Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

40138 69

#136 12/17/86

# EMISSION COMPLIANCE TESTS

Conducted At

NORWALK WASTEWATER TREATMENT PLANT
SOUTH SMITH STREET
NORWALK, CONNECTICUT

for

DORR-OLIVER INCORPORATED
77 HAVERMEYER LANE
STAMFORD, CONNECTICUT 06904

Submitted By

YORK RESEARCH CORPORATION
ONE RESEARCH DRIVE
STAMFORD, CONNECTICUT 06906

*Compliments of*

**ALBERTSON, SHARP & BACKUS, INC.**

*Consulting Engineers & Planners*

NORWALK, CONNECTICUT

REPORT NO. Y-3566

February 24, 1975

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## I. INTRODUCTION

York Research Corporation, an independent consultant in the field of environmental engineering, was retained by Dorr-Oliver Incorporated to conduct emission compliance tests at the Norwalk, Connecticut Waste Water Treatment Plant. The testing was performed in accordance with procedures described in Intent to Test Form No. 740138. The testing was conducted on December 26 and 27, 1974.

## II. SUMMARY OF TEST RESULTS

Table I summarizes the results of the test program.

TABLE I

SUMMARY OF TEST RESULTS

| Test No. | Date | Particulate (Gr/SCFD @ 12% $CO_2$) | $SO_x$ (ppm) | $NO_x$ (ppm) | Hydrocarbons (As Methane) (ppm) |
|---|---|---|---|---|---|
| 1 | 12/26 | .019 | 183 | 78.9 | 120 |
| 2 | 12/27 | .014 | 164 | 61.9 | 111 |
| 3 | 12/23 | .010 | 163 | 83.4 | 106 |
| Avg. | | .015 | 170 | 74.7 | 112 |
| Conn. State Limit | | .08 | 500 | 700 | - |

YORK RESEARCH CORPORATION
ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06906

JOB NUMBER: Y-8566

CLIENT: DORR-OLIVER
PLANT LOCATION: NORWALK,CONN.
UNIT TESTED: SEWAGE INCINERATOR

## PARTICULATE SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 1 | 2 | 3 | AVERAGE |
|---|---|---|---|---|---|
| GENERAL DATA | | | | | |
| DATE OF RUN | | DEC26,74 | DEC27,74 | DEC27,74 | |
| BAROMETRIC PRESSURE | IN.HG | 30.36 | 30.21 | 30.07 | |
| STACK PRESSURE, ABS. | IN.HG | 30.54 | 30.37 | 30.25 | |
| STACK AREA | SQ. FT | 3. | 3. | 3. | |
| NET TIME OF RUN | MIN | 140.0 | 140.0 | 140.0 | |
| PERCENT ISOKINETIC | | 100.7 | 99.1 | 98.2 | 99.3 |
| GAS DATA | | | | | |
| AVG STACK GAS VELOCITY | FPS | 62.159 | 65.694 | 68.656 | 65.503 |
| AVG STACK TEMPERATURE | DEG.F | 100.5 | 98.6 | 99.3 | 99.5 |
| ACTUAL STACK FLOWRATE | ACFM | 11711. | 12377. | 12935. | 12341. |
| STK FLOWRATE,DRY,STD | DSCFM | 10351. | 11046. | 11405. | 10934. |
| MOLECULAR WT-DRY STK GAS | | 29.71 | 29.96 | 30.01 | |
| MOLECULAR WT-STK GAS | | 28.73 | 29.08 | 29.05 | |
| MOLE FRACTION DRY GAS | | 0.916 | 0.927 | 0.921 | |
| GAS ANALYSIS (DRY PERCENT BASIS) | | | | | |
| CARBON DIOXIDE | | 9.0 | 10.8 | 11.0 | 10.3 |
| OXYGEN | | 6.8 | 5.8 | 6.2 | 6.3 |
| CARBON MONOXIDE | | 0. | 0. | 0. | 0. |
| NITROGEN | | 84.2 | 83.4 | 82.8 | 83.5 |
| MOISTURE BY VOL | | 8.4 | 7.3 | 7.9 | 7.9 |
| SAMPLE COLLECTION DATA | | | | | |
| TOTAL H2O COLLECTED | ML | 172.2 | 155.8 | 174.2 | |
| VOL H2O VAPOR-STD COND | SCF | 8.16 | 7.38 | 8.26 | |
| VOL DRY GAS-METER COND | DCF | 84.54 | 89.72 | 92.28 | |
| VOL DRY GAS-STD COND | DSCF | 89.12 | 93.54 | 95.75 | |
| AVG GAS METER TEMP | DEG.F | 51.7 | 55.1 | 55.3 | |
| AVG ORIF PRES DROP | IN.H2O | 1.383 | 1.546 | 1.674 | |
| PARTICULATE WEIGHT DATA | | | | | |
| NET WEIGHT PARTIAL | MG | 30.54 | 27.65 | 22.24 | 26.81 |
| NET WEIGHT TOTAL | MG | 84.79 | 78.06 | 57.02 | 73.29 |
| PARTICULATE EMISSIONS | | | | | |
| PARTIAL | | | | | |
| GRAINS PER SCFD | | 0.00528 | 0.00455 | 0.00358 | 0.00447 |
| GRAINS PER SCFD @12%CO2 | | 0.00704 | 0.00506 | 0.00390 | 0.00533 |
| GRAINS PER ACF | | 0.00466 | 0.00406 | 0.00315 | 0.00396 |
| POUNDS PER HOUR | | 0.47 | 0.43 | 0.35 | 0.42 |
| POUNDS PER PROCESS UNIT | | 0. | 0. | 0. | 0. |
| TOTAL | | | | | |
| GRAINS PER SCFD | | 0.01465 | 0.01285 | 0.00917 | 0.01222 |
| GRAINS PER SCFD @12%CO2 | | 0.01953 | 0.01428 | 0.01000 | 0.01461 |
| GRAINS PER ACF | | 0.01295 | 0.01147 | 0.00809 | 0.01084 |
| POUNDS PER HOUR | | 1.30 | 1.22 | 0.90 | 1.14 |
| POUNDS PER PROCESS UNIT | | 0. | 0. | 0. | 0. |

YORK RESEARCH CORPORATION
ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06906

JOB NUMBER: Y-8566

CLIENT: DORR-OLIVER
PLANT LOCATION: NORWALK, CONN.
UNIT TESTED: SEWAGE INCINERATOR

## PARTICULATE SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 1 | 2 | 3 | AVERAGE |
|---|---|---|---|---|---|
| GENERAL DATA | | | | | |
| DATE OF RUN | | DEC26,74 | DEC27,74 | DEC27,74 | |
| BAROMETRIC PRESSURE | MM.HG | 771.14 | 767.33 | 763.78 | |
| STACK PRESSURE, ABS. | MM.HG | 775.63 | 771.44 | 768.26 | |
| STACK AREA | M2 | 0.292 | 0.292 | 0.292 | |
| NET TIME OF RUN | MIN | 140.0 | 140.0 | 140.0 | |
| PERCENT ISOKINETIC | | 100.7 | 99.1 | 98.2 | 99.3 |
| GAS DATA | | | | | |
| AVG STACK GAS VELOCITY | M/S | 18.946 | 20.024 | 20.926 | 19.965 |
| AVG STACK TEMPERATURE | DEG.C | 38.1 | 37.0 | 37.4 | 37.5 |
| ACTUAL STACK FLOWRATE | AM3/M | 332. | 350. | 366. | 349. |
| STK FLOWRATE,DRY,STD | DNM3/M | 293. | 313. | 323. | 310. |
| MOLECULAR WT-DRY STK GAS | | 29.71 | 29.96 | 30.01 | |
| MOLECULAR WT-STK GAS | | 28.73 | 29.08 | 29.05 | |
| MOLE FRACTION DRY GAS | | 0.916 | 0.927 | 0.921 | |
| GAS ANALYSIS (DRY PERCENT BASIS) | | | | | |
| CARBON DIOXIDE | | 9.0 | 10.8 | 11.0 | 10.3 |
| OXYGEN | | 6.8 | 5.8 | 6.2 | 6.3 |
| CARBON MONOXIDE | | 0. | 0. | 0. | 0. |
| NITROGEN | | 84.2 | 83.4 | 82.8 | 83.5 |
| MOISTURE BY VOL | | 8.4 | 7.3 | 7.9 | 7.9 |
| SAMPLE COLLECTION DATA | | | | | |
| TOTAL H2O COLLECTED | ML | 172.2 | 155.8 | 174.2 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.23 | 0.21 | 0.23 | |
| VOL DRY GAS-METER COND | DM3 | 2.39 | 2.54 | 2.61 | |
| VOL DRY GAS-STD COND | DNM3 | 2.52 | 2.65 | 2.71 | |
| AVG GAS METER TEMP | DEG.C | 11.0 | 12.8 | 13.0 | |
| AVG ORIF PRES DROP | MM.H2O | 35.125 | 39.270 | 42.509 | |
| PARTICULATE WEIGHT DATA | | | | | |
| NET WEIGHT PARTIAL | MG | 30.54 | 27.65 | 22.24 | 26.81 |
| NET WEIGHT TOTAL | MG | 84.79 | 78.06 | 57.02 | 73.29 |
| PARTICULATE EMISSIONS | | | | | |
| PARTIAL | | | | | |
| MG/NORMALIZED CU.METERS | | 12.08 | 10.42 | 8.19 | 10.23 |
| MG/NORM. CU.M @12% CO2 | | 16.10 | 11.57 | 8.93 | 12.20 |
| MG/ACTUAL CU. METERS | | 10.67 | 9.30 | 7.22 | 9.06 |
| KILOGRAMS/HOUR | | 0.21 | 0.20 | 0.16 | 0.19 |
| KILOGM PER PROCESS UNIT | | 0. | 0. | 0. | 0. |
| TOTAL | | | | | |
| MG/NORMALIZED CU.METERS | | 33.53 | 29.41 | 20.99 | 27.97 |
| MG/NORM. CU.M @12% CO2 | | 44.70 | 32.68 | 22.89 | 33.42 |
| MG/ACTUAL CU. METERS | | 29.63 | 26.25 | 18.50 | 24.80 |
| KILOGRAMS/HOUR | | 0.59 | 0.55 | 0.41 | 0.52 |
| KILOGM PER PROCESS UNIT | | 0. | 0. | 0. | 0. |

## III. DISCUSSION

The incinerator was operated at its maximum capacity of 2000 lb./hr. dry sludge during the testing period. During all the testing $NO_2$ fuel oil was also burned in the incinerator to keep the temperature at the necessary level.

Comparison of the emission rates for Particulate, $SO_x$ and $NO_x$ with the allowable levels shows that the incinerator operates well within existing air pollution regulations.

Testing for hydrocarbon emissions was performed at the request of Connecticut DEP although there is no emission limit for hydrocarbons from this particular type of source.

## IV. SAMPLING METHODS & ANALYTICAL PROCEDURES

### A. Sampling Locations

Two sampling ports were installed at 90° angles 10' downstream of the outlet of the scrubber and 5' below the stack exit (Figure 1). Thirty-two sampling traverse points were selected in accordance with EPA Method 1, December 23, 1971 Federal Register. The location of these points is shown in Figure 2.

### B. Particulate

All particulate emission sampling and analysis was performed in accordance with EPA Method 5 as published in the Federal Register, Volume 36, Number 247, December 23, 1971. A schematic of the sampling train appears in Figure 3.

### C. Oxides of Nitrogen

All $NO_x$ emission sampling and analysis was performed in accordance with EPA Method 7 as published in the Federal Register, Volume 36, Number 247, December 23, 1971. A schematic of the sampling train appears as Figure 4.

### D. Oxides of Sulfur

All $SO_2$ emission sampling and analysis was performed in accordance with EPA Method 6 as published in the Federal Register, Volume 36, Number 247, December 23, 1971. The samples for $SO_3$ analysis were taken at the same time as the $SO_2$ sample and consisted of the isopropyl alcohol in the first impinger. The analysis was performed in the same manner. A schematic of the sampling train appears in Figure 5.

### E. Hydrocarbons

Samples for hydrocarbon emissions were taken in heated grab flasks (Figure 6). Analysis was performed by gas chromatography using flame ionization detection and comparison with a hexane standard. Calculations involving the different response for methane and molecular weight ratios allowed conversion to ppm as methane.

