INCINERATOR COMPLIANCE TEST

at

ENFIELD

SEWAGE TREATMENT PLANT

in

ENFIELD, CONNECTICUT

for

THE BSP DIVISION
ENVIROTECH SYSTEMS, INC.

Prepared By

YORK RESEARCH CORPORATION
ONE RESEARCH DRIVE
STAMFORD, CONNECTICUT 06906

REPORT NO. Y-8155 July 12th, 1973

TABLE OF CONTENTS

		PAGE
I.	ABSTRACT	1
II.	SUMMARY OF RESULTS	2
III.	GENERAL TEST METHODS	4
IV.	ANALYTICAL METHODS	6
V.	FIGURES	10
VI.	APPENDIX	18

Testing Acceptance Letter
Description of Operations
Operating Logs
Calculations
Calibration

I. ABSTRACT

On May 29th and June 1st, 1973, York Research, an independent consulting firm in the environmental field, began a series of emission sampling tests at the Enfield Sewage Treatment Plant in Enfield, Connecticut.

The purpose of these tests was to determine compliance with Connecticut State Regulations for particulate emissions from an incinerator. NO_x, SO_x, hydrocarbon and CO were also tested per a State request.

The Connecticut State Regulations as specified in "Administrative Regulations", Department of Environmental Protection, Abatement of Air Pollution, May 23, 1972, Page 14B, Section 19-508-18 "Control of Particulate Emissions" subsection (C)(3)(i) "Emission Standards. Particulates" states:

> No person shall construct, install, use or cause to be used any new (constructed or modified after June 1, 1972) incinerator which will result in particulate matter in the effluent in excess of 0.08 gr/SCF (0.18 gm/NM^3) corrected to 12% CO_2, maximum 2 hour average. No person shall use or cause to be used any existing incinerator which will emit more than 0.4 lb. particulate/1000 lbs. of flue gases adjusted to 50% excess air.

The following Table gives the results of the scrubber outlet sampling in terms as used in the Connecticut State Regulations.

Particulate Test	gr/SCF (12% CO_2)	lbs./1000 lbs. (Flue Gas @ 50% Excess Air)
1	.0140	.033
2	.0085	.014
3	.0103	.017
Average	.0109	.027
State Limitations	.08 gr/SCF (12% CO_2)	.4 lbs./1000 lbs. (Flue Gas @ 50% Excess Air)

II. SUMMARY OF RESULTS

OUTLET PARTICULATE

Test	1	2	3
Date	5-29-73	5-29-73	6-1-73
Time	1529-1724	1803-1957	1324-1516
Gas Velocity, FPM	1160	1080	1050
Gas Flow, SCFM	4480	4170	4170
Isokinetic Sampling Rate,%	103.3	102.3	100.2
Particulate Concentration, gr/SCF	.0165	.0071	.0079
gr/SCF (12% CO_2)	.0140	.0085	.0103
Particulate Emission Rate, lb/hr.	.6334	.2537	.2823
lbs/1000 lbs. (50% E.A.)	.033	.014	.017

SO_x

Test	1	2
Date	6-1-73	6-1-73
Time	1527-1547	1618-1638
SO_2 (ppm)	23.9	15.8
SO_3 (ppm)	3.69	1.97

NOTE: Only two tests were sampled due to the diminishing sludge supply.

NO_x

Test	1	2	3	4	5	6	7	8	9	10	11	12
Date	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73
Time	1420	1425	1427	1431	1433	1435	1437	1441	1444	1453	1455	1457
NO_2 (ppm)	41.6	48.3	45.1	61.2	61.7	99.8	106.9	77.2	56.8	55.7	91.8	69.3

@ 7.95

HYDROCARBON

Test	1	2	3	4	5	6	7	8
Date	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73
ppm*	4.80	3.36	2.81	8.42	4.86	10.82	2.40	5.07

5.32

*Based on $C_6 H_{14}$

III. GENERAL TEST METHODS

Particulate Sampling Train - EPA Method 5

The sampling apparatus consisted of a three (3) foot probe, cyclone bypass, filter, four impingers, dry gas meter, vacuum pump and flow meter (See Figure 1). The stainless steel, button-hook type probe tip (1) was connected by a stainless steel coupling (2) with asbestos packing to the probe. The probe (3) consisted of 5/8 inch outside diameter medium wall Pyrex glass tube with a ground balljoint on one end. The probe was logaritmically wound from the entrance end with 26-gauge nickel-chromium wire. During sampling, the wire was connected to a variable transformer to maintain a gas temperature of 250°F in the probe. The wire wound tube was wrapped with fiberglass tape and enclased in a 1-inch-OD stainless steel casing for protection. The end of the steel probe casing does not have the balljoint protruding but has a nut welded to it for connection to the stainless steel coupling used to attach the nozzle. The probe connects to a cyclone bypass (4). The cyclone bypass connects to a very coarse fritted glass filter holder (5), which holds a tared glass fiber filter. The cyclone, flask, and filter were contained in an electrically heated enclosed box (6) which is thermostatically maintained at a minimum temperature of 250°F to prevent water condensation. Attached to the heated box was an ice bath (7) containing four impingers connected in series with glass balljoints. The first impinger (8) receives the gas stream from the filter. This impinger is of the Greenburg-Smith design modified by replacing the tip with a 1/2 inch ID glass tube extending to 0.5 inches from the bottom of the flask. This impinger was initially filled with 100 milliliters of distilled water. The second impinger (9) is of the Greenburg-Smith design and like the first was initially filled with 100 milliliters of distilled water. The third impinger (10), which was left dry, is a Greenburg-Smith impinger modified like the first. The fourth impinger (11) is also a Greenburg-Smith type modified like the first and contained dry silica gel.

From the fourth impinger (11) the effluent stream flows through a check valve (13); flexible rubber vacuum tubing (14); vacuum gauge (15); a needle valve (16); a leakless vacuum pump (17), rated at 4 cubic feet per minute at 0 inches of mercury gauge pressure and 0 cubic feet per minute at 26 inches of mercury gauge pressure, and connected in parallel with a bypass valve (18); and a dry gas meter rated at .1 cubic foot per revolution (19). A calibrated orifice (20) completes the train and was used to measure instantaneous flow rates. The three thermometers (21) are dial type with a range of 25° to 125°F. A fourth thermometer in the heated portion of the box has a range

up to 500°F. The dual manometer (21) across the calibrated orifice is an inclined-vertical type graduated in hundredths of an inch of water from 0 to 1.0 inch and in tenths from 1 to 10 inches.

The circular outlet stack was measured as 30" I.D. Two ports 90° to each other were located approximately 7 feet above the nearest downstream restriction, and approximately 5 feet from the top of the stack. (See Figure 2) Six points were sampled in each port for ten minutes each. Readings were taken every five minutes. (See Figure 3) The location of each sampling position was determined by Method 1 of the Federal Register, December 23, 1971.

Readings Taken

During each run the following readings were taken at each point:

1. Point Designation
2. Clock Time
3. Dry gas meter reading (CF)
4. Velocity head (Δ P in inches water)
5. Desired pressure drop across orifice (Δ H in inches of water)
6. Actual pressure drop across orifice (Δ H in inches of water)
7. Dry gas temperature(°F) gas meter inlet
8. Dry gas temperature(°F) gas meter outlet
9. Vacuum pump gauge reading (in. Hg)
10. Filter box temperature (°F)
11. Dry gas temperature (°F) at the discharge of last impinger
12. Stack temperature (°F)
13. Stack pressure (inches water)

The relationship of Δ P reading with the Δ H reading is a function of the following variables:

1. Orifice calibration factor
2. Gas meter temperature
3. % moisture in the flue gas
4. Ratio of flue gas pressure to barometric pressure
5. Stack temperature
6. Sampling nozzle diameter

A nomograph was used to correlate all the above variables such that a direct relationship between Δ P and Δ H could be determined by the sampler within fifteen seconds and isokinetic conditions maintained throughout the test.

IV. ANALYTICAL PROCEDURE

Particulate

The filter discs were previously tare weighed and the weights recorded at York Research's Laboratory. Upon return they were dried, cooled in a dessicator, then weighed on an analytical balance. The amount of particulate collected is the difference in the weights. The probe and nozzle acetone wash solution is placed into a tared beaker, evaporated with an Infra-Red lamp and the beaker weighed again. The difference in weight is the weight of the particulate in the wash. This is combined with the filter catch as the weight of the sample.

Hydrocarbons

Hydrocarbon samples are collected by the grab sample technique. This method employs a 250 ml flask with a two-way valve at each end. One end of the flask is inserted in the sample stream and the other end is connected to a vacuum pump. The sample is collected by purging the flask with flue gas while heating to prevent condensation. The valve on the pump side is closed first then the valve on the stack side is closed. The sample is then sent to the lab for analysis. (See Figure 4)

Hydrocarbon samples are analyzed by use of the gas chromotography method.

Carbon Monoxide

Carbon Monoxide are analyzed by using the grab flasks used for hydrocarbons and analyzing them by non-dispersive Infra-Red (NDIR) analysis. Detection tubes are also used in the field as a check. The laboratory sample of CO comes from the 250 ml flask used for hydrocarbon collection.

Oxides of Nitrogen (EPA Method No. 7)

A grab sample is collected in an evacuated flask containing a dilute sulfuric acid - hydrogen peroxide absorbing solution.

The sampling procedure consists of pipetting 25 ml of H_2SO_4 - H_2O_2 absorbing solution into a 2 liter sampling flask. The flask is then evacuated to at least 3 in. Hg. absolute pressure. The next step is to evacuate the probe prior to sampling. The sample is then taken over a period of 15 seconds. After the sample has been collected, the flask is shaken for approximately 5 minutes. After this period the flask must be left with the sample for a minimum of 16 hours. After the 16 hours, the flask

is reshaken for a period of two minutes. After this the final pressure of the flask is recorded and the sample is transferred to the lab for analysis. The sampling apparatus used to collect oxide of nitrogen samples is shown in Figure 5.

In the laboratory, the amount of nitrogen in the sample is determined by the phenoldisulphonic method. This method is as follows:

The sample is placed in a beaker and NaOH is slowly added until the solution is neutral or slightly basic by litmus paper indication. This solution is then evaporated in the beaker used for neutralization. To the dry residue, two (2) milliliters of phenoldisulphonic acid are added and mixed to dampen all the precipitate. Then add two (2) milliliters of distilled water and mix thoroughly; add twenty (20) more milliliters of distilled water and mix. Add concentrated NH_4OH to this solution in excess of neutralization. Filter solution if necessary and transfer to a volumetric flask. Using a spectrophotometer at 420 Mu, compare results with a standard curve based on standard concentrations, and read milligrams of nitrogen in the sample.

