CERAMIC FILTRATION UNIT GLASS WOOL FIBER EMISSIONS ANALYSIS

HOLLINGSWORTH & VOSE FIBER COMPANY

Prepared for

HOLLINGSWORTH & VOSE FIBER COMPANY

CORVALLIS FACILITY

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The material and data in this report were prepared under the supervision and direction of the undersigned.

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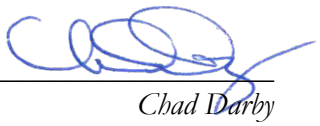

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ACRONYMS AND ABBREVIATIONS

Bison	Bison Engineering
CAO	Cleaner Air Oregon
CFU	Ceramic Filtration Unit
Chemoptix	Chemoptix Microanalysis, LLC
DEQ	Oregon Department of Environmental Quality
the facility	specialty glass fiber manufacturing facility
FB	flameblown
H&V	Hollingsworth & Vose Fiber Company
MFA	Maul Foster & Alongi, Inc.
PM	particulate matter
PTFE	Polytetrafluoroethylene
RC	rotary coarse
RF	rotary fine
URC	ultra rotary coarse

SUMMARY

Hollingsworth & Vose Fiber Company (H&V), in Corvallis, Oregon, has completed a study of process emissions to determine whether glass wool fiber is being emitted from any of the ceramic filtration units (CFUs) employed on-site for particulate matter (PM) emissions control. On November 2-5, 2022, Bison Engineering (Bison) conducted EPA Method 5 sampling on the discharge points of four CFUs, representing exhaust from the four primary fiber sizes/types manufactured by the facility. Samples were collected over three-hour test runs on both glass fiber filters (for gravimetric analysis) and polytetrafluoroethylene (PTFE) filters (for microscopy) concurrently. The gravimetric analysis confirmed that all tested emission points had measurable filterable PM emissions in one or more test runs. The microscopy analysis was conducted by Chemoptix Microanalysis, LLC (Chemoptix) on the PTFE filters for each test run of each CFU sampled. One filter from each CFU test was examined under greater magnification (500 times) to evaluate individual fiber dimensions. Fibers potentially meeting the glass wool fiber definition were found on only three of the four PTFE filters. No glass wool fibers were found on the ultra-rotary coarse (URC) test filter. Out of 400 total fields of view (100 fields of view on each PTFE filter) at 500 times magnification, only four potential glass wool fibers were found in total. While these fibers may or may not be glass wool, if they were to be treated as such, Chemoptix estimated that the fibers would account for less than 1 percent of the total mass of PM collected.

1 INTRODUCTION

H&V owns and operates a specialty glass fiber manufacturing facility (the "facility") that is regulated under Standard Air Contaminant Discharge Permit Number 02-2173-ST-01. The facility is located at 1115 SE Crystal Lake Drive in Corvallis, Oregon 97339. The facility consists of two buildings where manufacturing occurs, which are referred to as Glass Plant 1 and Glass Plant 2. Additional buildings are used for storage, maintenance, and administration.

The first stage of specialty glass fiber manufacturing at the facility involves melting solid raw materials in an electrically heated melting furnace. The molten glass is then delivered via natural gas-fired forehearths to stations that produce the fiber by either a rotary or flameblown fiberizer. Natural gas is combusted to maintain molten glass temperature as it passes through the forehearths. The fiber types produced by the facility are classified as rotary fine (RF), rotary coarse (RC), ultra-rotary coarse (URC), or flameblown (FB) based on fiber size and manufacturing method. Emission factors are based on these classifications. In all cases, the glass fibers are typically hundreds of microns in length, which is what allows the fibers to form mats for collection and for use in final products.

Exhaust from the glass melting furnaces, forehearths and all fiberizer positions installed at the facility is routed to CFUs for control of PM emissions. The CFUs, eighteen in total, each include hundreds of low-density ceramic filters arranged in parallel within an enclosure that functions similar to bags in a baghouse. CFU technology was chosen for its extremely high control efficiency and ability to collect and clear PM that might otherwise plug a traditional fabric-filter baghouse.

While numerous PM source tests over the last several years have demonstrated that the CFUs have an extremely low emissions rate, these tests do not identify the composition of the emitted material. For the purposes of the Cleaner Air Oregon (CAO) air toxics program, knowing the composition of the emissions can be important. The potential sources of process-related PM emissions from the CFUs include natural gas combustion products, bulking agent material used to help remove material from the CFUs during the cleaning cycle, glass wool fibers, and glass fragments or particles.

Glass wool fibers are synthetic vitreous fibers that are "at least 5 micrometers long and have an aspect ratio of at least 3 to 1 or sometimes 5 to 1 (the aspect ratio is the ratio of a fiber's length to its diameter)." [1] Glass wool fibers are a listed toxic air contaminant under the CAO program (ID 352). However, due to the length of the fibers in this classification it is believed that fibers are unable to pass through the ceramic filters in the CFUs.

In a letter dated September 22, 2022 from the Oregon Department of Environmental Quality (DEQ) to Anita Ragan at H&V, the DEQ stated it "recognizes that particles larger than 5 micrometers in length are not likely to travel through the CFU filtration media; however, potential emissions from these TEUs include leakage from ceramic filter seals and voids." Based on this, the DEQ

[1] Agency for Toxic Substances and Disease Registry. 2004. Toxicological Profile for Synthetic Vitreous Fibers (Update). U.S. Department of Health and Human Services. Public Health Service, Atlanta, GA.

recommended that H&V assume 100% of the filterable PM emissions (based on previous source tests) are glass wool fibers for purposes of the CAO emissions inventory.

H&V continuously monitors pressure drop and performs extensive dye testing on their CFUs to ensure the integrity of seals. There are also no "voids" in the CFUs leading to atmosphere. Based on this it was believed that the filterable PM is most likely not glass fiber, but the result of natural gas combustion products, bulking agent, or glass shot (small rounded glass particles formed from the fiberizers).

To test this hypothesis, H&V studied the CFU emissions with the intent of answering two questions:

1. Are the filterable PM emissions from the CFUs glass wool fibers?
2. If there are glass wool fibers present in the exhaust of the CFUs, how much of the filterable PM emission rate do they likely represent?

2 CFU FIBER EMISSIONS STUDY

To better understand the nature of the filterable PM emissions, H&V, Maul Foster & Alongi (MFA), and Bison collaborated and discussed several test methods or techniques that could be used. Ultimately it was decided that microscopy would be needed because glass wool fibers have specific dimensions (length and aspect ratio) that, if detected, would need to be measured. Chemical composition alone would not answer the question of whether glass particles were glass wool fibers. MFA and Bison consulted Chemoptix, owned by Stan Cassell and located in West Linn, Oregon, to help design a test program that would evaluate the presence of glass wool fibers.

2.1 Sampling Method

To conduct microscopy two requirements are critical: a sampling technique is needed that is recognized by regulatory agencies as capturing total filterable PM, and the sampling substrate must be a material that allows a microscopist to distinguish captured material from the substrate. It was decided that EPA Method 5 would be used to capture filterable material as this is the widely accepted method for capturing total PM.

2.2 Sampling Media

Chemoptix was instrumental in helping determine the optimal sampling media for Method 5. Choices included glass, quartz, and PTFE (commonly referred to as Teflon®) filters. Each of these has unique potential challenges for the purpose of this study. Both glass and quartz filters are made from materials that are similar in composition to the glass fiber manufactured at H&V. As a result, light reflection and refraction could make it difficult to get an accurate visual evaluation of the filters. PTFE filters do not have this issue as they are made from a completely different material. However, MFA learned from Chemoptix that PTFE filters have another issue that may affect microscopy but will not affect Method 5 sampling. In the manufacturing process the filter surface can develop a corrugated pattern

of ridges and troughs that are imperceptible to the naked eye but are problematic under a microscope when looking at lengths measured in microns. These ridges and troughs create shadows and lines that can result in inaccurate or difficult observations of the filter surface. Chemoptix indicated to MFA that they have seen this manufacturing issue in about 50 percent of PTFE filters.

To determine the appropriate sample media, Bison provided Chemoptix with glass, quartz, and PTFE filters and H&V provided Chemoptix with samples of fiber from their process. After placing some of the glass fiber material on each of these filter types, Chemoptix determined that PTFE filters would work best for this study. Moreover, Chemoptix determined that the PTFE filters provided by Bison did not have any corrugation from the manufacturing process.

It should be noted that even blemish-free PTFE filters have a top and bottom surface that is nearly identical and does not affect sampling for gravimetric analysis. However, the bottom surfaces of the filters have intentional ribs that most likely are present for structural support.

2.3 CFU Testing

Bison conducted emission testing of four CFUs from November 2-5, 2022.

Testing at each CFU involved operating a Method 5 sampling train for three, 3-hour test runs using a PTFE filter to collect total PM. Simultaneously, Bison operated a Method 5 sampling train with standard glass filters to collect total PM for gravimetric analysis. The purpose of the gravimetric analysis was to demonstrate that PM emissions, during the collection of material for microscopy, were consistent with emission rates typically expected. The Bison source test report is provided as Attachment A.

PTFE filters from the H&V testing were shipped to Chemoptix for analysis by microscopy. Glass fiber filters were analyzed by gravimetric analysis at Bison's lab in Helena, Montana. The Chemoptix report can be found as Attachment B.

Testing resulted in three filters for gravimetric analysis and three filters for microscopic analysis for each CFU. The microscopy was conducted at two magnifications: 100 times and 500 times. One filter for each fiber type was analyzed by 500 times magnification to resolve the specific dimensions of fibers captured on filters and to determine whether they met the length and aspect rations that define "glass wool fiber." Each of these four filters analyzed at 500 times magnification were examined at 100 transect locations on the filter's surface for a total of 400 transects examined. These filters are listed in Table 1.