### F. Gas Analysis

Samples for $CO_2$ and $O_2$ analysis were taken with York Research's acid leveling bottle technique (Figure 7). Analysis was performed with a Hays Portable Orsat gas analyzer. Carbon monoxide concentration was measured with detector tubes.

## TEST TEAM

Louis C. Millspaugh
Linda Biehl

Prepared By:

Louis C. Millspaugh
Louis C. Millspaugh
Environmental Test Engineer

Approved By:

Roy S. Egdall
Roy S. Egdall
Director-Environmental Sciences

# VI. APPENDIX

## A. FIGURES

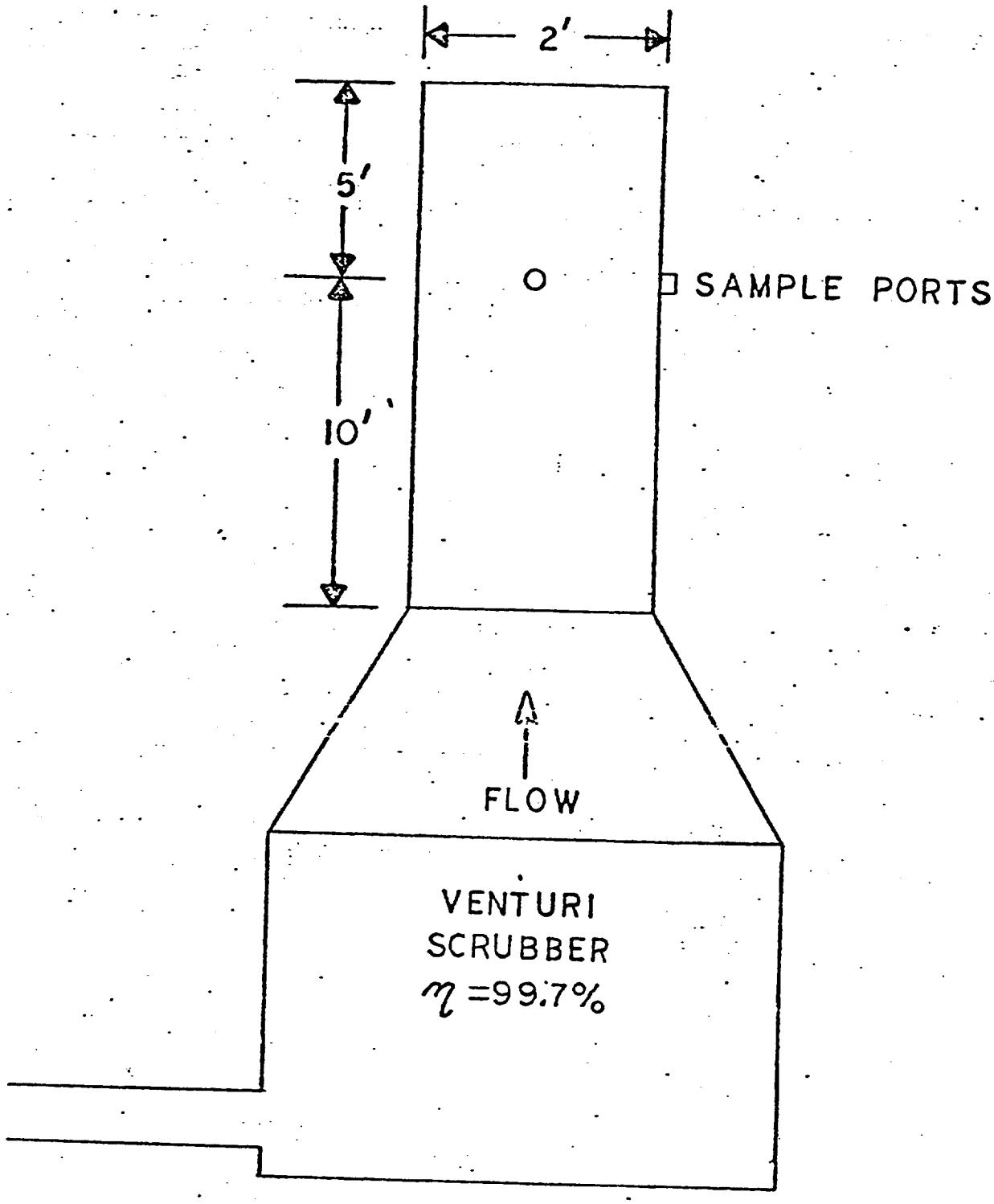
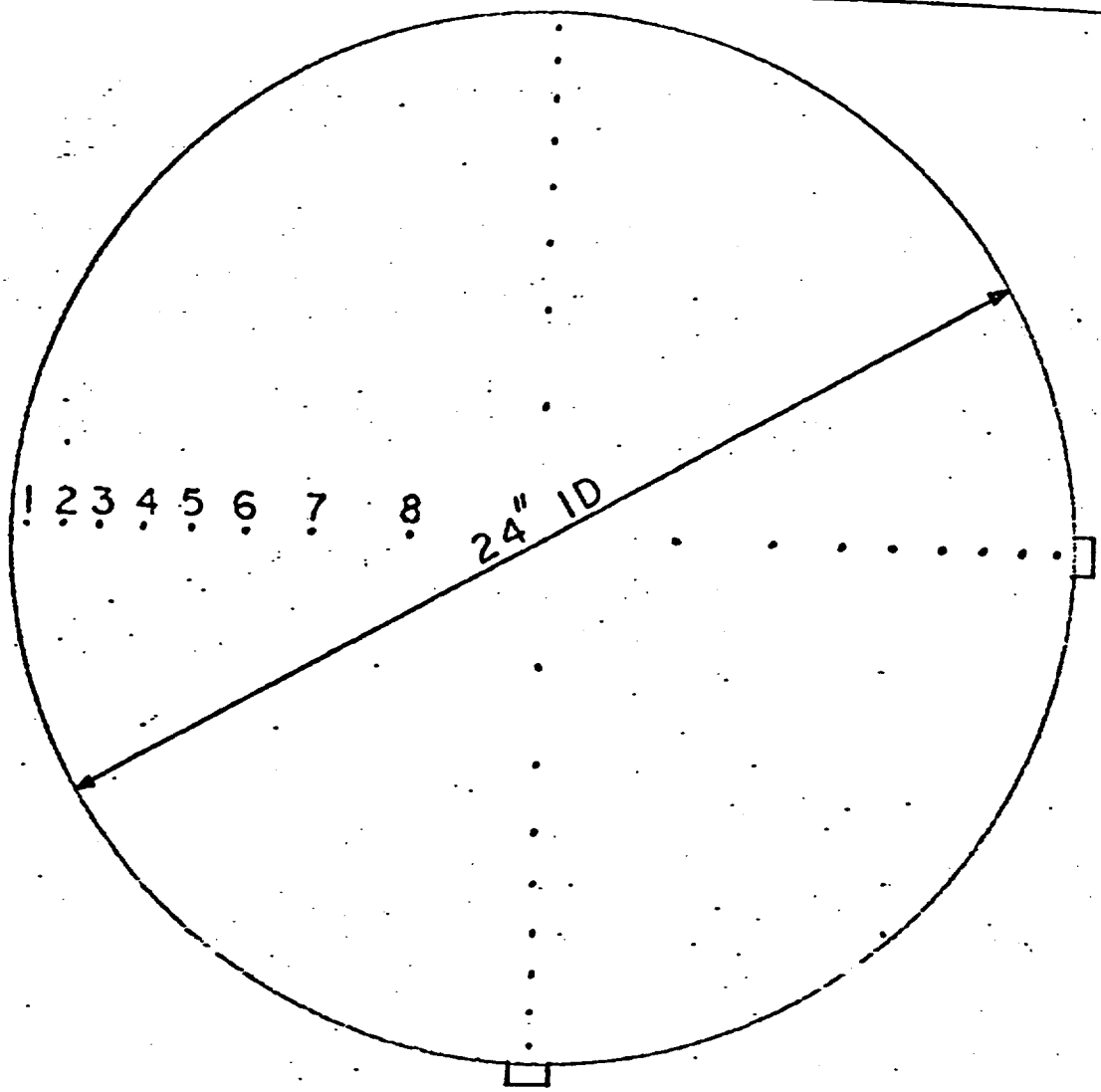



FIGURE 1

NTS




| POINT NO. | DIST. FROM INSIDE WALL |
|---|---|
| 1 | .4" |
| 2 | 1.2" |
| 3 | 2.0" |
| 4 | 3.0" |
| 5 | 4.1" |
| 6 | 5.3" |
| 7 | 6.8" |
| 8 | 9.0" |

SAMPLING POINT LOCATIONS

FIGURE 2

NTS

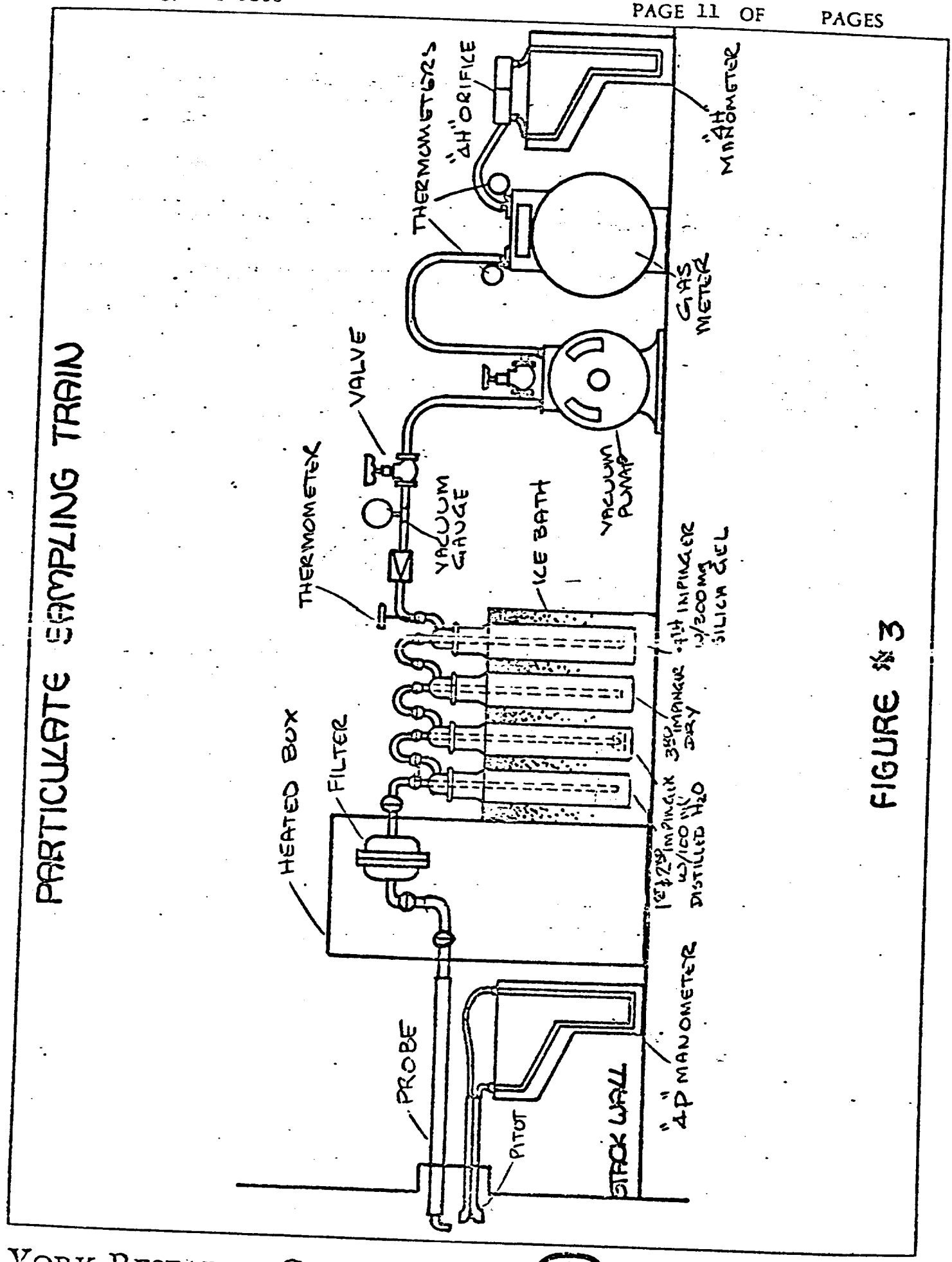

PARTICULATE SAMPLING TRAIN
THERMOMETERS
"ΔH" ORIFICE
"ΔH" MANOMETER
GAS METER
VALVE
THERMOMETER
VACUUM GAUGE
ICE BATH
VACUUM PUMP
4TH IMPINGER W/200MG SILICA GEL
3RD IMPINGER DRY
1ST & 2ND IMPINGER W/100 ml DISTILLED H2O
HEATED BOX
FILTER
PROBE
PITOT
STACK WALL
"ΔP" MANOMETER

