DETERMINATION OF VOC EMISSIONS
SOURCE FGREMANUFACTURE
MI-ROP-N0842-2013

GAGE PRODUCTS
FERNDALE, MICHIGAN

NOVEMBER 2013

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DETERMINATION OF VOC EMISSIONS
SOURCE FGREMANUFACTURE
MI-ROP-N0842-2013

PREPARED FOR:

GAGE PRODUCTS
FERNDALE, MICHIGAN

SUBMITTED:

December 20, 2013
HHMI PROJECT NO. 0913-004

PREPARED BY:

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RESULTS TABLES

Title
VOC EMISSIONS

FIGURES

Figure No.	Title
1	Vent Dimensions and Sampling Location
2	Method 25A Sampling Train Diagram

1.0 INTRODUCTION

HHMI was retained by Gage Products to perform a volatile organic material (VOC) emissions study on the Combined Thin Film Evaporators (Mi-Rop-N0842-2013) installed at their facility located in Ferndale, Michigan. The emissions source is part of a flexible group identified as FGREMANUFACTURE and is described as two thin film evaporators used to recycle a variety of blended solvents, and one distillation unit for processing product from the thin film evaporators and for remanufacturing incoming material. As part of the permit renewal process, Gage Products is required to demonstrate compliance by testing the source to show the emissions limits detailed in the ROP are not exceeded (Special Condition V.1. "Testing and Sampling").

Messrs. Mike Stockwell and Daniel Hassett on November 6, 2013, performed field services for the study. Messrs. Robert Elmouchi and Mark Dziadosz with the Michigan Department of Environmental Quality (MDEQ) monitored the field activities. Ms. Sharon Stahl with Gage Products provided coordination of plant processes with testing activities.

This report presents the results obtained as well as describes the techniques used in the performance of this testing study. A description of the process is presented in Section 2.0. A discussion of sampling and analytical procedures used during the test program is provided in Section 3.0. A discussion of the project results is presented in Section 4.0. A summary of the quality assurance procedures used in the performance of this study is presented in Section 5.0. The Result Table provides detailed summaries of the emissions data. Figures 1 and 2 present information regarding vent dimensions and the VOC sampling train. Appendix A presents example calculations for Test Run 1. Appendix B includes quality assurance information. Appendix C presents calculation data spreadsheets and copies of original field data sheets. Appendix D contains copies of analyzer concentration field data. Appendix E contains the process operating conditions during the testing.

2.0 PROCESS DESCRIPTION

FGREMANUFACTURE is described as two thin film evaporators used to recycle a variety of blended solvents, and one distillation unit for processing product from the thin film evaporators and for remanufacturing incoming material.

The thin-film evaporators operate in a batch fashion. The distillation column can operate either in batch or continuous mode. The system is designed to recycle a range of incoming solvent streams and the final emissions are a function of the vapor pressure of the recovered mixture. Some purge solvents contain acetone and other non-VOC solvents.

The control device consists of a closed vent system an ethylene glycol chilled condenser. Each solvent recovery unit has a separate product condenser. The control device regulating emissions is the final vent condenser.

It should be noted that the chiller used for cooling during this test series will be replaced in the near future with a more efficient unit. This is a process utility that will not adversely affect emissions, and is exempt under Rule 285: (a) Routine maintenance, parts replacement, or other repairs that are considered by the department to be minor, or relocation of process equipment within the same geographical site not involving any appreciable change in the quality, nature, quantity, or impact of the emission of an air contaminant therefrom; and (d) Reconstruction or replacement of air pollution control equipment with equivalent or more efficient equipment.

As mentioned, Appendix E contains the process operating conditions during the testing, and a process flow diagram.

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3.0 SAMPLING AND ANALYTICAL PROCEDURES

Total VOC was measured in the exhaust vent of the FGREMANUFACTURE process. Procedures employed for this study were conducted in accordance with the following applicable USEPA reference methodologies:

- Methods 1 and 2D (modified) to determine exhaust gas volumetric flow rates.
- Method 3 to determine exhaust gas molecular weights.
- Method 25A to determine VOC emissions in the exhaust gases during both emissions testing.

Descriptions of the procedures and methodologies performed to complete this testing project are presented individually in the following sub-sections.

3.1 USEPA TEST METHODS AND PROCEDURES

Testing procedures employed during the performance of this study were conducted in accordance with USEPA Methods 1, 2D, and 25A. A summary of the test procedures is presented below.

Method 1: Sample and Velocity Traverses for Stationary Sources

This method was used to confirm acceptability of the sampling location. The number of upstream and downstream stack/duct diameters from the sampling ports to the nearest flow disturbance was determined. Based on these determinations, the appropriate sampling location was confirmed. The sample port locations and the upstream and downstream dimensions are depicted in Figure 1.