Table 1. PTFE Sample Filters Examined at 500 Times Magnification

CFU	Sample Run Filter Examined	Chemoptix ID	Sample Media	H&V Fiber Type	Sample Date
CFU-112	1	G-MIC-12305	PTFE Membrane	Ultra Rotary Coarse	11/2/22
CFU-108	1	G-MIC-12308	PTFE Membrane	Rotary Coarse	11/3/22
CFU-118	1	G-MIC12311	PTFE Membrane	Rotary Fine	11/4/22
CFU-115*	2	G-MIC12315	PTFE Membrane	Flameblown	11/5/22

* In some cases, PTFE filters were sampled with the ribbed side up, resulting in nearly imperceptible ridges that restrict how closely a microscope lens can approach the surface. For instance, the PTFE filter from Run 1 of CFU-115 testing was oriented with the ribbed side up, so sample Run 2 was used for scanning for specific fibers at 500x magnification.

The remaining eight PTFE filters were examined at 100 times magnification for two reasons:

1. 500 times magnification transects are extremely labor intensive to conduct.
2. 100 times magnification provides better resolution of overall surface coverage of PM for estimating the portion of the filterable mass that is glass wool fiber.

3 STUDY FINDINGS

Source testing conducted by Bison using Method 5 with gravimetric analysis confirmed that PM emission rates from the CFUs during testing were as expected compared to previous compliance testing. This confirmed that microscopy should be able to see and identify PM normally present in CFU emissions. Some sample runs resulted in no mass detected after blank corrections were applied. However, as we learned from the microscopy there are extremely low levels of various non-fiber materials collected on all filters, regardless of the gravimetric results, and much of it looks like background PM (insect molts, skin cells, clothing and paper fibers, rust, and flooring abrasion particles). It is possible that the filter blanks acquired equal or more background PM during handling.

Due to the labor intensity of viewing filters in an extensive number of locations at distances measuring in microns, Chemoptix selected one PTFE filter for each CFU for examination at 500 times magnification to quantify the dimensions of any fibers found. All other PTFE filters were examined at 100 times magnification to get a better idea of overall deposition and composition of filterable PM.

The following findings from the 500 times magnification filter examinations suggest that little, and perhaps no, glass wool fiber is emitted from the CFUs:

- No glass wool fiber was found on the filter from Run 1 of CFU-112 (URC).
- Two glass wool fibers were found on the PTFE filter from Run 1 of CFU-108 (RC).
- One glass wool fiber was found on each of the PTFE filters from Run 1 of CFU-118 (RF) and Run 2 of CFU-115 (FB).

While the microscopy identified what appear to be glass wool fibers on three of the four filters examined, the number of fibers suggest that they could easily be from contamination during sample handling. The samples did contain epithelial slough (skin fragments) and fiber that appeared to be from textiles and paper, suggesting that during the transfer of filters to the sample containers dust may have settled onto the filters from clothing or skin, which could also explain the transfer of glass fiber to the filter surface. One glass fiber was identified as being greater than 100 micrometers in length (CFU-118), which seems far too large to pass through the ceramic filter media. Given the care with which the facility tests the CFUs for leakage it is unlikely that this was the source of the fiber. H&V conducts both external and internal (dye testing) inspections to ensure leakage is not an issue with the CFUs. Additionally, if the observed fibers had been due to leakage around a seal, far more fiber would likely have been found on the filter. Chemoptix made the following selected conclusions from their analysis:

- "Glass wool appears to be present only at trace levels to other particles contributing mass to these membranes. Their total mass is below quantitation. Glass wool fibers thus represent considerably less than <1% of the mass balance on these membranes.
- The accumulated mass on these filters appears to be related to the facility and ambient air, and not directly to manufacturing processes."

4 CONCLUSIONS

Based on both the quantitative and qualitative analyses conducted by Bison and Chemoptix, it appears that little, if any, glass wool fiber, having a length of greater than 5 micrometers and an aspect ratio of at least 3 to 1, is present in the emissions from the CFUs employed by H&V. To conservatively quantify glass fiber emissions from the CFUs for the CAO program, a value of 1% of the filterable particulate emission rate will be estimated.

LIMITATIONS

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

APPENDIX A

CERAMIC FILTRATION UNITS PARTICULATE MATTER TESTING- BISON ENGINEERING, INC.

EMISSIONS TEST TECHNICAL SUMMARY

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CERAMIC FILTRATION UNITS PARTICULATE MATTER TESTING

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STACK TESTING ACCREDITATION COUNCIL

ACCREDITED TO ASTM D7036 ONLY CERT #4675.01

BISON ENGINEERING, INC.

INTRODUCTION AND RESULTS

Hollingsworth & Vose Fiber Company (H&V) retained Bison Engineering, Inc. (Bison) to perform emissions testing at Glass Plants 1 and 2 at the H&V facility in Corvallis, Oregon. Testing was performed on ceramic filtration units (CFUs) 108, 112, 115 and 118 for engineering purposes. These CFUs represent emission points for the four types/sizes of glass fiber manufactured at the facility (rotary coarse, ultra rotary coarse, rotary fine and flameblown, respectively).

Testing on CFUs 108, 112, 155 and 118 was conducted to determine particulate matter (PM) emission rates and composition. Samples were collected on quartz filters for gravimetric analysis and on polytetrafluoroethylene (PTFE) filters for microscopy analysis. Quartz filter sampling and PTFE sampling was conducted simultaneously to confirm that there were measurable levels of particulate emissions while samples were being collected on PTFE filters for microscopy analysis. Three, 180-minute test runs were conducted for each sampling medium. Samples collected on PTFE filters were sent to Chemoptix in West Linn, Oregon for subsequent analysis with microscopy. Chemoptix reported the results of the microscopy analysis separately; those results are not included in this report.

Bison employed U.S. Environmental Protection Agency (EPA) emission test methods as described in Title 40 Code of Federal Regulations, Part 60 (40 CFR 60), Appendix A, and the Oregon Department of Environmental Quality (ODEQ) Source Sampling Manual. Tables 1-4 summarize the emission test results for CFUs 108, 112, 115 and 118. Raw and processed test data can be found in the appendix to this report.

Table 1 CFU 108 Rotary Coarse Engineering Test Results

Parameter	Units	Run 1	Run 2	Run 3	Average
Run Duration	minutes	180	180	180	**180**
Sample Volume	dscf	162.809	167.424	168.751	**166.328**
	dscm	4.61	4.74	4.78	**4.71**
Velocity	ft/s	67.80	70.62	71.42	**69.95**
Stack Area	ft^2	4.909	4.909	4.909	**4.909**
Stack Moisture	%v	1.27	1.31	1.78	**1.45**
Stack Temperature	°F	211.4	205.8	210.0	**209.1**
Volumetric Flow Rate	acfm	19,970	20,800	21,036	**20,602**
	adcfm	19,716	20,528	20,662	**20,302**
	dscfm	15,564	16,363	16,334	**16,087**
Filterable PM	gr/dscf	0.00E+00	1.80E-04	0.00E+00	**6.00E-05**
	lb/hr	0.00E+00	2.5E-02	0.00E+00	**8.41E-03**
	lb/lb glass	0.00E+00	6.63E-05	0.00E+00	**2.21E-05**
Condensable PM Inorganic	gr/dscf	9.72E-05	7.55E-05	8.38E-05	**8.55E-05**
	lb/hr	1.30E-02	1.06E-02	1.17E-02	**1.18E-02**
	lb/lb glass	3.33E-05	2.79E-05	2.99E-05	**3.04E-05**
Condensable PM Organic	gr/dscf	2.41E-05	3.08E-05	0.00E+00	**1.83E-05**
	lb/hr	3.22E-03	4.32E-03	0.00E+00	**2.51E-03**
	lb/lb glass	8.27E-06	1.14E-05	0.00E+00	**6.55E-06**
Total PM* (Filterable + Condensable)	gr/dscf	1.21E-04	2.86E-04	8.38E-05	**1.64E-04**
	lb/hr	1.62E-02	4.01E-02	1.17E-02	**2.27E-02**
	lb/lb glass	4.16E-02	1.06E-04	2.99E-05	**5.90E-05**
Glass Fiber Pull Rate	lb/hr	389.1	380.3	391.8	**387.1**

Note: Emission results derived from negative gravimetric results are reported as zero. These results are included in the three-run average.

