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.

3000 Tech Center Drive
Monroeville, Pennsylvania 15146-3055
Telephone (412) 829-2208
FAX (412) 829-2415

ADVANCED TECHNOLOGY SYSTEMS, INC.

Ref. No. IKM-1106

December 20, 1995

AP-42 Section 12.2
Reference —
Report Sect. 4
Reference 174

Ms. Coleen M. Hart
Environmental Control Engineer
USS Clairton Works
400 State Street
Clairton, PA 15025

Dear Ms. Hart:

Re: Measurement of Respirable Dust Concentrations and Emission Rates from Coal Pulverizer Buildings - Letter Report

This letter, with attachments, constitutes the report for the respirable dust measurements performed by Advanced Technology Systems, Inc. (ATS) at the First Unit Primary Pulverizer, First Unit Secondary Pulverizer, Second Unit Primary Pulverizer and Second Unit Secondary Pulverizer at the USS Clairton Works facility located in Clairton, Pennsylvania. Ambient air sampling for respirable dust within the pulverizer buildings was performed on November 30, 1995 (Second Unit Primary Pulverizer and Second Unit Secondary Pulverizer) and December 1, 1995 (First Unit Primary Pulverizer and First Unit Secondary Pulverizer) to quantify the respirable dust emission rates from these structures.

Respirable dust sampling was performed as part of a USS Clairton Works in-house engineering project in accordance with Allegheny County Health Department - Division of Air Quality (DAQ) Source Testing Manual, Chapter 53, "Determination of Inhalable Fugitive Particulate Emissions from Air Pollution Sources Within a Structure." A copy of this test method can be found in the attachment. Respirable dust measurements were conducted using a sampling train which consisted of a particle sizing cyclone, 37 mm filter, and a personnel sampling pump capable of sampling air at a flow rate between 1.615 and 1.785 liters per minute. Sample train air flow was monitored with the use of a primary gas flow standard (Buck Calibrator, Model M-5, manufactured by A.P. Buck, Inc.). Air velocity measurements were conducted with the use of a calibrated Sierra Instruments, Inc. air velocity measuring device (serial number 12161). Respirable dust and air velocity measurements were conducted at a maximum of three (3) window or door openings per structure. The air flow at the test sites was outward from the structure during the appropriate 90 minute sampling period. This was confirmed by measuring the air velocity at the sampling sites before and after each test period.

For each structure, respirable dust measurements were conducted simultaneously at the test sites. The reported respirable dust concentration for each structure was calculated as the average of the measured respirable dust concentrations for that structure. The reported outward air velocity for each structure was calculated as the average of the measured air velocities for that structure. Emission rates of respirable dust from each pulverizer were calculated from the knowledge of the average respirable dust concentrations, average outward air velocity from the pulverizer, and total open window or door area in which the air flow was outward during the testing period. A determination of whether the air flow at each open window or door was inward to the pulverizer or outward from the pulverizer was made immediately prior to and after the testing period. If the air flow was determined to be inward prior to and / or after the sampling period, then the air

To: Ms. Coleen M. Hart
Re: Respirable Dust Emissions from Coal Pulverizers - Letter Report

flow was considered to be inward during the sampling period. The air flow was considered to be outward during the sampling period if the air flow was determined to be outward prior to and after the sampling period.

The results of the test effort are summarized in the table below. Measured respirable dust emission rates are listed in units of pounds per hour (lb/hr).

| Pulverizer | Measured Respirable Dust Emission Rate (lb/hr) |
|---|---|
| First Unit Primary | 0.049 |
| First Unit Secondary | 0.006 |
| Second Unit Primary | 0.049 |
| Second Unit Secondary | 0.005 |

Copies of the field data sheets, equipment calibration results, analytical results, and calculations can be found in the attachment.

ATS appreciates the opportunity to provide air quality engineering services to USS Clairton Works. If you have any questions regarding this letter report, please call me at (412) 829-2208.

Very truly yours,

John P. Shimshock

John P. Shimshock, Ph.D.
Senior Project Scientist

Approved by:

R. P. Khosah

Robinson P. Khosah, Ph.D.
Director, Air Quality Management Division



ATS
ADVANCED TECHNOLOGY SYSTEMS, INC

# CHAPTER 53

## DETERMINATION OF INHALABLE FUGITIVE PARTICULATE EMISSIONS FROM AIR POLLUTION SOURCES WITHIN A STRUCTURE

Principle and Applicability and Limitations:

a. The method measures the mass concentration of respirable dust smaller than 10 micron particle size.

b. This method is applicable to respirable dust from the fugitive emission sources enclosed within a structure.

c. Depending on predominant wind direction during the sampling, air flow will be inward at some openings and outward at others. Only the openings with outward air flow will be responsible for fugitive emission and therefore, the area and air velocity through these openings will be taken into consideration for calculating emission rate.

d. Since the wind direction may change during sampling, the air flow which was outward may become inward at the same openings where the test is being carried out. Under this situation, the sampling must continue at the same opening.

If the air flow remains inward for more than 50 percent of sampling time, then the sample must be discarded and another opening should be selected for sampling.

A. Sample Points

By visual determination, select the openings with the most fugitive dust leakage out of the enclosed structure.

Each sampling area should be divided into 12 equal areas with the sample point at the centroid of each area.

B. Velocity and Temperature

The velocity of the air flowing through the sample point can be measured with a vane anemometer or Kurtz Model 441 or equivalent at the centroid of the sample point. The velocity should be measured at the beginning and end of the sampling period for each sample point. The total of 24 velocity measurements shall be made per two hour run.

The temperature of the air can be measured with a mercury thermometer before and after each test run.

C. Moisture

The moisture in the sampled air will be the relative humidity of the ambient air. This can be determined with a sling psychrometer and should be measured at least once at each opening.

D. Area of Openings

The area of every opening shall be measured in square feet.