Method 2D: Measurement of Gas Volume Flow Rates in Small Pipes and Ducts

This method was modified and used to determine the volumetric air flow exiting the vent. It should be noted that the exhaust vent from the process is 4-inches in diameter and has an extremely low and variable volumetric flow rate such that traditional USEPA reference methods cannot be used. To measure the volumetric flow rate, a flexible bag was installed on the exit of the process vent pipe. The bag had 4 orifice holes of known

diameter. Using standard engineering calculations for orifice plates, volumetric flow rate was calculated using pressure drop measurements across the orifices.

A corresponding exhaust gas volumetric flow rate was monitored at continuously throughout each 60-minute test run using a calibrated electronic manometer. Temperature readings were made on a calibrated pyrometer.

Exhaust gas flow rate data from the stack are presented in Appendix C.

Method 3: Gas Analysis for the Determination of Dry Molecular Weight

This method was used to determine the molecular weight of the flue gas. Grab samples of the exhaust gas were collected in and analyzed for oxygen (O_2) and carbon dioxide (CO_2) concentrations using a Fyrite Combustion gas analyzer.

The dry molecular weight of the stack gas was calculated based on the assumption that the primary constituents are oxygen, carbon dioxide, and nitrogen (other compounds present have a negligible relative effect on molecular weight). Having measured the oxygen and carbon dioxide concentrations, the percent stack gas was then equal to the sum of each constituent compound's molecular weight (lb/lb-mole) multiplied by its respective concentration.

Method 25A: Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

This method was used to measure VOC emissions concentrations in the exhaust gas. A JUM Engineering, Model VE-7 flame ionization analyzer (FIA) was used to conduct the VOC testing. Continuous samples were withdrawn from the exhaust vent through a probe, heated sample line, and pump prior to being subjected to the ionization flame.

The JUM VE-7 directs a portion of the sample through a capillary tube to the FID that ionizes the hydrocarbons to carbon. The detector determines the carbon concentration in terms of parts per million (ppm). The concentration of VOC was then converted to an

analog signal (voltage) and recorded on a computerized data acquisition system at 5-second intervals. The data were recorded in 2-second averages over the test period to determine the concentration for VOC reported as equivalent units of the calibration gas (propane). Final results used in determining VOC emission were converted in accordance with Method 25A and reported in terms of propane, the calibration gas. A sketch depicting the JUM VE-7 measurement train is presented in Figure 2.

3.2 SAMPLING LOCATION

Test ports are installed on the 4-inch diameter process vent pipe. The port is located 48 inches (12 duct diameters) upstream from the exit to atmosphere and 24 inches (6 duct diameters) upstream from the roof penetration.

4.0 DISCUSSION OF RESULTS

The VOC emission rate for each test run is shown in the Result Table. Supplemental information for each test run is provided with the field data and calculation information in Appendix C.

Based on the results of this VOC emission study, Source SRN: N0842 is in compliance with the VOC emission limit for FGREMANUFACTURE in accordance with the testing requirements of Special Condition V. 1. "Testing and Sampling" detailed in the air use Renewable Operating Permit (ROP) Number MI-ROP-N0842-2013.

5.0 QUALITY ASSURANCE

Quality assurance (QA) objectives required for this study followed applicable criteria detailed by each method used. Where applicable, reference method QA control procedures were followed to demonstrate creditability of the data developed. Quality assurance information for field equipment is provided in Appendix B. The procedures included, but were not limited to, the following:

- Sampling equipment was calibrated according to procedures contained in the "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III," EPA 600/4-72-b, September 1994.

- The sample trains were configured according to the appropriate test methods.

- Quality control checks of sample trains were performed on-site, including sample train and Pitot tube leak checks.

- The VOC FIA was calibrated in accordance with USEPA Method 25A. Calibration error was within the allowable limit of 5% of calibration gas value. Zero and calibration drift were both within the allowable limit of 3% of analyzer span for all test runs. FID response times (0-95% of span) were within the allowable 30 seconds, as required.

Four test runs were performed because Run 1 post-test QA/QC did not meet Method 25A calibration drift criteria. Run 1 was voided and a fourth test run was performed. Although Run 1 is reported, its results are not used in calculation of the run averages.

6.0 LIMITATIONS

This report is provided to Gage Products in response to a limited assignment. HHMI will not provide any information contained in, or associated with, this report to any unauthorized party without expressed written consent from Gage Products, unless required to do so by law or court order. HHMI accepts responsibility for the performance of the work, specified by the limited assignment, which is consistent with others in the industry, but disclaims any consequential damages arising from the information contained in this report.