After the amount of nitrogen in the sample is known, the concentration is calculated using the following formula.

$$\text{ppm } NO_x = \frac{(29.63)(\text{Mg } NO_x)(T_f + 460)}{(V_f)(P_i - P_f)}$$

Where:
- ppm NO_x = parts per million of NO_x
- Mg NO_x = milligrams of NO_x in sample
- T_f = flask temperature (°F)
- P_i = initial flask pressure (in. Hg.)
- P_f = final flask pressure
- V_f = flask volume

SO_2, SO_3 Analysis (EPA Method No. 6)

The sulfur dioxide sampling train consists of the following components arranged and illustrated schematically (See Figure 6): (1) glass wool filter, (2) an electrically heated glass probe, (3) variac, (4,5,6,7) four midget impingers, (8) ice bath, (9) drying tube containing silica gel, (10) vacuum gauge, (11) control valve, (12) vacuum pump, (13) dry gas meter, and (14) thermometer.

The probe is made of an 18" length of medium wall Pyrex tubing wound with 26 gauge nichrome heating wire. The front end of the probe includes a two-inch long area for insertion of glass wool to be used as a filtering device. The wire is connected to a variable transformer which allows the voltage and hence the heat input to be controlled. The wire is covered with a fiberglass insulation tape.

Samples of stack gas are drawn through a heated glass probe which is packed with glass wool in the sampling end. From the sampling probe the gas is drawn through three midget impingers.

The first midget impingers contain 15 ml of 80% isopropanol and 15 ml of 3% hydrogen peroxide to trap the SO_3 and SO_2 respectively. The third impinger is left dry and is followed by a drying tube packed with silica gel. The remaining gas goes to a vacuum pump, rotometer, and a dry gas meter for measurement of the quantity of gas sampled. The impinger set up is connected in series. The chamber near the bubbler outlet is stuffed with fine glass wool to prevent any H_2SO_4 from entering into the H_2O_2. An ice bath is provided for the bubbler and impingers. Attached to the outlet of the third impinger is a drying tube filled with silica gel of the indicator type. A bypass valve is provided for the leakless pump and a vacuum gauge and needle valve are installed at the inlet of the pump. The dry gas meter has a sensitivity of 0.001 cubic foot and is fitted with a thermometer on the meter inlet.

The sampling method draws the flue gas through the sampling train at the rate of .1 cubic foot per minute for a period of 20 minutes. After the actual sampling time the sample is aspirated on ambient air for the same length of time the sample was taken. After this step, the samples are transported to the lab for analyses.

In the laboratory the amount of sulfur dioxide and sulfur trioxide are measured as follows:

Dilute solution used for sampling to 50 ml. Pipette 10 ml. of this solution into a 125 ml. Erlenmeyer flask. Add 40 ml. of isopropanol and two to four drops of thorin indicator. Titrate to a pink endpoint using 0.01 N barium perchlorate. Run a blank with each series of samples.

The SO_2 and SO_3 concentration is calculated as follows:

$$C_{SO_2} = (7.05 \times 10^{-5} \frac{\text{lb-l}}{\text{g-ml}}) \frac{(V_t - V_{tb})\, N \left(\frac{V_{soln}}{V_a}\right)}{V_{m_{std}}}$$

Where:
- V_t = Volume of Barium perchlorate titrant used, ml.
- V_{tb} = Volume of Barium perchlorate titrant used in blank, ml.
- N = Normality of Barium perchlorate titrant, g-eq./l.
- V_{soln} = Total solution volume of SO_2, SO_3, 50 ml.
- V_a = Volume of sample aliquot titrated, ml.
- $V_{m_{std}}$ = Volume of gas sample through the dry gas meter (std. conditions), cu.ft.

CO_2 and O_2

CO_2 and O_2 samples were collected by traverse through a sampling tube attached to the particulate sampling probe and aspirated into leveling bottles as illustrated in Figure 7. The gas collected was immediately tested with an Orsat apparatus for CO_2 and O_2 concentration.

TEST TEAM

Louis Terracciano
Robert S. Epstein
Jerold Grabiner
Andrew Gabriel

Prepared By:

Robert S. Epstein
Asst. Project Director

Reviewed By:

Roy S. Eydall
Engineering Manager

Approved By:

Abraham J. Kurtz
Vice President-Operations

V. FIGURES

PARTICULATE SAMPLING TRAIN

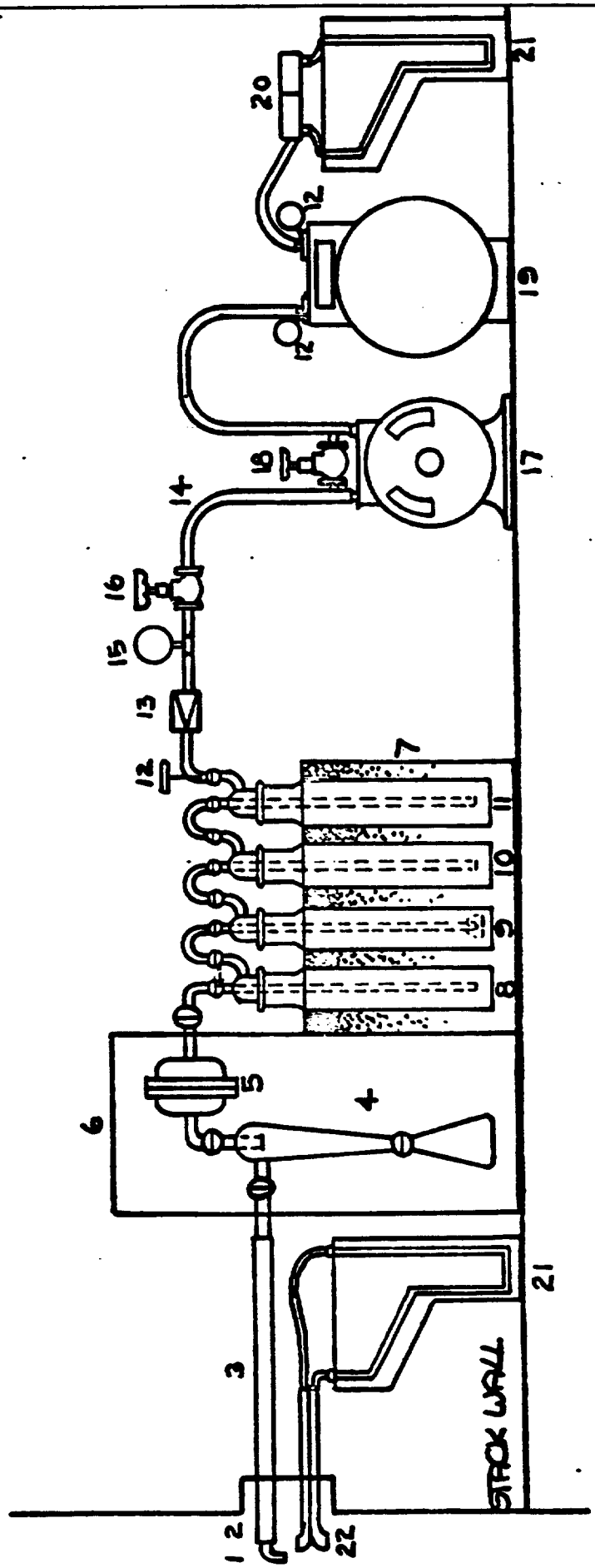
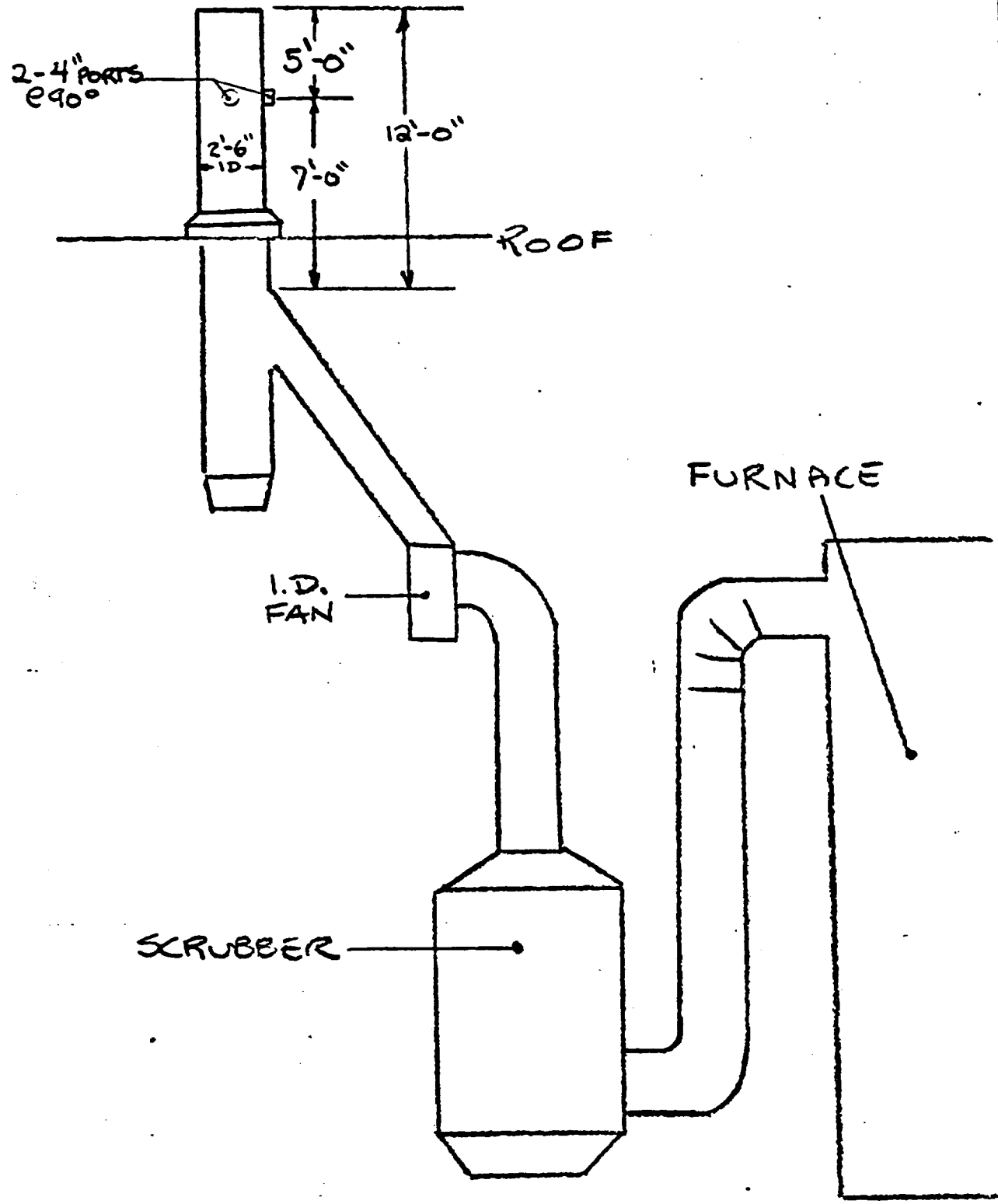
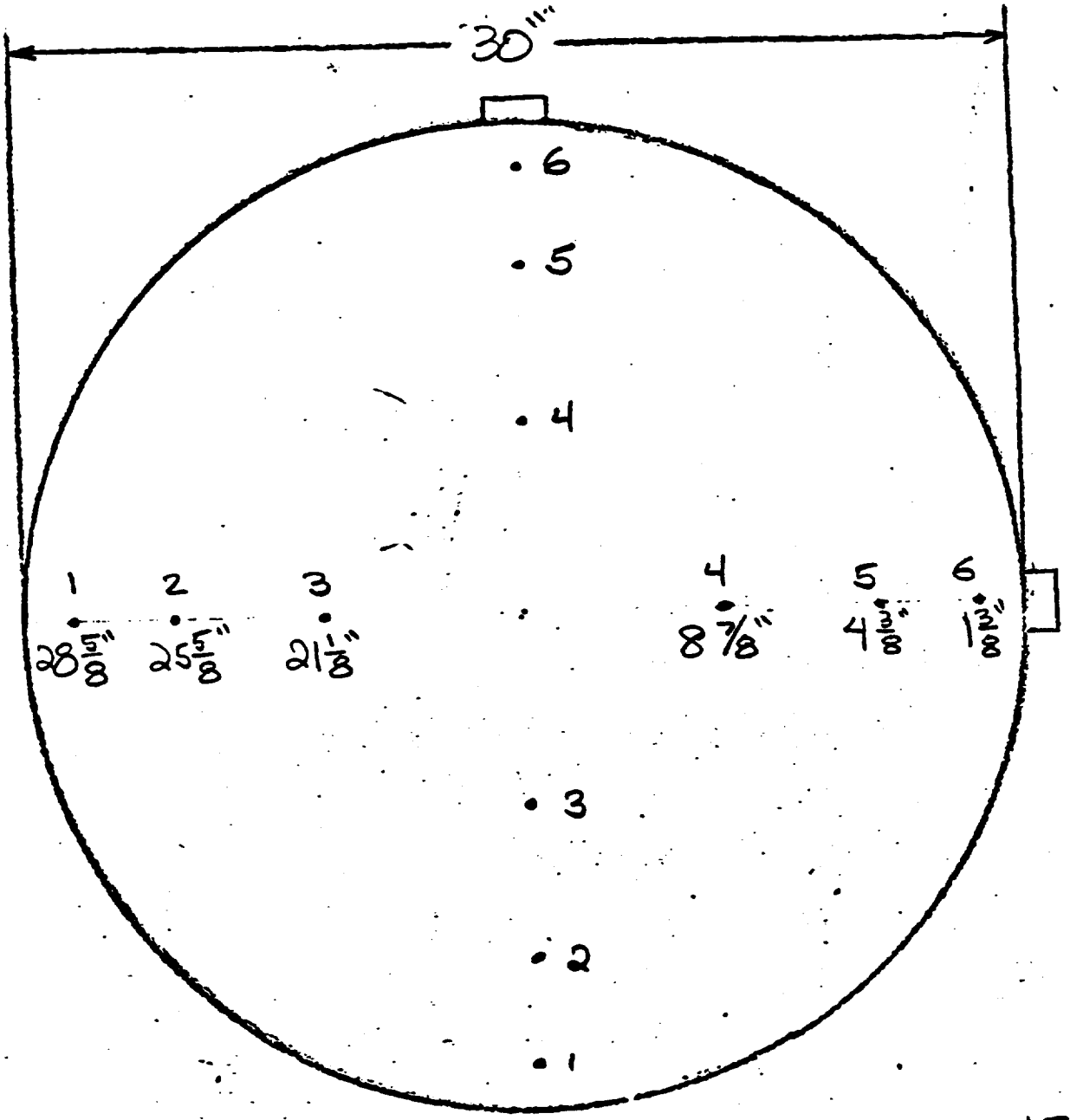


