# SOURCE TEST REPORT
# 2021 COMPLIANCE EMISSIONS TESTING

# UNITED STATES GYPSUM COMPANY
# RIVER ROUGE FACILITY
# RIVER ROUGE, MICHIGAN

## No. 1 CALCINING KETTLE (EU-36)

Prepared For:

**United States Gypsum Company-River Rouge**
10090 West Jefferson Avenue
River Rouge, MI 48218

For Submittal To:

**EGLE**
525 W. Allegan Street
Lansing, MI 48933

Prepared By:

**Montrose Air Quality Services, LLC**
4949 Fernlee Avenue
Royal Oak, MI 48073

| | |
|---|---|
| Document Number: | **MW049AS-009677-RT-918** |
| Test Date: | **December 21, 2021** |
| Submittal Date: | **February 7, 2022** |

ACCREDITED
TO ASTM D7036 ONLY

B3518_test_20211221

## REVIEW AND CERTIFICATION

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature: David Trahan Date: 01 / 07 / 2022

Name: David Trahan Title: Field Project Manager

I have reviewed, technically and editorially, details, calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature: Todd Wessel Date: 01 / 07 / 2022

Name: Todd Wessel Title: Client Project Manager

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# 1.0 INTRODUCTION

## 1.1 SUMMARY OF TEST PROGRAM

United States Gypsum Company-River Rouge (State Registration No.: B3518) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on the No. 1 Calcining Kettle (EU-36) at the United States Gypsum Company facility located in River Rouge, Michigan. Testing was performed on December 21, 2021, for the purpose of satisfying the emission testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit No. MI-ROP-B3518-2021.

The specific objectives were to:

- Verify the emissions of filterable particulate matter (FPM) and the percent opacity of visible emissions (VE) at the SV-36 Exhaust Stack, which is associated with the baghouse serving EU-36
- Conduct the test program with a focus on safety

Montrose performed the tests to measure the emission parameters listed in Table 1-1.

**TABLE 1-1**
**SUMMARY OF TEST PROGRAM**

| Test Date(s) | Unit ID/ Source Name | Activity/ Parameters | Test Methods | No. of Runs | Duration (Minutes) |
|---|---|---|---|---|---|
| 12/21/2021 | EU-36 / SV-36 | Velocity/Volumetric Flow Rate | EPA 1 & 2 | 3 | 60 |
| 12/21/2021 | EU-36 / SV-36 | $O_2$, $CO_2$ | EPA 3 | 3 | 60 |
| 12/21/2021 | EU-36 / SV-36 | Moisture | EPA 4 | 3 | 60 |
| 12/21/2021 | EU-36 / SV-36 | FPM | EPA 5 | 3 | 60 |
| 12/21/2021 | EU-36 / SV-36 | Opacity | EPA 9 | 3 | 60 |

To simplify this report, a list of Units and Abbreviations is included in Appendix D.1. Throughout this report, chemical nomenclature, acronyms, and reporting units are not defined. Please refer to the list for specific details.

This report presents the test results and supporting data, descriptions of the testing procedures, descriptions of the facility and sampling locations, and a summary of the quality assurance procedures used by Montrose. The average emission test results are summarized and compared to their respective permit limits in Table 1-2. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

The testing was conducted by the Montrose personnel listed in Table 1-3. The tests were conducted according to the Intent-to-Test notification dated November 2, 2021 that was submitted to the EGLE.

**TABLE 1-2**
**SUMMARY OF AVERAGE COMPLIANCE RESULTS -**
**EU-36**
**DECEMBER 21, 2021**

| Parameter/Units | Average Results | Emission Limits |
|---|---|---|
| **Filterable Particulate Matter (FPM)** | | |
| g/dscm | 0.0026 | 0.05 |
| lb/hr | 0.077 | 6.8 |
| **Visible Emissions (VE)** | | |
| % opacity (Highest 6-Minute Average) | 0.0 | 7 |

## 1.2 KEY PERSONNEL

A list of project participants is included below:

**Facility Information**

| | | |
|---|---|---|
| Source Location: | United States Gypsum Company-River Rouge<br>10090 West Jefferson Avenue<br>River Rouge, MI 48218 | |
| Project Contact: | Brent Wyatt | Johnnie Robinson |
| Role: | MFG, IT Supervisor | QC Supervisor |
| Company: | United States Gypsum Company-River Rouge | United States Gypsum Company-River Rouge |
| Telephone: | 313-655-1448 | 313-624-4278 |
| Email: | bnwyatt@usg.com | jrobinson@usg.com |

**Agency Information**

| | |
|---|---|
| Regulatory Agency: | EGLE |
| Agency Contact: | Karen Kajiya-Mills |
| Telephone: | 517-335-3122 |
| Email: | kajiya-millsk@michigan.gov |

**Testing Company Information**

| | | |
|---|---|---|
| Testing Firm: | Montrose Air Quality Services, LLC | |
| Contact: | Todd Wessel | David Trahan |
| Title: | Client Project Manager | Field Project Manager |
| Telephone: | 248-548-8070 | 248-548-8070 |
| Email: | twessell@montrose-env.com | dtrahan@montrose-env.com |

**Laboratory Information**

Laboratory: Montrose Royal Oak
City, State: Royal Oak, MI 48073
Method: EPA Method 5

Test personnel and observers are summarized in Table 1-3.

**TABLE 1-3**
**TEST PERSONNEL AND OBSERVERS**

| Name | Affiliation | Role/Responsibility |
|---|---|---|
| David Trahan | Montrose | Field Project Manager, QI |
| David Koponen | Montrose | Field Technician, Certified VE Observer |
| Michael Nummer | Montrose | Senior Field Technician |
| Brent Wyatt | United States Gypsum Company-River Rouge | Client Liaison/Test Coordinator |
| Johnnie Robinson | United States Gypsum Company-River Rouge | Observer |
| Regina Angelotti | EGLE | Observer |
| John Lamb | EGLE | Observer |

# 2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

## 2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

United States Gypsum Company-River Rouge manufactures a variety of gypsum products. The facility operates two calcining kettles (FG-Kettles), No. 1 Calcining Kettle (EU-36) and No. 3 Calcining Kettle (EU-38). Finely ground gypsum is fed into a kettle and then heated to the calcining temperature. Once the steam fluidizes the gypsum, it is ready for processing. Dust emissions from the kettles are controlled by baghouses. EU-36 was in operation for this test event.

## 2.2 FLUE GAS SAMPLING LOCATION

Information regarding the sampling location is presented in Table 2-1.

**TABLE 2-1**
**SAMPLING LOCATION**

| Sampling Location | Stack Inside Diameter (in.) | Distance from Nearest Disturbance | | Number of Traverse Points |
|---|---|---|---|---|
| | | Downstream EPA "B" (in./dia.) | Upstream EPA "A" (in./dia.) | |
| EU-36 Baghouse SV-36 Exhaust Stack | 25.8 | 480.0 / 18.6 | 720.0 / 28.0 | Isokinetic: 12 (6/port) |

The sampling location was verified in the field to conform to EPA Method 1. Acceptable cyclonic flow conditions were confirmed prior to testing using EPA Method 1, Section 11.4. See Appendix A.1 for more information.

## 2.3 OPERATING CONDITIONS AND PROCESS DATA

Emission tests were performed during normal EU-36 and baghouse operations.

Plant personnel were responsible for establishing the test conditions and collecting all applicable unit-operating data. The process data that was provided is presented in Appendix B. Data collected includes the following parameters:

- Average total throughput, ton/hr
- Pressure drop, in-$H_2O$

# 3.0 SAMPLING AND ANALYTICAL PROCEDURES

## 3.1 TEST METHODS

The test methods for this test program were presented previously in Table 1-1. Additional information regarding specific applications or modifications to standard procedures is presented below.

### 3.1.1 EPA Method 1, Sample and Velocity Traverses for Stationary Sources

EPA Method 1 is used to assure that representative measurements of volumetric flow rate are obtained by dividing the cross-section of the stack or duct into equal areas, and then locating a traverse point within each of the equal areas. Acceptable sample locations must be located at least two stack or duct equivalent diameters downstream from a flow disturbance and one-half equivalent diameter upstream from a flow disturbance.

The sample port and traverse point locations are detailed in Appendix A.

### 3.1.2 EPA Method 2, Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

EPA Method 2 is used to measure the gas velocity using an S-type pitot tube connected to a pressure measurement device, and to measure the gas temperature using a calibrated thermocouple connected to a thermocouple indicator. Typically, Type S (Stausscheibe) pitot tubes conforming to the geometric specifications in the test method are used, along with an inclined manometer. The measurements are made at traverse points specified by EPA Method 1.

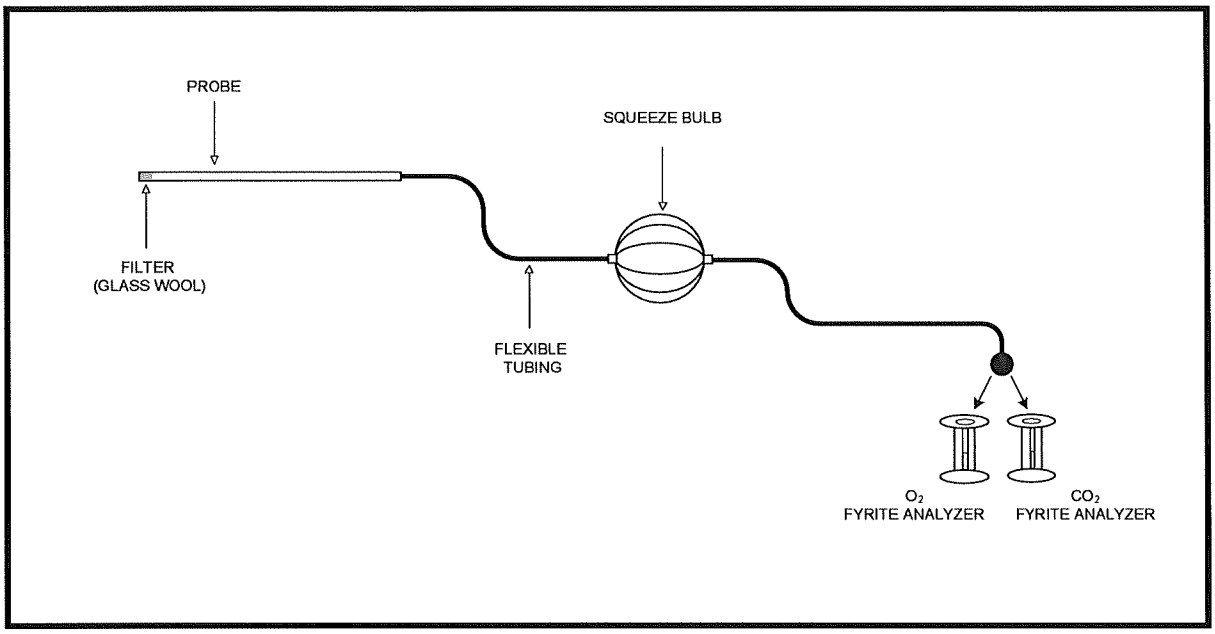
The typical sampling system is detailed in Figure 3-2.

### 3.1.3 EPA Method 3, Gas Analysis for the Determination of Dry Molecular Weight

EPA Method 3 is used to calculate the dry molecular weight of the stack gas using one of three methods. The first choice is to measure the percent $O_2$ and $CO_2$ in the gas stream. A gas sample is extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent $CO_2$ and percent $O_2$ using either an Orsat or a Fyrite analyzer. The second choice is to use stoichiometric calculations to calculate dry molecular weight. The third choice is to use an assigned value of 30.0, in lieu of actual measurements, for processes burning natural gas, coal, or oil.

The typical sampling system is detailed in Figure 3-1.

**FIGURE 3-1**
**EPA METHOD 3 (FYRITE ANALYZER) SAMPLING TRAIN**




### 3.1.4 EPA Method 4, Determination of Moisture Content in Stack Gas

EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed in an ice water bath. The impingers are weighed after each run to determine the percent moisture.