FIGURE #3

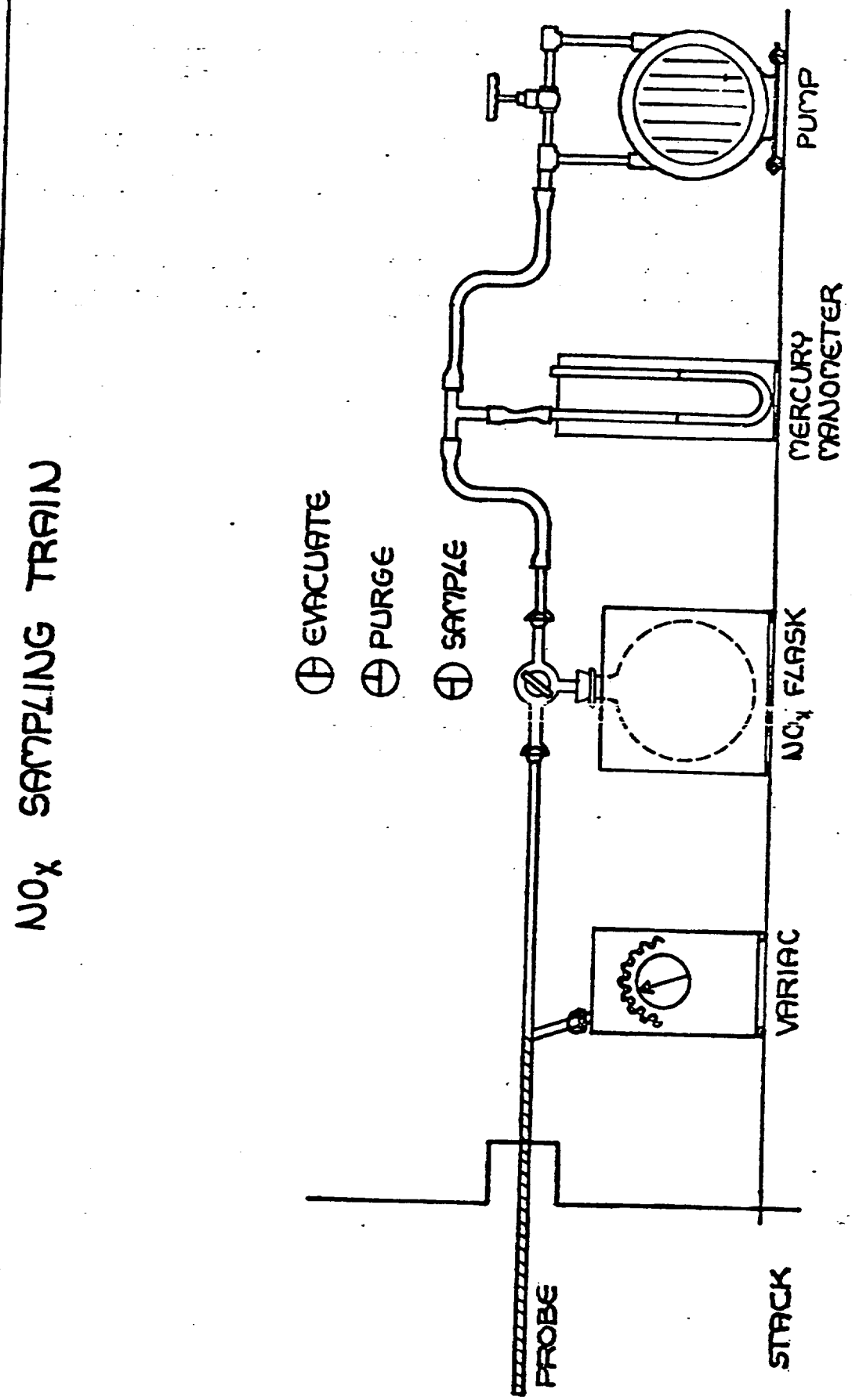
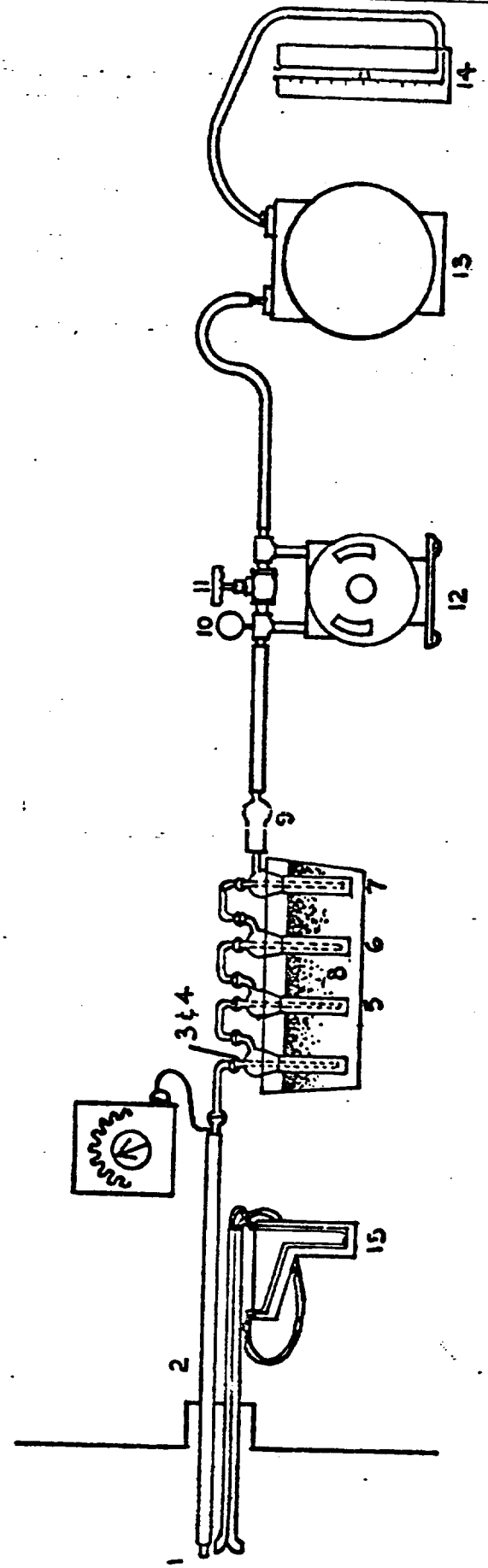
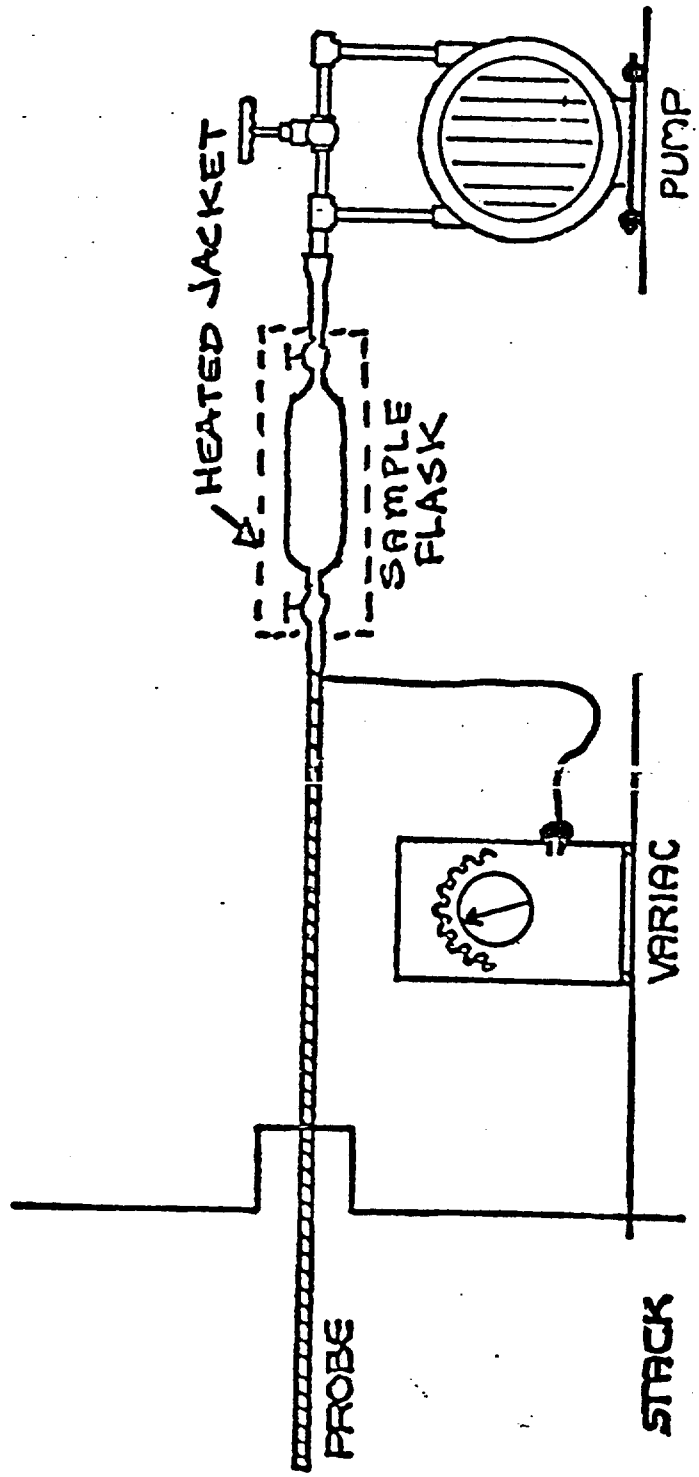