FIGURE #1

GAS FLOW
FIGURE 2

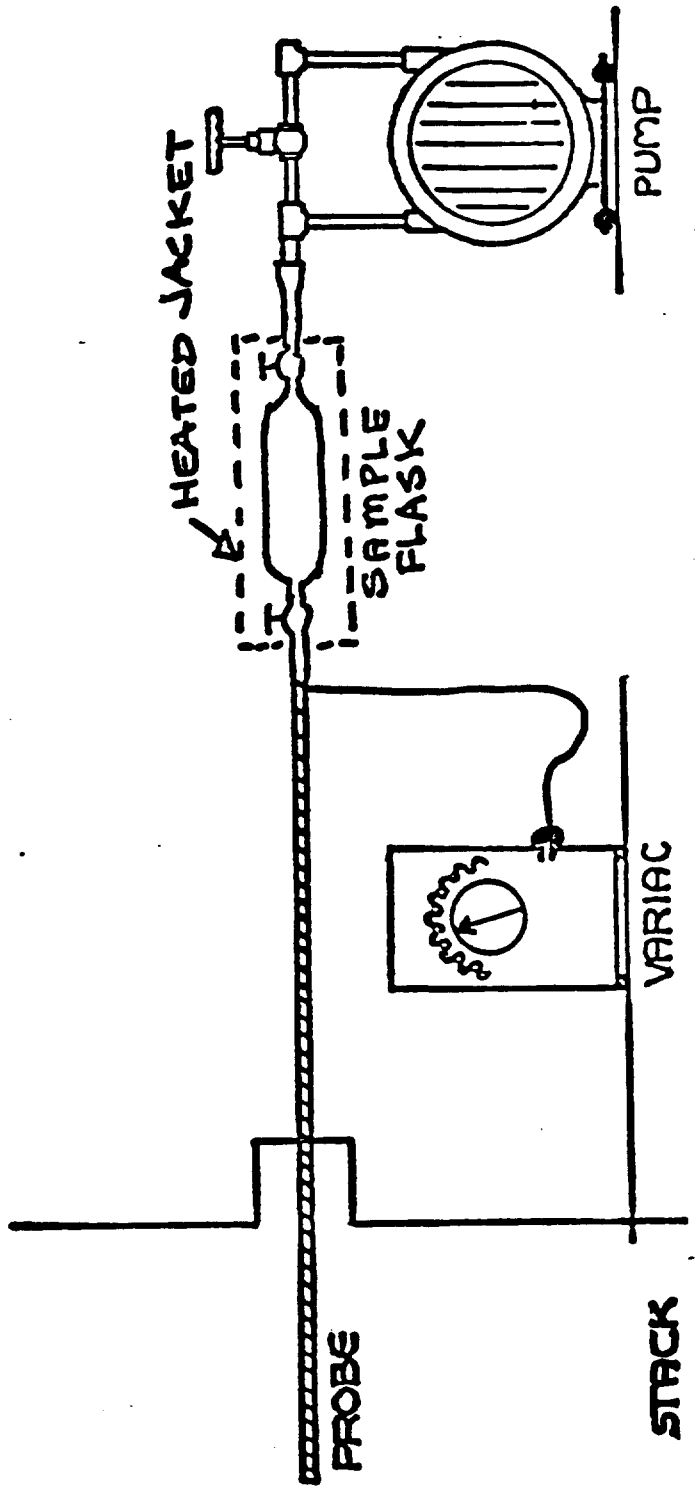


SAMPLING POINT LOCATION
FIGURE 3



THE DIMENSION INDICATED IS FROM THE PORT(ID) TO THE SAMPLING POINT

HYDROCARBON SAMPLING
FIGURE 4



