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## I. INTRODUCTION

Network Environmental, Inc. was retained by the Cabot Corporation in Midland, Michigan to perform an emission study at their facility. The purpose of the study was to conduct Total Chloromethanes emission sampling on the Fumed Silica Manufacturing Process (FG-SILICA-MFTING-PROCESS) in order to document compliance with Michigan Department of Environment, Great Lakes and Energy (EGLE) Renewable Operating Permit (ROP) No. MI-ROP-N6251-2020. MI-ROP-N6251-2020 has established the following emission limits for this source:

| Source | Emission Limit |
|---|---|
| Scrubber Exhaut (SV-7) | Total Chloromethanes: 21 PPM(v) & 8.9 Tons/Year |

Sampling was conducted on the Fumed Silica Manufacturing Process as follows:

**Scrubber Exhaust (SV-7)**

- Carbon Tetrachloride & Chloroform – U.S. EPA Method 18 (Charcoal Tubes)
- Methyl Chloride (chloromethane) & Methylene Chloride (dichloromethane) – U.S. EPA Method 18 (Tedlar Bags)
- Exhaust Gas Parameters (air flow rate, temperature, moisture and density) – U.S. EPA Methods 1 through 4

The sampling was performed on November 29, 2023 by Stephan K. Byrd, Richard D. Eerdmans and David D. Engelhardt of Network Environmental, Inc.. Assisting with the study were Mr. Kevin Musser of the Cabot Corporation and the operating staff of the facility. Ms. Gina McCann of the Michigan Department of Environment, Great Lakes and Energy (EGLE) – Air Quality Division was present to observe the sampling and source operation.

## II. PRESENTATION OF RESULTS

**II.1 TABLE 1**
**CHLOROMETHANE EMISION RESULTS (PPM) (1)**
**CABOT CORPORATION**
**MIDLAND, MICHIGAN**
**FUMED SILICA PROCESS SCRUBBER (SV-7)**
**NOVEMBER 29, 2023**

| Compound | Sample 1 (09:53-10:53) | Sample 2 (11:19-12:19) | Sample 3 (12:53-13:53) | Average |
|---|---|---|---|---|
| Carbon Tetrachloride | 0.329 | 0.437 | 0.384 | 0.383 |
| Chloroform | 0.092 | 0.125 | 0.118 | 0.111 |
| Methyl Chloride | N.D. (2) | N.D. (2) | N.D. (2) | N.D. (2) |
| Methylene Chloride | N.D. (2) | N.D. (2) | N.D. (2) | N.D. (2) |
| **Total Chloromethanes (3)** | **1.483** | **1.625** | **1.565** | **1.558** |

(1) PPM = Parts Per Million (v/v) On A Dry Basis
(2) N.D. = Non Detected at detection limits of 0.533 PPM for Methyl Chloride and 0.530 PPM for Methylene Chloride.
(3) Total = Additive total for chloromethane concentrations in PPMv. Detection limit values were added into the totals.

**II.2 TABLE 2**
**CHLOROMETHANE EMISSION RESULTS (LBS/HR)[1]**
**CABOT CORPORATION**
**MIDLAND, MICHIGAN**
**FUMED SILICA PROCESS SCRUBBER (SV-7)**
**NOVEMBER 29, 2023**

| Compound | Sample 1 (09:53-10:53) | Sample 2 (11:19-12:19) | Sample 3 (12:53-13:53) | Average |
|---|---|---|---|---|
| Carbon Tetrachloride | 0.0220 | 0.0293 | 0.0256 | 0.0256 |
| Chloroform | 0.0047 | 0.0065 | 0.0061 | 0.0058 |
| Methyl Chloride | N.D. [2] | N.D. [2] | N.D. [2] | N.D. [2] |
| Methylene Chloride | N.D. [2] | N.D. [2] | N.D. [2] | N.D. [2] |
| **Total Chloromethanes [3]** | **0.0580** | **0.0672** | **0.0630** | **0.0627** |

(1) Lbs/Hr = Pounds Per Hour. Calculated using 2,798 DSCFM for sample one, 2,807 DSCFM for sample two and 2,796 DSCFM for sample three.
(2) N.D. = Non Detected at detection limits of 0.0117 Lbs/Hr for Methyl Chloride and 0.0196 Lbs/Hr for Methylene Chloride.
(3) Total = Additive total for chloromethane emission rates in Lbs/Hr. Detection limit values were added into the totals.

