

Care is taken in transferring the contents to the sample containers.

A computer program developed by TRC is used to calculate mass emission rates in lb/hr, grain loading in grains per actual and grains per standard cubic foot, and the volume flow in the duct or stack. Reference is made to the Federal Register, December 23, 1971, for the formulas used in performing the required computations.

3.2 Orsat Measurements

Triplicate samples of the exhaust gas were extracted and analyzed for CO_2 and O_2 with an Orsat gas analyzer. These data were used in the calculation of flue gas density. Results are shown in Appendix A, pages A-1, A-4, and A-7.

APPENDIX A

PARTICULATE TEST DATA

SUMMARY OF RESULTS -- EPA METHOD #5

RUN NO. 1 OUTLET

NAME OF FIRM	METROPOLITAN DISTRICT COMMISSION
LOCATION	HARTFORD, CT
TYPE OF PROCESS	SLUDGE INCINERATOR
CONTROL EQUIPMENT	
MATERIAL PROCESSED	
PROCESS WEIGHT RATE TONS/HR	0.00
HEAT RATE MILLION BTU / HOUR	0.00
POLLUTANTS SAMPLED	PARTICULATES

DATE AND TIME OF TEST 7-13-77 1100 START, 1320 FINISH

****

EXIT SAMPLING STATION OBSERVED DATA

ATMOSPHERIC TEMPERATURE	80.	DEG F
ATMOSPHERIC PRESSURE	30.09	IN HG
STANDARD COND. TEMP.	68.	DEG F
DUCT AREA	19.63	SQ FT
NOZZLE DIAMETER	0.250	IN

ORSAT ANALYSIS OF DUCT GAS

DRY VOLUME BASIS

CARBON DIOXIDE	1.93
OXYGEN	17.50
CARBON MONOXIDE	0.00
NITROGEN	80.57

PARTICULATES COLLECTED WEIGHT IN MILLIGRAMS

PROBE	4.90
FILTER	10.60
TOTAL	15.50
ORG CONDENSIBLES	0.00
INORG CONDENSIBLES	0.00

WATER CONDENSED IN IMPINGERS	65.0	ML
WATER ABSORBED BY SILICA GEL	15.6	ML
TOTAL WATER COLLECTED	80.6	ML

DUCT VELOCITY TRAVERSE FPM AT DUCT CONDITIONS

POINT	PORT 1	PORT 2
1	1397.	1924.
2	1625.	1817.
3	1629.	1836.
4	1815.	1726.
5	1929.	1721.
6	2002.	1641.
7	2002.	1824.
8	2069.	1713.
9	2069.	1823.
10	2069.	1811.
11	2008.	1697.
12	1629.	1270.
AVG=	1853.4985	1733.5054

DUCT DENSITY DATA LBS/CF AT DUCT CONDITIONS

POINT	PORT 1	PORT 2
1	0.0635	0.0625
2	0.0626	0.0626
3	0.0623	0.0613
4	0.0627	0.0610
5	0.0622	0.0614
6	0.0619	0.0614
7	0.0619	0.0621
8	0.0618	0.0620
9	0.0613	0.0622
10	0.0618	0.0630
11	0.0615	0.0631
12	0.0623	0.0666
AVG=	0.0622	0.0624

SAMPLING DATA PORT 1

POINT	TIME	VEL HEAD IN H2O	ORIFICE PRESS IN H2O	METER INLET DEG F	TEMPS EXIT DEG F	METER VOLUME CU FT	DUCT PRESS / IN H2O	TEMP DEG F
1	5.0	0.250	0.800	89.	85.	2.60	-0.16	198.
2	5.0	0.280	0.890	90.	85.	2.88	-0.17	195.
3	5.0	0.250	0.800	91.	86.	2.52	-0.12	202.
4	5.0	0.250	0.800	94.	87.	2.66	-0.14	203.
5	5.0	0.220	0.690	92.	87.	2.43	-0.11	197.
6	5.0	0.240	0.765	94.	87.	2.58	-0.15	199.
7	5.0	0.280	0.890	94.	89.	2.78	-0.15	197.
8	5.0	0.320	1.050	90.	90.	3.10	-0.16	185.
9	5.0	0.320	1.050	90.	90.	3.14	-0.15	184.
10	5.0	0.310	0.980	91.	90.	3.03	-0.12	172.
11	5.0	0.280	0.890	94.	91.	2.75	-0.15	184.
12	5.0	0.180	0.580	92.	92.	2.75	-0.07	152.