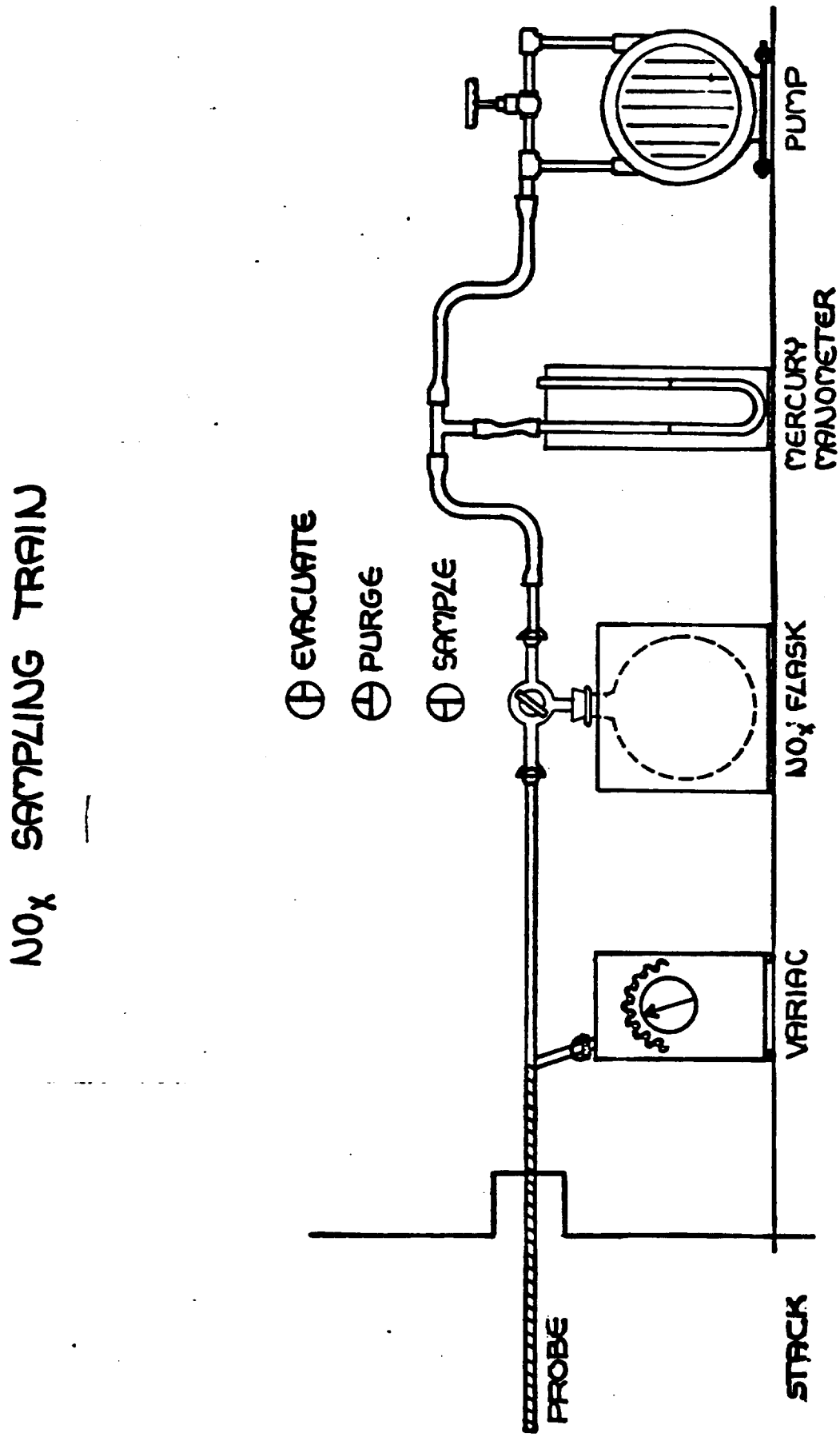

NOx SAMPLING TRAIN
⊕ EVACUATE
⊕ PURGE
⊕ SAMPLE
PUMP
MERCURY MANOMETER
NOx FLASK
VARIAC
PROBE
STACK

FIGURE #5

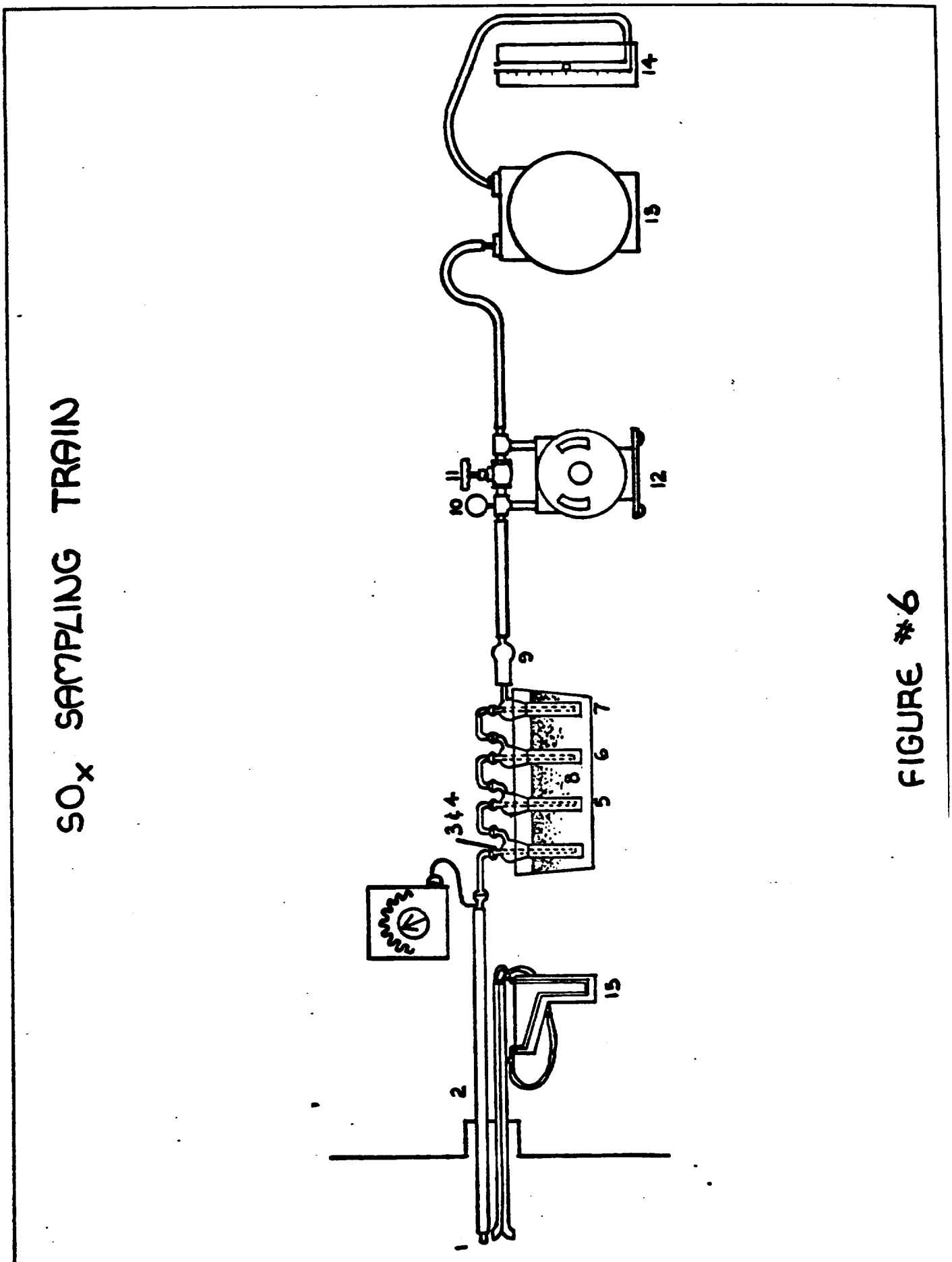
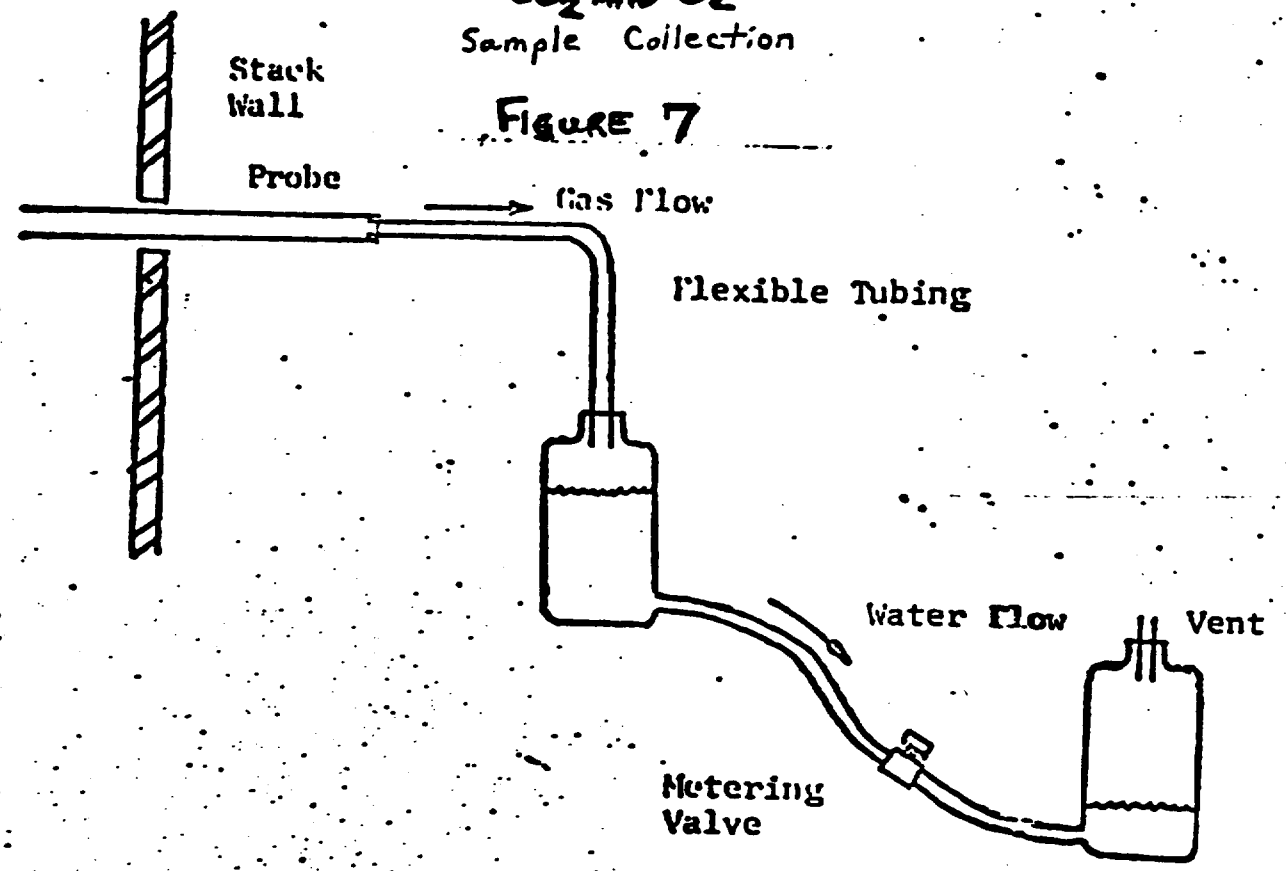