E. Sample for Inhalable Particulates:

1.0 Apparatus

1.1 Sampling train: The sample train consists of a 10 millimeter Dorr-Oliver cyclone connected to a filter holder (37 mm) loaded with a tared quartz filter and personal sampling pump

1.1.1 Personal sampling pump: A personal sampling pump capable of sampling air at 1.7 L/min ±5% with flexible tygon connecting tubing.

NOTE: Pulsation in the pump flowrate must be within ±20% of the mean flow.

1.1.2 Filter: Whatman type QM-A, 37 mm diameter quartz filter or equivalent supported with backup pad in a two-piece, 37 mm cassette filter holder held together by tape or cellulose shrink band.

1.1.3 Cyclone: 10 mm Dorr-Oliver nylon cyclone.

1.1.4 Sampling head holder: This holder must keep the cassette, cyclone and coupler together rigidly so that air enters only at the cyclone inlet.

2.0 Equipment for analysis:

2.1. Environmental chamber for balance. It shall be maintained at 20 degrees C ±0.3 degrees C and 50% ±5% relative humidity.

2.2. Vacuum desiccator.

3. Filter cassette preparation and pre-weighing before sampling.

3.1 Dry filters and backup pads under vacuum in the vacuum desiccator for at least 15 minutes. Release the vacuum, remove the desiccator cover, and equilibrate the filters in the environmental chamber for at least 1 hr. or,

3.2 Desiccate the filters and backup pads in the desiccator for 24 hrs.

3.3 Number the backup pads with a ballpoint pen and place one pad, the numbered side down, in the filter cassette bottom section.

3.4 Weigh the filters in the environmental chamber. Record the filter tare weight, $W_1$ (mg).

3.4.1 Zero the balance before each weighing.

3.4.2 Handle the filter with forceps (nylon forceps, if further analysis will be done).

3.5 Place a weighed filter on top of the backup pad in the filter cassette bottom section and allow to stand an additional 8 to 16 hours in the environmental chamber.

3.6 Reweigh the filters. If this tare weight differs by more than 0.01 mg from the first tare weight obtained in step 3.4 above, discard the filter.

NOTE: Insert a rod through the outlet hole of the filter cassette bottom section to raise the backup pad and filter so that the filter can be grasped with forceps.

3.7 Reassemble the filters in the filter cassettes and close firmly so that leakage around the filter will not occur. Place a plug in each opening of the filter cassette. Place a cellulose shrink band around the filter cassette, allow to dry, and mark with the same number as the backup pad.

3.8 Remove the cyclone's grit cap and vortex finder before use and inspect the cyclone interior. If the inside is visibly scored, discard this cyclone since the dust separation characteristics of the cyclone might be altered. Clean the interior of the cyclone to prevent reentrainment of large particles.

3.9 Assemble the sampler head. Check alignment of filter holder and cyclone in the sampling head to prevent leakage.

4. Procedure.

4.1 Calibration

4.1.1 Calibrate each personal sampling pump to 1.7 L/min. with a representative quartz filter in line.

4.2 Sampling procedure.

4.2.1 For door or window openings, sample at the centroid of each of 12 equal areas used during the velocity traverse for 10 minutes per point for a total of 120 minutes per run. The sample flow rate shall be 1.7 L/min. Three runs shall comprise a test, one each at three different window or door openings. The cyclone air intake shall face the window or door opening and shall be no more than 6 inches outside the plane of the door or the window.

NOTE: Do not allow the sampler assembly to be inverted at any time. Turning the cyclone to anything more than a horizontal orientation may deposit oversized material from the cyclone body onto the filter.

5. Sample preparation.

5.1 Wipe dust from the external surface of the filter cassette with a moist paper towel to minimize contamination. Discard the paper towel.

5.2 Remove the top and bottom plugs from the filter cassette. Place the filter cassettes in a vacuum desiccator for at least 15 min. followed by equilibration for at least 1 hr. in the environmental chamber, or desiccate the filter in desiccator for 24 hrs.

5.3 Remove the filter cassette band, pry open the filter cassette, and remove the filter by inserting a rod in the outlet hole of the filter cassette. Handle the filters very carefully by the edge to avoid loss of dust.

5.4 Zero the microbalance before all weighings. Use the same microbalance for weighing filters before and after sample collection. Calibrate the balance with National Bureau of Standards Class M weights.

5.5 Take two replicate blank filters for every batch of field samples for quality assurance on the sampling procedures. The set of replicate blank filters should be exposed to the same dust environment, either in a laboratory dust chamber or in the field. The quality control samples must be taken with the same equipment, procedures and personnel used in the routine field samples. Calculate precision from these replicates.

Take corrective action when the precision is out of control.

5.6 Weigh each filter, including field blanks. Record this post-sampling weight, $W_2$ (mg), beside its corresponding tare weight. Record anything remarkable about a filter (e.g., visible particles, overloaded, leaking, wet, torn, etc.).

6. Calculations.

6.1 Calculate the concentration of respirable dust, C ($mg/m^3$), in the air volume sampled, V (liters):

$$C = \frac{(W_2 - W_1) + B}{V} \cdot 10^3, \ mg/m^3 \qquad (1)$$

where: $W_1$ = tare weight of filter before sampling (mg).

$W_2$ = post-sampling weight of sample-containing filter (mg).

B = mean change in field blank filter weights between tare and post-sampling (mg) (+ or -).

V = Air volume sampled (liters)

6.2 Calculation of Air Volume rate through a door or window.

$$Vo_S = V_S \times A_S \qquad (2)$$

where: $Vo_S$ = Volumetric flowrate from a single window or door opening of $ft^3/min$.

Vs = Average of 24 velocity measurements by anemometer (ft/min) for a single window or door opening.

$A_S$ = Cross-sectional area of a single window or $ft^2$ door opening.

6.3 Calculation of Total Air Volume rate through the building.

$$Vo_t = V_A \times A_t \qquad (3)$$

where: $Vo_t$ = total volumetric outward flowrate from all building openings ($ft^3/min$).

$V_A$ = opening velocity averaged for 3 runs (ft/min).