SAMPLING DATA PORT 2

POINT	TIME	VEL HEAD IN H2O	ORIFICE PRESS IN H2O	METER INLET DEG F	TEMPS EXIT DEG F	METER VOLUME CU FT	DUCT PRESS / IN H2O	TEMP DEG F
1	5.0	0.180	0.580	95.	93.	2.25	-0.13	186.
2	5.0	0.220	0.690	94.	93.	2.42	-0.12	188.
3	5.0	0.220	0.690	95.	94.	2.47	-0.13	188.
4	5.0	0.220	0.690	95.	93.	2.44	-0.13	186.
5	5.0	0.220	0.690	96.	94.	2.71	-0.15	182.
6	5.0	0.250	0.800	97.	94.	2.44	-0.14	184.
7	5.0	0.300	0.950	97.	96.	2.98	-0.18	191.
8	5.0	0.280	0.890	100.	95.	2.38	-0.12	196.
9	5.0	0.280	0.890	98.	96.	3.18	-0.11	190.
10	5.0	0.320	1.050	101.	96.	3.08	-0.11	202.
11	5.0	0.280	0.890	101.	96.	2.78	-0.10	193.
12	5.0	0.180	0.580	101.	97.	2.25	-0.07	177.

RUN NO. 1 OUTLET

SUMMARY OF RESULTS -- EPA METHOD #5

RUN NO. 2 OUTLET

NAME OF FIRM	METROPOLITAN DISTRICT COMMISSION
LOCATION	HARTFORD, CT
TYPE OF PROCESS	SLUDGE INCINERATOR
CONTROL EQUIPMENT	
MATERIAL PROCESSED	
PROCESS WEIGHT RATE TONS/HR	0.00
HEAT RATE MILLION BTU / HOUR	0.00
POLLUTANTS SAMPLED	PARTICULATES

DATE AND TIME OF TEST 7-13-77 1430 START, 1650 FINISH

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EXIT SAMPLING STATION OBSERVED DATA

ATMOSPHERIC TEMPERATURE	80.	DEG F
ATMOSPHERIC PRESSURE	30.09	IN HG
STANDARD COND. TEMP.	68.	DEG F
DUCT AREA	19.63	SQ FT
NOZZLE DIAMETER	0.250	IN

ORSAT ANALYSIS OF DUCT GAS

DRY VOLUME BASIS

CARBON DIOXIDE	2.33
OXYGEN	17.43
CARBON MONOXIDE	0.00
NITROGEN	80.24

PARTICULATES COLLECTED WEIGHT IN MILLIGRAMS

PROBE	0.80
FILTER	13.60
TOTAL	14.40
ORG CONDENSIBLES	0.00
INORG CONDENSIBLES	0.00

WATER CONDENSED IN IMPINGERS	70.0	ML
WATER ABSORBED BY SILICA GEL	19.0	ML
TOTAL WATER COLLECTED	89.0	ML

DUCT VELOCITY TRAVERSE FPM AT DUCT CONDITIONS

POINT	PORT 1	PORT 2
1	1865.	1568.
2	1969.	1736.
3	1870.	1736.
4	1872.	1733.
5	1748.	1728.
6	1828.	1845.
7	1972.	2032.
8	2089.	1970.
9	2087.	1961.
10	2035.	2116.
11	1952.	1966.
12	1526.	1557.
AVG=	1900.9771	1828.8333

DUCT DENSITY DATA LBS/CF AT DUCT CONDITIONS

POINT	PORT 1	PORT 2
1	0.0594	0.0605
2	0.0597	0.0603
3	0.0591	0.0603
4	0.0590	0.0605
5	0.0595	0.0609
6	0.0593	0.0607
7	0.0595	0.0600
8	0.0606	0.0596
9	0.0607	0.0601
10	0.0619	0.0591
11	0.0607	0.0599
12	0.0639	0.0614
AVG=	0.0603	0.0603

