68

730083

#136

2/17/86

INCINERATOR COMPLIANCE TEST
AT
THE CITY OF STRATFORD
SEWAGE TREATMENT PLANT
IN
STRATFORD, CONNECTICUT
FOR

EIMCO - BSP DIVISION
ENVIROTECH CORPORATION
ONE DAVIS DRIVE
BELMONT, CALIFORNIA 94002

SEPTEMBER 15, 1974

PREPARED BY: L. A. Terracciano

LOUIS A. TERRACCIANO
PROJECT MANAGER

TABLE OF CONTENTS

I. ABSTRACT

An emission test program was conducted at the Stratford Wastewater Treatment Plant in Stratford, Connecticut from July 29 thru 31 inclusive. The purpose of the program was to determine compliance, with the applicable State of Connecticut air pollution codes, of the particulate and gaseous emissions discharged from the scrubber/afterburner system which services the incinerator. The scrubber/afterburner system was designed and installed by Envirotech Systems, Brisbane, California.

Sampling was conducted for particulate, NO_x, CO and total hydrocarbons in accordance with Connecticut requirements.

Test results indicate the following emissions based upon the average of three test runs for each compound.

Compound	Average Emission
Particulate	0.0558 0.0568 gr/scfd @ 12% CO_2
NO_x	208 ppm
CO	<100 ppm
Total Hydrocarbons	28.2 ppm as propane

A complete listing of the more salient test results has been tabularized in the following section. All raw data and calculation work sheets have been included in the Appendix Section of this report.

II. SUMMARY OF RESULTS

TABLE I

RUN NO.	1	2	3
DATE	7/30/74	7/31/74	7/31/74
STACK GAS DATA			
VELOCITY (FT/MIN)	4149	4070	4039
TEMPERATURE (°F)	495	504	516
PRESSURE ("HG,ABS.)	29.93	30.02	30.02
FLOWRATE (ACFM)	13,020	12,780	12,680
FLOWRATE (SCFMD)	6,688	6,515	6,396
% ISOKINETIC	95.4	98.5	95.8
GASEOUS EMISSION DATA			
CO_2 (%)	7.45	7.50	7.50
O_2 (%)	10.10	9.70	9.70
N_2 (%)	82.45	82.50	82.50
H_2O (%)	7.48	7.54	7.39
EXCESS AIR (%)	86.6	80.3	80.3
NOx (PPM)	203	214	208
CO (PPM)	< 100	< 100	< 100
TOTAL H/C (PPM AS PROPANE)	33.1	26.5	25.1
PARTICULATE EMISSION DATA			
GR/ACF	0.0172	0.0211	0.0165
GR/SCFD	0.0333	0.0415	0.0325
LBS/HR	1.92	2.31	1.77
GR/SCFD @ 12% CO_2	0.0537	0.0637	0.0500

III. DESCRIPTION OF OPERATIONS

The incinerator is a multiple-hearth furnace which is 16 ft. 9 in. in diameter and has 8 hearths. The temperature in the furnace is regulated by North American burners (burner manufacturer) which are located on hearths 2,3,5,6, and 7. The total burner system has a maximum capacity of 12,460,000 BTU/hr and consumes either 9134 CFH of natural gas or 60 GPM of No. 2 fuel oil. The furnace is designed to burn 7500 lb/hr of a mixture of primary and secondary sludge and on an intermittent basis 500 lb/hr of scum-grease.

SLUDGE & SCUM

80 % Moisture
60-70 % Volatile Solids (Dry Basis)
55.8 % Carbon (Volatile Basis)
8.2 % Hydrogen (Volatile Basis)
31.0 % Oxygen (Volatile Basis)
5.0 % Nitrogen (Volatile Basis)
11,000 % BTU/lb Heating Value (Volatile Basis) Sludge
17,000 % BTU/lb Heating Value (Volatile Basis) Scum

FUEL

NATURAL GAS	NO. 2 FUEL OIL
76.1 % Carbon	86.1 % Carbon
23.0 % Hydrogen	13.2 % Hydrogen
0.0 % Oxygen	0.0 % Oxygen
0.9 % Nitrogen	0.1 % Nitrogen
0.0 % Sulphur	0.6 % Sulphur
0.0 % CO_2	0.0 % CO_2
0.0 % Ash	0.0 % Ash
22,800 BTU/lb Heating Value	140,000 BTU/gal Heating Value

The combustion air for the sludge and/or other components of the waste introduced into the system through manually operated air ports is located at various hearth levels so that 50% excess air on the volatiles is maintained.

As the sludge is burned, a relatively large amount of gases is produced. What remains after combustion is a sterile ash which is transported to another location by suitable means. Along with the gases produced from the combustion of 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.

The scrubber is an impingement type using a total of 375 gpm of water for scrubbing the gases. The scrubber has an outlet volume

of 6,436 Acfm (max.) @ 115°F with a differential pressure of 9" wc at design conditions. The inlet dust loading (design) is 6161bs/10001bs flue gas (dry).

The induced draft fan is rated at 24" static pressure @ 7090 ACFM @ 115°F and 0 ft. above sea level at operating conditions.

The flue gas exiting the scrubber is conveyed through a heat exchanger/afterburner system which raises the discharge temperature from 115°F to 500°F. The afterburner system is rated for a maximum capacity of 1350 CFH of natural gas.

All the required operational data has been included in the following tables.

IV. PROCESS DATA

JOB NAME: Stratford, Conn.
JOB NO: 5745
DATE: 7/29/74

PERFORMANCE TEST DATA

TIME	WEIGHT SCALE READING	POUNDS	TEMPERATURES — RECORDER POINTS															Shaft Air Return, %	Shaft Speed RPM	Percent O2
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
1:00	725280	-	820	1050	1050	1460	1440	1390	980	320	90	440	490	100	100	400	120	100	60	1.80	12.3
2:00	733150	7870	840	1060	1210	1490	1640	1380	1000	340	140	430	580	110	120	430	140	120	69	2.1	7.0
3:00	741450	8300	870	1100	1200	1560	1680	1380	940	340	150	450	590	100	110	440	140	100	70	2.1	9.0
4:00	749780	8330	890	1130	1260	1620	1740	1380	910	320	130	460	600	100	110	450	160	100	60	2.1	8.7
5:00	757000	7220	900	1160	1210	1260	1860	1320	900	320	160	470	620	100	110	470	140	100	66	2.1	8.0
6:00	766150	9150	900	1030	1120	1520	1640	1300	850	310	120	480	570	100	100	430	130	100	65	2.1	10.0
7:00	775300	9150	830	1020	1130	1460	1590	1450	1000	340	180	440	580	100	110	440	140	100	60	2.1	7.3
8:00	783880	8580	850	1020	1150	1670	1680	1440	960	320	130	460	570	100	110	440	140	100	75	2.1	9.0
9:00	791500	7620	840	1100	1130	1600	1710	1440	950	310	120	460	560	100	110	440	140	100	65	2.1	8.3
10:00	799750	8250	840	1000	1120	1680	700	1430	960	310	120	460	560	100	120	440	130	100	65	2.1	7.5

RECORDER POINTS:

1 - Hearth 1
2 - Hearth 2
3 - Hearth 3
4 - Hearth 4
5 - Hearth 5
6 - Hearth 6
7 - Hearth 7
8 - Hearth 8
9 - Ash Discharge
10 - Shaft Cooling Air
11 - Scrubber Inlet
12 - I.D. Fan Inlet
13 - Recuperator Inlet
14 - Afterburner Inlet
15 - Scrubber Drain
16 - Afterburner Outlet

JOB NAME: Stratford, Conn.
JOB NO: 5745
DATE: 7/29/74

PERFORMANCE TEST DATA (Continued)