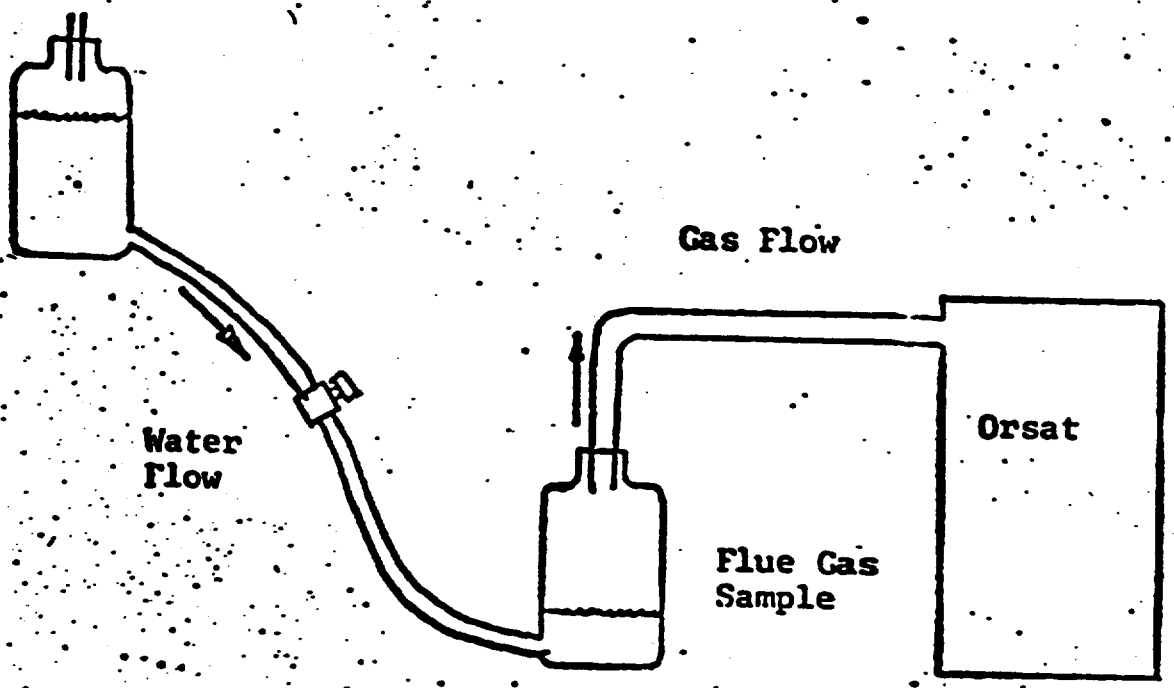
FIGURE #6

CO_2 AND O_2
Sample Collection

FIGURE 7



Sample recovery



VI. APPENDIX

OXIDES OF NITROGEN FIELD DATA

JOB NO. 8155

Date 5·29·73

Plant ENFIELD SEWAGE TREATMENT

Sample Collected By RSE

Run No. 1-6

Power Stat Setting 75%

Field Data

	1	2	3	4	5	6
Clock Time	1420	1425	1427	1431	1433	1435
Flask Number	1	2	3	4	5	6
Volume of flask less correction (liter)	2.042	2.061	2.033	2.034	2.066	2.055
Pressure before sampling in Hg.	-25.0	-25.3	-25.0	-25.2	-25.2	-25.1
Pressure after sampling in Hg.	-.5	-1.4	-2.9	-.1	-1.6	0
Flask temperature, °F	70	70	70	70	70	70

Remarks:

QUALITY CONTROLLED YORK RESEARCH CORPORATION

OXIDES OF NITROGEN FIELD DATA

JOB NO. 8155

Date 5.29.73

Plant ENFIELD SEWAGE TREATMENT

Sample Collected By R&E

Run No. 7-12

Power Stat Setting 75%

Field Data

	7	8	9	10	11	12
Clock Time	1437	1441	1444	1453	1455	1457
Flask Number	7	8	9	10	11	12
Volume of flask less correction (liter)	2.064	2.053	2.012	2.031	2.053	2.041
Pressure before sampling in Hg.	-25.3	-25.5	-25.5	-25.0	-25.5	-25.5
Pressure after sampling in Hg.	-2.5	-2.2	-2.3	0	-.7	-3.8
Flask temperature, °F	70	70	70	70	70	70

Remarks:

REPORT NO. 8155 Page of Pages

NO_x EMISSION DATA

RUN NO.	1	2	3	4	5	6	
Date	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	
mg NO_2	.1327	.1516	.1289	.1990	.1914	.3279	
T_f - Flask Temperature, °F	70	70	70	70	70	70	
V_f - Flask Volume, liters	2.042	2.061	2.033	2.034	2.066	2.055	
P_i - Initial Flask Vacuum, "Hg.	-25.0	-25.3	-25.0	-25.2	-25.2	-25.1	
P_f - Final Flask Vacuum, "Hg.	-.5	-1.4	-2.9	-.1	-1.6	0	
ppm NO_2	41.6	48.3	45.1	61.2	61.7	99.8	

$$\text{ppm } NO_2 = \frac{29.63 \times \text{mg } NO_2 \times (T_f + 460)}{V_f \times (P_i - P_f)}$$

#1 $\frac{29.63 \times .1327 \times 530}{2.042 \times 24.5} = 41.6$

#2 $\frac{29.63 \times .1516 \times 530}{2.061 \times 23.9} = 48.3$

#3 $\frac{29.63 \times .1289 \times 530}{2.033 \times 22.1} = 45.1$

#4 $\frac{29.63 \times .1990 \times 530}{2.034 \times 25.1} = 61.2$

#5 $\frac{29.63 \times .1914 \times 530}{2.066 \times 23.6} = 61.7$

#6 $\frac{29.63 \times .3279 \times 530}{2.055 \times 25.1} = 99.8$

REPORT NO. 8155 Page of Pages

NO_x EMISSION DATA

RUN NO.	7	8	9	10	11	12	
Date	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	5/29/73	
mg NO_2	.3203	.2350	.1687	.1800	.2976	.1952	
T_f - Flask Temperature, °F	70	70	70	70	70	70	
V_f - Flask Volume, liters	2.064	2.053	2.012	2.031	2.053	2.041	
P_i - Initial Flask Vacuum, "Hg.	-25.3	-25.5	-25.5	-25.0	-25.5	-25.5	
P_f - Final Flask Vacuum, "Hg.	-2.5	-2.2	-2.3	0	-.7	-3.8	
ppm NO_2	106.9	77.2	56.8	55.7	91.8	69.3	

$$\text{ppm } NO_2 = \frac{29.63 \times \text{mg } NO_2 \times (T_f + 460)}{V_f \times (P_i - P_f)}$$

#7 $\frac{29.63 \times .3203 \times 530}{2.064 \times 22.8} = 106.9$

#8 $\frac{29.63 \times .2350 \times 530}{2.053 \times 23.3} = 77.2$

#9 $\frac{29.63 \times .1687 \times 530}{2.012 \times 23.2} = 56.8$

#10 $\frac{29.63 \times .1800 \times 530}{2.031 \times 25.0} = 55$

#11 $\frac{29.63 \times .2976 \times 530}{2.053 \times 24.8} = 91.$

#12 $\frac{29.63 \times .1952 \times 530}{2.041 \times 21.7} = 69$

GAS SAMPLING FIELD DATA

JOB NO. 8155

Material Sampled for SOx

Date 6-1-73

Plant ENFIELD Location SCRUBBER OUTLET

Bar. Pressure 29.91 "Hg

Ambient Temp. 90

Run No. 1

Power Stat Setting 75%

Filter Used: Yes X No

Operator R&E

Comments:
Impinger #1 — ml
Impinger #2 — ml
Impinger #3 — ml
Impinger #4 — ml

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1527	384.098	.1	92
1532	384.735	.1	92
1537	385.103	.1	92
1542	385.662	.1	92
1547	285.903	.1	92

COMMENTS:

QUALITY CONTROLLED YORK

GAS SAMPLING FIELD DATA

JOB NO. 8155

Material Sampled for SOx

Date 6-1-73

Plant ENFIELD Location SCRUBBER OUTLET

Bar. Pressure 29.91 "Hg

Ambient Temp. 90

Run No. 2

Power Stat Setting 75%

Filter Used: Yes X No

Operator RSE

Comments:
Impinger #1 — ml
Impinger #2 — ml
Impinger #3 — ml
Impinger #4 — ml

CLOCK TIME	METER (Ft^3)	FLOW METER SETTING (CFM)	METER TEMPERATURE TM
1618	387.967	.1	92
1623	388.462	.1	92
1628	388.923	.1	92
1633	389.428	.1	92
1638	390.215	.1	92

COMMENTS:

QUALITY CONTROLLED YORK

REPORT NO. 8155 Page of Pages

SO_2 EMISSION DATA

RUN NO.	1	2				
Date	6/1/73	6/1/73				
mg SO_2	3.11	2.56				
Tm - Average Gas Meter Temperature, °F	92	92				
Pb - Barometric Pressure, "Hg abs.	29.91	29.91				
Vm - Volume of dry gas sampled @ meter conditions, $ft.^3$	1.805	2.248				
ppm SO_2	23.9	15.8				

$$\text{ppm } SO_2 = \frac{0.751 \times \text{mg } SO_2 \times (Tm + 460)}{Pb \times Vm}$$

#1 $\frac{0.751 \times 3.11 \times 552}{29.91 \times 1.805} = 23.9$

#2 $\frac{0.751 \times 2.56 \times 552}{29.91 \times 2.248} = 15.8$

ONLY TWO TEST WERE MADE DUE TO SLUDGE SUPPLY

QUALITY CONTROLLED YORK RESEARCH CORPORATION

REPORT NO. 8155 Page of Pages

SO_3 EMISSION DATA

RUN NO.	1	2						
Date	4/1/73	4/1/73						
mg SO_3	0.60	0.40						
T_m - Average Gas Meter Temperature, °F	92	92						
P_b - Barometric Pressure, "Hg abs.	29.91	29.91						
V_m - Volume of dry gas sampled @ meter conditions, $ft.^3$	1.805	2.248						
ppm SO_3	3.69	1.97						

$$\text{ppm } SO_3 = \frac{0.6008 \times \text{mg } SO_3 \times (T_m + 460)}{P_b \times V_m}$$

#1 $\dfrac{0.6008 \times 0.60 \times 552}{29.91 \times 1.805} = 3.69$

#2 $\dfrac{0.6008 \times 0.40 \times 552}{29.91 \times 2.248} = 1.97$

* ONLY TWO TESTS WERE MADE DUE TO SLUDGE SUPPLY THINNING OUT

QUALITY CONTROLLED YORK

REPORT NO. Y-8155 PAGE OF PAGES

HYDROCARBON EMISSION DATA

Job No. 8155

Date 5-29-73

Plant ENFIELD Location SCRUBBER OUTLET

Ambient Temp. 70

Operator R&E

Test No.	Time	Flask Temp.	Comments
1	1556	350°F	4.80 ppm
2	1610	350	3.36
3	1617	350	2.81
4	1625	350	8.42
5	1825	350	4.86
6	1837	350	10.82
7	1923	350	2.40
8	1942	350	5.07

YORK RESEARCH CORPORATION

TEMP PROBE CALIBRATION

	Thermometer Glass 0-230°F	Thermometer Glass 200-750°F	Thermocouple E.P.A. Train
Ambient Air	68°	—	69°
Water	212	212	212
Light Oil	—	375°	376°
OVEN WITH 1000°F THERMOMETER	—	775°	776°