*Total PM values in this table were derived from actual, measured gravimetric results. The results for all three runs were below the ODEQ Method 5 analytical detection limit for total PM as specified in the ODEQ Source Sampling Manual (7 milligrams). Detailed results can be found in the appendix to this report.

dscf – dry standard cubic feet
dscm – dry standard cubic meters
ft/s – feet per second
ft^2 – square feet
%v – percent by volume
°F – degrees Fahrenheit
acfm – actual cubic feet per minute, wet basis
adcfm – actual cubic feet per minute, dry basis
dscfm – cubic feet per minute corrected to standard conditions, dry basis
gr/dscf – grains per dry standard cubic foot
lb/hr – pounds per hour
lb/lb glass – pounds per pound of glass fiber pulled

Table 2 CFU 112 Ultra Rotary Coarse Engineering Test Results

Parameter	Units	Run 1	Run 2	Run 3	Average
Run Duration	minutes	180	180	180	**180**
Sample Volume	dscf	158.11	158.16	158.89	**158.39**
	dscm	4.48	4.48	4.50	**4.49**
Velocity	ft/s	71.29	70.81	70.87	**70.99**
Stack Area	ft^2	4.909	4.909	4.909	**4.909**
Moisture	%v	2.06	1.98	1.76	**1.93**
Stack Temperature	°F	235.8	240.1	235.8	**237.2**
Volumetric Flow Rate	acfm	20,998	20,856	20,874	**20,909**
	adcfm	20,565	20,443	20,507	**20,505**
	dscfm	15,480	15,427	15,576	**15,494**
Filterable PM	gr/dscf	0.00E+00	6.79E-05	2.54E-05	**3.11E-05**
	lb/hr	0.00E+00	8.97E-03	3.39E-03	**4.12E-03**
	lb/lb glass	0.00E+00	9.86E-06	3.70E-06	**4.52E-06**
Condensable PM Inorganic	gr/dscf	1.61E-04	0.00E+00	5.02E-05	**7.03E-05**
	lb/hr	2.13E-02	0.00E+00	6.70E-03	**9.34E-03**
	lb/lb glass	2.29E-05	0.00E+00	7.31E-06	**1.01E-05**
Condensable PM Organic	gr/dscf	1.52E-04	3.93E-04	6.80E-05	**2.04E-04**
	lb/hr	2.02E-02	5.20E-02	9.08E-03	**2.71E-02**
	lb/lb glass	2.16E-05	5.71E-05	9.91E-06	**2.96E-05**
Total PM* (Filterable + Condensable)	gr/dscf	3.13E-04	4.61E-04	1.44E-04	**3.06E-04**
	lb/hr	4.15E-02	6.10E-02	1.92E-02	**4.05E-02**
	lb/lb glass	4.45E-05	6.70E-05	2.09E-05	**4.41E-05**
Glass Fiber Pull Rate	lb/hr	931.9	910.3	916.1	**919.43**

Note: Emission results derived from negative gravimetric results are reported as zero. These results are included in the three-run average.

*Total PM values in this table were derived from actual, measured gravimetric results. The results for all three runs were below the ODEQ Method 5 analytical detection limit for total PM as specified in the ODEQ Source Sampling Manual (7 milligrams). Detailed results can be found in the appendix to this report.

Table 3 CFU 115 Flameblown Engineering Test Results

Parameter	Units	Run 1	Run 2	Run 3	Average
Run Duration	minutes	180	180	180	**180**
Sample Volume	dscf	147.34	145.55	146.97	**146.62**
	dscm	4.17	4.12	4.16	**4.15**
Velocity	ft/s	72.63	71.01	72.12	**71.92**
Stack Area	ft^2	5.585	5.585	5.585	**5.585**
Moisture	%v	1.63	2.27	1.93	**1.94**
Stack Temperature	°F	304.3	304.1	298.6	**302.3**
Volumetric Flow Rate	acfm	24,338	23,795	24,167	**24,100**
	adcfm	23,941	23,255	23,701	**23,632**
	dscfm	16,491	16,055	16,481	**16,342**
Filterable PM	gr/dscf	2.20E-04	8.88E-05	6.57E-05	**1.25E-04**
	lb/hr	3.12E-02	1.22E-02	9.28E-03	**1.76E-02**
	lb/lb glass	5.11E-04	2.00E-04	1.52E-04	**2.88E-04**
Condensable PM Inorganic	gr/dscf	7.65E-05	2.00E-04	1.43E-04	**1.40E-04**
	lb/hr	1.08E-02	2.75E-02	2.02E-02	**1.95E-02**
	lb/lb glass	1.77E-04	4.51E-04	3.31E-04	**3.20E-04**
Condensable PM Organic	gr/dscf	3.19E-04	6.12E-06	2.50E-04	**1.92E-04**
	lb/hr	4.51E-02	8.42E-04	3.54E-02	**2.71E-02**
	lb/lb glass	7.39E-04	1.38E-05	5.80E-04	**4.44E-04**
Total PM* (Filterable + Condensable)	gr/dscf	6.16E-04	2.95E-04	4.59E-04	**4.56E-04**
	lb/hr	8.71E-02	4.06E-02	6.48E-02	**6.41E-02**
	lb/lb glass	1.43E-03	6.65E-04	1.06E-03	**1.05E-03**
Glass Fiber Pull Rate	lb/hr	61.0	61.0	61.0	**61.0**

Note: Emission results derived from negative gravimetric results are reported as zero. These results are included in the three-run average.

*Total PM values in this table were derived from actual, measured gravimetric results. The results for all three runs were below the ODEQ Method 5 analytical detection limit for total PM as specified in the ODEQ Source Sampling Manual (7 milligrams). Detailed results can be found in the appendix to this report.

Table 4 CFU 118 Rotary Fine Engineering Test Results

Parameter	Units	Run 1	Run 2	Run 3	Average
Run Duration	minutes	180	180	180	**180**
Sample Volume	dscf	170.04	166.90	169.29	**168.75**
	dscm	4.82	4.73	4.79	**4.78**
Velocity	ft/s	78.92	78.60	76.24	**77.92**
Stack Area	ft^2	4.909	4.909	4.909	**4.909**
Moisture	%v	2.18	1.90	1.93	**2.00**
Stack Temperature	°F	263.7	273.2	248.8	**261.9**
Volumetric Flow Rate	acfm	23,245	23,151	22,456	**22,951**
	adcfm	22,738	22,711	22,023	**22,491**
	dscfm	16,581	16,347	16,369	**16,432**
Filterable PM	gr/dscf	0.00E+00	9.12E-05	3.32E-04	**1.41E-04**
	lb/hr	0.00E+00	1.28E-02	4.66E-02	**1.98E-02**
	lb/lb glass	0.00E+00	1.13E-04	4.32E-04	**1.82E-04**
Condensable PM Inorganic	gr/dscf	2.68E-04	0.00E+00	1.41E-04	**1.36E-04**
	lb/hr	3.80E-02	0.00E+00	1.98E-02	**1.93E-02**
	lb/lb glass	3.33E-04	0.00E+00	1.83E-04	**1.72E-04**
Condensable PM Organic	gr/dscf	1.50E-04	3.88E-04	2.10E-04	**2.49E-04**
	lb/hr	2.14E-02	5.44E-02	2.94E-02	**3.51E-02**
	lb/lb glass	1.87E-04	4.83E-04	2.73E-04	**3.14E-04**
Total PM* (Filterable + Condensable)	gr/dscf	4.18E-04	4.79E-04	6.83E-04	**5.27E-04**
	lb/hr	5.94E-02	6.72E-02	9.58E-02	**7.41E-02**
	lb/lb glass	5.20E-04	5.96E-04	8.88E-04	**6.68E-04**
Glass Fiber Pull Rate	lb/hr	114.3	112.7	107.9	**111.63**

Note: Emission results derived from negative gravimetric results are reported as zero. These results are included in the three-run average.

*Total PM values in this table were derived from actual, measured gravimetric results. The results for runs 1 and 2 were below the ODEQ Method 5 analytical detection limit for total PM as specified in the ODEQ Source Sampling Manual (7 milligrams). The gravimetric results for run 3 were above the analytical detection limit. The three-run averages are therefore considered detection limit limited (DLL), since they are calculated from two non-detect runs and one run with results above the detection limit. Detailed results can be found in the appendix to this report.

EMISSIONS TEST METHODS AND PROCEDURES

Bison testing personnel performed EPA test methods as described in 40 CFR 60, Appendix A. Table 5 summarizes the test methods used during this test campaign. More detailed method descriptions are provided below.

Table 2 Project Matrix

Source	Methods	Parameter	Test Plan and Comments
CFUs108, 112, 115, and 118	EPA 1	Measurement Locations	Determined prior to testing
	EPA 2	Volumetric Flow	Concurrent with ODEQ Method 5
	EPA 3	Molecular Weight	Determined prior to testing
	EPA 4	Moisture	Concurrent with ODEQ Method 5
	ODEQ 5	Total PM	Three 180-minute runs. Both methods performed simultaneously. ODEQ 5 samples were collected on quartz filters. Modified EPA 5 samples were collected on PTFE filters for subsequent analysis by microscopy.
	Modified EPA 5	PM	

EPA Reference Method 1, "Sample and Velocity Traverses for Stationary Sources." The objective of Method 1 is to determine a suitable location for testing and to determine the velocity and/or sample points for the source. The results of Method 1 sampling location and sample or velocity point measurement locations are included in the appendix to this report.

EPA Reference Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type-S Pitot Tube)." Concurrent with ODEQ Method 5. The objective of Method 2 is to determine volumetric flow. The average velocity, temperature, static pressure, and source area are used to calculate volumetric flow for the source.

EPA Reference Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." The objective of Method 3 is to determine the molecular weight of the source stream based on measured or assumed oxygen (O_2) and carbon dioxide (CO_2) concentrations.

EPA Reference Method 4, "Determination of Moisture Content in the Stack Gases." The objective of Method 4 is to determine the moisture content of a gas stream.

ODEQ Method 5, "Sampling Particulate Emissions from Stationary Sources." ODEQ Method 5 is an isokinetic sampling method for determination of total particulate matter emissions (filterable and condensable) from a source. The exhaust gas stream is sampled along a cross-section of the stack and PM is captured within the nozzle, probe, filter-bell, quartz fiber filter, and glass impingers. Condensable PM is measured in conjunction with Method 5 sampling. The condensable PM is captured in the impinger water located after the Method 5 filter. The impinger water is maintained below 68°F. Impinger water and the associated glassware rinses are recovered and evaporated during lab analysis for gravimetric determination of condensable PM. Method 5 incorporates Method 2 "velocity measurements" and Method 4 "moisture measurements." Figure 1 depicts the equipment configuration used for conducting Method 5 tests.