SAMPLING DATA PORT 1

POINT	TIME	VEL HEAD IN H2O	ORIFICE PRESS IN H2O	METER INLET DEG F	TEMPS EXIT DEG F	METER VOLUME CU FT	DUCT PRESS / IN H2O	TEMP DEG F
1	5.0	0.150	0.490	108.	103.	2.29	-0.07	198.
2	5.0	0.180	0.580	107.	103.	2.16	-0.10	201.
3	5.0	0.180	0.580	107.	103.	2.31	-0.10	204.
4	5.0	0.200	0.650	107.	102.	2.40	-0.09	203.
5	5.0	0.200	0.650	107.	103.	2.50	-0.11	204.
6	5.0	0.220	0.690	108.	104.	2.51	-0.12	201.
7	5.0	0.250	0.800	106.	104.	2.71	-0.12	196.
8	5.0	0.280	0.890	109.	104.	3.04	-0.11	194.
9	5.0	0.280	0.890	108.	105.	2.53	-0.11	194.
10	5.0	0.280	0.890	105.	104.	3.01	-0.10	177.
11	5.0	0.250	0.800	106.	104.	2.77	-0.10	186.
12	5.0	0.180	0.580	105.	104.	1.87	-0.03	154.

SAMPLING DATA PORT 2

POINT	TIME	VEL HEAD IN H2O	ORIFICE PRESS IN H2O	METER INLET DEG F	TEMPS EXIT DEG F	METER VOLUME CU FT	DUCT PRESS / IN H2O	TEMP DEG F
1	5.0	0.250	0.800	105.	104.	2.26	-0.12	163.
2	5.0	0.280	0.890	105.	104.	3.27	-0.11	163.
3	5.0	0.250	0.800	105.	105.	2.75	-0.14	163.
4	5.0	0.220	0.690	106.	106.	2.96	-0.11	164.
5	5.0	0.220	0.690	106.	105.	1.69	-0.11	165.
6	5.0	0.220	0.690	107.	107.	2.31	-0.09	166.
7	5.0	0.250	0.800	107.	107.	2.06	-0.11	178.
8	5.0	0.280	0.890	109.	107.	2.70	-0.13	177.
9	5.0	0.300	0.950	108.	107.	2.23	-0.12	178.
10	5.0	0.280	0.890	108.	106.	1.95	-0.09	180.
11	5.0	0.250	0.800	107.	106.	2.03	-0.09	180.
12	5.0	0.150	0.490	107.	106.	2.35	-0.04	174.

RUN NO. 2 OUTLET

SUMMARY OF RESULTS -- EPA METHOD #5

RUN NO. 3 OUTLET

NAME OF FIRM METROPOLITAN DISTRICT COMMISSION
LOCATION HARTFORD, CT
TYPE OF PROCESS SLUDGE INCINERATOR
CONTROL EQUIPMENT
MATERIAL PROCESSED
PROCESS WEIGHT RATE TONS/HR 0.00
HEAT RATE MILLION BTU / HOUR 0.00
POLLUTANTS SAMPLED PARTICULATES

DATE AND TIME OF TEST 7-14-77 0900 START, 1120 FINISH

****

EXIT SAMPLING STATION OBSERVED DATA

ATMOSPHERIC TEMPERATURE	80.	DEG F
ATMOSPHERIC PRESSURE	30.16	IN HG
STANDARD COND. TEMP.	68.	DEG F
DUCT AREA	19.63	SQ FT
NOZZLE DIAMETER	0.250	IN

ORSAT ANALYSIS OF DUCT GAS
DRY VOLUME BASIS

CARBON DIOXIDE	2.70
OXYGEN	16.80
CARBON MONOXIDE	0.00
NITROGEN	80.50

PARTICULATES COLLECTED WEIGHT IN MILLIGRAMS

PROBE	1.60
FILTER	12.80
TOTAL	14.40

ORG CONDENSIBLES	0.00
INORG CONDENSIBLES	0.00

WATER CONDENSED IN IMPINGERS	90.0	ML
WATER ABSORBED BY SILICA GEL	12.9	ML
TOTAL WATER COLLECTED	102.9	ML

DUCT VELOCITY TRAVERSE FPM AT DUCT CONDITIONS

POINT	PORT 1	PORT 2
1	1446.	1917.
2	1588.	1923.
3	1592.	1917.
4	1677.	1706.
5	1676.	1707.
6	1756.	1709.
7	1867.	1839.
8	1970.	1945.
9	1970.	2014.
10	1944.	1949.
11	1850.	1942.
12	1530.	1420.
AVG=	1739.128218	07.2471