Calibrated by: R Fraser

Meter Calibration

Accuracy within 1°F

Calibrated by: R Fraser

Calibration Calculations Meter and Pump Box

Date 5/9/73 Box No. S-1564 Meter No. _____

$$\Delta H_@ = \frac{0.0317 \text{ (Man. orifice)}}{P_b\,(T_d + 460)} \left(\frac{(T_w + 460)t}{CF_w}\right)^2$$

$$Y = \frac{CF_w\,P_b\,(T_@ \text{ avg.} + 460)}{CF_d\left(P_b + \frac{\text{Man. orifice}}{13.6}\right)(T_w + 460)}$$

Man.	$\Delta H_@$	Y
.5	2.09	
	$\frac{0.01585}{29.86\ (76 + 460)} \left(\frac{(73 + 460)}{\frac{13.65}{5}}\right)^2$	$Y = \frac{5 \times 29.86\ (77 + 460)}{5\ (29.86 + 0.0368)\ (73 + 460)}$
1.0	1.86	.99
	$\frac{0.0317}{29.86\ (78 + 460)} \left(\frac{(73 + 460)}{\frac{8.12}{5}}\right)^2$	$Y = \frac{5 \times 29.86\ (80 + 460)}{5.01\ (29.86 + 0.0737)\ (73 + 460)}$
2.0	1.97	1.00
	$\frac{0.0634}{29.86\ (80 + 460)} \left(\frac{(73 + 460)}{\frac{13.3}{10}}\right)^2$	$Y = \frac{10 \times 29.86\ (83.5 + 460)}{10.11\ (29.86 + 0.147)\ (73 + 460)}$
4.0	1.91	.99
	$\frac{0.1268}{29.86\ (84 + 460)} \left(\frac{(73 + 460)}{\frac{9.30}{10}}\right)^2$	$Y = \frac{10 \times 29.86\ (90.5 + 460)}{10.03\ (29.86 + 0.294)\ (73 + 460)}$
6.0		1.01
	$\frac{0.1902}{\_\_\_\_\ (\_\_\_ + 460)} \left(\frac{(\_\_\_ + 460)}{\_\_\_\_}\right)^2$	$Y = \frac{\_\_\_ \times \_\_\_\_\ (\_\_\_ + 460)}{\_\_\_\_\ (\_\_\_ + 0.431)\ (\_\_\_ + 460)}$
8.0		
	$\frac{0.2536}{\_\_\_\_\ (\_\_\_ + 460} \left(\frac{(\_\_\_ + 460)}{\_\_\_\_}\right)^2$	$Y = \frac{\_\_\_ \times \_\_\_\_\ (\_\_\_ + 460}{\_\_\_\_\ (\_\_\_ + 0.588)\ (\_\_\_ + 460)}$

YORK RESEARCH CORPORATION

PITOT TUBE CALIBRATION

$\frac{STD}{S}$ =	$\frac{.07}{.10}$	= $\sqrt{.7000}$	=	.836
	$\frac{.17}{.25}$	= $\sqrt{.6800}$	=	.824
	$\frac{.97}{.68}$	= $\sqrt{.6911}$	=	.831
	$\frac{.70}{.99}$	= $\sqrt{.7070}$	=	.840

Standard Pitot
Factor = 1.00

Calibrated By

D Lewis

Date

5/11/73

Pitot Tube # 16

STANFORD CONN

Date 5/9/73 710556 Box No. S-1564 Meter No.

Pump OK

Pump oil OK

Clean quick connects OK Valves OK

Manometers OK

Dry test meter OK

Thermometers OK

Lights OK Buzzer

Electrical check - Amphenol OK. ~~110 V receptl~~

Variac OK

Vacuum gauge OK

Leak check at 27" Hg. - Leakage = OK - No LEAK

Remarks Box RECAL WITHIN 90 DAYS

Initial each item when checked and write in any remarks.

Calibration - Orifice and Meter

Date 5/8/73 Box No. S-1564 Meter No. P_b 29.86

Man Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d avg.	Time t
0.5	5	5	73	78	76	77	8.18
1.0	5	5.01	73	82	78	80	13.33
2.0	10	10.11	73	87	80	83.5	9.50
4.0	10	10.03	73	97	84	90.5	
6.0	10						
8.0	10						

Calculate Y & $H_@$ at man. 2.0

$$Y = \frac{CF_w\, P_b\, (T_d \text{ ave.} + 460)}{CF_d\, (P_b + 0.147)\, (T_w + 460)}$$

$$Y = \frac{\quad}{\left(\quad + 0.147\right)\left(\quad + 460\right)} =$$

$$\Delta H_@ = \frac{0.0634}{P_b (OT_d + 460)} \left(\frac{(T_w + 460)}{CF_w}\right)^2$$

$$\Delta H_@ = \frac{0.0634}{\left(\quad + 460\right)} \left(\frac{\quad + 460}{\quad}\right)^2$$

Tolerances

$Y = 0.99 - 1.02 - 1.01$

$\Delta H_@ = 1.6 - 1.84 - 2.1$

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

STATE OFFICE BUILDING HARTFORD, CONNECTICUT 06115

DAN W. LUFKIN
COMMISSIONER

May 17, 1973

Mr. Bob Epstein
York Research Corp.
One Research Drive
Stamford, Connecticut 06906

Dear Mr. Epstein:

You are hereby notified that "Intent to Test" for number 730024 which describes a test plan for sampling emissions from the Enfield sewage sludge incinerator, is acceptable and meets the test criteria required by the State of Connecticut, Department of Environmental Protection.

The field tests will be observed by Carl Dodge unless you are otherwise notified. He should be informed of progress and problems that may alter the test program.

Very truly yours,

Carl Dodge
Senior Air Pollution Engineer

CD/lp

cc Henry Mosher
Envirotech Systems Inc.
BSP Division
P.O. Box 8158
San Francisco, Calif. 94128

Enfield, Conn. 5726
March 26, 1973

DESCRIPTION OF OPERATIONS

The incinerator is a multiple-hearth furnace which is 22 ft. 3 in. in diameter and has 6 hearths. The temperatures in the furnace are regulated by North American burners (manufacturer of burners) located on hearths 1, 2, 4, & 5. The total burner system has a maximum capacity of 16,000,000 Btu/hr and consumers 114 (gph) of #2 fuel oil. The furnace is designed to burn 12,600 lb/hr of a mixture of primary and secondary sludge and skum. The composition of the sludge, skum, and fuel are:

Sludge & Skum

75	%	Moisture
70.4	%	Volatile Solids (Dry Basis)
55.8	%	Carbon (Volatile Basis)
8.2	%	Hydrogen (Volatile Basis)
31.0	%	Oxygen (Volatile Basis)
5.0	%	Nitrogen (Volatile Basis)
0.0	%	Sulfur (Volatile Basis)
11,000		Btu/Lb Heating Value (Volatile Basis)

Enfield, Conn. 5726
March 26, 1973
Description of Operations (continued)

Fuel

#2 Fuel Oil

86.1	%	Carbon
13.2	%	Hydrogen
0.0	%	Oxygen
0.1	%	Nitrogen
0.6	%	Sulfur
0.0	%	CO_2
0.0	%	ASH
141,000		Btu/Lb Heating Value (Btu/Gal)

The combustion air for the sludge and/or other components of the waste will be supplied by separate fan such that 50% excess air on the volatiles is maintained.

As the sludge is burned, a relatively large amount of gases are produced. What remains after combustion is a sterile ash which is transported to another location by some suitable means. Along with the combustion gases produced by the sludge and auxiliary fuel (if any) is particulate matter. This particulate matter is passed through a scrubbing system which removes the dust particles. The resulting effluent gas stream then conforms to the local air pollution regulations.

Enfield, Conn. 5726
March 26, 1973
Description of Operations (continued)

The scrubber shall be an impingement type using 350 gpm total water for adequate scrubbing of gases. The scrubber will have an outlet volume of 13,690 ACFM (maximum) @ 166°F with a differential pressure of 6" W.C. at the designed scrubber outlet volume with an inlet dust loading of approximately 9 # particulates/1000 # dry gases. The emission rate shall not exceed 0.2 #/hr of particulates per 1000# of dry gases corrected to 50% excess air.

The induced draft fan shall be rated at 7.5 Δ P static pressure and 13,690 ACFM @ 166°F and 0 ft. above sea level at operating conditions.

ENFIELD W.P.C.P.
INC. OPERATION

STANDBY _____ BURNING ✓

DAY TUESDAY

DATE 5-29 1973

SLUDGE				TEMPERATURES °F								BURNERS ON				CONTROL SETTINGS									WATER COOL			MISCELLANEOUS		
TIME	METER	#/HR	30#	H-1	H-2	H-3	H-4	H-5	H-6	SCRUB INLET	ID FAN	SHAFT AIR	H-1	H-2	H-4	H-5	DRAFT	AIR PORTS	SHAFT AIR %	% O_2	SHAFT SPEED	SLUDGE COMB AIR	SCRUB DIFF.	SCRUB PRESSURE	ID SETTING	PRE-COOLER		SCRUB SPRAY	Filter #1	Filter #2	FUEL GPH
0:10	0			810 220	980	1140	1420	1360	520	60	70	260	✓		✓	✓	0.15	—	—	—	35	—	—	—	—	70	276	20	OFF	16%	39.0
1:10	5240	2620		830	1100	1170	1440	1370	530	140	70	270	✓		✓	✓	0.09	—	—	11%	35	—	3.4	4.0	7.5	"	"	"	OFF	16%	37.2
2:10	12375	3568		820	1080	1220	1450	1400	550	140	70	280	✓		✓	✓	0.09	2on4	—	8.7	35	—	3.6	4.1	7.5	"	"	"	6%	16%	41.0
3:10	27170	9021		810	960	1180	1450	1340	560	160	80	260	✓		✓	✓	0.075	"	20%	8.7	35	—	3.8	4.2	8.0	"	"	"	6%	16%	41.0
4:10	44160	11090		910	1150	1250	1430	1310	620	220	110	300	✓	✓	✓	✓	0.1	"	60%	7.3	35	—	6.2	7.2	10.5	"	"	"	6%	16%	56.0
5:10	58950	7485		910	1230	1350	1390	1130	530	240	100	310	✓	✓	✓	✓	0.1	"	50%	9.0	40	—	5.0	6.0	9.5	"	"	"	11%	14%	42.0
6:10	75240	8155		900	1180	1290	1390	1120	620	260	100	310	✓	✓	✓	✓	0.1	"	55%	8.0	40	—	5.2	6.4	10.0	"	"	"	14%	14%	42.0
7:10	92000	8376		900	1180	1290	1400	1120	610	260	100	310	✓	✓	✓	✓	0.1	"	55%	8.0	40	—	5.2	6.4	9.9	"	"	"	16%	14%	45.0
8:10	109750	8875		860	1070	1160	1420	1180	610	260	100	300	✓	✓	✓	✓	0.08	"	55%	8.0	35	—	5.0	6.0	9.5	"	"	"	16%	14%	44.0
9:10	128160	9205		810	980	1070	1320	1280	600	250	100	290	✓	✓	✓	✓	0.1	"	50%	7.5	30	—	4.8	5.6	9.5	"	"	"	17%	14%	33.0
0:10	147350	9595		800	950	1020	1400	1220	600	240	100	290	✓	✓	✓	✓	0.08	"	43%	7.5	50	—	4.4	5.4	9.3	"	"	"	17%	14%	
0:45	159877	6263																													
AVERAGE		7556		5:10	10:10	12:00	4:10	2:40	5:50	205	90	290					0.10		50	11.6	37		4.7	5.5	9.1				12%	15%	42