$A_t$ = cross-sectional area ($ft^2$) of all building openings where air flow was outwards.

6.4 Emission Rate Calculation (lb/hr)

$$C_t = 1.3216 \times 10^{-4} C_{avg} \times \frac{VO_t}{35.3} \qquad (4)$$

where: $C_t$ = total concentration lb/hr. from all openings.

$C_{avg}$ = average concentration $mg/m^3$ of 3 runs at 3 different openings.

$C_{avg} = (C_1 + C_2 + C_3)/3$

$C_1$ = concentration from run 1 $mg/m^3$

$C_2$ = concentration from run 2 $mg/m^3$

$C_2$ = concentration from run 3 $mg/m^3$

$VO_t$ = total volumetric flowrate from all building openings $\frac{ft^3}{min.}$

35.3 = conversion factor for converting cubic feet to cubic meters.

chap53

USS CLAIRTON WORKS - CLAIRTON, PENNSYLVANIA
MEASUREMENT OF RESPIRABLE DUST CONCENTRATIONS AND EMISSION RATES
FROM THE COAL PULVERIZER BUILDINGS

FIRST UNIT - PRIMARY PULVERIZER
TEST DATE: DECEMBER 1, 1995
TEST TIMES: 1000 - 1235 EST

| SITE NAME | RESPIRABLE DUST COLLECTED (g) | AIR VOLUME SAMPLED (L) | RESPIRABLE DUST CONCENTRATION (mg/m3) | AVERAGE AIR VELOCITY (fpm) | OPENING AREA FOR OUTWARD AIR FLOW (sq ft) | VOLUMETRIC FLOW RATE (cf/min) | RESPIRABLE DUST EMISSION RATE (lb/hr) |
|---|---|---|---|---|---|---|---|
| TOP FLOOR EAST WINDOW | 0.00073 | 154.0 | 4.74 | 217 | | | |
| MAIN LEVEL SOUTH DOOR | 0.00026 | 152.8 | 1.70 | 129 | | | |
| AVERAGE | | | 3.22 | 173 | | | |
| TOTAL | | | | | 23.61 | 4084.5 | 0.049 |

FIRST UNIT - SECONDARY PULVERIZER
TEST DATE: DECEMBER 1, 1995
TEST TIMES: 0945 - 1340 EST

| SITE NAME | RESPIRABLE DUST COLLECTED (g) | AIR VOLUME SAMPLED (L) | RESPIRABLE DUST CONCENTRATION (mg/m3) | AVERAGE AIR VELOCITY (fpm) | OPENING AREA FOR OUTWARD AIR FLOW (sq ft) | VOLUMETRIC FLOW RATE (cf/min) | RESPIRABLE DUST EMISSION RATE (lb/hr) |
|---|---|---|---|---|---|---|---|
| TOP FLOOR EAST WINDOW | 0.00037 | 149.6 | 2.47 | 135 | | | |
| AVERAGE | | | 2.47 | 135 | | | |
| TOTAL | | | | | 5.11 | 689.9 | 0.006 |

USS CLAIRTON WORKS - CLAIRTON, PENNSYLVANIA
MEASUREMENT OF RESPIRABLE DUST CONCENTRATIONS AND EMISSION RATES
FROM THE COAL PULVERIZER BUILDINGS

SECOND UNIT - PRIMARY PULVERIZER
TEST DATE: NOVEMBER 30, 1995
TEST TIMES: 0900 - 1230 EST

| SITE NAME | RESPIRABLE DUST COLLECTED (g) | AIR VOLUME SAMPLED (L) | RESPIRABLE DUST CONCENTRATION (mg/m3) | AVERAGE AIR VELOCITY (fpm) | OPENING AREA FOR OUTWARD AIR FLOW (sq ft) | VOLUMETRIC FLOW RATE (cf/min) | RESPIRABLE DUST EMISSION RATE (lb/hr) |
|---|---|---|---|---|---|---|---|
| FIFTH FLOOR EAST WINDOW #1 | 0.00009 | 153.4 | 0.59 | 115 | | | |
| FIFTH FLOOR SOUTH WINDOW #1 | 0.00023 | 154.8 | 1.49 | 217 | | | |
| FIFTH FLOOR EAST WINDOW #7 | 0.00016 | 149.2 | 1.07 | 138 | | | |
| AVERAGE | | | 1.05 | 157 | | | |
| TOTAL | | | | | 79.47 | 12450.3 | 0.049 |

SECOND UNIT - SECONDARY PULVERIZER
TEST DATE: NOVEMBER 30, 1995
TEST TIMES: 1300 - 1445 EST

| SITE NAME | RESPIRABLE DUST COLLECTED (g) | AIR VOLUME SAMPLED (L) | RESPIRABLE DUST CONCENTRATION (mg/m3) | AVERAGE AIR VELOCITY (fpm) | OPENING AREA FOR OUTWARD AIR FLOW (sq ft) | VOLUMETRIC FLOW RATE (cf/min) | RESPIRABLE DUST EMISSION RATE (lb/hr) |
|---|---|---|---|---|---|---|---|
| TOP FLOOR WEST WINDOW | 0.00013 | 155.1 | 0.84 | 156 | | | |
| AVERAGE | | | 0.84 | 156 | | | |
| TOTAL | | | | | 9.39 | 1464.8 | 0.005 |

# ADVANCED TECHNOLOGY SYSTEMS, INC.
## AIR QUALITY ENGINEERING
## ANALYTICAL REPORTING FORM

CLIENT USS - Clairton Works
PLANT LOCATION Clairton, PA
PROJECT NUMBER IKM 1106
UNIT TESTED Pulverizer Buildings