DUCT DENSITY DATA LBS/CF AT DUCT CONDITIONS

POINT	PORT 1	PORT 2
1	0.0592	0.0626
2	0.0590	0.0626
3	0.0587	0.0626
4	0.0583	0.0625
5	0.0587	0.0624
6	0.0590	0.0623
7	0.0592	0.0611
8	0.0596	0.0612
9	0.0596	0.0611
10	0.0612	0.0609
11	0.0603	0.0609
12	0.0635	0.0615
AVG=	0.0597	0.0618

SAMPLING DATA PORT 1

POINT	TIME	VEL HEAD IN H2O	ORIFICE PRESS IN H2O	METER INLET DEG F	TEMPS EXIT DEG F	METER VOLUME CU FT	DUCT PRESS / IN H2O	TEMP DEG F
1	5.0	0.150	0.490	87.	86.	1.58	-0.11	155.
2	5.0	0.200	0.650	87.	87.	2.33	-0.12	164.
3	5.0	0.200	0.650	88.	88.	2.40	-0.12	167.
4	5.0	0.250	0.800	89.	89.	2.46	-0.14	163.
5	5.0	0.280	0.890	90.	89.	2.95	-0.14	168.
6	5.0	0.300	0.950	91.	90.	3.03	-0.16	171.
7	5.0	0.300	0.950	90.	90.	2.57	-0.16	171.
8	5.0	0.320	1.050	91.	92.	3.87	-0.15	172.
9	5.0	0.320	1.050	92.	92.	2.47	-0.16	172.
10	5.0	0.320	1.050	91.	93.	3.06	-0.16	172.
11	5.0	0.300	0.950	93.	93.	2.85	-0.14	175.
12	5.0	0.200	0.650	91.	92.	2.55	-0.04	167.

SAMPLING DATA PORT 2

POINT	TIME	VEL HEAD IN H2O	ORIFICE PRESS IN H2O	METER INLET DEG F	TEMPS EXIT DEG F	METER VOLUME CU FT	DUCT PRESS / IN H2O	TEMP DEG F
1	5.0	0.280	0.890	93.	92.	3.25	-0.13	165.
2	5.0	0.250	0.800	93.	93.	2.48	-0.14	164.
3	5.0	0.250	0.800	94.	93.	2.42	-0.13	177.
4	5.0	0.220	0.690	93.	93.	2.68	-0.12	180.
5	5.0	0.220	0.690	93.	93.	2.33	-0.14	176.
6	5.0	0.200	0.650	92.	92.	2.24	-0.11	176.
7	5.0	0.250	0.800	90.	91.	2.74	-0.11	169.
8	5.0	0.220	0.690	92.	92.	2.72	-0.11	170.
9	5.0	0.250	0.800	89.	91.	2.36	-0.12	168.
10	5.0	0.250	0.800	90.	91.	2.48	-0.09	160.
11	5.0	0.220	0.690	91.	92.	2.43	-0.08	159.
12	5.0	0.130	0.430	90.	91.	1.66	-0.05	126.

RUN NO. 3 OUTLET

APPENDIX B

FIELD TEST DATA

FIELD DATA SHEET

Firm Name: MDC
Plant Location: Hartford
Test No.: Test #1
Sampling Location: Incinerator #1
Date: 7/13/77
Tester: CRL / AM

Pump No.: 72 [illegible]
Orifice No.: D2 1.75
Ambient Temp: 80 °F
Bar Press.: 30.0[illegible] "Hg
Probe ID No.: 44
Filter ID. No.: 873

Probe Diameter: .25 i
Assumed Moisture: 6 %
Test Duration: 120 m
Traverse Point Interval: 5 m
Probe Heater Setting: 2.5 a
Box Temp Setting: 275 °