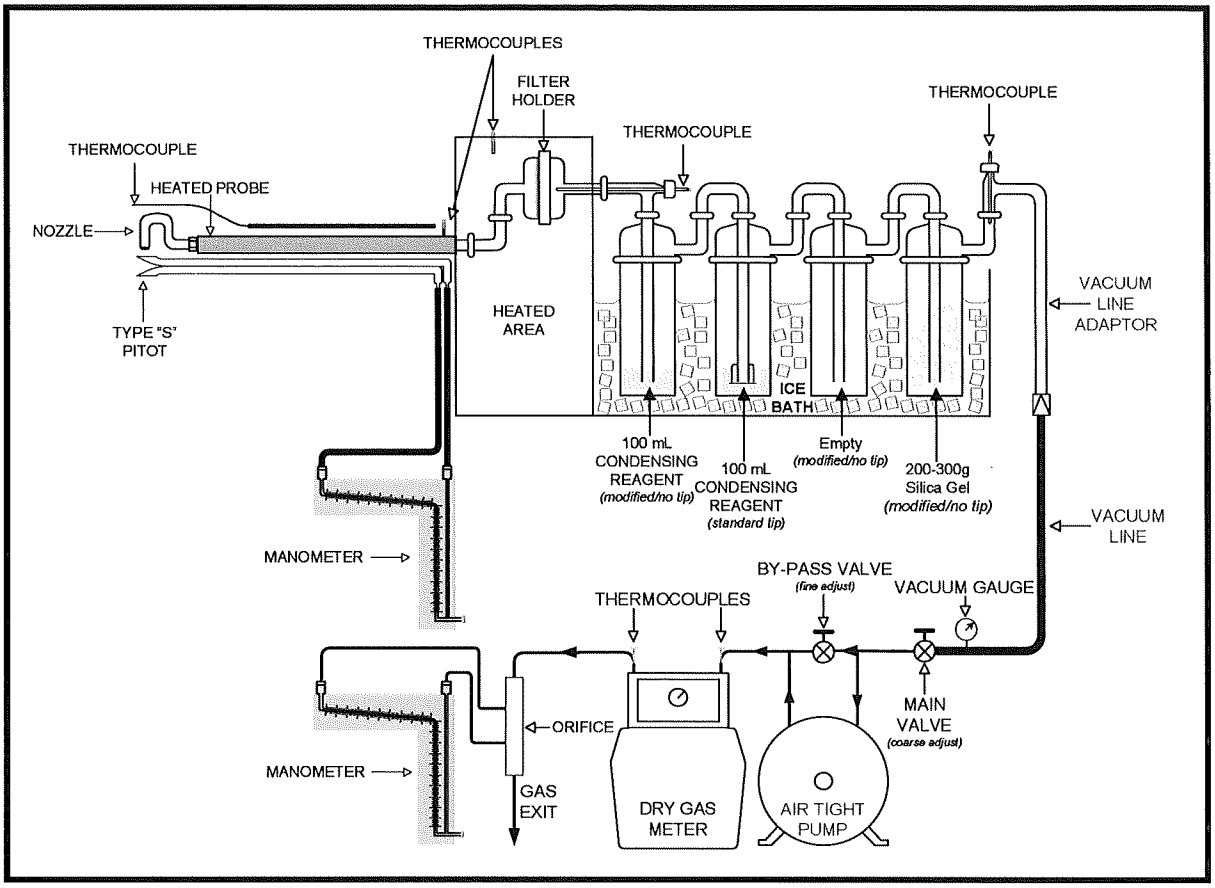
The typical sampling system is detailed in Figure 3-2.

### 3.1.5 EPA Method 5, Determination of Particulate Matter from Stationary Sources

EPA Method 5 is a manual, isokinetic method used to measure FPM emissions. The samples are analyzed gravimetrically. This method is performed in conjunction with EPA Methods 1 through 4. The stack gas is sampled through a nozzle, probe, filter, and impinger train. FPM results are reported in emission concentration and emission rate units.

The typical sampling system is detailed in Figure 3-2.

**FIGURE 3-2**
**EPA METHOD 5 SAMPLING TRAIN**




### 3.1.6 EPA Method 9, Visual Determination of the Opacity of Emissions

EPA Method 9 is used to observe the visual opacity of emissions (opacity). The observer stands at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to their back. The line of vision is perpendicular to the plume direction and does not include more than one plume diameter. Observations are recorded at 15-second intervals and are made to the nearest 5% opacity. The qualified observer is certified according to the requirements of EPA Method 9, section 3.1.

## 3.2 PROCESS TEST METHODS

The test plan did not require that process samples be collected during this test program; therefore, no process sample data are presented in this test report.

# 4.0 TEST DISCUSSION AND RESULTS

## 4.1 FIELD TEST DEVIATIONS AND EXCEPTIONS

Following Run 1 at the EU-36 Baghouse SV-36 Exhaust Stack, it was observed that the EPA Method 4 moisture recovery was higher than expected and the sample had not been collected at a rate isokinetic to that of the stack gas stream. The isokinetic sampling rate during Run 1 was 120.6% which was outside the acceptable range of 100±10% as specified by EPA Method 5, Section 8.5. Run 1 was voided, and an additional run (Run 4) was performed. Run 1 data is provided in the appendix of this report for informational purposes only.

## 4.2 PRESENTATION OF RESULTS

The average results are compared to the permit limits in Table 1-2. The results of individual compliance test runs performed are presented in Table 4-1. Emissions are reported in units consistent with those in the applicable regulations or requirements. Additional information is included in the appendices as presented in the Table of Contents.

**TABLE 4-1**
**FPM AND VISIBLE EMISSIONS RESULTS -**
**EU-36**

| Run Number | 2 | 3 | 4 | Average |
|---|---|---|---|---|
| **Date** | 12/21/2021 | 12/21/2021 | 12/21/2021 | -- |
| **Time** | 9:20-10:22 | 10:40-11:41 | 12:00-13:01 | -- |
| **Process Data** | | | | |
| Average total throughput, ton/hr * | 16.939 | 16.939 | 16.939 | 16.939 |
| **Flue Gas Parameters** | | | | |
| $O_2$, % volume dry | 21.00 | 21.00 | 21.00 | 21.00 |
| $CO_2$, % volume dry | 0.00 | 0.00 | 0.00 | 0.00 |
| flue gas temperature, °F | 188.9 | 190.2 | 194.8 | 191.3 |
| moisture content, % volume | 25.33 | 26.97 | 28.06 | 26.79 |
| volumetric flow rate, dscfm | 8,098 | 7,819 | 7,586 | 7,834 |
| **Filterable Particulate Matter (FPM)** | | | | |
| gr/dscf | 0.0014 | 0.0012 | 0.0008 | 0.0011 |
| g/dscm | 0.0033 | 0.0027 | 0.0018 | 0.0026 |
| lb/hr | 0.099 | 0.080 | 0.052 | 0.077 |
| **Visible Emissions (VE)** | | | | |
| % opacity (High 6-Minute Average) | 0.0 | 0.0 | 0.0 | 0.0 |

* Process data was provided by United States Gypsum personnel.

# 5.0 INTERNAL QA/QC ACTIVITIES

## 5.1 QA/QC AUDITS

The meter box and sampling trains used during sampling performed within the requirements of their respective methods. All post-test leak checks, minimum metered volumes, minimum sample durations, and percent isokinetics met the applicable QA/QC criteria.

Fyrite analyzer audits were performed during this test in accordance with EPA Method 3, Section 10.1 requirements. The results were within ± 0.5% of the respective audit gas concentrations.

EPA Method 9 was performed by a certified Visible Emissions Evaluator. For quality assurance, the observer obtained a view of the emissions with the best available contrasting background and with the sun oriented in the 140° sector to their back. Readings were taken every 15 seconds and made to the nearest 5% opacity.

EPA Method 5 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met, except if noted in Section 5.2. An EPA Method 5 reagent blank was analyzed. The maximum allowable amount that can be subtracted is 0.001% of the weight of the acetone blank. The blank did not exceed the maximum residue allowed.

## 5.2 QA/QC DISCUSSION

All QA/QC criteria were met during this test program.

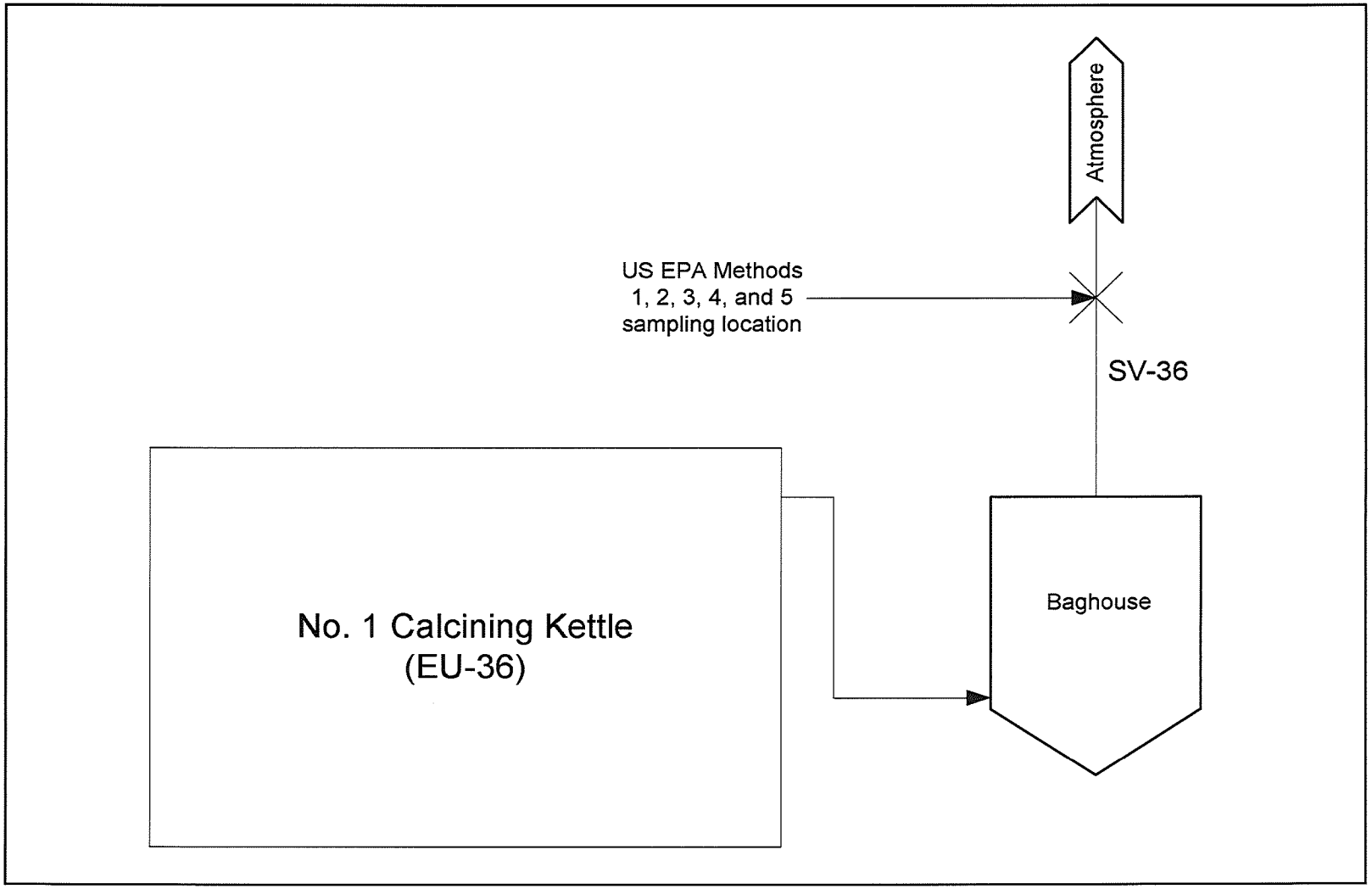
## 5.3 QUALITY STATEMENT

Montrose is qualified to conduct this test program and has established a quality management system that led to accreditation with ASTM Standard D7036-04 (Standard Practice for Competence of Air Emission Testing Bodies). Montrose participates in annual functional assessments for conformance with D7036-04 which are conducted by the American Association for Laboratory Accreditation (A2LA). All testing performed by Montrose is supervised on site by at least one Qualified Individual (QI) as defined in D7036-04 Section 8.3.2. Data quality objectives for estimating measurement uncertainty within the documented limits in the test methods are met by using approved test protocols for each project as defined in D7036-04 Sections 7.2.1 and 12.10. Additional quality assurance information is included in the report appendices. The content of this report is modeled after the EPA Emission Measurement Center Guideline Document (GD-043).