TEST DATE 11/30 & 12/1/95
DATE RECEIVED 11/30 & 12/1/95
DATE ANALYZED 12/6/95
ANALYTICAL METHOD Gravimetric Method

| Test Location | Filter ID Number | Component | Cyclone Weight Units ( ) | Filter Weight Units (g) | Soluble Portion of Front Half H20 Rinse Units ( ) | Soluble Portion of Front Half Acetone Rinse Units ( ) | Soluble Portion of Back Half H20 Rinse Units ( ) | Soluble Portion of Back Half Acetone Rinse Units ( ) | 0.22 µm Filter Insoluble Portion of Back Half H20 Rinse Units ( ) |
|---|---|---|---|---|---|---|---|---|---|
| 1ST Unit Primary Pulv. | 19 | Particulate | | 0.00073 | | | | | |
| 2ND Unit Secondary Pulv. | 20 | " | | 0.00013 | | | | | |
| 2ND Unit Primary Pulv. | 21 | " | | 0.00009 | | | | | |
| 1ST Unit Primary Pulv. | 23 | " | | 0.00026 | | | | | |
| 2ND Unit Primary Pulv. | 24 | " | | 0.00023 | | | | | |
| 2ND Unit Primary Pulv. | 27 | " | | 0.00016 | | | | | |
| 1ST Unit Secondary Pulv. | 29 | " | | 0.00037 | | | | | |
| BLANK | 22 | " | | 0.00000 | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

Analyst's Signature Patrick J. Stockton
Date 12/7/95
Comments

USS Clairton Works – Clairton, PA

1st Unit – Primary Pulverizer

~~November 30, 1995~~ December 1, 1995

| Floor | Window/ Door | Dimensions | Area ($ft^2$) | Pre-Test Time | Pre-Test Flow | Post-Test Time | Post-Test Flow |
|---|---|---|---|---|---|---|---|
| top | Window East | 51" x 9" | 3.19 | 1000 | out | 1230 | out |
| mid-level | Window West | 51" x 26" | 9.21 | 1000 | in | 1230 | in |
| main level | Door South | 84" x 35" | 20.42 | 1000 | out | 1230 | out |
| main level | Window North | 9" x 48" | 3.00 | 1005 | in | 1235 | in |

total outward flow area = 23.61 $ft^2$

USS Clairton Works

Facility 1st Unit Primary Pulverizer

Location Top Floor

Test Port East Window

Date 12-1-95 (Fri)

Operator JTS, PJS

B.P. 28.90

Filter # 19

Pump # 3

Test Time 1040/1233 EST

Relative Humidity

| Sampling Point | Flow Pre (fpm) | Temp Pre °F | Flow Post (fpm) | Temp. Post | Area |
|---|---|---|---|---|---|
| #1 | 283 | 64 | 139 | 63 | |
| #2 | 369 | | 176 | | |
| #3 | 360 | | 222 | | |
| #4 | 235 | | 270 | | |
| #5 | 256 | | 116 | | |
| #6 | 165 | | 163 | | |
| #7 | 123 | | 296 | | |
| #8 | 84 | | 239 | | |
| #9 | 81 | | 174 | | |
| #10 | 131 | | 288 | | |
| #11 | 281 | | 169 | | |
| #12 | 241 | | 358 | | |

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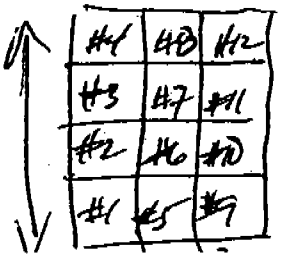
AVG

217

51"




218

overall average = 217 fpm

# ATS

CLIENT USS Clairton Works
TEST UNIT 1st Unit Primary Precipitator
PROJECT NO. 1144-1106
OPERATOR JTB, PJS

DATE 12-9-97 (FRI)
FILTER NO. 19
SITE NO. Top Floor East Window
BAROMETRIC PRESS. 28.90

| SAMPLE AREA # | CLOCK TIME EST | BUCK READING (cc/min) | AMBIENT TEMP. (°F) | RELATIVE HUMIDITY (%) | COMMENTS |
|---|---|---|---|---|---|
| 1 | 1052 | 1650, 1653, 1647 | 64 | | Pump #3 |
| 2 7.5 | 1059:30 | 1630, 1626, 1622 | | | |
| 3 15 | 1107 | 1627, 1620, 1620 | | | |
| 4 22.5 | 1114:30 | 1774, 1773, 1773 | | | |
| 5 30 | 1122 | 1776, 1775, 1780 | | | |
| 6 37.5 | 1129:30 | 1630, 1631, 1627 | | | |
| 7 45 | 1137 | 1620, 1627, 1621 | | | |
| 8 52.5 | 1144:30 | 1749, 1762, 1757 | | | |
| 9 60 | 1152 | 1768, 1773, 1778 | | | |
| 10 67.5 | 1159:30 | 1765, 1760, 1768 | | | |
| 11 75 | 1207 | 1770, 1771, 1773 | | | |
| 12 82.5 | 1214:30 | 1775, 1770, 1776 | | | |
| AVERAGE: 90 | 90 min run | 1711 | | | |

End 1222

↓

Sample volume = 154.02 L

USS Clairton Works

Facility 1st Unit Primary Pulverizer Level

Location ~~Main Floor~~ - Door South

Test Port South Door

Date 12-1-95 (Fri)

Operator KA

B.P. 29.90

Filter # 23

Pump # 1

Test Time 1025/1239 EST

Relative Humidity

| Sampling Point | Flow Pre (lpm) | Temp Pre °F | Flow Post (lpm) | Temp. Post | Area |
|---|---|---|---|---|---|
| #1 | 112 | 66 | 76 | 64 | |
| #2 | 79 | | 45 | | |
| #3 | 113 | | 70 | | |
| #4 | 174 | | 87 | | |
| #5 | 82 | | 79 | | |
| #6 | 121 | | 136 | | |
| #7 | 187 | | 44 | | |
| #8 | 95 | | 54 | | |
| #9 | 255 | | 80 | | |
| #10 | 208 | | 114 | | |
| #11 | 206 | | 418 | | |
| #12 | 76 | | 198 | | |

