Appendix 5

AP-42 Section 11.23
Reference 6
Report Sect. 4
Reference 3

# Emission Testing Report

## EMB Report No. 74-HAS-1

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.

## R E S E R V E  M I N I N G  C O M P A N Y

Silver Bay, Minnesota

Environmental Protection Agency
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

June 1974

# INTRODUCTION


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# INTRODUCTION

This report describes an emission and process sampling program conducted at the Reserve Mining Company taconite processing facilities located in Silver Bay, Minnesota, during the week of September 10, 1973. The plant processes taconite ore and produces pellets which are ideally suited for blast furnace feed. Approximately 85,000 tons per day of ore are received in railroad cars from the mine at Babbitt, Minnesota where it has been crushed to minus 4-inch size. The processing facility reduces the ore to minus 3/4-inch size by ten sets of cone crushers. The crushed ore is then delivered by belt to the Concentrator Building where it is ground and separated by 22 parallel units. Each unit consists of the following items operated in series: a rod mill, a rougher magnetic separator, a ball mill, a cleaner magnetic separator, a regrind ball mill, a finisher magnetic separator, and a disc filter. The filter cake is mixed with a small amount of bentonite clay and delivered to 36 large rotating drums which roll it into balls of about 1/2" diameter. The balls are then fed into 8 traveling grate pelletizing machines where they are first dried, then heated to over 2200°F, then passed through an oxidizing section, then a cooling section. This transforms them into hard pellets.

Four emission points were sampled for particulate matter--exhaust stack No. 110 on the west No. 104 fine crusher, waste gas stack on pelletizer No. 5, hood vent stack on pelletizer No. 5, east concentrator stack No. 118. These locations are shown in Figure 1. In addition, process samples were obtained at the outlet of the crusher, and from the conveyor belts which feed the pelletizer. The primary purpose of the test was to identify and quantify possible asbestos emissions.

Samples obtained were subjected to a series of analytical techniques designed to identify chemical composition and physical form. Specific emphasis was placed upon the identification and characterization of asbestos minerals. Techniques employed include X-ray diffraction, light microscope, and electron microscope procedures.

Emission samples were obtained by a Battelle (Columbus Laboratories) test team under contract and directed by EPA. Emission samples were analyzed by Battelle and by McCrone Associates. Process samples were analyzed by Battelle.

Prior stack tests to determine particulate matter emission rates have been conducted by the Company and by the State of Minnesota.

Reserve Mining results of particulate matter stack tests run on #6 pelletizer waste gas hood and exhaust stacks during February and March 1973, average 0.19 and 0.068 grains/scf for waste gas and hood exhaust, respectively. Company calculations give a dust load of 194.5 lbs/hr from #6 waste gas stack when its concentration was 0.215 grains/scf. The State of Minnesota made tests on the waste gas stacks of #5 and #6 pelletizer furnaces. At 135 wet tons/hr ball feed, the results were 0.52 and 0.61 grains/scf, respectively.

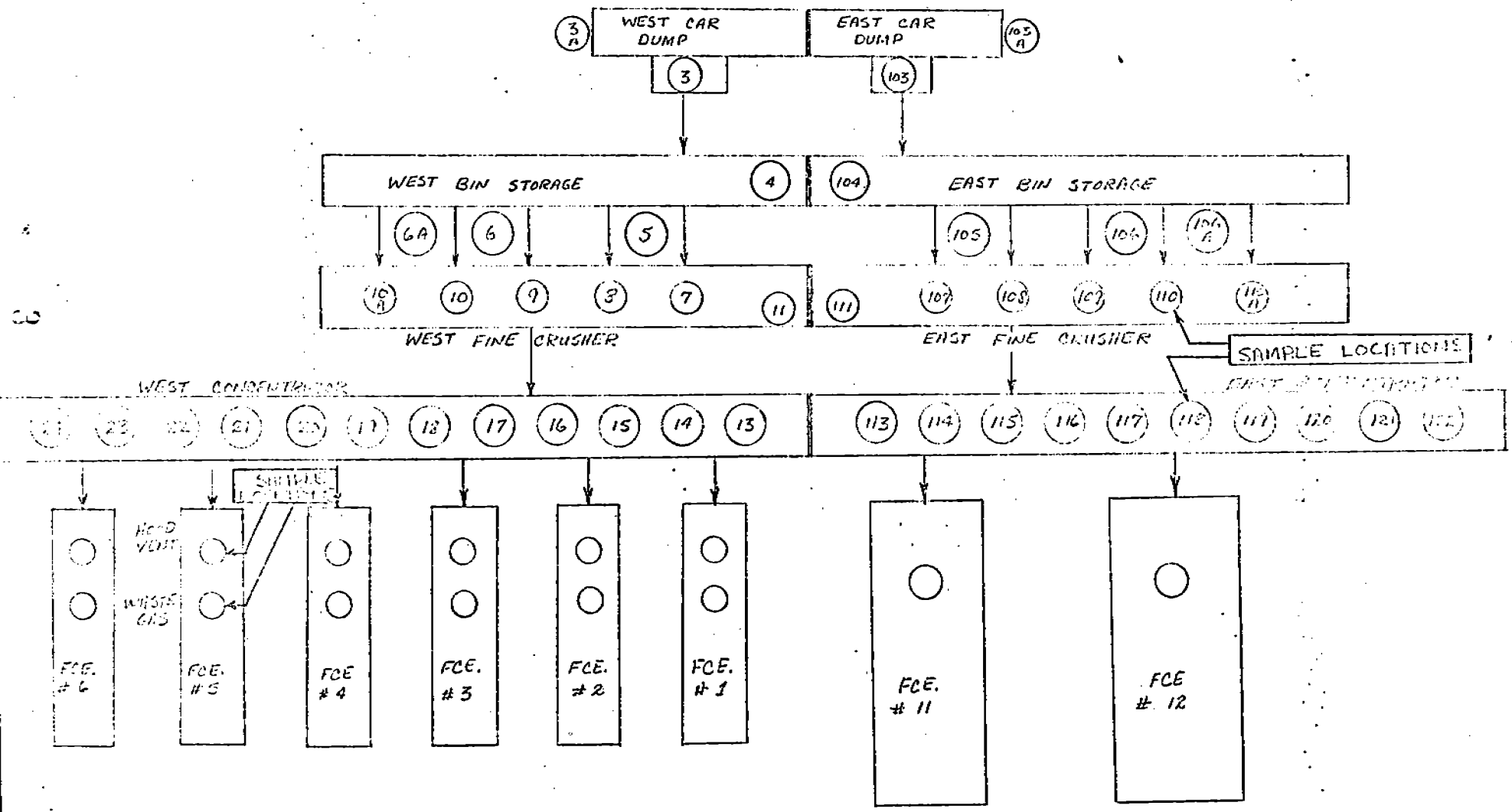


Figure 1: Sampling Locations, Reserve Mining Company, Silver Bay, Minnesota

## SUMMARY AND DISCUSSION OF RESULTS

Under Environmental Protection Agency direction, Battelle personnel collected a total of eleven particulate samples from four process emission locations at the Reserve Mining facility. Three samples were collected downstream of the control device serving one of the ten fine crusher lines; four samples were collected from the waste gas stack serving pelletizer No. 5; three samples were collected from the hood vent stack serving pelletizer No. 5; and one sample was collected after the control device serving one of the concentrator-storage bin systems.

The collected samples were then transported to EPA laboratories in Durham, North Carolina where the filter fractions were weighed. The samples from Run Nos. 1 (fine crusher), 6 (waste gas), and 10 (hood vent) were then sent to Battelle Columbus Laboratories for total particulate and asbestos analysis. The results of these analysis are covered in this report.

The samples from Run Nos. 2 (fine crusher), 5 (waste gas), 9 (hood vent), and 11 (concentrator) were sent to McCrone Associates, for asbestos analysis, and the results will be reported separately by the Office of Technical Analysis, EPA. The remaining samples have been stored for possible future analysis.

The sampling data for each of the eleven runs is summarized in Tables A-1 to A-10 in Appendix A. These summaries include sampling parameters and stack flow rate data.

The results of testing for the three runs that were analyzed by Battelle are summarized in Tables 1-18. The total particulate emissions found are given in Tables 1-3. The total asbestos emissions are given in Tables 4-6, and the amphibole emissions are given in Tables 7-9. Tables 10-18 are duplications in English units of the information presented in Tables 1-9.

The total particulate concentration found in the fine crusher exhaust was 11.3 mg/$NM^3$*. At a stack flow rate of 471 $NM^3$/min, the particulate mass flow rate was 0.32 kg/hr. Total asbestos accounted for 5.8 percent of the total mass in the sample, with essentially all of the asbestos being of the amphibole form. Only 0.02 percent of the asbestos was of the chrysotile form. The asbestos concentration and rate in the emissions was 0.65 mg/$NM^3$ and 0.02 kg/hr.

At the waste gas stack, the total particulate concentration was 355 mg/$DNM^3$ at 3270 $NM^3$/min flow, resulting in a particulate mass rate of 69.7 kg/hr. The asbestos weight was 0.2 percent of the total sample, with essentially all of the asbestos being amphibole. Chrysotile accounted for only 0.36 percent of the total asbestos. The asbestos emissions were at a concentration of 0.81 mg/$NM^3$ resulting in an emission rate of 0.16 kg/hr.

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*mg/$NM^3$ - Milligram/normal cubic meter, 21.1°C, 760 mmHg, dry

At the hood vent location, the total particulate concentration was 127.7 mg/$NM^3$ at a flow rate of 2700 $NM^3$/min. This results in a mass flow rate of 20.7 kg/hr. The weight of asbestos found in this sample was 0.35 percent of the total particulate weight. The asbestos concentration in the emission was 0.37 mg/$NM^3$ and the asbestos mass emission rate was 0.06 kg/hr. The asbestos was identified as the amphibole form, with no chrysotile being found.

The results reported for the fine crusher runs included the impinger water portion of the total sample, while results for the waste gas and hood vent locations do not. However, it is demonstrated by the results of Run 1 that essentially all (99.9%)of the asbestos was collected in the probe wash and filter portions of the sample, and that the addition of the asbestos mass collected in the impingers does not significantly effect the calculated results.

The sampling and analytical procedures are detailed in Section VII, and the complete laboratory report is given in Appendix C.

TABLE 1

PLANT: REPUBLIC MINING; SILVER BAY, MINNESOTA
LOCATION: FINE CRUSHER STACK110, TOTAL PARTICULATE EMISSIONS
OPERATOR: ENVIRONMENTAL PROTECTION AGENCY

PARTICULATE SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 3 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 9-11-73 | |
| STACK AREA | M2 | 0.369 | |
| NET TIME OF RUN | MIN | 120.0 | |
| BAROMETRIC PRESSURE | MM.HG | 739.14 | |
| AVG ORIFICE PRES DROP | MM.H2O | 44.704 | |
| VOL DRY GAS-METER COND | DM3 | 2.65 | |
| AVG GAS METER TEMP | DEG.C | 29.2 | |
| VOL DRY GAS-STD COND | DNM3 | 2.52 | |
| TOTAL H2O COLLECTED | ML | 19.2 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.03 | |
| PERCENT MOISTURE BY VOL | | 1.0 | |
| MOLE FRACTION DRY GAS | | 0.990 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.73 | |
| AVG STACK TEMPERATURE | DEG.C | 15.9 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 739.14 | |
| AVG STACK GAS VELOCITY | M/S | 21.706 | 21.706 |
| STK FLOWRATE, DRY,STD CN | DNM3/M | 471. | 471. |
| ACTUAL STACK FLOWRATE | AM3/M | 481. | 481. |
| PERCENT ISOKINETIC | | 98.1 | 98.1 |
| PARTICULATE WT-PARTIAL | MG | 26.70 | 26.70 |
| PARTICULATE WT-TOTAL | MG | 28.48 | 28.48 |
| PERC IMPINGER CATCH | | 6.3 | 6.3 |
| PART. LOAD-PTL,STD CN | MG/NM3 | 10.57 | 10.57 |
| PART. LOAD-TTL,STD CN | MG/NM3 | 11.27 | 11.27 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | ********** | ********** |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | ********** | ********** |
| PART. LOAD-PTL,STK CN | MG/AM3 | 10.35 | 10.35 |
| PART. LOAD-TTL,STK CN | MG/AM3 | 11.04 | 11.04 |
| PARTIC EMIS-PARTIAL | KG/HR | 0.30 | 0.30 |
| PARTIC EMIS-TOTAL | KG/HR | 0.32 | 0.32 |
| PART EMIS/WT PRD FD PTL | KG/MTON | 0.00073 | 0.00073 |
| PART EMIS/WT PRD FD TTL | KG/MTON | 0.00078 | 0.00078 |
| PERCENT EXCESS AIR | | ********** | |

TABLE 2

PLANT: RESERVE MINING CO., SILVER BAY, MINN.
LOCATION: WASTE GAS STACK, PELLETIZER NO. 5, TOTAL PARTICULATE EMISSIO
OPERATOR: ENVIORNMENTAL PROTECTION AGENCY

## PARTICULATE SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 6 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 09-12-73 | |
| STACK AREA | M2 | 2.590 | |
| NET TIME OF RUN | MIN | 37.0 | |
| BAROMETRIC PRESSURE | MM.HG | 743.71 | |
| AVG ORIFICE PRES DROP | MM.H2O | 46.990 | |
| VOL DRY GAS-METER COND | DM3 | 0.85 | |
| AVG GAS METER TEMP | DEG.C | 22.9 | |
| VOL DRY GAS-STD COND | DNM3 | 0.83 | |
| TOTAL H2O COLLECTED | ML | 53.8 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.07 | |
| PERCENT MOISTURE BY VOL | | 8.0 | |
| MOLE FRACTION DRY GAS | | 0.920 | |
| PERCENT CO2 BY VOL, DRY | | 0.8 | |
| PERCENT O2 BY VOL, DRY | | 20.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.2 | |
| MOLECULAR WT-DRY STK GAS | | 28.93 | |
| MOLECULAR WT-STK GAS | | 28.05 | |
| AVG STACK TEMPERATURE | DEG.C | 180.4 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 740.16 | |
| AVG STACK GAS VELOCITY | M/S | 36.252 | 36.252 |
| STK FLOWRATE, DRY,STD CN | DNM3/M | 3274. | 3274. |
| ACTUAL STACK FLOWRATE | AM3/M | 5634. | 5634. |
| PERCENT ISOKINETIC | | 105.4 | 105.4 |
| PARTICULATE WT-PARTIAL | MG | 294.30 | 294.30 |
| PARTICULATE WT-TOTAL | MG | 294.30 | 294.30 |
| PERC IMPINGER CATCH | | 0.0 | 0.0 |
| PART. LOAD-PTL,STD CN | MG/NM3 | 355.02 | 355.02 |
| PART. LOAD-TTL,STD CN | MG/NM3 | 355.02 | 355.02 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | 5325.33 | 5325.33 |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | 5325.33 | 5325.33 |
| PART. LOAD-PTL,STK CN | MG/AM3 | 206.18 | 206.18 |
| PART. LOAD-TTL,STK CN | MG/AM3 | 206.18 | 206.18 |
| PARTIC EMIS-PARTIAL | KG/HR | 69.74 | 69.74 |
| PARTIC EMIS-TOTAL | KG/HR | 69.74 | 69.74 |
| PART EMIS/WT PRD FD PTL | KG/MTON | 0.63534 | 0.63534 |
| PART EMIS/WT PRD FD TTL | KG/MTON | 0.63534 | 0.63534 |
| PERCENT EXCESS AIR | | 2200.7 | 2200.7 |

READY

TABLE 3

PLANT: RESERVE MINING CO., SILVER BAY, MINN.
LOCATION: HOOD VENT STACK, PELLETIZER NO. 5, TOTAL PARTICULATE EMISSIONS
OPERATOR: ENVIORNMENTAL PROTECTION AGENCY

## PARTICULATE SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 10 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 09-13-73 | |
| STACK AREA | M2 | 2.572 | |
| NET TIME OF RUN | MIN | 36.0 | |
| BAROMETRIC PRESSURE | MM.HG | 745.24 | |
| AVG ORIFICE PRES DROP | MM.H2O | 30.480 | |
| VOL DRY GAS-METER COND | DM3 | 0.65 | |
| AVG GAS METER TEMP | DEG.C | 25.6 | |
| VOL DRY GAS-STD COND | DNM3 | 0.63 | |
| TOTAL H2O COLLECTED | ML | 31.2 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.04 | |
| PERCENT MOISTURE BY VOL | | 6.2 | |
| MOLE FRACTION DRY GAS | | 0.938 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.17 | |
| AVG STACK TEMPERATURE | DEG.C | 120.0 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 742.70 | |
| AVG STACK GAS VELOCITY | M/S | 25.542 | 25.542 |
| STK FLOWRATE, DRY,STD CN | DNM3/M | 2705. | 2705. |
| ACTUAL STACK FLOWRATE | AM3/M | 3942. | 3942. |
| PERCENT ISOKINETIC | | 99.7 | 99.7 |
| PARTICULATE WT-PARTIAL | MG | 81.10 | 81.10 |
| PARTICULATE WT-TOTAL | MG | 81.10 | 81.10 |
| PERC IMPINGER CATCH | | 0.0 | 0.0 |
| PART. LOAD-PTL,STD CN | MG/NM3 | 127.74 | 127.74 |
| PART. LOAD-TTL,STD CN | MG/NM3 | 127.74 | 127.74 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | ********** | |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | ********** | |
| PART. LOAD-PTL,STK CN | MG/AM3 | 87.59 | 87.59 |
| PART. LOAD-TTL,STK CN | MG/AM3 | 87.59 | 87.59 |
| PARTIC EMIS-PARTIAL | KG/HR | 20.73 | 20.73 |
| PARTIC EMIS-TOTAL | KG/HR | 20.73 | 20.73 |
| PART EMIS/WT PRD FD PTL | KG/MTON | 0.16679 | 0.16679 |
| PART EMIS/WT PRD FD TTL | KG/MTON | 0.16679 | 0.16679 |
| PERCENT EXCESS AIR | | ********** | |

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TABLE 4

PLANT: RESERVE MINING COMPANY; SILVER BAY, MINNESOTA
LOCATION: FINE CRUSHER STACK 110, TOTAL ASBESTOS EMISSIONS
OPERATOR: ENVIRONMENTAL PROTECTION AGENCY

## PARTICULATE SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 3 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 9-11-73 | |
| STACK AREA | M2 | 0.369 | |
| NET TIME OF RUN | MIN | 120.0 | |
| BAROMETRIC PRESSURE | MM.HG | 739.14 | |
| AVG ORIFICE PRES DROP | MM.H2O | 44.704 | |
| VOL DRY GAS-METER COND | DM3 | 2.65 | |
| AVG GAS METER TEMP | DEG.C | 29.2 | |
| VOL DRY GAS-STD COND | DNM3 | 2.52 | |
| TOTAL H2O COLLECTED | ML | 19.2 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.03 | |
| PERCENT MOISTURE BY VOL | | 1.0 | |
| MOLE FRACTION DRY GAS | | 0.990 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.73 | |
| AVG STACK TEMPERATURE | DEG.C | 15.9 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 739.14 | |
| AVG STACK GAS VELOCITY | M/S | 21.706 | 21.706 |
| STK FLOWRATE, DRY, STD CN | DNM3/M | 471. | 471. |
| ACTUAL STACK FLOWRATE | AM3/M | 481. | 481. |
| PERCENT ISOKINETIC | | 98.1 | 98.1 |
| PARTICULATE WT-PARTIAL | MG | 1.65 | 1.65 |
| PARTICULATE WT-TOTAL | MG | 1.65 | 1.65 |
| PERC IMPINGER CATCH | | 0.1 | 0.1 |
| PART. LOAD-PTL,STD CN | MG/NM3 | 0.65 | 0.65 |
| PART. LOAD-TTL,STD CN | MG/NM3 | 0.65 | 0.65 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | ********** | |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | ********** | |
| PART. LOAD-PTL,STK CN | MG/AM3 | 0.64 | 0.64 |
| PART. LOAD-TTL,STK CN | MG/AM3 | 0.64 | 0.64 |
| PARTIC EMIS-PARTIAL | KG/HR | 0.02 | 0.02 |
| PARTIC EMIS-TOTAL | KG/HR | 0.02 | 0.02 |
| PART EMIS/WT PRD FD PTL | KG/MTON | 0.00005 | 0.00005 |
| PART EMIS/WT PRD FD TTL | KG/MTON | 0.00005 | 0.00005 |
| PERCENT EXCESS AIR | | ********** | |

TABLE 5

PLANT: RESERVE MINING CO., SILVER BAY, MINN.
LOCATION: WASTE GAS STACK, PELLETIZER NO. 5, TOTAL ASBESTOS EMISSIONS
OPERATOR: ENVIORNMENTAL PROTECTION AGENCY

## PARTICULATE SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 6 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 09-12-73 | |
| STACK AREA | M2 | 2.590 | |
| NET TIME OF RUN | MIN | 37.0 | |
| BAROMETRIC PRESSURE | MM.HG | 743.71 | |
| AVG ORIFICE PRES DROP | MM.H2O | 46.990 | |
| VOL DRY GAS-METER COND | DM3 | 0.85 | |
| AVG GAS METER TEMP | DEG.C | 22.9 | |
| VOL DRY GAS-STD COND | DNM3 | 0.83 | |
| TOTAL H2O COLLECTED | ML | 53.8 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.07 | |
| PERCENT MOISTURE BY VOL | | 8.0 | |
| MOLE FRACTION DRY GAS | | 0.920 | |
| PERCENT CO2 BY VOL, DRY | | 0.8 | |
| PERCENT O2 BY VOL, DRY | | 20.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.2 | |
| MOLECULAR WT-DRY STK GAS | | 28.93 | |
| MOLECULAR WT-STK GAS | | 28.05 | |
| AVG STACK TEMPERATURE | DEG.C | 180.4 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 740.16 | |
| AVG STACK GAS VELOCITY | M/S | 36.252 | 36.252 |
| STK FLOWRATE, DRY,STD CN | DNM3/M | 3274. | 3274. |
| ACTUAL STACK FLOWRATE | AM3/M | 5634. | 5634. |
| PERCENT ISOKINETIC | | 105.4 | 105.4 |
| PARTICULATE WT-PARTIAL | MG | 0.67 | 0.67 |
| PARTICULATE WT-TOTAL | MG | 0.67 | 0.67 |
| PERC IMPINGER CATCH | | 0.0 | 0.0 |
| PART. LOAD-PTL,STD CN | MG/NM3 | 0.81 | 0.81 |
| PART. LOAD-TTL,STD CN | MG/NM3 | 0.81 | 0.81 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | 12.09 | 12.09 |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | 12.09 | 12.09 |
| PART. LOAD-PTL,STK CN | MG/AM3 | 0.47 | 0.47 |
| PART. LOAD-TTL,STK CN | MG/AM3 | 0.47 | 0.47 |
| PARTIC EMIS-PARTIAL | KG/HR | 0.16 | 0.16 |
| PARTIC EMIS-TOTAL | KG/HR | 0.16 | 0.16 |
| PART EMIS/WT PRD FD PTL | KG/MTON | 0.00144 | 0.00144 |
| PART EMIS/WT PRD FD TTL | KG/MTON | 0.00144 | 0.00144 |
| PERCENT EXCESS AIR | | 2200.7 | 2200.7 |

READY

TABLE 6

PLANT: RESERVE MINING CO., SILVER BAY, MINN.
LOCATION: HOOD VENT STACK, PELLETIZER NO. 5, TOTAL ASBESTOS EMISSIONS
OPERATOR: ENVIORNMENTAL PROTECTION AGENCY

PARTICULATE SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 10 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 09-13-73 | |
| STACK AREA | M2 | 2.572 | |
| NET TIME OF RUN | MIN | 36.0 | |
| BAROMETRIC PRESSURE | MM.HG | 745.24 | |
| AVG ORIFICE PRES DROP | MM.H2O | 30.480 | |
| VOL DRY GAS-METER COND | DM3 | 0.65 | |
| AVG GAS METER TEMP | DEG.C | 25.6 | |
| VOL DRY GAS-STD COND | DNM3 | 0.63 | |
| TOTAL H2O COLLECTED | ML | 31.2 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.04 | |
| PERCENT MOISTURE BY VOL | | 6.2 | |
| MOLE FRACTION DRY GAS | | 0.938 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.17 | |
| AVG STACK TEMPERATURE | DEG.C | 120.0 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 742.70 | |
| AVG STACK GAS VELOCITY | M/S | 25.542 | 25.542 |
| STK FLOWRATE, DRY,STD CN | DNM3/M | 2705. | 2705. |
| ACTUAL STACK FLOWRATE | AM3/M | 3942. | 3942. |
| PERCENT ISOKINETIC | | 99.7 | 99.7 |
| PARTICULATE WT-PARTIAL | MG | 0.24 | 0.24 |
| PARTICULATE WT-TOTAL | MG | 0.24 | 0.24 |
| PERC IMPINGER CATCH | | 0.0 | 0.0 |
| PART. LOAD-PTL,STD CN | MG/NM3 | 0.37 | 0.37 |
| PART. LOAD-TTL,STD CN | MG/NM3 | 0.37 | 0.37 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | ********** | ********** |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | ********** | ********** |
| PART. LOAD-PTL,STK CN | MG/AM3 | 0.26 | 0.26 |
| PART. LOAD-TTL,STK CN | MG/AM3 | 0.26 | 0.26 |
| PARTIC EMIS-PARTIAL | KG/HR | 0.06 | 0.06 |
| PARTIC EMIS-TOTAL | KG/HR | 0.06 | 0.06 |
| PART EMIS/WT PRD FD PTL | KG/MTON | 0.00049 | 0.00049 |
| PART EMIS/WT PRD FD TTL | KG/MTON | 0.00049 | 0.00049 |

TABLE 7

PLANT: RESERVE MINING COMPANY; SILVER BAY, MINNESOTA
LOCATION: FINE CRUSHER STACK 110, AMPHIBOLE ASBESTOS EMISSIONS
OPERATOR: ENVIRONMENTAL PROTECTION AGENCY

## PARTICULATE SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 3 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 9-11-73 | |
| STACK AREA | M2 | 0.369 | |
| NET TIME OF RUN | MIN | 120.0 | |
| BAROMETRIC PRESSURE | MM.HG | 739.14 | |
| AVG ORIFICE PRES DROP | MM.H2O | 44.704 | |
| VOL DRY GAS-METER COND | DM3 | 2.65 | |
| AVG GAS METER TEMP | DEG.C | 29.2 | |
| VOL DRY GAS-STD COND | DNM3 | 2.52 | |
| TOTAL H2O COLLECTED | ML | 19.2 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.03 | |
| PERCENT MOISTURE BY VOL | | 1.0 | |
| MOLE FRACTION DRY GAS | | 0.990 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.73 | |
| AVG STACK TEMPERATURE | DEG.C | 15.9 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 739.14 | |
| AVG STACK GAS VELOCITY | M/S | 21.706 | 21.706 |
| STK FLOWRATE, DRY,STD CN | DNM3/M | 471. | 471. |
| ACTUAL STACK FLOWRATE | AM3/M | 481. | 481. |
| PERCENT ISOKINETIC | | 98.1 | 98.1 |
| PARTICULATE WT-PARTIAL | MG | 1.65 | 1.65 |
| PARTICULATE WT-TOTAL | MG | 1.65 | 1.65 |
| PERC IMPINGER CATCH | | 0.1 | 0.1 |
| PART. LOAD-PTL,STD CN | MG/NM3 | 0.65 | 0.65 |
| PART. LOAD-TTL,STD CN | MG/NM3 | 0.65 | 0.65 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | ********** | |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | ********** | |
| PART. LOAD-PTL,STK CN | MG/AM3 | 0.64 | 0.64 |
| PART. LOAD-TTL,STK CN | MG/AM3 | 0.64 | 0.64 |
| PARTIC EMIS-PARTIAL | KG/HR | 0.02 | 0.02 |
| PARTIC EMIS-TOTAL | KG/HR | 0.02 | 0.02 |
| PART EMIS/WT PRD FD PTL | KG/MTON | 0.00005 | 0.00005 |
| PART EMIS/WT PRD FD TTL | KG/MTON | 0.00005 | 0.00005 |
| PERCENT EXCESS AIR | | ********** | |

TABLE 8

PLANT: RESERVE MINING CO., SILVER BAY, MINN.
LOCATION: WASTE GAS STACK, PELLETIZER NO. 5, AMPHIBOLE EMISSIONS
OPERATOR: ENVIORNMENTAL PROTECTION AGENCY

## PARTICULATE SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 6 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 09-12-73 | |
| STACK AREA | M2 | 2.590 | |
| NET TIME OF RUN | MIN | 37.0 | |
| BAROMETRIC PRESSURE | MM.HG | 743.71 | |
| AVG ORIFICE PRES DROP | MM.H2O | 46.990 | |
| VOL DRY GAS-METER COND | DM3 | 0.85 | |
| AVG GAS METER TEMP | DEG.C | 22.9 | |
| VOL DRY GAS-STD COND | DNM3 | 0.83 | |
| TOTAL H2O COLLECTED | ML | 53.8 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.07 | |
| PERCENT MOISTURE BY VOL | | 8.0 | |
| MOLE FRACTION DRY GAS | | 0.920 | |
| PERCENT CO2 BY VOL, DRY | | 0.8 | |
| PERCENT O2 BY VOL, DRY | | 20.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.2 | |
| MOLECULAR WT-DRY STK GAS | | 28.93 | |
| MOLECULAR WT-STK GAS | | 28.05 | |
| AVG STACK TEMPERATURE | DEG.C | 180.4 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 740.16 | |
| AVG STACK GAS VELOCITY | M/S | 36.252 | 36.252 |
| STK FLOWRATE, DRY,STD CN | DNM3/M | 3274. | 3274. |
| ACTUAL STACK FLOWRATE | AM3/M | 5634. | 5634. |
| PERCENT ISOKINETIC | | 105.4 | 105.4 |
| PARTICULATE WT-PARTIAL | MG | 0.64 | 0.64 |
| PARTICULATE WT-TOTAL | MG | 0.64 | 0.64 |
| PERC IMPINGER CATCH | | 0.0 | 0.0 |
| PART. LOAD-PTL,STD CN | MG/NM3 | 0.78 | 0.78 |
| PART. LOAD-TTL,STD CN | MG/NM3 | 0.78 | 0.78 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | 11.67 | 11.67 |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | 11.67 | 11.67 |
| PART. LOAD-PTL,STK CN | MG/AM3 | 0.45 | 0.45 |
| PART. LOAD-TTL,STK CN | MG/AM3 | 0.45 | 0.45 |
| PARTIC EMIS-PARTIAL | KG/HR | 0.15 | 0.15 |
| PARTIC EMIS-TOTAL | KG/HR | 0.15 | 0.15 |
| PART EMIS/WT PRD FD PTL | KG/MTON | 0.00139 | 0.00139 |
| PART EMIS/WT PRD FD TTL | KG/MTON | 0.00139 | 0.00139 |
| PERCENT EXCESS AIR | | 2200.7 | 2200.7 |