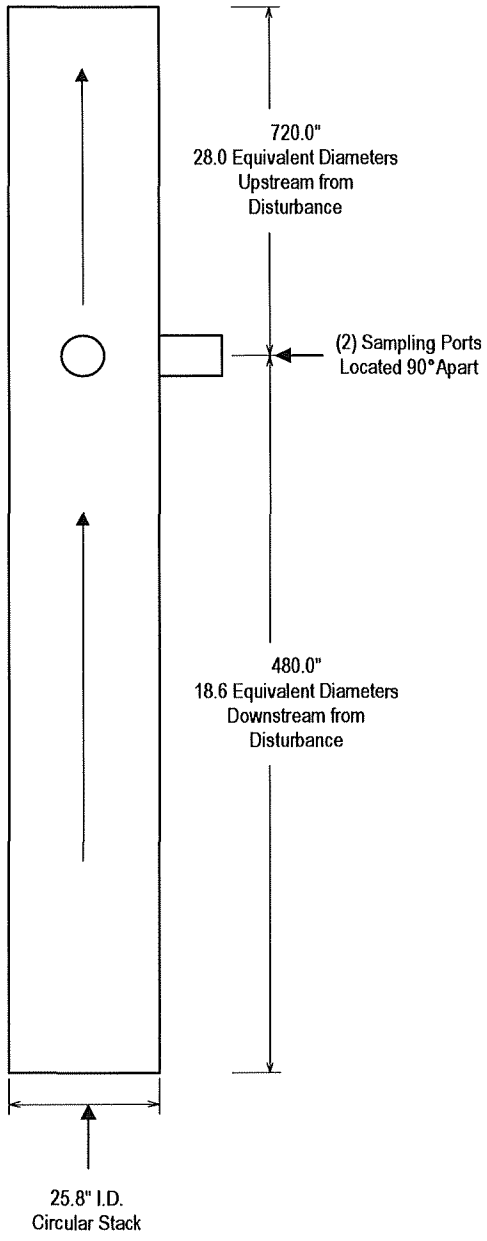
# APPENDIX A
# FIELD DATA AND CALCULATIONS

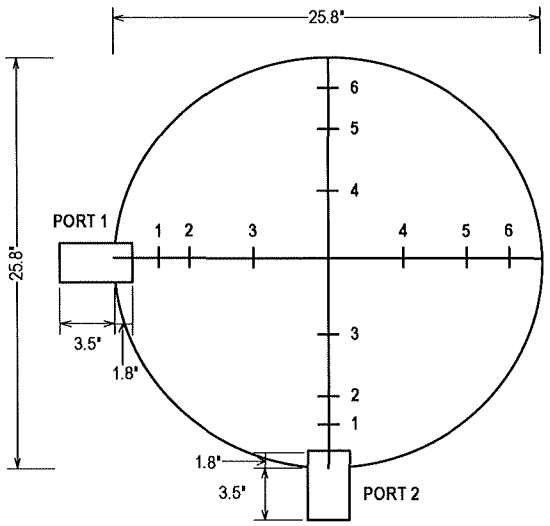
# Appendix A.1
# Sampling Locations

## EU-36 SAMPLING LOCATION SCHEMATIC



## EU-36 BAGHOUSE EXHAUST STACK TRAVERSE POINT LOCATION DRAWING




| Point | % of Stack Depth | Distance from Inside Wall (in.) PORT 1 | Distance from Inside Wall (in.) PORT 2 |
|---|---|---|---|
| 1* | 4.4 | 2.9 | 2.9 |
| 2 | 14.6 | 3.8 | 3.8 |
| 3 | 29.6 | 7.6 | 7.6 |
| 4 | 70.4 | 18.1 | 18.1 |
| 5 | 85.4 | 22.0 | 22.0 |
| 6 | 95.6 | 24.6 | 24.6 |

* Points adjusted per US EPA Method 1, Section 11.1.3.4

# Appendix A.2
# EU-36 Data Sheets

**TEST DATA**

| | |
|---|---|
| Number of Test Runs | 3 |
| Traverse Points | 12 |

| | Run 2 | Run 3 | Run 4 | Average |
|---|---|---|---|---|
| Stack Cross-Sectional Diameter 1 (**circular**) (in) | 25.8 | 25.8 | 25.8 | 25.8 |
| Stack Cross-Sectional Diameter 2 (**circular**) (in) | 25.8 | 25.8 | 25.8 | 25.8 |
| Pitot Tube Coefficient (Cp) | 0.84 | 0.84 | 0.84 | 0.84 |
| Barometric Pressure at Ground Level (Pbar) (in Hg) | 30.09 | 30.09 | 30.09 | 30.09 |
| Elevation Difference Between Ground Level and Meter Box Locations (ft) | 600 | 600 | 600 | 600 |
| Elevation Difference Between Ground Level and Sampling Locations (ft) | 700 | 700 | 700 | 700 |
| Initial Dry Gas Meter Reading (ft3) | 623.000 | 667.346 | 711.352 | |
| Final Dry Gas Meter Reading (ft3) | 667.120 | 711.150 | 753.330 | |
| Dry Gas Meter Calibration Factor (Gamma) | 0.994 | 0.994 | 0.994 | 0.994 |
| Dry Gas Meter Calibration Coefficient (Delta H@) | 1.78 | 1.78 | 1.78 | 1.78 |
| Total Sampling Run Time (Theta) (min) | 60 | 60 | 60 | 60 |
| Volume of Water Vapor Condensed in the Impingers (g) | 301.5 | 326.1 | 329.2 | 318.9 |
| Weight of Water Vapor Collected in Silica Gel (g) | 9.7 | 8.6 | 8.1 | 8.8 |
| Air Percent by Volume Oxygen in Stack Gas (%-dry) | 21.00 | 21.00 | 21.00 | 21.00 |
| Air Percent by Volume Carbon Dioxide in Stack Gas (%-dry) | 0.00 | 0.00 | 0.00 | 0.00 |
| Air Percent by Volume Nitrogen in Stack Gas (%-dry) | **79.00** | **79.00** | **79.00** | 79.00 |
| Average Pitot Rotation Angle | 5.8 | | | |
| Test Run Start Time (hrmin) | 12/21/2022 9:20 | 12/21/2022 10:40 | 12/21/2022 12:00 | |
| Test Run Stop Time (hrmin) | 12/21/2022 10:22 | 12/21/2022 11:41 | 12/21/2022 13:01 | |

**DETAILED RESULTS**

| **Stack Gas Conditions** | Run 2 | Run 3 | Run 4 | Average |
|---|---|---|---|---|
| Stack Cross-Sectional Area (A) (ft2) | 3.63 | 3.63 | 3.63 | 3.63 |
| Barometric Pressure at Sampling Location (in Hg) | 29.39 | 29.39 | 29.39 | 29.39 |
| Dry Molecular Weight of Stack Gas (Md) (lb/lb-mole) | 28.84 | 28.84 | 28.84 | 28.84 |
| Wet Molecular Weight of Stack Gas (Ms) (lb/lb-mole) | 26.10 | 25.92 | 25.80 | 25.94 |
| Average Absolute Stack Gas Pressure (Ps) (in Hg) | 29.34 | 29.34 | 29.34 | 29.34 |
| Average Stack Gas Static Pressure (ps) (in H2O) | -0.70 | -0.70 | -0.70 | -0.70 |
| Average Stack Gas Temperature (ts) (°F) | 188.9 | 190.2 | 194.8 | 191.3 |
| Average Stack Gas Temperature (Ts) (°R) | 648.9 | 650.2 | 654.8 | 651.3 |
| Average Stack Gas Velocity (Vs) (ft/sec) | 62.44 | 61.76 | 61.26 | 61.82 |
| Average Stack Gas Velocity (Vs) (ft/min) | 3,746 | 3,706 | 3,676 | 3,709 |
| Wet Volumetric Stack Gas Flow at Actual Conditions (Qaw) (acfm) | 13,601 | 13,454 | 13,345 | 13,467 |
| Wet Volumetric Stack Gas Flow at Standard Conditions (scfm) | 10,845 | 10,707 | 10,544 | 10,699 |
| Dry Volumetric Stack Gas Flow at Standard Conditions (Qstd) (dscfm) | 8,098 | 7,819 | 7,586 | 7,834 |
| Percent by Volume Moisture as measured in Stack Gas (%H2O) | 25.33 | 26.97 | 28.06 | 26.79 |

| **Test Results** | Run 2 | Run 3 | Run 4 | Average |
|---|---|---|---|---|
| Volume of Dry Gas Sampled at Standard Conditions (Vmstd) (dscf) | 43.256 | 42.741 | 40.783 | 42.260 |
| Rate of Dry Gas Sampled at Standard Conditions (dscfm) | 0.721 | 0.712 | 0.680 | 0.704 |
| Dry Mole Fraction of Flue Gas (Mfd) | 0.747 | 0.730 | 0.719 | 0.732 |
| Average Velocity Pressure (Delta P) (in H2O) | 0.89 | 0.87 | 0.84 | 0.87 |
| Average Square Root of Delta P | 0.94 | 0.93 | 0.92 | 0.93 |
| Average Pressure Differential of Orifice Meter (Delta H) (in H2O) | 1.68 | 1.65 | 1.48 | 1.61 |
| Average DGM Temperature (tm) (°F) | 69.5 | 72.0 | 74.1 | 71.9 |
| Average Dry Gas Meter Temperature (Tm) (°R) | 529.5 | 532.0 | 534.1 | 531.9 |
| Volume of Metered Gas Sample (Vm) (dry) (acf) | 44.120 | 43.804 | 41.978 | 43.301 |

**SAMPLING QA**

| | Run 2 | Run 3 | Run 4 | Average |
|---|---|---|---|---|
| Post-Test Meter Calibration Check Value (Yqa) | 0.9916 | 0.9911 | 0.9828 | 0.9885 |
| Post-Test/Pre-Test Calibration Factor Difference (%) | 0.25 | 0.29 | 1.13 | 0.55 |
| Allowable Post-Test Leak Rate (dscfm) | 0.020 | 0.020 | 0.020 | 0.020 |
| Current Sampling Rate Status | **OK** | **OK** | **OK** | |
| 1-Hour Sample Volume Based on Current Sampling Rate (dscf) | 43.256 | 42.741 | 40.783 | 42.260 |
| Probe Nozzle Diameter (in) | 0.241 | 0.241 | 0.241 | 0.241 |
| Percent Isokinetic of Sampling Rate (% I) | 102.0 | 104.4 | 102.7 | 103.0 |
| **In Field Isokinetic QA** | **GOOD** | **GOOD** | **GOOD** | |
| Count of Velocity Pressure Readings Below 0.05 in H2O | 0 | 0 | 0 | 0 |
| Sensitivity Factor for Differential Pressure Gauge (T) | 1.003 | 1.003 | 1.003 | 1.003 |
| **Is Meter Box Manometer Adequate (Yes / No) ?** | YES | YES | YES | |

**MEASURED DATA FROM TEST RUNS**

| Point Count | Run # | Run Time (min) | Pitot Delta P (in H2O) | Square Root of Delta P | Orifice Delta H (in H2O) | DGM Temp IN (°F) | DGM Temp OUT (°F) | Average DGM Temp (°F) | Stack Pressure (in H2O) | Stack Temp (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 0 | 0.99 | 0.995 | 1.90 | 68 | 68 | 68.00 | -0.7 | 188 |
| 2 | 2 | 5 | 0.94 | 0.970 | 1.80 | 68 | 68 | 68.00 | | 190 |
| 3 | 2 | 10 | 0.95 | 0.975 | 1.80 | 69 | 69 | 69.00 | | 192 |
| 4 | 2 | 15 | 0.85 | 0.922 | 1.60 | 69 | 69 | 69.00 | | 191 |
| 5 | 2 | 20 | 0.86 | 0.927 | 1.60 | 69 | 69 | 69.00 | | 193 |
| 6 | 2 | 25 | 0.86 | 0.927 | 1.60 | 70 | 70 | 70.00 | | 191 |
| 7 | 2 | 30 | 0.92 | 0.959 | 1.70 | 70 | 70 | 70.00 | | 186 |
| 8 | 2 | 35 | 0.96 | 0.980 | 1.80 | 70 | 70 | 70.00 | | 193 |
| 9 | 2 | 40 | 0.95 | 0.975 | 1.80 | 70 | 70 | 70.00 | | 194 |
| 10 | 2 | 45 | 0.87 | 0.933 | 1.60 | 70 | 70 | 70.00 | | 195 |
| 11 | 2 | 50 | 0.75 | 0.866 | 1.40 | 70 | 70 | 70.00 | | 188 |
| 12 | 2 | 55 | 0.82 | 0.906 | 1.60 | 71 | 71 | 71.00 | | 166 |
| 13 | 3 | 0 | 0.88 | 0.938 | 1.70 | 71 | 71 | 71.00 | -0.7 | 197 |
| 14 | 3 | 5 | 0.99 | 0.995 | 1.90 | 71 | 71 | 71.00 | | 198 |
| 15 | 3 | 10 | 0.95 | 0.975 | 1.80 | 71 | 71 | 71.00 | | 196 |
| 16 | 3 | 15 | 0.85 | 0.922 | 1.60 | 72 | 72 | 72.00 | | 196 |
| 17 | 3 | 20 | 0.77 | 0.877 | 1.50 | 72 | 72 | 72.00 | | 185 |
| 18 | 3 | 25 | 0.74 | 0.860 | 1.40 | 72 | 72 | 72.00 | | 163 |
| 19 | 3 | 30 | 0.95 | 0.975 | 1.80 | 72 | 72 | 72.00 | | 161 |
| 20 | 3 | 35 | 0.89 | 0.943 | 1.70 | 72 | 72 | 72.00 | | 200 |
| 21 | 3 | 40 | 0.90 | 0.949 | 1.70 | 72 | 72 | 72.00 | | 200 |
| 22 | 3 | 45 | 0.81 | 0.900 | 1.50 | 73 | 73 | 73.00 | | 202 |
| 23 | 3 | 50 | 0.83 | 0.911 | 1.60 | 73 | 73 | 73.00 | | 200 |
| 24 | 3 | 55 | 0.84 | 0.917 | 1.60 | 73 | 73 | 73.00 | | 184 |
| 25 | 4 | 0 | 0.92 | 0.959 | 1.60 | 73 | 73 | 73.00 | -0.7 | 200 |
| 26 | 4 | 5 | 0.90 | 0.949 | 1.60 | 73 | 73 | 73.00 | | 200 |
| 27 | 4 | 10 | 0.85 | 0.922 | 1.50 | 74 | 74 | 74.00 | | 202 |
| 28 | 4 | 15 | 0.85 | 0.922 | 1.50 | 74 | 74 | 74.00 | | 200 |
| 29 | 4 | 20 | 0.81 | 0.900 | 1.40 | 74 | 74 | 74.00 | | 201 |
| 30 | 4 | 25 | 0.80 | 0.894 | 1.40 | 74 | 74 | 74.00 | | 198 |
| 31 | 4 | 30 | 0.88 | 0.938 | 1.60 | 74 | 74 | 74.00 | | 186 |
| 32 | 4 | 35 | 0.91 | 0.954 | 1.60 | 74 | 74 | 74.00 | | 184 |
| 33 | 4 | 40 | 0.92 | 0.959 | 1.60 | 74 | 74 | 74.00 | | 194 |
| 34 | 4 | 45 | 0.78 | 0.883 | 1.40 | 75 | 75 | 75.00 | | 187 |
| 35 | 4 | 50 | 0.74 | 0.860 | 1.30 | 75 | 75 | 75.00 | | 196 |
| 36 | 4 | 55 | 0.75 | 0.866 | 1.30 | 75 | 75 | 75.00 | | 190 |