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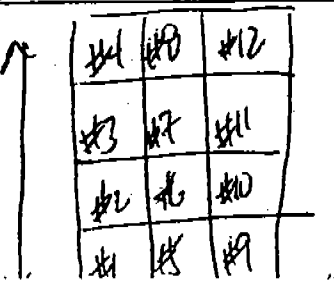
N6

142




117

overall average = 129 fpm

# ATS

CLIENT USS Clairton Works
TEST UNIT 6t Unit Primary Pulverizer
PROJECT NO. IKM-1106t
OPERATOR KA

DATE 12-1-95 (Fri)
FILTER NO. 23
SITE NO. Main Floor - South Door
BAROMETRIC PRESS. 28.90

| SAMPLE AREA # | CLOCK TIME EST | BUCK READING (cc/min) | AMBIENT TEMP. (°F) | RELATIVE HUMIDITY (%) | COMMENTS |
|---|---|---|---|---|---|
| 1 # | 1054 | 1706, 1705, 1707 | 66 | | Pump # 1 |
| 2 | 1102 | 1707, 1703, 1723 | 66 | | |
| 3 | 1109 | 1693, 1714, 1702 | 66 | | |
| 4 | 1117 | 1681, 1719, 1707 | 66 | | |
| 5 | 1124 | 1700, 1681, 1683 | 66 | | |
| 6 | 1132 | 1744, 1709, 1698 | 66 | | |
| 7 | 1140 | 1688, 1710, 1687 | 66 | | |
| 8 | 1147 | 1691, 1680, 1683 | 66 | | |
| 9 | 1154 | 1686, 1682, 1678 | 66 | | |
| 10 | 1202 | 1679, 1700, 1682 | 66 | | |
| 11 | 1209 | 1700, 1689, 1693 | 66 | | |
| 12 | 1217 | 1705, 1691, 1707 | 66 | | |
| AVERAGE: | ~~1224~~ | 1698 | | | |

END TIME: 1224
90 min run

Sample volume = 152.78 L

USS Clairton Works – Clairton, PA
1st Unit – Secondary Pulverizer
November 30, 1995

| Floor | Window/ [redacted] | Dimensions | Area ($ft^2$) | Pre-Test Time | Pre-Test Flow | Post-Test Time | Post-Test Flow |
|---|---|---|---|---|---|---|---|
| top | East ~~East~~ | 16"x46" | 5.11 | 1600 | out | Did not | |
| top (conveyor) | ~~East~~ West | 13"x34" | 3.07 | 1600 | in | conduct | testing |

USS Clairton Works – Clairton, PA
1st Unit – Secondary Pulverizer
December 1, 1995

| Floor | Window | Dimensions | Area ($ft^2$) | Pre-Test Time | Pre-Test Flow | Post-Test Time | Post-Test Flow |
|---|---|---|---|---|---|---|---|
| top | East | 16"x46" | 5.11 | 0945 | out | 1340 | out |
| top (conveyor) | West | 13"x34" | 3.07 | 0945 | in | 1340 | in |

total outward flow area = 5.11 $ft^2$

Facility USS Clairton Works  B.P. ~~29.50~~ 28.90

Location 1st Unit Secondary Pulverizer  Filter # 29

Test Port ~~East~~ Window - Top Floor  Pump # 4

Date ~~12-1-95 (Fri)~~  Test Time ~~0900~~ / 0945 / 1340 EST

Operator PJB, KA, JPS  Relative Humidity

| Sampling Point | | Flow (fpm) Pre | Temp Pre °F | Flow (fpm) Post | Temp. Post | Area |
|---|---|---|---|---|---|---|
| #1 | 125 | ~~60~~ | ~~59~~ | 38 | 70°F | |
| #2 | 116 | ~~52~~ | 66°F | 84 | | |
| #3 | 119 | ~~46~~ | | 158 | | |
| #4 | 115 | ~~35~~ | | 98 | | |
| #5 | 76 | ~~42~~ | | 65 | | |
| #6 | 125 | ~~65~~ | | 63 | | |
| #7 | 103 | ~~84~~ | | 79 | | |
| #8 | 111 | ~~96~~ | | 65 | | |
| #9 | 207 | ~~156~~ | | 82 | | |
| #10 | 452 | ~~189~~ | | 119 | | |
| #11 | ~~354~~ | ~~178~~ | | 93 | | |
| #12 | 313 | ~~199~~ | | 65 | | |

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AVG ~~209~~ 185

| | | |
|---|---|---|
| ~~#4~~ | ~~#8~~ | ~~#12~~ |
| ~~#3~~ | ~~#7~~ | ~~#11~~ |
| #2 | ~~#6~~ | ~~#10~~ |
| #1 | ~~#5~~ | ~~#9~~ |

84

Overall average = 135 fpm

# ATS

CLIENT USS Clairton Works
TEST UNIT 1st Unit Secondary Pulverizer
PROJECT NO. #KM-1106
OPERATOR PJS, KA, JPS

DATE ~~11-30-95 (Thurs)~~ 12-1-95 (Fri)
FILTER NO. 29
SITE NO. Top Floor - ~~West~~ East Window
BAROMETRIC PRESS. ~~29.30~~ 28.90

| SAMPLE AREA # | | CLOCK TIME EST | BUCK READING (cc/min) | AMBIENT TEMP. (°F) | RELATIVE HUMIDITY (%) | COMMENTS |
|---|---|---|---|---|---|---|
| 1 | | 1210 | 1657, 1660, 1662 | ~~59~~ 66 | | Pump #4 |
| 2 | 7.5 | 1217:30 | 1662, 1660, 1657 | | | |
| 3 | 15 | 1225 | 1668, 1658, 1647 | | | |
| 4 | 22.5 | 1232:30 | 1657, 1657, 1663 | | | |
| 5 | 30 | 1240 | 1670, 1675, 1664 | | | |
| 6 | 37.5 | ~~1~~ 1247:30 | 1680, 1678, 1672 | | | |
| 7 | 45 | 1255 | 1675, 1676, 1667 | | | |
| 8 | 52.5 | 1302:30 | 1665, 1674, 1661 | | | |
| 9 | 60 | 1310 | 1652, 1657, 1667 | | | |
| 10 | 67.5 | 1317:30 | 1664, 1663, 1647 | | | |
| 11 | 75 | 1325 | 1661, 1653, 1661 | | | |
| 12 | 82.5 | 1332:30 | 1656, 1624, 1662 | | | |
| AVERAGE: | 90 | 90 min run | 1662 | | | |