READY

TABLE 9

PLANT: RESERVE MINING CO., SILVER BAY, MINN.
LOCATION: HOOD VENT STACK, PELLETIZER NO. 5, AMPHIBOLE EMISSIONS
OPERATOR: ENVIORNMENTAL PROTECTION AGENCY

## PARTICULATE SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 10 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 09-13-73 | |
| STACK AREA | M2 | 2.572 | |
| NET TIME OF RUN | MIN | 36.0 | |
| BAROMETRIC PRESSURE | MM.HG | 745.24 | |
| AVG ORIFICE PRES DROP | MM.H2O | 30.480 | |
| VOL DRY GAS-METER COND | DM3 | 0.65 | |
| AVG GAS METER TEMP | DEG.C | 25.6 | |
| VOL DRY GAS-STD COND | DNM3 | 0.63 | |
| TOTAL H2O COLLECTED | ML | 31.2 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.04 | |
| PERCENT MOISTURE BY VOL | | 6.2 | |
| MOLE FRACTION DRY GAS | | 0.938 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.17 | |
| AVG STACK TEMPERATURE | DEG.C | 120.0 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 742.70 | |
| AVG STACK GAS VELOCITY | M/S | 25.542 | 25.542 |
| STK FLOWRATE, DRY, STD CN | DNM3/M | 2705. | 2705. |
| ACTUAL STACK FLOWRATE | AM3/M | 3942. | 3942. |
| PERCENT ISOKINETIC | | 99.7 | 99.7 |
| PARTICULATE WT-PARTIAL | MG | 0.24 | 0.24 |
| PARTICULATE WT-TOTAL | MG | 0.24 | 0.24 |
| PERC IMPINGER CATCH | | 0.0 | 0.0 |
| PART. LOAD-PTL, STD CN | MG/NM3 | 0.37 | 0.37 |
| PART. LOAD-TTL, STD CN | MG/NM3 | 0.37 | 0.37 |
| PART. LOAD-PTL, STD CN @ 12% CO2 | | ********** | ********** |
| PART. LOAD-TTL, STD CN @ 12% CO2 | | ********** | ********** |
| PART. LOAD-PTL, STK CN | MG/AM3 | 0.26 | 0.26 |
| PART. LOAD-TTL, STK CN | MG/AM3 | 0.26 | 0.26 |
| PARTIC EMIS-PARTIAL | KG/HR | 0.06 | 0.06 |
| PARTIC EMIS-TOTAL | KG/HR | 0.06 | 0.06 |
| PART EMIS/WT PRD FD PTL | KG/MTON | 0.00049 | 0.00049 |
| PART EMIS/WT PRD FD TTL | KG/MTON | 0.00049 | 0.00049 |
| PERCENT EXCESS AIR | | ********** | |

EADY

TABLE 10

PLANT: RESERVE MINING, SILVER BAY, MINNESOTA
LOCATION: FINE CRUSHER STACK110, TOTAL PARTICULATE EMISSIONS
OPERATOR: ENVIRONMENTAL PROTECTION AGENCY

PARTICULATE SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 3 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 9-11-73 | |
| STACK AREA | FT2 | 3.976 | |
| NET TIME OF RUN | MIN | 120.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.10 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.760 | |
| VOL DRY GAS-METER COND | DCF | 93.70 | |
| AVG GAS METER TEMP | DEG.F | 84.6 | |
| VOL DRY GAS-STD COND | DSCF | 89.06 | |
| TOTAL H2O COLLECTED | ML | 19.2 | |
| VOL H2O VAPOR-STD COND | SCF | 0.91 | |
| PERCENT MOISTURE BY VOL | | 1.0 | |
| MOLE FRACTION DRY GAS | | 0.990 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.73 | |
| AVG STACK TEMPERATURE | DEG.F | 60.7 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.10 | |
| AVG STACK GAS VELOCITY | FPS | 71.214 | 71.214 |
| STK FLOWRATE, DRY,STD CN | DSCFM | 16644. | 16644. |
| ACTUAL STACK FLOWRATE | ACFM | 16989. | 16989. |
| PERCENT ISOKINETIC | | 98.1 | 98.1 |
| PARTICULATE WT-PARTIAL | MG | 26.70 | 26.70 |
| PARTICULATE WT-TOTAL | MG | 28.48 | 28.48 |
| PERC IMPINGER CATCH | | 6.3 | 6.3 |
| PART. LOAD-PTL,STD CN | GR/DSCF | 0.00462 | 0.00462 |
| PART. LOAD-TTL,STD CN | GR/DSCF | 0.00493 | 0.00493 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | ********** | ********** |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | ********** | ********** |
| PART. LOAD-PTL,STK CN | GR/ACF | 0.00452 | 0.00452 |
| PART. LOAD-TTL,STK CN | GR/ACF | 0.00482 | 0.00482 |
| PARTIC EMIS-PARTIAL | LB/HR | 0.66 | 0.66 |
| PARTIC EMIS-TOTAL | LB/HR | 0.70 | 0.70 |
| PART EMIS/WT PRD FD PTL | LB/TON | 0.00146 | 0.00146 |
| PART EMIS/WT PRD FD TTL | LB/TON | 0.00156 | 0.00156 |
| PERCENT EXCESS AIR | | ********** | ********** |

TABLE 11

PLANT: RESERVE MINING CO., SILVER BAY, MINN.
LOCATION: WASTE GAS STACK, PELLETIZER NO. 5, TOTAL PARTICULATE EMISSION
OPERATOR: ENVIORNMENTAL PROTECTION AGENCY

## PARTICULATE SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 6 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 09-12-73 | |
| STACK AREA | FT2 | 27.882 | |
| NET TIME OF RUN | MIN | 37.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.28 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.850 | |
| VOL DRY GAS-METER COND | DCF | 29.90 | |
| AVG GAS METER TEMP | DEG.F | 73.2 | |
| VOL DRY GAS-STD COND | DSCF | 29.21 | |
| TOTAL H2O COLLECTED | ML | 53.8 | |
| VOL H2O VAPOR-STD COND | SCF | 2.55 | |
| PERCENT MOISTURE BY VOL | | 8.0 | |
| MOLE FRACTION DRY GAS | | 0.920 | |
| PERCENT CO2 BY VOL, DRY | | 0.8 | |
| PERCENT O2 BY VOL, DRY | | 20.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.2 | |
| MOLECULAR WT-DRY STK GAS | | 28.93 | |
| MOLECULAR WT-STK GAS | | 28.05 | |
| AVG STACK TEMPERATURE | DEG.F | 356.8 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.14 | |
| AVG STACK GAS VELOCITY | FPS | 118.936 | 118.936 |
| STK FLOWRATE, DRY,STD CN | DSCFM | 115621. | 115621. |
| ACTUAL STACK FLOWRATE | ACFM | 198972. | 198972. |
| PERCENT ISOKINETIC | | 105.4 | 105.4 |
| PARTICULATE WT-PARTIAL | MG | 294.30 | 294.30 |
| PARTICULATE WT-TOTAL | MG | 294.30 | 294.30 |
| PERC IMPINGER CATCH | | 0.0 | 0.0 |
| PART. LOAD-PTL,STD CN | GR/DSCF | 0.15514 | 0.15514 |
| PART. LOAD-TTL,STD CN | GR/DSCF | 0.15514 | 0.15514 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | 2.32712 | 2.32712 |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | 2.32712 | 2.32712 |
| PART. LOAD-PTL,STK CN | GR/ACF | 0.09010 | 0.09010 |
| PART. LOAD-TTL,STK CN | GR/ACF | 0.09010 | 0.09010 |
| PARTIC EMIS-PARTIAL | LB/HR | 153.75 | 153.75 |
| PARTIC EMIS-TOTAL | LB/HR | 153.75 | 153.75 |
| PART EMIS/WT PRD FD PTL | LB/TON | 1.27068 | 1.27068 |
| PART EMIS/WT PRD FD TTL | LB/TON | 1.27068 | 1.27068 |
| PERCENT EXCESS AIR | | 2200.7 | 2200.7 |

TABLE 12

PLANT: RESERVE MINING CO., SILVER BAY, MINN.
LOCATION: HOOD VENT STACK, PELLETIZER NO. 5, TOTAL PARTICULATE EMISSIONS
OPERATOR: ENVIRONMENTAL PROTECTION AGENCY

## PARTICULATE SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 10 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 09-13-73 | |
| STACK AREA | FT2 | 27.688 | |
| NET TIME OF RUN | MIN | 36.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.34 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.200 | |
| VOL DRY GAS-METER COND | DCF | 23.10 | |
| AVG GAS METER TEMP | DEG.F | 78.1 | |
| VOL DRY GAS-STD COND | DSCF | 22.37 | |
| TOTAL H2O COLLECTED | ML | 31.2 | |
| VOL H2O VAPOR-STD COND | SCF | 1.48 | |
| PERCENT MOISTURE BY VOL | | 6.2 | |
| MOLE FRACTION DRY GAS | | 0.938 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.17 | |
| AVG STACK TEMPERATURE | DEG.F | 248.0 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.24 | |
| AVG STACK GAS VELOCITY | FPS | 83.800 | 83.800 |
| STK FLOWRATE, DRY,STD CN | DSCFM | 95509. | 95509. |
| ACTUAL STACK FLOWRATE | ACFM | 139214. | 139214. |
| PERCENT ISOKINETIC | | 99.7 | 99.7 |
| PARTICULATE WT-PARTIAL | MG | 81.10 | 81.10 |
| PARTICULATE WT-TOTAL | MG | 81.10 | 81.10 |
| PERC IMPINGER CATCH | | 0.0 | 0.0 |
| PART. LOAD-PTL,STD CN | GR/DSCF | 0.05582 | 0.05582 |
| PART. LOAD-TTL,STD CN | GR/DSCF | 0.05582 | 0.05582 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | ********** | ********** |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | ********** | ********** |
| PART. LOAD-PTL,STK CN | GR/ACF | 0.03828 | 0.03828 |
| PART. LOAD-TTL,STK CN | GR/ACF | 0.03828 | 0.03828 |
| PARTIC EMIS-PARTIAL | LB/HR | 45.70 | 45.70 |
| PARTIC EMIS-TOTAL | LB/HR | 45.70 | 45.70 |
| PART EMIS/WT PRD FD PTL | LB/TON | 0.33357 | 0.33357 |
| PART EMIS/WT PRD FD TTL | LB/TON | 0.33357 | 0.33357 |
| PERCENT EXCESS AIR | | ********** | |

PLANT: RESERVE MINING COMPANY; SILVER BAY, MINNESOTA
LOCATION: FINE CRUSHER STACK(10), TOTAL ASBESTOS EMISSIONS
OPERATOR: ENVIRONMENTAL PROTECTION AGENCY

TABLE 13

PARTICULATE SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 3 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 9-11-73 | |
| STACK AREA | FT2 | 3.976 | |
| NET TIME OF RUN | MIN | 120.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.10 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.760 | |
| VOL DRY GAS-METER COND | DCF | 93.70 | |
| AVG GAS METER TEMP | DEG.F | 84.6 | |
| VOL DRY GAS-STD COND | DSCF | 89.06 | |
| TOTAL H2O COLLECTED | ML | 19.2 | |
| VOL H2O VAPOR-STD COND | SCF | 0.91 | |
| PERCENT MOISTURE BY VOL | | 1.0 | |
| MOLE FRACTION DRY GAS | | 0.990 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.73 | |
| AVG STACK TEMPERATURE | DEG.F | 60.7 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.10 | |
| AVG STACK GAS VELOCITY | FPS | 71.214 | 71.214 |
| STK FLOWRATE, DRY,STD CN | DSCFM | 16644. | 16644. |
| ACTUAL STACK FLOWRATE | ACFM | 16989. | 16989. |
| PERCENT ISOKINETIC | | 98.1 | 98.1 |
| PARTICULATE WT-PARTIAL | MG | 1.65 | 1.65 |
| PARTICULATE WT-TOTAL | MG | 1.65 | 1.65 |
| PERC IMPINGER CATCH | | 0.1 | 0.1 |
| PART. LOAD-PTL,STD CN | GR/DSCF | 0.00029 | 0.00029 |
| PART. LOAD-TTL,STD CN | GR/DSCF | 0.00029 | 0.00029 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | ********** | ********** |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | ********** | ********** |
| PART. LOAD-PTL,STK CN | GR/ACF | 0.00028 | 0.00028 |
| PART. LOAD-TTL,STK CN | GR/ACF | 0.00028 | 0.00028 |
| PARTIC EMIS-PARTIAL | LB/HR | 0.04 | 0.04 |
| PARTIC EMIS-TOTAL | LB/HR | 0.04 | 0.04 |
| PART EMIS/WT PRD FD PTL | LB/TON | 0.00009 | 0.00009 |
| PART EMIS/WT PRD FD TTL | LB/TON | 0.00009 | 0.00009 |
| PERCENT EXCESS AIR | | ********** | |

TABLE 14

PLANT: RESERVE MINING CO., SILVER BAY, MINN.
LOCATION: WASTE GAS STACK, PELLETIZER NO. 5, TOTAL ASBESTOS EMISSIONS
OPERATOR: ENVIORNMENTAL PROTECTION AGENCY

PARTICULATE SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 6 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 09-12-73 | |
| STACK AREA | FT2 | 27.882 | |
| NET TIME OF RUN | MIN | 37.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.28 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.850 | |
| VOL DRY GAS-METER COND | DCF | 29.90 | |
| AVG GAS METER TEMP | DEG.F | 73.2 | |
| VOL DRY GAS-STD COND | DSCF | 29.21 | |
| TOTAL H2O COLLECTED | ML | 53.8 | |
| VOL H2O VAPOR-STD COND | SCF | 2.55 | |
| PERCENT MOISTURE BY VOL | | 8.0 | |
| MOLE FRACTION DRY GAS | | 0.920 | |
| PERCENT CO2 BY VOL, DRY | | 0.8 | |
| PERCENT O2 BY VOL, DRY | | 20.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.2 | |
| MOLECULAR WT-DRY STK GAS | | 28.93 | |
| MOLECULAR WT-STK GAS | | 28.05 | |
| AVG STACK TEMPERATURE | DEG.F | 356.8 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.14 | |
| AVG STACK GAS VELOCITY | FPS | 118.936 | 118.936 |
| STK FLOWRATE, DRY,STD CN | DSCFM | 115621. | 115621. |
| ACTUAL STACK FLOWRATE | ACFM | 198972. | 198972. |
| PERCENT ISOKINETIC | | 105.4 | 105.4 |
| PARTICULATE WT-PARTIAL | MG | 0.67 | 0.67 |
| PARTICULATE WT-TOTAL | MG | 0.67 | 0.67 |
| PERC IMPINGER CATCH | | 0.0 | 0.0 |
| PART. LOAD-PTL,STD CN | GR/DSCF | 0.00035 | 0.00035 |
| PART. LOAD-TTL,STD CN | GR/DSCF | 0.00035 | 0.00035 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | 0.00528 | 0.00528 |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | 0.00528 | 0.00528 |
| PART. LOAD-PTL,STK CN | GR/ACF | 0.00020 | 0.00020 |
| PART. LOAD-TTL,STK CN | GR/ACF | 0.00020 | 0.00020 |
| PARTIC EMIS-PARTIAL | LB/HR | 0.35 | 0.35 |
| PARTIC EMIS-TOTAL | LB/HR | 0.35 | 0.35 |
| PART EMIS/WT PRD FD PTL | LB/TON | 0.00288 | 0.00288 |
| PART EMIS/WT PRD FD TTL | LB/TON | 0.00288 | 0.00288 |
| PERCENT EXCESS AIR | | 2200.7 | 2200.7 |

TABLE 15

PLANT: RESERVE MINING CO., SILVER BAY, MINN.
LOCATION: HOOD VENT STACK, PELLETIZER NO. 5, TOTAL ASBESTOS EMISSIONS
OPERATOR: ENVIORNMENTAL PROTECTION AGENCY

PARTICULATE SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 10 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 09-13-73 | |
| STACK AREA | FT2 | 27.688 | |
| NET TIME OF RUN | MIN | 36.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.34 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.200 | |
| VOL DRY GAS-METER COND | DCF | 23.10 | |
| AVG GAS METER TEMP | DEG.F | 78.1 | |
| VOL DRY GAS-STD COND | DSCF | 22.37 | |
| TOTAL H2O COLLECTED | ML | 31.2 | |
| VOL H2O VAPOR-STD COND | SCF | 1.48 | |
| PERCENT MOISTURE BY VOL | | 6.2 | |
| MOLE FRACTION DRY GAS | | 0.938 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.17 | |
| AVG STACK TEMPERATURE | DEG.F | 248.0 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.24 | |
| AVG STACK GAS VELOCITY | FPS | 83.800 | 83.800 |
| STK FLOWRATE, DRY,STD CN | DSCFM | 95509. | 95509. |
| ACTUAL STACK FLOWRATE | ACFM | 139214. | 139214. |
| PERCENT ISOKINETIC | | 99.7 | 99.7 |
| PARTICULATE WT-PARTIAL | MG | 0.24 | 0.24 |
| PARTICULATE WT-TOTAL | MG | 0.24 | 0.24 |
| PERC IMPINGER CATCH | | 0.0 | 0.0 |
| PART. LOAD-PTL,STD CN | GR/DSCF | 0.00016 | 0.00016 |
| PART. LOAD-TTL,STD CN | GR/DSCF | 0.00016 | 0.00016 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | ********** | |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | ********** | |
| PART. LOAD-PTL,STK CN | GR/ACF | 0.00011 | 0.00011 |
| PART. LOAD-TTL,STK CN | GR/ACF | 0.00011 | 0.00011 |
| PARTIC EMIS-PARTIAL | LB/HR | 0.13 | 0.13 |
| PARTIC EMIS-TOTAL | LB/HR | 0.13 | 0.13 |
| PART EMIS/WT PRD FD PTL | LB/TON | 0.00098 | 0.00098 |
| PART EMIS/WT PRD FD TTL | LB/TON | 0.00098 | 0.00098 |
| PERCENT EXCESS AIR | | ********** | |

TABLE 16

PLANT: RESERVE MINING COMPANY; SILVER BAY, MINNESOTA
LOCATION: FINE CRUSHER STACK 110, AMPHIBOLE ASBESTOS EMISSIONS
OPERATOR: ENVIRONMENTAL PROTECTION AGENCY

## PARTICULATE SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 3 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 9-11-73 | |
| STACK AREA | FT2 | 3.976 | |
| NET TIME OF RUN | MIN | 120.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.10 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.760 | |
| VOL DRY GAS-METER COND | DCF | 93.70 | |
| AVG GAS METER TEMP | DEG.F | 84.6 | |
| VOL DRY GAS-STD COND | DSCF | 89.06 | |
| TOTAL H2O COLLECTED | ML | 19.2 | |
| VOL H2O VAPOR-STD COND | SCF | 0.91 | |
| PERCENT MOISTURE BY VOL | | 1.0 | |
| MOLE FRACTION DRY GAS | | 0.990 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.73 | |
| AVG STACK TEMPERATURE | DEG.F | 60.7 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.10 | |
| AVG STACK GAS VELOCITY | FPS | 71.214 | 71.214 |
| STK FLOWRATE, DRY,STD CN | DSCFM | 16644. | 16644. |
| ACTUAL STACK FLOWRATE | ACFM | 16989. | 16989. |
| PERCENT ISOKINETIC | | 98.1 | 98.1 |
| PARTICULATE WT-PARTIAL | MG | 1.65 | 1.65 |
| PARTICULATE WT-TOTAL | MG | 1.65 | 1.65 |
| PERC IMPINGER CATCH | | 0.1 | 0.1 |
| PART. LOAD-PTL,STD CN | GR/DSCF | 0.00029 | 0.00029 |
| PART. LOAD-TTL,STD CN | GR/DSCF | 0.00029 | 0.00029 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | ********** | |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | ********** | |
| PART. LOAD-PTL,STK CN | GR/ACF | 0.00028 | 0.00028 |
| PART. LOAD-TTL,STK CN | GR/ACF | 0.00028 | 0.00028 |
| PARTIC EMIS-PARTIAL | LB/HR | 0.04 | 0.04 |
| PARTIC EMIS-TOTAL | LB/HR | 0.04 | 0.04 |
| PART EMIS/WT PRD FD PTL | LB/TON | 0.00009 | 0.00009 |
| PART EMIS/WT PRD FD TTL | LB/TON | 0.00009 | 0.00009 |
| PERCENT EXCESS AIR | | ********** | |

TABLE 17

PLANT: RESERVE MINING CO., SILVER BAY, MINN.
LOCATION: WASTE GAS STACK, PELLETIZER NO. 5, AMPHIBOLE EMISSIONS
OPERATOR: ENVIORNMENTAL PROTECTION AGENCY

## PARTICULATE SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 6 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 09-12-73 | |
| STACK AREA | FT2 | 27.882 | |
| NET TIME OF RUN | MIN | 37.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.28 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.850 | |
| VOL DRY GAS-METER COND | DCF | 29.90 | |
| AVG GAS METER TEMP | DEG.F | 73.2 | |
| VOL DRY GAS-STD COND | DSCF | 29.21 | |
| TOTAL H2O COLLECTED | ML | 53.8 | |
| VOL H2O VAPOR-STD COND | SCF | 2.55 | |
| PERCENT MOISTURE BY VOL | | 8.0 | |
| MOLE FRACTION DRY GAS | | 0.920 | |
| PERCENT CO2 BY VOL, DRY | | 0.8 | |
| PERCENT O2 BY VOL, DRY | | 20.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.2 | |
| MOLECULAR WT-DRY STK GAS | | 28.93 | |
| MOLECULAR WT-STK GAS | | 28.05 | |
| AVG STACK TEMPERATURE | DEG.F | 356.8 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.14 | |
| AVG STACK GAS VELOCITY | FPS | 118.936 | 118.936 |
| STK FLOWRATE, DRY,STD CN | DSCFM | 115621. | 115621. |
| ACTUAL STACK FLOWRATE | ACFM | 198972. | 198972. |
| PERCENT ISOKINETIC | | 105.4 | 105.4 |
| PARTICULATE WT-PARTIAL | MG | 0.64 | 0.64 |
| PARTICULATE WT-TOTAL | MG | 0.64 | 0.64 |
| PERC IMPINGER CATCH | | 0.0 | 0.0 |
| PART. LOAD-PTL,STD CN | GR/DSCF | 0.00034 | 0.00034 |
| PART. LOAD-TTL,STD CN | GR/DSCF | 0.00034 | 0.00034 |
| PART. LOAD-PTL,STD CN @ 12% CO2 | | 0.00510 | 0.00510 |
| PART. LOAD-TTL,STD CN @ 12% CO2 | | 0.00510 | 0.00510 |
| PART. LOAD-PTL,STK CN | GR/ACF | 0.00020 | 0.00020 |
| PART. LOAD-TTL,STK CN | GR/ACF | 0.00020 | 0.00020 |
| PARTIC EMIS-PARTIAL | LB/HR | 0.34 | 0.34 |
| PARTIC EMIS-TOTAL | LB/HR | 0.34 | 0.34 |
| PART EMIS/WT PRD FD PTL | LB/TON | 0.00278 | 0.00278 |
| PART EMIS/WT PRD FD TTL | LB/TON | 0.00278 | 0.00278 |
| PERCENT EXCESS AIR | | 2200.7 | 2200.7 |

TABLE 18

PLANT: RESERVE MINING CO., SILVER BAY, MINN.
LOCATION: HOOD VENT STACK, PELLETIZER NO. 5, AMPHIBOLE EMISSIONS
OPERATOR: ENVIORNMENTAL PROTECTION AGENCY

PARTICULATE SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 10 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 09-13-73 | |
| STACK AREA | FT2 | 27.688 | |
| NET TIME OF RUN | MIN | 36.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.34 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.200 | |
| VOL DRY GAS-METER COND | DCF | 23.10 | |
| AVG GAS METER TEMP | DEG.F | 78.1 | |
| VOL DRY GAS-STD COND | DSCF | 22.37 | |
| TOTAL H2O COLLECTED | ML | 31.2 | |
| VOL H2O VAPOR-STD COND | SCF | 1.48 | |
| PERCENT MOISTURE BY VOL | | 6.2 | |
| MOLE FRACTION DRY GAS | | 0.938 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.17 | |
| AVG STACK TEMPERATURE | DEG.F | 248.0 | |
| NET SAMPLING POINTS | | 1 | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.24 | |
| AVG STACK GAS VELOCITY | FPS | 83.800 | 83.800 |
| STK FLOWRATE, DRY, STD CN | DSCFM | 95509. | 95509. |
| ACTUAL STACK FLOWRATE | ACFM | 139214. | 139214. |
| PERCENT ISOKINETIC | | 99.7 | 99.7 |
| PARTICULATE WT-PARTIAL | MG | 0.24 | 0.24 |
| PARTICULATE WT-TOTAL | MG | 0.24 | 0.24 |
| PERC IMPINGER CATCH | | 0.0 | 0.0 |
| PART. LOAD-PTL, STD CN | GR/DSCF | 0.00016 | 0.00016 |
| PART. LOAD-TTL, STD CN | GR/DSCF | 0.00016 | 0.00016 |
| PART. LOAD-PTL, STD CN @ 12% CO2 | | ********** | |
| PART. LOAD-TTL, STD CN @ 12% CO2 | | ********** | |
| PART. LOAD-PTL, STK CN | GR/ACF | 0.00011 | 0.00011 |
| PART. LOAD-TTL, STK CN | GR/ACF | 0.00011 | 0.00011 |
| PARTIC EMIS-PARTIAL | LB/HR | 0.13 | 0.13 |
| PARTIC EMIS-TOTAL | LB/HR | 0.13 | 0.13 |
| PART EMIS/WT PRD FD PTL | LB/TON | 0.00098 | 0.00098 |
| PART EMIS/WT PRD FD TTL | LB/TON | 0.00098 | 0.00098 |
| PERCENT EXCESS AIR | | ********** | |

## SUMMARY AND DISCUSSION OF PROCESS SAMPLE ANALYSIS

Process samples were obtained at two locations on the same days that the stacks at these respective facilities were tested.

Samples of the output from this crusher group were collected at the discharge of the conveyor in the concentrator building on September 11, 1973. It was not possible to sample the output from an individual crusher set. Samples were taken using the established plant sampling technique. A sampling pan, about 1 1/2" wide x 12" long, x 12" deep, was inserted in the belt discharge stream at the middle and both sides. Duplicate samples were taken, one for EPA and one retained by the company. Samples were taken every hour on the hour from 8:00 a.m. to 3:00 p.m.

Samples of the green pellets were taken on September 12, 1974, from the three conveyor belts which discharge to the conveyor which feeds this pelletizer. Samples were taken every hour on the hour from 10:00 a.m. to 5:00 p.m. inclusive. Duplicate samples were taken for EPA and the company.

A report of the analysis of these samples has been prepared separately and is entitled "Sample Process Material at Taconite Plant" final report Task 22, Contract No. 68-02-0230, by R. J. Kuryvial and C. W. Metton, February 1974. This report is available from the Office of Technical Analysis, EPA.

## PROCESS DESCRIPTION

A schematic flow diagram of the process is attached (Figure III-1). The ore is received in railroad cars from the mine where it has been crushed to minus 4-inch size. The ore is crushed to minus 3/4-inch size by cone type crushers. It is then ground wet in rod mills and ball mills and separated by magnetic separators into concentrate and tailings. The tailings are pumped into Lake Superior. The concentrate is mixed with a small amount of bentonite clay and introduced into large rotating drums which roll it into balls of about 1/2" diameter. The balls are fed into a traveling grate pelletizing machine where they are first dried, then heated to over 2200°F, passed through an oxidizing section, then a cooling section. This transforms them into hard pellets, ideally suited for blast furnace feed.

The raw ore is about 24 percent iron and the concentrate if 65 percent iron. The asbestos type mineral in the ore is said to be amosite and said to range from 20 to 30 percent in content.

Detailed descriptions of the operations and controls are given in the following sections.

a. Car Dumping and Fine Crushing

The ore is received from the mine in railroad ore cars. It has been crushed at the mine to minus 4-inch size. A rotary car dumper lifts two cars at a time and dumps their contents into two receiving pits. Water sprays are actuated when cars are being dumped to suppress dust emissions. The pits are each ventilated by a fan of 50,000 cfm capacity which is vented to a multiple cyclone collector (multiclone).

From the dump pits the ore is fed to a belt conveyor, and transported to storage bins in the fine crusher building. From the storage bins, a system of belt conveyors delivers the ore to ten sets of crushers in parallel. Each set consists of two cone-type crushers in series, with a vibrating screen between the crushers. The ore is crushed to minus 3/4-inch size.

The conveyor belt transfer points are controlled by ten multiclones, each with its own stack. Each of the ten sets of crushers, with its screens, is controlled by a Type W Rotoclone.

The crushers discharge to two belt conveyors which deliver the crushed ore to two transfer bins in the concentrator building. These bins transfer the ore to two conveyors which discharge to 22 storage bins, each of which feeds a rod mill. The transfer points in this system are vented by 24 multiclones, each with its own stack. Water is added at the rod mills and all the subsequent grinding, magnetic separation and regrinding is done in slurry form.

b. The Pelletizing Furnaces

There are eight furnaces which bake the moist iron oxide balls from the balling drums, turning them into hard $Fe_2O_3$ (hematite) pellets, suitable for blast furnace feed. Furnaces 1 - 6 operate at about 135 wet tons/hr. Furnaces 11 and 12 are larger and operate at about 290 wet tons/hr. The amount of bentonite additive in the moist balls is very small, only in the range of 18 - 27 lbs/hr.

The moist load disappears into the totally enclosed furnace where it first contacts about 90,000 scfm of hot combustion gases recirculated

from the ignition section. This gas passes upward through the ball bed and exits from the "hood stack" at about 225°F. The balls are thus gently dried, then they move into an ignition section. Here, several oil burners force combustion gases downward through the bed and maintain a temperature of about 2350°F on top of the bed. The hot air from this operation plus part of the drying hot air is discharged at about 400 - 500°F through the waste gas stack and amounts to about 110,000 scfm. A following section is called the "induration section," where no oil is burned, but where an exothermic reaction with oxygen of the air occurs and heats all the bed to a yellow heat. This is due to oxidation of ferrous iron at the bed temperature.

$$4\ (Fe\ O.\ Fe_2O_3) + O_2 \rightarrow 6\ Fe_2\ O_3$$

magnetite hematite

Other forms of ferrous iron are also oxidized. Air passes downward through the bed. The exhaust from these sections is reused in the drying and ignition sections.