NOx SAMPLING TRAIN
EVACUATE
PURGE
SAMPLE
PUMP
MERCURY MANOMETER
NOx FLASK
VARIAC
PROBE
STACK

FIGURE 4



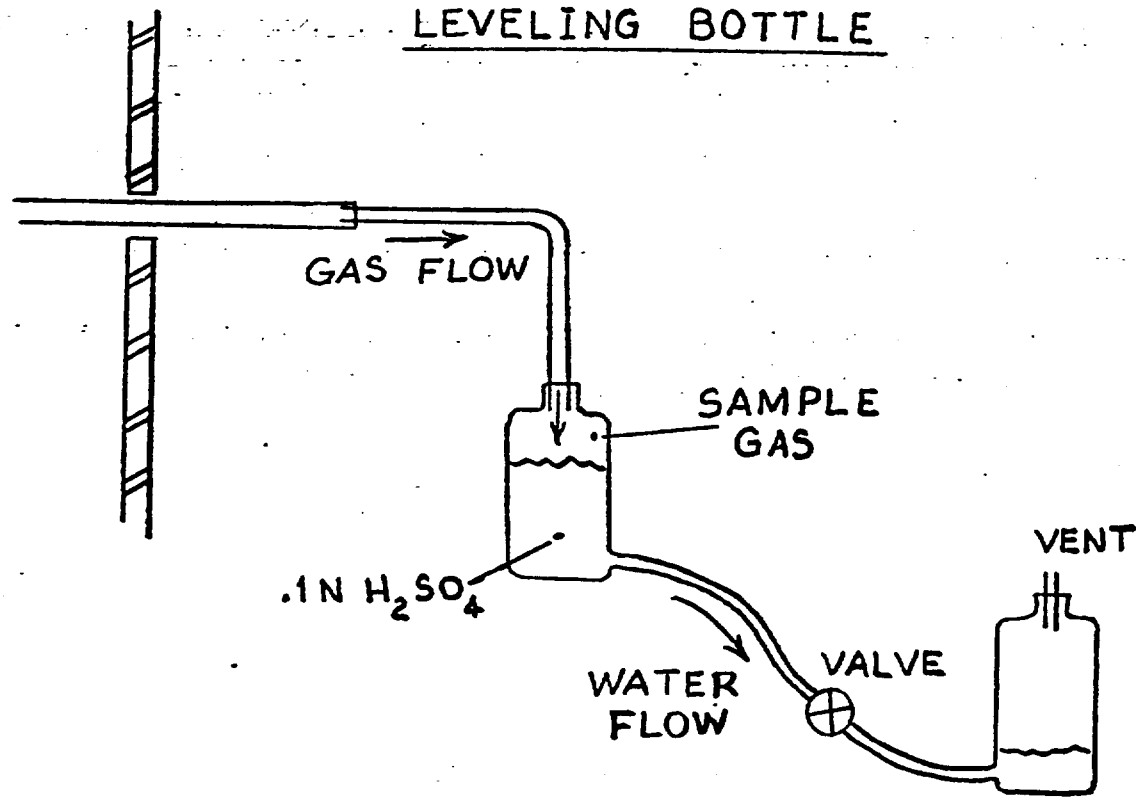

$SO_2$ SAMPLING TRAIN

FIGURE # 5




HYDROCARBON SAMPLING
FIGURE 6

## FLUE GAS COLLECTION BY LEVELING BOTTLE




## ORSAT SAMPLE ANALYSIS

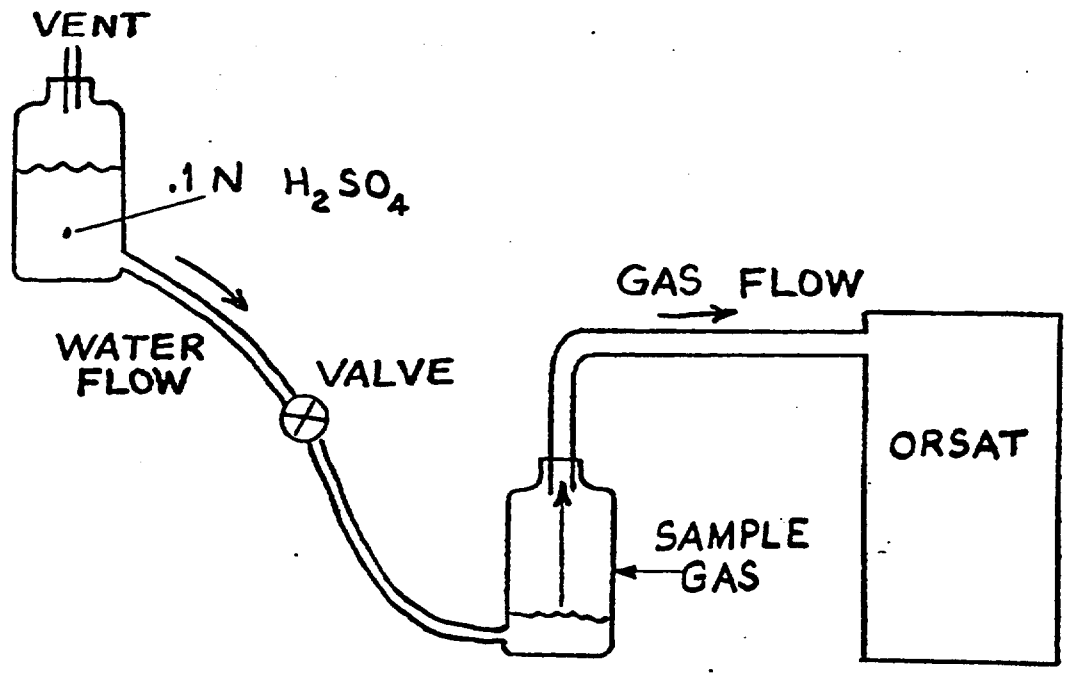



FIGURE # 7

## B. ANALYTICAL DATA

# ANALYTICAL DATA

PLANT Norwalk Waste Incinerator

DATE 12/26/74

SAMPLING LOCATION Stack

SAMPLE TYPE EPA Method 5 Particulate

RUN NUMBER 1

SAMPLE BOX NUMBER 7-101

CLEAN-UP MAN LCM

COMMENTS:

## FRONT HALF

| | | LABORATORY RESULTS |
|---|---|---|
| ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER | CONTAINER F1-1652 | 30.54 mg |
| FILTER NUMBER F1-1652 | CONTAINER 13 | 54.25 mg |
| FRONT HALF SUBTOTAL | | 84.79 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 | | 84.79 mg |

## MOISTURE

IMPINGERS

FINAL VOLUME 344 ml

INITIAL VOLUME 200 ml

NET VOLUME 144 ml

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | 328.2 g | g | g |
| INITIAL WEIGHT | 300.0 g | g | g |
| NET WEIGHT | 28.2 g | g | g |

TOTAL MOISTURE 172.2 g

ES-044

# ANALYTICAL DATA

PLANT Norwalk Waste Incinerator

DATE 12/27/74

SAMPLING LOCATION Stack

SAMPLE TYPE EPA Method 5 Particulate

RUN NUMBER 2

SAMPLE BOX NUMBER 7-101

CLEAN-UP MAN LCM

COMMENTS:

## FRONT HALF

| | | LABORATORY RESULTS |
|---|---|---|
| ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER | CONTAINER F1-1644 | 27.65 mg |
| FILTER NUMBER F1-1644 | CONTAINER 14 | 50.41 mg |
| | FRONT HALF SUBTOTAL | 78.06 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 | 78.06 mg |

## MOISTURE

IMPINGERS

| | | |
|---|---|---|
| FINAL VOLUME | 331 | ml |
| INITIAL VOLUME | 200 | ml |
| NET VOLUME | 131 | ml |

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | 324.8 g | g | g |
| INITIAL WEIGHT | 300.0 g | g | g |
| NET WEIGHT | 24.8 g | g | g |

TOTAL MOISTURE 155.8 g

ES-044

# ANALYTICAL DATA

PLANT Norwalk Waste Incinerator

DATE 12/27/74

SAMPLING LOCATION Stack

SAMPLE TYPE EPA Method 5 Particulate

RUN NUMBER 3

SAMPLE BOX NUMBER 7-101

CLEAN-UP MAN LCM

COMMENTS:

## FRONT HALF

| | | LABORATORY RESULTS |
|---|---|---|
| ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER | CONTAINER F1-1632 | 22.24 mg |
| FILTER NUMBER F1-1637 | CONTAINER 15 | 34.78 mg |
| | FRONT HALF SUBTOTAL | 57.02 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 | 57.02 mg |

## MOISTURE

IMPINGERS

FINAL VOLUME 342. ml

INITIAL VOLUME 200 ml

NET VOLUME 142 ml

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | 332.2 g | _____ g | _____ g |
| INITIAL WEIGHT | 300.0 g | _____ g | _____ g |
| NET WEIGHT | 32.2 g | _____ g | _____ g |

TOTAL MOISTURE 174.2 g

ES-044

# ANALYSIS REPORT

Project Number Y-8566

Date 1/7/75

Client Dorr Oliver Norwalk

Report to Incline

| York No. | Test No. | Sample Description | Test Required | Results |
|---|---|---|---|---|
| 1 | 1A | Hydrocarbon Flask | Hydrocarbon as Methane (ppm) | 114. |
| 2 | 1B | | | 128. |
| 3 | 1C | | | 117. |
| 4 | 2A | | | 111. |
| 5 | 2B | | | 114. |
| 6 | 2C | | | 108. |
| 7 | 3A | | | 113. |
| 8 | 3B | | | 85. |
| 9 | 3C | | | 119. |

Analyst _____

Approved _____

## C. $SO_2$ AND $NO_x$ EMISSION DATA

# $SO_x$ EMISSION DATA
as $SO_2$

Client Dorr Oliver Norwalk Sludge Incinerator

Plant Location Norwalk Ct.

Unit Tested Sludge Incinerator

Load Full

| Run Number | 1 | 2 | 3 | | | |
|---|---|---|---|---|---|---|
| Date | 12-26-74 | 12-27-74 | 12-27-74 | | | |
| mg $SO_2$ Collected | 25.6 | 24.9 | 26.6 | | | |
| ppm $SO_2$ by Volume Dry | 183. | 164. | 163. | | | |
| Stack Flow (SCFMD) | 10351 | 11046. | 11405 | | | |
| Lb./Hr. $SO_2$ | 18.7 | 18.0 | 18.5 | | | |
| MMBTU/Hr. Heat Input | — | — | — | | | |
| Lb./MMBTU $SO_2$ | — | — | — | | | |
| % $O_2$ | 5.5 | 6.1 | 5.8 | | | |
| ppm $SO_2$ @ % $O_2$ | — | — | — | | | |
| % Excess Air | — | — | — | | | |
| ppm $SO_2$ @ % Excess Air | — | — | — | | | |
| mg $SO_3$ Collected | — | — | — | | | |
| ppm $SO_3$ by Volume Dry | — | — | — | | | |
| Lb./Hr. $SO_3$ | — | — | — | | | |
| Lb./MMBTU $SO_3$ | — | — | — | | | |
| ppm $SO_3$ @ % $O_2$ | — | — | — | | | |
| ppm $SO_3$ @ % Excess Air | — | — | — | | | |



QUALITY CONTROLLED YORK RESEARCH CORPORATION

REPORT NO. Y8566



## OXIDES OF NITROGEN EMISSIONS

Client NORWALK SEWAGE INCINERATOR

Plant Location NORWALK, CONN

Unit Tested

Load FULL LOAD

| Run Number | 1A | 1B | 1C | 2A | 2B | 2C |
|---|---|---|---|---|---|---|
| Date | 12-26-74 | | | 12-27-74 | | |
| Mg. $NO_2$ Collected | .281 | .341 | .318 | .140 | .307 | .254 |
| PPM as $NO_2$ by Volume Dry | 72.14 | 85.76 | 78.8 | 36.98 | 81.52 | 67.10 |
| Stack Flow (SCFMD) | 10,351 | 10,351 | 10,351 | 11,046 | 11,046 | 11,046 |
| Lb/Hr. as $NO_2$ | 5.3 | 6.3 | 5.79 | 2.91 | 6.41 | 5.27 |
| MMBTU/Hr. Heat Input | | | | | | |
| Lb/MMBTU as $NO_2$ | | | | | | |
| % $O_2$ | | | | | | |
| PPM as $NO_2$ @ _____ %$O_2$ | | | | | | |
| % Excess Air | | | | | | |
| PPM as $NO_2$ @ _____ % Excess Air | | | | | | |



QUALITY CONTROLLED YORK RESEARCH CORPORATION

REPORT NO. Y8566



## OXIDES OF NITROGEN EMISSIONS

Client NORWALK SEWAGE INCINERATOR

Plant Location NORWALK CONN.