ME	DRAFT							ID Fan Valve Pos. PSIG	Total Scrubber Water GPM	BURNERS					FUEL METER READING	Fuel Consumption Ft^3	REMARKS
	1	2	3	4	5	6	7			2	3	5	6	7			
:00	1.4	9.5	3.8	0.1	0.15	0.4		7.0	140	0	2	2	2	1	9901580		2 slide doors open
:00	1.6	9.5	3.6	0	0.12	0.37		7.0	140	0	2	2	2	1	9906250	4670	~~HTIB Bur on 3,5,6,7~~ Polymer tank - 10 gal/in
:00	1.7	9.7	4.1	0	0.12	0.32		7.0	130	0	2	2	2	1	9910660	4410	2 doors htb. 5
:00	1.7	10.0	4.5	0	0.12	0.30		7.0	130	0	2	2	2	1	9915050	4390	~~moisture- 80%~~ lost feed 1430
:00	2.0	10.7	5.4	0	0.12	0.30		7.0	130	0	2	2	2	1	9919210	4160	back to orig. feed 1500
:00	1.6	10.0	3.4	0	0.12	0.35		7.0	120	0	2	2	2	1	9922610	3400	
:00	1.7	9.7	3.7	0	0.13	0.37		7.0	120	0	2	2	2	1	9927090	4480	
:00	1.5	9.5	3.7	0	0.12	0.33		7.0	120	0	2	2	2	1	9930830	3740	
:00	1.5	9.6	3.5	0	0.13	0.33		7.0	120	0	2	2	2	1	9934550	3720	
:00	1.6	9.7	4.0	0	0.12	0.33		7.0	120	0	2	2	2	1	9938230	3680	

DRAFT SENSING POINTS:
1 -Scrubber inlet
2 -Scrubber outlet
3 -Recuperator inlet
4 -Return air pressure
5 -Hearth 1
6 -Hearth 4

A-18

JOB NAME: Stratford, Conn.
JOB NO: 5745
DATE: 7/30/74

PERFORMANCE TEST DATA

TIME	WEIGHT SCALE READING	POUNDS	TEMPERATURES — RECORDER POINTS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Shaft Air Return, %	Shaft Speed RPH	Percent O2
1:00	829020	-	850	1020	1150	1310	1500	1460	1030	210	100	420	590	100	120	430	140	100			
2:00	837650	8630	850	1040	1150	1320	1500	1550	1040	300	140	410	600	100	110	460	160	100	20	2.15	10.5
3:00	847000	9350	870	1030	1150	1320	1480	1540	1030	310	140	430	610	100	110	460	150	100	25	2.15	7.3
4:00	856400	9400	870	1040	1200	1380	1540	1580	1080	350	170	430	640	120	110	470	170	100	20	2.15	7.5
5:00	865700	9301	900	1060	1210	1400	1500	1560	1100	320	130	460	630	100	120	460	140	100	35	2.15	6.0
6:00	874150	8450	930	1040	1180	1350	1380	1460	1100	340	150	460	660	100	120	460	160	100	45	2.15	10.0
7:00	882450	8300	910	1040	1170	1620	1460	1460	1090	320	130	470	640	110	120	460	140	100	70	2.15	8.0
8:00	891000	8550	870	980	1100	1330	1420	1450	1040	320	100	460	610	100	110	440	140	100	40	2.15	9.5
9:00	900350	9350	880	980	1140	1390	1370	1460	1090	340	140	460	630	100	140	430	150	100	0	2.15	11.0
10:00	909450	9100	900	1110	1220	1400	1450	1500	1200	430	200	450	640	100	110	460	150	100	0	2.15	9.5
																			20	2.15	9.0

RECORDER POINTS:

1 - Hearth 1
2 - Hearth 2
3 - Hearth 3
4 - Hearth 4
5 - Hearth 5
6 - Hearth 6
7 - Hearth 7
8 - Hearth 8
9 - Ash Discharge
10 - Shaft Cooling Air
11 - Scrubber Inlet
12 - I.D. Fan Inlet
13 - Recuperator Inlet
14 - Afterburner Inlet
15 - Scrubber Drain
16 - Afterburner Outlet

JOB NAME: Stratford, Conn.
JOB NO: 5745
DATE: 7/30/74

PERFORMANCE TEST DATA (Continued)

E	DRAFT							ID Fan Valve Pos. PSIG	Total Scrubber Water (GPM)	BURNERS					FUEL METER READING	Fuel Consumption Ft^3	REMARKS
	1	2	3	4	5	6	7			2	3	5	6	7			
0	0.1	1.8	10.3	0.3	0	4.7	0.9	7	130	1	2	2	2	1	9983150		start performance test fuel (gas)
0	0.12	1.7	9.6	0.32	0	3.6	0.7	7	130	1	2	2	2	1	9989840	6690	2 slide doors open hth 5
0	0.1	1.7	10.0	0.3	0	4.1	0.8	7	130	1	2	2	2	1	9995570	5730	ash sample taken 12:30
0	0.1	1.8	10.0	0.3	0	4.2	0.8	7	130	1	2	2	2	1	0001720	6150	2 A.P. with S hth 5
0	0.1	1.9	10.5	0.3	0	5.1	1.0	7	110	1	2	2	2	1	0007130	5410	start grease 15:15
0	0.1	2.9	13.5	0.1	0	8.7	1.8	15	100	1	2	2	2	1	0013950	6820	grease sample 13:55
0	0.12	1.7	10.5	0.28	0	5.0	0.8	7	110	1	2	2	2	1	0020990	7040	1530- stack test stopped
0	0.12	1.8	10.3	0.30	0	5.0	0.9	7	100	1	2	2	2	1	0026500	5510	air comb. 5 min off 1 min on
0	0.11	2.3	11.3	0.30	0	5.4	1.0	8	120	1	2	2	2	1	0032050	5550	Grease off 17:15
0	0.11	1.9	10.6	0.30	0	5.0	0.9	7	120	1	2	2	2	1	0038360	6310	Sludge dropped off 17:30

RAFT SENSING POINTS:
1 - Hearth 1
2 - Scrubber Inlet
3 - Scrubber Outlet
4 - Hearth 4
5 - Return Air Pressure
6 - Recuperator Inlet
7 - Afterburner Inlet

JOB NAME: Stratford, Conn.
JOB NUMBER: 5745
DATE: 7/31/74

PERFORMANCE TEST DATA

ME	WEIGHT SCALE READING	POUNDS	TEMPERATURES RECORDER POINTS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Shaft Air Return, %	Shaft Speed RPM	Percent O_2
:00	930910	- -	830	1000	1110	1340	1420	1250	1040	280	100	440	550	100	110	410	120	-	65	2.15	12.7
:00	939200	8290 (2)	820	940	1000	1060	1150	1400	1220	300	170	400	570	100	120	400	130	-	67	2.15	12.3
:00	949270	- -	910	1130	1180	1550	1570	1380	1200	300	120	490	600	100	100	440	120	-	68	2.25	11.7
:00	957000	7730	880	1150	960	1310	1530	1510	1200	340	100	470	610	100	110	450	130	-	65	2.25	10.5
:07	965690	8690 (3)	930	1060	1110	1300	1520	1580	1100	400	200	460	650	100	110	480	150	-	65	2.25	7.3
:00	972450	6760	920	1080	1150	1330	1510	1600	1100	420	190	460	650	100	140	480	140	-	60	2.25	7.0
:00	979740	7290	950	1100	1200	1570	1700	1450	990	380	150	470	660	100	110	480	140	-	70	2.25	6.0
:00	985450	5710	910	1100	1160	1650	1770	1470	940	350	130	480	630	100	110	480	140	-	65	2.25	7.5
:10	992100	6650	950	1170	1170	1680	1690	1340	840	320	130	490	650	100	110	480	130	-	65	2.25	10.5
:45	994858	2758																			

RECORDER POINTS:

1 - Hearth 1
2 - Hearth 2
3 - Hearth 3
4 - Hearth 4
5 - Hearth 5
6 - Hearth 6
7 - Hearth 7
8 - Hearth 8
9 - Ash Discharge
10 - Shaft Cooling Air
11 - Scrubber Inlet
12 - I.D. Fan Inlet
13 - Recuperator Inlet
14 - Afterburner Inlet
15 - Scrubber Drain
16 - Afterburner Outlet

JOB NAME: Stratford, Conn.
JOB NO: 5745
DATE: 7/31/74

PERFORMANCE TEST DATA (Continued)

TIME	DRAFT							ID Fan Valve Pos. PSIG	Total Scrubber Water GPM	BURNERS					FUEL METER READING	Fuel Consumption (oil) Gal.	REMARKS
	1	2	3	4	5	6	7			2	3	5	6	7			
																	start-feed 9:15
:00	0.1	1.5	9.4	0.3	0	4.0	0.8	7	110	1	2	2	2	2	- - -		Re-zero scale -tare 0 Start performance test
:00	0.1	1.8	10.4	0.3	0	4.8	0.9	7	120	2	2	2	2	2	00473.0		Oil meter
															00525.5	52.50	Stop feed - wet sludge sludge burns very little
:00	0.1	1.4	9.3	0.32	0	3.9	0.8	7	115	2	2	2	2	2	000623.25		Appears to have low vol.
:00	0.1	1.7	9.5	0.35	0	3.6	0.6	7	120	2	2	2	2	2	000677.50	54.25	steady burn
:07	0.1	1.9	10.5	0.3	0	4.4	1.8	7	120	2	2	2	2	0	000744.25	66.75	cleaned scrubber water indicating flowmet
:00	0.1	1.7	10.0	0.3	0	3.9	0.7	7	140	2	2	2	2	0	000793.50	49.25	Difficulty in maintng. design feed from filter
:00	0.1	2.0	10.5	0.2	0	5.0	1.0	7	140	2	2	2	2	0	000858.25	64.75	lost more feed 19:30
:00	0.1	1.5	9.4	0.3	.	3.6	0.6	7	140	2	2	2	2	0	000896.00	37.75	
:10	0.1	1.3	8.9	0.3	0	3.0	0.5	6	140	2	2	2	2	0	000955.50	59.5	Primary tanks off 20:50 low feed
:45															000977.30	21.80	Discontinue test- out of sludge 21:45

DRAFT SENSING POINTS:
1 - Hearth 1
2 - Scrubber Inlet
3 - Scrubber Outlet
4 - Hearth 4
5 - Return Air Pressure
6 - Recuperator Inlet
7 - Afterburner Inlet

A-22

JOB NAME: Stratford, Conn.
JOB NO: 5745
DATE: 8/ 1/74

PERFORMANCE TEST DATA

TIME	WEIGHT SCALE READING	POUNDS	TEMPERATURES RECORDER POINTS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Shaft Air Return, %	Shaft Speed RPM	Percent O_2
:00	006730	-	950	1140	1200	1500	1500	1400	1080.	320	100	450	630	100	110	460	120		50	2.25	10.3
:00	011720	4990	950	1150	1210	1750	1630	1300	870	320	100	460	650	100	110	480	130		55	2.25	9.0
:00	017380	5660	940	1210	1210	1630	1500	1000	710	290	120	480	630	100	110	470	120		60	2.25	11.0
:00	022390	5010	930	1170	1140	1670	1550	920	640	270	120	480	440	100	110	460	120		55	2.25	12.5
:00	028000	5610	880	1160	1120	1550	1460	880	590	250	100	450	590	100	120	440	120		50	1.9	13.5
:00	033560	5560	880	1090	1100	1450	1420	830	650	260	110	430	580	100	110	430	120		45	1.9	13.5
:00	038660	5100	870	1090	1200	1340	1360	820	530	250	110	410	590	100	110	430	120		70	1.9	12.5
:00		4700																			
:00	048060	4700	780	1200	1060	1380	1380	780	490	250	120	400	590	100	110	430	120		55	1.9	13.0

RECORDER POINTS:

1 - Hearth 1
2 - Hearth 2
3 - Hearth 3
4 - Hearth 4
5 - Hearth 5
6 - Hearth 6
7 - Hearth 7
8 - Hearth 8
9 - Ash Discharge
10 - Shaft Cooling Air
11 - Scrubber Inlet
12 - I.D. Fan Inlet
13 - Recuperator Inlet
14 - Afterburner Inlet
15 - Scrubber Drain
16 - Afterburner Outlet

JOB NAME: Stratford, Conn.
JOB NO: 5745
DATE: 8/1/74

PERFORMANCE TEST DATA (Continued)

TIME	DRAFT							ID Fan Valve Pos. PSIG	Total Scrubber Water GPM	BURNERS					FUEL METER READING	Fuel Consumption Ft^3	REMARKS
	1	2	3	4	5	6	7			2	3	5	6	7			
):00	.08	1.3	9.0	0.3	0	3.1	0.5	6	140	2	2	2	2	1	0083730		
:00	0.11	1.4	9.0	0.34	0	3.0	0.5	7	140	2	2	2	2	0	0088730	5000	
:00	.12	1.3	9.0	.37	0	3.0	0.5	6	140	2	2	2	0	0	0093180	4450	start grease
:00	.1	1.1	8.4	.35	0	2.5	0.4	6	140	2	2	1	0	0	0096470	3290	mixed previous night grease off 13:05
:00	.1	1.3	8.7	.32	0	3.0	0.5	6	140	2	2	1	0	0	0100320	3850	
:00	.1	1.3	9.0	.35	0	3.3	0.6	7	140	2	2	1	0	0	0104290	3970	
:00	.1	1.4	9.0	.32	0	3.3	0.6	7	140	2	2	1	0	0	0108520	4230	
																4075	
:00	.1	1.2	8.9	.32	0	3.4	0.6	6	140	2	2	1	0	0	0116670	4075	Low sludge-test over

DRAFT SENSING POINTS:
1 - Hearth 1
2 - Scrubber Inlet
3 - Scrubber Outlet
4 - Hearth 4
5 - Return Air Pressure
6 - Recuperator Inlet
7 - Afterburner Inlet

A-24

V. GENERAL SAMPLING METHODS - APPARATUS AND PROCEDURE

A. APPARATUS - EPA METHOD 5

The sampling train consisted of a five foot probe, cyclone bypass, filter, four impingers, vacuum pump, gas meter and flowmeter as illustrated in Figure 1. The stainless steel, button-hook type probe tip (1) was connected to the probe by a stainless steel coupling (2). The probe (3) was a 5/8 inch O.D. medium wall Pyrex glass tube with a ground ball joint on one end. The probe was logarithmically wound from the entrance end with heating tape and a temperature sensor was attached to monitor probe temperature during sampling. The heating tape was connected to a variable transformer to maintain a gas temperature of 250°F in the probe. The glass tube was wrapped with fiber glass tape and encased in a one inch O.D. stainless steel casing for protection. One end of the probe casing has a nut welded to it for connection to the stainless steel coupling. The probe was connected to the cyclone bypass (4) by means of ball and socket joints. All glass to glass connections are made using ball and socket joints. The cyclone bypass was connected to a very coarse fritted glass filter holder (5) which holds a tared glass fiber filter. The cyclone bypass and filter holder were contained in an electrically heated enclosed box (6) which was 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. 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 I.D. 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) is of the Greenburg-Smith design modified like the first and was left dry as a carryover trap. The fourth impinger (11) is also a modified Greenburg-Smith and contained 300 grams of silica gel.

From the fourth impinger 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 four cubic feet per minute at zero inches of mercury gauge pressure and zero cubic feet per minute at twenty-six inches of mercury gauge pressure, and connected in parallel with a bypass valve (18); and a dry gas meter rated at one cubic foot per revolution (19) which compensates the gas volume for temperature to 70°F. A calibrated orifice (20) completes the train and was used to measure instantaneous flow rate. Temperature sensors are used to measure stack, probe, heater box, first impinger inlet, fourth impinger outlet and gas meter temperatures. Velocity pressure and orifice pressure drop were measured by Magnihelic gauges (21) which are represented as an inclined manometer in the illustration.