TOTAL RUNNING TIME 10:10 THRU 20:45 = 10hr 35 min

POUNDS TO INC. 159877 ÷ 2 = 79,938

FUEL	METER	GALLONS
	126535	63381 3500
	125242	67892 2900
	1293	489 600

REMARKS: PERFORMANCE TEST! ① FILTER #2 CAKE ON AT 10:10, 3% POLYMER AT 11:00

② START 2ND FILTER AT 12:05 CAKE ON AT 12:15

③ ASH SAMPLE TAKEN AT 16:20 THEREFORE EMITTING DUST PARTICLES TO STACK,

④ TOTAL 95 lbs. POLYMER USED.

ENFIELD W.P.C.P.
INC. OPERATION

STANDBY _____ BURNING _____

DAY Friday

DATE 6/1 1973

SLUDGE				TEMPERATURES °F								BURNERS ON				CONTROL SETTINGS									WATER GPM			MISCELLANEOUS				
TIME	METER	#/HR	%M	H-1	H-2	H-3	H-4	H-5	H-6	SCRUB INLET	ID FAN	SHAFT AIR	H-1	H-2	H-4	H-5	DRAFT	AIR PORTS	SHAFT AIR %	% O_2	SHAFT SPEED	SLUDGE COMB AIR	SCR'B DIFF. in W.C.	SCRUB PRESSURE in W.C.	ID SETTING PSIG	PRE-COOLER	[illegible]	SCRUB SPRAY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0805	0			900	1140	1220	1480	1380	620	120	90	770	✓	✓	✓	✓	-	-	-	-	36	-				70	2%	20			136612	71029	
1005	7535	3768		830	1140	1250	1600	1400	650	110	70	710	✓	✓	✓	✓	0.08	None	None	9.8	36	-	3.6	4.0	8	110	2%	20	15%	0 SF	130727	71290	54
1105	13550	6028		830	1110	1370	1660	1382	580	170	90	810	✓	✓	✓	✓	0.08	3 ON 6	None	7.5	36	-	4.2	4.9	9	70	2%	20	15%	12%	132812	71366	44
1205	44200	11823		920	1100	1200	1420	1260	510	260	90	820	✓	✓	✓	✓	0.13	5 ON 6	30	7.5	36	-	5.8	6.8	10	70	2%	20	16%	14%	130959	71416	67
1305	65110	10955		990	1120	1180	1420	1350	520	180	110	830	✓	✓	✓	✓	0.10	6 ON 6	55	7.0	36		7.6	9.2	11.8	75	2%	20	8%	14%	131081	71462	85
1405	83225	9453		910	1100	1180	1420	1210	490	260	100	830	✓	✓	✓	✓	0.08	8 ON 6	35	6.3	36		5.7	6.6	10.0	75	2%	20	10%	14%	131218	71531	51
1505	98220	7998		870	1110	1110	1430	1250	450	260	100	820	✓	✓	✓	✓	0.10	11	35	6.3	36		5.6	6.6	10	75	2%	20	10%	14%	131337	71613	49
1605	109100	5540		860	1210	1440	1440	1220	420	210	80	820	✓	✓	✓	✓	0.10	11	10	8.0	36		4.2	4.7	7	75	2%	20	10%	14%	131461	71691	40
1705	121000	5950		890	1100	1320	1400	1220	400	190	80	800	✓	✓	✓	✓	0.08	11	0	8.4	36		4.2	4.7	9	76	2%	20	10%	14%	131579	71783	32
AVERAGE		7563		880	1120	1250	1450	1280	515	200	90	820					0.09		20	7.6	36		5.1	5.9	9.6	73	2%	20	12	14%			52

TOTAL RUNNING TIME _____

POUNDS TO INC. _____

FUEL SUPPLY	RETURN	SUPPLY TANK METER
SYSTEM		9675
START	71143	

REMARKS: Cake Feed started at 0905; Second filter on 1105

Burning looks good - stack appears to be Ringlemann 1 or less and little particulates. Some sludge balls but very small

1530 - running low on sludge - torque meter now at 1/8

Test Over - 1705

59796
59965

PARTICULATE CALCULATIONS

The following are the basic equations used in calculating final data as found in the final summary.

1. Volume of dry gas sampled at standard conditions - 70°F, 29.92" Hg, ft.^{3}

$$V_{m_{std}} = \frac{17.7 \times V_m \left(P_b + \frac{P_m}{13.6}\right)}{(T_m + 460)} = \text{Ft.}^3$$

2. Volume of water vapor at 70°F and 29.92" Hg, Ft.^{3}

$$V_{w_{gas}} = 0.0474 \times V_w = \text{Ft.}^3$$

3. % Moisture in stack gas

$$\%M = \frac{100 \times V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} = \%$$

4. Mole fraction of dry gas

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

5. Average molecular weight of dry stack gas

$$M\,W_d = \left(\%\,CO_2 \times \frac{44}{100}\right) + \left(\%O_2 \times \frac{32}{100}\right) + \left(\%N_2 \times \frac{28}{100}\right)$$

6. Molecular weight of stack gas

$$M\,W = M\,W_d \times M_d + 18\,(1 - M_d)$$

7. Stack velocity at stack conditions, fpm

$$V_s = 4350 \times \sqrt{\Delta P_s \times (T_s + 460)} \left(\frac{1}{P_s \times M\,W}\right)^{1/2} = \text{fpm}$$

8. Stack gas volume at standard conditions, SCFM

$$Q_s = \frac{0.123 \times V_s \times A_s \times M_d \times P_s}{(T_s + 460)} = \text{SCFM}$$

9. Percent isokinetic

$$\%I = \frac{1032 \times (T_s + 460) \times V_{m_{std}}}{V_s \times T_t \times P_s \times M_d \times (D_n)^2} = \%$$

10. Particulate - probe, cyclone and filter, gr/SCF

$$C_{an} = 0.0154 \times \frac{M_f}{V_{m\ std}} = \text{gr/SCF}$$

11. Particulate total, gr/SCF

$$C_{ao} = \frac{0.0154 \times M_t}{V_{m\ std}} = \text{gr/SCF}$$

12. Particulate - probe, cyclone and filter, gr/CF at stack conditions

$$C_{at} = \frac{17.7 \times C_{an} \times P_s \times M_d}{(T_s + 460)} = \text{gr/CF}$$

13. Particulate - total, gr/CF at stack conditions

$$C_{au} = \frac{17.7 \times C_{ao} \times P_s \times M_d}{(T_s + 460)} = \text{gr/CF}$$

14. Particulate - probe, cyclone and filter, lb/hr.

$C_{aw} = 0.00857 \times C_{an} \times Q_s$ = lb/hr.

15. Particulate - total, lb/hr.

$C_{ax} = 0.00857 \times C_{ao} \times Q_s$ = lb/hr.

16. % Excess air at sampling point

$$\% \text{ EA} = \frac{100 \times \% O_2}{0.264 \times \% N_2 - \% O_2} = \%$$

17. $$\frac{\text{Lb.(Part.)}}{10^3 \text{ lb. Flue Gas @ 50\% Ex. Air}} = \frac{\text{gr.(Part.)}}{\text{SCF @ 50\% Ex. Air}} \times \frac{\text{Lb.(Part.)}}{7000 \text{ gr}} \times \frac{10^3 \text{ lb-MOL}}{\text{MW-}10^3 \text{ Lb Flue Gas}} \times \frac{387 \text{ SCF}}{\text{Lb.-MOL}}$$

REPORT NO. PAGE OF PAGES

SOURCE TESTING CALCULATION FORMS

Test No. 8155 No. Runs 3

Name of Firm ENVIROTECH

Location of Plant ENFIELD, CONN.

Type of Plant SEWAGE TREATMENT

Control Equipment WET SCRUBBER

Sampling Point Locations OUTLET OF SCRUBBER

Pollutants Sampled PARTICULATE PER EPA #5

Time of Particulate Test:

Run No. 1 Date 5-29-73 Begin 1529 End 1734

Run No. 2 Date 5-29-73 Begin 1803 End 2007

Run No. 3 Date 6-1-73 Begin 1324 End 1526

PARTICULATE EMISSION DATA

Run No.	1	2	3	
P_b barometric pressure, "Hg Absolute	29.72	29.72	29.91	
P_m orifice pressure drop, "H_2O	1.04	.901	.824	
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	68.265	62.924	60.886	
T_m Average Gas Meter Temperature, °F	97.6	93.5	90.7	
V_m Volume of Dry Gas Sampled @ Standard std. conditions, ft.^{3}	64.567	59.936	58.653	
V_w Total H_2O collected, ml., Impingers & Silica Gel.	108.9	108.2	77.1	
V_w gas Volume of Water Vapor Collected ft.^{3} @ Standard Conditions*	5.16	5.13	3.68	

* 70°F, 29.92" Hg.