Unit Tested

Load FULL LOAD

| | | | | | | |
|---|---|---|---|---|---|---|
| Run Number | 3A | 3B | 3C | | | |
| Date | 12-27-74 | | | | | |
| Mg. $NO_2$ Collected | 325 | .252 | .379 | | | |
| PPM as $NO_2$ by Volume Dry | 84.56 | 67.58 | 98.13 | | | |
| Stack Flow (SCFMD) | 11,405 | 11,405 | 11,405 | | | |
| Lb/Hr. as $NO_2$ | 6.88 | 5.50 | 5.15 | | | |
| MMBTU/Hr. Heat Input | | | | | | |
| Lb/MMBTU as $NO_2$ | | | | | | |
| % $O_2$ | | | | | | |
| PPM as $NO_2$ @ _____ %$O_2$ | | | | | | |
| % Excess Air | | | | | | |
| PPM as $NO_2$ @ _____ % Excess Air | | | | | | |



QUALITY CONTROLLED YORK RESEARCH CORPORATION

## D. TRAVERSE DATA

YORK RESEARCH CORPORATION
ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06906

JOB NUMBER: Y-8566

CLIENT: DORR-OLIVER
LAMT LOCATION: NORWALK,CONN.
UNIT TESTED: SEWAGE INCINERATOR
DUCT NUMBER: OUTLET
DUCT AREA: 3.14SQ.FT.,24" DIA.
DUCT LOCATION: OUTLET
FILTER NUMBERS: FL-1652

TEST NUMBER: 1
DATE: DEC26,74
TEST COND: 2000 LBS/HR
BAR. PRESS-IN HG: 30.36
PITOT TUBE FACTOR: 0.850
TIME TEST STARTED: 1330

| SAMPLE POINT — | ELAP TIME (MIN) | SAMPLE VOLUME (DCF) | PITOT RDG (INH2O) | ORIFICE RDG (INH2O) | METERTEMP (DEG.F) IN | OUT | NOZ DIA (IN) | STACK TEMP (DF) | STACK VEL (FPS) | %I — — |
|---|---|---|---|---|---|---|---|---|---|---|
| STAR | 0. | 647.572 | | | | | | | | |
| A1 | 5.0 | 651.200 | 1.600 | 1.900 | 42. | 38. | 0.188 | 100. | 73.429 | 104.7 |
| A2 | 10.0 | 654.320 | 1.000 | 1.180 | 56. | 41. | 0.188 | 105. | 58.309 | 112.4 |
| A3 | 15.0 | 657.300 | 1.000 | 1.180 | 57. | 42. | 0.188 | 100. | 58.050 | 106.7 |
| A4 | 20.0 | 660.160 | 1.200 | 1.480 | 59. | 43. | 0.188 | 100. | 63.591 | 93.3 |
| A5 | 25.0 | 663.580 | 1.450 | 1.700 | 60. | 43. | 0.188 | 95. | 69.589 | 101.0 |
| A6 | 30.0 | 666.920 | 1.200 | 1.480 | 57. | 43. | 0.188 | 95. | 63.306 | 108.7 |
| A7 | 35.0 | 669.600 | 1.100 | 1.300 | 56. | 43. | 0.188 | 100. | 60.884 | 91.5 |
| A8 | 40.0 | 672.720 | 1.100 | 1.300 | 56. | 42. | 0.188 | 100. | 60.884 | 106.7 |
| A9 | 45.0 | 675.540 | 1.000 | 1.180 | 55. | 42. | 0.188 | 100. | 58.050 | 101.2 |
| A10 | 50.0 | 678.340 | 0.900 | 1.070 | 55. | 42. | 0.188 | 100. | 55.071 | 105.2 |
| A11 | 55.0 | 681.180 | 0.900 | 1.070 | 55. | 42. | 0.188 | 105. | 55.317 | 107.9 |
| A12 | 60.0 | 684.000 | 1.000 | 1.180 | 57. | 42. | 0.188 | 105. | 58.309 | 101.4 |
| A13 | 65.0 | 686.520 | 0.800 | 0.970 | 58. | 43. | 0.188 | 105. | 52.153 | 101.1 |
| A14 | 70.0 | 689.020 | 0.800 | 0.970 | 58. | 47. | 0.188 | 100. | 51.922 | 99.5 |
| STAR | 70.0 | 689.020 | | | | | | | | |
| B1 | 75.0 | 692.200 | 1.500 | 1.780 | 51. | 41. | 0.188 | 100. | 71.097 | 93.7 |
| B2 | 80.0 | 695.520 | 1.500 | 1.780 | 59. | 43. | 0.188 | 100. | 71.097 | 96.9 |
| B3 | 85.0 | 698.700 | 1.400 | 1.650 | 61. | 44. | 0.188 | 105. | 68.992 | 96.3 |
| B4 | 90.0 | 702.060 | 1.350 | 1.600 | 63. | 44. | 0.188 | 105. | 67.749 | 103.4 |
| B5 | 95.0 | 705.200 | 1.200 | 1.480 | 64. | 44. | 0.188 | 105. | 63.874 | 102.4 |
| B6 | 100.0 | 708.320 | 1.200 | 1.480 | 64. | 45. | 0.188 | 105. | 63.874 | 101.6 |
| B7 | 105.0 | 711.640 | 1.300 | 1.550 | 64. | 45. | 0.188 | 100. | 66.188 | 103.4 |
| B8 | 110.0 | 714.900 | 1.300 | 1.550 | 67. | 46. | 0.188 | 95. | 65.891 | 100.8 |
| B9 | 115.0 | 717.920 | 1.200 | 1.480 | 67. | 47. | 0.188 | 95. | 63.306 | 97.0 |
| B10 | 120.0 | 721.000 | 1.180 | 1.420 | 66. | 48. | 0.188 | 95. | 62.777 | 99.8 |
| B11 | 125.0 | 724.120 | 1.180 | 1.420 | 66. | 47. | 0.188 | 100. | 63.059 | 101.6 |
| B12 | 130.0 | 727.580 | 1.100 | 1.300 | 66. | 47. | 0.188 | 100. | 60.884 | 116.7 |
| B13 | 135.0 | 730.000 | 1.100 | 1.300 | 65. | 47. | 0.188 | 100. | 60.884 | 81.7 |
| B14 | 140.0 | 732.112 | 0.800 | 0.970 | 65. | 47. | 0.188 | 100. | 51.922 | 83.5 |

YORK RESEARCH CORPORATION
ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06906

JOB NUMBER: Y-8566

CLIENT: DORR-OLIVER
PLANT LOCATION: NORWALK,CONN.
UNIT TESTED: SEWAGE INCINERATOR
DUCT NUMBER: OUTLET
DUCT AREA: 3.14SQ.FT.,24" DIA.
DUCT LOCATION: OUTLET
FILTER NUMBERS: FL-1644

TEST NUMBER: 2
DATE: DEC27,74
TEST COND: 2000 LBS/HR
BAR. PRESS-IN HG: 30.21
PITOT TUBE FACTOR: 0.850
TIME TEST STARTED: 0805

| SAMPLE POINT — | ELAP TIME (MIN) | SAMPLE VOLUME (DCF) | PITOT RDG (INH2O) | ORIFICE RDG (INH2O) | METERTEMP (DEG.F) IN | OUT | NOZ DIA (IN) | STACK TEMP (DF) | STACK VEL (FPS) | %I -- -- |
|---|---|---|---|---|---|---|---|---|---|---|
| STAR | 0. | 732.200 | | | | | | | | |
| B1 | 5.0 | 735.840 | 1.500 | 1.750 | 42. | 34. | 0.188 | 90. | 70.217 | 107.0 |
| B2 | 10.0 | 739.060 | 1.400 | 1.650 | 52. | 36. | 0.188 | 95. | 68.144 | 97.3 |
| B3 | 15.0 | 742.280 | 1.400 | 1.650 | 57. | 37. | 0.188 | 95. | 68.144 | 96.8 |
| B4 | 20.0 | 745.500 | 1.300 | 1.550 | 59. | 38. | 0.188 | 100. | 65.960 | 100.6 |
| B5 | 25.0 | 749.000 | 1.300 | 1.550 | 61. | 40. | 0.188 | 100. | 65.960 | 108.9 |
| B6 | 30.0 | 752.300 | 1.450 | 1.700 | 63. | 42. | 0.188 | 100. | 69.662 | 96.9 |
| B7 | 35.0 | 755.360 | 1.400 | 1.650 | 65. | 45. | 0.188 | 100. | 68.450 | 91.1 |
| B8 | 40.0 | 758.640 | 1.300 | 1.550 | 65. | 45. | 0.188 | 105. | 66.254 | 101.7 |
| B9 | 45.0 | 762.000 | 1.300 | 1.550 | 66. | 45. | 0.188 | 100. | 65.960 | 103.6 |
| B10 | 50.0 | 765.000 | 1.200 | 1.480 | 67. | 46. | 0.188 | 100. | 63.372 | 96.1 |
| B11 | 55.0 | 768.120 | 1.200 | 1.480 | 67. | 47. | 0.188 | 100. | 63.372 | 99.9 |
| B12 | 60.0 | 771.000 | 1.000 | 1.180 | 66. | 47. | 0.188 | 100. | 57.851 | 101.0 |
| B13 | 65.0 | 773.520 | 1.000 | 1.180 | 66. | 48. | 0.188 | 95. | 57.592 | 87.9 |
| B14 | 70.0 | 776.000 | 0.800 | 0.950 | 66. | 49. | 0.188 | 95. | 51.512 | 96.6 |
| STAR | 70.0 | 776.000 | | | | | | | | |
| A1 | 75.0 | 779.520 | 1.700 | 2.000 | 65. | 49. | 0.188 | 100. | 75.428 | 94.8 |
| A2 | 80.0 | 783.100 | 1.650 | 1.950 | 67. | 51. | 0.188 | 105. | 74.642 | 97.9 |
| A3 | 85.0 | 786.700 | 1.600 | 1.880 | 68. | 51. | 0.188 | 105. | 73.502 | 99.9 |
| A4 | 90.0 | 790.120 | 1.600 | 1.880 | 70. | 52. | 0.188 | 100. | 73.176 | 94.2 |
| A5 | 95.0 | 793.540 | 1.450 | 1.700 | 69. | 52. | 0.188 | 100. | 69.662 | 99.0 |
| A6 | 100.0 | 796.880 | 1.400 | 1.650 | 68. | 52. | 0.188 | 100. | 68.450 | 98.5 |
| A7 | 105.0 | 800.260 | 1.400 | 1.650 | 68. | 51. | 0.188 | 95. | 68.144 | 99.3 |
| A8 | 110.0 | 803.580 | 1.300 | 1.550 | 66. | 51. | 0.188 | 95. | 65.665 | 101.4 |
| A9 | 115.0 | 806.820 | 1.250 | 1.510 | 64. | 50. | 0.188 | 100. | 64.679 | 101.6 |
| A10 | 120.0 | 809.940 | 1.250 | 1.510 | 63. | 49. | 0.188 | 100. | 64.679 | 98.0 |
| A11 | 125.0 | 813.220 | 1.200 | 1.480 | 65. | 49. | 0.188 | 100. | 63.372 | 105.0 |
| A12 | 130.0 | 816.140 | 1.100 | 1.300 | 64. | 49. | 0.188 | 95. | 60.403 | 97.2 |
| A13 | 135.0 | 819.000 | 1.000 | 1.180 | 64. | 48. | 0.188 | 95. | 57.592 | 100.0 |
| A14 | 140.0 | 821.922 | 1.000 | 1.180 | 63. | 48. | 0.188 | 95. | 57.592 | 102.2 |

YORK RESEARCH CORPORATION
ONE RESEARCH DRIVE, STAMFORD, CONNECTICUT 06906

JOB NUMBER: Y-8566

CLIENT: DORR-OLIVER
PLANT LOCATION: NORWALK,CONN.
UNIT TESTED: SEWAGE INCINERATOR
DUCT NUMBER: OUTLET
DUCT AREA: 3.14SQ.FT.,24" DIA.
DUCT LOCATION: OUTLET
FILTER NUMBERS: FL-1637