## TEST DATA - EPA Method 5

| Gravimetric Weights | Run 2 | Run 3 | Run 4 | Average |
|---|---|---|---|---|
| Total Particulate Weight in Sample (mg) | 4.0 | 3.3 | 2.1 | 3.1 |

## DETAILED RESULTS

| Emission Results | Run 2 | Run 3 | Run 4 | Average |
|---|---|---|---|---|
| Filterable Particulate Matter Emission Rate (lb/hr) | 0.099 | 0.080 | 0.052 | 0.077 |

| Concentration Results | Run 2 | Run 3 | Run 4 | Average |
|---|---|---|---|---|
| Filterable Particulate Matter Concentration (grains/dscf) | 0.0014 | 0.0012 | 0.0008 | 0.0011 |
| Filterable Particulate Matter Concentration (g/dscm) | 0.0033 | 0.0027 | 0.0018 | 0.0026 |

| Sample Volume Conversions | Run 1 | Run 2 | Run 3 | Average |
|---|---|---|---|---|
| Volume of Dry Gas Sampled at Standard Conditions, dscm | 1.225 | 1.210 | 1.155 | 1.197 |

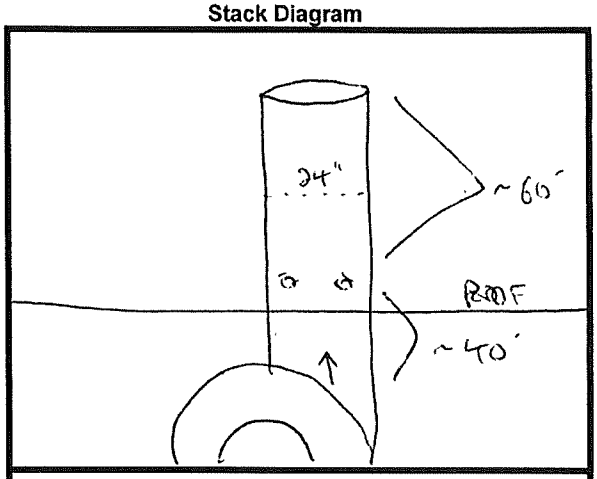
# MAQS

USEPA METHOD 2 GAS VELOCITY TRAVERSE
AND VOLUMETRIC FLOWRATE DATA SHEET

Client: US GYPSUM
Sampling Location: KETTLE BAGHOUSE
Run Number: PREFLOW
Date: 10-20-21 Time: ~12:45

| | | |
|---|---|---|
| Port and Stack | 27.5 | in. |
| Port | 3.5 | in. |
| Nipple Protrusion | 1.75 | in. |
| Stack Diameter | 24 | in. |
| Bar. Pressure | 30.13 | in Hg |
| Static Pressure | -.10 | in $H_2O$ |
| Moisture % | ~2 | |
| % CO2 | 0 | % CO 0 |
| % O2 | 21 | % N2 .79 |

**Stack Diagram**




Weather conditions:
COLD, CLEAR

Operators: DT/JW Manometer ID: MB12
Pitot Tube number: S'C Umbilical ID: UMB5 Site Elevation: ~600 ft. Upstream: ~60° ~~in.~~
Pitot Tube factor, Cp: .84 Pitot Line ID: - Port Height: ~100 ft. Downstream: ~40° ~~in.~~
Leak Check- Positive: Pre: ☒ @ 4" Post: ☒ @ 4" Negative: Pre: ☒ @ 4" Post: ☒ @ 4"

| % of Stack Diameter | Point Distance (in.) | Traverse Point Number | Velocity Head (ΔP) in H2O | Stack Temp °F | Null Angle (zero ΔP angle) | Flow Angle Ø (90° from null angle) |
|---|---|---|---|---|---|---|
| | | 1 | .81 | 185 | +5 | |
| | | 2 | .83 | 190 | +5 | |
| | | 3 | .85 | 194 | -5 | |
| | | 4 | .85 | 195 | -5 | |
| | | 5 | .80 | 194 | -10 | |
| | | 6 | .80 | 192 | -5 | |
| | | | | | | |
| | | 1 | .81 | 181 | +10 | |
| | | 2 | .85 | 187 | +10 | |
| | | 3 | .89 | 191 | +5 | |
| | | 4 | .83 | 195 | -5 | |
| | | 5 | .79 | 197 | -5 | |
| | | 6 | .74 | 194 | 0 | |

## US EPA Method 1 Traverse Point Determination

| Relative Port Location | Left | Right |
|---|---|---|
| From Far Wall to Outside of Port (in.) | 27.5 | 27.5 |
| Nipple Length or Wall Thickness (in.) | 3.5 | 3.5 |
| Port Protrusion Length (opt) (in.) | 1.8 | 1.8 |
| Depth of Stack or Duct (in.) | 25.8 | 25.8 |

| | |
|---|---|
| Stack or Duct Type | Circular |
| Port Hole Inner Diameter (in.) | -- |
| Stack or Duct Width (If Rectangular) (in.) | |
| Stack Outer Circumference (in.) | |
| Number of Ports Traversed | 2 |
| Elevation of Meter Box from Ground Level (ft) | 600 |
| Elevation of Ports from Ground Level (ft) | 700 |
| Stack Build-up (in.) | 0.0 |
| | |
| Stack Cross-Sectional Diameter 1 (in) | 25.8 |
| Stack Cross-Sectional Diameter 2 (in) | 25.8 |

| | |
|---|---|
| "Vertical" or "Horizontal" Flow | Vertical |
| Direction of Flow | Up |
| "Velocity" or "Isokinetic" Traverse | Isokinetic |

| | |
|---|---|
| Port Distance Upstream from Flow Disturbance (in.) | 720.0 |
| Diameters Upstream from Flow Disturbance ( ³ 0.5 De) | 28.0 |
| Minimum Traverse Points Needed for a Velocity Traverse * | 12 |
| Minimum Traverse Points Needed for a Isokinetic Traverse * | 12 |

| | |
|---|---|
| Port Distance Downstream from Flow Disturbance (in.) | 480.0 |
| Diameters Downstream from Flow Disturbance ( ³ 2.0 De) | 18.6 |
| Minimum Traverse Points Needed for a Velocity Traverse * | 12 |
| Minimum Traverse Points Needed for a Isokinetic Traverse * | 12 |

| | |
|---|---|
| Minimum Traverse Points per Method 1 | 12 |
| Number of Traverse Points for this Circular Stack or Duct | 12 |
| Point Overide | |

| | |
|---|---|
| Duct Area - $in^2$ | 520.77 |
| Duct Area - $ft^2$ | 3.6164 |

Note:
Add nipple protrusion length to Point 1 only.
Actual nipple length = ( length - protrusion )

Relocate to a distance equal to the inside diameter of the nozzle being used or to the above minimum distances, whichever is larger.

This Stack having a diameter greater than 24-inches, shall have no traverse points located within 1.0-inch of the stack wall.

**'Pt. Adj.' denotes that the traverse point has been adjusted to 1-inch from the stack wall.**

New Method 1 verified on 12/20/2021 by: DT/MN

| | Port | Point | % of Duct Depth | Dist. From Inside Wall (Decimal) | Dist. From Outside Wall (Decimal) |
|---|---|---|---|---|---|
| *Pt. Adj* | 1 | 1 | 4.4 | 2.9 | 4.7 |
| | 1 | 2 | 14.6 | 3.8 | 5.5 |
| | 1 | 3 | 29.6 | 7.6 | 9.4 |
| | 1 | 4 | 70.4 | 18.1 | 19.9 |
| | 1 | 5 | 85.4 | 22.0 | 23.7 |
| | 1 | 6 | 95.6 | 24.6 | 26.4 |
| *Pt. Adj* | 2 | 1 | 4.4 | 2.9 | 4.7 |
| | 2 | 2 | 14.6 | 3.8 | 5.5 |
| | 2 | 3 | 29.6 | 7.6 | 9.4 |
| | 2 | 4 | 70.4 | 18.1 | 19.9 |
| | 2 | 5 | 85.4 | 22.0 | 23.7 |
| | 2 | 6 | 95.6 | 24.6 | 26.4 |

# Method 3 Fyrite Field Data

Effective Date: 11/2/15
Rev No. 2
Issued by: Quality Manager

**Plant Name:** US GYPSUM

**Test Location:** KETTLE MOUTHOUSE

$CO_2$ Zero: Y / N  $O_2$ Zero: Y / N

15 pumps to purge
18 pumps to sample

| EPA Method 3 Fyrite Analysis Audit | | Analyzed by:: BT 12-20-22 |
|---|---|---|
| Time of Analysis | %$CO_2$ Audit Gas Conc (%) 10.11 | %$O_2$ Audit Gas Conc (%) 9.776 |
| 8:30 | 10 | 10 |
| 8:35 | 10 | 10 |
| 8:40 | 10 | 10 |
| Analyzer I.D. - | A - FYR - 2 | Audit Gas Cylinder I.D.: CC185775 |

*NOTE: The average of the three passes of %$CO_2$ and %$O_2$ must agree within ± 0.5% of the audit gas concentration value.

Run Number: 1 VOID  Analyzed by:: MN

| Time of Sample Collection | Time of Analysis | %$CO_2$ (A) | %$O_2$ (B) | %$N_2$ (100 - (A + B)) |
|---|---|---|---|---|
| GRAB | 8:04 | 0 | 21 | 79 |
| | 8:17 | 0 | 21 | 79 |
| | 8:38 | 0 | 21 | 79 |
| Analyzer I.D. - | A - FYR - 2 | Tedlar Bag I.D.: | - | - M3/TB |

Run Number: 2  Analyzed by:: MN

| Time of Sample Collection | Time of Analysis | %$CO_2$ (A) | %$O_2$ (B) | %$N_2$ (100 - (A + B)) |
|---|---|---|---|---|
| GRAB | 9:22 | 0 | 21 | 79 |
| | 9:42 | 0 | 21 | 79 |
| | 9:59 | 0 | 21 | 79 |
| Analyzer I.D. - | A - FYR - 2 | Tedlar Bag I.D.: | - | - M3/TB |

Run Number: 3  Analyzed by:: MN

| Time of Sample Collection | Time of Analysis | %$CO_2$ (A) | %$O_2$ (B) | %$N_2$ (100 - (A + B)) |
|---|---|---|---|---|
| GRAB | 10:42 | 0 | 21 | 79 |
| | 11:03 | 0 | 21 | 79 |
| | 11:19 | 0 | 21 | 79 |
| Analyzer I.D. - | A - FYR - 2 | Tedlar Bag I.D.: | - | - M3/TB |

# Method 3 Fyrite Field Data

Effective Date: 11/2/15
Rev No. 2
Issued by: Quality Manager

**Plant Name:** US GYPSUM

**Test Location:** LITTLE MOUNTAIN

$CO_2$ Zero: Y / N  $O_2$ Zero: Y / N

15 pumps to purge
18 pumps to sample

| EPA Method 3 Fyrite Analysis Audit | | Analyzed by:: |
|---|---|---|
| Time of Analysis | $\%CO_2$ Audit Gas Conc (%) ____ | $\%O_2$ Audit Gas Conc (%) ____ |
| | | |
| | | |
| | | |
| Analyzer I.D. - A - FYR - | Audit Gas Cylinder I.D.: | |

*NOTE: The average of the three passes of $\%CO_2$ and $\%O_2$ must agree within ± 0.5% of the audit gas concentration value.

