

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
BUREAU OF AIR QUALITY CONTROL

STAPPA/ALAPCO

SOURCE TEST REPORT

2.1

#122
11/04/86
Bl 2.2
#59
4.0

NAME: East Norriton and Plymouth Township Joint Sewer Authority

PROCESS/SOURCE TESTED: Sludge Incinerator

TEST NO. 00586

TEST DATE: July 8, 1986

POLLUTANT SAMPLED: Particulate

ACTUAL EMISSIONS: 0.107 gr./dscf (corrected to 12% CO₂)

ALLOWABLE EMISSIONS: 0.10 gr./dscf (corrected to 12% CO₂)



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REPORT PREPARED BY: John Pitulski

REPORT APPROVED BY: L. B. DeHaven
LBD

**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
BUREAU OF AIR QUALITY CONTROL**

**EAST NORRITON AND PLYMOUTH TOWNSHIP JOINT SEWER AUTHORITY
NORRISTOWN, PENNSYLVANIA**

PROCESS DESCRIPTION

The East Norriton and Plymouth Township Joint Sewer Authority operates a natural gas-fired Honeywell automatic multiple hearth sewerage sludge incinerator at its Norristown facility. This incinerator was designed having ten hearths with hearths Nos. 4, 6 and 8 equipped with dual natural gas-fired burners. Test No. 00586 was conducted on July 8, 1986 in the scrubber exhaust stack of the incinerator.

The grease and sludge are separated with the grease going to a concentrator and the sludge undergoing a series of preliminary and secondary treatments. The sludge is transported to a flocculator where lime is added for thickening, polymers for chemical breakdown and potassium permanganate for odor control. The treated sludge is then introduced into the two Parkison high pressure belt presses where this dewatering operation reduces the moisture content of the sludge to about 25 percent. The grease from the concentrator is deposited directly on the dewatered sludge and both are conveyed to an opening located at the top of the incinerator where it is distributed onto the first hearth. The sludge is then moved by a system of rotating rabble arms towards an opening along the outside wall of the incinerator where it falls to the second hearth. These arms are equipped with a cooling air channel to prevent melting at high temperatures. The cooling air is provided by a forced draft fan rated at 3900 CFM. Approximately 80-90 percent of the air in this totally enclosed system is recirculated where it is reutilized as drying air. The remaining 10-20 percent of the cooling air is exhausted through a warm air exhaust stack. The sludge is then raked towards an opening at the center of the second hearth. This reversal process continues with each hearth until the sludge reaches the last hearth where the end product is removed by a bucket and screw conveyor to the ash hopper.

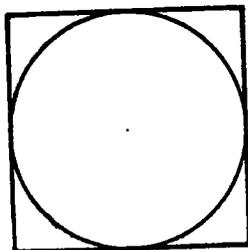
Combustion air for the burners is provided by means of a turbo blower forced draft fan rated at 160 psi pressure. The hot flue gases travel countercurrent to the sludge flow and are drawn through a Nichols cyclonic internal jet scrubber by a Robinson induced draft fan rated at 24,500 CFM. From the fan, the flue gases are ducted to the atmosphere through a 51-inch diameter stack having a discharge point approximately 75 feet above grade.

A process flow diagram is shown in Figure 1.