TEST NUMBER: 3
DATE: DEC27,74
TEST COND: 2000 LBS/HR
BAR. PRESS-IN HG: 30.07
PITOT TUBE FACTOR: 0.850
TIME TEST STARTED: 1106

| SAMPLE POINT -- | ELAP TIME (MIN) | SAMPLE VOLUME (DCF) | PITOT RDG (INH2O) | ORIFICE RDG (INH2O) | METERTEMP (DEG.F) IN | OUT | NOZ DIA (IN) | STACK TEMP (DF) | STACK VEL (FPS) | %I -- -- |
|---|---|---|---|---|---|---|---|---|---|---|
| STAR | 0. | 822.038 | | | | | | | | |
| A1 | 5.0 | 825.600 | 1.600 | 1.880 | 46. | 42. | 0.188 | 100. | 73.365 | 101.6 |
| A2 | 10.0 | 828.940 | 1.650 | 1.950 | 55. | 43. | 0.188 | 100. | 74.503 | 92.9 |
| A3 | 15.0 | 832.420 | 1.700 | 2.000 | 57. | 43. | 0.188 | 100. | 75.623 | 95.2 |
| A4 | 20.0 | 836.000 | 1.500 | 1.750 | 61. | 45. | 0.188 | 105. | 71.352 | 104.1 |
| A5 | 25.0 | 839.420 | 1.500 | 1.750 | 62. | 45. | 0.188 | 100. | 71.036 | 99.0 |
| A6 | 30.0 | 842.700 | 1.550 | 1.850 | 63. | 46. | 0.188 | 95. | 71.887 | 92.8 |
| A7 | 35.0 | 845.880 | 1.400 | 1.650 | 64. | 47. | 0.188 | 95. | 68.320 | 94.5 |
| A8 | 40.0 | 849.240 | 1.400 | 1.650 | 63. | 47. | 0.188 | 95. | 68.320 | 99.9 |
| A9 | 45.0 | 852.420 | 1.350 | 1.600 | 63. | 47. | 0.188 | 95. | 67.089 | 96.3 |
| A10 | 50.0 | 854.900 | 1.350 | 1.600 | 60. | 47. | 0.188 | 100. | 67.391 | 75.6 |
| A11 | 55.0 | 858.100 | 1.200 | 1.480 | 60. | 47. | 0.188 | 100. | 63.536 | 103.5 |
| A12 | 60.0 | 861.300 | 1.200 | 1.480 | 61. | 47. | 0.188 | 100. | 63.536 | 103.4 |
| A13 | 65.0 | 864.260 | 1.000 | 1.180 | 61. | 47. | 0.188 | 100. | 58.001 | 104.7 |
| A14 | 70.0 | 867.000 | 0.900 | 1.050 | 61. | 47. | 0.188 | 100. | 55.024 | 102.1 |
| STAR | 70.0 | 867.000 | | | | | | | | |
| B1 | 75.0 | 870.720 | 1.900 | 2.250 | 60. | 47. | 0.188 | 100. | 79.948 | 95.8 |
| B2 | 80.0 | 874.240 | 1.700 | 2.000 | 64. | 47. | 0.188 | 100. | 75.623 | 95.4 |
| B3 | 85.0 | 878.100 | 1.700 | 2.000 | 64. | 47. | 0.188 | 105. | 75.960 | 105.1 |
| B4 | 90.0 | 881.560 | 1.550 | 1.850 | 66. | 47. | 0.188 | 100. | 72.210 | 98.0 |
| B5 | 95.0 | 884.940 | 1.500 | 1.750 | 69. | 49. | 0.188 | 100. | 71.036 | 96.9 |
| B6 | 100.0 | 888.360 | 1.500 | 1.750 | 69. | 49. | 0.188 | 95. | 70.718 | 97.6 |
| B7 | 105.0 | 892.000 | 1.450 | 1.700 | 69. | 50. | 0.188 | 95. | 69.529 | 105.5 |
| B8 | 110.0 | 895.160 | 1.400 | 1.650 | 69. | 52. | 0.188 | 100. | 68.627 | 93.5 |
| B9 | 115.0 | 898.460 | 1.400 | 1.650 | 67. | 51. | 0.188 | 100. | 68.627 | 97.9 |
| B10 | 120.0 | 901.680 | 1.350 | 1.600 | 67. | 51. | 0.188 | 100. | 67.391 | 97.2 |
| B11 | 125.0 | 905.200 | 1.400 | 1.650 | 68. | 51. | 0.188 | 100. | 68.627 | 104.3 |
| B12 | 130.0 | 908.520 | 1.200 | 1.480 | 67. | 50. | 0.188 | 100. | 63.536 | 106.4 |
| B13 | 135.0 | 911.600 | 1.200 | 1.480 | 66. | 50. | 0.188 | 100. | 63.536 | 98.8 |
| B14 | 140.0 | 914.320 | 1.000 | 1.180 | 66. | 50. | 0.188 | 100. | 58.001 | 95.5 |

## E. RAW FIELD DATA

Y-8566

# FIELD DATA

PLANT NORWALK WASTE WATER INCIN.
DATE 12/26/77
SAMPLING LOCATION STACK
SAMPLE TYPE EPA #5 PART
RUN NUMBER #1
OPERATOR LCM
AMBIENT TEMPERATURE 30
BAROMETRIC PRESSURE 30.36
STATIC PRESSURE, ($P_s$) 2.4" WATER POSITIVE
FILTER NUMBER (s) FL-1652

IMP #1 -236 ml
IMP #2,3 -108 ml

PROBE LENGTH AND TYPE 4' EPA
NOZZLE I.D. 3/16
ASSUMED MOISTURE, % 7
SAMPLE BOX NUMBER 7-101
METER BOX NUMBER 3-1049
METER $\Delta H_@$ 1.82
C FACTOR .94
PROBE HEATER SETTING 90
HEATER BOX SETTING 300
REFERENCE $\Delta p$ 1.55

BURNING 2000/HR DRY SOLID

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

| TRAVERSE POINT NUMBER | SAMPLING TIME, min | CLOCK TIME (24 hr CLOCK) | GAS METER READING ($V_m$), $ft^3$ | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | ORIFICE PRESSURE DIFFERENTIAL ($\Delta H$), in. $H_2O$ DESIRED | ORIFICE PRESSURE DIFFERENTIAL ($\Delta H$), in. $H_2O$ ACTUAL | STACK TEMPERATURE ($T_s$), °F | DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F | DRY GAS METER TEMPERATURE OUTLET ($T_{m\ out}$), °F | PUMP VACUUM, in. Hg | SAMPLE BOX TEMPERATURE, °F | IMPINGER TEMPERATURE, °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| START | 0 | 1330 | 647.572 | | | | | | | | | |
| A1 | 5 | 1335 | 651.20 | 1.60 | 1.90 | 1.90 | 100 | 42 | 38 | 4 | 300 | 34 |
| 2 | 10 | 1340 | 654.32 | 1.00 | 1.18 | 1.18 | 105 | 56 | 41 | 4 | 300 | 38 |
| 3 | 15 | 1345 | 657.30 | 1.00 | 1.18 | 1.15 | 100 | 57 | 42 | 4 | 300 | 40 |
| 4 | 20 | 1350 | 660.16 | 1.20 | 1.48 | 1.48 | 100 | 59 | 43 | 4 | 300 | 42 |
| 5 | 25 | 1355 | 663.58 | 1.45 | 1.70 | 1.70 | 95 | 60 | 43 | 4 | 300 | 42 |
| 6 | 30 | 1400 | 666.92 | 1.20 | 1.48 | 1.48 | 95 | 57 | 43 | 4 | 300 | 45 |
| 7 | 35 | 1405 | 669.60 | 1.10 | 1.30 | 1.30 | 100 | 56 | 43 | 4 | 300 | 47 |
| 8 | 40 | 1410 | 672.72 | 1.10 | 1.30 | 1.30 | 100 | 56 | 42 | 4 | 300 | 48 |
| 9 | 45 | 1415 | 675.54 | 1.00 | 1.18 | 1.18 | 100 | 55 | 42 | 4 | 300 | 47 |
| 10 | 50 | 1420 | 678.34 | .90 | 1.07 | 1.07 | 100 | 55 | 42 | 3 | 300 | 48 |
| 11 | 55 | 1425 | 681.18 | .90 | 1.07 | 1.07 | 105 | 55 | 42 | 3 | 300 | 50 |
| 12 | 60 | 1430 | 684.00 | 1.00 | 1.18 | 1.18 | 105 | 57 | 42 | 3 | 300 | 50 |
| 13 | 65 | 1435 | 686.52 | .80 | .97 | .97 | 105 | 58 | 43 | 3 | 300 | 50 |
| 14 | 70 | 1440 | 689.020 | .80 | .97 | .97 | 100 | 58 | 47 | 3 | 300 | 50 |
| START | 70 | 1442 | 689.020 | — | — | — | — | — | — | — | — | — |
| B1 | 75 | 1447 | 692.20 | 1.50 | 1.78 | 1.78 | 100 | 51 | 41 | 3 | 300 | 50 |
| 2 | 80 | 1452 | 695.52 | 1.50 | 1.78 | 1.78 | 100 | 54 | 43 | 3 | 300 | 56 |
| 3 | 85 | 1457 | 698.70 | 1.40 | 1.65 | 1.65 | 105 | 61 | 44 | 3 | 300 | 63 |
| 4 | 90 | 1502 | 702.06 | 1.35 | 1.60 | 1.60 | 105 | 63 | 44 | 3 | 300 | 65 |
| 5 | 95 | 1507 | 705.20 | 1.20 | 1.48 | 1.48 | 105 | 64 | 44 | 3 | 300 | 68 |
| 6 | 100 | 1512 | 708.32 | 1.20 | 1.48 | 1.48 | 105 | 64 | 45 | 3 | 300 | 70 |
| 7 | 105 | 1517 | 711.64 | 1.30 | 1.55 | 1.55 | 100 | 64 | 45 | 3 | 300 | 70 |
| 8 | 110 | 1522 | 714.90 | 1.30 | 1.55 | 1.55 | 95 | 67 | 46 | 3 | 300 | 72 |

COMMENTS:

ES-041

Y-8566

# FIELD DATA

QUALITY CONTROLLED YORK RESEARCH CORPORATION

PLANT NORWALK INCIN.
DATE 12/26
SAMPLING LOCATION
SAMPLE TYPE
RUN NUMBER #1
OPERATOR LCM
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, ($P_s$)
FILTER NUMBER (s)

TEST #1 CONTINUED

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER $\Delta H_@$
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE $\Delta p$

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

| TRAVERSE POINT NUMBER | SAMPLING TIME, min | CLOCK TIME (24-hr CLOCK) | GAS METER READING ($V_m$), $ft^3$ | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | ORIFICE PRESSURE DIFFERENTIAL ($\Delta H$), in. $H_2O$ DESIRED | ORIFICE PRESSURE DIFFERENTIAL ($\Delta H$), in. $H_2O$ ACTUAL | STACK TEMPERATURE ($T_s$), °F | DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F | DRY GAS METER TEMPERATURE OUTLET ($T_{m\ out}$), °F | PUMP VACUUM, in. Hg | SAMPLE BOX TEMPERATURE, °F | IMPINGER TEMPERATURE, °F | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B 9 | 115 | 1527 | 717.92 | 1.20 | 1.48 | 1.48 | 95 | 67 | 47 | 3 | 300 | 72 | |
| 10 | 120 | 1532 | 721.00 | 1.18 | 1.42 | 1.42 | 95 | 66 | 48 | 3 | 300 | 74 | $CO_2$ |
| 11 | 125 | 1537 | 724.12 | 1.18 | 1.42 | 1.42 | 100 | 66 | 47 | 3 | 300 | 72 | 11.5 |
| 12 | 130 | 1542 | 727.58 | 1.10 | 1.30 | 1.30 | 100 | 66 | 47 | 3 | 300 | 72 | 12.0 |
| 13 | 135 | 1547 | 730.00 | 1.10 | 1.30 | 1.30 | 100 | 65 | 47 | 3 | 300 | 72 | |
| 14 | 140 | 1552 | 732.112 | .80 | .97 | .97 | 100 | 65 | 47 | 3 | 300 | 72 | |
| | | | 84.54 | | | | | | | | | | |
| | | | | | | | 100.54 | | 51.73 | | | | |
| | | | AVG | 1.156 | .1383 | | | | | | | | |

COMMENTS:

ES-041

Y-8566

# FIELD DATA

QUALITY CONTROLLED YORK RESEARCH CORPORATION

PLANT NORWALK WASTE WATER INCIN.
DATE 12/27/74
SAMPLING LOCATION STACK, SCRUBBER
SAMPLE TYPE EPA 5 PART.
RUN NUMBER #2
OPERATOR LCM
AMBIENT TEMPERATURE 35
BAROMETRIC PRESSURE 30.21
STATIC PRESSURE, ($P_s$) +2.2" H2O
FILTER NUMBER (s) FL-1644

IMP# 1 - 165 ml
IMP#2,3 - 166 ml

PROBE LENGTH AND TYPE 4' EPA.
NOZZLE I.D. 3/16
ASSUMED MOISTURE, % 7
SAMPLE BOX NUMBER 7-101
METER BOX NUMBER 5-1049
METER $\Delta H_@$ 1.82
C FACTOR .94
PROBE HEATER SETTING 90
HEATER BOX SETTING 300
REFERENCE $\Delta p$ 1.55