end 1340

↓ sample volume = 149.58 L

USS Clairton Works - Clairton, PA

2nd Unit - Primary Pulverizer

November 30, 1995

| Floor | Window / ~~Door~~ | Dimensions | Area ($ft^2$) | Pre-Test Time Flow | Post-Test Time Flow |
|---|---|---|---|---|---|
| 3 | Window - ~~East~~ West | 36"×52" | 13.00 | 0926 in | 1225 in |
| 3 | Window - ~~North~~ South | 28"×49" | 9.53 | 0926 in | 1225 in |
| ~~6~~7 | Window - ~~South~~ North | 58"×49" | 19.74 | 0910 out | 1221 in |
| ~~6~~7 | Window - ~~East~~ West | 56"×48" | 18.67 | 0910 in | 1221 out |
| ✓ ~~4~~5 | Window - ~~East~~ East #1 | 20"×47" | 6.53 | 0915 out | 1210 out |
| ~~4~~5 | Window - ~~East~~ East #2 | 22"×47" | 7.18 | 0915 out | 1216 out |
| ~~4~~5 | Window - ~~East~~ East #3 | 21"×47" | 6.85 | 0915 out | 1216 out |
| ~~4~~5 | Window - ~~East~~ East #4 | 18"×47" | 5.88 | 0917 out | 1216 out |
| ~~4~~5 | Window - ~~East~~ East #5 | 25"×47" | 8.16 | 0917 out | 1216 out |
| ~~4~~5 | Window - ~~East~~ East #6 | 21"×47" | 6.85 | 0918 out | 1215 out |
| ✓ ~~4~~5 | Window - ~~North~~ South #1 | 20"×47" | 6.53 | 0918 out | 1215 out |
| ~~4~~5 | Window - ~~East~~ West #1 | 25"×47" | 8.16 | 0919 in | 1219 in |
| ~~4~~5 | Window - ~~East~~ West #2 | 73"×37" | 18.76 | 0920 in | 1219 in |
| ~~4~~5 | Window - ~~East~~ West #3 | 15"×47" | 4.90 | 0920 in | 1219 in |
| ✓ ~~4~~5 | Window - ~~East~~ East #7 | 25"×47" | 8.16 | 0922 out | 1213 out |
| ~~4~~5 | Window - ~~East~~ East #8 | 26"×48" | 8.67 | 0923 out | 1218 out |
| ~~4~~5 | Window - ~~East~~ East #9 | 19"×48" | 6.33 | 0923 out | 1218 out |
| ~~4~~5 | Window - ~~East~~ East #10 | 25"×48" | 8.33 | 0923 out | 1218 out |

✓ = Sampling location

total ~~out~~ outward flow area = 79.47 $ft^2$

USS Clairton Works

Facility 2nd Unit Primary Pulverizer

Location 5th floor, ~~boot window #1~~ East

Test Port ~~East~~ Window #1

Date 11-30-95 (Thurs)

Operator PJS

B.P. 29.30

Filter # 21

Pump # 1

Test Time 1020 / 1210 EST

Relative Humidity 64%

| Sampling Point | Flow Pre (fpm) | Temp Pre °F | Flow Post (fpm) | Temp. Post | Area |
|---|---|---|---|---|---|
| #1 | 50 | 60°F | 33 | 67°F | |
| #2 | 45 | | 76 | | |
| #3 | 95 | | 161 | | |
| #4 | 76 | | 185 | | |
| #5 | 41 | | 215 | | |
| #6 | 68 | | 74 | | |
| #7 | 131 | | 65 | | |
| #8 | 128 | | 177 | | |
| #9 | 287 | | 147 | | |
| #10 | 139 | | 68 | | |
| #11 | 218 | | 54 | | |
| #12 | 110 | | 109 | | |

dc-180.cht

AVG 116

47"

| | | |
|---|---|---|
| ~~#4~~ | ~~#8~~ | ~~#12~~ |
| #3 | #7 | #11 |
| #2 | #6 | #10 |
| #1 | #5 | #9 |

114

overall average = 115 fpm

# ATS

Pump #1

CLIENT USS Clairton Works
TEST UNIT 2nd Unit Primary Pulverizer
PROJECT NO. IKM- 1106
OPERATOR [illegible]

DATE 11-30-95
FILTER NO. 21
SITE NO. ~~80~~ 5th floor ~~toilet~~ Window #1
BAROMETRIC PRESS. 29.30

| SAMPLE AREA # | CLOCK TIME EST | BUCK READING (cc/min) | AMBIENT TEMP. (°F) | RELATIVE HUMIDITY (%) | COMMENTS |
|---|---|---|---|---|---|
| 1 | 1030 | 1763, 1763, 1768 | 60 | 64 | |
| 2 | 1038 | 1743, 1744, 1750 | 60 | 69 | |
| 3 | 1046 | 1760, 1752, 1758 | 60 | 69 | |
| 4 | 1054 | 1740, 1738, 1737 | 60 | 69 | |
| 5 | 1101 | 1647, 1637, 1632 | 60 | 69 | |
| 6 | 1108 | 1670, 1675, 1678 | 60 | 69 | |
| 7 | 1115 | 1691, 1697, 1686 | 61 | 69 | |
| 8 | 1123 | 1689, 1686, 1685 | 65 | 69 | |
| 9 | 1130 | 1682, 1712, 1689 | 65 | 69 | |
| 10 | 1138 | 1703, 1712, 1720 | 65 | 69 | |
| 11 | 1146 | 1681, 1687, 1691 | 65 | 69 | |
| 12 | 1153 | 1671, 1674, 1660 | 65 | 69 | |
| AVERAGE: | 90min run | 1705 | 62 | 69 | |