TEST DATA SUMMARY

	PARTICULATE
No.....	00586
Test Date.....	07/08/86
No. of Traverse Points/Sampling Points.....	12/24
Stack or Duct Area at Sampling Plane (sq ft).....A	14.1
Barometric Pressure (preliminary traverse) (in. Hg).....Pbp	31.60
(sample traverse) (in. Hg).....Pbs	31.60
Condensate Volume (ml).....Vlc	266.8
Avg. Pressure Drop at Orifice (in. WG).....DH	1.2
Avg. Meter Temperature (deg F).....Tm	115
Volume of Water Vapor Condensed (scf).....Vwc	12.6
Meter Y-factor.....Yf	0.99
Volume of Gas Sampled (dscf).....Vms	56.0
Total Sample Time (min).....e	96.0
Moisture in Gas Stream (%).....Bws	18.4
Dry Molecular Wt. (preliminary traverse) (lb/lb-mole).....Mdp	29.30
(sample traverse) (lb/lb-mole).....Mds	29.30
Molecular Wt. (preliminary traverse) (lb/lb-mole).....Msp	27.22
(sample traverse) (lb/lb-mole).....Mss	27.22
Pitot Tube Coefficient (preliminary traverse).....Cpp	0.810
(sample traverse).....Cps	0.810
Average Corrected Velocity (preliminary traverse) (fps)...Vsp	17.4
(sample traverse) (fps).....Vss	15.9
Stack Static Pressure (in. WG).....Pg	0.04
Average Stack Temperature (preliminary traverse) (deg F)..Tsp	127
(sample traverse) (deg F).....Tss	139
Volumetric Flow Rate (preliminary traverse) (dscfm).....Qsp	11,500
(sample traverse) (dscfm).....Qss	10,300
Sample Nozzle Diameter (in.).....Dn	0.375
Percent Isokinetic Sampling (%).....I	104.6
Weight Collected (gm).....Mn	0.1793
Pollutant Concentration (gr/dscf). (Actual).....Cs	0.049
Allowable Pollutant Concentration (gr/dscf). (12% CO ₂).....	0.1
Pollutant Mass Emission Rate (lb/hr).....E	4.8
Allowable Mass Emission Rate (lb/hr).....	NA
Pollutant Concentration (ppm).....C	NA
Allowable Pollutant Concentration (ppm).....	NA
Heat Input To Combustion Unit (mm btu/hr).....HI	NA
Pollutant Mass Emission Rate (lb/mm btu).....E'	NA
Allowable Mass Emission Rate (lb/mm btu).....	NA
Pollutant Concentration (gr./dscf) (12% CO ₂).....	0.107

SAMPLING LOCATION INFORMATION



Distance from wall to point (in.):

1. 1.08	4. 9.03	7. 32.86	10. 44.97
2. 3.41	5. 12.75	8. 38.25	11. 47.58
3. 6.02	6. 18.13	9. 41.96	12. 49.91

Flue configuration: 51" I.D.
 Port location: EXHAUST STACK
 No. of ports: 2 @ 90

Area: 14.1 sq.ft.

00586

SAMPLING TRAIN

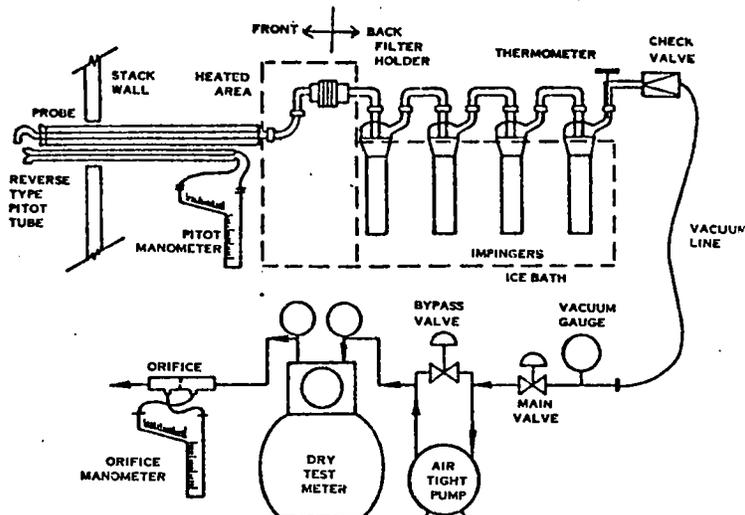
Nozzle No. D-2 (Dn = 0.375 in.)