Port	Point	Time Min	Velocity ΔP in H_2O	ΔH in H_2O	T_M in °F	T_M Out °F	P_{STACK} in H_2O	T_{STACK} °F	Initial Meter Volume cu. ft.	PROBE	Pump Vac. in Hg	Remarks
1	1	5	.26	.80	89	85	-.16	198	90074	1	12	
	2	50	.27	.89	90	85	-.17	195	90534	1		
	3	50	.25	.80	91	86	-.12	202	90822	1		
	4	50	.25	.80	94	87	-.14	203	91074	1		
	5	50	.22	.69	92	87	-.11	197	91340	1		
	6	50	.24	.765	94	87	-.15	199	91583	1		
	7	50	.28	.89	94	89	-.15	197	91871	1		
	8	50	.32	1.05	90	90	-.18	195	92119	1		
	9	50	.32	1.05	90	90	-.15	184	92429	1		
	10	50	.31	.98	91	90	-.12	192	92743	1		
	11	50	.28	.87	94	91	-.15	184	93046	1		
	12	50	.17	.58	92	92	-.07	152	93321	1		
									93596	1		
									32.07			

FIELD DATA SHEET

Firm Name: MDC
Plant Location: Hartford
Test No.: Test #1
Sampling Location: Incinerator #1
Date: 7/13/77
Tester: CRL/AM

Pump No.: 72 0094
Orifice No.: D-2 1175
Ambient Temp: 80 °F
Bar Press.: 30.09 "Hg
Probe ID No.: 44
Filter ID. No.: 873

Probe Diameter: .25 i
Assumed Moisture: 6 %
Test Duration: 120 m
Traverse Point Interval: 5 m
Probe Heater Setting: 2.5 a
Box Temp Setting: 275 °

Port	Point	Time Min (3–5)	Velocity ΔP in H_2O (6–10)	ΔH in H_2O (12–15)	T_M in °F (18–20)	T_M Out °F (23–25)	P_{STACK} in H_2O (26–30)	T_{STACK} °F (32–35)	Initial Meter Volume cu. ft. (40–45)	PROBE (50)	Pump Vac. in Hg	Remarks
2	1	50	18	58	95	92	-13	186	93596	1	12	90.1-1
	2	50	22	69	94	93	-12	188	93821	1		5P756
	3	50	22	69	95	94	-13	188	94058	1		44
	4	50	22	59	95	92	-13	186	94[illegible]	1		4.5 65
	5	50	22	69	95	94	-15	132	94534	1		
	6	50	25	80	97	94	-14	184	94825	1		
	7	50	30	95	97	96	-18	191	95069	1		
	8	50	22	89	100	95	-12	196	95367	1		
	9	50	22	89	98	96	-11	190	95605	1		
	10	50	32	105	101	96	-11	202	95923	1		
	11	50	23	97	101	96	-10	193	96231	1		
	12	50	18	58	101	97	-07	177	96509	1	↓	
									96734	1		
									31.28			

FIELD DATA SHEET

Firm Name	MDC	Pump No.	720094	Probe Diameter	.25 in
Plant Location	Hartford	Orifice No.	D-2 1.75	Assumed Moisture	6 %
Test No.	Test #2	Ambient Temp	80 °F	Test Duration	120 min
Sampling Location	RLR #1	Bar Press.	30.09 "Hg	Traverse Point Interval	5 min
Date	7/13/77	Probe ID No.	44	Probe Heater Setting	[illegible] amps
Tester	CRE / AM	Filter ID. No.	872	Box Temp Setting	[illegible] °F

Port	Point	Time Min (3–5)	Velocity ΔP in H_2O (6–10)	ΔH in H_2O (12–15)	T_M in °F (18–20)	T_M Out °F (23–25)	P_{STACK} in H_2O (26–30)	T_{STACK} °F (32–35)	Initial Meter Volume cu. ft. (40–45)	PROBE (50)	Pump Vac. in Hg	Remarks
2	1	50	.15	.49	108	103	-.07	198	97755	1	[illegible]	1430 start
	2	50	.12	.52	107	103	-.10	201	[illegible]	1		
	3	50	.18	.58	107	103	-.10	204	97900	1		
	4	50	.20	.65	107	102	-.09	203	97431	1		
	5	50	.20	.65	107	103	-.11	204	97671	1		
	6	50	.22	.69	108	104	-.12	201	97921	1		
	7	50	.25	.80	106	104	-.12	198	98172	1		
	8	50	.23	.69	109	104	-.11	194	98443	1		
	9	50	.23	.71	109	105	-.11	194	98747	1		
	10	50	.22	.79	105	104	-.10	177	99000	1		
	11	50	.25	.80	106	104	-.10	196	99301	1		
	12	50	.18	.58	105	104	-.03	194	99[illegible]8	1		
									99765	1		