Run Number: 4 Analyzed by:: MN

| Time of Sample Collection | Time of Analysis | $\%CO_2$ ( A ) | $\%O_2$ ( B ) | $\%N_2$ ( 100 - ( A + B ) ) |
|---|---|---|---|---|
| GRAB | 12:02 | 0 | 21 | 79 |
| | 12:12 | 0 | 21 | 79 |
| | 12:22 | 0 | 21 | 79 |

Analyzer I.D. - A - FYR - 2 Tedlar Bag I.D.: - - M3/TB

Run Number: Analyzed by::

| Time of Sample Collection | Time of Analysis | $\%CO_2$ ( A ) | $\%O_2$ ( B ) | $\%N_2$ ( 100 - ( A + B ) ) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

Analyzer I.D. - A - FYR - Tedlar Bag I.D.: - - M3/TB

Run Number: Analyzed by::

| Time of Sample Collection | Time of Analysis | $\%CO_2$ ( A ) | $\%O_2$ ( B ) | $\%N_2$ ( 100 - ( A + B ) ) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

Analyzer I.D. - A - FYR - Tedlar Bag I.D.: - - M3/TB

MAQS
D:\Testing\ACT Test Methods\M003\Method 3 - Fyrite.xls
(Method 3 - Fyrite.xls-Fyrite Field Data) 5/30/2019
1 of 1

Job Number: PROJ-009677
Done By / Date: MN / 12-21-21
Final Check By / Date: DT / 12-22-21

# US EPA Method 3 Dry Molecular Weight Calculation

Run 2

| | %CO2 | %O2 | %N2 | Molecular Weight | Mean Difference |
|---|---|---|---|---|---|
| | 0.00 | 21.00 | 79.0 | 28.84 | 0.000 |
| | 0.00 | 21.00 | 79.0 | 28.84 | 0.000 |
| | 0.00 | 21.00 | 79.0 | 28.84 | 0.000 |
| Average | 0.00 | 21.00 | 79.00 | 28.84 | |

Run 3

| | %CO2 | %O2 | %N2 | Molecular Weight | Mean Difference |
|---|---|---|---|---|---|
| | 0.00 | 21.00 | 79.0 | 28.84 | 0.000 |
| | 0.00 | 21.00 | 79.0 | 28.84 | 0.000 |
| | 0.00 | 21.00 | 79.0 | 28.84 | 0.000 |
| Average | 0.00 | 21.00 | 79.00 | 28.84 | |

Run 4

| | %CO2 | %O2 | %N2 | Molecular Weight | Mean Difference |
|---|---|---|---|---|---|
| | 0.00 | 21.00 | 79.0 | 28.84 | 0.000 |
| | 0.00 | 21.00 | 79.0 | 28.84 | 0.000 |
| | 0.00 | 21.00 | 79.0 | 28.84 | 0.000 |
| Average | 0.00 | 21.00 | 79.00 | 28.84 | |

MONTROSE AIR QUALITY SERVICES

**Sample Recovery & Calibration Check Data**



**Project Information**

Date: 12-21-21 Project #: PROJ-009677

Customer / Facility: US GYPSUM - RIVER RANGE

Unit ID / Sample Location: KETTLE BAGHOUSE

Run #: 1, 2, 3 Operator: DT

**Equipment Identification**

Ref. Thermometer: CAL ICT 2

Hygrometer:

Field Balance: SCALE 6

Check Weights: CAL ICT 2

Calipers: MN

**Balance Audit:** (Field balance must be within 0.5g of check weight mass)

| Date: | 12-20-21 | 12-21-21 | | |
|---|---|---|---|---|
| Standard mass, g | 500.0 | 500.0 | | |
| Field balance mass, g | 500.0 | 500.0 | | |

**Ambient Conditions (Mobile Lab)**

Relative humidity, %:

Temperature, °F:

Mobile lab # :

**Moisture Determination**

VOID

| | Contents | Run 1 Initial | Run 1 Final | Run 1 Net Gain | Run 2 Initial | Run 2 Final | Run 2 Net Gain | Run 3 Initial | Run 3 Final | Run 3 Net Gain |
|---|---|---|---|---|---|---|---|---|---|---|
| Knockout | | | | | | | | | | |
| Impinger 1 | | 739.3 | 913.8 | 174.5 | 755.5 | 975.2 | 219.7 | 737.1 | 927.4 | 190.3 |
| Impinger 2 | | 756.0 | 863.5 | 107.5 | 768.5 | 845.0 | 76.5 | 762.0 | 892.6 | 130.6 |
| Impinger 3 | | 650.7 | 703.9 | 45.2 | 656.8 | 662.1 | 5.3 | 659.0 | 664.2 | 5.2 |
| Impinger 4 | | | | 327.2 | | | 301.5 | | | 326.1 |
| Impinger 5 | | | | | | | | | | |
| Impinger 6 | | | | | | | | | | |
| Impinger 7 | | | | | | | | | | |
| Impinger 8 | | | | | | | | | | |
| Silica Gel | | 934.6 | 970.6 | 36 | 966.6 | 976.3 | 9.7 | 1007.5 | 1016.1 | 8.6 |
| Train Net Gain (Vlc) | | | | 363.2 | | | 311.2 | | | 334.7 |

**Nozzle Measurements** (Difference between any two measurements must not be more than 0.004 in (0.1 mm))

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Nozzle 1 diameters | .241 | D1 | .241 | D2 | .241 | D3 | .241 | Average |
| Nozzle 2 diameters | | D1 | | D2 | | D3 | | Average |
| Nozzle 3 diameters | | D1 | | D2 | | D3 | | Average |

**Nozzle Material:** ☐ quartz ☐ glass ☒ steel ☐ titanium ☐ inconel ☐ other

**Probe Type:** ☒ heated ☐ unheated ☐ air-cooled ☐ water-cooled ☐ other

**Probe Liner:** ☐ quartz ☒ glass ☐ steel ☐ Teflon ☐ other

**Filter Information**

Front Half: ☐ Quartz Fiber ☒ Glass Fiber ☐ Teflon ☐ Teflon/Quartz ☐ Other:

Filter Number: Run 1: H-828 Run 2: H-826 Run 3: H-825 Run ____: ____

Back Half: ☐ Quartz Fiber ☐ Glass Fiber ☐ Teflon ☐ Teflon/Quartz ☐ Other:

**Reagent Information**

| Type | Lot Number |
|---|---|
| | |
| | |
| | |
| | |

**Sample Observations**

Run 1

Run 2

Run 3

RECEIVED
FEB 09 2022
AIR QUALITY DIVISION

QA/QC Check: Completeness: X Legibility: X Accuracy: X Specifications: X

Checked by: DT Team Leader: DT

001AS-OPS-RBETA

MONTROSE AIR QUALITY SERVICES

**Sample Recovery & Calibration Check Data**



**Project Information**

Date: 12-21-21 Project #: PROJ-009677

Customer / Facility: US GYPSUM

Unit ID / Sample Location: KETTLE BAGHOUSE

Run #: 4 Operator: DT

**Equipment Identification**

Ref. Thermometer: CAL ICT 2

Hygrometer: _____

Field Balance: SCALE 6

Check Weights: CAL ICT 2

Calipers: MV

**Balance Audit:** (Field balance must be within 0.5g of check weight mass)

Date: 12-21-21

| | | | | |
|---|---|---|---|---|
| Standard mass, g | 500.0 | | | |
| Field balance mass, g | 500.0 | | | |

**Ambient Conditions (Mobile Lab)**

Relative humidity, %: _____

Temperature, °F: _____

Mobile lab # : _____

**Moisture Determination**

| | Contents | Run 4 Initial | Run 4 Final | Run 4 Net Gain | Run 2 Initial | Run 2 Final | Run 2 Net Gain | Run 3 Initial | Run 3 Final | Run 3 Net Gain |
|---|---|---|---|---|---|---|---|---|---|---|
| Knockout | | | | | | | | | | |
| Impinger 1 | | 767.4 | 948.3 | 180.9 | | | | | | |
| Impinger 2 | | 778.0 | 922.6 | 144.6 | | | | | | |
| Impinger 3 | | 661.6 | 665.3 | 3.7 | | | | | | |
| Impinger 4 | | | | =329.2 | | | | | | |
| Impinger 5 | | | | | | | | | | |
| Impinger 6 | | | | | | | | | | |
| Impinger 7 | | | | | | | | | | |
| Impinger 8 | | | | | | | | | | |
| Silica Gel | | 976.1 | 984.2 | 8.1 | | | | | | |
| Train Net Gain (Vlc) | | | | 337.3 | | | | | | |

**Nozzle Measurements** (Difference between any two measurements must not be more than 0.004 in (0.1 mm))

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Nozzle 1 diameters | .241 | D1 | .241 | D2 | .241 | D3 | .241 | Average |
| Nozzle 2 diameters | | D1 | | D2 | | D3 | | Average |
| Nozzle 3 diameters | | D1 | | D2 | | D3 | | Average |

**Nozzle Material:** ☐ quartz ☐ glass ☒ steel ☐ titanium ☐ inconel ☐ other _____

**Probe Type:** ☒ heated ☐ unheated ☐ air-cooled ☐ water-cooled ☐ other _____

**Probe Liner:** ☐ quartz ☒ glass ☐ steel ☐ Teflon ☐ other _____

**Filter Information**

Front Half: ☐ Quartz Fiber ☒ Glass Fiber ☐ Teflon ☐ Teflon/Quartz ☐ Other: _____

Filter Number: Run 4: 11-829 Run 2: _____ Run 3: _____ Run ____: _____

Back Half: ☐ Quartz Fiber ☐ Glass Fiber ☐ Teflon ☐ Teflon/Quartz ☐ Other: _____

**Reagent Information**

| Type | Lot Number |
|---|---|
| | |
| | |
| | |
| | |
| | |

**Sample Observations**

Run 1 _____

Run 2 _____

Run 3 _____

QA/QC Check: Completeness: K Legibility: K Accuracy: K Specifications: K

Checked by: DT Team Leader: DT

001AS-OPS-RBETA

# US EPA Method 4 Gravimetric Determination for Moisture
# US EPA Method 5 Sampling Train

**RUN 2**

| | Initial (g) | Final (g) | Net (g) |
|---|---|---|---|
| Impinger No. 1 | **755.5** | **975.2** | 219.7 |
| Impinger No. 2 | **768.5** | **845.0** | 76.5 |
| Impinger No. 3 | **656.8** | **662.1** | 5.3 |
| | | **Total Condensed (g):** | **301.5** |
| Silica Gel | **966.6** | **976.3** | 9.7 |
| | | **Total Absorbed (g):** | **9.7** |
| | | **Overall Total (g):** | **311.2** |

**RUN 3**

| | Initial (g) | Final (g) | Net (g) |
|---|---|---|---|
| Impinger No. 1 | **737.1** | **927.4** | 190.3 |
| Impinger No. 2 | **762.0** | **892.6** | 130.6 |
| Impinger No. 3 | **659.0** | **664.2** | 5.2 |
| | | **Total Condensed (g):** | **326.1** |
| Silica Gel | **1007.5** | **1016.1** | 8.6 |
| | | **Total Absorbed (g):** | **8.6** |
| | | **Overall Total (g):** | **334.7** |

**RUN 4**

| | Initial (g) | Final (g) | Net (g) |
|---|---|---|---|
| Impinger No. 1 | **767.4** | **948.3** | 180.9 |
| Impinger No. 2 | **778.0** | **922.6** | 144.6 |
| Impinger No. 3 | **661.6** | **665.3** | 3.7 |
| | | **Total Condensed (g):** | **329.2** |
| Silica Gel | **976.1** | **984.2** | 8.1 |
| | | **Total Absorbed (g):** | **8.1** |
| | | **Overall Total (g):** | **337.3** |

MONTROSE AIR QUALITY SERVICES

EPA Method 5 Field Datasheet (Isokinetic)

Page 1 of 1

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30 of 121

**Project Information**

Date 12-21-21 Project # PROJ-009677

Customer/Facility US GYPSUM

Unit ID/Sample Location KETTLE BAGHOUSE

Run # 1 Operator BT / AN

**Sampling Conditions**

Static Pressure, in. $H_2O$ -.70 Ambient Temp, °F 28

Barometric Pressure, in. Hg 30.09 Ref. Barometer ID NOAA

Wind Speed / Direction NNW 5E Precipitation, Y / N, type NO

Probe / Filter Temp Range, °F 240 ± 25°F

**Sampling Equipment IDs**

Meterbox ID MB 12

Umbilical ID UMB 5

Nozzle ID S-1-4

Pitot / Probe ID S'C

Manometer ID MB12

Sensitivity 10"H2O

**Calibration**

Meterbox Y .994

Meterbox ΔH@, in. $H_2O$ 1.78

Nozzle diameter, Dn, in. .241

Pitot coefficient, Cp .84

Manometer zero and level ☒ yes

K-Factor

**Equipment Checks**

| | Pre | Mid | Post |
|---|---|---|---|
| Pitot (+), pass @ in. $H_2O$ | ☑ @ 4" | ☐ @ | ☒ @ 4" |
| Pitot (-), pass @ in. $H_2O$ | ☑ @ 4" | ☐ @ | ☒ @ 4" |
| Pitot visual inspection | ☒ pass | ☐ pass | ☑ pass |
| Nozzle visual inspection | ☒ pass | ☐ pass | ☒ pass |
| Meter, cfm @ in. Hg | .000 @ 15" | @ | .000 @ 5" |
| Intermediate leak check volume, $ft^3$ | / | | / |