The final operation is cooling of the pellet bed. Air goes downward and is partly reused for drying and partly discharged from the second stage cooling stack at about 20,000 scfm.

The plant produces ten million tons/yr of pellets. The gas emission from all eight pelleting furnaces is 1,900,000 scfm. There are no emission controls. There are six stacks per furnace on the roof of the pelletizing furnace building. They are, in order: hood exhaust; waste gas; recuperation (capped); 1st stage cooler; 2nd stage cooler; pellet dump end.

PROCESS OPERATION DURING TEST

a. Fine Crusher Test. 9-11-73

The ten sets of crushers are divided into two groups. Each group discharges to a belt conveyor which delivers the crushed ore to the concentrator building. Each crusher set consists of the following items in series: a vibrating screen, a primary cone crusher, a vibrating screen, a secondary cone crusher. Each of these four devices is enclosed and all vented to a Type W Rotoclone, size 30.

The crusher set tested was no. 104. The dust collector was no. 110. The feed rate to the crusher was measured and recorded on a circular chart. The readings fluctuated considerably. An eye-ball average was made of the chart traces for the following periods, in tons per hour:

| | |
|---|---|
| 11:00 - 11:00 : 550 | 3:00 - 4:00 : 500 |
| 11:00 - 12:00 : 500 | 4:00 - 5:00 : 450 |
| 1:00 - 2:00 : 600 | 5:00 - 6:00 : 450 |
| 2:00 - 3:00 : 550 | |

Opacity readings of the collector stack were read at various times. Readings were made with the sun at my back. Readings were recorded at the following times:

| | |
|---|---|
| 10:00 : 15% | 4:00 : 10% |
| 10:30 : 15% | 4:30 : 10% |
| 1:30 : 10% | 5:00 : 10% |
| 2:30 : 10% | 5:30 : 10% |
| 3:30 : 10% | |

When the plume was observed looking towards the sun, the opacity appeared to be very much greater.

b. Pelletizing Furnace Stack Test. 9-12-73

The flue gas (waste gas) stack was sampled on September 12, 1973. The unit tested was pelletizer no. 5. This unit and two others had been modified by the addition of a roll screen to remove fines from the green pellet feed in an effort to reduce emissions.

The pelletizer operator recorded the average feed rate each hour. The following readings, in tons per hour, were taken from his log sheet:

| | |
|---|---|
| 9:00 - 10:00 : 137 | 2:00 - 3:00 : 115 |
| 10:00 - 11:00 : 137 | 3:00 - 4:00 : 121 |
| 11:00 - 12:00 : 135 | 4:00 - 5:00 : 121 |
| 12:00 - 1:00 : 132 | 5:00 - 6:00 : 131 |
| 1:00 - 2:00 : 120 | 6:00 - 7:00 : 136 |

Opacity readings were taken at various times from the roof, with the sun to the observer's back. It was noted that the position of the sun made little difference in the appearance of the plume. The weather was clear and cool with a breeze estimated as 15 MPH. The following opacities were recorded:

| | |
|---|---|
| 10:30 : 15% | 5:10 : 5% |
| 11:15 : 15% | 6:15 : 5% |
| 11:30 : 10% | 6:30 : 5% |
| 3:15 : 10% | 7:00 : 5% |
| 3:45 : 10% | |

c. Dryer (hood) Stack Test. 9-13-73

The pellet feed rates in tons per hour from the operator's log sheet were as follows:

| | | | |
|---|---|---|---|
| 6:00 - 7:00 | 134 | 11:00 - 12:00 | 133 |
| 7:00 - 8:00 | 136 | 12:00 - 1:00 | 137 |
| 8:00 - 9:00 | 132 | 1:00 - 2:00 | 138 |
| 9:00 -10:00 | 136 | 2:00 - 3:00 | 137 |
| 10:00 -11:00 | 134 | | |

Visible emissions from the stack were very light. The weather was clear and cool with a brisk wind. The following opacity readings were recorded:

| | | | |
|---|---|---|---|
| 10:00 a.m. | 5% | 12:50 p.m. | 5% |
| 10:15 | 0 | 2:00 | 5% |
| 10:30 | 5% | 2:15 | 0 |
| 10:40 | 5% | 2:30 | 0 |
| 10:50 | 0 | 2:45 | 0 |
| 11:00 | 0 | 2:50 | 10% |
| 11:15 | 5% | 2:53 | 15% |
| 12:10 p.m. | 5% | 2:55 | 0 |
| 12:30 | 5% | 3:00 | 0 |
| 12:40 | 5% | | |

Visible emissions from the stacks of the other pelletizers were casually observed, but not recorded. Nearly all the other pelletizers had emissions of greater opacity than the one being tested. Several had emissions which were in the range of 15-30% opacity most of the time, with occasional periods of much higher rates--up to 100% opacity for a few minutes, several times a day.

d. Concentrator Stack Test. 9-13-73

Collector system no. 118 in the East Concentrator Building was tested in the late afternoon of September 13, 1973. No ore samples were collected, and no material flow rates were available. However, the average discharge rate of each bin is about 160 tons/hr. based on an average of 85,000 tons/day of ore received at the plant.

No visible emissions were observed from the stack being tested, nor from any of the other 21 stacks in the two concentrator buildings. The ore appeared to be damp and no visible dust was observed when the tripper was filling a bin.

## LOCATION OF SAMPLING POINTS

1. Fine Crusher No. 10

Sampling was conducted downstream of the Rotoclone serving the number 104 fine crusher set, on stack No. 110. The ports were located 127" (4.7 diameters) downstream of the nearest disturbance and 24" (0.89 diameters) upstream of the exit to the atmosphere. The 27" diameter crossection was divided into 16 equal areas and sampling was to be conducted at the centroid of each area. However, since the outmost points on each diameter were less than 1 inch from the stack wall, sampling was not conducted at point 1 and 8 on each diameter. Method 1 (Federal Register, Vol. 36, No. 247, December 23, 1971) requires 36 sampling points for a location such as was available here; however, only a 12-point traverse was used. Because of the relatively small stack diameter, the reduction of traverse points should not effect the representativeness of the sample.

2. Waste Gas Stream, Pelletizer No. 5

Sampling was conducted on the uncontrolled waste gas stream at a location approximately 75' (~12 diameters) downstream of the nearest disturbance and 50' (~8 diameters) upstream of the exit to the atmosphere. The 71 1/2-inch diameter stack was divided into 12 equal areas and sampling was conducted at the centroid of each equal area.

3. Hood Vent Exhaust, Pelletizer No. 5

Sampling was conducted on the uncontrolled stack serving the hood vent stream at a location approximately 48' (8.1 diameters) downstream of the nearest disturbance and 40' (6.8 diameters) upstream of the exit to

the atmosphere. The 71 1/4" diameter cross-section was divided into 12 equal areas and sampling was conducted at the centroid of each equal area.

4. Concentrator Location

Sampling was conducted on the control system No. 118 serving the No. 11 and 12 bins and their conveying systems. The sampling ports were located 32' (9.8 diameters) downstream of the nearest disturbance and 26' (7.8 diameters) upstream of the exit to the atmosphere. The 39 3/4" diameter cross-section was divided into 12 equal areas and sampling was conducted at the centroid of each equal area.

## SAMPLING AND ANALYTICAL PROCEDURES

The procedures used to collect the samples were essentially identical to those outlined in Method 5 (Federal Register, December 23, 1971) with the following exceptions:

1. A Millipore type AA membrance filter was substituted for the MSA 1106 BH glass fiber filter.

2. Filter and probe heating was not maintained at 225°F since maximum temperature allowable for the membrane filter is ~200°F. This temperature was maintained at 150-180°F, which was above the dew point of all streams sampled.

3. No acetone washings were used in the train cleanup. The probe was washed with water only and was kept separate from the impinger contents and wash.

At the fine crusher location, sampling was conducted for five minutes at each of 12 traverse points for a total test time of 60 minutes. At the waste gas and hood vent locations, sampling was conducted for three minutes at each of 12 traverse points for a total run time of 36 minutes for each test. At the concentrator location, sampling was conducted for ten minutes at each of 12 traverse points for a total test time of 120 minutes.

Prior to each run, the sampling train was leak-checked and any leakage was corrected prior to the start of testing. After sampling the train was sealed and moved to the cleanup area intact. There it was disassembled and the filter was placed in a glassene envelop and sealed.

The probe and front half of the filter holder were washed with distilled, deionized water and placed in a glass shipping bottle. The back half of the filter and the remainder of the impinger train were rinsed with water and added to the impinger contents in a separate shipping bottle. These containers were sealed and packed for shipment.

Upon return to the EPA laboratories in Durham, the filters were weighed and the samples were separated for shipment to several laboratories for analysis. Runs 3, 6, and 10 were sent to Battelle Columbus for asbestos identification and analysis by electron microscope. The complete analysis procedure is given in Appendix C in Battelle's laboratory report.

# APPENDIX A

## COMPLETE CALCULATION RESULTS AND SAMPLE CALCULATIONS

TABLE A-1

PLANT: RESERVE MINING FINE CRUSHER STACK NO.10
LOCATION: SILVER BAY MINN.
OPERATOR: EPA

SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 1 | 2 | 3 | AVER |
|---|---|---|---|---|---|
| DATE OF RUN | | 9-11-73 | 9-11-73 | 9-11-73 | |
| STACK AREA | FT2 | 3.976 | 3.976 | 3.976 | |
| NET TIME OF RUN | MIN | 60.0 | 120.0 | 120.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.08 | 29.08 | 29.10 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.800 | 1.790 | 1.760 | |
| VOL DRY GAS-METER COND | DCF | 46.70 | 94.90 | 93.70 | |
| AVG GAS METER TEMP | DEG.F | 76.2 | 79.1 | 84.6 | |
| VOL DRY GAS-STD COND | DSCF | 45.06 | 91.07 | 89.06 | |
| TOTAL H2O COLLECTED | ML | 13.1 | 21.3 | 19.2 | |
| VOL H2O VAPOR-STD COND | SCF | 0.62 | 1.01 | 0.91 | |
| PERCENT MOISTURE BY VOL | | 1.4 | 1.1 | 1.0 | |
| MOLE FRACTION DRY GAS | | 0.986 | 0.989 | 0.990 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | 0.0 | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | 21.0 | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | 0.0 | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | 79.0 | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | 28.84 | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.69 | 28.72 | 28.73 | |
| AVG STACK TEMPERATURE | DEG.F | 67.6 | 62.0 | 60.7 | |
| NET SAMPLING POINTS | | | | | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.08 | 29.08 | 29.10 | |
| AVG STACK GAS VELOCITY | FPS | 72.417 | 71.904 | 71.214 | 71.8 |
| STK FLOWRATE, DRY,STD CN | DSCFM | 16634. | 16738. | 16644. | 1667 |
| ACTUAL STACK FLOWRATE | ACFM | 17276. | 17153. | 16989. | 1713 |
| PERCENT ISOKINETIC | | 99.4 | 99.8 | 98.1 | 99 |

TABLE A-2

PLANT: RESERVE MINING FINE CRUSHER STACK NO.10
LOCATION: SILVER BAY MINN.
OPERATOR: EPA

SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 1 | 2 | 3 | AVERAGE |
|---|---|---|---|---|---|
| DATE OF RUN | | 9-11-73 | 9-11-73 | 9-11-73 | |
| STACK AREA | M2 | 0.369 | 0.369 | 0.369 | |
| NET TIME OF RUN | MIN | 60.0 | 120.0 | 120.0 | |
| BAROMETRIC PRESSURE | MM.HG | 738.63 | 738.63 | 739.14 | |
| AVG ORIFICE PRES DROP | MM.H2O | 45.720 | 45.466 | 44.704 | |
| VOL DRY GAS-METER COND | DM3 | 1.32 | 2.69 | 2.65 | |
| AVG GAS METER TEMP | DEG.C | 24.6 | 26.2 | 29.2 | |
| VOL DRY GAS-STD COND | DNM3 | 1.28 | 2.58 | 2.52 | |
| TOTAL H2O COLLECTED | ML | 13.1 | 21.3 | 19.2 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.02 | 0.03 | 0.03 | |
| PERCENT MOISTURE BY VOL | | 1.4 | 1.1 | 1.0 | |
| MOLE FRACTION DRY GAS | | 0.986 | 0.989 | 0.990 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | 0.0 | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | 21.0 | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | 0.0 | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | 79.0 | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | 28.84 | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.69 | 28.72 | 28.73 | |
| AVG STACK TEMPERATURE | DEG.C | 19.8 | 16.7 | 15.9 | |
| NET SAMPLING POINTS | | | | | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 738.63 | 738.63 | 739.14 | |
| AVG STACK GAS VELOCITY | M/S | 22.073 | 21.916 | 21.706 | 21.898 |
| STK FLOWRATE, DRY,STD CN | DNM3/M | 471. | 474. | 471. | 472. |
| ACTUAL STACK FLOWRATE | AM3/M | 489. | 486. | 481. | 485. |
| PERCENT ISOKINETIC | | 99.4 | 99.8 | 98.1 | 99.1 |

TABLE A-3

PLANT: RESERVE MINING WASTE GAS STACK NO.29 (SHORT RUN DUE TO MOISTURE PROBLE
LOCATION: SILVER BAY MINN.
OPERATOR: EPA

SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 4 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 9-12-73 | |
| STACK AREA | FT2 | 27.882 | |
| NET TIME OF RUN | MIN | 20.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.28 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.780 | |
| VOL DRY GAS-METER COND | DCF | 16.70 | |
| AVG GAS METER TEMP | DEG.F | 66.7 | |
| VOL DRY GAS-STD COND | DSCF | 16.51 | |
| TOTAL H2O COLLECTED | ML | 30.9 | |
| VOL H2O VAPOR-STD COND | SCF | 1.46 | |
| PERCENT MOISTURE BY VOL | | 8.1 | |
| MOLE FRACTION DRY GAS | | 0.919 | |
| PERCENT CO2 BY VOL, DRY | | 0.8 | |
| PERCENT O2 BY VOL, DRY | | 20.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.2 | |
| MOLECULAR WT-DRY STK GAS | | 28.93 | |
| MOLECULAR WT-STK GAS | | 28.04 | |
| AVG STACK TEMPERATURE | DEG.F | 323.0 | |
| NET SAMPLING POINTS | | | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.14 | |
| AVG STACK GAS VELOCITY | FPS | 112.761 | 112.761 |
| STK FLOWRATE, DRY,STD CN | DSCFM | 114204. | 114204. |
| ACTUAL STACK FLOWRATE | ACFM | 188641. | 188641. |
| PERCENT ISOKINETIC | | 111.6 | 111.6 |

TABLE A-4

PLANT: RESERVE MINING WASTE GAS STACK NO.29 (SHORT RUN DUE TO MOISTURE PROBLEM
LOCATION: SILVER BAY MINN.
OPERATOR: EPA

SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 4 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 9-12-73 | |
| STACK AREA | M2 | 2.590 | |
| NET TIME OF RUN | MIN | 20.0 | |
| BAROMETRIC PRESSURE | MM.HG | 743.71 | |
| AVG ORIFICE PRES DROP | MM.H2O | 45.212 | |
| VOL DRY GAS-METER COND | DM3 | 0.47 | |
| AVG GAS METER TEMP | DEG.C | 19.3 | |
| VOL DRY GAS-STD COND. | DNM3 | 0.47 | |
| TOTAL H2O COLLECTED | ML | 30.0 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.04 | |
| PERCENT MOISTURE BY VOL | | 8.1 | |
| MOLE FRACTION DRY GAS | | 0.919 | |
| PERCENT CO2 BY VOL, DRY | | 0.8 | |
| PERCENT O2 BY VOL, DRY | | 20.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.2 | |
| MOLECULAR WT-DRY STK GAS | | 28.93 | |
| MOLECULAR WT-STK GAS | | 28.04 | |
| AVG STACK TEMPERATURE | DEG.C | 101.7 | |
| NET SAMPLING POINTS | | | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 740.16 | |
| AVG STACK GAS VELOCITY | M/S | 34.370 | 34.370 |
| STK FLOWRATE, DRY,STD CN | DNM3/M | 3234. | 3234. |
| ACTUAL STACK FLOWRATE | AM3/M | 5342. | 5342. |
| PERCENT ISOKINETIC | | 111.6 | 111.6 |

TABLE A-5

PLANT: RESERVE MINING WASTE GAS STACK NO.29
LOCATION: SILVER BAY, MINN.
OPERATOR: EPA

SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 5 | 6 | 7 | AVERAGE |
|---|---|---|---|---|---|
| DATE OF RUN | | 9-12-73 | 9-12-73 | 9-12-73 | |
| STACK AREA | FT2 | 27.882 | 27.882 | 27.882 | |
| NET TIME OF RUN | MIN | 36.0 | 37.0 | 36.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.28 | 29.28 | 29.28 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.950 | 1.850 | 2.070 | |
| VOL DRY GAS-METER COND | DCF | 29.00 | 29.90 | 30.20 | |
| AVG GAS METER TEMP | DEG.F | 76.1 | 73.2 | 84.7 | |
| VOL DRY GAS-STD COND | DSCF | 28.19 | 29.21 | 28.90 | |
| TOTAL H2O COLLECTED | ML | 54.6 | 53.8 | 63.4 | |
| VOL H2O VAPOR-STD COND | SCF | 2.59 | 2.55 | 3.01 | |
| PERCENT MOISTURE BY VOL | | 8.4 | 8.0 | 9.4 | |
| MOLE FRACTION DRY GAS | | 0.916 | 0.920 | 0.906 | |
| • PERCENT CO2 BY VOL, DRY | | 0.8 | 0.8 | 0.8 | |
| PERCENT O2 BY VOL, DRY | | 20.0 | 20.0 | 20.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | 0.0 | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.2 | 79.2 | 79.2 | |
| MOLECULAR WT-DRY STK GAS | | 28.93 | 28.93 | 28.93 | |
| MOLECULAR WT-STK GAS | | 28.01 | 28.05 | 27.90 | |
| AVG STACK TEMPERATURE | DEG.F | 358.6 | 356.8 | 335.1 | |
| NET SAMPLING POINTS | | | | | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.14 | 29.14 | 29.14 | |
| AVG STACK GAS VELOCITY | FPS | 118.007 | 118.936 | 120.024 | 118.989 |
| • STK FLOWRATE, DRY,STD CN | DSCFM | 113992. | 115621. | 118051. | 115888. |
| ACTUAL STACK FLOWRATE | ACFM | 197417. | 198972. | 200792. | 199060. |
| PERCENT ISOKINETIC | | 106.0 | 105.4 | 104.9 | 105.5 |

TABLE A-6

PLANT: RESERVE MINING WASTE GAS STACK NO.29
LOCATION: SILVER BAY, MINN.
OPERATOR: EPA

SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 5 | 6 | 7 | AVERAGE |
|---|---|---|---|---|---|
| DATE OF RUN | | 9-12-73 | 9-12-73 | 9-12-73 | |
| STACK AREA | M2 | 2.590 | 2.590 | 2.590 | |
| NET TIME OF RUN | MIN | 36.0 | 37.0 | 36.0 | |
| BAROMETRIC PRESSURE | MM.HG | 743.71 | 743.71 | 743.71 | |
| AVG ORIFICE PRES DROP | MM.H2O | 49.530 | 46.990 | 52.578 | |
| VOL DRY GAS-METER COND | DM3 | 0.82 | 0.85 | 0.86 | |
| AVG GAS METER TEMP | DEG.C | 24.5 | 22.9 | 29.3 | |
| VOL DRY GAS-STD COND | DNM3 | 0.80 | 0.83 | 0.82 | |
| TOTAL H2O COLLECTED | ML | 54.6 | 53.8 | 63.4 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.07 | 0.07 | 0.09 | |
| PERCENT MOISTURE BY VOL | | 8.4 | 8.0 | 9.4 | |
| MOLE FRACTION DRY GAS | | 0.916 | 0.920 | 0.906 | |
| PERCENT CO2 BY VOL, DRY | | 0.8 | 0.8 | 0.8 | |
| PERCENT O2 BY VOL, DRY | | 20.0 | 20.0 | 20.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | 0.0 | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.2 | 79.2 | 79.2 | |
| MOLECULAR WT-DRY STK GAS | | 28.93 | 28.93 | 28.93 | |
| MOLECULAR WT-STK GAS | | 28.01 | 28.05 | 27.90 | |
| AVG STACK TEMPERATURE | DEG.C | 181.4 | 180.4 | 168.4 | |
| NET SAMPLING POINTS | | | | | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 740.16 | 740.16 | 740.16 | |
| AVG STACK GAS VELOCITY | M/S | 35.968 | 36.252 | 36.583 | 36.268 |
| STK FLOWRATE, DRY, STD CN | DNM3/M | 3228. | 3274. | 3343. | 3282. |
| ACTUAL STACK FLOWRATE | AM3/M | 5590. | 5634. | 5686. | 5637. |
| PERCENT ISOKINETIC | | 106.0 | 105.4 | 104.9 | 105.5 |

TABLE A-7

PLANT: RESERVE MINING PELLETIZER HOOD EXHAUST STACK NO.32
LOCATION: SILVER BAY, MINN.
OPERATOR: EPA

SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 8 | 9 | 10 | AVERAGE |
|---|---|---|---|---|---|
| DATE OF RUN | | 9-13-73 | 9-13-73 | 9-13-73 | |
| STACK AREA | FT2 | 27.688 | 27.688 | 27.688 | |
| NET TIME OF RUN | MIN | 36.0 | 36.0 | 36.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.37 | 29.34 | 29.34 | |
| AVG ORIFICE PRES DROP | IN.H2O | 1.250 | 1.260 | 1.200 | |
| VOL DRY GAS-METER COND | DCF | 23.70 | 23.70 | 23.10 | |
| AVG GAS METER TEMP | DEG.F | 81.5 | 76.4 | 78.1 | |
| VOL DRY GAS-STD COND | DSCF | 22.84 | 23.03 | 22.37 | |
| TOTAL H2O COLLECTED | ML | 31.2 | 30.9 | 31.2 | |
| VOL H2O VAPOR-STD COND | SCF | 1.48 | 1.46 | 1.48 | |
| PERCENT MOISTURE BY VOL | | 6.1 | 6.0 | 6.2 | |
| MOLE FRACTION DRY GAS | | 0.939 | 0.940 | 0.938 | |
| • PERCENT CO2 BY VOL, DRY | | 0.0 | 0.0 | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | 21.0 | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | 0.0 | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | 79.0 | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | 28.84 | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.18 | 28.19 | 28.17 | |
| AVG STACK TEMPERATURE | DEG.F | 237.0 | 239.6 | 248.0 | |
| NET SAMPLING POINTS | | | | | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.27 | 29.24 | 29.24 | |
| AVG STACK GAS VELOCITY | FPS | 84.750 | 85.789 | 83.800 | 84.780 |
| • STK FLOWRATE, DRY,STD CN | DSCFM | 98341. | 99183. | 95509. | 97677. |
| ACTUAL STACK FLOWRATE | ACFM | 140792. | 142518. | 139214. | 140841. |
| PERCENT ISOKINETIC | | 98.9 | 98.9 | 99.7 | 99.1 |

TABLE A-8

PLANT: RESERVE MINING PELLETIZER HOOD EXHAUST STACK NO.32
LOCATION: SILVER BAY, MINN.
OPERATOR: EPA

SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 8 | 9 | 10 | AVERAG |
|---|---|---|---|---|---|
| DATE OF RUN | | 9-13-73 | 9-13-73 | 9-13-73 | |
| STACK AREA | M2 | 2.572 | 2.572 | 2.572 | |
| NET TIME OF RUN | MIN | 36.0 | 36.0 | 36.0 | |
| BAROMETRIC PRESSURE | MM.HG | 746.00 | 745.24 | 745.24 | |
| AVG ORIFICE PRES DROP | MM.H2O | 31.750 | 32.004 | 30.480 | |
| VOL DRY GAS-METER COND | DM3 | 0.67 | 0.67 | 0.65 | |
| AVG GAS METER TEMP | DEG.C | 27.5 | 24.7 | 25.6 | |
| VOL.DRY GAS-STD COND | DNM3 | 0.65 | 0.65 | 0.63 | |
| TOTAL H2O COLLECTED | ML | 31.2 | 30.9 | 31.2 | |
| VOL H2O VAPOR-STD COND | [illegible] | [illegible] | 0.04 | 0.04 | |
| PERCENT MOISTURE BY VOL | | 6.1 | 6.0 | 6.2 | |
| MOLE FRACTION DRY GAS | | 0.939 | 0.940 | 0.938 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | 0.0 | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | 21.0 | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | 0.0 | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | 79.0 | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | 28.84 | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.18 | 28.19 | 28.17 | |
| AVG STACK TEMPERATURE | DEG.C | 113.9 | 115.3 | 120.0 | |
| NET SAMPLING POINTS | | | | | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 743.46 | 742.70 | 742.70 | |
| AVG STACK GAS VELOCITY | M/S | 25.832 | 26.149 | 25.542 | 25.84 |
| STK FLOWRATE, DRY,STD CN | DNM3/M | 2785. | 2809. | 2705. | 2766 |
| ACTUAL STACK FLOWRATE | AM3/M | 3987. | 4036. | 3942. | 3988 |
| PERCENT ISOKINETIC | | 98.9 | 98.9 | 99.7 | 99. |

TABLE A-9

PLANT: RESERVE MINING CONVEYOR STACK NO.20
LOCATION: SILVER BAY, MINN.
OPERATOR: EPA

SUMMARY IN ENGLISH UNITS

| DESCRIPTION | UNITS | 11 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 9-13-73 | |
| STACK AREA | FT2 | 8.618 | |
| NET TIME OF RUN | MIN | 120.0 | |
| BAROMETRIC PRESSURE | IN.HG | 29.25 | |
| AVG ORIFICE PRES DROP | IN.H2O | 2.600 | |
| VOL DRY GAS-METER COND | DCF | 112.40 | |
| AVG GAS METER TEMP | DEG.F | 63.5 | |
| VOL DRY GAS-STD COND | DSCF | 111.95 | |
| TOTAL H2O COLLECTED | ML | 12.0 | |
| VOL H2O VAPOR-STD COND | SCF | 0.57 | |
| PERCENT MOISTURE BY VOL | | 0.5 | |
| MOLE FRACTION DRY GAS | | 0.995 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.79 | |
| AVG STACK TEMPERATURE | DEG.F | 74.7 | |
| NET SAMPLING POINTS | | | |
| STACK PRESSURE, ABSOLUTE | IN.HG | 29.21 | |
| AVG STACK GAS VELOCITY | FPS | 52.119 | 52.119 |
| STK FLOWRATE, DRY,STD CN | DSCFM | 25940. | 25940. |
| ACTUAL STACK FLOWRATE | ACFM | 26949. | 26949. |
| PERCENT ISOKINETIC | | 102.9 | 102.9 |

TABLE A-10

PLANT: RESERVE MINING CONVEYOR STACK NO.20
LOCATION: SILVER BAY, MINN.
OPERATOR: EPA

SUMMARY IN METRIC UNITS

| DESCRIPTION | UNITS | 11 | AVERAGE |
|---|---|---|---|
| DATE OF RUN | | 9-13-73 | |
| STACK AREA | M2 | 0.801 | |
| NET TIME OF RUN | MIN | 120.0 | |
| BAROMETRIC PRESSURE | MM.HG | 742.95 | |
| AVG ORIFICE PRES DROP | MM.H2O | 66.040 | |
| VOL DRY GAS-METER COND | DM3 | 3.18 | |
| AVG GAS METER TEMP | DEG.C | 17.5 | |
| VOL DRY GAS-STD COND | DNM3 | 3.17 | |
| TOTAL H2O COLLECTED | ML | 12.0 | |
| VOL H2O VAPOR-STD COND | NM3 | 0.02 | |
| PERCENT MOISTURE BY VOL | | 0.5 | |
| MOLE FRACTION DRY GAS | | 0.995 | |
| PERCENT CO2 BY VOL, DRY | | 0.0 | |
| PERCENT O2 BY VOL, DRY | | 21.0 | |
| PERCENT CO BY VOL, DRY | | 0.0 | |
| PERCENT N2 BY VOL, DRY | | 79.0 | |
| MOLECULAR WT-DRY STK GAS | | 28.84 | |
| MOLECULAR WT-STK GAS | | 28.79 | |
| AVG STACK TEMPERATURE | DEG.C | 23.7 | |
| NET SAMPLING POINTS | | | |
| STACK PRESSURE, ABSOLUTE | MM.HG | 741.93 | |
| AVG STACK GAS VELOCITY | M/S | 15.886 | 15.886 |
| STK FLOWRATE, DRY,STD CN | DNM3/M | 735. | 735. |
| ACTUAL STACK FLOWRATE | AM3/M | 763. | 763. |
| PERCENT ISOKINETIC | | 102.9 | 102.9 |

# APPENDIX A. SAMPLE CALCULATIONS

## Nomenclature

| | |
|---|---|
| $P_b$ | Barometric Pressure, mm. Hg. |
| $P_m$ | Average Orifice Pressure Drop, mm. $H_2O$ |
| $T_m$ | Average Dry Gas Meter Temperature, °C |
| $V_m$ | Volume of Dry Gas Sampled at Meter Conditions, $Am^3$ |
| $V_{m_{std}}$ | Volume of Dry Gas Sampled at Standard Conditions(1), $Nm^3$ |
| $V_w$ | Total $H_2O$ Collected in Impingers and Silica Gel, ml |
| $V_{w_{std}}$ | Volume of Water Vapor Collected at Standard Conditions(1), $Nm^3$ |
| %M | Percent Moisture in Stack Gas, by Volume |
| $M_d$ | Mole Fraction Dry Stack Gas |
| $\%CO_2$ | Percent $CO_2$ by volume, dry |
| $\%O_2$ | Percent $O_2$ by volume, dry |
| %CO | Percent CO by volume, dry |
| $\%N_2$ | Percent $N_2$ by volume, dry |
| $MW_d$ | Molecular Weight of Dry Stack Gas, gm/gm-mole |
| MW | Molecular Weight of Wet Stack Gas, gm/gm-mole |
| $C_p$ | Pitot Tube Coefficient |
| $P_s$ | Stack Gas Pressure, mm. Hg., absolute |
| $T_s$ | Stack Gas Temperature, °C |
| $\overline{T}_s$ | Average Stack Gas Temperature, °C |
| $\Delta P_s$ | Velocity head, mm. $H_2O$ |
| $V_s$ | Average Stack Gas Velocity, Stack Conditions, Am/s |
| $A_s$ | Stack Area, $m^2$ |
| $Q_s$ | Stack Gas Flow Rate at Standard Conditions(1), dry $Nm^3/min$ |

| | |
|---|---|
| $Q_a$ | Stack Gas Flow Rate at Stack Conditions, $Am^3/min$ |
| $T_t$ | Net Time of Test, min. |
| $D_n$ | Sampling Nozzle Diameter, mm. |
| %I | Percent Isokinetic |
| $m_f$ | Particulate Collected in Probe, cyclone and filter, mg. |
| $m_t$ | Total Particulate Collected, mg. |
| $I_c$ | Percent of Particulate Caught in Impingers |
| $C_{sf}$ | Particulate Concentrations at Standard Conditions(1), dry, based on probe, cyclone and filter catch, $mg/Nm^3$ |
| $C_{st}$ | Particulate Concentration at Standard Conditions(1), dry, based on total catch, $mg/Nm^3$ |
| $C_{af}$ | Particulate Concentration at Stack Conditions, based on probe, cyclone and filter catch, $mg/Am^3$ |
| $C_{at}$ | Particulate Concentration at Stack Conditions, based on total catch, $mg/Am^3$ |
| $E_f$ | Particulate Emission Rate, based on probe, cyclone and filter catch, kg/hr |
| $E_t$ | Particulate Emission Rate, based on total particulate catch, kg/hr |
| $P_u$ | Unit Process Rate, Crusher feed rate or Green pellet feed rate, Mton/hr. |
| $PE_f$ | Particulate Emission Rate on a Process Basis, probe, cyclone and filter catch, kg/ Mton |
| $PE_t$ | Particulate Emission Rate on a Process Basis, total catch kg/ Mton |
| %EA | Percent Excess Air in Stack Gas |