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FIELD DATA SHEET

Firm Name: MDC
Plant Location: Hanford
Test No.: Test #2
Sampling Location: BLR #1
Date: 7/13/77
Tester: CRL / AM

Pump No.: [illegible]
Orifice No.: DO 1.75
Ambient Temp: [illegible] °F
Bar Press.: 30.09 "Hg
Probe ID No.: [illegible]
Filter ID. No.: 872

Probe Diameter: .25
Assumed Moisture: 6
Test Duration: 120
Traverse Point Interval: 5
Probe Heater Setting: 2.5
Box Temp Setting: [illegible]

Port	Point	Time Min	Velocity ΔP in H_2O	ΔH in H_2O	T_M in °F	T_M Out °F	P_{STACK} in H_2O	T_{STACK} °F	Initial Meter Volume cu. ft.	PROBE	Pump Vac. in Hg	Remarks
1	1	50	.25	.80	105	104	-.12	163	99765			PW 2-
	2	50	.28	.79	105	104	-.11	163	99991			SG 1
	3	50	.25	.80	105	105	-.14	163	100318			SP 7
	4	50	.22	.69	106	106	-.11	164	100593			Hg 7
	5	50	.22	.69	106	105	-.11	165	101029			
	6	50	.22	.69	107	107	-.09	166	101058			
	7	50	.25	.70	107	107	-.11	178	101229			
	8	50	.28	.79	109	107	-.13	177	101495			
	9	50	.30	.85	108	107	-.12	178	101765			
	10	50	.28	.89	108	106	-.09	180	101982			
	11	50	.25	.80	107	106	-.09	180	102193			
	12	50	.15	.49	107	106	-.04	174	102376		V	
									102621			

page 1 of 2

FIELD DATA SHEET

rm Name	MDC	Pump No.	720094	Probe Diameter	.25 i
ant Location	Hartford	Orifice No.	D-2 1.75	Assumed Moisture	6 %
st No.	Test #3	Ambient Temp	80 °F	Test Duration	120 m
mpling Location	BLR 1	Bar Press.	30.16 "Hg	Traverse Point Interval	5 m
te	7/14/77	Probe ID No.	44	Probe Heater Setting	2.5 a
ster	CRL / AM	Filter ID. No.	871	Box Temp Setting	275 °

Port	Point	Time Min (3–5)	Velocity ΔP in H_2O (6–10)	ΔH in H_2O (12–15)	T_M in °F (18–20)	T_M Out °F (23–25)	P_{STACK} in H_2O (26–30)	T_{STACK} °F (32–35)	Initial Meter Volume cu. ft. (40–45)	PROBE (50)	Pump Vac. in Hg	Remarks
2	1	50	15	49	87	86	-11	155	02636	1		0900
	2	50	20	65	87	87	-12	164	02794	1		
	3	50	20	65	88	88	-12	167	03027	1		
	4	50	~~25~~	80	89	89	-14	~~162~~	03267	1		
	5	50	~~28~~	89	90	89	-14	168	03513	1		
	6	50	30	95	91	90	-16	171	03808			
	7	50	30	95	90	90	-16	171	04111	1		
	8	50	32	105	91	92	-15	172	04368			
	9	50	32	105	92	92	-16	172	04755			
	10	50	32	105	91	93	-16	172	05002			
	11	50	30	95	93	93	-14	175	05308			
	12	50	20	65	91	92	-04	167	05593			
									05848			
									32.12			