END 1200 pm

↓

sample volume = 153.43 L

USS Clairton Works

Facility 2nd Unit Primary Rougher

Location 5th floor

Test Port ~~North~~ South Window #1

Date 11-30-95 (Thurs)

Operator JTS

B.P. 29.30

Filter # 24

Pump # 3

Test Time 1020/1215 EST

Relative Humidity 64%

| Sampling Point | Flow (fpm) Pre | Temp Pre °F | Flow (fpm) Post | Temp. Post | Area |
|---|---|---|---|---|---|
| #1 | 153 | 60°F | 174 | 67F | |
| #2 | 95 | | 202 | | |
| #3 | 65 | | 295 | | |
| #4 | 135 | | 168 | | |
| #5 | 94 | | 128 | | |
| #6 | 125 | | 104 | | |
| #7 | 60 | | 65 | | |
| #8 | 106 | | 213 | | |
| #9 | 260 | | 324 | | |
| #10 | 325 | | 420 | | |
| #11 | 367 | | 574 | | |
| #12 | 140 | | 617 | | |

dc-180.cht

AVG 160 274

47"

| | | |
|---|---|---|
| #4 | #8 | #12 |
| #3 | #7 | #11 |
| #2 | #6 | #10 |
| #1 | #5 | #9 |

overall average = 217 fpm

# ATS

CLIENT USS Clairton Works
TEST UNIT 2nd Unit Primary Pulverizer
PROJECT NO. IKM-1106
OPERATOR JPS

DATE 11-30-95 (Thursday)
FILTER NO. 24 South
SITE NO. 5th Floor ~~North~~ Window #1
BAROMETRIC PRESS. 29.30

| SAMPLE AREA # | CLOCK TIME EST | BUCK READING (cc/min) | AMBIENT TEMP. (°F) | RELATIVE HUMIDITY (%) | COMMENTS |
|---|---|---|---|---|---|
| 1 | 1034 | 1640, 1637, 1636 | 60 | 64 | Pump #3 |
| 2 | 1041:30 | 1632, 1636, 1621 | 60 | 64 | |
| 3 | 1049 | 1634, 1630, 1634 | 60 | 69 | |
| 4 | 1056:30 | 1731, 1734, 1733 | 61 | 69 | |
| 5 | 1104 | 1721, 1730, 1731 | 62 | 69 | |
| 6 | 1111:30 | 1754, 1759, 1756 | 63 | 69 | |
| 7 | 1119 | 1755, 1754, 1759 | 64 | 69 | |
| 8 | 1126:30 | 1758, 1746, 1757 | 65 | 69 | |
| 9 | 1134 | 1763, 1765, 1765 | 65 | 69 | |
| 10 | 1141:30 | 1742, 1755, 1757 | 65 | 69 | |
| 11 | 1149 | 1746, 1757, 1760 | 65 | 69 | |
| 12 | 1156:30 / 1204 | 1746, 1751, 1752 | 65 | 69 | |
| AVERAGE: | 90 min run | 1720 | 63 | 69 | |

End 1204

Sample volume = 154.84 L

USS Clairton Works

Facility 2nd Unit Primary Pulverizer

Location 5th floor East

Test Port ~~West~~ Window #7

Date 11-30-95 (Thurs)

Operator KA

B.P. 29.30

Filter # 27

Pump # 4

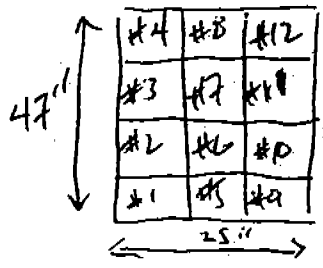
Test Time 1020 / 1213 EST

Relative Humidity 64%

| Sampling Point | Flow Pre (fpm) | Temp Pre °F | Flow Post (fpm) | Temp. Post | Area |
|---|---|---|---|---|---|
| #1 | 122 | 60°F | 82 | 67°F | |
| #2 | 98 | | 206 | | |
| #3 | 157 | | 293 | | |
| #4 | 131 | | 284 | | |
| #5 | 109 | | 146 | | |
| #6 | 107 | | 173 | | |
| #7 | 71 | | 136 | | |
| #8 | 111 | | 101 | | |
| #9 | 68 | | 86 | | |
| #10 | 91 | | 92 | | |
| #11 | 204 | | 81 | | |
| #12 | 248 | | 57 | | |

dc-180.cht

AVG 131




145

overall average = 138 fpm

# ATS

CLIENT USS Clairton Works
TEST UNIT 2nd Unit Primary Pulverizer
PROJECT NO. IKM-1106
OPERATOR KA

DATE 11-30-95 (Thurs)
FILTER NO. 27 East
SITE NO. 5th floor ~~[illegible]~~ Window #7
BAROMETRIC PRESS. 29.30

| SAMPLE AREA # | CLOCK TIME EST | BUCK READING (cc/min) | AMBIENT TEMP. (°F) | RELATIVE HUMIDITY (%) | COMMENTS |
|---|---|---|---|---|---|
| 1 | 1031 | 1677, 1684, 1670 | 60 | 64 | Pump #4 |
| 2 | 1039 | 1663, 1678, 1675 | 60 | 69 | |
| 3 | 1046 | 1681, 1690, 1662 | 60 | 69 | |
| 4 | 1053 | 1680, 1650, 1672 | 60 | 69 | |
| 5 | 1101 | 1662, 1679, 1652 | 60 | 69 | |
| 6 | 1108 | 1639, 1627, 1665 | 60 | 69 | |
| 7 | 1115 | 1663, 1652, 1646 | 60 | 69 | |
| 8 | 1122 | 1651, 1646, 1642 | 60 | 69 | |
| 9 | 1130 | 1653, 1654, 1676 | 60 | 69 | |
| 10 | 1138 | 1642, 1638, 1643 | 60 | 69 | |
| 11 | 1145 | 1637, 1643, 1652 | 60 | 69 | |
| 12 | 1153 | 1645, 1650, 1642 | 60 | 69 | |
| AVERAGE: | 90 min run | 1658 | 60 | 69 | |