PARTICULATE SAMPLING TRAIN

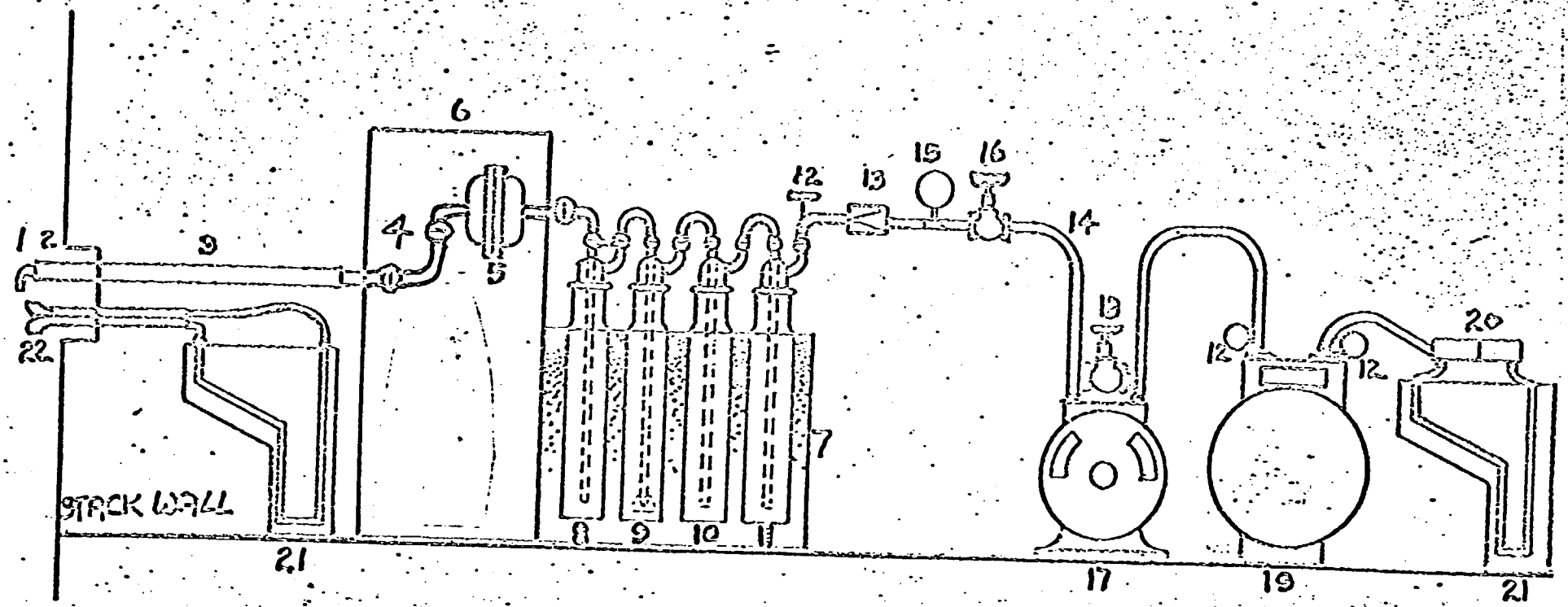


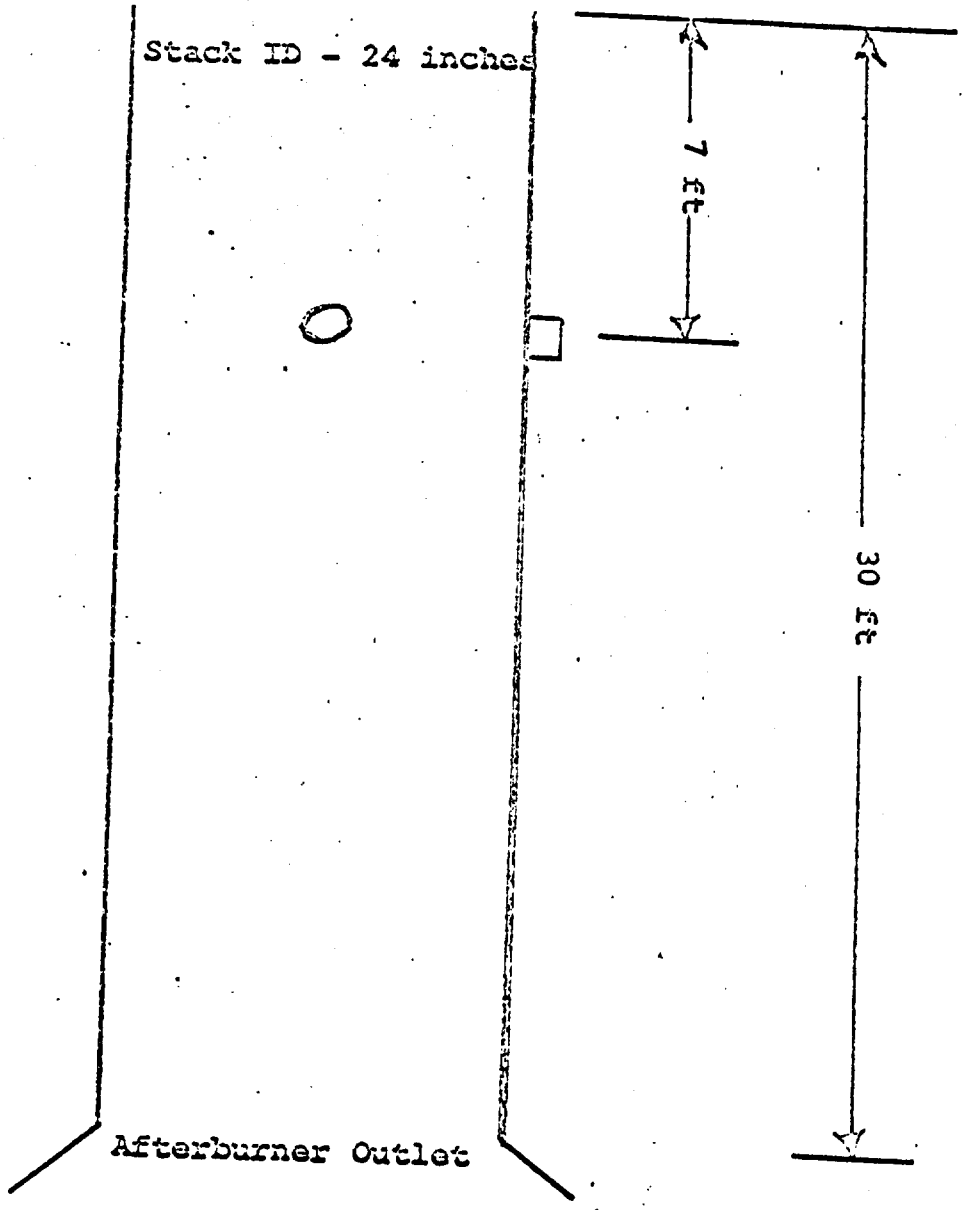
FIGURE 1

B. PROCEDURE - EPA METHOD 5

Particulate sampling was conducted from two test ports located about three feet above the roof level. This position corresponded to eight stack diameters downstream and two upstream from any flow disturbance. The test ports were located at 90° to each other and twelve points were chosen for sampling, for five minutes each, pursuant to EPA Method 1 Procedure. The distances from the inside wall of the stack to the sampling point, calculated as per EPA Method 1 Procedure, were as follows.