**ALT 011** TC ID:

| | Ambient °F | Ref. °F |
|---|---|---|
| Stack S'C 1 | 28 | 28 |
| Probe S'C 2 | 28 | 28 |
| Filter Box MB6 | 28 | 28 |
| Filter Exit FE5 | 28 | 28 |
| Meter outlet MB12 | 28 | 28 |
| Impinger Exit FC8 | 28 | 28 |
| Other | | |

Ref. Thermometer ID CAL ICH 2

Continuity Check ☐ Continuity w/ Proper Polarity

Notes:

| Traverse Point # | Elapsed Time | Clock Time 24hr | DGM Reading, Vm, $ft^3$ | Velocity Head, ΔP in $H_2O$ | Orifice Pressure Differential, ΔH Target | Orifice Pressure Differential, ΔH Actual | Stack Temp, °F | Probe Temp, °F | Filter Temp, °F Box | Filter Temp, °F Exit | Impinger Exit Temp, °F | Dry Gas Meter Temperature, °F Inlet | Dry Gas Meter Temperature, °F Outlet | | Pump Vacuum, in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 8:00 | 567.60 | 1.10 | 3.28 | 3.30 | 133 | 250 | | 250 | 32 | 62 | 62 | | 3.5 |
| 2 | 5 | | 572.74 | .90 | 2.68 | 2.70 | 146 | 250 | | 249 | 34 | 62 | 62 | | 3 |
| 3 | 10 | | 577.48 | .82 | 2.44 | 2.50 | 150 | 248 | | 250 | 47 | 63 | 63 | | 3 |
| 4 | 15 | | 581.80 | 1.00 | 2.96 | 3.00 | 158 | 250 | | 250 | 50 | 64 | 64 | | 4 |
| 5 | 20 | | 586.85 | .93 | 2.75 | 2.80 | 159 | 250 | | 250 | 52 | 65 | 65 | | 3.5 |
| 6 | 25 | | 591.63 | .98 | 2.90 | 2.90 | 159 | 250 | | 250 | 54 | 66 | 66 | | 3.5 |
| | 30 | 8:30 | 596.42 | | | | | | | | | | | | |
| 1 | 30 | 8:31 | 596.42 | 1.00 | 2.95 | 3.00 | 155 | 250 | | 250 | 57 | 66 | 66 | | 3.5 |
| 2 | 35 | | 601.38 | 1.00 | 2.94 | 3.00 | 176 | 251 | | 251 | 56 | 67 | 67 | | 3.5 |
| 3 | 40 | | 606.11 | .95 | 2.78 | 2.80 | 180 | 250 | | 250 | 65 | 67 | 67 | | 3.5 |
| 4 | 45 | | 610.73 | .92 | 2.69 | 2.70 | 181 | 250 | | 250 | 67 | 67 | 67 | | 3 |
| 5 | 50 | | 615.14 | .87 | 2.53 | 2.60 | 183 | 250 | | 250 | 66 | 68 | 68 | | 3 |
| 6 | 55 | | 619.26 | .89 | 2.59 | 2.60 | 173 | 250 | | 250 | 65 | 68 | 68 | | 3 |
| | 60 | 9:01 | 623.78 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | |
| Averages | | | | | | | | | | | | | | | |

VOID

QA/QC Check: Completeness ✓ Legibility ✓ Accuracy ✓ Specifications ✓ Checked By BT Team Leader BT

001AS-QMS-FM-225RB

MONTROSE AIR QUALITY SERVICES

EPA Method 5 Field Datasheet (Isokinetic)



MW049AS-009677-RT-918

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**Project Information**

Date 12-21-21 Project # PROJ-009677

Customer/Facility US GYPSUM

Unit ID/Sample Location KETTLE BAGHOUSE

Run # 2 Operator DT / MW

**Sampling Conditions**

Static Pressure, in. $H_2O$ -.70 Ambient Temp, °F 27

Barometric Pressure, in. Hg 30.09 Ref. Barometer ID NONA

Wind Speed / Direction CALM Precipitation, Y / N, type NO

Probe / Filter Temp Range, °F 248 ± 25°F

**ALT 011** TC ID:

| | Ambient °F | Ref. °F |
|---|---|---|
| Stack | | |
| Probe | | |
| Filter Box | | |
| Filter Exit | | |
| Meter outlet | | |
| Impinger Exit | | |
| Other | | |

Ref. Thermometer ID

Continuity Check ☐ Continuity w/ Proper Polarity

Notes:

**Sampling Equipment IDs**

Meterbox ID MB12

Umbilical ID UMB 5

Nozzle ID S-1-4

Pitot / Probe ID S'C

Manometer ID MB12

Sensitivity 10" H2O

**Calibration**

Meterbox Y .994

Meterbox ΔH@, in. $H_2O$ 1.78

Nozzle diameter, Dn, in. .241

Pitot coefficient, Cp .84

Manometer zero and level ☒ yes

K-Factor

**Equipment Checks**

| | Pre | Mid | Post |
|---|---|---|---|
| Pitot (+), pass @ in. $H_2O$ | ☒ @ 4" | ☐ @ | ☒ @ 4" |
| Pitot (-), pass @ in. $H_2O$ | ☒ @ 4" | ☐ @ | ☒ @ 4" |
| Pitot visual inspection | ☒ pass | ☐ pass | ☒ pass |
| Nozzle visual inspection | ☒ pass | ☐ pass | ☒ pass |
| Meter, cfm @ in. Hg | .000 @ 15" | @ | .000 @ 5" |

Intermediate leak check volume, $ft^3$ / /

| Traverse Point # | Elapsed Time | Clock Time 24hr | DGM Reading, Vm, $ft^3$ | Velocity Head, ΔP in $H_2O$ | Orifice Pressure Differential, ΔH Target | Orifice Pressure Differential, ΔH Actual | Stack Temp, °F | Probe Temp, °F | Filter Temp, °F Box | Filter Temp, °F Exit | Impinger Exit Temp, °F | Dry Gas Meter Temperature, °F Inlet | Dry Gas Meter Temperature, °F Outlet | | Pump Vacuum, in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 9:10 | 623.00 | .99 | 1.83 | 1.90 | 188 | 244 | | 250 | 34 | 68 | 68 | | 3.5 |
| 2 | 5 | | 626.97 | .94 | 1.73 | 1.80 | 190 | 250 | | 251 | 32 | 68 | 68 | | 3 |
| 3 | 10 | | 630.66 | .95 | 1.75 | 1.80 | 192 | 250 | | 250 | 33 | 69 | 69 | | 3 |
| 4 | 15 | | 634.37 | .85 | 1.56 | 1.60 | 191 | 250 | | 250 | 34 | 69 | 69 | | 3 |
| 5 | 20 | | 637.90 | .86 | 1.58 | 1.60 | 193 | 250 | | 250 | 35 | 69 | 69 | | 3 |
| 6 | 25 | | 641.63 | .86 | 1.58 | 1.60 | 191 | 250 | | 250 | 36 | 70 | 70 | | 3 |
| | 30 | 9:50 | 645.27 | | | | | | | | | | | | |
| 1 | 30 | 9:52 | 645.27 | .92 | 1.69 | 1.70 | 186 | 250 | | 250 | 36 | 70 | 70 | | 3.5 |
| 2 | 35 | | 649.01 | .96 | 1.77 | 1.80 | 193 | 250 | | 249 | 36 | 70 | 70 | | 3.5 |
| 3 | 40 | | 652.77 | .95 | 1.75 | 1.80 | 194 | 250 | | 250 | 36 | 70 | 70 | | 3.5 |
| 4 | 45 | | 656.52 | .87 | 1.60 | 1.60 | 195 | 250 | | 250 | 37 | 70 | 70 | | 3.5 |
| 5 | 50 | | 660.20 | .75 | 1.38 | 1.40 | 188 | 250 | | 250 | 38 | 70 | 70 | | 3.5 |
| 6 | 55 | | 663.60 | .82 | 1.51 | 1.60 | 166 | 250 | | 250 | 38 | 71 | 71 | | 3.5 |
| | 60 | 10:22 | 667.12 | | | | | | | | | | | | |
| Averages | | | | | | | | | | | | | | | |

QA/QC Check: Completeness ✓ Legibility ✓ Accuracy ✓ Specifications ✓ Checked By DT Team Leader DT

MONTROSE AIR QUALITY SERVICES

EPA Method 5 Field Datasheet (Isokinetic)

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| Project Information | | Sampling Conditions | | ALT 011 | TC ID: | Ambient °F | Ref. °F |
|---|---|---|---|---|---|---|---|
| Date 12-21-21 | Project # P20J-009677 | Static Pressure, in. $H_2O$ -.70 | Ambient Temp, °F 29 | Stack | | | |
| Customer/Facility US GYPSUM | | Barometric Pressure, in. Hg 30.09 | Ref. Barometer ID NOAA | Probe | | | |
| Unit ID/Sample Location KETTLE LIGHTHOUSE | | Wind Speed / Direction ~2mph LSE | Precipitation, Y / N, type NO | Filter Box | | | |
| Run # 3 | Operator DT / MW | Probe / Filter Temp Range, °F 248 ±25°F | | Filter Exit | | | |
| | | | | Meter outlet | | | |
| | | | | Impinger Exit | | | |
| | | | | Other | | | |

| Sampling Equipment IDs | | Calibration | | Equipment Checks | Pre | Mid | Post |
|---|---|---|---|---|---|---|---|
| Meterbox ID | MB12 | Meterbox Y | .994 | Pitot (+), pass @ in. $H_2O$ | ☒ @ 4" | ☐ @ | ☒ @ 4" |
| Umbilical ID | WMB5 | Meterbox ΔH@, in. $H_2O$ | 1.78 | Pitot (-), pass @ in. $H_2O$ | ☒ @ 4" | ☐ @ | ☒ @ 4" |
| Nozzle ID | S-1-4 | Nozzle diameter, Dn, in. | .241 | Pitot visual inspection | ☒ pass | ☐ pass | ☒ pass |
| Pitot / Probe ID | 5'C | Pitot coefficient, Cp | .84 | Nozzle visual inspection | ☒ pass | ☐ pass | ☒ pass |
| Manometer ID | MB12 | Manometer zero and level | ☒ yes | Meter, cfm @ in. Hg | .00 @ 15" | @ | 1.000 @ 5" |
| Sensitivity | 10" $H_2O$ | K-Factor | | Intermediate leak check volume, $ft^3$ | / | / | / |

Notes:

| Traverse Point # | Elapsed Time | Clock Time 24hr | DGM Reading, Vm, $ft^3$ | Velocity Head, ΔP in $H_2O$ | Orifice Pressure Differential, ΔH | | Stack Temp, °F | Probe Temp, °F | Filter Temp, °F | | Impinger Exit Temp, °F | Dry Gas Meter Temperature, °F | | | Pump Vacuum, in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Target | Actual | | | Box | Exit | | Inlet | Outlet | | |
| 1 | 0 | 10:40 | 667.546 | .88 | 1.61 | 1.70 | 197 | 239 | | 251 | 36 | 71 | 71 | | 2 |
| 2 | 5 | | 671.07 | .99 | 1.81 | 1.90 | 198 | 250 | | 251 | 37 | 71 | 71 | | 2.5 |
| 3 | 10 | | 674.97 | .95 | 1.74 | 1.80 | 196 | 250 | | 250 | 36 | 71 | 71 | | 2.5 |
| 4 | 15 | | 678.74 | .85 | 1.56 | 1.60 | 196 | 250 | | 250 | 37 | 72 | 72 | | 2.5 |
| 5 | 20 | | 682.36 | .77 | 1.42 | 1.50 | 195 | 250 | | 249 | 37 | 72 | 72 | | 2 |
| 6 | 25 | | 685.80 | .74 | 1.37 | 1.40 | 163 | 250 | | 251 | 38 | 72 | 72 | | 2 |
| | 30 | 11:40 | 689.15 | | | | | | | | | | | | |
| 1 | 30 | 11:41 | 689.15 | .95 | 1.77 | 1.80 | 161 | 249 | | 250 | 39 | 72 | 72 | | 3 |
| 2 | 35 | | 693.01 | .89 | 1.66 | 1.70 | 200 | 251 | | 250 | 39 | 72 | 72 | | 3 |
| 3 | 40 | | 696.75 | .90 | 1.67 | 1.70 | 200 | 251 | | 251 | 39 | 72 | 72 | | 2.5 |
| 4 | 45 | | 700.43 | .81 | 1.50 | 1.50 | 202 | 250 | | 250 | 40 | 73 | 73 | | 2.5 |
| 5 | 50 | | 704.02 | .83 | 1.54 | 1.60 | 200 | 250 | | 250 | 42 | 73 | 73 | | 2.5 |
| 6 | 55 | | 707.61 | .84 | 1.56 | 1.60 | 184 | 251 | | 250 | 43 | 73 | 73 | | 2.5 |
| | 60 | 11:41 | 711.15 | | | | | | | | | | | | |
| Averages | | | | | | | | | | | | | | | |

QA/QC Check: Completeness ✓ Legibility ✓ Accuracy ✓ Specifications ✓ Checked By DT Team Leader DT