Calculations

1. Volume of Dry Gas Sampled at Standard Conditions[1]

$$V_{m_{std}} = \frac{0.3875 \times V_m \times (P_b + P_m/13.6)}{(T_m + 273)} = \frac{0.3875 \times 2.65 \times (739.14 - \frac{44.7}{13.6})}{(29.2 + 273)}$$

$$= 2.52 \text{ Nm}^3$$

2. Volume of Water Vapor at Standard Conditions[1]

$$V_{w_{gas}} = 0.0012 \times V_w = 0.0012 \times 19.2 = 0.03 \text{ Nm}^3$$

3. Percent Moisture in Stack Gas by Volume

$$\%M = \frac{100 \times V_{w_{gas}}}{V_{w_{gas}} + V_{m_{std}}} = \frac{100 \times 0.03}{0.03 + 2.52} = 1.0 \%$$

4. Mole Fraction Dry Stack Gas

$$M_d = \frac{100 - \%M}{100} = \frac{100 - 1.0}{100} = 0.99$$

5. Molecular Weight of Dry Stack Gas

$$MW_d = (\%CO_2 \times \frac{44}{100}) + (\%O_2 \times \frac{32}{100}) + [(\%CO + \%N_2) \times \frac{28}{100}] =$$

$$(0.0 \times .44) + (21 \times 0.32) + [(0.0 + 79) \times .28]$$

$$= 28.84 \text{ gm/gm-mole}$$

6. Molecular Weight of Wet Stack Gas

$$MW = MW_d \times M_d + 18(1-M_d) = 28.84 \times .99 + 18(1 - .99)$$

$$= 28.73 \text{ gm/gm-mole}$$

7. Stack Gas Velocity at Stack Conditions[2]

$$V_s = 34.98 \times C_p \times \sqrt{\Delta P_s \times (T_s + 273)} \left[\frac{1}{P_s \times MW}\right]^{\frac{1}{2}} =$$

$$34.98 \times .85 \times 106.35 \left[\frac{1}{739.14 \times 28.73}\right]^{\frac{1}{2}} = 21.7 \text{ Am/sec}$$

8. Stack Gas Volumetric Flow Rate at Standard Conditions[1], dry

$$Q_s = \frac{23.25 \times V_s \times A_s \times M_d \times P_s}{(T_s + 273)} = \frac{23.25 \times 21.7 \times 0.369 \times .99 \times 739.14}{(15.9 + 273)}$$

$$= 471 \text{ Nm}^3/\text{min}$$

9. Stack Gas Volumetric Flow Rate at Stack Conditions

$$Q_a = \frac{2.58 \times Q_s(\bar{T}_s + 273)}{P_s \times M_d} = \frac{2.58 \times 471 \ (15.9 + 273)}{739.14 \times .99}$$

$$= 481 \text{ Am}^3/\text{min}$$

10. Percent Isokinetic

$$\%I = \frac{54{,}120 \times (\bar{T}_s + 273) \times V_{m_{std}}}{V_s \times T_t \times P_s \times M_d \times (D_n)^2}$$

$$= \frac{54{,}120 \times (15.9 + 273) \times 2.52}{21.7 \times 120. \times 739.14 \times .99 \times (4.62)^2} = 98.1 \%$$

11. Particulate Concentration at Standard Conditions[1], dry, based on probe, cyclone and filter catch

$$C_{sf} = \frac{m_f}{V_{m_{std}}} = \frac{26.7}{2.52} = 10.57 \text{ mg/Nm}^3$$

12. Particulate Concentration at Standard Conditions[1], dry, based on total catch

$$C_{st} = \frac{m_t}{V_{m_{std}}} = \frac{28.48}{2.52} = 11.27 \text{ mg/Nm}^3$$

13. Particulate Concentration at Stack Conditions, based on probe, cyclone, and filter catch

$$C_{af} = \frac{0.3875 \times C_{sf} \times P_s \times M_d}{(T_s + 273)} = \frac{0.3875 \times 10.57 \times 739.14 \times .99}{(15.9 + 273)}$$

$$= 10.35 \text{ mg/Am}^3$$

14. Particulate Concentration at Stack Conditions, based on total catch

$$C_{at} = \frac{0.3875 \times C_{sf} \times P_s \times M_d}{(\overline{T}_s + 273)} = \frac{0.3875 \times 11.27 \times 739.14 \times .99}{(15.9 + 273)}$$

$$= 11.04 \text{ mg/Am}^3$$

15. Particulate Emission Rate, based on probe, cyclone, and filter catch

$$E_f = 1{,}000{,}000 \times C_{sf} \times Q_s = 1{,}000{,}000 \times 10.57 \times 471 = 0.30 \text{ kg/hr}$$

16. Particulate Emission Rate, based on total catch

$$E_t = 1{,}000{,}000 \times C_{st} \times Q_s = 1{,}000{,}000 \times 11.27 \times 471 = 0.32 \text{ kg/hr}$$

17. Particulate Emission Rate on a Process Basis, probe, cyclone, and filter catch

$$PE_f = \frac{E_f}{P_u} = \frac{0.30}{409.5 \text{ Mton/hr}} = \underline{0.00073 \text{ kg/Mton}} \text{ crusher feed}$$

18. Particulate Emission Rate on a Process Basis, total catch

$$PE_t = \frac{E_t}{P_u} = \frac{0.032}{409.5} = \underline{0.00073 \text{ kg/Mton}} \text{ crusher feed}$$

19. Asbestos emissions calculated in the same manner as Items 11-18.

---

(1) Standard Conditions: 21.1°C, 760 mm. Hg.

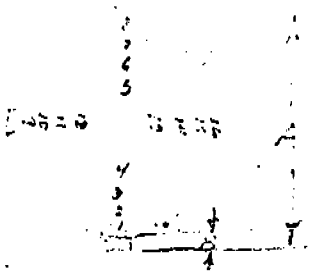
(2) $\sqrt{\Delta P_s \times (T_s + 273)}$ is determined by averaging the square root of the product of the velocity head ($\Delta P_s$) and the absolute stack temperature ($T_s + 273$) at each sampling point.

APPENDIX B

Field Data

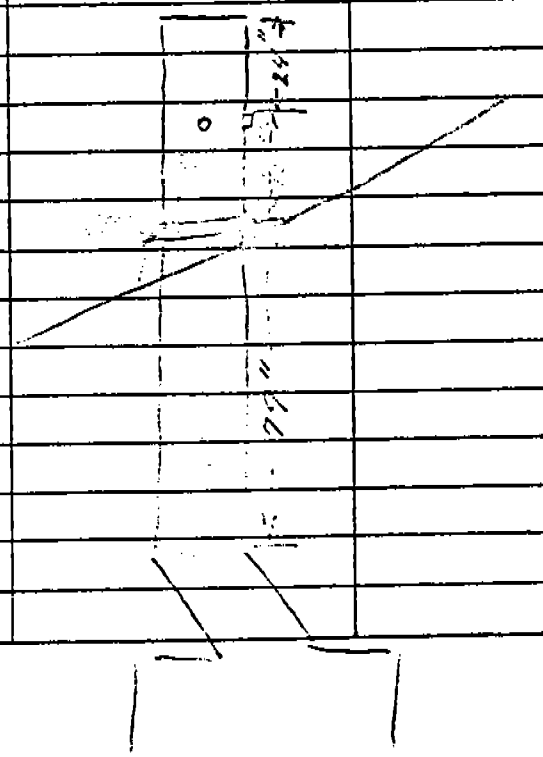
# TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT [illegible]
DATE [illegible]
SAMPLING LOCATION [illegible] 112 (Line 104)
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE A) [illegible]
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE B) [illegible]
STACK I.D., (DISTANCE A - DISTANCE B) [illegible]
NEAREST UPSTREAM DISTURBANCE [illegible] 10'
NEAREST DOWNSTREAM DISTURBANCE [illegible]
CALCULATOR



SCHEMATIC OF SAMPLING LOCATION

| TRAVERSE POINT NUMBER | FRACTION OF STACK I.D. | STACK I.D. | PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH) | DISTANCE B | TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5) |
|---|---|---|---|---|---|
| 1 | .033 | 27" | .891 delete | 3" | — |
| 2 | .105 | 27" | 2.83 | 3" | ~~5.83~~ 5 7/8 |
| 3 | .194 | | 5.24 | 3" | 8. 8 1/4 |
| 4 | .323 | | 8.72 | 3" | 11 3/4 |
| 5 | .677 | | 18.28 | 3" | 21 1/4 |
| 6 | .806 | | 21.7[illegible] | 3" | 24 3/4 |
| 7 | .885 | | 23.9 | 3" | 26 7/8 |
| 8 | .967 | | 26.1 delete | 3" | — |



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4/72

# NOMOGRAPH DATA

PLANT Reserve Mining

DATE 2-11-73

SAMPLING LOCATION Fine Crusher stack

| | | |
|---|---|---|
| CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. $H_2O$ | $\Delta H_@$ | [illegible] |
| AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F | $T_{m_{avg.}}$ | [illegible] |
| PERCENT MOISTURE IN GAS STREAM BY VOLUME | $B_{wo}$ | 2 |
| BAROMETRIC PRESSURE AT METER, in. Hg | $P_m$ | 29.08 |
| STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. $H_2O$) | $P_s$ | 29.08 |
| RATIO OF STATIC PRESSURE TO METER PRESSURE | $P_s/P_m$ | 1 |
| AVERAGE STACK TEMPERATURE, °F | $T_{s_{avg.}}$ | 65 |
| AVERAGE VELOCITY HEAD, in. $H_2O$ | $\Delta p_{avg.}$ | [illegible] |
| MAXIMUM VELOCITY HEAD, in. $H_2O$ | $\Delta p_{max.}$ | 2.4 |
| C FACTOR | | 0.98 |
| CALCULATED NOZZLE DIAMETER, in. | | |
| ACTUAL NOZZLE DIAMETER, in. | | 0.182 |
| REFERENCE $\Delta p$, in. $H_2O$ | | 1.65 |

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Stack gas
Swirling.
Stack ID
Surface wet.

# FIELD DATA

PLANT Pacific Mining
DATE 7-11-83
SAMPLING LOCATION East Primary Stack
SAMPLE TYPE Particulate
RUN NUMBER 1
OPERATOR
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.05
STATIC PRESSURE, ($P_s$) -0.05
FILTER NUMBER (s) 1000023

PROBE LENGTH AND TYPE 10' glass lined
NOZZLE I.D. 0.187
ASSUMED MOISTURE, % 3
SAMPLE BOX NUMBER 1
METER BOX NUMBER 1
METER $\Delta H_@$ 1.72
C FACTOR 0.99
PROBE HEATER SETTING 150
HEATER BOX SETTING 150
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. $H_2O$ | | STACK TEMPERATURE ($T_s$), °F | DRY GAS METER TEMPERATURE | | PUMP VACUUM, in. Hg | SAMPLE BOX TEMPERATURE, °F | IMPINGER TEMPERATURE, °F | Probe °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DESIRED | ACTUAL | | INLET ($T_{m\,in}$), °F | OUTLET ($T_{m\,out}$), °F | | | | |
| | 1003 | 648.3 | | | | | | | | | | |
| 2 | 5 1008 | 651.1 | 1.3 | 1.5 | 1.3 | 61 | 69 | 62 | 5 | 130 | 57 | 126 |
| 3 | 5 1013 | 654.9 | 1.3 | 1.5 | 1.5 | 68 | 72 | 72 | 5 | 144 | 55 | 140 |
| 4 | 5 1020 | 658.7 | 1.7 | 1.6 | 1.6 | 68 | 80 | 72 | 5½ | 151 | 54 | 135 |
| 5 | 5 1025 | 662.3 | 1.9 | 2.15 | 2.15 | 68 | 75 | 72 | 7 | 155 | 54 | 138 |
| 6 | 5 1030 | 650.7 | 1.85 | 2.1 | 2.1 | 70 | 79 | 72 | 7 | 132 | 55 | 131 |
| 7 | 5 1035 | 654.7 | 1.7 | 2.0 | 2.0 | 68 | 86 | 72 | 7 | 171 | 55 | 140 |
| | 1032 | ↓ | | | | | | | | | | |
| 8 | 5 1042 | 658.5 | 1.3 | 1.5 | 1.5 | 65 | 75 | 73 | 6 | 155 | 54 | 158 |
| 9 | 5 1047 | 661.8 | 1.2 | 1.35 | 1.3 | 66 | 82 | 73 | 5 | 147 | 55 | 134 |
| 10 | 5 1052 | 665.0 | 0.9 | 1.0 | 1.0 | 68 | 83 | 74 | 4½ | 144 | 56 | 142 |
| 11 | 5 1057 | 668.9 | 1.9 | 2.15 | 2.15 | 70 | 84 | 74 | 7 | 154 | 55 | 142 |
| 12 | 5 1103 | 673.2 | 2.1 | 2.35 | 2.25 | 70 | 86 | 75 | 8 | 161 | 55 | 145 |
| 13 | 5 1107 | 678.0 | 2.2 | 2.5 | 2.5 | 69 | 86 | 75 | 8 | 134 | 55 | 128 |
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COMMENTS:

# ANALYTICAL DATA

PLANT Reserve

DATE 9-11-73

SAMPLING LOCATION FINE CRUSHER

SAMPLE TYPE PARTICULATE

RUN NUMBER 1

SAMPLE BOX NUMBER _____

CLEAN-UP MAN J. Faught

COMMENTS:

## FRONT HALF

~~ACETONE~~ WATER WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

FILTER NUMBER 100003

LABORATORY RESULTS

CONTAINER S-73-004 501 _____ mg

CONTAINER S-73-004-502 _____ mg

FRONT HALF SUBTOTAL _____ mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

~~ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER~~

CONTAINER S-73004 503 _____ mg

~~ETHER-CHLOROFORM EXTRACTION~~ _____ mg

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

## MOISTURE

| | | | | |
|---|---|---|---|---|
| IMPINGERS | 205 | | | |
| FINAL VOLUME | ~~[illegible]~~ ml | | | |
| INITIAL VOLUME | 200. ml | | | |
| NET VOLUME | ~~[illegible]~~ 5.0 ml | | | |
| SILICA GEL | | | | |
| FINAL WEIGHT | 483.1 g | _____ g | _____ g | |
| INITIAL WEIGHT | 475.0 g | _____ g | _____ g | |
| NET WEIGHT | ~~[illegible]~~ 8.1 g | _____ g | _____ g | |

TOTAL MOISTURE 13.1 g

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4/72

# FIELD DATA

PLANT Bunge Mining
DATE [illegible]
SAMPLING LOCATION Fire Feather stack
SAMPLE TYPE Particulate
RUN NUMBER 2
OPERATOR [illegible]
AMBIENT TEMPERATURE [illegible]
BAROMETRIC PRESSURE [illegible]
STATIC PRESSURE, ($P_s$) [illegible]
FILTER NUMBER (s) 1000004

PROBE LENGTH AND TYPE 4' Glass lined
NOZZLE I.D. 0.189
ASSUMED MOISTURE, % 2
SAMPLE BOX NUMBER 2
METER BOX NUMBER 1
METER $\Delta H_@$ 1.75
C FACTOR 0.99
PROBE HEATER SETTING [illegible]
HEATER BOX SETTING 250
REFERENCE $\Delta p$ 1.64

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 10 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. $H_2O$ | | 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 | | | |
| | | | 678.1 | | | | | | | | | |
| 2 | 10 | 1 19 | 685.4 | 1.3 | 1.5 | 1.5 | 61 | 69 | 67 | 6 | 143 | 52 |
| 3 | 10 | 1 29 | 692.7 | 1.35 | 1.52 | 1.55 | 62 | 70 | 69 | 6½ | 177 | 60 |
| 4 | 10 | 1 39 | 700.2 | 1.45 | 1.62 | 1.60 | 60 | 82 | 70 | 7 | 142 | 56 |
| 5 | 10 | 1 49 | 708.6 | 1.9 | 2.12 | 2.12 | 61 | 85 | 71 | 8½ | 166 | 58 |
| 6 | 10 | 1 59 | 717.0 | 1.8 | 2.0 | 2.0 | 61 | 86 | 71 | 8½ | 145 | 58 |
| 7 | 10 | 2 09 | 725.2 | 1.7 | 1.9 | 1.9 | 62 | 87 | 73 | 8 | 170 | 57 |
| | | 2 09 | ↓ | | | | | | | | | |
| 10 | 10 | 2 14 | 732.8 | 1.3 | 1.5 | 1.5 | 61 | 80 | 71 | 6 | 148 | 59 |
| 11 | 10 | 2 24 | 739.7 | 1.1 | 1.25 | 1.25 | 61 | 84 | 73 | 6 | 159 | 55 |
| 12 | 10 | 2 34 | 745.7 | 0.88 | 1.0 | 1.0 | 62 | 85 | 74 | 5 | 162 | 57 |
| 13 | 10 | 2 44 | 754.3 | 2.0 | 2.25 | 2.25 | 61 | 91 | 74 | 9 | 157 | 55 |
| 14 | 10 | 2 54 | 763.3 | 2.15 | 2.4 | 2.4 | 67 | 95 | 78 | 9½ | 159 | 56 |
| 15 | 10 | 3 04 | 773.0 | 2.2 | 2.45 | 2.45 | 65 | 100 | 84 | 9½ | 155 | 55 |
| | | | Total 94.9 | | | | | | | | | |

COMMENTS:

EPA (Our) 235
4 72

# ANALYTICAL DATA

PLANT Reserve

DATE 9-11-73

SAMPLING LOCATION FINE CRUSHER

SAMPLE TYPE PARTICULATE

RUN NUMBER 2

SAMPLE BOX NUMBER _____

CLEAN-UP MAN J Faught

COMMENTS:

## FRONT HALF

~~ACETONE~~ WATER WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

FILTER NUMBER Loooo04

LABORATORY RESULTS

CONTAINER S-73-004-506 _____ mg

CONTAINER S-73-004-505 _____ mg

FRONT HALF SUBTOTAL _____ mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

~~ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER~~

CONTAINER S-73-004-504 _____ mg

~~ETHER-CHLOROFORM EXTRACTION~~ _____ mg

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

## MOISTURE

IMPINGERS

| | | | |
|---|---|---|---|
| FINAL VOLUME | 208 ml | | |
| INITIAL VOLUME | 200 ml | | |
| NET VOLUME | 8 ml | | |

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | 488.3 g | _____ g | _____ g |
| INITIAL WEIGHT | 475.0 g | _____ g | _____ g |
| NET WEIGHT | 13.3 g | _____ g | _____ g. |

TOTAL MOISTURE 21.3 g

EPA (Dur) 231
4/72

# FIELD DATA

PLANT Revere Mining
DATE 9-11-73
SAMPLING LOCATION Fine Crusher Stack 110 (Line 104)
SAMPLE TYPE Particulate
RUN NUMBER 3
OPERATOR [illegible] Bob Poling
AMBIENT TEMPERATURE 78
BAROMETRIC PRESSURE 29.10
STATIC PRESSURE, ($P_s$)
FILTER NUMBER (s) 1000005

PROBE LENGTH AND TYPE 4' Glass lined
NOZZLE I.D. 0.182
ASSUMED MOISTURE, % 2
SAMPLE BOX NUMBER 3
METER BOX NUMBER 1
METER $\Delta H_@$ 1.72
C FACTOR 0.98
PROBE HEATER SETTING 150
HEATER BOX SETTING 150
REFERENCE $\Delta p$ 1.65

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 10 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 | Prob. Temp °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 3 [illegible] | 773.2 | | | | | | | | | | |
| 2 | 10 | 3 [illegible] | 780.5 | 1.35 | 1.5 | 1.5 | 62 | 89 | 82 | 7½ | 154 | 63 | 142 |
| 3 | 10 | 4 05 | 787.6 | 1.35 | 1.5 | 1.5 | 58 | 90 | 81 | 8 | 165 | 62 | 156 |
| 4 | 10 | 4 [illegible] | 795.0 | 1.4 | 1.58 | 1.55 | 60 | 88 | 79 | 8½ | 167 | 65 | 153 |
| 5 | 10 | 4 25 | 802.6 | 1.9 | 2.12 | 2.1 | 61 | 94 | 85 | 11 | 154 | 67 | 146 |
| 6 | 10 | 4 35 | 812.2 | 1.85 | 2.08 | 2.1 | 61 | 95 | 86 | 11 | 153 | 66 | 139 |
| 7 | 10 | 4 [illegible] | 830.8 | 1.75 | 1.98 | | 59 | 95 | 86 | 10½ | 158 | 64 | 119 |
| | | 4 50 | ↓ | | | | | | | | | | |
| 10 | 10 | 5 00 | 827.9 | 1.25 | 1.4 | 1.4 | 57 | 91 | 85 | 7 | 163 | 58 | 140 |
| 11 | 10 | 5 10 | 834.3 | 1.0 | 1.12 | 1.1 | 58 | 82 | 77 | 6 | 145 | 63 | 144 |
| 12 | 10 | 5 20 | 840.2 | 0.82 | 0.95 | 0.95 | 62 | 83 | 76 | 5½ | 174 | 62 | 152 |
| 13 | 10 | 5 30 | 848.5 | 1.9 | 2.12 | 2.1 | 63 | 84 | 73 | 10 | 159 | 61 | 151 |
| 14 | 10 | 5 40 | 857.7 | 2.2 | 2.45 | 2.45 | 64 | 88 | 78 | 11 | 152 | 61 | 140 |
| 15 | 10 | 5 50 | 866.9 | 2.1 | 2.35 | 2.35 | 63 | 88 | 77 | 11½ | 155 | 60 | 138 |
| | | | 93.7 | | | | | | | | | | |

COMMENTS:

EPA (Dur) 235
4-72

# ANALYTICAL DATA

PLANT Reserve

DATE 9-11-73

SAMPLING LOCATION FC

SAMPLE TYPE #2 PARTICULATE

RUN NUMBER 3

SAMPLE BOX NUMBER _____

CLEAN-UP MAN J Faught

COMMENTS:

## FRONT HALF

LABORATORY RESULTS

WATER
~~ACETONE~~ WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER S-73-004 507 _____ mg

FILTER NUMBER 1000005

CONTAINER S-73-004-508 _____ mg

FRONT HALF SUBTOTAL _____ mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

~~ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER~~

CONTAINER S-73004509 _____ mg

~~ETHER-CHLOROFORM EXTRACTION~~ _____ mg

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

## MOISTURE

IMPINGERS

| | | | |
|---|---|---|---|
| FINAL VOLUME | 205 ml | | |
| INITIAL VOLUME | 200 ml | | |
| NET VOLUME | 5 ml | | |

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | 489.2 g | _____ g | _____ g |
| INITIAL WEIGHT | 475.0 g | _____ g | _____ g |
| NET WEIGHT | 14.2 g | _____ g | _____ g |

TOTAL MOISTURE 19.2 g

EPA (Dur) 231
4/72

# DRY MOLECULAR WEIGHT DETERMINATION

PLANT Reserve Mining Co

DATE 12-11-73

SAMPLING TIME (24-hr CLOCK) 1320 - 1345 and 1610 - 1640 PM

SAMPLING LOCATION Flue Exhaust Stack

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Bag

ANALYTICAL METHOD Orsat

AMBIENT TEMPERATURE 65° ± 5°

OPERATOR Ben Furnace

COMMENTS:

| RUN / GAS | 1 | | 2 | | 3 | | AVERAGE NET VOLUME | MULTIPLIER | MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) $M_d$, lb/lb-mole |
|---|---|---|---|---|---|---|---|---|---|
| | ACTUAL READING | NET | ACTUAL READING | NET | ACTUAL READING | NET | | | |
| $CO_2$ | 0.0 | 0 | 0.0 | 0 | | | | 44/100 | |
| $O_2$ (NET IS ACTUAL $O_2$ READING MINUS ACTUAL $CO_2$ READING) | 21.0 | 21.0 | 21.0 | 21.0 | | | | 32/100 | |
| CO (NET IS ACTUAL CO READING MINUS ACTUAL $O_2$ READING) | 21.0 | 0.0 | 21.0 | 0.0 | | | | 28/100 | |
| $N_2$ (NET IS 100 MINUS ACTUAL CO READING) | 79.0 | 79.0 | 79.0 | 79.0 | | | | 28/100 | |
| | | | | | | | | TOTAL | |

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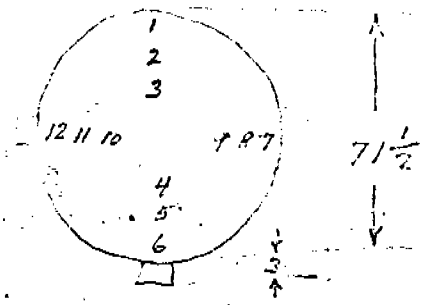
4/72

# TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Roane [illegible]
DATE 9-12-73
SAMPLING LOCATION Waste Gas Stack
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE A) 74 1/2
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE B) 3
STACK I.D., (DISTANCE A - DISTANCE B) ~71 1/2"
NEAREST UPSTREAM DISTURBANCE ~75 ft
NEAREST DOWNSTREAM DISTURBANCE 50 ft
CALCULATOR [illegible]




SCHEMATIC OF SAMPLING LOCATION

| TRAVERSE POINT NUMBER | FRACTION OF STACK I.D. | STACK I.D. | PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH) | DISTANCE B | TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5) |
|---|---|---|---|---|---|
| 1 | 4.4 | 71 1/2 | 3.1/4 | | 6.1/4 |
| 2 | 14.7 | | 10.5 | | 13.5 |
| 3 | 29.5 | | 21.1 | | 24.1 |
| 4 | 70.5 | | 50.4 | | 53.4 |
| 5 | 85.3 | | 61.0 | | 64.0 |
| 6 | 95.6 | | 68.4 | | 71.4 |
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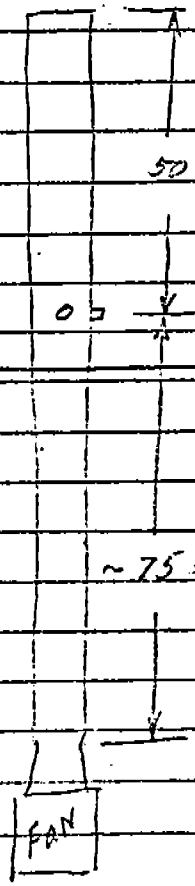

# PRELIMINARY VELOCITY TRAVERSE

PLANT Revere Mining Co
DATE 9-12-72
LOCATION Western Bar Stack
STACK I.D. 71 ± inches
BAROMETRIC PRESSURE, in. Hg 29.28
STACK GAUGE PRESSURE, in. $H_2O$
OPERATORS [illegible]

| TRAVERSE POINT NUMBER | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|
| 1 | 3.0 | 305 |
| 2 | 3.1 | 306 |
| 3 | 2.5 | 305 |
| 4 | 2.2 | 310 |
| 5 | 2.9 | 308 |
| 6 | 3.0 | 307 |
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| | | |
| AVERAGE | 2.8 | 307 |

SCHEMATIC OF TRAVERSE POINT LAYOUT

| TRAVERSE POINT NUMBER | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|
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| | | |
| AVERAGE | | |

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4/72

## NOMOGRAPH DATA

PLANT Revere Mining

DATE 9-12-73

SAMPLING LOCATION Waste Gas Stack

| | | |
|---|---|---|
| CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. $H_2O$ | $\Delta H_@$ | 1.72 |
| AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F | $T_{m_{avg.}}$ | 70 |
| PERCENT MOISTURE IN GAS STREAM BY VOLUME | $B_{wo}$ | 7 |
| BAROMETRIC PRESSURE AT METER, in. Hg | $P_m$ | 29.28 |
| STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. $H_2O$) | $P_s$ | 29.14 |
| RATIO OF STATIC PRESSURE TO METER PRESSURE | $P_s/P_m$ | 0.99 |
| AVERAGE STACK TEMPERATURE, °F | $T_{s_{avg.}}$ | 307 |
| AVERAGE VELOCITY HEAD, in. $H_2O$ | $\Delta p_{avg.}$ | 2.8 |
| MAXIMUM VELOCITY HEAD, in. $H_2O$ | $\Delta p_{max.}$ | 3.1 |
| C FACTOR | | 0.9 |
| CALCULATED NOZZLE DIAMETER, in. | | 0.17 |
| ACTUAL NOZZLE DIAMETER, in. | | 0.182 |
| REFERENCE $\Delta p$, in. $H_2O$ | | 2.5 |

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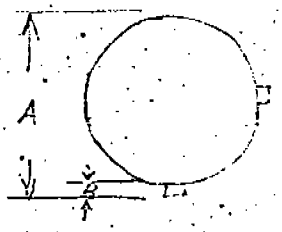
PROBE LENGTH AND TYPE 2 ft
NOZZLE I.D. 0.182
ASSUMED MOISTURE, % 7
SAMPLE BOX NUMBER 1
METER BOX NUMBER 1
METER $\Delta H_@$ 1.72
C FACTOR 0.9
PROBE HEATER SETTING
HEATER BOX SETTING 150
REFERENCE $\Delta p$ 2.5