## III. DISCUSSION OF RESULTS

The results of the testing are presented in Tables 1 – 2 (Sections II.1 – II.2) as follows:

**III.1 Chloromethane Concentration (PPM) Emission Results (SV-7) (Table 1) –** The chloromethane concentration results are summarized in Table 1 as follows:

- Chloromethane Compound
- Sample & Time
- Chloromethane Concentration (PPM) – Parts Per Million (v/v) On A Dry Basis

Total chloromethane emission concentrations (PPM) were calculated by adding the PPM of each of the quantified species. In the cases where a compound was not detected, the detection limit value was used when calculating the total chloromethane concentration.

**III.2 Chloromethane Emission Rate (Lbs/Hr) Results (SV-7) (Table 2) –** The chloromethane mass emission results are summarized in Table 2 as follows:

- Chloromethane Compound
- Sample & Time
- Chloromethane Mass Emission Rate (Lbs/Hr) – Pounds Per Hour

Total chloromethane mass emission rates (Lbs/Hr) were calculated by adding the Lbs/Hr of each of the quantified species. In the cases where a compound was not detected, the detection limit value was used when calculating the total chloromethane mass emission rate.

## IV. SAMPLING AND ANALYTICAL PROTOCOL

The sampling location was as follows:

- **Scrubber Exhaust (SV-7) –** The sampling was conducted on the 18 inch I.D. off-gas line upstream of the 24 inch I.D. exhaust stack. The sampling location was approximately two (2) duct diameters downstream from the nearest disturbance and greater than two duct diameter upstream from the next disturbance.

**IV.1 Carbon Tetrachloride & Chloroform –** The sampling for these compounds was conducted by employing U.S. EPA Method 18. The samples were collected on charcoal sorbent tubes using pumps equipped with calibrated critical orifices (at approximately 500 cc/min). Prior to collection in the charcoal tubes, the exhaust gas was passed through midget impingers containing DI water (the first with 15 ml & the second empty) in order to condense any stack moisture before entering the tubes. A duplicate spiked sample was run simultaneously with each sampling run (tubes were spiked with 108 ug of carbon tetrachloride & 101 ug of chloroform. Six (6) samples (3 sample runs & 3 spiked/duplicates) were collected from the scrubber exhaust. Each sample was sixty (60) minutes in duration.

The impingers and tubes were recovered and refrigerated until submitted to the laboratory. The samples (water fraction & charcoal tubes) were analyzed for the compounds by gas chromatography (GC). All the quality assurance and quality control procedures listed in the method were incorporated in the sampling and analysis.

Results were corrected for recovery efficiencies. The recovery efficiency for each compound was as follows:

| Compound | Sample | Date | Time | % Recovery |
|---|---|---|---|---|
| Carbon Tetrachloride | 1 | 11/29/23 | 09:53-10:53 | 109.71 |
| | 2 | 11/29/23 | 11:19-12:19 | 103.39 |
| | 3 | 11/29/23 | 12:53-13:53 | 107.32 |
| | | | | |
| Chloroform | 1 | 11/29/23 | 09:53-10:53 | 102.02 |
| | 2 | 11/29/23 | 11:19-12:19 | 97.54 |
| | 3 | 11/29/23 | 12:53-13:53 | 99.25 |
| These recovery efficiencies were used in calculating the final results as per U.S. EPA Method 18. | | | | |

A diagram of the sampling train can be seen in Figure 1.