Modified EPA Reference Method 5, "Determination of Particulate Emissions from Stationary Sources" (Methods 2 & 4 Inclusive). Method 5 is an isokinetic sampling method for determination of filterable PM emissions from a source. The exhaust gas stream is sampled along a cross-section of the stack and PM is captured within the nozzle, probe, filter-bell and quartz fiber filter. Method 5 incorporates Method 2 "velocity measurements" and Method 4 "moisture measurements." In performing Method 5 for this test campaign, Bison used PTFE filters to collect samples, rather than the standard quartz filters.

APPENDIX: TEST DATA

BISON ENGINEERING, INC.

COMPANY	**Hollingsworth and Vose**
FACILITY	**Glass Plant 1**
LOCATION	**Corvallis OR**
SOURCE	**CFU112**
DATE	**11/02/22**
METHOD	**Modified M5**
POLLUTANT	**PM**

Pre-Test Traverse

Client: **Hollingsworth and Vose**
Location: **Corvallis OR**
Source: **CFU112**

Stack Temp: 190 °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	1.40	0
2	1.50	3
3	1.60	0
4	1.70	0
5	1.70	5
6	1.40	0
7	1.20	0
8	1.00	0
9	1.00	0
10	1.20	5
11	1.30	5
12	1.50	0
13	1.70	0
14	1.70	5
15	1.60	0
16	1.40	2
17		
18		
19		
20		
21		
22		
23		
24		
Average:	1.43	2

Flow is found to be: Non-cyclonic

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth and Vose**	**Run:**	**1**
Location:	**Corvallis OR**	**Start Time:**	**7:55**
Source:	**CFU112**	**End Time:**	**11:02**
EPA Method:	**Modified M5**	**Date:**	**11/2/2022**
Box Operator:	**MK**		
Technician(s):	**CMF**		

Environmental Conditions/Test Notes:
39 RAINY 2-4 MPH OUT OF SOUTH WEST

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box 12	Probe ID	4C	Liner type	Glass		
Y factor	1.0313	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.84	Hot box ID	B4	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	4C	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	4				

Source Information:

Barometric Pressure	29.72	"Hg	O_2	20.10	%
Static Pressure	-0.5	"H_2O	CO_2	0.50	%
Ave. ΔP	1.32	"H_2O	Rec. Nz.	0.199	inches
Stack Temperature	200	°F			
Assumed moisture	1.50	%			
Assumed meter temp.	75	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	14	8

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	WS2	

Post Test Calculations:

Sample volume	155.813	dcf	Ave. ΔP	1.241	"H_2O
Wet mol. weight	28.69	M_s (actual)	Ave. √ΔP	1.112	"H_2O
Actual H_2O	1.77	%	Ave. ΔH	2.675	"H_2O
Std. meter vol.	159.826	dscf	Ave. T_s	233.0	°F
Isokinetic Average	100.3	%	Ave. T_m	70.8	°F

Moisture/Lab:

Filter, #	PTFE1		
	Initial	Final	Gain
Impingers, g	2,293.7	2,322.2	28.5
Silica gel, g	896.0	928.4	32.4
		Total water gain, g:	60.9

Traverse Point	Time (min.)	Meter Volume (dcf) 0.000	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
1	7.5	5.020	0.75	220	64	1.62	1.60	1	248	37
2	15.0	11.390	1.20	229	65	2.57	2.60	1	248	39
3	22.5	18.010	1.30	230	66	2.79	2.80	1.5	255	40
4	30.0	24.510	1.30	227	67	2.80	2.80	1.5	250	45
5	37.5	30.740	1.10	227	69	2.38	2.40	1.5	257	48
6	45.0	36.890	1.10	228	69	2.38	2.40	1.5	255	50
7	52.5	43.520	1.30	228	70	2.81	2.80	1.5	251	54
8	60.0	50.130	1.40	229	70	3.03	3.00	1.5	250	56
9	67.5	57.120	1.30	233	71	2.80	2.80	1.5	252	60
10	75.0	63.610	1.30	234	72	2.80	2.80	1.5	248	60
11	82.5	70.320	1.30	237	72	2.79	2.80	1.5	249	60
12	90.0	77.384	1.40	238	73	3.00	3.00	1.5	248	60
13	97.5	83.020	0.94	235	72	2.02	2.00	1.5	256	51
14	105.0	89.230	1.10	233	72	2.37	2.40	1.5	242	51
15	112.5	95.740	1.20	237	72	2.57	2.60	1.5	250	53
16	120.0	102.150	1.20	238	72	2.57	2.60	1.5	249	54
17	127.5	109.050	1.30	240	73	2.78	2.80	1.5	250	56
18	135.0	115.900	1.40	239	73	3.00	3.00	1.5	264	56
19	142.5	122.530	1.30	238	73	2.79	2.80	1.5	250	55
20	150.0	129.210	1.40	236	73	3.01	3.00	1.5	234	55
21	157.5	135.910	1.30	231	73	2.82	2.80	1.5	252	53
22	165.0	142.530	1.30	231	73	2.82	2.80	1.5	262	53
23	172.5	149.190	1.30	237	71	2.78	2.80	1.5	250	54
24	180.0	155.813	1.30	237	74	2.80	2.80	1.5	254	54

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth and Vose**		**Run:** **2**
Location:	**Corvallis OR**		**Start Time:** **11:40**
Source:	**CFU112**		**End Time:** **15:01**
EPA Method:	**Modified M5**	**Environmental Conditions/Test Notes:**	**Date:** **11/2/2022**
Box Operator:	**MK**	39 RAINY 2-4 MPH OUT OF SOUTH WEST	
Technician(s):	**CMF**		

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box 12	Probe ID	4C	Liner type	Glass		
Y factor	1.0313	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.84	Hot box ID	B4	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	4C	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	4				

Source Information:

Barometric Pressure	29.98	"Hg	O_2	20.10	%
Static Pressure	-0.5	"H_2O	CO_2	0.50	%
Ave. ΔP	1.32	"H_2O	Rec. Nz.	0.201	inches
Stack Temperature	200	°F			
Assumed moisture	1.77	%			
Assumed meter temp.	70.8	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	9

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	WS2	

Post Test Calculations:

Sample volume	155.506	dcf	Ave. ΔP	1.217	"H_2O
Wet mol. weight	28.67	M_s (actual)	Ave. √ΔP	1.101	"H_2O
Actual H_2O	1.94	%	Ave. ΔH	2.621	"H_2O
Std. meter vol.	159.941	dscf	Ave. T_s	235.8	°F
Isokinetic Average	101.3	%	Ave. T_m	73.9	°F

Moisture/Lab:

Filter, #	PTFE 2		
	Initial	Final	Gain
Impingers, g	2,260.3	2,292.1	31.8
Silica gel, g	890.6	926.0	35.4
		Total water gain:	67.2

Traverse Point	Time (min.)	Meter Volume (dcf) 0.000	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
1	7.5	5.640	0.92	232	71	1.98	2.00	2.5	260	47
2	15.0	11.120	1.00	235	72	2.14	2.10	4	247	47
3	22.5	16.970	1.10	239	72	2.34	2.30	5	249	49
4	30.0	23.310	1.20	238	72	2.56	2.60	6	250	51
5	37.5	30.000	1.30	236	73	2.79	2.80	7.5	249	54
6	45.0	36.750	1.40	236	73	3.00	3.00	7.5	251	56
7	52.5	43.480	1.30	234	74	2.80	2.80	7.5	243	57
8	60.0	50.180	1.30	234	74	2.80	2.80	7.5	250	58
9	67.5	56.350	1.10	234	74	2.37	2.40	7.5	254	58
10	75.0	63.000	1.20	235	75	2.58	2.60	7.5	249	58
11	82.5	69.850	1.40	235	75	3.02	3.00	8	255	58
12	90.0	76.782	1.30	235	75	2.80	2.80	7.5	255	58
13	97.5	82.500	0.98	230	74	2.12	2.10	7.5	249	46
14	105.0	88.480	1.00	234	73	2.15	2.20	7.5	256	46
15	112.5	94.910	1.20	234	73	2.58	2.60	7.5	257	47
16	120.0	101.380	1.20	238	73	2.56	2.60	7.5	253	49
17	127.5	108.230	1.30	238	73	2.78	2.80	7.5	251	49
18	135.0	114.710	1.20	240	74	2.56	2.60	7.5	247	51
19	142.5	121.140	1.20	236	75	2.58	2.60	7.5	254	50
20	150.0	127.850	1.30	236	74	2.79	2.80	7.5	252	51
21	157.5	134.770	1.40	235	75	3.02	3.00	8	249	51
22	165.0	141.660	1.30	236	76	2.80	2.80	7.5	252	53
23	172.5	148.550	1.20	238	76	2.58	2.60	7.5	252	55
24	180.0	155.506	1.40	240	77	3.01	3.00	8	251	56

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth and Vose**		**Run:** **3**
Location:	**Corvallis OR**		**Start Time:** **15:45**
Source:	**CFU112**		**End Time:** **18:50**
EPA Method:	**Modified M5**	**Environmental Conditions/Test Notes:**	**Date:** **11/2/2022**
Box Operator:	**MK**	39 RAINY 2-4 MPH OUT OF SOUTH WEST	
Technician(s):	**CMF**		

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box 12	Probe ID	4C	Liner type	Glass		
Y factor	1.0313	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.84	Hot box ID	B4	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	4C	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	4				