ES

| DRY GAS METER TEMPERATURE | | PUMP VACUUM, in. Hg | SAMPLE BOX TEMPERATURE, °F | IMPINGER TEMPERATURE, °F | |
|---|---|---|---|---|---|
| INLET ($T_{m_{in}}$), °F | OUTLET ($T_{m_{out}}$), °F | | | | |
| 62 | 63 | 10 | 152 | 50 | 93 |
| 64 | 61 | 10 | 153 | 54 | 106 |
| 70 | 62 | 9 | 153 | 58 | 117 |
| 70 | 66 | 9 | 161 | 58 | 122 |
| 73 | 66 | 12 | 161 | 58 | 114 |
| 74 | 66 | 10½ | 154 | 58 | 110 |
| | | | | | |
| 71 | 67 | 20 | 151 | 60 | 105 |

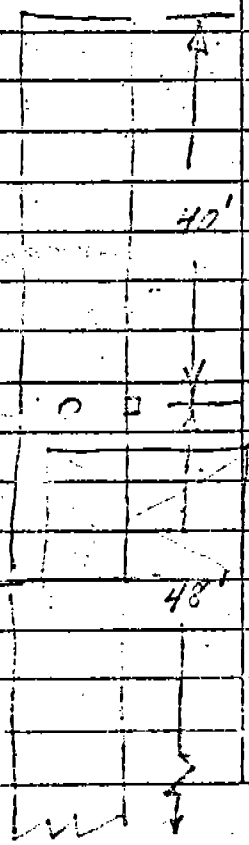
# TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Revere Printing Co.
DATE 8-13-93
SAMPLING LOCATION Wood Exhaust Stack
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE A) 77 3/4"
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE B) 3"
STACK I.D., (DISTANCE A - DISTANCE B) 71 1/4"
NEAREST UPSTREAM DISTURBANCE 42 ft
NEAREST DOWNSTREAM DISTURBANCE 40 ft
CALCULATOR E. Peluso




SCHEMATIC OF SAMPLING LOCATION

| TRAVERSE POINT NUMBER | FRACTION OF STACK I.D. | STACK I.D. | PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH) | DISTANCE B | TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5) |
|---|---|---|---|---|---|
| 1 | 4.4 | 71 1/4 | 3.14 | 3 | 6.14 |
| 2 | 14.7 | | 10.5 | | 13.5 |
| 3 | 29.5 | | 21.1 | | 24.1 |
| 4 | 70.5 | | 50.4 | | 53.4 |
| 5 | 85.3 | | 61.0 | | 64.0 |
| 6 | 95.6 | | 68.4 | | 71.4 |



# ANALYTICAL DATA

PLANT Reserve

DATE 9-12-73

SAMPLING LOCATION WASTE GAS STACK

SAMPLE TYPE PARTICULATE

RUN NUMBER 4

SAMPLE BOX NUMBER _____

CLEAN-UP MAN J Faught

COMMENTS:

## FRONT HALF

~~ACETONE~~ WATER WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

FILTER NUMBER 100006

LABORATORY RESULTS

CONTAINER 5-73-004 510 _____ mg

CONTAINER 5-73-004-511 _____ mg

FRONT HALF SUBTOTAL _____ mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

~~ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER~~

CONTAINER 5-73-004 512 _____ mg

~~ETHER-CHLOROFORM EXTRACTION~~ _____ mg

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

## MOISTURE

IMPINGERS

| | | | |
|---|---|---|---|
| FINAL VOLUME | 226 ml | | |
| INITIAL VOLUME | 200 ml | | |
| NET VOLUME | 26 ml | | |

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | 479.9 g | _____ g | _____ g |
| INITIAL WEIGHT | 475.0 g | _____ g | _____ g |
| NET WEIGHT | 4.9 g | _____ g | _____ g |

TOTAL MOISTURE 30.9 g

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# FIELD DATA

PLANT Reverse Mining Co
DATE
SAMPLING LOCATION Waste Gas Stack
SAMPLE TYPE
RUN NUMBER
OPERATOR
AMBIENT TEMPERATURE 167
BAROMETRIC PRESSURE
STATIC PRESSURE, ($P_s$)
FILTER NUMBER (s) 1000007

PROBE LENGTH AND TYPE 9ft
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER 3
METER BOX NUMBER 1
METER $\Delta H_@$ 1.72
C FACTOR 0.9
PROBE HEATER SETTING Heat tape on probe O.D.
HEATER BOX SETTING 170
REFERENCE $\Delta p$ 2.5

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. $H_2O$ | | STACK TEMPERATURE ($T_s$), °F | DRY GAS METER TEMPERATURE | | PUMP VACUUM, in. Hg | SAMPLE BOX TEMPERATURE, °F | IMPINGER TEMPERATURE, °F | Probe Temp. °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DESIRED | ACTUAL | | INLET ($T_{m\,in}$), °F | OUTLET ($T_{m\,out}$), °F | | | | |
| | 2 [illegible] | 889.3 | | | | | | | | | | |
| 7 | 3 2 33 | 891.1 | 1.4 | 1.0 | 1.0 | 357 | 74 | 76 | 6 | 180 | 62 | 115 |
| 8 | 3 2 36 | 893.0 | 1.5 | 1.1 | 1.1 | 354 | 74 | 76 | 7 | 189 | 61 | 135 |
| 9 | 3 2 39 | 894.9 | 1.6 | 1.2 | 1.2 | 356 | 76 | 74 | 7½ | 193 | 62 | 144 |
| 10 | 3 2 42 | 897.4 | 3.5 | 2.5 | 2.5 | 361 | 77 | 74 | 14 | 184 | 64 | 150 |
| 11 | 3 2 45 | 900.4 | 4.2 | 3.0 | 2.95 | 362 | 79 | 75 | 18 | 184 | 67 | 148 |
| 12 | 3 2 48 | 903.3 | 3.6 | 2.6 | 2.6 | 356 | 78 | 73 | 16 | 177 | 69 | 141 |
| | 2 53 | * | | | | | | | | | | |
| 1 | 3 2 56 | 905.9 | 3.0 | 2.2 | 2.2 | 356 | 81 | 76 | 12 | 176 | 72 | 121 |
| 2 | 3 2 57 | 908.5 | 2.9 | 2.1 | 2.1 | 358 | 80 | 76 | 12 | 178 | 73 | 129 |
| 3 | 3 3 02 | 910.8 | 2.3 | 1.7 | 1.7 | 361 | 76 | 75 | 11 | 179 | 68 | 138 |
| 4 | 3 3 05 | 913.2 | 2.5 | 1.8 | 1.8 | 361 | 76 | 75 | 11 | 181 | 68 | 147 |
| 5 | 3 3 08 | 915.8 | 3.1 | 2.25 | 2.25 | 363 | 79 | 76 | 14 | 185 | 72 | 148 |
| 6 | 3 3 11 | 918.3 | 2.8 | 2.0 | 2.0 | 358 | 75 | 74 | 12 | 177 | 65 | 144 |
| | | | | | | | | | | | | |
| | | -29.0 | | | | | | | | | | |
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COMMENTS:

EPA (Dur) 235
4 72

# ANALYTICAL DATA

PLANT Reserve

DATE 9-12-73

SAMPLING LOCATION WASTE GAS STACK

SAMPLE TYPE PARTICULATE

RUN NUMBER 5

SAMPLE BOX NUMBER _____

CLEAN-UP MAN J Faught

COMMENTS:

## FRONT HALF

WATER
~~ACETONE~~ WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

FILTER NUMBER 100007

LABORATORY RESULTS

CONTAINER S-73 004 513 _____ mg

CONTAINER S-73-004-514 _____ mg

FRONT HALF SUBTOTAL _____ mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

~~ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER~~

CONTAINER S-73 004 515 _____ mg

~~ETHER-CHLOROFORM EXTRACTION~~ _____ mg

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

## MOISTURE

IMPINGERS

| | | | |
|---|---|---|---|
| FINAL VOLUME | 246 ml | | |
| INITIAL VOLUME | 200 ml | | |
| NET VOLUME | 46 ml | | |

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | 483.6 g | _____ g | _____ g |
| INITIAL WEIGHT | 475.0 g | _____ g | _____ g |
| NET WEIGHT | 8.6 g | _____ g | _____ g |

TOTAL MOISTURE 54.6

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# FIELD DATA

PLANT Reserve Mining Co
DATE 9-12-73
SAMPLING LOCATION Waste Gas Stack
SAMPLE TYPE Particulate
RUN NUMBER 6
OPERATOR [illegible]
AMBIENT TEMPERATURE 78
BAROMETRIC PRESSURE 29.28
STATIC PRESSURE, ($P_s$) 29.14
FILTER NUMBER (s) 1000008

PROBE LENGTH AND TYPE 9 ft SS 316
NOZZLE I.D. 0.182
ASSUMED MOISTURE, % 7
SAMPLE BOX NUMBER 1
METER BOX NUMBER 1
METER $\Delta H_@$ 1.72
C FACTOR 0.9
PROBE HEATER SETTING None
HEATER BOX SETTING 170
REFERENCE $\Delta p$ 2.5

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 3 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 | Probe Temp °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4[illegible] | 919.6 | | | | | | | | | | |
| 1 | 3 | 4 13 | 922.3 | 3.0 | 2.2 | 2.2 | 355 | 73 | 72 | 17 | 193 | 59 | 124 |
| 2 | 3 | 4 16 | 924.8 | 2.9 | 2.1 | 2.1 | 357 | 72 | 71 | 19 | 189 | 61 | 137 |
| 3 | 3 | 4 19 | 927.1 | 2.1 | 1.55 | 1.6 | 354 | 73 | 72 | 18 | 180 | 63 | 148 |
| 4 | 3 | 4 22 | 929.4 | 2.4 | 1.75 | 1.75 | 354 | 76 | 73 | 14 | 176 | 63 | 154 |
| 5 | 3 | 4 25 | 931.9 | 3.1 | 2.25 | 2.1 | 354 | 75 | 73 | 20 | 179 | 64 | 153 |
| 6 | 3 | 4 28 | 934.4 | 2.8 | 2.0 | 2.0 | 349 | 75 | 73 | 20 | 172 | 64 | 147 |
| | | 4 32 | ↓ | | | | | | | | | | |
| 7 | 3 | 4 35 | 936.6 | 1.5 | 1.1 | 1.1 | 352 | 72 | 73 | 9 | 150 | 59 | 128 |
| 8 | 3 | 4 38 | 938.5 | 1.8 | 1.35 | 1.35 | 356 | 73 | 73 | 10 | 194 | 59 | 129 |
| 9 | 3 | 4 41 | 940.6 | 1.9 | 1.4 | 1.4 | 361 | 73 | 74 | 11 | 200 | 60 | 137 |
| 10 | 3 | 4 44 | 943.4 | 3.4 | 2.5 | 2.4 | 366 | 73 | 73 | 19 | 178 | 59 | 142 |
| 11 | 3 | 4 [illegible] | 946.6 | 4.1 | 3.1 | 2.1* | 363 | 75 | 72 | 20 | 170 | 60 | 131 |
| 12 | 3 | 4 51 | 949.5 | 3.9 | 2.8 | 2.1* | 361 | 75 | 73 | 20 | 185 | 62 | 127 |

COMMENTS:

* Low voltage

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4 72

# ANALYTICAL DATA

PLANT Reserve Mining

DATE 9-12-73

SAMPLING LOCATION WASTE GAS STACK

SAMPLE TYPE PARTICULATE

RUN NUMBER 6

SAMPLE BOX NUMBER _____

CLEAN-UP MAN _____

COMMENTS:

## FRONT HALF

LABORATORY RESULTS

WATER
~~ACETONE~~ WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER S-73 004 516 _____ mg

FILTER NUMBER 100008 _____

CONTAINER S-73-004-517 _____ mg

FRONT HALF SUBTOTAL _____ mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

~~ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER~~

CONTAINER S-73 004 518 _____ mg

~~ETHER-CHLOROFORM EXTRACTION~~ _____ mg

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

## MOISTURE

IMPINGERS

| | | | |
|---|---|---|---|
| FINAL VOLUME | 246 ml | | |
| INITIAL VOLUME | 200 ml | | |
| NET VOLUME | 46 ml | | |

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | 482.8 g | _____ g | _____ g |
| INITIAL WEIGHT | 475.0 g | _____ g | _____ g |
| NET WEIGHT | 7.8 g | _____ g | _____ g |

TOTAL MOISTURE 53.8 g

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# FIELD DATA

Orsat:
$CO_2$ 0.8
$O_2$ 20.0
CO 0.0

PLANT Peerless Mining Co
DATE [illegible]
SAMPLING LOCATION [illegible] Stack
SAMPLE TYPE [illegible]
RUN NUMBER 1
OPERATOR [illegible]
AMBIENT TEMPERATURE [illegible]
BAROMETRIC PRESSURE [illegible]
STATIC PRESSURE, ($P_s$) 27.14
FILTER NUMBER (s) [illegible]

PROBE LENGTH AND TYPE [illegible] SS 316
NOZZLE I.D. 0.182
ASSUMED MOISTURE, % [illegible]
SAMPLE BOX NUMBER [illegible]
METER BOX NUMBER 1
METER $\Delta H_@$ 1.72
C FACTOR [illegible]
PROBE HEATER SETTING [illegible]
HEATER BOX SETTING 177
REFERENCE $\Delta p$ [illegible]

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY [illegible] 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. $H_2O$ | | STACK TEMPERATURE ($T_s$), °F | DRY GAS METER TEMPERATURE | | PUMP VACUUM, in. Hg | SAMPLE BOX TEMPERATURE, °F | IMPINGER TEMPERATURE, °F | Probe Temp °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DESIRED | ACTUAL | | INLET ($T_{m\ in}$), °F | OUTLET ($T_{m\ out}$), °F | | | | |
| | | 953.4 | | | | | | | | | | |
| [illegible] | 3 6[illegible] | 955.2 | 1.4 | 1.05 | 1.05 | 331 | 85 | 82 | 6 | 175 | 66 | 127 |
| [illegible] | 3 6[illegible] | 957.2 | 1.6 | 1.2 | 1.2 | 327 | 86 | 83 | 7 | 177 | 66 | 128 |
| [illegible] | 3 6[illegible] | 959.1 | 1.7 | 1.26 | 1.25 | 328 | 84 | 82 | 7 | 178 | 68 | 129 |
| [illegible] | 3 6[illegible] | 961.7 | 3.8 | 2.7 | 2.7 | 331 | 87 | 84 | 14 | 182 | 72 | 134 |
| [illegible] | 3 6[illegible] | 964.2 | 4.7 | 3.45 | 3.1 | 337 | 88 | 85 | 18* | 184 | 77 | 139 |
| [illegible] | 3 6[illegible] | 967.9 | 4.0 | 2.9 | 2.9 | 339 | 90 | 86 | 16 | 185 | 78 | 140 |
| | [illegible] 6[illegible] | ↓ | | | | | | | | | | |
| [illegible] | 3 6[illegible] | 970.8 | 3.3 | 2.4 | 2.4 | 335 | 85 | 85 | 12 | 178 | 67 | 122 |
| [illegible] | 3 6[illegible] | 973.4 | 3.0 | 2.2 | 2.2 | 340 | 83 | 85 | 12 | 179 | 65 | 132 |
| [illegible] | 3 6[illegible] | 975.8 | 2.3 | 1.7 | 1.7 | 341 | 82 | 84 | 10 | 175 | 64 | 139 |
| [illegible] | 3 7[illegible] | 978.2 | 2.5 | 1.8 | 1.8 | 336 | 83 | 84 | 10½ | 177 | 67 | 144 |
| [illegible] | 3 7[illegible] | 980.9 | 3.3 | 2.4 | 2.4 | 338 | 84 | 85 | 12 | 177 | 68 | 141 |
| [illegible] | 3 7[illegible] | 983.6 | 2.9 | 2.1 | 2.1 | 338 | 86 | 86 | 12 | 178 | 70 | 140 |

COMMENTS:

* Voltage 102

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4 72

# ANALYTICAL DATA

PLANT Reserve

DATE 9-12-73

SAMPLING LOCATION WASTE GAS STACK

SAMPLE TYPE PARTICULATE

RUN NUMBER 7

SAMPLE BOX NUMBER _____

CLEAN-UP MAN J. Faught

COMMENTS:

## FRONT HALF

LABORATORY RESULTS

WATER
~~ACETONE~~ WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER S-73 004 519 _____ mg

FILTER NUMBER 100009 _____

CONTAINER S-73-004-520 _____ mg

FRONT HALF SUBTOTAL _____ mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

~~ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER~~

CONTAINER S-73-004-521 _____ mg

~~ETHER-CHLOROFORM~~ EXTRACTION _____ mg

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

## MOISTURE

IMPINGERS

| | | | |
|---|---|---|---|
| FINAL VOLUME | 256 ml | | |
| INITIAL VOLUME | 200 ml | | |
| NET VOLUME | 56 ml | | |

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | 4824 g | _____ g | _____ g |
| INITIAL WEIGHT | 475.0 g | _____ g | _____ g |
| NET WEIGHT | 7.4 g | _____ g | _____ g |

TOTAL MOISTURE 63.4 g

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| | | | | | |
|---|---|---|---|---|---|
| AL | 00 | 00 | 00 | 00 | IPLIER |
| 28.93 | 22.18 | 0.00 | 4.40 | 0.35 | MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) $M_d$, lb/lb-mole |

# PRELIMINARY VELOCITY TRAVERSE

PLANT Reuse Mining Co.
DATE 7-12-83
LOCATION Pelletizer Heat Exhaust Stack
STACK I.D. 7'-5"
BAROMETRIC PRESSURE, in. Hg 29.37
STACK GAUGE PRESSURE, in. $H_2O$
OPERATORS [illegible]

SCHEMATIC OF TRAVERSE POINT LAYOUT

| TRAVERSE POINT NUMBER | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|
| 1 | 1.3 | 219 |
| 2 | 1.5 | 226 |
| 3 | 1.2 | 229 |
| 4 | 1.7 | 229 |
| 5 | 1.6 | 230 |
| 6 | 1.6 | 230 |
| 7 | 1.4 | 217 |
| 8 | 1.8 | 227 |
| 9 | 2.0 | 232 |
| 10 | 1.6 | 231 |
| 11 | 1.7 | 232 |
| 12 | 1.7 | 230 |
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| AVERAGE | | |

| TRAVERSE POINT NUMBER | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|
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| AVERAGE | | |

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4/72

# NOMOGRAPH DATA

PLANT Revere Mining Co

DATE 9-13-73

SAMPLING LOCATION Pelletizer Head Exhaust Stack

| | | |
|---|---|---|
| CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. $H_2O$ | $\Delta H_@$ | 1.72 |
| AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F | $T_{m_{avg.}}$ | 80 |
| PERCENT MOISTURE IN GAS STREAM BY VOLUME | $B_{wo}$ | 12 |
| BAROMETRIC PRESSURE AT METER, in. Hg | $P_m$ | 29.37 |
| STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. $H_2O$) | $P_s$ | 29.27 |
| RATIO OF STATIC PRESSURE TO METER PRESSURE | $P_s/P_m$ | 1 |
| AVERAGE STACK TEMPERATURE, °F | $T_{s_{avg.}}$ | 228 |
| AVERAGE VELOCITY HEAD, in. $H_2O$ | $\Delta p_{avg.}$ | 1.7 |
| MAXIMUM VELOCITY HEAD, in. $H_2O$ | $\Delta p_{max.}$ | 2.0 |
| C FACTOR | | 0.85 |
| CALCULATED NOZZLE DIAMETER, in. | | 0.19 |
| ACTUAL NOZZLE DIAMETER, in. | | 0.182 |
| REFERENCE $\Delta p$, in. $H_2O$ | | 2.4 |

-.14

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# FIELD DATA

PLANT Reserve Mining Co
DATE [illegible]
SAMPLING LOCATION Pelletizer Hood Exhaust Stack
SAMPLE TYPE Particulate
RUN NUMBER 8
OPERATOR [illegible] Poling
AMBIENT TEMPERATURE 60
BAROMETRIC PRESSURE 29.37
STATIC PRESSURE, ($P_s$) 29.27
FILTER NUMBER (s) 1000011

PROBE LENGTH AND TYPE 9 ft. SS. 316
NOZZLE I.D. 0.183
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 3
METER BOX NUMBER 1
METER $\Delta H_@$ 1.72
C FACTOR 0.[illegible]
PROBE HEATER SETTING None
HEATER BOX SETTING 170
REFERENCE $\Delta p$ 2.4

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 3 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 | ACTUAL | STACK TEMPERATURE ($T_s$), °F | DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F | OUTLET ($T_{m\,out}$), °F | PUMP VACUUM, in. Hg | SAMPLE BOX TEMPERATURE, °F | IMPINGER TEMPERATURE, °F | Pro. Tem. °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10[illegible] | 988.1 | | | | | | | | | | |
| 7 | 3 | 10[47] | 990.2 | 1.7 | 1.3 | 1.3 | 236 | 81 | 81 | 6 | 191 | 48 | 117 |
| 8 | 3 | 10[50] | 992.2 | 1.8 | 1.4 | 1.4 | 233 | 87 | 82 | 7 | 188 | 49 | 118 |
| 9 | 3 | 10[53] | 994.2 | 1.6 | 1.25 | 1.25 | 238 | 87 | 82 | 7 | 199 | 50 | 119 |
| 10 | 3 | 10[56] | 996.2 | 1.7 | 1.35 | 1.35 | 239 | 87 | 82 | 7 | 192 | 60 | 118 |
| 11 | 3 | 10[59] | 998.2 | 1.7 | 1.35 | 1.35 | 235 | 85 | 82 | 7 | 188 | 60 | 110 |
| 12 | 3 | 11[02] | 1000.0 | 1.3 | 1.02 | 1.0 | 231 | 84 | 82 | 6 | 178 | 60 | 110 |
| | | 11[02] | ↓ | | | | | | | | | | |
| 1 | 3 | 11[07] | 1002.1 | 1.7 | 1.3 | 1.3 | 244 | 83 | 80 | 7 | 191 | 60 | 110 |
| 2 | 3 | 11[12] | 1004.0 | 1.6 | 1.25 | 1.25 | 239 | 82 | 80 | 7 | 187 | 60 | 113 |
| 3 | 3 | 11[15] | 1006.0 | 1.7 | 1.3 | 1.3 | 241 | 81 | 79 | 10 | 186 | 60 | 123 |
| 4 | 1 | 11[16] * | ↓ | 1.5 | 1.15 | 1.15~0.4 | | | | 23 | | | |
| 4 | 2 | 11[21] 11[22] | | 1.5 | 1.15 | 1.15 | 236 | 81 | 80 | 6 | 160 | 60 | 96 |
| 5 | 3 | 11[26] | 1009.9 | 1.6 | 1.25 | 1.25 | 236 | 80 | 74 | 6 | 161 | 60 | 98 |
| 6 | 3 | 11[29] | 1011.8 | 1.5 | 1.15 | 1.15 | 233 | 78 | 75 | 6 | 173 | 59 | 95 |

COMMENTS: * Stopped no Flow

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4-72

# ANALYTICAL DATA

PLANT Reserve

DATE 9-13-73

SAMPLING LOCATION Hood VENT STACK

SAMPLE TYPE PARTICULATE

RUN NUMBER 8

SAMPLE BOX NUMBER _____

CLEAN-UP MAN J Faught

COMMENTS:

## FRONT HALF

LABORATORY RESULTS

WATER
~~ACETONE~~ WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER S-73004522 _____ mg

FILTER NUMBER 1000011 _____

CONTAINER S-73-004-523 _____ mg

FRONT HALF SUBTOTAL _____ mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

~~ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER~~

CONTAINER S-73004524 _____ mg

~~ETHER-CHLOROFORM EXTRACTION~~ _____ mg

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

## MOISTURE

IMPINGERS

| | | | |
|---|---|---|---|
| FINAL VOLUME | 225 ml | | |
| INITIAL VOLUME | 200 ml | | |
| NET VOLUME | 25 ml | | |

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | 481.2 g | _____ g | _____ g |
| INITIAL WEIGHT | 475.0 g | _____ g | _____ g |
| NET WEIGHT | 6.2 g | _____ g | _____ g |

TOTAL MOISTURE 31.6

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# FIELD DATA

PLANT Peerless Mining Co.
DATE 9-13-73
SAMPLING LOCATION Kitchen Hood Exhaust stack
SAMPLE TYPE Particulate
RUN NUMBER 9
OPERATOR Paul Bailey
AMBIENT TEMPERATURE 63
BAROMETRIC PRESSURE 29.24
STATIC PRESSURE, ($P_s$) 29.24
FILTER NUMBER (s) 1000010

PROBE LENGTH AND TYPE 9 ft SS 316
NOZZLE I.D. 0.182
ASSUMED MOISTURE, % 6
SAMPLE BOX NUMBER 1
METER BOX NUMBER 1
METER $\Delta H_@$ 1.72
C FACTOR 0.94
PROBE HEATER SETTING Amb
HEATER BOX SETTING 120
REFERENCE $\Delta p$ 2.0

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 3 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. $H_2O$ | | STACK TEMPERATURE ($T_s$), °F | DRY GAS METER TEMPERATURE | | PUMP VACUUM, in. Hg | SAMPLE BOX TEMPERATURE, °F | IMPINGER TEMPERATURE, °F | Probe Temp °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1222 | 12.1 | | DESIRED | ACTUAL | | INLET ($T_{m\ in}$), °F | OUTLET ($T_{m\ out}$), °F | | | | |
| 7 | 3 | 1224 | 14.1 | 1.7 | 1.3 | 1.3 | 241 | 80 | 80 | 7 | 195 | 66 | 116 |
| 8 | 3 | 1227 | 16.2 | 1.7 | 1.3 | 1.3 | 244 | 74 | 79 | 7 | 184 | 71 | 119 |
| 9 | 3 | 1230 | 18.2 | 1.7 | 1.3 | 1.3 | 243 | 74 | 73 | 7 | 200 | 67 | 122 |
| 10 | 3 | 1233 | 20.1 | 1.6 | 1.2 | 1.2 | 235 | 76 | 73 | 7 | 172 | 70 | 114 |
| 11 | 3 | 1236 | 22.0 | 1.6 | 1.25 | 1.25 | 242 | 76 | 74 | 7 | 170 | 73 | 111 |
| 12 | 3 | 1239 | 23.9 | 1.5 | 1.15 | 1.15 | 241 | 82 | 81 | 7 | 165 | 74 | 114 |
| | | 1242 | ↓ | | | | | | | | | | |
| 1 | 3 | 1242 | - | 1.7 | 1.3 | 1.3 | 242 | 76 | 75 | 7 | 190 | 71 | 109 |
| 2 | 3 | 1245 | 27.9 | 1.8 | 1.4 | 1.4 | 234 | 76 | 76 | 7 | 167 | 71 | 104 |
| 3 | 3 | 1248 | 29.9 | 1.6 | 1.25 | 1.25 | 235 | 75 | 74 | 7 | 151 | 66 | 104 |
| 4 | 3 | 1251 | 32.0 | 1.8 | 1.4 | 1.4 | 243 | 75 | 73 | 7 | 153 | 65 | 103 |
| 5 | 3 | 1254 | 34.0 | 1.7 | 1.3 | 1.3 | 241 | 82 | 79 | 7 | 146 | 66 | 105 |
| 6 | 3 | 1257 | 35.8 | 1.3 | 1.0 | 1.0 | 234 | 77 | 75 | 6 | 161 | 67 | 103 |
| | | | | | | | | | | | | | |
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COMMENTS:

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# ANALYTICAL DATA

PLANT Reserve

DATE 9-13-73

SAMPLING LOCATION HOOD VENT STACK

SAMPLE TYPE PARTICULATE

RUN NUMBER 9

SAMPLE BOX NUMBER _____

CLEAN-UP MAN J Faught

COMMENTS:

## FRONT HALF

LABORATORY RESULTS

WATER
~~ACETONE~~ WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER S 73 004 525 _____ mg

FILTER NUMBER 1000010 _____

CONTAINER S-73-004-526 _____ mg

FRONT HALF SUBTOTAL _____ mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

~~ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER~~

CONTAINER S-73 004527 _____ mg

~~ETHER-CHLOROFORM EXTRACTION~~ _____ mg

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

## MOISTURE

IMPINGERS

| | | | |
|---|---|---|---|
| FINAL VOLUME | 225 ml | | |
| INITIAL VOLUME | 200 ml | | |
| NET VOLUME | 25 ml | | |

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | 480.9 g | _____ g | _____ g |
| INITIAL WEIGHT | 475.0 g | _____ g | _____ g |
| NET WEIGHT | 5.9 g | _____ g | _____ g |

TOTAL MOISTURE 30.9 g

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# FIELD DATA

Orsat
$CO_2$ 0.0
$O_2$ 21.0
Co 0.0

PLANT Reserve Mining Co
DATE 9-13-73
SAMPLING LOCATION Pelletizer Hood Exhaust stack
SAMPLE TYPE Particulate
RUN NUMBER 10
OPERATOR [illegible] Bob [illegible]
AMBIENT TEMPERATURE 65
BAROMETRIC PRESSURE 29.34
STATIC PRESSURE, ($P_s$) 29.24
FILTER NUMBER (s) 1000012

PROBE LENGTH AND TYPE 9 ft SS 316
NOZZLE I.D. 0.182
ASSUMED MOISTURE, % 6
SAMPLE BOX NUMBER 3
METER BOX NUMBER 1
METER $\Delta H_@$ 1.72
C FACTOR 0.94
PROBE HEATER SETTING None
HEATER BOX SETTING 150
REFERENCE $\Delta p$ 2.4

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 3 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 | Pro Temp °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2 23 P | 36.4 | | | | | | | | | | |
| 7 | 3 | 2 28 | 38.5 | 1.7 | 1.3 | 1.3 | 234 | 80 | 76 | 8 | 150 | 63 | 118 |
| 8 | 3 | 2 31 | 40.4 | 1.7 | 1.3 | 1.3 | 234 | 80 | 76 | 8 | 149 | 66 | 120 |
| 9 | 3 | 2 34 | 42.4 | 1.6 | 1.25 | 1.25 | 237 | 79 | 76 | 8 | 153 | 65 | 119 |
| 10 | 3 | 2 37 | 44.2 | 1.3 | 1.0 | 1.0 | 238 | 78 | 75 | 7 | 155 | 67 | 117 |
| 11 | 3 | 2 40 | | 1.6 | 1.25 | 1.25 | 235 | 78 | 74 | 8 | 158 | 63 | 114 |
| 12 | 3 | 2 [illegible] | 48.0 | 1.4 | 1.1 | 1.1 | 231 | 77 | 74 | 7 | 154 | 66 | 107 |
| | | 2 54 | 48.7 * | | | | | | | | | | |
| 1 | 3 | 2 57 | 50.2 | 1.6 | 1.25 | 1.25 | 241 | 81 | 75 | 8 | 158 | 68 | 103 |
| 2 | 3 | 3 00 | 52.2 | 1.6 | 1.25 | 1.25 | 326 (X) | 78 | 77 | 9 | 159 | 69 | 104 |
| 3 | 3 | 3 03 | 54.5 | 1.7 | 1.3 | 1.3 | 258 | 79 | 78 | 9 | 158 | 71 | 115 |
| 4 | 3 | 3 06 | 56.1 | 1.5 | 1.15 | 1.15 | 247 | 80 | 80 | 8 | 165 | 76 | 115 |
| 5 | 3 | 3 09 | 57.9 | 1.5 | 1.15 | 1.15 | 252 | 82 | 80 | 8 | 163 | 76 | 114 |
| 6 | 3 | 3 12 | 59.7 | 1.4 | 1.1 | 1.1 | 243 | 82 | 80 | 8 | 157 | 76 | 110 |