**IV.2 Methyl Chloride (chloromethane) & Methylene Chloride (dichloromethane) –** The Methyl Chloride & Methylene Chloride emissions were determined in accordance with U.S. EPA Reference Method 18. Three (3) samples were collected from the scrubber exhaust. Each sample was sixty (60) minutes in duration. The samples were collected in Tedlar bags. Prior to collection in the Tedlar bag, the exhaust gas was passed through midget impingers containing DI water (the first with 15 ml & the second empty) in

order to condense any stack moisture before entering the bag. The water impinger contents and bags were sent to the analytical laboratory over night and analyzed for Methyl Chloride & Methylene Chloride by GC.

All the quality assurance and quality control procedures (QA/QC) listed in the methods were incorporated in the sampling and analysis. As part of the QA/QC, the laboratory spiked a bag with Methyl Chloride (9.17 ppm) & Methylene Chloride (8.69 ppm) to determine the recovery efficiency. The recovery efficiency for the spiked bag was 93.5% for Methyl Chloride & 94.9% for Methylene Chloride. These recovery efficiencies were used by the laboratory to adjust the results before reporting.

A diagram of the sampling train can be seen in Figure 2.

**IV.3 Exhaust Gas Parameters** – In addition to the other determinations, the exhaust gas parameters (air flow rate, temperature, moisture, and density) were determined by employing U.S. EPA Reference Methods 1 through 4.

Moisture was determined using the wet bulb/dry bulb technique. Integrated bag samples were collected from the back of the Method 18 sampling train and analyzed for oxygen and carbon dioxide concentrations (gas density) by Orsat in accordance with U.S. EPA Method 3.

All the quality control and quality assurance requirements listed in the methods were incorporated in the sampling and analysis.

This report was prepared by:

David D. Engelhardt
Vice President

This report was reviewed by:

R. Scott Cargill
Project Manager

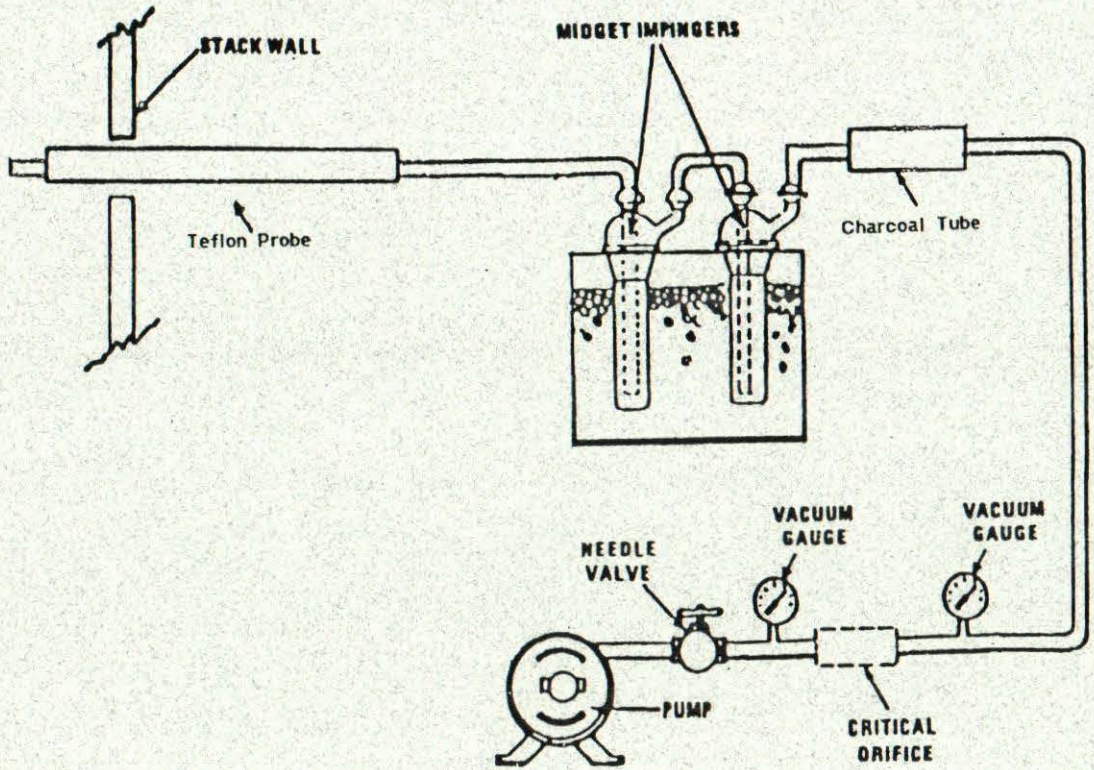


**Figure 1**

**Method 18 - Charcoal Tube Sampling Train**

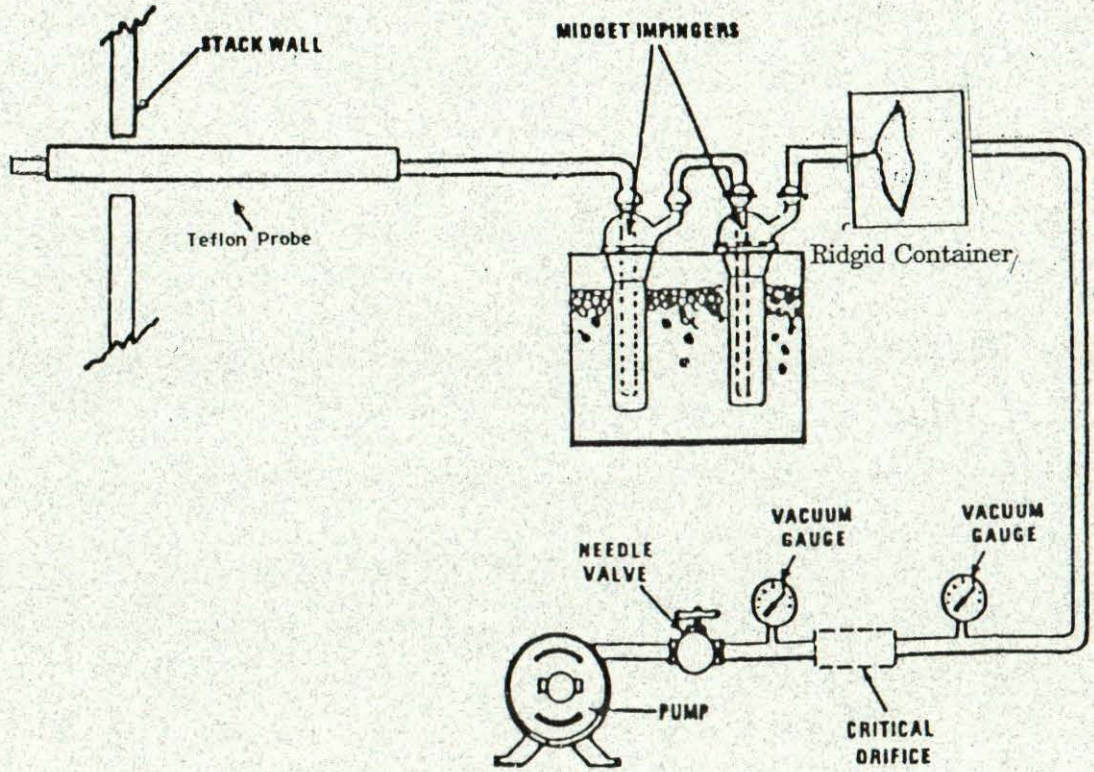


**Figure 2**

**Method 18 - Tedlar Bag Sampling Train**