Source Information:

Barometric Pressure	29.99	"Hg	O_2	20.10	%
Static Pressure	-0.5	"H_2O	CO_2	0.50	%
Ave. ΔP	1.32	"H_2O	Rec. Nz.	0.200	inches
Stack Temperature	200	°F			
Assumed moisture	1.94	%			
Assumed meter temp.	73.9	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	17	10

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	WS2	

Post Test Calculations:

Sample volume	158.401	dcf	Ave. ΔP	1.236	"H_2O
Wet mol. weight	28.72	M_s (actual)	Ave. √ΔP	1.11	"H_2O
Actual H_2O	1.48	%	Ave. ΔH	2.679	"H_2O
Std. meter vol.	161.872	dscf	Ave. T_s	232.5	°F
Isokinetic Average	101.0	%	Ave. T_m	77.6	°F

Moisture/Lab:

Filter, #	29.99		
	Initial	Final	Gain
Impingers, g	2,300.7	2,325.9	25.2
Silica gel, g	928.4	954.7	26.3
		Total water gain:	51.5

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		0.000								
1	7.5	6.250	1.10	206	74	2.46	2.50	4	250	53
2	15.0	12.250	1.00	213	75	2.22	2.20	4	258	52
3	22.5	18.380	1.20	219	75	2.64	2.60	5	251	54
4	30.0	25.230	1.30	222	76	2.85	2.90	5	250	56
5	37.5	31.760	1.20	227	76	2.61	2.60	5	256	62
6	45.0	38.200	1.10	232	77	2.38	2.40	5	254	63
7	52.5	44.860	1.20	233	77	2.59	2.60	5	247	64
8	60.0	51.520	1.30	234	77	2.81	2.80	5	252	54
9	67.5	58.210	1.30	235	78	2.81	2.80	5	248	54
10	75.0	65.230	1.40	235	77	3.02	3.00	5	250	53
11	82.5	72.080	1.30	235	78	2.81	2.80	6	250	53
12	90.0	78.880	1.30	237	78	2.80	2.80	6	249	53
13	97.5	84.700	0.97	240	76	2.07	2.10	5	252	52
14	105.0	91.270	1.10	236	78	2.37	2.40	5	251	53
15	112.5	98.030	1.20	238	78	2.58	2.60	5	251	53
16	120.0	104.530	1.20	237	79	2.59	2.60	5	237	52
17	127.5	111.070	1.30	237	79	2.81	2.80	5	250	53
18	135.0	117.840	1.30	238	79	2.80	2.80	5	250	53
19	142.5	124.550	1.30	238	79	2.80	2.80	5	251	53
20	150.0	131.270	1.20	238	80	2.59	2.60	5	250	53
21	157.5	138.000	1.30	239	79	2.80	2.80	5	249	53
22	165.0	144.830	1.40	238	79	3.02	3.00	6	259	53
23	172.5	151.610	1.40	237	79	3.02	3.00	6	250	53
24	180.0	158.401	1.30	237	79	2.81	2.80	5	250	53

EPA Method 4
Impinger Weights Summary

Client:	**Hollingsworth and Vose**
Location:	**Corvallis OR**
Source:	**CFU112**
EPA Method:	**Modified M5**
Box Operator:	**MK**
Technician(s):	**CMF**

Run 1
Impinger gain by weight (g):

#	Initial	Final	Gain
1	812.6	759.3	-53.3
2	820.1	876.0	55.9
3	661.0	686.9	25.9
4			
5			
6			
Totals:	2,293.7	2,322.2	28.5

Run 2
Impinger gain by weight (g):

#	Initial	Final	Gain
1	806.1	786.6	-19.5
2	779.2	817.9	38.7
3	675.0	687.6	12.6
4			
5			
6			
Totals:	2,260.3	2,292.1	31.8

Run 3
Impinger gain by weight (g):

#	Initial	Final	Gain
1	759.3	725.8	-33.5
2	876.0	922.5	46.5
3	665.4	677.6	12.2
4			
5			
6			
Totals:	2,300.7	2,325.9	25.2

BISON ENGINEERING, INC.

COMPANY	**Hollingsworth & Vose Fiber Company**
FACILITY	**Glass Plant 1**
LOCATION	**Corvallis OR**
SOURCE	**CFU112**
DATE	**11/02/22**
METHOD	**Oregon Method 5**
POLLUTANT	**Particulate Matter**

EPA Method 1
Stack Parameters and Traverse Points

Client: **Hollingsworth & Vose Fiber Company**
Location: **Corvallis OR**
Source: **CFU112**
Facility: **Glass Plant 1**

Type of Testing: P (P for Particulate; V for Velocity/Nonparticulate)
Type of Duct: C (C for circular; R for rectangular)

Number of ports available:	2	
Number of ports to be used:	2	
Port diameter:	5	inches
Sampling location height (approx.):		feet
Stack height (approx.):		feet
Circular ID (Rectangular Depth):	30.00	inches
Port depth and/or wall thickness:	6.00	inches
Stack width (Rectangular only):		inches

Equivalent Diameter
If rectangular = $\frac{2*Depth*Width}{Depth + Width}$ = 30.00 inches (If circular = duct ID)

Stack/duct area = 4.909 sq.feet 706.9 sq. inches

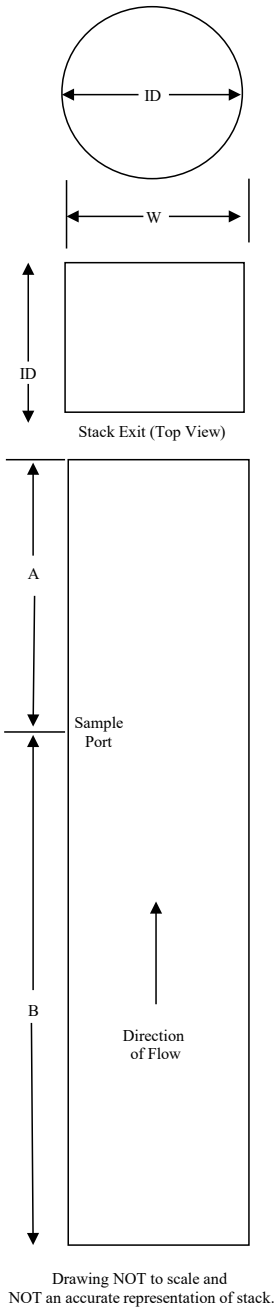
Sample Port Location:	Downstream flow disturbance from process B	Upstream flow disturbance toward exit A
Number of Inches:	145.00	96.00
Number of Diameters:	4.83	3.20

Minimum Number of Traverse Points: 24

Traverse points less than 1.0 inch from the stack wall are relocated to a distance of 1.0 inch.

Points	% of diameter	Distance from inside wall (in.)	Distance including port (in.)
1	2.1	0.63	6 5/8
2	6.7	2.01	8
3	11.8	3.54	9 1/2
4	17.7	5.31	11 1/4
5	25.0	7.50	13 1/2
6	35.6	10.68	16 5/8
7	64.4	19.32	25 3/8
8	75.0	22.50	28 1/2
9	82.3	24.69	30 3/4
10	88.2	26.46	32 1/2
11	93.3	27.99	34
12	97.9	29.37	35 3/8

Reference Diagram



Pre-Test Traverse

Client: **Hollingsworth & Vose Fiber Company**
Location: **Corvallis OR**
Source: **CFU112**

Stack Temp: 190 °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	1.40	0
2	1.50	3
3	1.60	0
4	1.70	0
5	1.70	5
6	1.40	0
7	1.20	0
8	1.00	0
9	1.00	0
10	1.20	5
11	1.30	5
12	1.50	0
13	1.70	0
14	1.70	5
15	1.60	0
16	1.40	2
17		
18		
19		
20		
21		
22		
23		
24		
Average:	1.43	2

Flow is found to be: Non-cyclonic

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**1**
Location:	**Corvallis OR**	**Start Time:**	**7:55**
Source:	**CFU112**	**End Time:**	**11:02**
EPA Method:	**Oregon Method 5**	**Date:**	**11/2/2022**
Box Operator:	**MK**		
Technician(s):	**CMF**		

Environmental Conditions/Test Notes:
39 RAINY 2-4 MPH OUT OF SOUTH WEST
Started with probe all they way in the stack

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	SB-2	Probe ID	1005200	Liner type	Glass		
Y factor	1.0010	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.737	Hot box ID	HHB8	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	1005200	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	6				

Source Information:

Barometric Pressure	29.72	"Hg	O_2	20.10	%
Static Pressure	-0.5	"H_2O	CO_2	0.50	%
Ave. ΔP	1.32	"H_2O	Rec. Nz.	0.199	inches
Stack Temperature	200	°F			
Assumed moisture	1.50	%			
Assumed meter temp.	75	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	12

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	WS2	

Post Test Calculations:

Sample volume	158.335	dcf	Ave. ΔP	1.210	"H_2O
Wet mol. weight	28.66	M_s (actual)	Ave. √ΔP	1.098	"H_2O
Actual H_2O	2.06	%	Ave. ΔH	2.429	"H_2O
Std. meter vol.	158.112	dscf	Ave. T_s	235.8	°F
Isokinetic Average	100.9	%	Ave. T_m	68.9	°F

Moisture/Lab:

Filter, #	Q75		
	Initial	Final	Gain
Impingers, g	2,136.6	2,175.8	39.2
Silica gel, g	914.3	945.7	31.4
		Total water gain, g:	70.6