BURNIN #2 OIL WITH SLUD

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

| TRAVERSE POINT NUMBER | SAMPLING TIME, min | CLOCK TIME (24-hr CLOCK) | GAS METER READING ($V_m$), $ft^3$ | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | ORIFICE PRESSURE DIFFERENTIAL ($\Delta H$), in. $H_2O$ DESIRED | ORIFICE PRESSURE DIFFERENTIAL ($\Delta H$), in. $H_2O$ ACTUAL | STACK TEMPERATURE ($T_s$), °F | DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F | DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F | PUMP VACUUM, in. Hg | SAMPLE BOX TEMPERATURE, °F | IMPINGER TEMPERATURE, °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| START | 0 | 805 | 732.200 | | | | | | | | | |
| B1 | 5 | 810 | 735.84 | 1.50 | 1.75 | 1.75 | 90 | 42 | 34 | 3 | 300 | 40 |
| 2 | 10 | 815 | 739.06 | 1.40 | 1.65 | 1.65 | 95 | 52 | 36 | 3 | 300 | 40 |
| 3 | 15 | 820 | 742.28 | 1.40 | 1.65 | 1.65 | 95 | 57 | 37 | 3 | 300 | 52 |
| 4 | 20 | 825 | 745.50 | 1.30 | 1.55 | 1.55 | 100 | 59 | 38 | 3 | 300 | 54 |
| 5 | 25 | 830 | 749.00 | 1.30 | 1.55 | 1.55 | 100 | 61 | 40 | 3 | 300 | 58 |
| 6 | 30 | 835 | [illegible] | 1.45 | 1.70 | 1.70 | 100 | 63 | 42 | 3 | 300 | 62 |
| 7 | 35 | 840 | 755.36 | 1.40 | 1.65 | 1.65 | 100 | 65 | 45 | 3 | 300 | 66 |
| 8 | 40 | 845 | 758.64 | 1.30 | 1.55 | 1.55 | 105 | 65 | 45 | 3 | 300 | 66 |
| 9 | 45 | 850 | 762.00 | 1.30 | 1.55 | 1.55 | 100 | 66 | 45 | 3 | 300 | 67 |
| 10 | 50 | 855 | 765.00 | 1.20 | 1.48 | 1.48 | 100 | 67 | 46 | 3 | 300 | 67 |
| 11 | 55 | 900 | 768.12 | 1.20 | 1.48 | 1.48 | 100 | 67 | 47 | 3 | 300 | 66 |
| 12 | 60 | 905 | 771.00 | 1.00 | 1.18 | 1.18 | 100 | 66 | 47 | 3 | 300 | 66 |
| 13 | 65 | 910 | 773.52 | 1.00 | 1.18 | 1.18 | 95 | 66 | 48 | 3 | 300 | 62 |
| 14 | 70 | 915 | 776.000 | .80 | .95 | .95 | 95 | 66 | 49 | 2 | 300 | 62 |
| START | 70 | 916 | 776.000 | — | — | — | — | — | — | — | — | — |
| #1 | 75 | 921 | 779.52 | 1.70 | 2.00 | 2.00 | 100 | 65 | 49 | 3 | 300 | 58 |
| 2 | 80 | 926 | 783.10 | 1.65 | 1.95 | 1.95 | 105 | 67 | 51 | 3 | 300 | 61 |
| 3 | 85 | 931 | 786.70 | 1.60 | 1.88 | 1.88 | 105 | 68 | 51 | 3 | 300 | 64 |
| 4 | 90 | 936 | 790.12 | 1.60 | 1.88 | 1.88 | 100 | 70 | 52 | 3 | 300 | 65 |
| 5 | 95 | 941 | 793.54 | 1.45 | 1.70 | 1.70 | 100 | 69 | 52 | 3 | 300 | 65 |
| 6 | 100 | 946 | 796.88 | 1.40 | 1.65 | 1.65 | 100 | 68 | 52 | 3 | 300 | 65 |
| 7 | 105 | 951 | 800.26 | 1.40 | 1.65 | 1.65 | 95 | 68 | 51 | 3 | 300 | 64 |
| 8 | 110 | 956 | 803.58 | 1.30 | 1.55 | 1.55 | 95 | 66 | 51 | 3 | 300 | 62 |

$CO_2$ 11.5 12.

COMMENTS:

ES-041

Y-8566

# FIELD DATA

QUALITY CONTROLLED YORK RESEARCH CORPORATION

PLANT NORWALK WASTE WATER INCIN.
DATE 12/27/74
SAMPLING LOCATION
SAMPLE TYPE
RUN NUMBER
OPERATOR LCM
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, ($P_s$)
FILTER NUMBER (s)

TEST #2 (CONT.)

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER $\Delta H_@$
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE $\Delta p$

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY _____ MINUTES

| TRAVERSE POINT NUMBER | SAMPLING TIME, min | CLOCK TIME (24-hr CLOCK) | GAS METER READING ($V_m$), $ft^3$ | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | ORIFICE PRESSURE DIFFERENTIAL ($\Delta H$), in. $H_2O$ DESIRED | ORIFICE PRESSURE DIFFERENTIAL ($\Delta H$), in. $H_2O$ ACTUAL | STACK TEMPERATURE ($T_s$), °F | DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F | DRY GAS METER TEMPERATURE OUTLET ($T_{m\ out}$), °F | PUMP VACUUM, in. Hg | SAMPLE BOX TEMPERATURE, °F | IMPINGER TEMPERATURE, °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 115 | 1001 | 806.87 | 1.25 | 1.51 | 1.51 | 100 | 64 | 50 | 3 | 300 | 58 |
| 10 | 120 | 1006 | 809.94 | 1.25 | 1.51 | 1.51 | 100 | 63 | 49 | 3 | 300 | 58 |
| 11 | 125 | 1011 | 813.22 | 1.20 | 1.48 | 1.48 | 100 | 65 | 49 | 3 | 300 | 57 |
| 12 | 130 | 1016 | 816.14 | 1.10 | 1.30 | 1.30 | 95 | 64 | 49 | 3 | 300 | 57 |
| 13 | 135 | 1021 | 819.00 | 1.00 | 1.13 | 1.18 | 95 | 64 | 48 | 3 | 300 | 56 |
| 14 | 140 | 1026 | 821.922 | 1.00 | 1.18 | 1.18 | 95 | 63 | 48 | 3 | 300 | 56 |
| | | | 89.722 | | | | | | | | | |
| | | | AVG. | 1.375 | 1.546 | | 98.57 | | 54.00 | | | |

COMMENTS:

ES-041

Y-8566

FIELD DATA

QUALITY CONTROLLED YORK RESEARCH CORPORATION

PLANT NORWALK WASTE WATER INCIN.
DATE 12/27/74
SAMPLING LOCATION SCRUBBER STACK
SAMPLE TYPE EPA #5. PART.
RUN NUMBER #3
OPERATOR LCM
AMBIENT TEMPERATURE 40
BAROMETRIC PRESSURE 30.07
STATIC PRESSURE, ($P_s$) -2.4
FILTER NUMBER (s) FL-1637

IMP#1 -174 ml
IMP#2,3 -168 ml

PROBE LENGTH AND TYPE 4' EPA
NOZZLE I.D. 3/16
ASSUMED MOISTURE, % 7
SAMPLE BOX NUMBER 7-101
METER BOX NUMBER S-1049
METER $\Delta H_@$ 1.82
C FACTOR .94
PROBE HEATER SETTING 90
HEATER BOX SETTING 300
REFERENCE $\Delta p$ 1.55

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

| TRAVERSE POINT NUMBER | SAMPLING TIME, min | CLOCK TIME (24 hr CLOCK) | GAS METER READING ($V_m$), $ft^3$ | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | ORIFICE PRESSURE DIFFERENTIAL ($\Delta H$), in. $H_2O$ DESIRED | ORIFICE PRESSURE DIFFERENTIAL ($\Delta H$), in. $H_2O$ ACTUAL | STACK TEMPERATURE ($T_s$), °F | DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F | DRY GAS METER TEMPERATURE OUTLET ($T_{m\ out}$), °F | PUMP VACUUM, in. Hg | SAMPLE BOX TEMPERATURE, °F | IMPINGER TEMPERATURE, °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| START | 0 | 1106 | 822.038 | | | | | | | | | |
| A1 | 5 | 1111 | 825.60 | 1.60 | 1.85 | 1.88 | 100 | 46 | 42 | 3 | 300 | 46 |
| 2 | 10 | 1116 | 828.41 | 1.65 | 1.95 | 1.95 | 100 | 55 | 43 | 3 | 300 | 47 |
| 3 | 15 | 1121 | 832.42 | 1.70 | 2.00 | 2.00 | 100 | 57 | 43 | 3 | 300 | 48 |
| 4 | 20 | 1126 | 836.00 | 1.50 | 1.75 | 1.75 | 105 | 61 | 45 | 3 | 300 | 53 |
| 5 | 25 | 1131 | 839.42 | 1.50 | 1.75 | 1.75 | 100 | 62 | 45 | 3 | 300 | 55 |
| 6 | 30 | 1136 | 842.70 | 1.55 | 1.85 | 1.85 | 95 | 63 | 46 | 3 | 300 | 57 |
| 7 | 35 | 1141 | 845.88 | 1.40 | 1.65 | 1.65 | 95 | 64 | 47 | 3 | 300 | 57 |
| 8 | 40 | 1146 | 849.24 | 1.40 | 1.65 | 1.65 | 95 | 63 | 47 | 3 | 300 | 57 |
| 9 | 45 | 1151 | 852.42 | 1.35 | 1.60 | 1.60 | 95 | 63 | 47 | 3 | 300 | 57 |
| 10 | 50 | 1156 | 854.90 | 1.35 | 1.60 | 1.60 | 100 | 60 | 47 | 3 | 300 | 60 |
| 11 | 55 | 1201 | 858.10 | 1.20 | 1.46 | 1.48 | 100 | 60 | 47 | 3 | 300 | 60 |
| 12 | 60 | 1206 | 861.30 | 1.20 | 1.46 | 1.48 | 100 | 61 | 47 | 3 | 300 | 60 |
| 13 | 65 | 1211 | 864.26 | 1.00 | 1.18 | 1.18 | 100 | 61 | 47 | 3 | 300 | 60 |
| 14 | 70 | 1216 | 867.000 | 1.00 | 1.05 | 1.05 | 100 | 61 | 47 | 3 | 300 | 60 |
| STOP | 70 | 1217 | 867.000 | — | — | — | — | — | — | — | — | — |
| B1 | 75 | 1222 | 870.72 | 1.90 | 2.25 | 2.25 | 100 | 60 | 47 | 3 | 300 | 58 |
| 2 | 80 | 1227 | 874.34 | 1.70 | 2.00 | 2.00 | 100 | 64 | 47 | 3 | 300 | 60 |
| 3 | 85 | 1232 | 878.10 | 1.70 | 2.00 | 2.00 | 105 | 64 | 47 | 3 | 300 | 62 |
| 4 | 90 | 1237 | 881.56 | 1.55 | 1.85 | 1.85 | 100 | 66 | 47 | 3 | 300 | 62 |
| 5 | 95 | 1242 | 884.94 | 1.50 | 1.75 | 1.75 | 100 | 69 | 49 | 3 | 300 | 64 |
| 6 | 100 | 1247 | 888.36 | 1.50 | 1.75 | 1.75 | 95 | 69 | 49 | 3 | 300 | 65 |
| 7 | 105 | 1252 | 892.00 | 1.45 | 1.70 | 1.70 | 95 | 69 | 50 | 3 | 300 | 68 |
| 8 | 110 | 1257 | 895.16 | 1.40 | 1.65 | 1.65 | 100 | 69 | 52 | 3 | 300 | 68 |

COMMENTS:

ES-041

Y-8566

# FIELD DATA

QUALITY CONTROLLED YORK RESEARCH CORPORATION

PLANT NORWALK WATER WASTE INCIN.
DATE 12/27/74
SAMPLING LOCATION
SAMPLE TYPE
RUN NUMBER #-3
OPERATOR LCM
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, ($P_s$)
FILTER NUMBER (s)

TEST #3 (CONT.)