MONTROSE AIR QUALITY SERVICES

EPA Method 5 Field Datasheet (Isokinetic)



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**Project Information**

Date 12-21-21 Project # PROJ-009677

Customer/Facility US GYPSUM

Unit ID/Sample Location KETTLE INTERFACE

Run # 4 Operator DT / MW

**Sampling Conditions**

Static Pressure, in. $H_2O$ -.70 Ambient Temp, °F 29

Barometric Pressure, in. Hg 30.09 Ref. Barometer ID NONA

Wind Speed / Direction ~4mph SE Precipitation, Y / N, type NO

Probe / Filter Temp Range, °F 248 ± 25°F

**ALT 011** TC ID:

| | Ambient °F | Ref. °F |
|---|---|---|
| Stack | | |
| Probe | | |
| Filter Box | | |
| Filter Exit | | |
| Meter outlet | | |
| Impinger Exit | | |
| Other | | |

Ref. Thermometer ID

Continuity Check ☐ Continuity w/ Proper Polarity

Notes:

**Sampling Equipment IDs**

Meterbox ID MB12

Umbilical ID UMB5

Nozzle ID S-1-4

Pitot / Probe ID S1C

Manometer ID MB12

Sensitivity 10" $H_2O$

**Calibration**

Meterbox Y .994

Meterbox ΔH@, in. $H_2O$ 1.78

Nozzle diameter, Dn, in. .241

Pitot coefficient, Cp .84

Manometer zero and level ☑ yes

K-Factor

**Equipment Checks**

| | Pre | Mid | Post |
|---|---|---|---|
| Pitot (+), pass @ in. $H_2O$ | ☑ @ 4" | ☐ @ | ☑ @ 4" |
| Pitot (-), pass @ in. $H_2O$ | ☒ @ 4" | ☐ @ | ☒ @ 4" |
| Pitot visual inspection | ☑ pass | ☐ pass | ☒ pass |
| Nozzle visual inspection | ☑ pass | ☐ pass | ☒ pass |
| Meter, cfm @ in. Hg | .000 @15" | @ | .000 @ 5" |

Intermediate leak check volume, $ft^3$ / /

| Traverse Point # | Elapsed Time | Clock Time 24hr | DGM Reading, Vm, $ft^3$ | Velocity Head, ΔP in $H_2O$ | Orifice Pressure Differential, ΔH Target | ΔH Actual | Stack Temp, °F | Probe Temp, °F | Filter Temp, °F Box | Filter Temp, °F Exit | Impinger Exit Temp, °F | Dry Gas Meter Temperature, °F Inlet | Dry Gas Meter Temperature, °F Outlet | | Pump Vacuum, in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 12:00 | 711.352 | .92 | 1.57 | 1.60 | 200 | 242 | | 247 | 39 | 73 | 73 | | 3 |
| 2 | 5 | | 714.93 | .90 | 1.54 | 1.60 | 200 | 250 | | 251 | 37 | 73 | 73 | | 3 |
| 3 | 10 | | 718.47 | .85 | 1.45 | 1.50 | 202 | 250 | | 251 | 37 | 74 | 74 | | 3 |
| 4 | 15 | | 721.99 | .85 | 1.45 | 1.50 | 200 | 250 | | 251 | 38 | 74 | 74 | | 3 |
| 5 | 20 | | 725.49 | .81 | 1.38 | 1.40 | 201 | 250 | | 249 | 39 | 74 | 74 | | 3 |
| 6 | 25 | | 728.92 | .80 | 1.37 | 1.40 | 198 | 250 | | 249 | 39 | 74 | 74 | | 3 |
| | 30 | 12:30 | 732.37 | | | | | | | | | | | | |
| 1 | 30 | 12:31 | 732.37 | .88 | 1.51 | 1.60 | 186 | 245 | | 249 | 40 | 74 | 74 | | 3 |
| 2 | 35 | | 736.00 | .91 | 1.57 | 1.60 | 184 | 250 | | 250 | 38 | 74 | 74 | | 3 |
| 3 | 40 | | 739.65 | .92 | 1.58 | 1.60 | 194 | 250 | | 250 | 39 | 74 | 74 | | 3 |
| 4 | 45 | | 743.30 | .78 | 1.34 | 1.40 | 187 | 250 | | 250 | 39 | 75 | 75 | | 3 |
| 5 | 50 | | 746.75 | .74 | 1.28 | 1.30 | 196 | 250 | | 250 | 39 | 75 | 75 | | 3 |
| 6 | 55 | | 750.04 | .75 | 1.29 | 1.30 | 190 | 251 | | 250 | 40 | 75 | 75 | | 3 |
| | 60 | 13:01 | 753.33 | | | | | | | | | | | | |
| Averages | | | | | | | | | | | | | | | |

QA/QC Check: Completeness ✓ Legibility ✓ Accuracy ✓ Specifications ✓ Checked By DT Team Leader DT

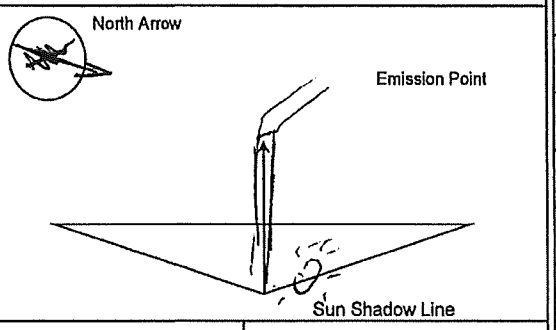
# MONTROSE AIR QUALITY SERVICES, LLC

Method 9, Opacity Datasheet

Run No. 1 VOID Project No. 009677

| | | | |
|---|---|---|---|
| Client | US Gypsum | Start Time | 8:00 |
| Address | 10090 W Jefferson | Stop Time | 9:00 |
| Location | R. Rouge MI | Date | 12-21-21 |

**Sketch of Location**




| | |
|---|---|
| Process | Unit |
| Control Equipment | Baghouse |

Describe Emission Point Skinny Silver stack closest to door on roof

| | |
|---|---|
| Height of Emission Point (ft) Start 160' Stop 160' | Height Relative to Observer (ft) Start 20' Stop 20' |
| Distance to Emission Point. (ft) Start 80' Stop 80' | Direction to Emiss. Point. (Degrees) Start 260° Stop 260° |
| Vertical Angle to Observation Pt. Start 30 Stop 4 | Direction to Observation Point Start WSW Stop WSW |

Describe Emissions Start Steam, None Stop 4

| | |
|---|---|
| Emission Color Start — Stop — | Water Plume Attached ☑ Detached ☐ None ☐ |

Point in plume at which observations were made: After steam plume

Describe Plume Background Start Sky Stop Sky

| | |
|---|---|
| Background Color Start Blue Stop Blue | Sky Conditions Start Clear Stop Clear |
| Wind Speed (mph) Start 1 Stop 1 | Wind Direction Start SSE Stop S |

| | | |
|---|---|---|
| Ambient Temperature (°F) Start 24 Stop 76 | Wet Bulb — | RH Percent 88 |

Observers Name David Kramer

Observers Signature

Certified By Matthew Green Date of Certification 9-29-21

Additional Comments:

| Sec Min | 0 | 15 | 30 | 45 | | 0 | 15 | 30 | 45 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 37 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 38 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 41 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 42 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 43 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 44 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 45 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 46 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 47 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 48 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 0 | 49 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 51 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 52 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 53 | 0 | 0 | 0 | 0 |
| 24 | 0 | 0 | 0 | 0 | 54 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 55 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 56 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 57 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 0 | 58 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 0 | 59 | 0 | 0 | 0 | 0 |

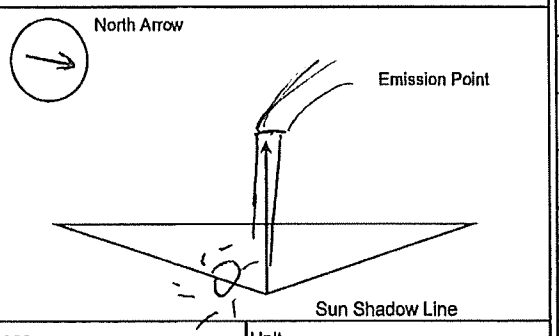
# MONTROSE AIR QUALITY SERVICES, LLC

Method 9, Opacity Datasheet

Run No. 2 Project No. P05-0009667

| | | | |
|---|---|---|---|
| Client | US Gypsum | Start Time | 9:20 |
| Address | 4000 W Jefferson | Stop Time | 10:20 |
| Location | R. Rouge MI | Date | 12-21-21 |

Sketch of Location




| | |
|---|---|
| Process | Unit |
| Control Equipment | Baghouse |

Describe Emission Point Shinny Silver Stack closest to door, on roof

| | |
|---|---|
| Height of Emission Point (ft) Start 160 Stop 160 | Height Relative to Observer (ft) Start 20 Stop 20 |
| Distance to Emission Point. (ft) Start 80 Stop " | Direction to Emiss. Point. (Degrees) Start 260 Stop 260 |
| Vertical Angle to Observation Pt. Start 30 Stop " | Direction to Observation Point. Start WSW Stop " |

Describe Emissions

Start none, steam Stop "

| | |
|---|---|
| Emission Color Start - Stop - | Water Plume Attached ☑ Detached ☐ None ☐ |

Point in plume at which observations were made:

After steam plume

Describe Plume Background

Start Sky Stop Sky

| | |
|---|---|
| Background Color Start Blue Stop Grey | Sky Conditions Start clear Stop cloudy |
| Wind Speed (mph) Start 1 Stop 4 | Wind Direction Start S Stop SE |

| | | |
|---|---|---|
| Ambient Temperature (°F) Start 27 Stop 34 | Wet Bulb — | RH Percent 90 |

Observers Name David Koppanen

Observers Signature

Certified By Whitlan Green Date of Certification 9-24-21

Additional Comments:

| Sec | 0 | 15 | 30 | 45 | | 0 | 15 | 30 | 45 |
|---|---|---|---|---|---|---|---|---|---|
| Min | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 37 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 38 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 41 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 42 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 43 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 44 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 45 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 46 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 47 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 48 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 0 | 49 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 51 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 52 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 53 | 0 | 0 | 0 | 0 |
| 24 | 0 | 0 | 0 | 0 | 54 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 55 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 56 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 57 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 0 | 58 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 0 | 59 | 0 | 0 | 0 | 0 |

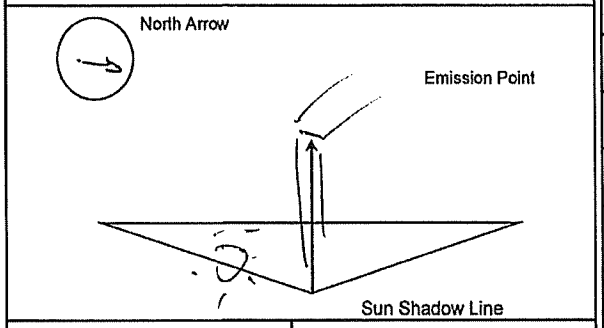
# MONTROSE AIR QUALITY SERVICES, LLC

Method 9, Opacity Datasheet

Run No. 3 Project No. Proj-009667

| | | | |
|---|---|---|---|
| Client | CIS Gypsum | Start Time | 10:40 |
| Address | 10090 W Jefferson | Stop Time | 11:40 |
| Location | R. Davis, MI | Date | 12-21-21 |

Sketch of Location




| | |
|---|---|
| Process | Unit |
| Control Equipment | Baghouse |

Describe Emission Point Shiny silver stack closest to clear, on roof

| | |
|---|---|
| Height of Emission Point (ft) Start 160' Stop 160' | Height Relative to Observer (ft) Start 20' Stop 20' |
| Distance to Emission Point. (ft) Start 80' Stop " | Direction to Emiss. Point. (Degrees) Start 260° Stop " |
| Vertical Angle to Observation Pt. Start 30 Stop " | Direction to Observation Point. Start WSW Stop WSW |

Describe Emissions Start steam, rare Stop "

| | |
|---|---|
| Emission Color Start — Stop — | Water Plume Attached ☑ Detached ☐ None ☐ |

Point in plume at which observations were made: After steam

Describe Plume Background Start Sky Stop Sky

| | |
|---|---|
| Background Color Start Grey Stop " | Sky Conditions Start cloudy Stop " |
| Wind Speed (mph) Start 4 Stop 6 | Wind Direction Start SE Stop SSE |

| | | |
|---|---|---|
| Ambient Temperature (°F) Start 34 Stop 35 | Wet Bulb — | RH Percent 81 |

Observers Name David Vigneron

Observers Signature

Certified By Whitney Green Date of Certification 9-29-21

Additional Comments:

| Sec | 0 | 15 | 30 | 45 | | 0 | 15 | 30 | 45 |
|---|---|---|---|---|---|---|---|---|---|
| Min | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 37 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 38 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 41 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 42 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 43 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 44 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 45 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 46 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 47 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 48 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 0 | 49 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 51 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 52 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 53 | 0 | 0 | 0 | 0 |
| 24 | 0 | 0 | 0 | 0 | 54 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 55 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 56 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 57 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 0 | 58 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 0 | 59 | 0 | 0 | 0 | 0 |