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		397.000								
1	7.5	403.650	1.20	231	66	2.42	2.40	0.5	250	48
2	15.0	410.120	1.30	234	66	2.61	2.60	0.5	250	39
3	22.5	417.170	1.30	233	66	2.62	2.60	0.5	251	42
4	30.0	424.180	1.40	230	66	2.83	2.80	0.5	251	43
5	37.5	431.380	1.40	220	67	2.88	2.90	0.5	251	46
6	45.0	438.490	1.30	219	67	2.68	2.70	0.5	249	47
7	52.5	445.170	1.30	231	68	2.64	2.60	0.5	251	47
8	60.0	452.410	1.40	233	68	2.83	2.80	0.5	251	48
9	67.5	458.170	1.00	237	69	2.01	2.00	0.5	251	48
10	75.0	464.080	1.00	237	69	2.01	2.00	0.5	251	48
11	82.5	470.270	1.10	239	69	2.21	2.20	0.5	251	46
12	90.0	476.135	0.90	241	69	1.80	1.80	0.5	250	46
13	97.5	482.620	1.20	240	70	2.41	2.40	0.5	252	43
14	105.0	489.420	1.30	240	70	2.61	2.60	0.5	250	43
15	112.5	496.470	1.40	241	70	2.81	2.80	0.5	250	45
16	120.0	503.280	1.30	242	70	2.60	2.60	0.5	253	46
17	127.5	509.400	1.00	243	70	2.00	2.00	0.5	253	47
18	135.0	516.380	1.30	242	70	2.60	2.60	0.5	251	46
19	142.5	522.860	1.30	242	70	2.60	2.60	0.5	251	45
20	150.0	529.320	1.20	239	70	2.41	2.40	0.5	249	45
21	157.5	535.970	1.20	234	71	2.44	2.40	0.5	250	45
22	165.0	542.650	1.20	235	71	2.43	2.40	0.5	250	45
23	172.5	549.360	1.10	237	71	2.22	2.20	0.5	251	46
24	180.0	555.335	0.94	239	71	1.89	1.90	0.5	252	48

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**2**
Location:	**Corvallis OR**	**Start Time:**	**11:40**
Source:	**CFU112**	**End Time:**	**15:01**
EPA Method:	**Oregon Method 5**	**Date:**	**11/2/2022**
Box Operator:	**MK**		
Technician(s):	**CMF**		

Environmental Conditions/Test Notes:
39 RAINY 2-4 MPH OUT OF SOUTH WEST

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	SB-2	Probe ID	1005200	Liner type	Glass		
Y factor	1.001	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.737	Hot box ID	HHB8	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	1005200	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	6				

Source Information:

Barometric Pressure	29.98	"Hg	O_2	20.10	%
Static Pressure	-0.5	"H_2O	CO_2	0.50	%
Ave. ΔP	1.32	"H_2O	Rec. Nz.	0.201	inches
Stack Temperature	200	°F			
Assumed moisture	2.06	%			
Assumed meter temp.	68.9	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	8

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	WS2	

Post Test Calculations:

Sample volume	157.955	dcf	Ave. ΔP	1.195	"H_2O
Wet mol. weight	28.66	M_s (actual)	Ave. √ΔP	1.092	"H_2O
Actual H_2O	1.98	%	Ave. ΔH	2.392	"H_2O
Std. meter vol.	158.161	dscf	Ave. T_s	240.1	°F
Isokinetic Average	101.3	%	Ave. T_m	72.0	°F

Moisture/Lab:

Filter, #	Q76		
	Initial	Final	Gain
Impingers, g	2,241.5	2,276.0	34.5
Silica gel, g	935.8	969.1	33.3
		Total water gain:	67.8

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		555.910								
1	7.5	562.770	1.30	241	70	2.58	2.60	0.5	252	51
2	15.0	569.930	1.40	243	71	2.78	2.80	0.5	252	52
3	22.5	577.110	1.40	243	71	2.78	2.80	0.5	255	54
4	30.0	583.960	1.30	242	71	2.58	2.60	0.5	250	54
5	37.5	590.900	1.20	239	71	2.40	2.40	0.5	253	53
6	45.0	597.620	1.30	238	71	2.60	2.60	0.5	250	52
7	52.5	604.300	1.20	237	72	2.41	2.40	0.5	250	54
8	60.0	610.840	1.20	237	72	2.41	2.40	0.5	252	54
9	67.5	617.200	1.10	238	72	2.20	2.20	0.5	249	54
10	75.0	623.760	1.10	238	72	2.20	2.20	0.5	251	54
11	82.5	630.220	1.10	238	72	2.20	2.20	0.5	249	54
12	90.0	636.380	0.90	238	72	1.80	1.80	0.5	250	54
13	97.5	643.000	1.30	238	72	2.60	2.60	0.5	253	48
14	105.0	649.610	1.20	240	72	2.40	2.40	0.5	250	50
15	112.5	656.090	1.30	241	72	2.59	2.60	0.5	250	52
16	120.0	662.890	1.30	240	71	2.59	2.60	0.5	250	53
17	127.5	669.500	1.20	240	72	2.40	2.40	0.5	250	53
18	135.0	675.670	1.10	242	72	2.19	2.20	0.5	250	55
19	142.5	682.190	1.20	240	73	2.40	2.40	0.5	252	55
20	150.0	688.780	1.20	250	73	2.37	2.40	0.5	250	55
21	157.5	695.050	1.10	238	73	2.21	2.20	0.5	250	56
22	165.0	701.590	1.20	239	73	2.41	2.40	0.5	252	56
23	172.5	708.130	1.20	240	73	2.40	2.40	0.5	250	57
24	180.0	713.865	0.89	242	74	1.78	1.80	0.5	250	58

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**3**
Location:	**Corvallis OR**	**Start Time:**	**15:45**
Source:	**CFU112**	**End Time:**	**18:50**
EPA Method:	**Oregon Method 5**	**Date:**	**11/2/2022**
Box Operator:	**MK**		
Technician(s):	**CMF**		

Environmental Conditions/Test Notes:
39 RAINY 2-4 MPH OUT OF SOUTH WEST

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	SB-2	Probe ID	1005200	Liner type	Glass		
Y factor	1.001	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.737	Hot box ID	HHB8	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	1005200	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	6				

Source Information:

Barometric Pressure	29.99	"Hg	O_2	20.10	%
Static Pressure	-0.5	"H_2O	CO_2	0.50	%
Ave. ΔP	1.32	"H_2O	Rec. Nz.	0.201	inches
Stack Temperature	200	°F			
Assumed moisture	1.98	%			
Assumed meter temp.	72	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	17	12

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	WS2	

Post Test Calculations:

Sample volume	159.660	dcf	Ave. ΔP	1.206	"H_2O
Wet mol. weight	28.69	M_s (actual)	Ave. √ΔP	1.097	"H_2O
Actual H_2O	1.76	%	Ave. ΔH	2.429	"H_2O
Std. meter vol.	158.891	dscf	Ave. T_s	235.8	°F
Isokinetic Average	100.8	%	Ave. T_m	75.5	°F

Moisture/Lab:

Filter, #	Q77		
	Initial	Final	Gain
Impingers, g	2,110.4	2,136.2	25.8
Silica gel, g	945.4	979.9	34.5
		Total water gain:	60.3

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		714.130								
1	7.5	721.100	1.30	210	74	2.73	2.70	0.5	251	56
2	15.0	728.130	1.30	217	74	2.70	2.70	0.5	251	58
3	22.5	734.890	1.40	224	74	2.88	2.90	0.5	250	61
4	30.0	741.920	1.30	227	75	2.67	2.70	0.5	250	62
5	37.5	748.600	1.20	232	75	2.44	2.40	0.5	250	62
6	45.0	755.560	1.30	234	75	2.64	2.60	0.5	249	67
7	52.5	762.190	1.20	235	75	2.43	2.40	0.5	251	66
8	60.0	768.550	1.10	238	75	2.22	2.20	0.5	250	61
9	67.5	774.820	1.10	238	75	2.22	2.20	0.5	251	55
10	75.0	781.540	1.20	239	76	2.42	2.40	0.5	250	52
11	82.5	787.990	1.10	238	75	2.22	2.20	0.5	250	50
12	90.0	794.650	1.10	239	76	2.22	2.20	0.5	250	49
13	97.5	801.840	1.40	240	77	2.83	2.80	0.5	250	49
14	105.0	808.420	1.20	240	71	2.40	2.40	0.5	252	49
15	112.5	815.630	1.50	240	70	2.99	3.00	0.5	251	49
16	120.0	821.990	1.10	241	77	2.22	2.20	0.5	252	50
17	127.5	829.000	1.20	241	77	2.42	2.40	0.5	251	49
18	135.0	835.970	1.30	241	77	2.62	2.60	0.5	251	50
19	142.5	842.250	1.10	241	77	2.22	2.20	0.5	250	50
20	150.0	848.650	1.20	241	77	2.42	2.40	0.5	251	50
21	157.5	855.210	1.10	242	77	2.22	2.20	0.5	250	50
22	165.0	861.530	1.20	243	77	2.41	2.40	0.5	251	50
23	172.5	867.970	1.10	240	77	2.22	2.20	0.5	251	50
24	180.0	873.790	0.94	239	78	1.90	1.90	0.5	250	50

EPA Method 4
Impinger Weights Summary

Client: **Hollingsworth & Vose Fiber Company**
Location: **Corvallis OR**
Source: **CFU112**
EPA Method: **Oregon Method 5**
Box Operator: **MK**
Technician(s): **CMF**

Run 1
Impinger gain by weight (g):