Point No.	Distance from Inside Wall (")
1	1.06
2	3.53
3	7.08
4	16.92
5	20.47
6	22.94

Figure II
Stack Configuration and Sample Port Location



VI. ANALYTICAL PROCEDURE

A. PARTICULATE

The filter discs were previously dried, desiccated and tare weighed and the tare weights recorded. Upon return to the laboratory, they were again dried, desiccated and weighed to the nearest 0.1 mg. The difference in the two weights was recorded as the amount of collected particulate. The probe and front half wash acetone solution was quantitatively transferred to a tared beaker and dried under an IR lamp. The difference in weight of the beaker with and without residue was recorded as the amount of particulate in the wash. This was combined with the weight of the filter catch and reported as the total weight of collected particulate.

B. HYDROCARBONS

Total hydrocarbon analysis was conducted at the job site using a Scott - Model 215 Total Hydrocarbon Analyzer with heated line (400°F). The instrument and associated heated sections were initially allowed to equilibrate with respect to temperature and flame stability for approximately 30 minutes. The unit was then calibrated for zero reference and span reference and sample gas, span gas and zero gas flowrate through the electrometer. Hydrocarbon free air, purchased from and analyzed by the Air Products Company, was used as the zero gas and the combustion air for the hydrogen flame. The calibration or span gas used was a mixture of 515 ppm propane in nitrogen, purchased from and analyzed by the Matheson Company. The fuel used was a mixture of 40% hydrogen and 60% argon purchased from and analyzed by the Matheson Company.

C. CARBON MONOXIDE

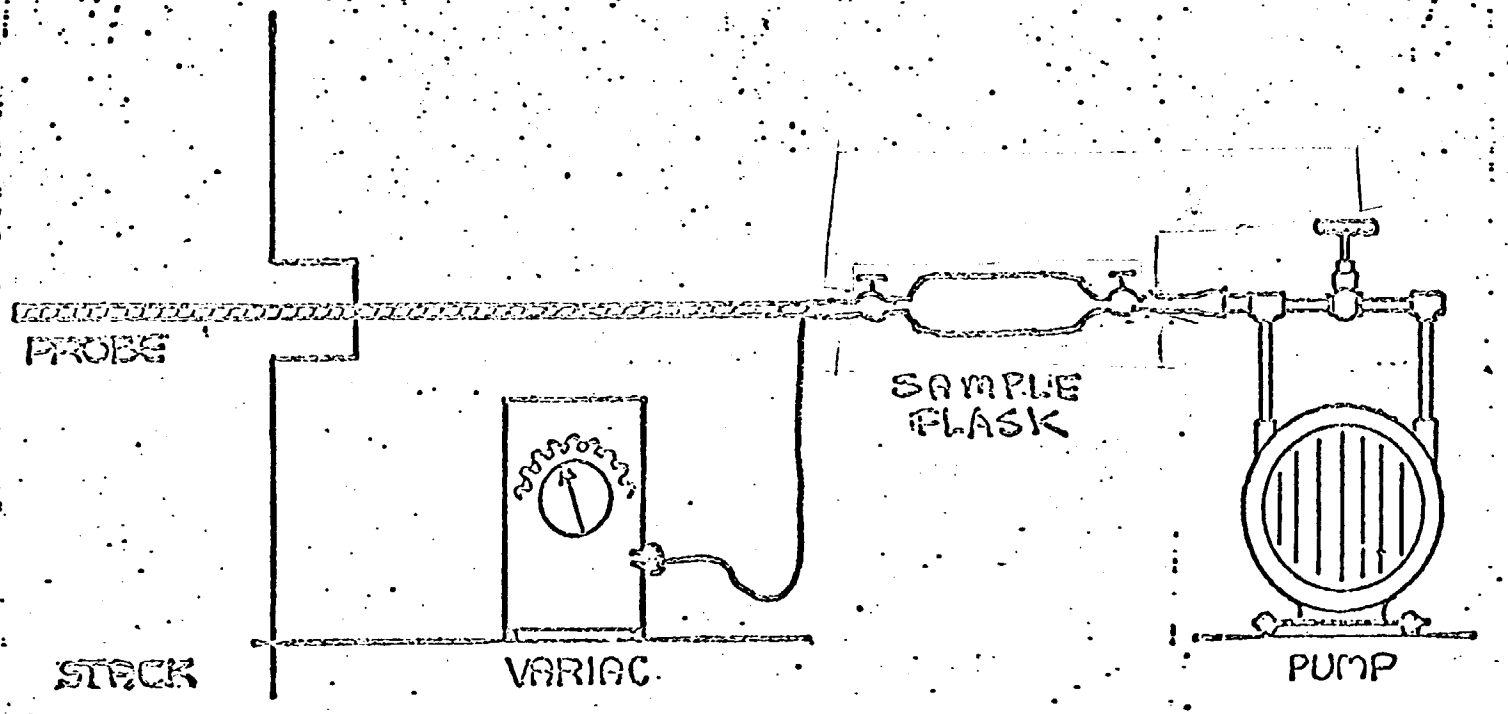
Carbon monoxide was to be analyzed from 250 ml grab flasks. At the time of analysis it was found that a minimum of 2 liters was required for NDIR analysis. Accordingly, the state DEP was notified and permission was granted to use hydrogen flame chromotography to perform this analysis. Figure 3 illustrates the collection system.

D. OXIDES OF NITROGEN

Nine grab samples were collected in accordance with EPA Method 7 Procedure (see Figure 4). Two liter round bottom flasks, containing 25 ml of a dilute sulphuric acid-hydrogen peroxide absorbing solution, were initially evacuated using a vacuum pump. The sample was then slowly aspirated (30 seconds) from the stack into the flask through a heated glass lined probe. After collection of the sample, the flask was vigorously shaken for