REPORT NO. 8155

PARTICULATE EMISSION DATA (cont'd)

Run No.	1	2	3	
%M - % Moisture in the stack gas by volume	7.4	8.0	5.9	
M_d - Mole fraction of dry gas	.926	.920	.941	
% CO_2	10.0	10.0	9.17	
% O_2	7.95	7.95	8.87	
% N_2	82.05	82.05	81.96	
M W $_d$ - Molecular weight of dry stack gas	29.92	29.92	29.82	
M W - Molecular weight of stack gas	29.04	28.97	29.12	
Δ Ps - Velocity Head of stack gas, In. H_2O	—	—	—	
T_s - Stack Temperature, °F	119	115	115	
$\sqrt{\Delta P_s X (T_s+460)}$	8.09	7.52	7.30	
P_s - Stack Pressure, "Hg. Absolute	29.74	29.74	29.89	
V_s - Stack Velocity @ stack conditions, fpm	1160	1080	1050	
A_s - Stack Area, $in.^2$	660	660	660	
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	4480	4170	4170	
T_t - Net Time of Test, min.	120	120	120	
D_n - Sampling Nozzle Diameter, in.	.313	.313	.313	
%I - Percent isokinetic	103.3	102.3	100.2	
m_f - Particulate - probe, cyclone and filter, mg.	69.2	27.6	30.0	
m_t - Particulate - total, mg.	—	—	—	
C_{an} - Particulate - probe, cyclone, and filter, gr/SCF	.0165	.0071	.0079	
C_{ao} - Particulate - total, gr/SCF	—	—	—	
C_{a+} - Particulate - probe, cyclone, and	.0139	.0058	.0068	

REPORT NO. 8155 Page of Pages

PARTICULATE EMISSION DATA (cont'd)

Run No.	1	2	3	
C_{au} - Particulate, total, gr/cf @ stack cond.	—	—	—	
C_{aw} - Particulate, probe, cyclone, and filter, lb/hr.	.6334	.2537	.2823	
C_{ax} - Particulate - total, lb/hr.	—	—	—	
%EA - % Excess air @ sampling point	58.0	58.0	69.5	

* 70°F. 29.92" Hg.

gr/SCF @ 12% CO_2	.0140	.0085	.0103
lbs/1000 lbs FLUE GAS @ 50% EXCESS AIR	.033	.014	.017

QUALITY CONTROLLED YORK RESEARCH

JOB NO. 8155
Plant ENFIELD
Run No. 1
Location SCRUBBER OUTLET
Date 5.29.73
Operator LAT/RBE
Sample Box No. 7-102
Meter Box No. S-1564
Meter Δ H 1.97
Factor 1.05

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER# FL-238
PITOT K = .824

Ambient Temp °F 80
Bar.Press. "Hg 29.72
Assumed Moisture % 12
Heater Box Setting, °F 300
Probe Tip Dia., In. 5/16 (.3126)
Probe Length 3FT
Probe Heater Setting 300
Avg. ΔP — Avg. ΔH —

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice Δ H in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
E 1	1529	186.462	.12	1.10	1.10	93	93	3	300	65	—	120
1	1534	189.44	.12	1.10	1.10	92	93	3	300	65	—	120
2	1539	192.42	.12	1.10	1.10	101	94	3.5	300	65	—	120
2	1544	195.35	.12	1.10	1.10	101	94	3.5	300	65	—	120
3	1549	198.27	.12	1.10	1.00	102	95	3.5	300	65	—	120
3	1554	201.22	.12	1.10	1.00	102	95	3.5	300	65	—	120
4	1559	204.16	.11	1.00	1.00	102	95	3.5	300	65	—	120
4	1604	206.88	.11	1.00	1.00	102	95	3.5	200	65	—	120
5	1609	209.61	.11	1.00	1.00	101	95	3.5	200	70	—	120
5	1614	212.39	.11	1.00	1.00	101	95	3.5	200	70	—	120
6	1619	215.16	.11	1.00	1.00	101	95	3.5	300	70	—	120
6	1624	217.91	.11	1.00	1.00	101	95	3.5	300	70	—	120
END	1629	220.673	—	—	—	—	—	—	—	—	—	—
51	1634	220.673	.13	1.20	1.20	101	95	3.5	300	70	—	120

JOB NO. 8155 TEST #1 5.29.73

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
				Desired	Actual	Inlet	Outlet					
S2	1644	227.73	.12	1.10	1.10	101	95	3.5	300	70	—	120
2	1649	230.30	.12	1.10	1.10	101	95	3.5	300	70	—	120
3	1654	232.86	.10	.92	.92	101	95	3.5	300	70	—	118
3	1659	235.58	.10	.92	.92	101	95	3.5	300	70	—	118
4	1704	238.30	.11	1.00	1.00	101	95	3.0	300	70	—	118
4	1709	241.06	.11	1.00	1.00	101	95	3.0	300	70	—	118
5	1714	243.81	.11	1.00	1.00	101	95	3.0	300	70	—	117
5	1719	246.66	.11	1.00	1.00	101	95	3.0	300	70	—	118
6	1724	249.50	.10	.92	.92	101	95	3.0	300	70	—	115
6	1729	252.11	.10	.92	.92	101	95	3.0	300	70	—	115
END	1734	254.727	—	—	—	—	—	—	—	—	—	—

JOB NO. 8165

Plant ENFIELD

Run No. 2

Location SCRUBBER OUTLET

Date 5-29-73

Operator LAT / R&E

Sample Box No. 7-102

Meter Box No. S-1564

Meter ΔH 1.97

Y Factor 1.05

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER # FL-223

PITOT K = .824

Ambient Temp °F 80

Bar. Press. "Hg 29.72

Assumed Moisture % 8

Heater Box Setting, °F 300

Probe Tip Dia., In. 5/16 (.3125)

Probe Length 3FT

Probe Heater Setting 300

Avg. ΔP — Avg. ΔH —

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
S1	1803	255.602	.11	.98	.98	91	89	3	300	65	—	120
1	1808	258.35	.11	.98	.98	91	89	3	300	65	—	120
2	1813	261.09	.10	.92	.92	94	88	3	300	65	—	120
2	1818	263.81	.10	.92	.92	94	88	3	300	65	—	120
3	1823	266.53	.10	.92	.92	96	91	3	300	65	—	120
3	1828	269.19	.10	.92	.92	96	91	3	300	65	—	120
4	1833	271.84	.10	.92	.92	97	90	2.5	300	70	—	120
4	1838	274.23	.10	.92	.92	97	90	2.5	300	70	—	120
5	1843	276.61	.10	.92	.92	99	90	3	300	70	—	120
5	1848	276.36	.10	.92	.92	99	90	3	300	70	—	120
6	1853	282.11	.10	.92	.92	99	90	3	300	70	—	120
6	1858	284.86	.10	.92	.92	99	90	3	300	70	—	120
END	1903	287.614	—	—	—	—	—	—	—	—	—	—
E 1	1907	287.614	.09	.82	.82	97	90	2.5	300	70	—	102
			.09	.82	.82	97	90	2.5	300	70	—	102

JOB NO. 8155 TEST #2 5-29-73

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
				Desired	Actual	Inlet	Outlet					
E 2	1917	292.40	.10	.92	.92	99	99	2.5	300	70	—	110
2	1922	295.19	.10	.92	.92	99	99	2.5	300	70	—	110
3	1927	297.98	.10	.92	.92	99	99	2.5	300	70	—	110
3	1932	300.69	.10	.92	.92	99	99	2.5	300	70	—	110
4	1937	303.40	.10	.92	.92	99	99	2.5	300	70	—	110
4	1942	306.00	.10	.92	.92	99	99	2.5	300	70	—	110
5	1947	308.60	.10	.92	.92	99	99	3.0	300	70	—	110
5	1952	311.26	.10	.92	.92	99	99	3.0	300	70	—	110
6	1957	313.89	.08	.73	.73	99	99	3.0	300	70	—	110
6	2002	316.21	.08	.73	.73	99	99	3.0	300	70	—	110
END	2007	318.526	—	—	—	—	—	—	—	—	—	—

JOB NO. 8155

Plant ENFIELD, CONN.

Run No. 3

Location SCRUBBER OUTLET

Date 6-1-73

Operator LAT/RSE

Sample Box No. 7-102

Meter Box No. S-1564

Meter ΔH 1.97

Factor 1.08

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point.

PATHOLOGICAL INCINERATORS- read and record every 5 minutes.

FILTER# FL-266
PITOT K= .824

Ambient Temp °F 80

Bar.Press. "Hg 29.91

Assumed Moisture % 8

Heater Box Setting, °F 300

Probe Tip Dia., In. 5/16 (.3125)

Probe Length 3 FT

Probe Heater Setting 300

Avg. ΔP — Avg. ΔH —

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
S1	1324	323.212	.10	.89	.89	82	82	2	300	60	—	105
1	1329	325.81	.10	.89	.89	82	82	2	300	60	—	105
2	1334	328.40	.08	.73	.73	87	84	2	300	60	—	105
2	1339	330.74	.08	.73	.73	87	84	2	300	60	—	105
3	1344	333.08	.08	.73	.73	92	87	2.5	300	60	—	115
3	1349	335.42	.08	.73	.73	92	87	2.5	300	60	—	115
4	1354	337.76	.08	.73	.73	91	81	3	300	64	—	120
4	1359	340.13	.08	.73	.73	91	89	3	300	64	—	120
5	1404	342.50	.10	.89	.89	92	90	3	300	66	—	120
5	1409	345.02	.10	.89	.89	92	90	3	300	66	—	120
6	1414	347.54	.08	.73	.73	92	90	3	300	68	—	120
6	1419	349.91	.08	.73	.73	92	90	3	300	68	—	120
END	1424	352.274	—	—	—	—	—	—	—	—	—	—
E 1	1426	352.274	.09	.82	.82	90	90	3	300	70	—	110
	1431	354.93	.09	.82	.82	90	90	3	300	70	—	110

JOB NO. 8155 TEST #3 6-1-73

Point	Clock Time	Dry Gas Meter, CF	Pitot in.H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in.Hg	Stack Temp. °F
				Desired	Actual	Inlet	Outlet					
E 2	1436	357.39	.08	.73	.73	96	92	3	300	70	—	120
2	1441	359.78	.08	.72	.73	96	92	3	300	70	—	120
3	1446	362.17	.08	.73	.73	96	93	3	300	70	—	120
3	1451	364.55	.08	.73	.73	96	93	3	300	70	—	120
4	1456	366.98	.10	.89	.87	96	93	3	300	70	—	120
4	1501	369.65	.10	.89	.87	96	93	3	300	70	—	120
5	1506	372.31	.11	.98	.98	94	92	3	300	70	—	120
5	1511	375.17	.11	.98	.98	94	92	3	300	70	—	120
6	1516	378.02	.14	1.25	1.25	94	93	4	300	70	—	110
6	1521	381.06	.14	1.25	1.25	94	92	4	300	70	—	110
END	1526	384.098	—	—	—	—	—	—	—	—	—	—