#	Initial	Final	Gain
1	769.5	762.2	-7.3
2	747.1	781.4	34.3
3	620.0	632.2	12.2
4			
5			
6			
Totals:	2,136.6	2,175.8	39.2

Run 2
Impinger gain by weight (g):

#	Initial	Final	Gain
1	768.1	763.8	-4.3
2	781.1	811.5	30.4
3	692.3	700.7	8.4
4			
5			
6			
Totals:	2,241.5	2,276.0	34.5

Run 3
Impinger gain by weight (g):

#	Initial	Final	Gain
1	731.8	715.2	-16.6
2	756.0	789.4	33.4
3	622.6	631.6	9.0
4			
5			
6			
Totals:	2,110.4	2,136.2	25.8

Oregon Methods 1-5
Filterable and Condensable Particulate
Results Summary

Client: **Hollingsworth & Vose Fiber Company**
Source: **CFU112**
Location: **Corvallis, OR**

Run			1	2	3	
Date			11/2/2022	11/2/2022	11/2/2022	
Run Start Time			7:55	11:40	15:45	
Run End Time			11:02	15:01	18:50	
Duration, min.			180	180	180	Average
Barometric Pressure, "Hg			29.72	29.98	29.99	**29.90**
Nozzle Dia., in.			0.225	0.225	0.225	**0.225**
Isokinetic Average, %			100.9	101.3	100.8	**101.0**
Sample Volume, dscf			158.112	158.161	158.891	**158.388**
Sample Volume, dscm			4.477	4.479	4.499	**4.485**
Stack Diameter, in.			30.00	30.00	30.00	**30.00**
Stack Area, sq.ft.			4.909	4.909	4.909	**4.909**
CO_2 %vd			0.50	0.50	0.50	**0.50**
O_2 %vd			20.10	20.10	20.10	**20.10**
Static Press., "H_2O			-0.50	-0.50	-0.50	**-0.50**
H_2O %v			2.06	1.98	1.76	**1.93**
Wet Molecular Weight, lb/lb-mole			28.66	28.66	28.69	**28.67**
Velocity, FPS			71.29	70.81	70.87	**70.99**
ADCFM			20,565	20,443	20,507	**20,505**
ACFM			20,998	20,856	20,874	**20,909**
DSCFM			15,480	15,427	15,576	**15,494**
Stack Temperature, ^{o}F			235.8	240.1	235.8	**237.2**
Filterable Particulate	Concentration, C_s	gr/dscf	0.00E+00	6.79E-05	2.54E-05	**3.11E-05**
		µg/dscm	0.0	155.3	58.1	**71.1**
	Mass	lb/hr	0.00E+00	8.97E-03	3.39E-03	**4.12E-03**
		lb/lb glass	0.00E+00	9.86E-06	3.70E-06	**4.52E-06**
Inorganic CPM	Concentration, C_s	gr/dscf	1.61E-04	0.00E+00	5.02E-05	**7.03E-05**
		µg/dscm	367.7	0.0	114.8	**160.8**
	Mass	lb/hr	2.13E-02	0.00E+00	6.70E-03	**9.34E-03**
		lb/lb glass	2.29E-05	0.00E+00	7.31E-06	**1.01E-05**
Organic CPM	Concentration, C_s	gr/dscf	1.52E-04	3.93E-04	6.80E-05	**2.04E-04**
		µg/dscm	347.8	900.2	155.6	**467.9**
	Mass	lb/hr	2.02E-02	5.20E-02	9.08E-03	**2.71E-02**
		lb/lb glass	2.16E-05	5.71E-05	9.91E-06	**2.96E-05**
Total PM Filterable + Condensable	Concentration, C_s	gr/dscf	ND 3.13E-04	ND 4.61E-04	ND 1.44E-04	ND **3.06E-04**
		µg/dscm	ND 715.5	ND 1055.5	ND 328.5	ND **699.8**
	Mass	lb/hr	ND 4.15E-02	ND 6.10E-02	ND 1.92E-02	ND **4.05E-02**
		lb/lb glass	ND 4.45E-05	ND 6.70E-05	ND 2.09E-05	ND **4.41E-05**
Production Data	Glass Fiber Pull Rate	lb/hr	931.9	910.3	916.1	**919.4**

ND - Non-detect. Measured total PM was less than the ODEQ Method 5 analytical detection limit specified in the ODEQ Source Sampling Manual.

Isokinetic Field Data
Field Data and Calculations
Particulate Emissions and Gas Stream Characteristics

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**1**
Source:	**CFU112**	**Date:**	**11/2/2022**
Location:	**Corvallis, OR**	**Start Time:**	**7:55**
Method:	**ODEQ 5**	**End Time:**	**11:02**

Sampling Data				Traverse Data			
Time	**Meter**	**ΔH**	**Meter**	**Traverse**	**Dp**	**Stack**	
min.	**ft^3**	**"H_2O**	**T_m ^oF**	**Point**	**"H_2O**	**T_s ^oF**	**√Dp**
	397.000						
8	403.650	2.40	66	1	1.20	231	1.095
15	410.120	2.60	66	2	1.30	234	1.140
23	417.170	2.60	66	3	1.30	233	1.140
30	424.180	2.80	66	4	1.40	230	1.183
38	431.380	2.90	67	5	1.40	220	1.183
45	438.490	2.70	67	6	1.30	219	1.140
53	445.170	2.60	68	7	1.30	231	1.140
60	452.410	2.80	68	8	1.40	233	1.183
68	458.170	2.00	69	9	1.00	237	1.000
75	464.080	2.00	69	10	1.00	237	1.000
83	470.270	2.20	69	11	1.10	239	1.049
90	476.135	1.80	69	12	0.90	241	0.949
98	482.620	2.40	70	13	1.20	240	1.095
105	489.420	2.60	70	14	1.30	240	1.140
113	496.470	2.80	70	15	1.40	241	1.183
120	503.280	2.60	70	16	1.30	242	1.140
128	509.400	2.00	70	17	1.00	243	1.000
135	516.380	2.60	70	18	1.30	242	1.140
143	522.860	2.60	70	19	1.30	242	1.140
150	529.320	2.40	70	20	1.20	239	1.095
158	535.970	2.40	71	21	1.20	234	1.095
165	542.650	2.40	71	22	1.20	235	1.095
173	549.360	2.20	71	23	1.10	237	1.049
180	555.335	1.90	71	24	0.94	239	0.970

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**1**
Source:	**Corvallis, OR**	**Date:**	**11/02/22**

Field Data Input Continued

Moisture Data			Stack Dimensional Data:		
Total Test Time	180.0	min	Circular		
Sample Time Interval	7.5	min	Diameter	30.000	in
Meter Volume, V_m	158.335	dcf	Rectangular		
Water Weight	70.6	g	Width		in
Nozzle Diameter, N_z	0.225	in.	Length		in
Nozzle Area	0.000276	sq.ft.	Stack Area	4.909	sq.ft.
Traverse Data			Molecular Weight:		
Barometric Pressure, P_b	29.72	"Hg	CO_2 Average	0.50	%vd
Static Pressure	-0.50	"H_2O	O_2 Average	20.10	%vd
Pitot Factor, C_p	0.84				
Meter Cal Factor	1.0010	Y			

Field Data Averages

Meter			Stack		
ΔH	2.429	"H_2O	√Dp	1.098	"H_2O
Temperature, T_m	68.9	^oF	Temperature, T_s	235.8	^oF
Temperature, T_m	528.6	^oA (^oR)	Temperature, T_s	695.5	^oA (R)
Pressure Meter, P_m	29.899	"Hg	Pressure Stack, P_s	29.683	"Hg

Field Data Calculations

Meter Box Capture			EPA Method 2 Stack Gas Flowrate:		
Standard Volume, $V_{m(std)}$	158.112	dscf	Velocity, V_s	71.29	fps
	4.477	dscm	Volume (actual)	20,998	acfm
Actual Volume, $V_{m(actual)}$	214.475	awcf		20,565	adcfm
Gas Stream Moisture			Volume (standard)	948,319	wscf/hr
Moisture Vapor, $V_{w(std)}$	3.329	scf		928,784	dscf/hr
Moisture, B_{ws}	0.0206			15,480	dscf/min
Moisture EPA M4	2.06	%v		15,805	wscf/min
Moisture @ Saturation	NA	%v (for T_s < 212°F)			
EPA Method 3 Gas Density					
Dry, M_d	28.88	lb/lb-mole			
Wet, M_s	28.66	lb/lb-mole			
Percent Isokinetic	100.9	%			

Laboratory Results

EPA Method 5					
Filterable PM	0.0000	grams			
Emissions:					
Concentration, C_s	0.00E+00	gr/dscf			
	0.0	µg/dscm			
Mass Emissions	0.00E+00	lb/hr			
Back Half:					
Inorganic CPM	0.0016	grams	Organic CPM	0.0016	grams
Inorganic CPM, C_s	1.61E-04	gr/dscf	Organic CPM, C_s	1.52E-04	gr/dscf
	367.7	µg/dscm		347.8	µg/dscm
Mass Emissions	2.13E-02	lb/hr	Mass Emissions	2.02E-02	lb/hr

Isokinetic Field Data
Field Data and Calculations
Particulate Emissions and Gas Stream Characteristics

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**2**
Source:	**CFU112**	**Date:**	**11/2/2022**
Location:	**Corvallis, OR**	**Start Time:**	**11:40**
Method:	**ODEQ 5**	**End Time:**	**15:01**