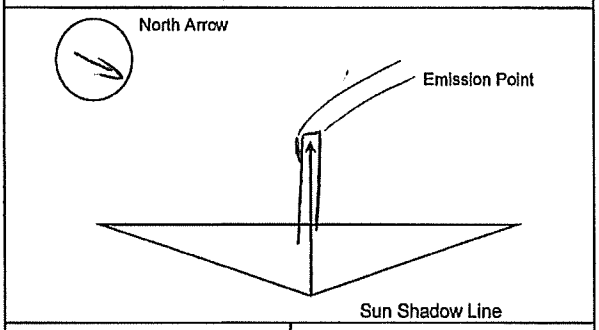
# MONTROSE AIR QUALITY SERVICES, LLC

Method 9, Opacity Datasheet

Run No. 1.1 Project No Proj-009677

| | | | |
|---|---|---|---|
| Client | US Gypsum | Start Time | 12:00 |
| Address | 10090 W Jefferson | Stop Time | 13:00 |
| Location | Baton Rouge, LA | Date | 12-21-21 |

**Sketch of Location**




| | |
|---|---|
| Process | Unit |
| Control Equipment | Baghouse |

Describe Emission Point: Shiny silver stack closest to door, on roof

| Height of Emission Point (ft) | Height Relative to Observer (ft) |
|---|---|
| Start 160' Stop 160' | Start 20' Stop 20' |

| Distance to Emission Point. (ft) | Direction to Emiss. Point. (Degrees) |
|---|---|
| Start 80' Stop 80' | Start 260° Stop 260° |

| Vertical Angle to Observation Pt. | Direction to Observation Point. |
|---|---|
| Start 30 Stop 30 | Start WSW Stop WSW |

Describe Emissions
Start Steam, none Stop "

| Emission Color | Water Plume |
|---|---|
| Start — Stop — | Attached ☑ Detached ☐ None ☐ |

Point in plume at which observations were made:
After steam plume

Describe Plume Background
Start sky Stop sky

| Background Color | Sky Conditions |
|---|---|
| Start Grey Stop Grey | Start cloud Stop cloud |

| Wind Speed (mph) | Wind Direction |
|---|---|
| Start 6 Stop 10 | Start SSE Stop S |

| Ambient Temperature (°F) | Wet Bulb | RH Percent |
|---|---|---|
| Start 35 Stop 37 | — | 78 |

Observers Name David Vaughan
Observers Signature DaVaughan
Certified By Nicholas Green Date of Certification 9-29-21

Additional Comments:

| Sec | 0 | 15 | 30 | 45 | | 0 | 15 | 30 | 45 |
|---|---|---|---|---|---|---|---|---|---|
| Min | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | — | 36 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 37 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 38 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 41 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 42 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 43 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 44 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 45 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 46 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 47 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 48 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 0 | 49 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 51 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 52 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 53 | 0 | 0 | 0 | 0 |
| 24 | 0 | 0 | 0 | 0 | 54 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 55 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 56 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 57 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 0 | 58 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 0 | 59 | 0 | 0 | 0 | 0 |

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# Appendix A.3
# Example Calculations

# EPA Methods 1, 2, 3, 4, and 5 Nomenclature and Sample Calculations

## Run No. - 1

### Constants

| | | | |
|---|---|---|---|
| $CO_2F_{wt}$= 44.0 | in wg= 0.073529 | $NO_2F_{wt}$= 46.01 | $HClF_{wt}$= 36.46 |
| $O_2F_{wt}$= 32.0 | gr= 0.000142857 | $COF_{wt}$= 28.01 | $SO_2F_{wt}$= 64.06 |
| $CON_2F_{wt}$= 28.0 | mmBtu= 1000000 Btu | $H_2SO_4F_{wt}$= 98.08 | $Cl_2F_{wt}$= 70.91 |
| $H_2OF_{wt}$= 18.015 | $CF_{wt}$= 12.011 | $T_{std}$= 527.67 | $P_{std}$= 29.92 |
| $ArF_{wt}$= 40.0 | $PF_{wt}$= 44.0962 | | |

### Stack Variables

| | | | |
|---|---|---|---|
| Cp = | 0.84 | | pitot tube coefficient (dimensionless) |
| $P_{bar}$ = | 30.09 | in. Hg | barometric pressure |
| $E_{box}$ = | 600 | ft | elevation difference between ground level and meter box |
| $E_{sam}$ = | 700 | ft | elevation difference between ground level and sampling ports |
| $\gamma$ = | 0.9940 | | gamma, dry gas meter calibration factor (dimensionless) |
| $\theta$ = | 60.0 | min | net run time (minutes) |
| $V_{lc}$ = | 311.2 | g | total mass of liquid collected in impingers (g) |
| $\%CO_2$ = | 0.00 | % | percent $CO_2$ by volume (dry basis) (dimensionless) |
| $\%O_2$ = | 21.00 | % | percent $O_2$ by volume (dry basis) (dimensionless) |
| $\%N_2$ = | 79.00 | % | percent $N_2$ by volume (dry basis) (dimensionless) |
| A = | 3.6305 | $ft^2$ | stack cross-sectional area |
| $P_g$ = | -0.70 | in. $H_2O$ | flue gas static pressure |
| $T_{savg}$ = | 648.92 | R | average absolute flue gas temperature (460R+tsavg °F) |
| $SQ\Delta P_{avg}$ = | 0.94 | in. wg | average square root $\Delta P$ |
| $\Delta H$ = | 1.68 | in. wg | average pressure differential of orifice meter |
| $T_m$ = | 529.50 | R | dry gas meter temperature (460R+tsavg °F) |
| $V_m$ = | 44.12 | $ft^3$ | volume of metered gas sample (dry actual cubic feet) |
| $D_n$ = | 0.241 | in. | sampling nozzle diameter |

## Calculated Stack Variables

### Barometric pressure at sampling location

NOTE: Barometric pressure recorded at ground level

$$P_{sam} = P_{bar} - [ ( E_{sam} / 100 \text{ ft} ) * 0.1 \text{ in. Hg} ]$$

$$P_{sam} = 30.09 - ( ( 700.0 / 100 ) * 0.1 )$$

$$P_{sam} = 29.39 \text{ in. Hg}$$

### Volume of dry gas sampled at standard conditions (dscf)

$$V_{mstd} = \gamma * Vm * [ P_{bar} - ( [ ( E_{box} / 100 \text{ ft} ) * 0.1 \text{ in. Hg} ] + ( \Delta H / 13.6 ) ) / P_{std} ] * ( T_{std} / T_m )$$

$$V_{mstd} = 0.9940 * 44.120 * ( ( 30.09 - ( ( 600.0 / 100 ) * 0.1 ) + ( 1.6833 / 13.6 ) ) / 29.92 ) * ( 527.7 / 529.500 )$$

$$V_{mstd} = 43.256 \text{ ft}^3$$

### Volume of water vapor at standard conditions (68 °F, scf)

$$V_{wstd} = ( 0.04716 \text{ ft}^3/\text{g} ) * Vlc$$

$$V_{wstd} = ( 0.04716 * 311.2 )$$

$$V_{wstd} = 14.7 \text{ ft}^3$$

**Percent moisture by volume as measured in flue gas**

$\%H_2O$ (Measured) = 100 * [ $V_{wstd}$ / ( $V_{wstd}$ + $V_{mstd}$ ) ]

$\%H_2O$ (Measured) = 100 * ( 14.676 / ( 14.676 + 43.256 ) )

$\%H_2O$ (Measured) = 25.33

$\%H_2O$ (Saturated) = ( 100 / $P_{sam}$ ) * 10 ^ ( 6.6911 - ( 3144 / ( $T_{savg}$ + 390.86 - 460 ) ) )

$\%H_2O$ (Saturated) = ( 100 / 29.338529 ) * 10 ^ ( 6.6911 - ( 3144 / ( 648.916667 + 390.86 - 460 ) ) )

$\%H_2O$ (Saturated) = 63.24

$\%H_2O$ = 25.33

**Absolute flue gas pressure**

$P_s = P_{sam} + ( Pg / 13.6 )$

$P_s = 29.39 + ( -0.70 / 13.6 )$

$P_s$ = 29.34 in. Hg

**Dry mole fraction of flue gas (dimensionless)**

$M_{fd} = 1 - ( \%H_2O / 100 )$

$M_{fd} = 1 - ( 25.33 / 100 )$

$M_{fd}$ = 0.747

**Dry molecular weight of flue gas (lb/lb-mole)**

$M_d = [ ( \%CO_2 / 100 ) * 44.0 ] + [ ( \%O_2 / 100 ) * 32.0 ] + [ ( ( 100 - \%CO_2 - \%O_2 ) / 100 ) * 28.0 ]$

$M_d$ = ( ( 0.00 / 100 ) * 44.0 ) + ( ( 21.00 / 100 ) * 32.0 ) + ( ( ( 100 - 0.00 - 21.00 ) / 100 ) * 28.0 )

$M_d$ = 28.84 lb/lb-mole

$M_d$ = 28.84

**Wet molecular weight of flue gas (lb/lb-mole)**

$M_s = M_d * M_{fd} + ( H_2OF_{wt} * ( \%H_2O / 100 ) )$

$M_s = 28.840 * 0.747 + 18.02 * ( 25.33 / 100 )$

$M_s$ = 26.10 lb/lb-mole

**Average flue gas velocity (ft/sec)**

$v_s = 85.49 * Cp * ( SQ\Delta P_{avg} ) * ( T_{savg} / ( P_s * M_s ) )^{0.5}$

$v_s = 85.49 * 0.84 * ( 0.9445 ) * ( 648.92 / ( 29.339 * 26.098 ) ) ^ 0.5$

$v_s$ = 62.44 ft/sec

**Wet volumetric flue gas flow rate at actual conditions (acfm)**

$Q_{aw} = v_s * A * 60$ sec/min

$Q_{aw} = 62.440 * 3.631 * 60$

$Q_{aw}$ = 13,601 $ft^3$/min

**Wet volumetric flue gas flow rate at standard conditions (scfm)**

$Q_{sdw} = v_s * A * ( T_{std} / T_{savg} ) * ( P_s / P_{std} ) * 60$ sec/min

$Q_{sdw} = 62.440 * 3.631 * ( 527.7 / 648.917 ) * ( 29.339 / 29.92 ) * 60$

$Q_{sdw} =$ 10,845 $ft^3$/min

**Dry volumetric flue gas flow rate at standard conditions (dscfm)**

$Q_{sd} = M_{fd} * v_s * A * ( T_{std} / T_{savg} ) * ( P_s / P_{std} ) * 60$ sec/min

$Q_{sd} = 0.747 * 62.4402 * 3.6305 * ( 527.7 / 648.917 ) * ( 29.339 / 29.92 ) * 60$

$Q_{sd} =$ 8,098 $ft^3$/min

**Percent Excess Air**

$\%EA = [ \%O_2 - ( 0.5 ) * \%CO ] / [ 0.264 * ( 100 - \%CO_2 - \%O_2 ) - ( \%O_2 - 0.5 * \%CO ) ]$

$\%EA = ( ( 21.00 - ( 0.5 ) * 0.00 ) / ( 0.264 * ( 100 - 0.00 - 21.00 ) - ( 21.00 - 0.5 * 0.00 ) ) ) * 100$

$\%EA =$ -14583.33 %

## Isokinetic Calculations

**Percent isokinetic of sampling rate (%)**

$\%I = ( P_{std} / T_{std} ) * ( T_{savg} / P_s ) * [ V_{mstd} / ( v_s * M_{fd} * \theta ) * ( \pi * ( D_n / 2 )^2 / 144 ) ] * (100 / 60 )$

$\%I = (29.92 / 527.7) * (648.917 / 29.339) * (43.256 / (62.4402 * 0.747 * 60.0 * 3.141593 * (0.241 / 2) ^ 2) / 144) * ( 100 / 60 )$

$\%I =$ 102.0 %

## Method 5 Calculations

**Filterable PM total catch weight (mg)**

$mg_{quan} =$ 4.0 mg

**Filterable PM concentration (grains/dscf)**

$C_{grcm} = 0.0154322 * mg_{quan} / V_{mstd}$

$C_{grcm} = 0.0154322 * 4.00 / 43.256$

$C_{grcm} =$ 0.0014 $gr/ft^3$

**Filterable PM concentration (g/dscm)**

$C_{gdscm} = ( mg_{quan} / 1000 ) / ( Vmstd * 0.02832 )$

$C_{gdscm} = ( 4.0 / 1000 ) / ( 43.256 / 0.02832 )$

$C_{gdscm} =$ 0.0033 g/dscm

**Filterable PM mass emission rate (lb/hr)**

$EMR_{lbhr} = ( mg_{quan} / V_{mstd} ) * Q_{sd} * ( 60 / 453592 )$

$EMR_{lbhr} = 4.00 / 43.256 * 8,097.6 * ( 60 / 453592 )$

$EMR_{lbhr} =$ 0.099 lb/hr

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