Sample Box No. 525

Probe No. 474 (Cps = 0.810)

Module No. 504

Impinger Solution: DIST. WATER



LABORATORY RESULTS

SAMPLE WEIGHTS (PARTICULATE)

TRAIN COMPONENT	INSOLUBLE wt.(gm)	SOLUBLE wt.(gm)
Front Half	0.0042	0.0269
Filter #51100	0.1341	
Filter #		
Filter #		
Filter #		
Back Half	0.0141	0.1846*
Subtotals	0.1524	0.2115
Total Less *		0.1793 gm

CONDENSATE (ml)

IMPINGER NO.	FINAL	INITIAL
1(H2O)	319.0	150.0
2(H2O)	225.0	150.0
3(H2O)	160.0	150.0
4		
5		
Silica Gel	408.4	395.6
TOTAL (Vlc)		266.8 ml

GAS ANALYSIS

	PRELIM.	SAMPLING
%CO	0.0	0.0
%CO2	4.5	4.5
%O2	14.5	14.5
%N2	81.0	81.0

CONDENSATE VOLUME

$$V_{wc} = 0.0474 \times V_{lc}$$

$$V_{wc} = 0.0474 \times 266.8 = 12.6 \text{ SCF}$$

MOISTURE BY VOLUME

$$B_{ws} = \frac{V_{wc}}{V_{wc} + V_{ms}}$$

$$B_{ws} = 18.4\%$$

DRY MOLECULAR WEIGHT

$$M_d = (\%CO \times 0.28) + (\%CO_2 \times 0.44) + (\%O_2 \times 0.32) + (\%N_2 \times 0.28)$$

$$M_{dp} = (0.0 \times 0.28) + (4.5 \times 0.44) + (14.5 \times 0.32) + (81.0 \times 0.28) = 29.30$$

$$M_{ds} = (0.0 \times 0.28) + (4.5 \times 0.44) + (14.5 \times 0.32) + (81.0 \times 0.28) = 29.30$$

MOLECULAR WEIGHT

$$M_s = (B_{ws} \times 18.00) + (M_d \times (1 - B_{ws}))$$

$$M_{sp} = (0.184 \times 18.00) + (29.30 \times (1 - 0.184)) = 27.22$$

$$M_{ss} = (0.184 \times 18.00) + (29.30 \times (1 - 0.184)) = 27.22$$

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**EAST NORRITON AND PLYMOUTH TOWNSHIP JOINT SEWER AUTHORITY
NORRISTOWN, PENNSYLVANIA**

SLUDGE INCINERATOR OPERATING DATA

<u>Time</u>	<u>Sludge Tons/Hour</u>	<u>Hearth Temperatures °F</u>								<u>Stack Temp. °F</u>
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
1:45 P.M.	4.2	660	850	930	1130	1220	1075	290	160	155
2:15 P.M.	4.0	600	825	820	1050	1330	1075	290	160	150
2:30 P.M.	4.0	610	820	830	1045	1415	1120	300	160	155
2:45 P.M.	3.4	600	810	810	1010	1325	1220	340	160	160
3:00 P.M.	3.8	675	830	930	1100	1575	1300	400	165	170
3:30 P.M.	3.6	690	870	980	1160	1530	1210	430	175	165
3:45 P.M.	3.8	730	890	1050	1220	1580	1175	390	175	170
4:00 P.M.	3.8	750	930	1120	1280	1515	1160	390	175	170
4:15 P.M.	4.3	730	940	1070	1240	1475	1110	380	175	170
4:30 P.M.	3.9	770	950	1140	1300	1470	1110	390	180	170
5:00 P.M.	4.1	790	990	1170	1300	1410	1090	400	180	170
5:15 P.M.	3.8	760	995	1120	1290	1430	1080	400	185	170

WET SCRUBBER DATA

<u>Time</u>	<u>ΔP</u>	<u>% CO₂</u>
1:40 P.M.	4.2	3.0
2:10 P.M.	4.2	2.0
2:25 P.M.	4.2	3.0
2:40 P.M.	4.2	4.0
3:30 P.M.	4.2	5.0
3:45 P.M.	4.2	5.5
4:00 P.M.	4.2	5.5
4:15 P.M.	4.2	5.5
4:30 P.M.	4.1	6.5
4:45 P.M.	4.1	5.5
5:00 P.M.	4.1	5.0
5:15 P.M.	4.1	5.5
5:30 P.M.	4.1	6.0