FIGURE 3

CARBON MONOXIDE SAMPLING SYSTEM



NO_x SAMPLING TRAIN

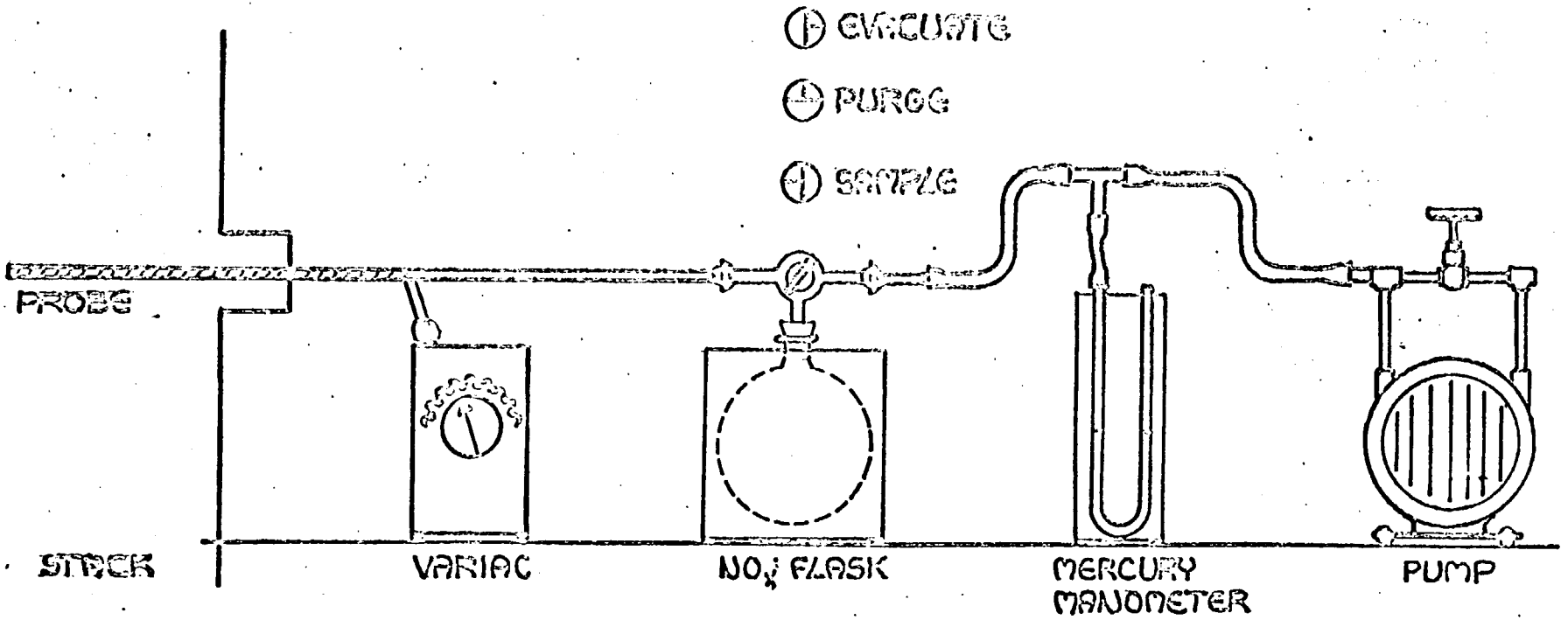


Figure 4

D. OXIDES OF NITROGEN

five minutes and was allowed to stand for 24 hours to completely absorb the NO_x. After the 24 hour period, the flask was again shaken and the final pressure recorded. The sample was then transferred to a container and neutralized using NaOH. The sample was then analyzed using the phenoldisulphonic acid method.

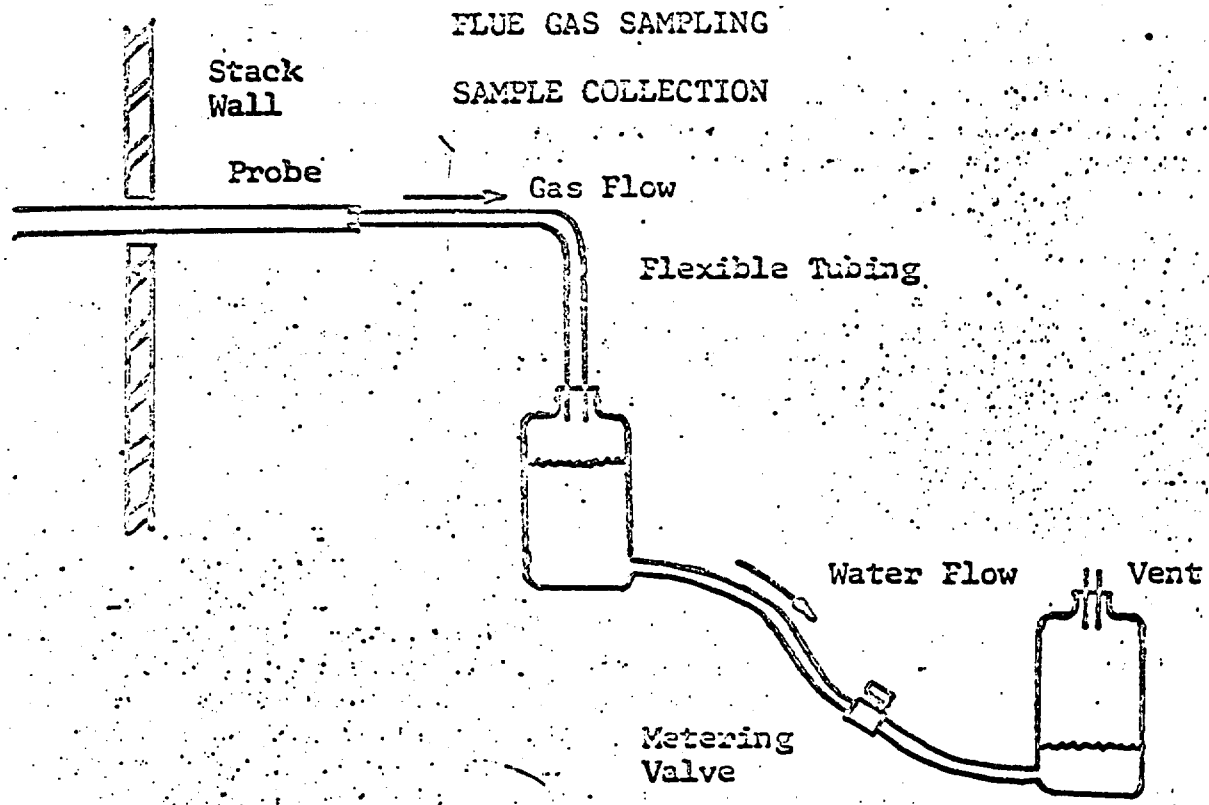
E. CO_2 and O_2

Samples for orsat analysis were collected by traverse through a sampling tube attached to the particulate sampling probe and aspirated into leveling bottles as illustrated in Figure 5.

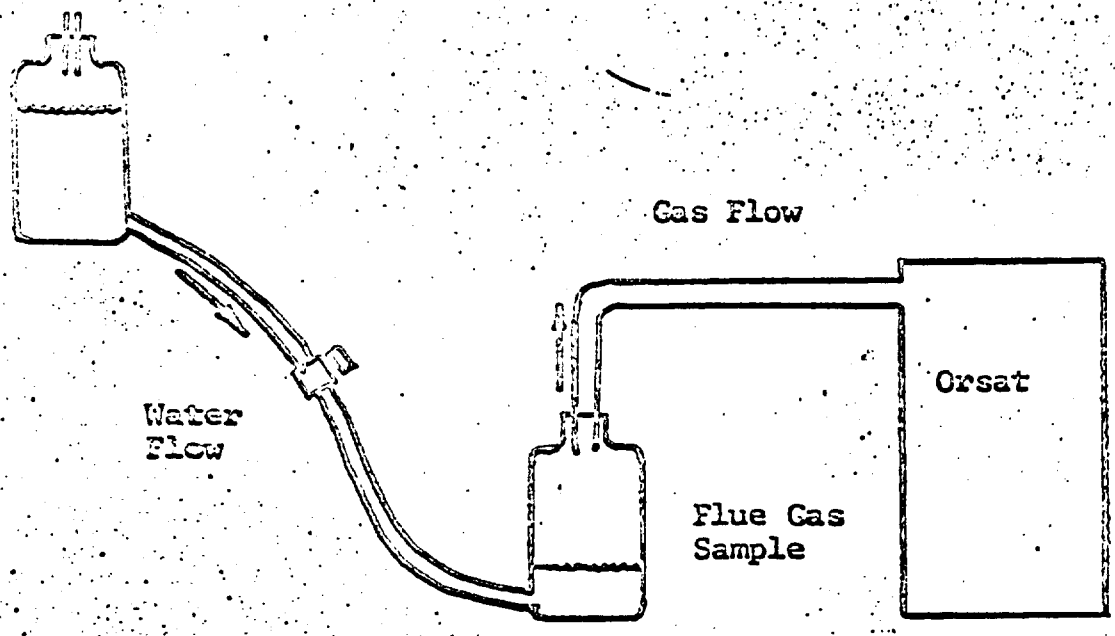
Figure 5

FLUE GAS SAMPLING

SAMPLE COLLECTION



Sample recovery



VII. APPENDIX

REPORT NO. PAGE OF PAGES

SOURCE TESTING CALCULATION FORMS

Test No. No. Runs

Name of Firm City of Stratford - Enviroteck Systems

Location of Plant Stratford Conn

Type of Plant Sewage Treatment

Control Equipment Wet Scrubber / Afterburner System

Sampling Point Locations Outlet of Wet Scrubber / Afterburner System

Pollutants Sampled Particulate

Time of Particulate Test:

Run No.	1	Date	7/30/74	Begin	1448	End	1652
Run No.	2	Date	7/31/74	Begin	1213	End	1318
Run No.	3	Date	7/31/74	Begin	1615	End	1717

PARTICULATE EMISSION DATA

Run No.	1	2	3	
P_b barometric pressure, "Hg Absolute	29.90	29.99	29.99	
P_m orifice pressure drop, "H_2O	.75	.75	.72	
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	41.70	41.80	39.93	
T_m Average Gas Meter Temperature, °F	70	70	70	
V_m Volume of Dry Gas Sampled @ Standard std. conditions, ft.^{3}	41.72	41.94	40.06	
V_w Total H_2O collected, ml., Impingers & Silica Gel.	71.2	72.2	67.4	
V_w Volume of Water Vapor Collected gas ft.^{3} @ Standard Conditions*	3.37	3.42	3.19	

* 70°F, 29.92" Hg.