This report is intended solely for the use of Gage Products. The scope of services performed for this assignment may not be appropriate to comply with the requirements of other similar process operations, facilities, or regulatory agencies. Any use of the information or conclusions presented in this report, for purposes other than the defined assignment, is done so at the sole risk of the user.

This emission testing survey was conducted and report developed by the following H & H Monitoring, Inc. personnel:

Mike Stockwell
Technician

Daniel L. Hassett
President

RESULT TABLE

Results Table

VOC Emissions
Combined Thin Film Evaporators and Distillation Column
Gage Products
11/6/2013

Run	Test Time		Flowrate		VOC concentration	VOC Emission
Number	Start	Stop	ACFM	SCFM	ppmv	lb/hr
1*	10:18	11:18	1.584	1.607	48,560	0.536
2	12:14	13:14	1.319	1.326	36,800	0.335
3	13:53	14:53	1.861	1.871	30,410	0.391
4	15:26	16:26	2.060	2.064	31,620	0.448
Average			1.747	1.753	32,943	0.391

*Note: The post-test QA/QC for Run 1 was not met. Therefore, the run was voided and the results were not used in the average.

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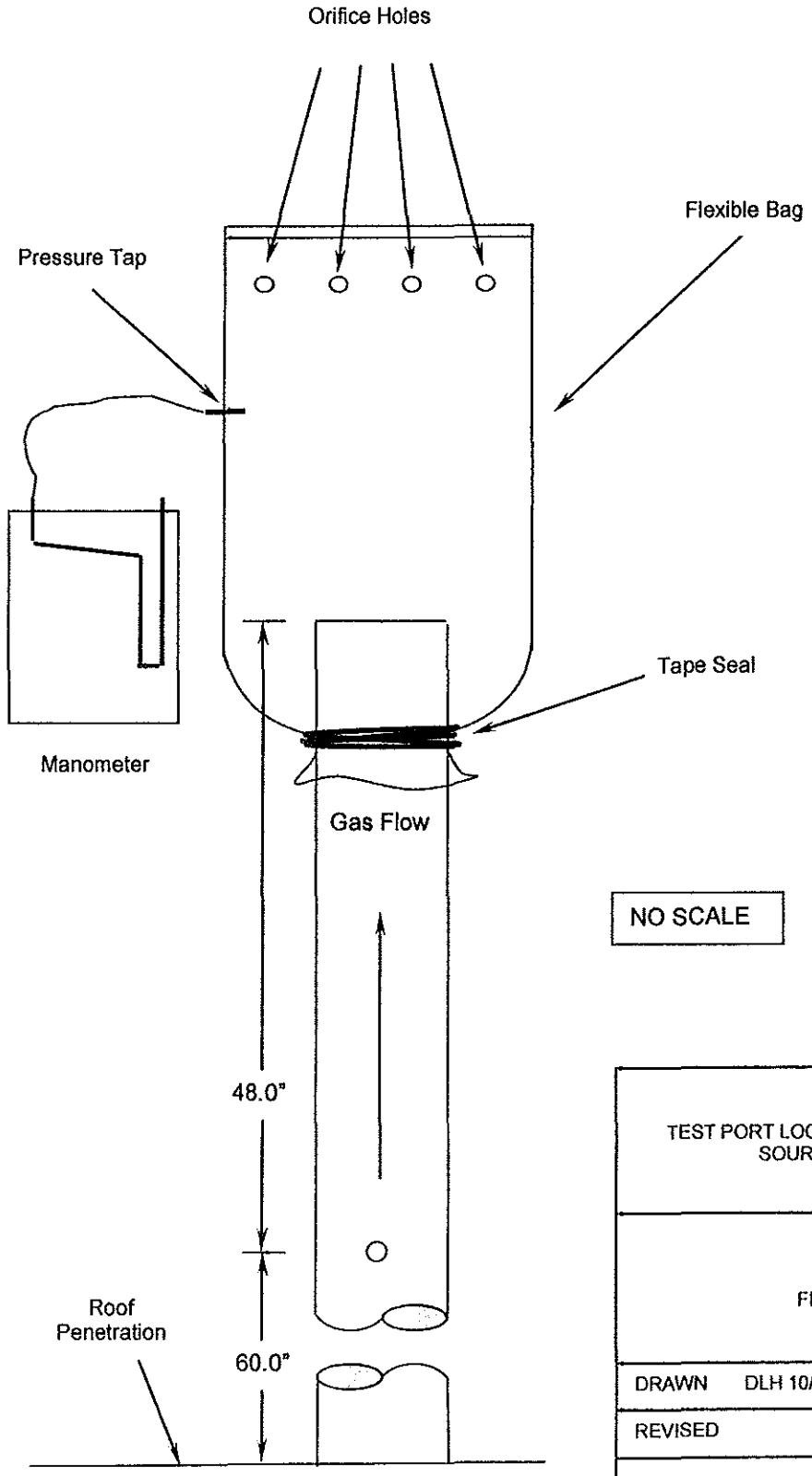
FIGURES