COMMENTS:

(*) New Vacuum pump (X) This temp checked OK

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# ANALYTICAL DATA

PLANT Reserve

DATE 9-13-73

SAMPLING LOCATION Hood Vent stack

SAMPLE TYPE PARTICULATE

RUN NUMBER 10

SAMPLE BOX NUMBER _____

CLEAN-UP MAN J Fawyer

COMMENTS:

## FRONT HALF

LABORATORY RESULTS

~~ACETONE~~ WATER WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER S-73 004 528 _____ mg

FILTER NUMBER 100012 _____

CONTAINER S-73-004-529 _____ mg

FRONT HALF SUBTOTAL _____ mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

~~ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER~~

CONTAINER S-73 004530 _____ mg

~~ETHER-CHLOROFORM EXTRACTION~~ _____ mg

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

## MOISTURE

IMPINGERS

| | | |
|---|---|---|
| FINAL VOLUME | 226 | ml |
| INITIAL VOLUME | 200 | ml |
| NET VOLUME | 26 | ml |

SILICA GEL

| | | | | | |
|---|---|---|---|---|---|
| FINAL WEIGHT | 480.2 | g | _____ g | _____ | g |
| INITIAL WEIGHT | 475.0 | g | _____ g | _____ | g |
| NET WEIGHT | 5.2 | g | _____ g | _____ | g |

TOTAL MOISTURE 31.2

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# DRY MOLECULAR WEIGHT DETERMINATION

PLANT Reserve Mining Co — COMMENTS:
DATE 4-13-73
SAMPLING TIME (24-hr CLOCK) 12³⁰ - 12⁵⁵ + 2³⁰ - 3⁰⁰ PM
SAMPLING LOCATION Pelletizer Hood Exhaust Stack
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Bag
ANALYTICAL METHOD Orsat
AMBIENT TEMPERATURE 63 + 65
OPERATOR Ben Furnace

| RUN / GAS | 1 | | 2 | | 3 | | AVERAGE NET VOLUME | MULTIPLIER | MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) $M_d$, lb/lb-mole |
|---|---|---|---|---|---|---|---|---|---|
| | ACTUAL READING | NET | ACTUAL READING | NET | ACTUAL READING | NET | | | |
| $CO_2$ | 0.0 | 0.0 | 0.0 | 0.0 | | | | 44/100 | 0 |
| $O_2$ (NET IS ACTUAL $O_2$ READING MINUS ACTUAL $CO_2$ READING) | 21.0 | 21.0 | 21.0 | 21.0 | | | | 32/100 | 6.3 |
| CO (NET IS ACTUAL CO READING MINUS ACTUAL $O_2$ READING) | 21.0 | 0.0 | 21.0 | 0.0 | | | | 28/100 | 0 |
| $N_2$ (NET IS 100 MINUS ACTUAL CO READING) | 79.0 | 79 | 79.0 | 79 | | | | 28/100 | 22.2 |
| | | | | | | | | TOTAL | 28.5 |

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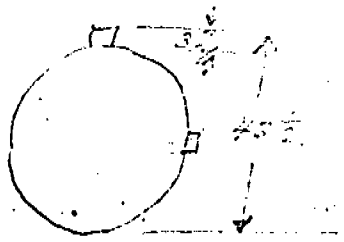
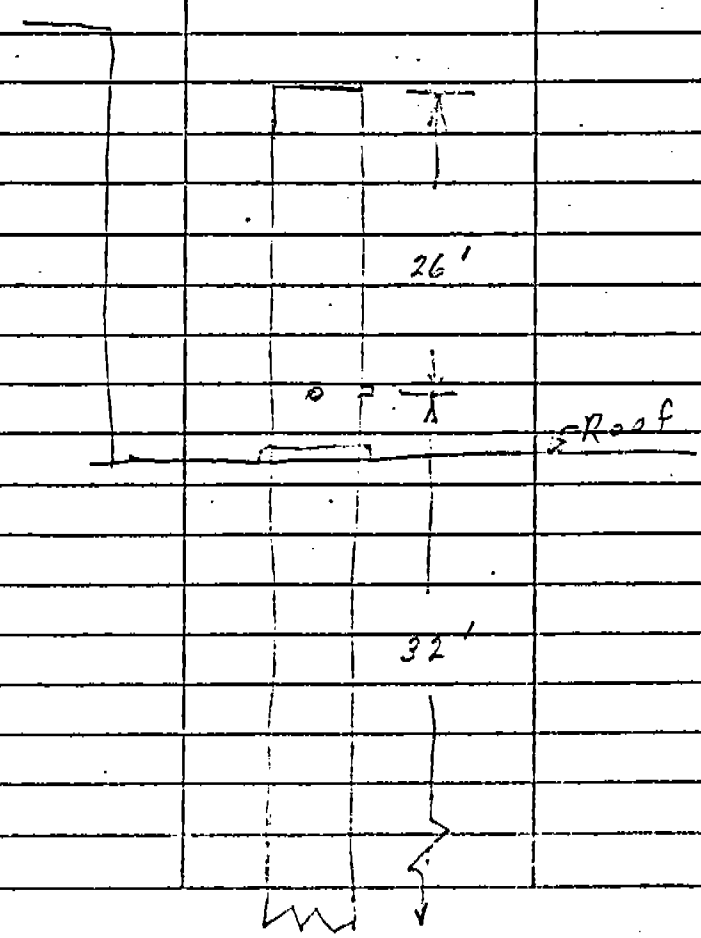
# TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Reserve Mining Co.
DATE 9-13-73
SAMPLING LOCATION Conveyor to Roof Shell Stack
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE A) 43 1/2
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE B) 3 3/4"
STACK I.D., (DISTANCE A - DISTANCE B) 39 3/4"
NEAREST UPSTREAM DISTURBANCE 8 d
NEAREST DOWNSTREAM DISTURBANCE 26 ft
CALCULATOR [illegible]




SCHEMATIC OF SAMPLING LOCATION

| TRAVERSE POINT NUMBER | FRACTION OF STACK I.D. | STACK I.D. | PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH) | DISTANCE B | TRAVERSE POINT LOCAT FROM OUTSIDE OF NIPPL (SUM OF COLUMNS 4 & 5 |
|---|---|---|---|---|---|
| 1 | 4.4 | 39 3/4 | 1 3/4 | 5 1/2 | |
| 2 | 14.7 | | 5 1/2 | 9 1/4 | |
| 3 | 29.5 | | 11 3/4 | 15 1/2 | |
| 4 | 70.5 | | 28.0 | 31 3/4 | |
| 5 | 85.3 | | 34.0 | 37 3/4 | |
| 6 | 95.6 | | 38.0 | 41 3/4 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |

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# PRELIMINARY VELOCITY TRAVERSE

PLANT Reserve Mining Co.
DATE 9-13-72
LOCATION Conveyor to Rod Mill Stack
STACK I.D. [illegible]
BAROMETRIC PRESSURE, in. Hg [illegible]
STACK GAUGE PRESSURE, in. $H_2O$ -0.6 [illegible]
OPERATORS [illegible]

| TRAVERSE POINT NUMBER | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|
| 1 | 0.87 | 64 |
| 2 | 0.91 | 65 |
| 3 | 0.88 | 67 |
| 4 | 0.87 | 67 |
| 5 | 0.89 | [illegible] |
| 6 | 0.72 | 67 |
| 7 | 0.72 | 66 |
| 8 | 0.90 | 67 |
| 9 | 0.92 | 67 |
| 10 | 0.91 | 67 |
| 11 | 0.89 | 67 |
| 12 | 0.68 | 68 |
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| AVERAGE | | |

SCHEMATIC OF TRAVERSE POINT LAYOUT

| TRAVERSE POINT NUMBER | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|
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| AVERAGE | | |

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# NOMOGRAPH DATA

PLANT Reeves Mines

DATE 9-13-73

SAMPLING LOCATION Conveyor to Rod Mill stack

| | | |
|---|---|---|
| CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. $H_2O$ | $\Delta H_@$ | 1.72 |
| AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F | $T_{m_{avg.}}$ | 80 |
| PERCENT MOISTURE IN GAS STREAM BY VOLUME | $B_{wo}$ | 2 |
| BAROMETRIC PRESSURE AT METER, in. Hg | $P_m$ | 29.25 |
| STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. $H_2O$) | $P_s$ | 29.21 |
| RATIO OF STATIC PRESSURE TO METER PRESSURE | $P_s/P_m$ | 1 |
| AVERAGE STACK TEMPERATURE, °F | $T_{s_{avg.}}$ | 67 |
| AVERAGE VELOCITY HEAD, in. $H_2O$ | $\Delta p_{avg.}$ | 0.85 |
| MAXIMUM VELOCITY HEAD, in. $H_2O$ | $\Delta p_{max.}$ | 0.92 |
| C FACTOR | 1.0 | |
| CALCULATED NOZZLE DIAMETER, in. | 0.21 | |
| ACTUAL NOZZLE DIAMETER, in. | 0.235 | |
| REFERENCE $\Delta p$, in. $H_2O$ | 0.58 | |

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# FIELD DATA

PLANT Reserve Mining Co
DATE [illegible]
SAMPLING LOCATION [illegible] Bed Mill Stack
SAMPLE TYPE Particulate
RUN NUMBER 11
OPERATOR [illegible] Poling
AMBIENT TEMPERATURE [illegible]
BAROMETRIC PRESSURE [illegible]
STATIC PRESSURE, ($P_s$) [illegible]
FILTER NUMBER (s) 1500013

PROBE LENGTH AND TYPE [illegible] glass lined
NOZZLE I.D. 0.[illegible]"
ASSUMED MOISTURE, % [illegible]
SAMPLE BOX NUMBER 1
METER BOX NUMBER 1
METER $\Delta H_@$ 1.72
C FACTOR 1.0
PROBE HEATER SETTING —
HEATER BOX SETTING —
REFERENCE $\Delta p$ 0.58

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 10 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 | Probe Temp °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5[illegible] | [illegible] | | | | | | | | | | |
| 7 | 4 * | [illegible] | ↓ | 0.[illegible] | [illegible] | | | | | - | - | — | 99 |
| | | [illegible] | ↓ | | | | | | | | | | |
| 7 | 6 | 6[illegible] | - | 0.78 | [illegible] | 2.5 | 73 | 66 | [illegible] | 11 | 130 | 55 | 99 |
| 8 | 10 | 6[illegible] | 77.5 | 0.87 | 2.7 | 2.7 | 72 | 6[illegible] | [illegible] | 11 | 133 | 58 | 95 |
| 9 | 10 | 6[illegible] | 8[illegible] | .91 | [illegible] | [illegible] | 74 | 65 | [illegible] | 12 | 117 | 59 | 93 |
| 10 | 10 | 6[illegible] | 98.7 | .89 | [illegible] | .8 | 74 | 67 | 61 | 12 | 107 | 58 | 92 |
| 11 | 10 | 6[illegible] | 108.5 | .87 | [illegible] | .8 | 75 | 67 | 61 | 12 | 100 | 59 | 90 |
| 12 | 10 | 6[illegible] | 117.0 | .63 | [illegible] | 2.0 | 75 | 67 | 60 | 9 | 100 | 57 | 92 |
| | | 6[illegible] | ↓ | | | | | | | | | | |
| 1 | 10 | 7[illegible] | | .78 | 2.[illegible] | 2.[illegible] | 76 | 67 | 61 | 10 | 113 | 58 | 96 |
| 2 | 10 | 7[illegible] | 135.6 | .90 | 2.8 | 2.8 | 75 | 68 | 61 | 12 | 115 | 58 | 96 |
| 3 | 10 | 7[illegible] | 145.1 | .85 | 2.7 | 2.8 | 75 | 69 | 62 | 12 | 115 | 58 | 96 |
| 4 | 10 | 7[illegible] | 154.7 | .87 | 2.7 | 2.7 | 76 | 69 | 63 | 12 | 112 | 58 | 96 |
| 5 | 10 | 7[illegible] | 164.2 | .87 | 2.6 | 2.6 | 76 | 68 | 62 | 12 | 112 | 58 | 92 |
| 6 | 10 | 7[illegible] | 172.301 | .6[illegible] | 1.9 | 1.9 | 75 | 66 | 61 | 9 | 109 | [illegible] | 93 |

COMMENTS:

* more impinger [illegible] in #1 impinger.
Put equal amounts in #1 & 2 impingers

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# ANALYTICAL DATA

PLANT Reserve

DATE 9-13-73

SAMPLING LOCATION conveyor to Rod Mill

SAMPLE TYPE PARTICULATE

RUN NUMBER 11

SAMPLE BOX NUMBER _____

CLEAN-UP MAN J Faught

COMMENTS:

## FRONT HALF

LABORATORY RESULTS

WATER
~~ACETONE~~ WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER S-73-004 531 _____ mg

FILTER NUMBER Looo013 _____

CONTAINER S-73-004-532 _____ mg

FRONT HALF SUBTOTAL _____ mg

## BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

~~ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER~~

CONTAINER S-73-004 533 _____ mg

~~ETHER-CHLOROFORM EXTRACTION~~ _____ mg

CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

## MOISTURE

IMPINGERS

| | | | |
|---|---|---|---|
| FINAL VOLUME | 196 ml | | |
| INITIAL VOLUME | 200 ml | | |
| NET VOLUME | −4 ml | | |

SILICA GEL

| | | | |
|---|---|---|---|
| FINAL WEIGHT | 491.0 g | _____ g | _____ g |
| INITIAL WEIGHT | 475.0 g | _____ g | _____ g |
| NET WEIGHT | 16. g | _____ g | _____ g |

TOTAL MOISTURE 12.0

EPA (Dur) 231
4/72

# DRY MOLECULAR WEIGHT DETERMINATION

PLANT Reserve Mining Co

DATE 9-13-73

SAMPLING TIME (24-hr CLOCK) 5^45 PM — 7^52 PM

SAMPLING LOCATION

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS)

ANALYTICAL METHOD

AMBIENT TEMPERATURE

OPERATOR E. Schmidt

COMMENTS:

assumed ambient air thru stack.

| RUN / GAS | 1 | | 2 | | 3 | | AVERAGE NET VOLUME | MULTIPLIER | MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) $M_d$, lb/lb-mole |
|---|---|---|---|---|---|---|---|---|---|
| | ACTUAL READING | NET | ACTUAL READING | NET | ACTUAL READING | NET | | | |
| $CO_2$ | | | | | | | | 44/100 | |
| $O_2$ (NET IS ACTUAL $O_2$ READING MINUS ACTUAL $CO_2$ READING) | | | | | | | | 32/100 | |
| CO (NET IS ACTUAL CO READING MINUS ACTUAL $O_2$ READING) | | | | | | | | 28/100 | |
| $N_2$ (NET IS 100 MINUS ACTUAL CO READING) | | | | | | | | 28/100 | |
| | | | | | | | | TOTAL | |

EPA (Dur) 230
4/72

# APPENDIX C

## Laboratory Report

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL ENVIRONMENTAL RESEARCH CENTER
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

SUBJECT: Process Emission Samples From Duluth DATE: March 14, 1974

FROM: F. P. Scaringelli
Chief, ESAS

TO: R. L. Ajax
Chief, EMB

THROUGH: O/D, QAEML

As per your memorandum of February 5, 1974, we are transmitting for your use the following items:

a) A xerox copy of the data sheets showing the accumulative particulate matter and the weights of the filter from which these values were computed. These are pages copied from laboratory notes of Gary McAlister, Chemist.

b) Documentation of Chain of Custody - Sampling handling log; Source Sample request and report; letter of transmittal of samples to Battelle with certified mail receipt superimposed; and the cover letter from the Battelle Analytical report.

All other information that you require, has been requested from Battelle. They will be transmitted to you as soon as received.

cc: Dr. Shearer
D. Goodwin
Dr. Thompson
R. H. Jungers

Enclosures

SPECIAL MEMBRANE SAMPLES 9/[illegible]

PROC A group of 12 membrane filters (11 samples and one blank) were received by John Frazer on 9/17/73. The filters were special stack samples taken from Reserve Mining Co in Minnesota. After receipt the filters were locked in the controlled temperature - humidity ~~balance~~ balance room (N-124, FC, RTP, N.C.) to condition themselves. The samples are to be weighed and the amount of impacted particulate matter [illegible]. The balance to be used (the same one on which the blank filters were originally weighed) is a Mettler, EPA # 032383.

Tara, [illegible] and [illegible] [illegible]

DATA:

| FILTER # | WT + sample gr | [illegible] | NET WT |
|---|---|---|---|
| 1000003 | 0.4554 | 0.4537 | 0.0017 |
| 1000004 | 0.4665 | 0.4537 | 0.0128 |
| 1000005 | 0.4679 | [illegible] | 0.0150 |
| 1000006 | 0.4988 | 0.4524 | 0.0464 |
| 1000007 | 0.4839 | 0.4527 | 0.0312 |
| 1000008 | 0.4783 | 0.4530 | 0.0253 |
| 1000009 | 0.4854 | 0.4522 | 0.0332 |
| 1000010 | 0.4615 | [illegible] | 0.0084 |
| 1000011 | 0.4600 | [illegible] | 0.0067 |
| 1000012 | 0.4642 | [illegible] | 0.0107 |
| 1000013 | 0.4571 | 0.4531 | 0.0040 |
| 1000014 | 0.4532 | 0.4534 | 0.0002 |

Certified True Copy
[illegible] 3/1/74

TEMP: Begining = 72° F END = 72°

% HUM: Begining = 42% END = 45%

BALANCE: Begining, 10g = .9998 gr END = .9996 gr

| [illegible] # | Wt. % | Cond. % |
|---|---|---|
| [illegible] | ~~.4537~~ | |
| 1000002 | .4539 | |
| -3 | .4537 | |
| -4 | .4537 | |
| -5 | .4529 | |
| -6 | .4524 | |
| -7 | .4527 | |
| -8 | .4530 | |
| -9 | .4522 | |
| -10 | .4531 | |
| -11 | .4533 | |
| -12 | .4535 | |
| -13 | .4531 | |
| 14 | .4534 | |
| -15 | .4716 | .4715 |
| -16 | .4549 | |
| -17 | .4723 | |
| -18 | .4731 | |
| -19 | .4729 | |
| -20 | .4733 | |
| -21 | .4712 | |
| -22 | .4719 | |
| -23 | .4716 | |
| -24 | .4718 | |
| -25 | .4705 | |
| -26 | .4713 | |
| -27 | .4710 | |
| -28 | .4709 | |
| -29 | .4716 | |

| Filter # | Wt. % | Cond. % |
|---|---|---|
| 1000030 | .4725 | |
| -31 | .4717 | |
| -32 | .4716 | |
| -33 | .4722 | |
| -34 | .4728 | .4727 |
| -35 | .4727 | |
| -36 | .4674 | |
| -37 | .4674 | |
| -38 | .4668 | |
| -39 | .4683 | |
| -40 | .4675 | |
| -41 | .4691 | |
| -42 | .4677 | |
| -43 | .4685 | |
| -44 | .4686 | |
| -45 | .4695 | |
| -46 | .4690 | |
| -47 | .4695 | |
| -48 | .4696 | |
| -49 | .4705 | |
| -50 | .4710 | |
| -51 | .4725 | |
| -52 | .4721 | |
| -53 | .4335 | |
| -54 | .4335 | |
| -55 | .4325 | |
| -56 | .4308 | |
| -57 | .4350 | |
| -58 | .4342 | |

Reserve Mining Test #74-HAS-1

Sample Identification*

| Fine Crusher Stack | Run 1 | Run 2 | Run 3 | Run 4 |
|---|---|---|---|---|
| Probe | 501 | 506 | 507 | --- |
| Filter | 502 | 505 | 508 | --- |
| Impinger | 503 | 504 | 509 | --- |
| **Waste Gas Stack** | **Run 4** | **Run 5** | **Run 6** | **Run 7** |
| Probe | 510 | 513 | 516 | 519 |
| Filter | 511 | 514 | 517 | 520 |
| Impinger | 512 | 515 | 518 | 521 |
| **Hood Vent Stack** | **Run 8** | **Run 9** | **Run 10** | |
| Probe | 522 | 525 | 528 | |
| Filter | 523 | 526 | 529 | |
| Impinger | 524 | 527 | 530 | |
| **Concentrator Stack** | **Run 11** | | | |
| Probe | 531 | | | |
| Filter | 532 | | | |
| Impinger | 533 | | | |

*The numbers shown are the final three digits in an 8-number code: S-73-004-xxx (for example the probe wash for run #1, fine crusher is identified: S-73-004-501).

REPORT OF ANALYSIS
TRACE ELEMENTS
ppm - for solid samples
ug/ml - for liquid samples

Mark (x) for specific analysis
Mark (x) in block to left of No. to run when requesting all analysis on that line

| Ident No. | Hg | Be | Cd | As | V | Mn | Ni | Sb | Cr | Zn | Cu | Pb | Se | B | F | Li | Ag | Sn | Fe | Sr | Na | K | Ca | Si | Mg | Ba | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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Analysis Method: 1-NAA, 2-SSMS, 3-OES, 4-AA, 5-ASV, 6-XRF, and 7-other

Comments:

Other Analysis - Use Table B to fill analysis requested (above each column)

Mark (x) for specific analysis requested

| Ident No. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
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| Analyst | | | | | | | | | | | |
| Method | | | | | | | | | | | |

Comments:

REPORT OF ANALYSIS
TRACE ELEMENTS
ppm - for solid samples
ug/ml - for liquid samples

Mark (x) for specific analysis
Mark (xx) in block to left of Ident. No. when requesting all analysis on that line

| Ident No. | Hg | Be | Cd | As | V | Mn | Ni | Sb | Cr | Zn | Cu | Pb | Se | B | I | Li | Ag | Sn | Fe | Sr | Na | K | Ca | Si | Mg | Ba | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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Analysis Method: 1-NAA, 2-SSMS, 3-OES, 4-AA, 5-ASV, 6-XRF, and 7-other

Comments:

Other Analysis - Use Table B to fill analysis requested (above each column)

Mark (x) for specific analysis requested

| Ident No. | | | | | | | | | | | |
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| Analyst | | | | | | | | | | | |
| Method | | | | | | | | | | | |

Comments:

REPORT OF ANALYSIS
TRACE ELEMENTS
ppm - for solid samples
ug/ml - for liquid samples

Mark (x) for specific analysis
Mark (x) in block to left of Ident. No. when requesting all analysis on that line

| Ident No. | Hg | Be | Cd | As | V | Mn | Ni | Sb | Cr | Zn | Cu | Pb | Se | B | F | Li | Ag | Sn | Fe | Sr | Mo | K | Ca | Si | Mg | Ba | | | | | Analyst's Initial |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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Analysis Method: 1-NAA, 2-SSMS, 3-OES, 4-AA, 5-ASV, 6-XRF, and 7-other

Comments:

Other Analysis - Use Table B to fill analysis requested (above each column)

Mark (x) for specific analysis requested

| Ident No. | | | | | | | | | | | |
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| Analyst | | | | | | | | | | | |
| Method | | | | | | | | | | | |

Comments:

# SOURCE SAMPLE REQUEST & REPORT
(MUST BE FILLED OUT FOR EACH TEST RUN)

SAMPLING DATE 73 | 9 | 12 (YR | MO | DAY)

FIRST IDENT. NO. USED S-73-004-510

LAST IDENT. NO. USED S-73-004-512

TEST NO 74 HAS 1

RUN NO 4

INDUSTRY _____ (USE TABLE A)

COMPANY Reserve Mining

ADDRESS Silver Bay, Minn.

SAMPLING METHOD Mod. EPA 5 (Millipore Filter)

UNIT PROCESS OPERATION Waste Gas Vent

AIR POLLUTION CONTROL None

FUEL USED _____

☐ INLET ☒ OUTLET

GAS VOLUME SAMPLED (METER VOL IN FT³) 16.7

| IDENT NO | DESCRIPTION OF SAMPLE OR SAMPLE FRACTION | SAMPLE WT (SOLID) MG | SAMPLE VOL (LIQUID) ML | ANALYSIS REQUESTED - GENERAL COMMENTS (APPROX CONCENTRATIONS - POSSIBLE INTERFERENCES ETC) (INDICATE SPECIFIC ANALYSIS ON BACKSIDE) |
|---|---|---|---|---|
| 510 | Probe water wash | | | mass, asbestos |
| 511 | filter (1000.006) | | | " " |
| 512 | impinger contents + wash (2 bottles) | | | " " 26 ml condensate |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
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| | | | | |

COMMENTS: _____

SAMPLING CONTRACTOR Battelle (IF APPLICABLE)

PROJECT OFFICER Winton Kelly

REQUEST REVIEWED BY [signature] 9/17/73

DATE OF REQUEST _____

DATE ANALYSIS REQUESTED _____

DATE OF REQUEST _____ (TO BE FILLED IN BY SSFAB)

EPAIDUR215

# SOURCE SAMPLE REQUEST & REPORT

(MUST BE FILLED OUT FOR EACH TEST-RUN)

SAMPLING DATE: YR 73 | MO 9 | DAY 12

FIRST IDENT. NO. USED: S 73 004 513

LAST IDENT. NO. USED: S 73-004 515

TEST NO: 74 IIAS 1

RUN NO: 5

INDUSTRY: _____ (USE TABLE A)

COMPANY: Reserve Mining

ADDRESS: Silver Bay, Minn

SAMPLING METHOD: Mod. EPA 5 (Millipore filter)

UNIT PROCESS OPERATION: Waste Gas Vent

AIR POLLUTION CONTROL: None

FUEL USED: _____

☐ INLET ☒ OUTLET

GAS VOLUME SAMPLED (METER VOL IN FT³): 29.0

| IDENT NO | DESCRIPTION OF SAMPLE OR SAMPLE FRACTION | SAMPLE WT (SOLID) MG | SAMPLE VOL (LIQUID) ML | ANALYSIS REQUESTED - GENERAL COMMENTS (APPROX CONCENTRATIONS - POSSIBLE INTERFERENCES ETC) (INDICATE SPECIFIC ANALYSIS ON BACKSIDE) |
|---|---|---|---|---|
| 513 | Probe water Wash | | | mass, asbestos |
| 514 | filter (1000 cm²) | | | " " |
| 515 | impinger contents & wash (2 bottles) | | | " " (46 ml stock condensate) |
| | | | | |
| | | | | |
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COMMENTS: _____

SAMPLING CONTRACTOR (IF APPLICABLE): Battelle

PROJECT OFFICER: Winton Kelly

REQUEST REVIEWED BY: GB 9/7/73

DATE OF REQUEST: _____

DATE ANALYSIS REQUESTED: _____

DATE OF REQUEST (TO BE FILLED IN BY SSFAB): _____

EPA(OUR)245

# SOURCE SAMPLE REQUEST & REPORT

(MUST BE FILLED OUT FOR EACH TEST RUN)

SAMPLING DATE: 73 (YR) 9 (MO) 12. (DAY)

FIRST IDENT. NO. USED: S 73 004 516

LAST IDENT. NO. USED: S 73 004 518

TEST NO 74 HAS 1

RUN NO 6

INDUSTRY _____ (USE TABLE A)

COMPANY Reserve Mining

ADDRESS Silver Bay, Minn.

SAMPLING METHOD Mod. EPA 5 (Millipore Filter)

UNIT PROCESS OPERATION Waste Gas Vent

AIR POLLUTION CONTROL None

FUEL USED _____

[ ] INLET [X] OUTLET

GAS VOLUME SAMPLED (METER VOL IN FT$^3$) 29.9

| IDENT NO | DESCRIPTION OF SAMPLE OR SAMPLE FRACTION | SAMPLE WT (SOLID) MG | SAMPLE VOL (LIQUID) ML | ANALYSIS REQUESTED - GENERAL COMMENTS (APPROX CONCENTRATIONS - POSSIBLE INTERFERENCES ETC) (INDICATE SPECIFIC ANALYSIS ON BACKSIDE) |
|---|---|---|---|---|
| 516 | Probe water wash | | | mass asbestos |
| 517 | Filter (1000008) | | | " " |
| 518 | Impinger contents+wash (2 bottles) | | | " " (46ml condensate) |
| | | | | |
| | | | | |
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COMMENTS: _____

SAMPLING CONTRACTOR Battelle (IF APPLICABLE)

PROJECT OFFICER Winton Kelly

REQUEST REVIEWED BY _____ 5/7/73

DATE OF REQUEST _____

DATE ANALYSIS REQUESTED _____

DATE OF REQUEST _____ (TO BE FILLED IN BY SSFAB)

EPA(DUR)45

# SOURCE SAMPLE REQUEST & REPORT
(MUST BE FILLED OUT FOR EACH TEST RUN)

SAMPLING DATE 73 (YR) 9 (MO) 12 (DAY)

FIRST IDENT. NO. USED S-73-004-519

LAST IDENT. NO. USED S-73-004-521

TEST NO 74 HAS 1

RUN NO 7

INDUSTRY _____ (USE TABLE A)

COMPANY Reserve Mining

ADDRESS Silver Bay, Minn.