PARTICULATE EMISSION DATA (cont'd)

Run No.	1	2	3	
%M - % Moisture in the stack gas by volume	7.48	7.54	7.39	
M_d - Mole fraction of dry gas	.925	.925	.926	
% CO_2	7.45	7.80	7.80	
% O_2	10.10	9.70	9.70	
% N_2	82.45	82.50	82.50	
M W d - Molecular weight of dry stack gas	29.60	29.64	29.64	
M W - Molecular weight of stack gas	28.73	28.76	28.78	
$\triangle$ Ps - Velocity Head of stack gas, In. H_2O	—	—	—	
T_s - Stack Temperature, °F	495	504	516	
$\sqrt{\triangle P_s X (T_s+460)}$	28.640	28.156	27.946	
P_s - Stack Pressure, "Hg. Absolute	29.93	30.02	30.02	
V_s - Stack Velocity @ stack conditions, fpm	4149	4070	4039	
A_s - Stack Area, $in.^2$	452	452	452	
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	6688	6515	6396	
T_t - Net Time of Test, min.	60	60	60	
D_n - Sampling Nozzle Diameter, in.	.25	.25	.25	
%I - Percent isokinetic	95.4	98.5	95.8	
m_f - Particulate - probe, cyclone and filter, mg.	90.4	112.9	84.3	
m_t - Particulate - total, mg.	—	—	—	
C_{an} - Particulate - probe, cyclone, and filter, gr/SCF	.0333	.0415	.0305	
C_{ao} - Particulate - total, gr/SCF	—	—	—	
C_{at} - Particulate - probe, cyclone, and filter gr/cf @ stack conditions	.0171	.0211	.0165	

REPORT NO._____ 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.	1.92	2.31	1.77	
C_{ax} - Particulate - total, lb/hr.	—	—	—	
%EA - % Excess air @ sampling point	86.6	80.3	80.3	

* 70°F. 29.92" Hg.

FIELD DATA

PLANT Enviroteck - Stratford
DATE 7/30/74
SAMPLING LOCATION After Cyclone Outlet
SAMPLE TYPE Particulate
RUN NUMBER 1
OPERATOR FHT
AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE 29.90
STATIC PRESSURE, (P_s) 29.93
FILTER NUMBER (s) 212

Meter Start
2008.50

PROBE LENGTH AND TYPE 6 ft glass
NOZZLE I.D. 1/4
ASSUMED MOISTURE, % 10
SAMPLE BOX NUMBER 1
METER BOX NUMBER 1
METER $\Delta H_@$ —
C FACTOR —
PROBE HEATER SETTING 300
HEATER BOX SETTING 300
REFERENCE Δp 1.75

49 ml

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

TRAVERSE POINT NUMBER	CLOCK TIME (24-hr CLOCK) / SAMPLING TIME, min	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
				DESIRED	ACTUAL		INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F			
A-1	1448	2012.0	.85	.74	.74	490	70	70	5	300	55
2	1453	2015.4	.85	.74	.74	490	70	70	5	300	55
3	1458	2018.8	.84	.73	.73	490	70	70	5	310	55
4	1503	2022.2	.80	.69	.69	490	70	70	5	310	60
5	1508	2026.1	1.00	.87	.87	480	70	70	7	320	60
6	1513	2029.7	.85	.74	.74	480	70	70	6	320	60
B-1	1627	2033.6	1.10	.95	.95	495	70	70	6	320	65
2	1632	2036.8	.70	.61	.61	500	70	70	4	320	65
3	1637	2039.7	.70	.61	.61	510	70	70	4	320	65
4	1642	2042.5	.60	.52	.52	520	70	70	3	310	70
5	1647	2046.3	1.00	.87	.87	500	70	70	6	300	70
6	1652	2050.20	1.09	.87	.87	500	70	70	7	300	70
		41.7	.96		1.74	495					

COMMENTS:

FIELD DATA

PLANT Enviro-tech - Stratford
DATE 7/31/74
SAMPLING LOCATION Atterbury outlet
SAMPLE TYPE Particulate
RUN NUMBER 2
OPERATOR ZAT
AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE 29.99
STATIC PRESSURE, (P_s) 30.02
FILTER NUMBER (s) 102

meter Start
2050.25

PROBE LENGTH AND TYPE 6 ft glass
NOZZLE I.D. 1/4
ASSUMED MOISTURE, % 10
SAMPLE BOX NUMBER 1
METER BOX NUMBER 1
METER ΔH@ —
C FACTOR —
PROBE HEATER SETTING 300
HEATER BOX SETTING 300
REFERENCE Δp 1.15

SCHEMATIC OF TRAVERSE POINT LAYOUT

50 ml

READ AND RECORD ALL DATA EVERY 5 MINUTES

TRAVERSE POINT NUMBER	CLOCK TIME (24-hr CLOCK) / SAMPLING TIME, min	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
				DESIRED	ACTUAL		INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F			
A-1	1213	2053.6	.90	.80	.80	460	70	70	3	260	50
2	1218	2056.8	.75	.68	.68	460	70	70	3	280	50
3	1223	2060.0	.75	.68	.68	450	70	70	3	310	50
4	1228	2064.0	.70	.63	.63	520	70	70	3	310	55
5	1233	2067.6	.80	.72	.72	570	70	70	3	320	55
6	1238	2071.1	.80	.72	.72	580	70	70	3	320	60
B-1	1253	2074.9	1.10	1.00	1.00	530	70	70	4	320	60
2	1258	2078.4	.75	.68	.68	540	70	70	3	320	60
3	1303	2081.2	.60	.54	.54	540	70	70	3	320	60
4	1308	2084.5	.80	.72	.72	480	70	70	4	320	60
5	1313	2088.3	1.00	.90	.90	460	70	70	4	320	65
6	1318	2092.05	1.00	.90	.90	460	70	70	4	320	65
		41.4	.93		1.1	504					

COMMENTS:

FIELD DATA

PLANT Enviroteck - Stratford
DATE 7/31/24
SAMPLING LOCATION Stack Common Outlet
SAMPLE TYPE Particulate
RUN NUMBER 3
OPERATOR ZJT
AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE 29.99
STATIC PRESSURE, (P_s) 30.02
FILTER NUMBER (s) 103

Meter Start
2092.68

PROBE LENGTH AND TYPE 6ft glass
NOZZLE I.D. 1/4
ASSUMED MOISTURE, % 10
SAMPLE BOX NUMBER 1
METER BOX NUMBER 1
METER $\Delta H_@$ —
C FACTOR —
PROBE HEATER SETTING 300
HEATER BOX SETTING 300
REFERENCE Δp 1.15

47 ml

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

TRAVERSE POINT NUMBER	CLOCK TIME (24-hr CLOCK) / SAMPLING TIME, min	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
				DESIRED	ACTUAL		INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F			
A-1	1615	2096.0	.85	.76	.76	500	70	70	5	310	50
2	1620	2099.5	.85	.76	.76	510	70	70	5	320	55
3	1625	2102.7	.70	.63	.63	510	70	70	4	310	55
4	1630	2105.5	.60	.54	.54	510	70	70	4	310	55
5	1635	2108.4	.60	.54	.54	510	70	70	4	310	55
6	1640	2112.1	.90	.81	.81	510	70	70	6	310	55
B-1	1652	2115.6	.90	.81	.81	520	70	70	6	310	60
2	1657	2118.7	.75	.68	.68	525	70	70	4	320	60
3	1702	2121.8	.75	.68	.68	525	70	70	4	325	60
4	1707	2125.3	.85	.76	.76	530	70	70	5	320	60
5	1712	2128.8	.90	.81	.81	525	70	70	5	320	65
6	1717	2132.61	1.00	.90	.90	525	70	70	5	320	65
		39.93	.40		4.80	5.17					