END 12:01 PM

Sample volume = 149.20 L

USS Clairton Works - Clairton, PA

2nd Unit - Secondary Pulverizer

November 30, 1995

| Floor | Window/ ~~Door~~ | Dimensions | Area ($ft^2$) | Pre-Test Time | Pre-Test Flow | Post-Test Time | Post-Test Flow |
|---|---|---|---|---|---|---|---|
| top | ~~East~~ West | 26"x52" | 9.39 | 1306 | out | 1445 | out |
| top | ~~North~~ South | 27"x52" | 9.75 | 1300 | in | 1445 | in |
| mid-level | ~~North~~ South | 24"x52" | 8.67 | 1300 | in | 1445 | in |

total outward flow area = 9.39 $ft^2$

Facility USS Clairton Works
2nd Unit Secondary Precipitator

B.P. 29.30

Location Top Floor

Filter # 20

Test Port ~~East~~ West Window

Pump # A

Date 11-30-95 (Thurs)

Test Time 1306 / 1445 EST

Operator ~~PB~~ RJS, KA, JPS

Relative Humidity 65%

| Sampling Point | Flow (fpm) Pre | Temp Pre °F | Flow (fpm) Post | Temp. Post | Area |
|---|---|---|---|---|---|
| #1 | 174 | 60°F | 190 | 54°F | |
| #2 | 255 | | 170 | | |
| #3 | 245 | | 260 | | |
| #4 | 208 | | 186 | | |
| #5 | 138 | | 140 | | |
| #6 | 122 | | 92 | | |
| #7 | 131 | | 108 | | |
| #8 | 112 | | 131 | | |
| #9 | 198 | | 160 | | |
| #10 | 131 | | 163 | | |
| #11 | 134 | | 115 | | |
| #12 | 122 | | 61 | | |

dc-180.cht

NG

164

148

52"

| | | |
|---|---|---|
| ~~#4~~ | ~~#8~~ | ~~#12~~ |
| ~~#3~~ | ~~#7~~ | ~~#11~~ |
| ~~#2~~ | ~~#6~~ | ~~#10~~ |
| ~~#1~~ | ~~#5~~ | ~~#9~~ |

overall average = 156 fpm

# ATS

CLIENT USS Clairton Works
TEST UNIT 2nd Unit secondary Rheniper
PROJECT NO. IKM-1106
OPERATOR PJS

DATE 11-30-95 (THUR)
FILTER NO. 20 West
SITE NO. Top Floor ~~East~~ Window
BAROMETRIC PRESS. 29.30

| SAMPLE AREA # | CLOCK TIME EST | BUCK READING (cc/min) | AMBIENT TEMP. (°F) | RELATIVE HUMIDITY (%) | COMMENTS |
|---|---|---|---|---|---|
| 1 | 1311 | 1694, 1694, 1693 | 60 | 65 | Pump #4 |
| 2 | 1319 | 1723, 1722, 1729 | 60 | 65 | |
| 3 | 1327 | 1720, 1729, 1737 | 60 | 65 | |
| 4 | 1334 | 1736, 1734, 1727 | 60 | 65 | |
| 5 | 1342 | 1708, 1709, 1711 | 60 | 65 | |
| 6 | 1350 | 1726, 1713, 1717 | 60 | 65 | |
| 7 | 1357 | 1733, 1731, 1750 | 60 | 65 | |
| 8 | 1404 | 1709, 1708, 1714 | 60 | 65 | |
| 9 | 1411 | 1752, 1734, 1726 | 60 | 65 | |
| 10 | 1419 | 1728, 1739, 1735 | 60 | 65 | |
| 11 | 1427 | 1734, 1719, 1721 | 60 | 65 | |
| 12 | 1434 | 1735, 1722, 1741 | 60 | 65 | |
| AVERAGE: | 90 minutes | 1724 | 60 | 65 | |

END 1441

→ Sample volume = 155.13 L

SIERRA
INSTRUMENTS, INC.

5 Harris Court
Monterey, CA 93940

Outside CA (800) 866-0200
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Telex: 337795 CVBS CARV
FAX (408) 373-4402

# CERTIFICATE OF CALIBRATION
# VELOCITY/TEMPERATURE

(Calibrated in Sierra Instruments' Calibration Lab)

I HEREBY CERTIFY THAT SIERRA INSTRUMENTS, PART NUMBER 631-HT2,

SERIAL NUMBER(S) 12161 SUPPLIED TO ADVANCED TECHNOLOGY SYSTEMS

ON PURCHASE ORDER NUMBER 1046 WAS MANUFACTURED IN ACCORDANCE WITH ALL THE TERMS AND SPECIFICATIONS OF THE PURCHASE ORDER REFERENCED TO THE ABOVE. I FURTHER CERTIFY THAT THIS INSTRUMENT HAS AN ACCURACY OF ±2.50F READING & ±2%, FULL SCALE AND THAT ALL STANDARDS USED TO CALIBRATE VELOCITY METERS OR SYSTEMS BY SIERRA INSTRUMENTS ARE TRACEABLE TO NATIONAL BUREAU OF STANDARDS TESTS AND CALIBRATIONS. TEMPERATURE IS TRACEABLE TO ASTM #50F. THE ACURACY OF THIS INSTRUMENT IS WITHIN STATED SPECIFICATIONS.

JAIME PEREZ

CAL. LAB. MGR. SIGNATURE

MARCH 06, 1995
DATE

APPLICABLE NBS TEST NUMBER FOR AIR VELOCITY: TN235890
7750608

APPLICABLE ASTM #50F FOR TEMPERATURE