SAMPLING METHOD Mod. EPA 5 (Millipore filter)

UNIT PROCESS OPERATION Waste Gas Vent

AIR POLLUTION CONTROL None

FUEL USED _____

☐ INLET ☒ OUTLET

GAS VOLUME SAMPLED (METER VOL IN FT³) 30.2

| IDENT NO | DESCRIPTION OF SAMPLE OR SAMPLE FRACTION | SAMPLE WT (SOLID) MG | SAMPLE VOL (LIQUID) ML | ANALYSIS REQUESTED - GENERAL COMMENTS (APPROX CONCENTRATIONS - POSSIBLE INTERFERENCES ETC) (INDICATE SPECIFIC ANALYSIS ON BACKSIDE) |
|---|---|---|---|---|
| 519 | Probe Water Wash | | | mass asbestos |
| 520 | Filter (1000009) | | | " " |
| 521 | impinger contents + wash (2 bottles) | | | " " 56 ml stack condensate |
| | | | | |
| | | | | |
| | | | | |
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COMMENTS: _____

SAMPLING CONTRACTOR Battelle (IF APPLICABLE)

PROJECT OFFICER Winton Kelly

REQUEST REVIEWED BY [signature] 9/17/73

DATE OF REQUEST _____ DATE ANALYSIS REQUESTED _____ DATE OF REQUEST _____ (TO BE FILLED IN BY SSFAB)

EPA/DUR/245

# SOURCE SAMPLE REQUEST & REPORT
(MUST BE FILLED OUT FOR EACH TEST RUN)

SAMPLING DATE 73 | 9 | 13 (YR | MO | DAY)

FIRST IDENT. NO. USED 5-73-004-522

LAST IDENT. NO. USED 5-73 004-524

TEST NO 74 HHS-1

RUN NO 5

INDUSTRY _____ (USE TABLE A)

COMPANY Reserve Mining

ADDRESS Silver Bay, Minn

SAMPLING METHOD Mod. EPAS (Millipore filter)

UNIT PROCESS OPERATION Hood Vent

AIR POLLUTION CONTROL None

FUEL USED _____

☐ INLET ☒ OUTLET

GAS VOLUME SAMPLED (METER VOL IN FT³) 23.7

| IDENT NO | DESCRIPTION OF SAMPLE OR SAMPLE FRACTION | SAMPLE WT (SOLID) MG | SAMPLE VOL (LIQUID) ML | ANALYSIS REQUESTED - GENERAL COMMENTS (APPROX CONCENTRATIONS - POSSIBLE INTERFERENCES ETC) (INDICATE SPECIFIC ANALYSIS ON BACKSIDE) |
|---|---|---|---|---|
| 522 | Probe water wash | | | mass acetate |
| 523 | Filter (1000 a.u) | | | " " |
| 524 | Impinger contents wash (2 bottles) | | | " " 25ml stock condensate |
| | | | | |
| | | | | |
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COMMENTS: _____

SAMPLING CONTRACTOR Battelle (IF APPLICABLE)

PROJECT OFFICER Wilton Kelly

REQUEST REVIEWED BY [illegible] 9/17/73

DATE OF REQUEST _____

DATE ANALYSIS REQUESTED _____

DATE OF REQUEST _____ (TO BE FILLED IN BY SSFAB)

EPA/DUR/245

# SOURCE SAMPLE REQUEST & REPORT
(MUST BE FILLED OUT FOR EACH TEST RUN)

SAMPLING DATE 73 (YR) 9 (MO) 13 (DAY)

FIRST IDENT. NO. USED S-73-004-525

LAST IDENT. NO. USED S-73-004-527

TEST NO 74 HAS 1

RUN NO 9

INDUSTRY _____ (USE TABLE A)

COMPANY Reserve Mining

ADDRESS Silver Bay, Minn.

SAMPLING METHOD Mod EPA 5 (Millipore filter

UNIT PROCESS OPERATION Roof Vent

AIR POLLUTION CONTROL none

FUEL USED _____

☐ INLET ☒ OUTLET

GAS VOLUME SAMPLED (METER VOL IN $FT^3$) 23.7

| IDENT NO | DESCRIPTION OF SAMPLE OR SAMPLE FRACTION | SAMPLE WT (SOLID) MG | SAMPLE VOL (LIQUID) ML | ANALYSIS REQUESTED - GENERAL COMMENTS (APPROX CONCENTRATIONS - POSSIBLE INTERFERENCES ETC) (INDICATE SPECIFIC ANALYSIS ON BACKSIDE) |
|---|---|---|---|---|
| 525 | Probe water wash | | | mass asbestos |
| 526 | filter (100 mg) | | | " " |
| 522 | Impinger contents + wash (2 bottles) | | | " " 25 ml concentrate |

COMMENTS: _____

SAMPLING CONTRACTOR Battelle (IF APPLICABLE)

PROJECT OFFICER Winton Kelly

REQUEST REVIEWED BY _____ 9/17/73

DATE OF REQUEST _____

DATE ANALYSIS REQUESTED _____

DATE OF REQUEST _____ (TO BE FILLED IN BY SSFAB)

EPA/DUR/245

# SOURCE SAMPLE REQUEST & REPORT

(MUST BE FILLED OUT FOR EACH TEST RUN)

SAMPLING DATE: 73 | 9 | 13 (YR | MO | DAY)

FIRST IDENT. NO. USED: 5-73-004 528

LAST IDENT. NO. USED: 5-73-004 - 530

TEST NO 74 HAS 1

RUN NO 10

INDUSTRY _____ (USE TABLE A)

COMPANY Reserve Mining

ADDRESS Silver Bay, Minn.

SAMPLING METHOD EPAS Mod. (Millipore filter)

UNIT PROCESS.OPERATION Hood vent

AIR POLLUTION CONTROL None

FUEL USED _____

☐ INLET ☒ OUTLET

GAS VOLUME SAMPLED (METER VOL IN $FT^3$) 23.3

| IDENT NO | DESCRIPTION OF SAMPLE OR SAMPLE FRACTION | SAMPLE WT. (SOLID) MG | SAMPLE VOL (LIQUID) ML | ANALYSIS REQUESTED - GENERAL COMMENTS (APPROX CONCENTRATIONS - POSSIBLE INTERFERENCES ETC) (INDICATE SPECIFIC ANALYSIS ON BACKSIDE) |
|---|---|---|---|---|
| 528 | Probe water wash | | | mass asbestos |
| 529 | filter (1000012) | | | " " |
| 530 | impinger contents + wash (2 bottles) | | | " " (26 ml condensate) |
| | | | | |
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COMMENTS: _____

SAMPLING CONTRACTOR Battelle (IF APPLICABLE)

PROJECT OFFICER Winston Kelly

REQUEST REVIEWED BY _____ 9/7/73

DATE OF REQUEST _____

DATE ANALYSIS REQUESTED _____

DATE OF REQUEST _____ (TO BE FILLED IN BY SSFAB)

EPA DUR 215

# SOURCE SAMPLE REQUEST & REPORT
(MUST BE FILLED OUT FOR EACH TEST RUN)

SAMPLING DATE 73 | 9 | 13 (YR | MO | DAY)

FIRST IDENT. NO. USED 5-73 001 - 531

LAST IDENT. NO. USED 5-73 004 - 533

TEST NO 74 HMS 1

RUN NO 11

INDUSTRY _____ (USE TABLE A)

COMPANY Reserve Mining

ADDRESS Silver Bay, Minn.

SAMPLING METHOD Modified S (Millipore Filter)

UNIT PROCESS OPERATION Conveyor to Rod Mill

AIR POLLUTION CONTROL multidone

FUEL USED _____

☐ INLET ☒ OUTLET

GAS VOLUME SAMPLED (METER VOL IN FT³) 112.4

| IDENT NO | DESCRIPTION OF SAMPLE OR SAMPLE FRACTION | SAMPLE WT (SOLID) MG | SAMPLE VOL (LIQUID) ML | ANALYSIS REQUESTED - GENERAL COMMENTS (APPROX CONCENTRATIONS - POSSIBLE INTERFERENCES ETC) (INDICATE SPECIFIC ANALYSIS ON BACKSIDE) |
|---|---|---|---|---|
| 531 | Probe water wash | | | mass asbestos |
| 532 | Filter (1000 013) | | | " " |
| 533 | impinger contents + wash (2 bottles) | | | " " — also stack condensate |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

COMMENTS: _____

SAMPLING CONTRACTOR Battelle (IF APPLICABLE)

PROJECT OFFICER Winston Kelly

REQUEST REVIEWED BY _____ 2/17/73

DATE OF REQUEST _____

DATE ANALYSIS REQUESTED _____

DATE OF REQUEST 0 (TO BE FILLED IN BY SSFAB)

EPA-DUP-145

# SAMPLE HANDLING LOG

Task or Contract Number Task Order No. 21 Reserve Mining

Source Identification [illegible]

Test Run Number 1

Pollutant(s) in Sample [illegible]

| Task | Date | Time | Personnel | Remarks |
|---|---|---|---|---|
| Sampling | [illegible] | | | |
| Probe Technician | | | [illegible] | |
| Meter Technician | | | F Schulz | |
| Other | | | [illegible] | |
| Transport of Train to Cleanup Site | " | 11:15 | [illegible] | |
| Train Disassembly | " | 11:40 | John [illegible] | |
| Train Cleanout | " | " | John [illegible] | |
| Packing and Storage | " | " | " " | |
| Shipment to Analysis Site | 9/14/73 | [illegible] | Winton Kelly | checked as baggage from [illegible] -> [illegible] |
| Lab Analysis | [illegible] | [illegible] | [illegible] | |
| Write Up | | | | |

Certified True Copy
F P Scarangelli

SAMPLE HANDLING LOG

Task or Contract Number Task Order No. 21 Revere Mining Co

Source Identification Fine Crusher Stack 110 (Line 104)

Test Run Number 2

Pollutant(s) in Sample [illegible]

| Task | Date | Time | Personnel | Remarks |
|---|---|---|---|---|
| Sampling | 9-11-73 | 1:00 p | | |
| Probe Technician | | | [illegible] | |
| Meter Technician | | | [illegible] | |
| Other | | | | |
| Transport of Train to Cleanup Site | " | 3:10 p | [illegible] | |
| Train Disassembly | " | 3:40 | John [illegible] | |
| Train Cleanout | " | " | John [illegible] | |
| Packing and Storage | " | " | " " | |
| Shipment to Analysis Site | 9/14/73 | 2:00 pm | Winton Kelly | Checked as baggage from Duluth - Raleigh |
| Lab Analysis | 9/17/73 | 1:45 pm | [illegible] | |
| Write Up | | | | |

SAMPLE HANDLING LOG

Task or Contract Number Task Order No. 21 Revere Mining Co.

Source Identification [illegible] stack 110 (Line 100)

Test Run Number 3

Pollutant(s) in Sample [illegible]

| Task | Date | Time | Personnel | Remarks |
|---|---|---|---|---|
| Sampling | 9-11-73 | 3 45 pm | | |
| Probe Technician | | | Bob Peling | |
| Meter Technician | | | F Schulz | |
| Other | | | Ben Furnace | |
| Transport of Train to Cleanup Site | " | [illegible] pm | Bob Peling | |
| Train Disassembly | " | 7 00 | John Faught | |
| Train Cleanout | " | " | " " | |
| Packing and Storage | " | " | " " | |
| Shipment to Analysis Site | 9/14/73 | 2 [illegible] pm | Winton Kelly | checked as baggage [illegible] → Raleigh |
| Lab Analysis | [illegible] | 1:45 PM | [illegible] | |
| Write Up | | | | |

# SAMPLE HANDLING LOG

Task or Contract Number: Task Order No. 21

Source Identification: [illegible] (Reserve [illegible])

Test Run Number: 4

Pollutant(s) in Sample: [illegible]

| Task | Date | Time | Personnel | Remarks |
|---|---|---|---|---|
| Sampling | 9-12-73 | 10:40 A | | |
| Probe Technician | " | | Bob Poling | |
| Meter Technician | " | | [illegible] | |
| Other | " | | Ben Furnace | |
| Transport of Train to Cleanup Site | " | 11:10 A | Ben Furnace | |
| Train Disassembly | " | 11:30 | John Faught | |
| Train Cleanout | " | " | " " | |
| Packing and Storage | " | " | " " | |
| Shipment to Analysis Site | 9/14/73 | 2:[illegible] | Winton Kelly | [illegible] as baggage [illegible] to Raleigh |
| Lab Analysis | 9/14/73 | [illegible] | | |
| Write Up | | | | |

SAMPLE HANDLING LOG

Task or Contract Number Task Order No. 21

Source Identification [illegible] (Reserve [illegible])

Test Run Number 5

Pollutant(s) in Sample Particulate

| Task | Date | Time | Personnel | Remarks |
|---|---|---|---|---|
| Sampling | 9-12-73 | 2 30 p | | |
| Probe Technician | | | [illegible] | |
| Meter Technician | | | [illegible] | |
| Other | | | Ben Furnace | |
| Transport of Train to Cleanup Site | " | 3 15 p | Ben Furnace | |
| Train Disassembly | " | 3 30 | John Faught | |
| Train Cleanout | " | " | | |
| Packing and Storage | " | " | " " | |
| Shipment to Analysis Site | 9/14/73 | 2 [illegible] pm | Winter Kelly | checked as [illegible] [illegible] |
| Lab Analysis | 9/19/73 | 1:45 pm | [illegible] | |
| Write Up | | | | |

# SAMPLE HANDLING LOG

Task or Contract Number Task Order No. 21

Source Identification [illegible] (Rivers [illegible])

Test Run Number [illegible]

Pollutant(s) in Sample [illegible]

| Task | Date | Time | Personnel | Remarks |
|---|---|---|---|---|
| Sampling | 9-12-73 | 4:10 P | | |
| Probe Technician | | | Bob Peling | |
| Meter Technician | | | E Schulz | |
| Other | | | Ben Furnace | |
| Transport of Train to Cleanup Site | " | 5:00 P | " " | |
| Train Disassembly | " | 5:30 | John Faught | |
| Train Cleanout | " | " | " " | |
| Packing and Storage | " | " | " " | |
| Shipment to Analysis Site | 9/14/73 | 2 pm | Winton Kelly | [illegible] Duluth [illegible] |
| Lab Analysis | [illegible] | [illegible] | | |
| Write Up | | | | |

# SAMPLE HANDLING LOG

Task or Contract Number: Task Order No. 21

Source Identification: [illegible] (Reserve Mining [illegible])

Test Run Number: 7

Pollutant(s) in Sample: Particulate

| Task | Date | Time | Personnel | Remarks |
|---|---|---|---|---|
| Sampling | 9-12-73 | 6:22 | | |
| Probe Technician | | | Bob Poling | |
| Meter Technician | | | E. Schultz | |
| Other | | | [illegible] | |
| Transport of Train to Cleanup Site | " | 7:10 | " " | |
| Train Disassembly | " | 7:30 | John Faught | |
| Train Cleanout | " | " | " " | |
| Packing and Storage | " | " | " " | |
| Shipment to Analysis Site | 9/14/73 | 2:40 pm | [illegible] Kelly | [illegible] Luggage Duluth - Raleigh |
| Lab Analysis | 9/17/73 | [illegible] | [illegible] | |
| Write Up | | | | |

# SAMPLE HANDLING LOG

Task or Contract Number: Task Order No. 21

Source Identification: [illegible] Head Exhaust [illegible]

Test Run Number: [illegible]

Pollutant(s) in Sample: [illegible]

| Task | Date | Time | Personnel | Remarks |
|---|---|---|---|---|
| Sampling | 9-13-73 | 10:44 A | E Schulz | |
| Probe Technician | | | Bob [illegible] | |
| Meter Technician | | | E. Schulz | |
| Other | | | Ben Furnace | |
| Transport of Train to Cleanup Site | " | 11:30 | " " | |
| Train Disassembly | " | 11:40 | John Faught | |
| Train Cleanout | " | " | " " | |
| Packing and Storage | " | " | " " | |
| Shipment to Analysis Site | 9/14/73 | 2:[illegible] pm | Winton Kelly | [illegible] Dulah → [illegible] |
| Lab Analysis | | | | |
| Write Up | | | | |

# SAMPLE HANDLING LOG

Task or Contract Number Task [illegible]

Source Identification Pollutant Hood Exhaust Stack

Test Run Number 9

Pollutant(s) in Sample Particulate

| Task | Date | Time | Personnel | Remarks |
|---|---|---|---|---|
| Sampling | 9-13-73 | [illegible] | | |
| Probe Technician | " | | Bob Pohing | |
| Meter Technician | " | | E Schulz | |
| Other | " | | Ben Furnace | |
| Transport of Train to Cleanup Site | " | 1 05 P. | " " | |
| Train Disassembly | " | 1 15 | John Faught | |
| Train Cleanout | " | " | " " | |
| Packing and Storage | " | " | " " | |
| Shipment to Analysis Site | 9/14/73 | 2 [illegible] | Winton Kelly | [illegible] |
| Lab Analysis | 9/17/73 | [illegible] | [illegible] | |
| Write Up | | | | |

SAMPLE HANDLING LOG

Task or Contract Number Task Order No. 21

Source Identification [illegible] Stack

Test Run Number 10

Pollutant(s) in Sample [illegible]

| Task | Date | Time | Personnel | Remarks |
|---|---|---|---|---|
| Sampling | 9-13-73 | 2:35p | | |
| Probe Technician | " | | Bob [illegible] | |
| Meter Technician | " | | E Schulz | |
| Other | " | | Bea Furnace | |
| Transport of Train to Cleanup Site | " | 3:15 | " " | |
| Train Disassembly | " | 3:30 | John Faught | |
| Train Cleanout | " | " | " " | |
| Packing and Storage | " | " | " " | |
| Shipment to Analysis Site | 9/14/73 | 2:[illegible] | Winton Kelly | checked as [illegible] Duluth [illegible] |
| Lab Analysis | [illegible] | [illegible] | | |
| Write Up | | | | |

SAMPLE HANDLING LOG

Task or Contract Number Task Order No 1

Source Identification Conveyor for Rod Mill Stack

Test Run Number 11

Pollutant(s) in Sample Particulate

| Task | Date | Time | Personnel | Remarks |
|---|---|---|---|---|
| Sampling | 9-13-73 | 5:45 P | | |
| Probe Technician | " | | Bob Poling | |
| Meter Technician | " | | E Schulz + Ben Furnace | |
| Other | | | Ben Furnace | |
| Transport of Train to Cleanup Site | " | | " " | |
| Train Disassembly | " | | John Fought | |
| Train Cleanout | " | | " " | |
| Packing and Storage | " | | " " | |
| Shipment to Analysis Site | 9/14/73 | [illegible] | Winton Kelly | [illegible] |
| Lab Analysis | [illegible] | [illegible] | [illegible] | |
| Write Up | | | | |

NERC:QAEML:ALB:RJThompson:cbf:136A,Chemstrand,RTP,NC,x2265:10/23/73

RECEIPT FOR CERTIFIED MAIL—30¢ (plus postage)

SENT TO
Mr. R. E. Heffelfinger
STREET AND NO. Battelle Columbus Lab
505 King Avenue
P.O., STATE AND ZIP CODE
Columbus, Ohio 43201

OPTIONAL SERVICES FOR ADDITIONAL FEES
RETURN RECEIPT SERVICES
1. [illegible] delivered 15¢
2. Shows to whom, date and where delivered 25¢
[illegible] addressee only [illegible]
DELIVER TO ADDRESSEE ONLY
SPECIAL DELIVERY (extra fee required)

PS Form 3800 Nov.1971 NO INSURANCE COVERAGE PROVIDED— NOT FOR INTERNATIONAL MAIL (See other [illegible])

No. 375829

Mr. R. E. Heffelfinger
Battelle Columbus Lab
505 King Avenue
Columbus, Ohio 43201

Dear Mr. Heffelfinger

Enclosed are [illegible] for asbestos which consist of:

| Sample Set | 1 | 2 | 3 |
|---|---|---|---|
| Probe Sample No. | 507 | 516 | 528 |
| Filter Sample No. | 508 | 517 | 529 |
| Impinger | 509 | | |

Please determine:

1) asbestos fiber length distribution;

2) identification of different asbestos species present; and

3) determination of mass of asbestos present in each sample (for the impinger sample #509 and the probe samples #507, #516, and #528). This will require filtration of an aliquot (1/4) on a tared membrane and weighing the dried particulate matter caught at 45% RH ± 5% RH and 72 ± 1°C. The balance of liquid samples #507, #516, #528, and #509 should be returned.

It would be appreciated if you could give these samples as high a priority as possible and report by airmail; they should be charged to Task 14 of Contract No. 68-02-[illegible].

Your usual cooperation will be appreciated.

Sincerely yours,

Certified from [illegible]

Richard J. [illegible]
Chief, [illegible]
[illegible]
Monitoring Laboratory

Enclosures

Doc: R. [illegible]
T. [illegible]

JAN 7 1974

Battelle
Columbus Laboratories
505 King Avenue
Columbus, Ohio 43201
Telephone (614) 299-3151
Telex 24-5454

January 4, 1974

Dr. Richard J. Thompson
Chief, Analytical Laboratory Branch
Quality Assurance and Environmental
Monitoring Laboratory
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina 27711

Dear Dr. Thompson:

Analyses for asbestos content of Samples 507, 508, 509, 516, 517, 528 and 529 have been completed. These samples were described in your letter dated October 29, 1973. The analytical procedure and analytical results are presented in Appendix A.

If you have any questions please call me at Extension 3397 or Carl Melton at Extension 2781.

Very truly yours,

R. E. Heffelfinger
Associate Manager
Analytical Chemistry Section

REH:aha

Enc.

True Copy
J Pasquelli

APPENDIX A

## ANALYTICAL PROCEDURE

### Liquid Samples

An aliquot from each of the liquid samples numbered 597, 509, 516 and 528 was filtered on a tared membrane filter and the collected particulate matter was dried and weighed at 50% RH and 72C. Carbon was vapor deposited over the surface of the filter, the filter was dissolved away in acetone and the carbon film was placed in the transmission electron microscope where fiber counts and measurements of fiber lengths and widths were made at 12000 x magnification over known areas as defined by 200 mesh openings in an electron microscope support grid. Also in the electron microscope identification of asbestos species was established by selected area electron diffraction and fiber morphology. Only those particles having an aspect ratio of 3:1 or greater were defined as fibers.

The volume of each fiber was computed by multiplying the width squared times the length. The mass of asbestos species was obtained by multiplying its total volume in the sample times the density of the asbestos species (density of amphibole = 3.4 and that of chrycotile = 2.56). Then the weight percent of asbestos present in the sample was calculated by dividing the mass of the asbestos by the weight of the dried particulate.

Fiber length distribution is presented in graphical form which expresses cumulative percent by number vs. the average fiber lengths assigned to size classes. The point at which the curve intersects 50% on

on the graph indicator the mean particle length with respect to fiber population in the sample.

## Filter Samples

Filter samples 508, 517 and 529 had been weighed by EPA and the weight was given on the sample envelope; consequently, no weighings of the collected particulate were made in this laboratory. Rather, to obtain an aliquot of the sample for analysis, a measured radial section was taken from each filter sample. The aliquot was low-temperature asked and redeposited on a 25 mm membrane filter where it was coated with vapor deposited carbon. As in the case of the water samples, the filter was dissolved away and the carbon film bearing the particulate was examined in the transmission electron microscope. Asbestos species were then identified, and length and width measurements were made for the purpose of expressing results in fiber length distribution and mass of asbestos present in each sample.

## Results of Analyses

Analytical results are presented in Table I and Figures 1 through 8. Table I lists samples and mass of asbestos in each sample. The figures are plots of cumulative percent by number vs. fiber length in μm.

TABLE I. ASBESTOS MASS DATA

| Sample Description | Weight of Dry Sample Particulate | Mass of Asbestos, µg | | % Asbestos in Sample | |
|---|---|---|---|---|---|
| | | Chrysotile | Amphibole | Chrysotile | Amphibole |
| S-73-004-507 (Run No. 1-C) | 0.0117 g | 0 | 775. | 0 | 6.6 % |
| S-73-004-508 (1000005A, Run 3) | 0.0150 g | 0 | 875. | 0 | 5.8 % |
| S-73-004-509 (Bubbler No. 1, Test F6-3) | 0.00122 g | 0.17 | 0.4 | 0.013 | 0.033 |
| S-73-004-509 (Bubbler No. 2, Run No. 1-C) | 0.000562 g | 0.14 | 1.5 | 0.025 | 0.27 |
| S-73-004-516 (Probe Wash P-3) | 0.2690 g | 2.3 | 470. | 0.0009 | 0.2 |
| S-73-004-517 (1000008A, Run 6) | 0.0253 g | 0 | 175. | 0 | 0.7 |
| S-73-004-528 (Probe Wash P-7) | 0.0704 g | 0 | 212. | 0 | 0.33 |
| S-73-004-529 (1000012A, Run 10) | 0.0107 g | 0 | 71. | 0 | 0.7 |

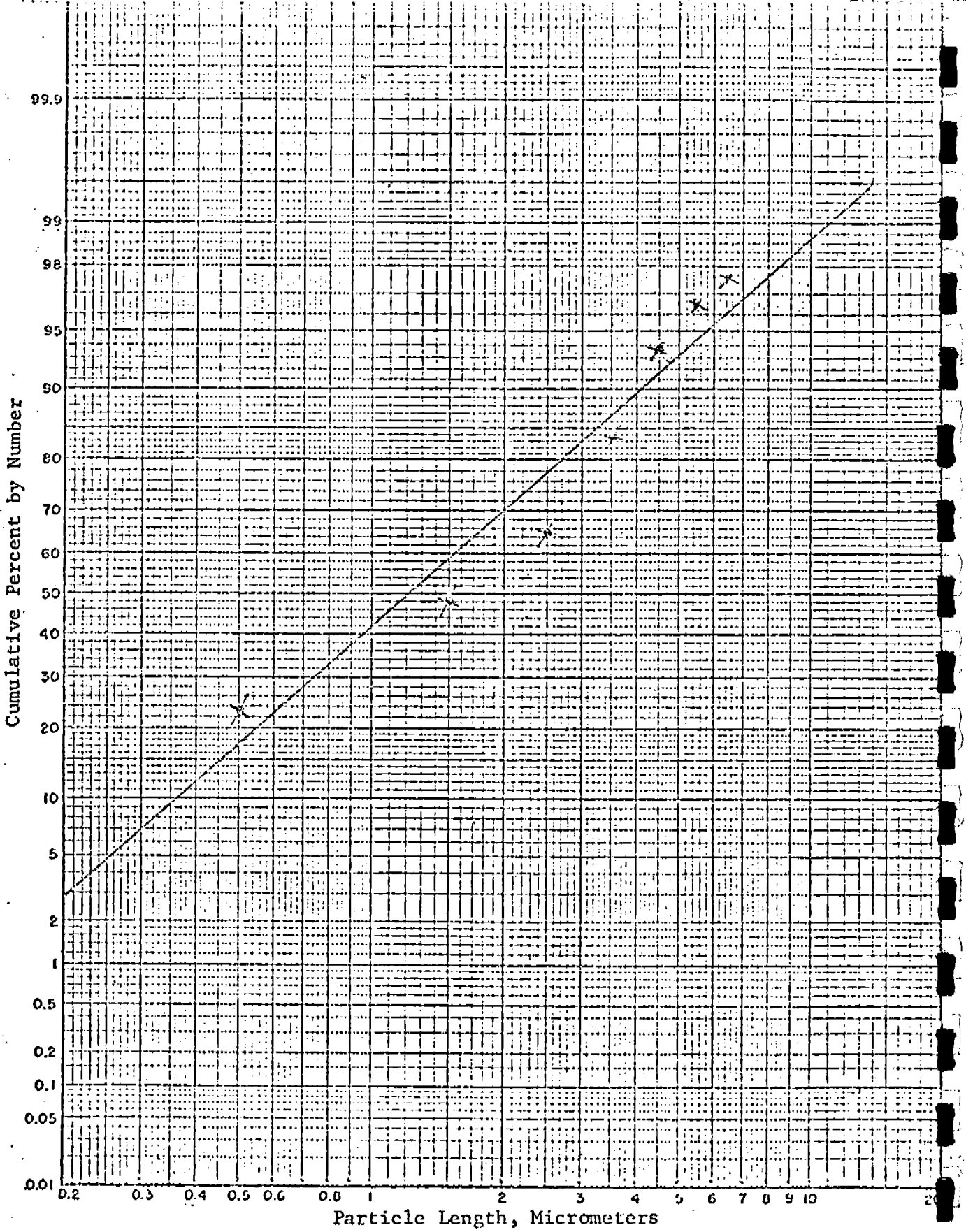


FIGURE 1. Sample S-73-004-507, Run No. 1-C,
Asbestos Type: Amphibole

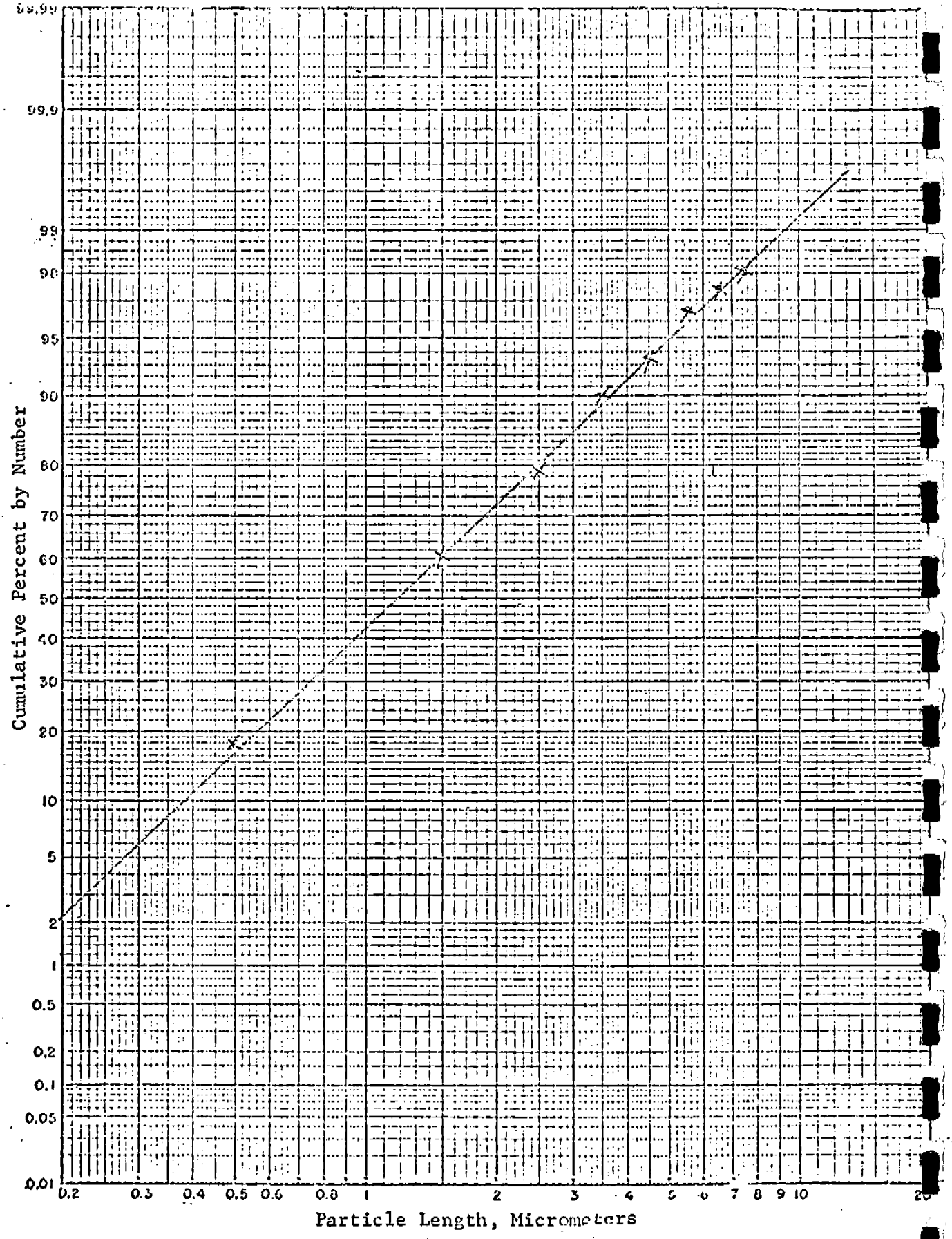


FIGURE 2. Sample S-73-004-508, 1000005A, Run 3
Asbestos Type: Amphibole

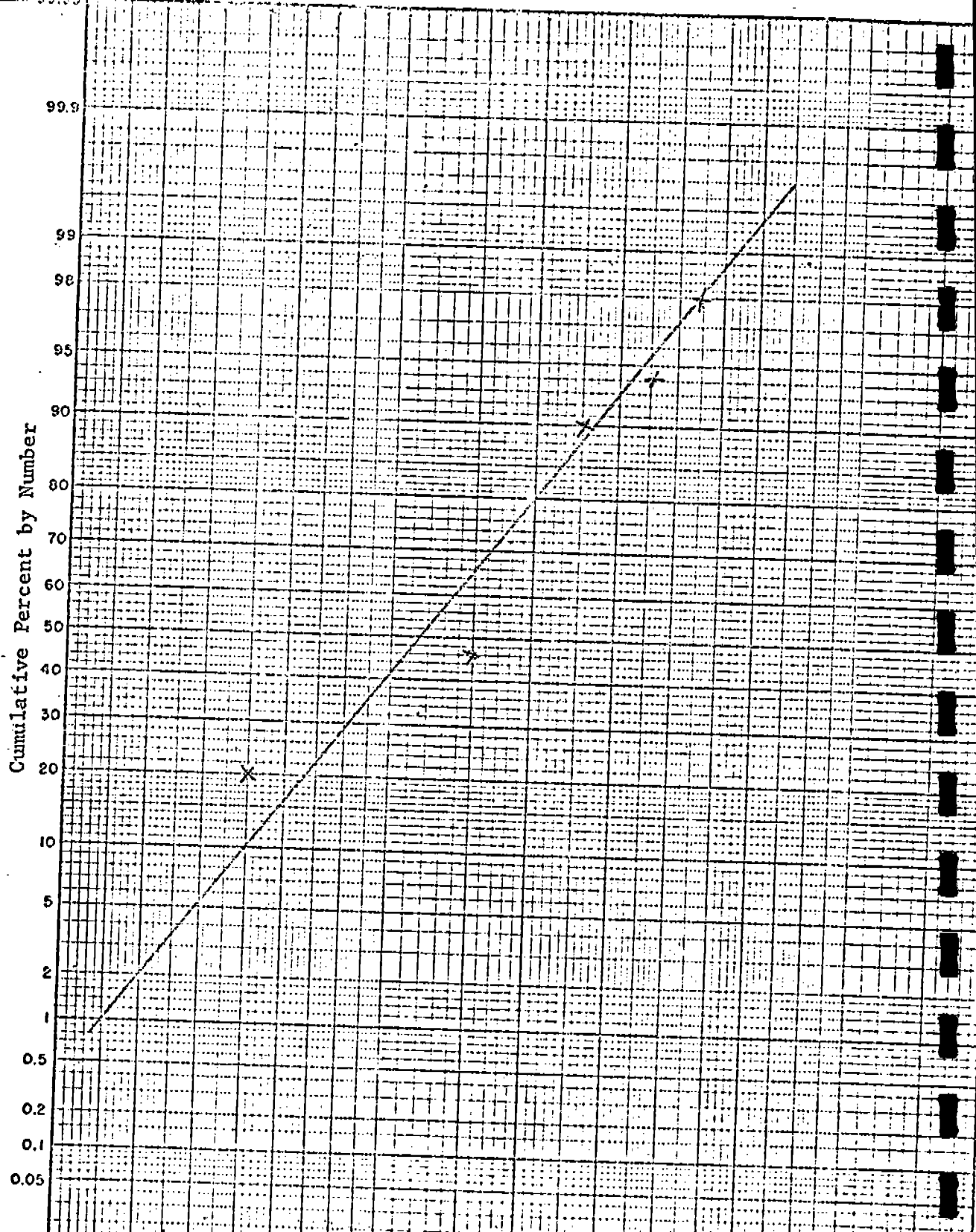


FIGURE 3a. Sample S-73-004-509, Bubbler No. 1, Test FC-3
Asbestos Type: Amphibole