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER $\Delta H_@$
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE $\Delta p$

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY _____ MINUTES

| TRAVERSE POINT NUMBER | SAMPLING TIME, min | CLOCK TIME (24-hr CLOCK) | GAS METER READING ($V_m$), $ft^3$ | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | ORIFICE PRESSURE DIFFERENTIAL ($\Delta H$), in. $H_2O$ DESIRED | ORIFICE PRESSURE DIFFERENTIAL ($\Delta H$), in. $H_2O$ ACTUAL | STACK TEMPERATURE ($T_s$), °F | DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F | DRY GAS METER TEMPERATURE OUTLET ($T_{m\ out}$), °F | PUMP VACUUM, in. Hg | SAMPLE BOX TEMPERATURE, °F | IMPINGER TEMPERATURE, °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 115 | 1302 | 898.46 | 1.40 | 1.65 | 1.65 | 100 | 67 | 51 | 3 | 300 | 68 |
| 10 | 120 | 1307 | 901.68 | 1.35 | 1.60 | 1.60 | 100 | 67 | 51 | 3 | 300 | 68 |
| 11 | 125 | 1312 | 905.20 | 1.40 | 1.65 | 1.65 | 100 | 68 | 51 | 3 | 300 | 70 |
| 12 | 130 | 1317 | 908.52 | 1.20 | 1.48 | 1.48 | 100 | 67 | 50 | 3 | 300 | 70 |
| 13 | 135 | 1322 | 911.60 | 1.20 | 1.48 | 1.48 | 100 | 66 | 50 | 3 | 300 | 70 |
| 14 | 140 | 1327 | 914.320 | 1.00 | 1.18 | 1.18 | 100 | 66 | 50 | 3 | 300 | 70 |
| | | | | | | | | | 55.34 | | | |
| | | | AVG. | 1.413 | 1.674 | | 99.29 | | | | | |
| | | | 92.282 | | | | | | | | | |

COMMENTS:

ES-041

JOB NO. 1-2266

Material Sampled for $SO_x$

Date 12/26/74

Plant Norwalk Square Tower Location Norwalk, Conn

Bar. Pressure 30.40 "Hg Comments: Full Load

Ambient Temp. 30° F

Run No. #1

Power Stat Setting 70

Filter Used: Yes ____ No ✓

Operator LR

| CLOCK TIME | METER ($Ft^3$) | FLOW METER SETTING (CFM) | METER TEMPERATURE TM |
|---|---|---|---|
| ~~13:30~~ | ~~241.7~~ | | 30°F |
| 13:35 | 241.792 | .5 | 30°F |
| 13:40 | 242.170 | .5 | 30°F |
| 13:45 | 242.600 | .55 | 30°F |
| 13:50 | 243.031 | .55 | 30°F |
| 13:55 | 243.485 | .6 | 30°F |
| | Purge 13:55 to 14:15 | | |
| | | | |

Comments: 1.69

Impinger Bucket No. ____

Meter Box No. ____

NCAP 36 (12/67)

Material Sampled for _____

Date 12/27/74

Plant Norwalk Steam Turbine Location Norwalk Conn.

Bar. Pressure 30.21 "Hg Comments: Full Load

Ambient Temp. 32°F

Run No. #2

Power Stat Setting _____

Filter Used: Yes ____ No X

Operator LR

| CLOCK TIME | METER ($Ft^3$) | FLOW METER SETTING (CFM) | METER TEMPERATURE TM |
|---|---|---|---|
| 8:25 | 246.166 | 6 | 32°F |
| 8:30 | 246635 | 6 | 34°F |
| 8:35 | 247085 | 6 | 34°F |
| 8:40 | 247575 | 6 | 34°F |
| 8:45 | 248028 | 6 | 34°F |
| | Purge 8:45 to 9:05 | | |
| | | | |
| | | | |

Comments: 1.862

Impinger Bucket No. _____

Meter Box No. _____

NCAP 36 (12/67)

Job No. _____

Material Sampled for SO2

Date 12/27/78

Plant Norwalk Savings Incinerator Location Norwalk Conn

Bar. Pressure 30.07 "Hg Comments: Full Load

Ambient Temp. 47°F

Run No. #3

Power Stat Setting —

Filter Used: Yes ____ No X

Operator LB

| CLOCK TIME | METER ($Ft^3$) | FLOW METER SETTING (CFM) | METER TEMPERATURE TM |
|---|---|---|---|
| 11:10 | 250.015 | 6.5 | 40°F |
| 11:15 | 250.437 | 6.5 | 40°F |
| 11:20 | 251.016 | 7.0 | 40°F |
| 11:25 | 251.565 | 7.0 | 42°F |
| 11:30 | 252.060 | 6.7 | 42°F |
| | Avg. 11:30 to 11:35 | | |
| | | | |
| | | | |

Comments: 2.045

Impinger Bucket No. _____

Meter Box No. _____

NCAP 36 (12/57)

# OXIDES OF NITROGEN FIELD DATA

Job No. Y-8566

Client Norwalk Water Sewage Incinerator

Plant Location Norwalk Conn

Unit No. 1 #Test #1

Sampling Location STACK

Operator LB

| | (36) | 37 | 38 | | | |
|---|---|---|---|---|---|---|
| Run Number | 1/A | 1/B | 1/C | | | |
| Date | 12/20/72 | 12/26/72 | 12/20/72 | | | |
| Flask Number | 28 | 25 | 27 | | | |
| Flask Volume Corrected (liters) ($V_f$) | | | | | | |
| Initial Flask Vacuum (in.Hg) (Pi) | 28.0 | 27.8 | 27.9 | | | |
| Final Flask Vacuum (in.Hg) ($P_f$ | 0.5 | 0.0 | +.1 | | | |
| Flask Temperature ($T_f$) | 30°F | 30°F | 30°F | | | |
| % $O_2$ | 5.5 | 5.5 | 6.0 | | | |
| | 13:40 | 14:10 | 14:45 | | | |
| | 9:45 | 9:47 | 9:48 | | | |

14.4 14.5
13.4 13.5
27.8 28.0

ES-054

# OXIDES OF NITROGEN FIELD DATA

Job No. Y-8566

Client Norwalk Sewage Incinerator

Plant Location Norwalk, Conn

Unit No. 1 Test #2

Sampling Location STACK

Operator LB

| | 39 | 40 | 41 | | | |
|---|---|---|---|---|---|---|
| Run Number | 2A | 2B | 2C | | | |
| Date | 12/27/74 | 12/27/74 | 12/27/74 | | | |
| Flask Number | 6 | 10 | 8 | | | |
| Flask Volume Corrected (liters) ($V_f$) | | | | | | |
| Initial Flask Vacuum (in.Hg) (Pi) | ~~27.7~~ 27.7 | 27.9 | 27.8 | | | |
| Final Flask Vacuum (in.Hg) (Pf | +.4 | +1.0 | +.4 | | | |
| Flask Temperature ($T_f$) | 32° | 32° | 32° | | | |
| % $O_2$ | 6.2 | 6.0 | 6.0 | | | |
| | 8:50 | 9:30 | 10:00 | | | |
| | 9:15 | 9:15 | 9:15 | | | |

| | | |
|---|---|---|
| 14.5 | 14.6 | 14.6 |
| 13.2 | 13.3 | 13.2 |
| 27.7 | 27.9 | 27.8 |

12/30/74

ES-054

QUALITY CONTROLLED YORK RESEARCH CORPORATION

# OXIDES OF NITROGEN FIELD DATA

Job No. X-85GG

Client Norwalk Sewage Treatment

Plant Location Norwalk, Conn.

Unit No. 1 #3

Sampling Location STACK - roof

Operator LB

| | 42 | 43 | 44 | | | |
|---|---|---|---|---|---|---|
| Run Number | 3/A | 3/B | 3/C | | | |
| Date | 12/27/74 | 12/27/74 | 12/27/74 | | | |
| Flask Number | 25 | 28 | 27 | | | |
| Flask Volume Corrected (liters) ($V_f$) | | | | | | |
| Initial Flask Vacuum (in.Hg) (Pi) | 27.6 | 27.6 | 27.7 | | | |
| Final Flask Vacuum (in.Hg) (Pf | 0 | +.6 | +.4 | | | |
| Flask Temperature ($T_f$) | 42° | 42° | 42° | | | |
| % $O_2$ | 5.7 | 5.9 | 5.9 | | | |
| | 11:35 | 12:00 | 12:30 | | | |
| | 9:20 | 9:20 | 9:20 | 12/30/74 | | |

14.4
13.2
27.6

ES-054

QUALITY CONTROLLED YORK RESEARCH CORPORATION

JOB NO. Y-8566

ORSAT FIELD DATA

Location Norwalk Waste Water Sewage Incinerator

Comments:

Date 12/26/74

Time

Operator JB

| Test | ($CO_2$) Reading 1 | ($O_2$) Reading 2 | (CO) Reading 3 |
|---|---|---|---|
| * 1 | 9.2 9.0 9.0 | 6.8 | — |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

10.3
-1.6
8.7

17.4
1.6
15.8
9
6.8

17.4

JOB NO Y-8566

ORSAT FIELD DATA

Location Stack

Comments:

Date 12/27/74

Time

Operator LB

| Test | ($CO_2$) Reading 1 | ($O_2$) Reading 2 | (CO) Reading 3 |
|---|---|---|---|
| 2 | 11<br>10.8<br>10.8<br>10.8 | 5.8 | |
| 3 | 10.8<br>11.0<br>11.0 | 6.2 | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

16
16.6
16.6
10.8
5.8

17.2
17.2

## F. CALCULATIONS

# 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

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

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.

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

15. Particulate - total, lb/hr.

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

16. % Excess air at sampling point

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

## GASEOUS EMISSIONS CALCULATIONS

### GENERAL EQUATIONS

A. Parts Per Million (ppm) by Volume Dry:

$$ppm = \frac{(48.15)(mg_{comp})(T_m + 460)}{(MW)(V_m)(P_m)}$$

$$ppm\ @\ \underline{X}\ \%\ EA = ppm\ measured \times \frac{(Total\ Air\ @\ meas'd.\ EA)}{(Total\ Air\ @\ \underline{X}\ \%\ EA)}$$

Where: Total Air = 100 + EA (For $O_2$, equivalent Excess Air Used)

B. Pounds Per Hour (Lb./Hr.):

$$Lb./Hr. = \frac{(7.467 \times 10^{-6})(mg_{comp})(Q_s)(T_m + 460)}{(V_m)\ (P_m)}$$

Where:
- $mg_{comp}$ = weight of component sampled (mg)
- $T_m$ = Temperature of Meter (°F)
- MW = Molecular weight of Component
- $V_m$ = Metered gas volume (ACF)
- $P_m$ = Meter pressure (in. Hg absolute)
- $Q_s$ = Stack gas flow (SCFMD)

### SPECIFIC EQUATIONS

$SO_2$, Sulfur Dioxide (MW=64.1)

$$ppm = \frac{(.7512)(mg\ SO_2)(T_m + 460)}{(P_m)\ (V_m)}$$

$SO_3$, Sulfur Trioxide (MW=80.1)

$$ppm = \frac{(.6011)(mg\ SO_3)(T_m + 460)}{(P_m)\ (V_m)}$$

Hg, Mercury (MW=200.6)

$$ppm = \frac{(.2400)(mg\ Hg)(T_m + 460)}{(P_m)\ (V_m)}$$

$F^-$, Fluoride (MW=19.0)

$$ppm = \frac{(2.534)(mg\ F^-)(T_m + 460)}{(P_m)\ (V_m)}$$

$Cl^-$, Chloride (MW=35.5)

$$ppm = \frac{(1.356)(mg\ Cl^-)(T_m + 460)}{(P_m)\ (V_m)}$$

HCl, Hydrogen Chloride (MW=36.5)

$$ppm = \frac{(1.319)(mg\ HCl)(T_m + 460)}{(P_m)\ (V_m)}$$

$NO_x$, Oxides of Nitrogen as $NO_2$ (MW=46.0)

$$ppm = \frac{(1.047)(mg\ NO_2)(T_F + 460)}{(P_i - P_f)\ (V_F,\ CF)}$$

F denotes Flask
i denotes initial
f denotes final
$V_F$, CF = liters/28.32

ES 056-1/74