NO SCALE

FIGURE 1

TEST PORT LOCATION AND FLOW MEASUREMENT
SOURCE FGREMANUFACTURE

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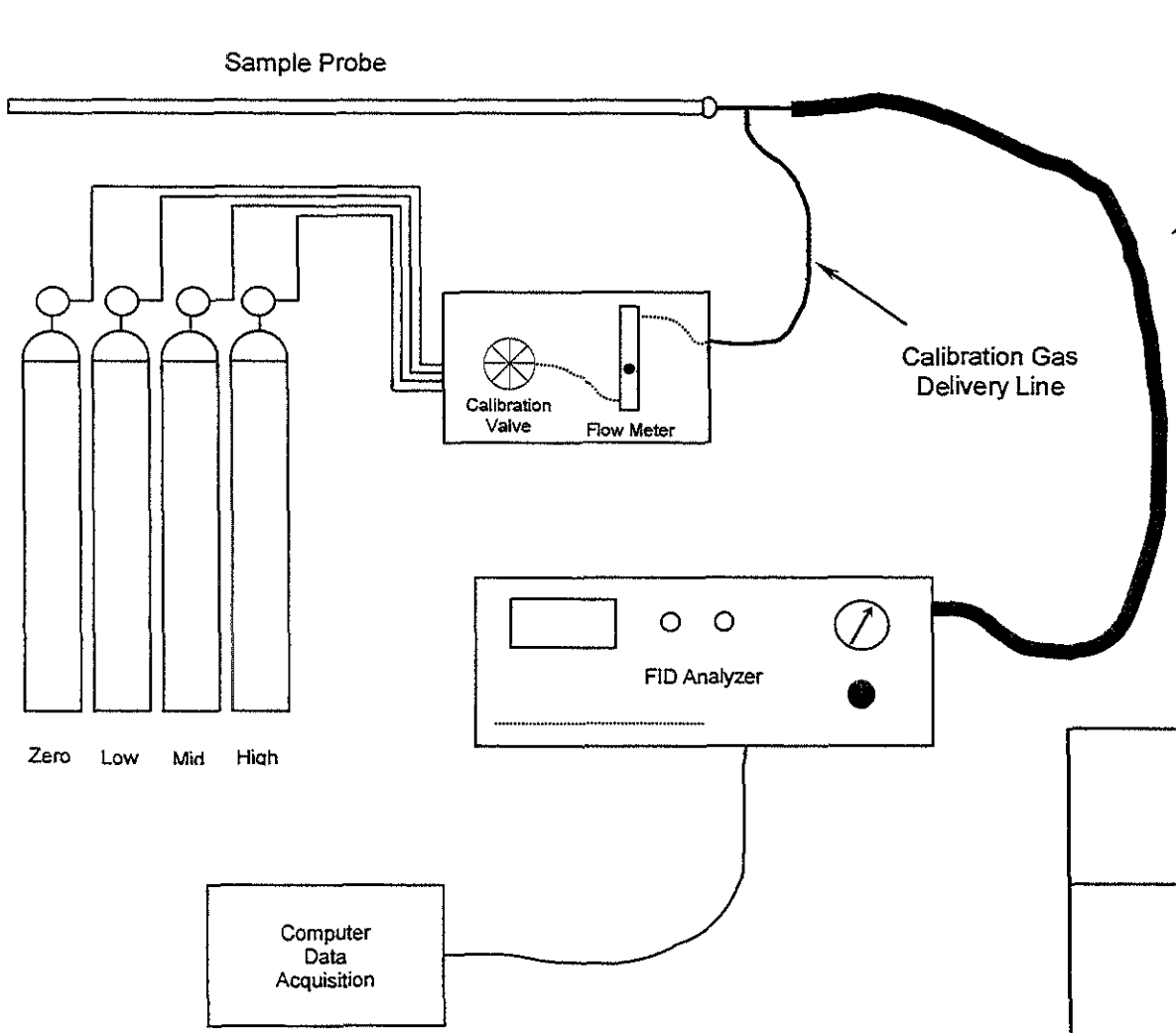

FIGURE 3

METHOD 25A VOC SAMPLING TRAIN

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