Page 2 of 2

FIELD DATA SHEET

irm Name	MDC	Pump No.	720094	Probe Diameter	.25 i
lant Location	Hartford	Orifice No.	D2 175	Assumed Moisture	6 %
est No.	Test #3	Ambient Temp	80 °F	Test Duration	120 m
ampling Location	BLR #1	Bar Press.	30.16 "Hg	Traverse Point Interval	5 m
ate	7/14/77	Probe ID No.	44	Probe Heater Setting	2.5 a
ester	CRL / AM	Filter ID. No.	871	Box Temp Setting	275 °

Port	Point	Time Min (3–5)	Velocity ΔP in H_2O (6–10)	ΔH in H_2O (12–15)	T_M in °F (18–20)	T_M Out °F (23–25)	P_{STACK} in H_2O (26–30)	T_{STACK} °F (32–35)	Initial Meter Volume cu. ft. (40–45)	PROBE (50)	Pump Vac. in Hg	Remarks
1	1	50	22	89	93	92	-13	165	05849	1	12	GP 753
	2	50	25	80	93	93	-14	164	06173	1	1	PW 3-3
	3	50	25	80	94	93	-13	177	06421	1	1	SG 124
	4	50	22	69	93	93	-12	180	06663	1	1	[illegible] 90 [illegible]
	5	50	22	69	93	92	-14	176	06931	1	1	
	6	50	25	65	92	92	-11	176	07161	1	1	
	7	50	25	70	90	91	-11	169	07328	1	1	
	8	50	22	69	90	90	-11	170	07662	1		
	9	50	25	80	91	91	-12	168	07934	1	1	
	10	50	25	80	90	91	-09	160	08170	1	1	
	11	50	22	69	91	92	-08	159	08418	1	1	
	12	50	13	43	90	91	-05	186	08661	1	1	
									08827			

APPENDIX C

PROCESS INFORMATION

T.T. # _____

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	65.0	70.0	90.0
	silica gel	15.6	19.0	12.0
2.	Stack Pressure - Absolute (IN. HG)	30.08	30.09	30.15
3.	Avg. Stack Temp. (^{o}F)	189.0	182.0	167.0
4.	Meter Volume (Actual Cubic Feet)	64.60	58.66	61.91
5.	Avg. Meter Temperature (^{o}F)	93.1	105.7	90.0
6.	Atmospheric Press. (IN. HG)	30.09	30.09	30.16
7.	Avg. Orifice Press. Drop (IN. H_2O)	0.816	0.745	0.786
8.	Pitot Coefficient	0.830	0.830	0.830
9.	Stack Area (Ft^2)	19.63	19.63	19.63
10.	Nozzle Diameter (IN.)	0.250	0.250	0.250
11.	Total Test Time (Min.)	120	120	120
12.	Heat Input (MBTU/HR)			
13.	Total Particulate Collected (MG)	15.50	14.40	14.40
14.	Avg. Stack Temperature (^{o}F)	189.0	182.0	167.0
15.	Avg. Velocity Press. Drop (IN. H_2O)	0.256	0.234	0.245
II.	ORSAT Analysis:			
	per cent CO_2	1.93	2.33	2.70
	per cent O_2	17.50	17.43	16.8
	per cent CO	-	-	-
III.	Moisture Content (Per Cent H_2O)	5.77	7.08	7.50

I.T.T. #_____ Test Report Data Form #1-5

Process Information: SEWAGE SLUDGE INCINERATORS

I. Results

	TEST NUMBER 1	2	3		
1. Particulates (lb/1000 lb)	0.045	0.039	0.031	Avg.	0.038
(gr/SCF @ 12% CO_2)	0.024	0.021	0.016	Avg.	0.020

II. Description

1. Maximum Feed Rate (lb/hr) 7 TPH one furnace
2. Normal Feed Rate 5 TPH
3. Method of Feeding Belt and Screw Conveyor
4. Method of Stoking Rabbling
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	2	3	
1. Actual Burner Firing Rate (gal/hr, CFH)	15,000	15,000	17,500	
2. Material Incinerated:				
% moisture	13.5	13.5	12.1	ave = 13.0
feed rate (lb/hr)	5	5	5	
incineration outlet temperature(s) (°F)	800	800	800	

ANY ADDITIONAL INFORMATION AVAILABLE:

THIS FORM MUST BE COMPLETED AND INLCUDED IN FINAL REPORT.