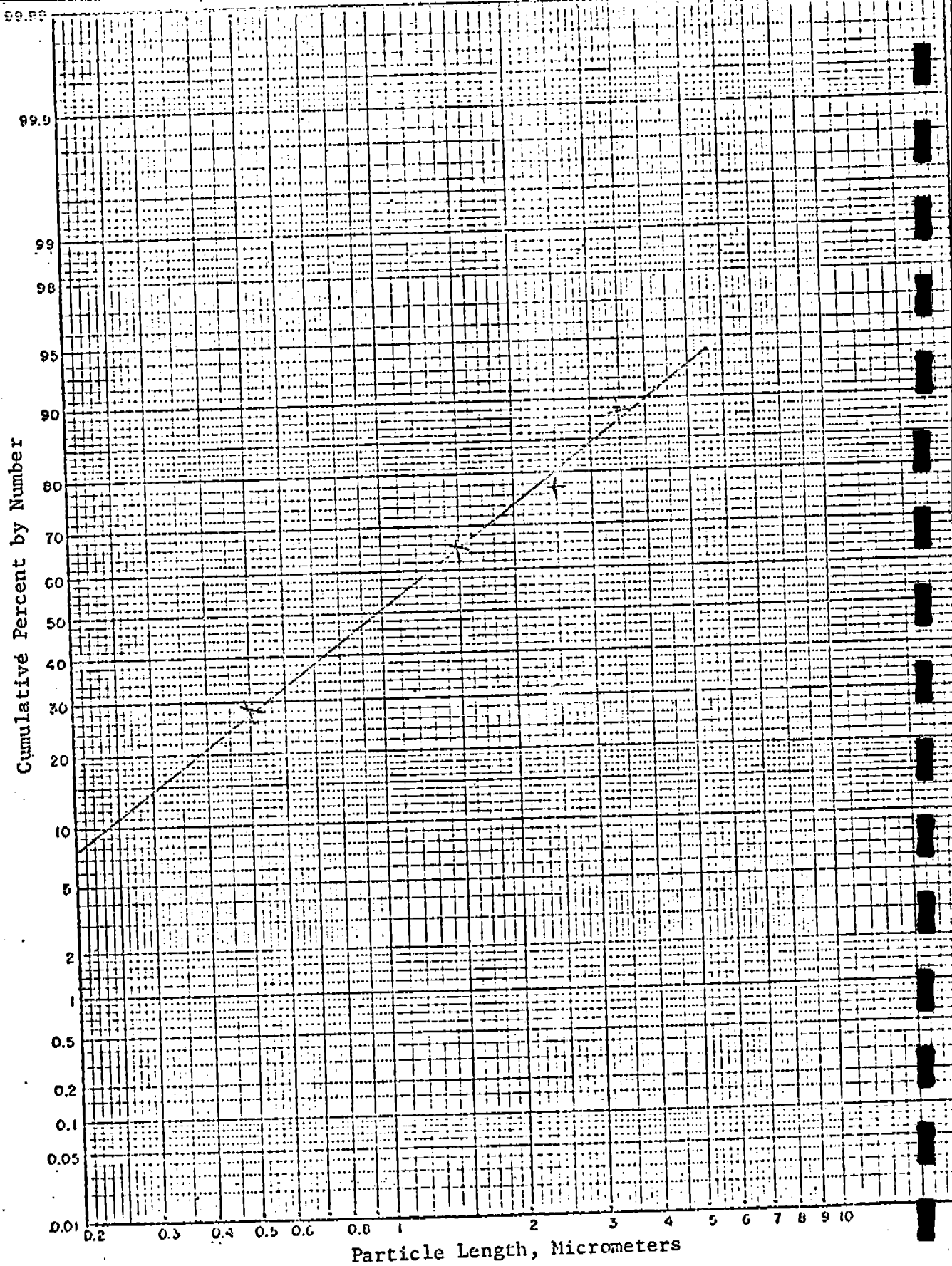


FIGURE 4b. Sample S-73-004-509, Bubbler No. 2, Run No. 1-C
Asbestos Type: Chrysotile

Battelle
Columbus Laboratories
505 King Avenue
Columbus, Ohio 43201
Telephone (614) 299-3151
Telex 24-5454

March 13, 1974

Dr. Frank P. Scaringelli
Environmental Sample Analysis Section
Analytical Chemistry Branch
Environmental Protection Agency
Research Triangle Park, North Carolina 27711

Dear Dr. Scaringelli:

This letter is in response to your request for clarification of data reported in the letter report to Dr. Thompson dated January 4, 1974. The report concerns samples 507, 508, 509, 516, 517, 528, and 529, which are described in Dr. Thompson's letter dated October 29, 1973. It is my understanding that you want to know (1) the original volume of each liquid sample received (2) the calculations employed to obtain reported values including aliquots taken, etc. and (3) an explanation of the cumulative size-frequency curves shown in Figures 1 through 8.

The original volume of each liquid sample was measured and recorded and are given in Table 1. Subsequently, all samples as received were placed on rollers for one hour to disperse the particulate uniformly before removing an aliquot. Then an aliquot was removed, diluted with water, and 0.1% aerosol OT was added to promote the dispersion of particulate. The diluted aliquots in plastic bottles were rolled for three hours, and several aliquots from each sample were deposited on 25 mm Millipore HAWP (0.45 μ pore size) filters to be able to select a suitable concentration of particulate for counting and measuring asbestos fibers in the electron microscope. The filters bearing the deposited particulate were coated with a carbon film by vapor deposition, a piece was cut from each carbon-coated filter, and the filter was dissolved away to leave the particulate supported by the carbon film which was then placed in the transmission electron microscope where measurements and counts of amphibole and chrysotile asbestos fibers were made at 12000X over areas delineated by 200-mesh electron microscope support grid openings.

The ratio of the area of the filter over which particulate was deposited to the area of the grid openings over which the measurements of fiber lengths and widths were made is the factor used to compute the total population and mass of asbestos in the aliquot deposited on the 25 mm filter. In each case the diameter of the deposit on the filter was 17.6 millimeters (8.8 mm or 8800 μ radius) and the area of one grid opening was 90 x 90 μ = 8100 $\mu^2$.

Therefore, the calculation of the factor became

$$\frac{\pi\ (8800\ \mu)^2}{8100\ \mu^2 \times \text{no. of grid openings;}}$$

for one grid opening the factor is $3.0 \times 10^4$ which we have named grid area factor/filter. Further calculations to obtain the concentration of fibers in the original sample from the aliquots taken in the case of the liquid samples are exemplified by the following case (Sample 507);

Step 1 - 30 ml were removed from original sample and diluted to 200 ml

Step 2 - A 5 ml aliquot was removed from the 200 ml diluted sample then diluted further with filtered deionized water and the entire quantity of particulate contained in this 5 ml aliquot was deposited on the 25 mm filter to create the dispersion from which fiber counts were made.

That volume of the original sample deposited over the effective filtering area was therefore: 5 ml/filter/200 ml x 15 ml = 0.375 ml/filter. Consequently, when 80 amphibole fibers were found over the area of 3 grid openings the calculation of the number of fibers per milliliter of original sample is

$$\frac{3 \times 10^4 \text{ grid area factor/filter}}{0.375 \text{ ml/filter}} \times \frac{80 \text{ fibers}}{3 \text{ grid areas}}$$

$= 2.13 \times 10^6$ fibers/ml. Since the original volume of the sample was measured to be 108 ml, the number of fibers in the total sample is 108 ml sample x $2.13 \times 10^6$ fibers/ml = $2.31 \times 10^8$ fibers/sample.

Length and width measurements to 0.1 μ were made on individual fibers and the volume of each fiber was computed by multiplying the length times the width squared. The volumes of all fibers measured within a sample were totaled, multiplied by the density (3.4 for amphiboles and 2.56 for chrysotile) to obtain the mass. Then the value obtained for the mass of fibers measured was multiplied by the aliquot factors to get the total mass of asbestos per ml of sample, and in turn multiplied by the original sample volume to get the mass of asbestos in the sample. One cubic micron multiplied times the density yields results in picograms which was more conveniently converted to micrograms for reporting. On this basis the 80 fibers measured in Sample 507 were computed to have a mass of 269 p.g.. Therefore the total mass of

TABLE I. DATA AND CALCULATED RESULTS

| Sample No. | As Received Sample Vol. (ml) | Aliquots: Original Sample Vol. Taken (or Filter Section) | Aliquots: Diluted to | Aliquots: Filtered Volume | Weight of Particulate in Orig. Sample | Fibers Measured: Ch | Fibers Measured: Am | Mass of Measured Fibers: Ch | Mass of Measured Fibers: Am | No. of Fibers/Sample: Ch | No. of Fibers/Sample: Am | Mass/Sample: Ch | Mass/Sample: Am |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S73-004-507 | 108 ml | 15 ml | 200 ml | 5 ml | 108 µg/ml | 0 | 80/3 Grid Openings | 0 | 269 Pg | 0 | $2.3 \times 10^8$ | 0 µg | 775 µg |
| S73-004-508 | - | 45° Section | 1000 ml | 20 ml | 0.0150 g/filter | 0 | 101/2 Grid Openings | 0 | 146 Pg | 0 | $6.1 \times 10^8$ | 0 | 875 µg |
| S73-004-509 (Bubbler No.1) | 179 ml | 25 ml | 100 ml | 70 ml | 6.86 µg/ml | 15 | 51/6 Grid Openings | 0.33 Pg | 7.2 Pg | $7.7 \times 10^5$ | $2.6 \times 10^6$ | 0.17 µg | 0.4 µg |
| S73-004-509 (Bubbler No. 2) | 148 | 25 ml | 200 ml | 145 ml | 3.8 µg/ml | 17 | 57/5 Grid Openings | 0.31 Pg | 33.9 Pg | $7.8 \times 10^5$ | $2.6 \times 10^6$ | 0.14 µg | 1.5 µg |
| S73-004-516 | 224 | 25 ml | 600 ml | 2 ml | 1202 µg/ml | 14 | 28/8 Grid Openings | 0.23 Pg | 47.1 Pg | $1.4 \times 10^8$ | $2.8 \times 10^8$ | 2.3 µg | 471 µg |
| S73-004-517 | - | 45° Section | 1000 ml | 20 ml | 0.0253 g/filter | 0 | 57/4 Grid Openings | 0 | 58.2 Pg | 0 | $1.71 \times 10^8$ | 0 | 175 µg |
| S73-004-528* | 241 | 25 ml | 600 ml | 2 ml | 292 µg/ml | 0 | 14/6 Grid Openings | 0 | 14.0 Pg | 0 | $2.0 \times 10^8$ | 0 | 201 µg |
| S73-004-528* | 241 | 10 ml | 400 ml | 4 ml | 292 µg/ml | 0 | 11/8 Grid Openings | 0 | 26.1 Pg | 0 | $1.0 \times 10^8$ | 0 | 234 µg |
| S73-004-529 | - | 45° Section | 1000 ml | 20 ml | 0.0107 g/filter | 0 | 18/7 Grid Openings | 0 | 41.6 Pg | 0 | $3.1 \times 10^4$ | 0 | 71 µg |

* Duplicate determinations.
Ch- Chrysotile
Am- Amphibole

SAMPLING TASK LOG

Plant [redacted]
Date 10/17/73

Plant Location [redacted]
Recorded by [redacted]

| Comments | Run | Sampling location (Port) | Pollutant | Clock Time Began | Clock Time Ended | Elapsed Time (min) | Sample Nos. |
|---|---|---|---|---|---|---|---|
| [redacted] | | | | | | | |
| [redacted] | 1 | [redacted] 2-7 | " | [redacted] | [redacted] | 30 | [redacted] |
| [redacted] | 1 | [redacted] 10-15 | " | [redacted] | [redacted] | 30 | |
| [redacted] | 2 | point 2-7 | " | [redacted] | [redacted] | 60 | [redacted] |
| [redacted] | 2 | point 10-15 | " | [redacted] | [redacted] | 60 | |
| | 3 | [redacted] 2-6 | " | [redacted] | [redacted] | 30 | [redacted] |
| [redacted] | 3 | point 4 | " | [redacted] | [redacted] | 3 | |
| [redacted] | 3 | point 4 | " | [redacted] | [redacted] | 10 | |

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# Emission Test Report
## Review Checklist

Reviewer: Brian Shrager
Review Date: 3/31/92

A. Background Information

1. Facility name: Reserve Mining Company

   Location: Silver Bay, Minnesota

2. Source category: Taconite ore processing

3. Test date: Week of Sept. 10, 1973

4. Test sponsor: EPA

5. Testing contractor: Battelle

6. Purpose of test: To identify and quantify possible asbestos emissions.

7. Pollutants measured

   (PM) PM-10 CO $SO_2$ $NO_x$ VOC Pb $CO_2$

   Others (list): Asbestos

8. Process overview: On an attached page provide a block diagram of the unit operations and associated air pollution control systems at the facility. Identify process tested with letters from the beginning of the alphabet (A, B, C, etc.) and APC systems with letters from end of alphabet (V, W, X, etc.). Also identify test locations with Arabic numerals (1,2,3, ...). Using the ID symbols from that sketch complete the table below that identifies processes or unit operations tested.

| Test ID | Process | Process ID | Emissions tested | | APCD (controlled emissions only) |
|---|---|---|---|---|---|
| | | | Uncontrolled | Controlled | |
| 1 | Fine crusher | A | | ✓ | Rotoclone |
| 2 | Pelletizing furnace | B | ✓ | | |
| 3 | Dryer (pelletizing) | C | ✓ | | |
| 4 | Ore conveyor (concent.) | D | | ✓ | Collector system #118 |
| | | | | | |
| | | | | | |

## B. Process Information

1. **Provide a brief narrative description of the process. With as much detail as possible, (e.g., if a furnace or conveyor system is used, identify the type of unit) describe the equipment used for those operations tested. (Note: If process description provided in test report is adequate, attach copy or reproduce here.)**

A schematic flow diagram of the process is attached (Figure III-1). The ore is received in railroad cars from the mine where it has been crushed to minus 4-inch size. The ore is crushed to minus 3/4-inch size by cone type crushers. It is then ground wet in rod mills and ball mills and separated by magnetic separators into concentrate and tailings. The tailings are pumped into Lake Superior. The concentrate is mixed with a small amount of bentonite clay and introduced into large rotating drums which roll it into balls of about 1/2" diameter. The balls are fed into a traveling grate pelletizing machine where they are first dried, then heated to over 2200°F, passed through an oxidizing section, then a cooling section. This transforms them into hard pellets, ideally suited for blast furnace feed.

The raw ore is about 24 percent iron and the concentrate if 65 percent iron. The asbestos type mineral in the ore is said to be amosite and said to range from 20 to 30 percent in content.

Of the missing runs, ½ were sent to McCrone Associates to be analyzed and printed by EPA's Office of Tech. Analysis and ½ were stored for "possible future analysis."

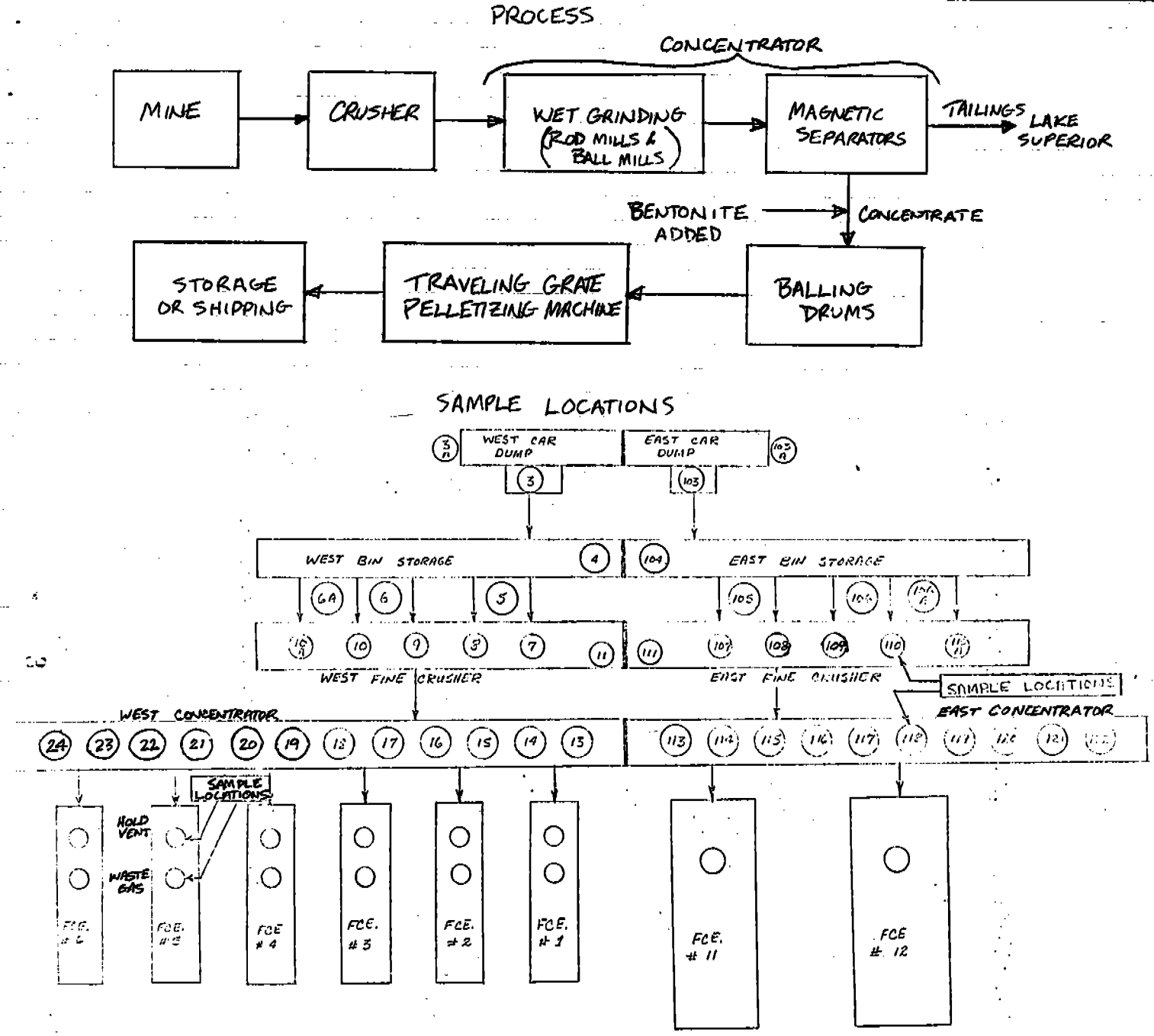


Figure 1: Sampling Locations, Reserve Mining Company, Silver Bay, Minnesota

2. For each process tested list feedstock materials and products. Indicate if activity factors are for feed (F) rate or product (P) rate.

| Process ID | Feedstock materials | Products | Basis for activity factor | F/P |
|---|---|---|---|---|
| A | Ore (≤4 inch) | Fine ore | Feed rate | F |
| B | Green balls | Pellets | Feed rate | F |
| C | Green balls | Pellets | Feed rate | F |
| D | Fine ore (≤3/4 inch) | Concentrate | * Feed rate | * |
| | | | | |
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* No material flow rates available. Avg. discharge rate given (from bins)

Basis for data: Pg. 29-32
(Indicate page/table Nos. in test report)

3. For each process or operation tested and each test run note process capacity and operating rate during test.

| Process ID | Capacity | Units | Test run | Process rate | Units |
|---|---|---|---|---|---|
| A | | | 1 | 515 | tons/hr |
| | | | 2 | | |
| | | | 3 | | |
| | | | 4 | | |
| B | | | 1 | 129 | tons/hr |
| | | | 2 | | |
| | | | 3 | | |
| | | | 4 | | |
| C | | | 1 | 135 | tons/hr |
| | | | 2 | | |
| | | | 3 | | |
| | | | 4 | | |
| D | | | 1 | 160* | tons/hr |
| | | | 2 | | |
| | | | 3 | | |
| | | | 4 | | |

Basis for data: Pg. 29-32

C. Air Pollution Control Systems Tested

1. For each air pollution control system pollution control system identified in A.8, note the following

| ID | Type of APCD | Manufacturer | Model No. |
|---|---|---|---|
| A | Rotoclone | | TYPE W |
| | | | |
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Note: Be as specific as possible in identifying APCD. For example, indicate "pulse jet fabric filter" rather than simply "fabric filter."

2. For each system identified above, provide a narrative description. For fugitive systems describe capture techniques as well as the removal techniques (use a separate page if necessary)

3. Using the attached parameter list for guidance complete the table below. (Use additional pages as needed.)

| APCD ID | Parameter | Units | Readings | | | |
|---|---|---|---|---|---|---|
| | | | Run 1 | Run 2 | Run 3 | Run 4 |
| A | | | | | | |
| Type of APCD: Rotoclone | | | | | | |
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D. Sampling and Analysis Methods

1. Complete the following table

| Test location stct | Pollutant | S & A method | Reference/ conditional method | Deviations noted |
|---|---|---|---|---|
| ~~Alt A, B, C~~ | PM, ASBESTOS | Method 5 | (Y)/N | (Y)/N |
| | | | Y/N | Y/N |
| | | | Y/N | Y/N |
| | | | Y/N | Y/N |
| | | | Y/N | Y/N |
| D | | | Y/N | Y/N |
| | | | Y/N | Y/N |
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| | | | Y/N | Y/N |
| | | | Y/N | Y/N |
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| | | | Y/N | Y/N |
| | | | Y/N | Y/N |
| | | | Y/N | Y/N |
| | | | Y/N | Y/N |
| | | | Y/N | Y/N |
| | | | Y/N | Y/N |

2. If a method used was not a reference or conditional method, provide a narrative discussion including any data manipulation needed to make results correspond to reference or conditional method results.

3. Describe any deviations identified above.

1. A millipore type AA membrane filter was substituted for the MSA 1106 BH glass fiber filter.
2. Filter and probe heating was not maintained at 225°F since maximum temperature allowable for the membrane filter is ~200°F. This temperature was maintained at 150-180°F, which was above the dew point of all streams sampled.
3. No acetone washings were used in the train cleanup. The probe was washed with water only and was kept separate from the impinger contents and wash.

E. Emission Data Documentation

1. Tabulate the following stack gas data from the test report. (Use additional pages as needed.)

| Test ID | Parameter | Units | Values reported | | | |
|---|---|---|---|---|---|---|
| | | | Run 1 | Run 2 | Run 3 | Run 4 |
| 1 | Stack temperature | °F | 60.7 | | | |
| | Moisture | ML | 19.2 | | | |
| | Oxygen | % BY VOL. DRY | 21.0 | | | |
| | Volumetric flow, actual | ACFM | 16,989 | | | |
| | Volumetric flow, standard | DSCFM | 16,644 | | | |
| | Percent isokinetic | | 98.1 | | | |
| | Pollutant concentration: | | | | | |
| | PM | MG | 26.70 | | | |
| | PM (condensibles) | MG | 1.78 | | | |
| | ASBESTOS | MG | 1.65 | | | |
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| | | | | | | |
| 2 | Stack temperature | °F | 356.8 | | | |
| | Moisture | ML | 53.8 | | | |
| | Oxygen | % BY VOL. DRY | 20.0 | | | |
| | Volumetric flow, actual | ACFM | 198,972 | | | |
| | Volumetric flow, standard | DSCFM | 115,621 | | | |
| | Percent isokinetic | | 105.4 | | | |
| | Pollutant concentration: | | | | | |
| | PM | MG | 294.30 | | | |
| | PM (condensibles) | MG | 0 | | | |
| | ASBESTOS | | 0.67 | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| 3 | Stack temperature | °F | 248.0 | | | |
| | Moisture | ML | 31.2 | | | |
| | Oxygen | % BY VOL. DRY | 21.0 | | | |
| | Volumetric flow, actual | ACFM | 139,214 | | | |
| | Volumetric flow, standard | DSCFM | 95,509 | | | |
| | Percent isokinetic | | 99.7 | | | |
| | Pollutant concentration: | | | | | |
| | PM | MG | 81.10 | | | |
| | PM (condensibles) | MG | 0 | | | |
| | ASBESTOS | MG | 0.24 | | | |
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2. Tabulate pollutant mass flux rates

| Test ID | Pollutant | Units | Mass flux rates | | | |
|---|---|---|---|---|---|---|
| | | | Run 1 | Run 2 | Run 3 | Run 4 |
| 1 | PM | lb/hr | 0.66 | | | |
| | ASBESTOS | lb/hr | 0.04 | | | |
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| 2 | PM | lb/hr | 153.75 | | | |
| | ASBESTOS | lb/hr | 0.35 | | | |
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| 3 | PM | lb/hr | 45.70 | | | |
| | ASBESTOS | lb/hr | 0.13 | | | |
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3. Present example emission factor calculations below.

TEST 1

PM 0.66 lb/hr ÷ 515 tons/hr = 1.28E-3 lb/ton of feed ore

4. Tabulate emission factors

| Process | Pollutant | Units | Average emission factor | |
|---|---|---|---|---|
| | | | Uncontrolled | Controlled |
| A | PM | lb/ton feed ore | | 1.28E-03 |
| | ASBESTOS | lb/ton feed ore | | 7.77E-05 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| B | PM | lb/ton feed | 1.19 | |
| | ASBESTOS | lb/ton feed | 2.71E-03 | |
| | | | | |
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| | | | | |
| C | PM | lb/ton feed | 0.339 | |
| | ASBESTOS | lb/ton feed | 9.63E-04 | |
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**ATTACHMENT A**
**APCD PARAMETERS**

| Type of APCD | Parameters |
|---|---|
| Fabric filter | Cleaning mechanism<br>Bag type<br>Cleaning frequency<br>Air to cloth ratio (A/C)<br>Pressure drop<br>Inlet temperature |
| ESP | Type (wet or dry)<br>Number of fields<br>Rapping cycle (if dry)<br>Specific Collection Area (SCA)<br>Particulate resistivity (if known)<br>Spark rate<br>Current and power levels |
| Venturi (or other high energy) scrubber | Pressure drop<br>Liquid/gas (L/G) ratio<br>Mist eliminator type |
| Packed-bed scrubber | Packing depth<br>L/G ratio<br>Caustic use (Y/N)<br>pH<br>Mist eliminator type |
| Carbon absorber | Bed depth<br>Superficial gas velocity<br>Bed temperature<br>Desorption mechanism (media)<br>Flue-gas moisture<br>Cycle length<br>Time-on-line after breakthrough |