COMMENTS:

ANALYTICAL DATA

PLANT City of Stratford

DATE 7/30/74

SAMPLING LOCATION Afterburner Outlet

SAMPLE TYPE Particulate

RUN NUMBER 1

SAMPLE BOX NUMBER 1

CLEAN-UP MAN FHT

COMMENTS:

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER 1 — 35.5 mg

FILTER NUMBER 212 — CONTAINER 2 — 54.9 mg

FRONT HALF SUBTOTAL 90.4 mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ — _____ mg

ETHER-CHLOROFORM EXTRACTION — _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ — _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT 90.4 mg

MOISTURE

IMPINGERS

FINAL VOLUME	249 ml
INITIAL VOLUME	200 ml
NET VOLUME	49 ml

SILICA GEL

FINAL WEIGHT	322.2 g	_____ g	_____ g
INITIAL WEIGHT	300.0 g	_____ g	_____ g
NET WEIGHT	22.2 g	_____ g	_____ g

TOTAL MOISTURE 71.2 g

EPA (Dur) 231
4/72

ANALYTICAL DATA

PLANT City of Stratford

DATE 7/31/74

SAMPLING LOCATION Afterburner Outlet

SAMPLE TYPE Particulate

RUN NUMBER 2

SAMPLE BOX NUMBER 1

CLEAN-UP MAN FHT

COMMENTS:

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER 1 — 42.7 mg

FILTER NUMBER 102 — CONTAINER 2 — 70.2 mg

FRONT HALF SUBTOTAL 112.9 mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ — _____ mg

ETHER-CHLOROFORM EXTRACTION — _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ — _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT 112.9 mg

MOISTURE

IMPINGERS

FINAL VOLUME	250 ml		
INITIAL VOLUME	200 ml		
NET VOLUME	50 ml		

SILICA GEL

FINAL WEIGHT	322.2 g	_____ g	_____ g
INITIAL WEIGHT	300.0 g	_____ g	_____ g
NET WEIGHT	22.2 g	_____ g	_____ g

TOTAL MOISTURE 72.2 g

EPA (Dur) 231
4/72

ANALYTICAL DATA

PLANT City of Stratford

DATE 7/31/74

SAMPLING LOCATION Afterburner Outlet

SAMPLE TYPE Particulate

RUN NUMBER 3

SAMPLE BOX NUMBER 1

CLEAN-UP MAN JAT

COMMENTS:

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER 1 — 36.0 mg

FILTER NUMBER 103 — CONTAINER 2 — 48.3 mg

FRONT HALF SUBTOTAL 84.3 mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ — _____ mg

ETHER-CHLOROFORM EXTRACTION — _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ — _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT 84.3 mg

MOISTURE

IMPINGERS

FINAL VOLUME	247	ml
INITIAL VOLUME	200	ml
NET VOLUME	47	ml

SILICA GEL

FINAL WEIGHT	320.4 g	_____ g	_____ g
INITIAL WEIGHT	300.0 g	_____ g	_____ g
NET WEIGHT	20.4 g	_____ g	_____ g

TOTAL MOISTURE 67.4 g

EPA (DLA) 231
4/72

BAGGS OF NITROGEN FIELD [illegible]

JOB NO. _____

Date 7/30/74

Plant Stratford

Sample Collected By JAT

Run No. 1-5V

Power Stat Setting 50%

Field Data

Clock Time	1430	1500	1535	1615	1650
Flask Number	1	2	3	4	5
Volume of flask less correction (liter)	2.031	2.047	2.044	2.035	2.023
Pressure before sampling in Hg.	23.2	23.4	23.1	23.3	23.0
Pressure after sampling in Hg.	3.0	1.5	3.1	1.1	3.1
Flask temperature, °F	70	70	70	70	70

Remarks:

Final Pressure and Flask Temp of laboratory

OXIDES OF NITROGEN FIELD DATA

JOB NO. _____

Date 7/31/74

Plant Stratford

Sample Collected By JAT

Run No. 6-9 V

Power Stat Setting 50%

Field Data

Clock Time	1045	1115	1200	1240	
Flask Number	6	7	8	9	
Volume of flask less correction (liter)	2.046	2.016	2.021	2.041	
Pressure before sampling in Hg.	22.8	23.1	23.2	23.0	
Pressure after sampling in Hg.	3.1	3.0	1.5	3.1	
Flask temperature, °F	70	70	70	70	

Remarks:

NO_x EMISSION DATA

RUN NO.	1	2	3	4	5		
Date	7/30	7/30	7/30	7/30	7/30		
mg NO_2	.585	.499	.545	.485	.608		
T_f - Flask Temperature, °F	70	70	70	70	70		
V_f - Flask Volume, liters	2.031	2.047	2.044	2.035	2.023		
P_i - Initial Flask Vacuum, "Hg.	23.2	23.4	23.1	23.3	23.0		
P_f - Final Flask Vacuum, "Hg.	3.0	1.5	3.1	1.1	3.1		
ppm NO_2	224	175	209	169	237		

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

NO_x EMISSION DATA

RUN NO.	6	7	8	9			
Date	7/31	7/31	7/31	7/31			
mg NO_2	.604	.552	.564	.538			
T_f - Flask Temperature, °F	70	70	70	70			
V_f - Flask Volume, liters	2.046	2.016	2.021	2.041			
P_i - Initial Flask Vacuum, "Hg.	22.8	23.1	23.2	23.0			
P_f - Final Flask Vacuum, "Hg.	3.1	3.0	1.5	3.1			
ppm NO_2	235	214	202	208			

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

TOTAL HYDROCARBON ANALYZER
FIELD DATA SHEET

Plant Enviroteh
Date 7/30/74
Sampling Location Outlet
Hydrocarbon Composition
Test Number
Sampled By

Calibration Gas 515 ppm Propane Analyzer Response 515 ppm

Test Point Location	Clock Time	Analyzer Response
1841		34.0
1842		35.0
1843		34.0
1844		33.5
1845		32.0
1846		33.5
1847		32.5
1848		33.0
1849		35.0
1850		36.0
1851		35.0
1852		35.5
1853		34.0
1854		33.0
1855		32.5

Test Point Location	Clock Time	Analyzer Response
1856	~~32~~	32.5
1857		32.0
1858		31.5
1859		30.0
1900		29.0
1901		29.5
1902		29.5
1903		27.5
1904		28.5
1905		27.0
1906		26.0
1907		27.0
1908		27.5
1909		25.0
1910		25.0

Emission Testing Labs Inc.

27-5

TOTAL HYDROCARBON ANALYZER
FIELD DATA SHEET

Plant ENVIROTECH
Date 7/30/74
Sampling Location OUTLET

Hydrocarbon Composition _____
Test Number _____
Sampled By _____

Calibration Gas 515 PPM PROPANE Analyzer Response 515 PPM

Test Point Location	Clock Time	Analyzer Response
1911		25.0
1912		25.0
1913		24.0
1914		23.5
1915		26.5
1916		29.5
1917		27.0
1918		26.0
1919		25.5
1920		26.0
1921		26.0
1922		24.0
1923		27.5
1924		27.0
1925		26.5

Test Point Location	Clock Time	Analyzer Response
1926		29.5
1927		21.5
1928		25.5
1929		26.0
1930		25.5
1931		27.0
1932		22.5
1933		25.0
1934		26.0
1935		25.5
1936		24.5
1937		24.5
1938		24.0
1939		22.0
1940		22.0