Sampling Data				Traverse Data			
Time	**Meter**	**ΔH**	**Meter**	**Traverse**	**Dp**	**Stack**	
min.	**ft^3**	**"H_2O**	**T_m °F**	**Point**	**"H_2O**	**T_s °F**	**√Dp**
	555.910						
8	562.770	2.60	70	1	1.30	241	1.140
15	569.930	2.80	71	2	1.40	243	1.183
23	577.110	2.80	71	3	1.40	243	1.183
30	583.960	2.60	71	4	1.30	242	1.140
38	590.900	2.40	71	5	1.20	239	1.095
45	597.620	2.60	71	6	1.30	238	1.140
53	604.300	2.40	72	7	1.20	237	1.095
60	610.840	2.40	72	8	1.20	237	1.095
68	617.200	2.20	72	9	1.10	238	1.049
75	623.760	2.20	72	10	1.10	238	1.049
83	630.220	2.20	72	11	1.10	238	1.049
90	636.380	1.80	72	12	0.90	238	0.949
98	643.000	2.60	72	13	1.30	238	1.140
105	649.610	2.40	72	14	1.20	240	1.095
113	656.090	2.60	72	15	1.30	241	1.140
120	662.890	2.60	71	16	1.30	240	1.140
128	669.500	2.40	72	17	1.20	240	1.095
135	675.670	2.20	72	18	1.10	242	1.049
143	682.190	2.40	73	19	1.20	240	1.095
150	688.780	2.40	73	20	1.20	250	1.095
158	695.050	2.20	73	21	1.10	238	1.049
165	701.590	2.40	73	22	1.20	239	1.095
173	708.130	2.40	73	23	1.20	240	1.095
180	713.865	1.80	74	24	0.89	242	0.943

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**2**
Source:	**Corvallis, OR**	**Date:**	**11/02/22**

Field Data Input Continued

Moisture Data			Stack Dimensional Data:		
Total Test Time	180.0	min	Circular		
Sample Time Interval	7.5	min	Diameter	30.000	in
Meter Volume, V_m	157.955	dcf	Rectangular		
Water Weight	67.8	g	Width		in
Nozzle Diameter, N_z	0.225	in.	Length		in
Nozzle Area	0.000276	sq.ft.	Stack Area	4.909	sq.ft.
Traverse Data			Molecular Weight:		
Barometric Pressure, P_b	29.98	"Hg	CO_2 Average	0.50	%vd
Static Pressure	-0.50	"H_2O	O_2 Average	20.10	%vd
Pitot Factor, C_p	0.84				
Meter Cal Factor	1.0010	Y			

Field Data Averages

Meter			Stack		
ΔH	2.392	"H_2O	√Dp	1.092	"H_2O
Temperature, T_m	72.0	^oF	Temperature, T_s	240.1	^oF
Temperature, T_m	531.7	^oA (^oR)	Temperature, T_s	699.8	^oA (R)
Pressure Meter, P_m	30.156	"Hg	Pressure Stack, P_s	29.943	"Hg

Field Data Calculations

Meter Box Capture			EPA Method 2 Stack Gas Flowrate:		
Standard Volume, $V_{m(std)}$	158.161	dscf	Velocity, V_s	70.81	fps
	4.479	dscm	Volume (actual)	20,856	acfm
Actual Volume, $V_{m(actual)}$	213.818	awcf		20,443	adcfm
Gas Stream Moisture			Volume (standard)	944,346	wscf/hr
Moisture Vapor, $V_{w(std)}$	3.197	scf		925,648	dscf/hr
Moisture, B_{ws}	0.0198			15,427	dscf/min
Moisture EPA M4	1.98	%v		15,739	wscf/min
Moisture @ Saturation	NA	%v (for T_s < 212°F)			
EPA Method 3 Gas Density					
Dry, M_d	28.88	lb/lb-mole			
Wet, M_s	28.66	lb/lb-mole			
Percent Isokinetic	101.3	%			

Laboratory Results

Front Half:					
Filterable PM	0.0007	grams			
Emissions:					
Concentration, C_s	6.79E-05	gr/dscf			
	155.3	µg/dscm			
Mass Emissions	8.97E-03	lb/hr			
Back Half:					
Inorganic CPM	0.0000	grams	Organic CPM	0.0040	grams
Inorganic CPM, C_s	0.00E+00	gr/dscf	Organic CPM, C_s	3.93E-04	gr/dscf
	0.0	µg/dscm		900.2	µg/dscm
Mass Emissions	0.00E+00	lb/hr	Mass Emissions	5.20E-02	lb/hr

Isokinetic Field Data
Field Data and Calculations
Particulate Emissions and Gas Stream Characteristics

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**3**
Source:	**CFU112**	**Date:**	**11/2/2022**
Location:	**Corvallis, OR**	**Start Time:**	**15:45**
Method:	**ODEQ 5**	**End Time:**	**18:50**

Sampling Data				Traverse Data			
Time	**Meter**	**ΔH**	**Meter**	**Traverse**	**Dp**	**Stack**	
min.	**ft^3**	**"H_2O**	**T_m ^oF**	**Point**	**"H_2O**	**T_s ^oF**	**√Dp**
	714.130						
8	721.100	2.70	74	1	1.30	210	1.140
15	728.130	2.70	74	2	1.30	217	1.140
23	734.890	2.90	74	3	1.40	224	1.183
30	741.920	2.70	75	4	1.30	227	1.140
38	748.600	2.40	75	5	1.20	232	1.095
45	755.560	2.60	75	6	1.30	234	1.140
53	762.190	2.40	75	7	1.20	235	1.095
60	768.550	2.20	75	8	1.10	238	1.049
68	774.820	2.20	75	9	1.10	238	1.049
75	781.540	2.40	76	10	1.20	239	1.095
83	787.990	2.20	75	11	1.10	238	1.049
90	794.650	2.20	76	12	1.10	239	1.049
98	801.840	2.80	77	13	1.40	240	1.183
105	808.420	2.40	71	14	1.20	240	1.095
113	815.630	3.00	70	15	1.50	240	1.225
120	821.990	2.20	77	16	1.10	241	1.049
128	829.000	2.40	77	17	1.20	241	1.095
135	835.970	2.60	77	18	1.30	241	1.140
143	842.250	2.20	77	19	1.10	241	1.049
150	848.650	2.40	77	20	1.20	241	1.095
158	855.210	2.20	77	21	1.10	242	1.049
165	861.530	2.40	77	22	1.20	243	1.095
173	867.970	2.20	77	23	1.10	240	1.049
180	873.790	1.90	78	24	0.94	239	0.970

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**3**
Source:	**Corvallis, OR**	**Date:**	**11/02/22**

Field Data Input Continued

Moisture Data			Stack Dimensional Data:		
Total Test Time	180.0	min	Circular		
Sample Time Interval	7.5	min	Diameter	30.000	in
Meter Volume, V_m	159.660	dcf	Rectangular		
Water Weight	60.3	g	Width		in
Nozzle Diameter, N_z	0.225	in.	Length		in
Nozzle Area	0.000276	sq.ft.	Stack Area	4.909	sq.ft.
Traverse Data			Molecular Weight:		
Barometric Pressure, P_b	29.99	"Hg	CO_2 Average	0.50	%vd
Static Pressure	-0.50	"H_2O	O_2 Average	20.10	%vd
Pitot Factor, C_p	0.84				
Meter Cal Factor	1.0010	Y			

Field Data Averages

Meter			Stack		
ΔH	2.429	"H_2O	√Dp	1.097	"H_2O
Temperature, T_m	75.5	^oF	Temperature, T_s	235.8	^oF
Temperature, T_m	535.2	^oA (^oR)	Temperature, T_s	695.5	^oA (R)
Pressure Meter, P_m	30.169	"Hg	Pressure Stack, P_s	29.953	"Hg

Field Data Calculations

Meter Box Capture			EPA Method 2 Stack Gas Flowrate:		
Standard Volume, $V_{m(std)}$	158.891	dscf	Velocity, V_s	70.87	fps
	4.499	dscm	Volume (actual)	20,874	acfm
Actual Volume, $V_{m(actual)}$	212.936	awcf		20,507	adcfm
Gas Stream Moisture			Volume (standard)	951,307	wscf/hr
Moisture Vapor, $V_{w(std)}$	2.844	scf		934,564	dscf/hr
Moisture, B_{ws}	0.0176			15,576	dscf/min
Moisture EPA M4	1.76	%v		15,855	wscf/min
Moisture @ Saturation	NA	%v (for T_s < 212°F)			
EPA Method 3 Gas Density					
Dry, M_d	28.88	lb/lb-mole			
Wet, M_s	28.69	lb/lb-mole			
Percent Isokinetic	100.8	%			

Laboratory Results

Front Half:					
Filterable PM	0.0003	grams			
Emissions:					
Concentration, C_s	2.54E-05	gr/dscf			
	58.1	µg/dscm			
Mass Emissions	3.39E-03	lb/hr			
Back Half:					
Inorganic CPM	0.0005	grams	Organic CPM	0.0007	grams
Inorganic CPM, C_s	5.02E-05	gr/dscf	Organic CPM, C_s	6.80E-05	gr/dscf
	114.8	µg/dscm		155.6	µg/dscm
Mass Emissions	6.70E-03	lb/hr	Mass Emissions	9.08E-03	lb/hr

Oregon Method 5
Filterable and Condensable Particulate
Laboratory Gravimetric Data

Client: **Hollingsworth & Vose Fiber Company**
Source: **CFU112**
Location: **Corvallis, OR**

Run	Sample Description	g, #	Initial (grams)	Final (grams)	Net Gain	Blank Correction	Corrected Gain (grams)	
1	CPM Organics (Acetone BH)	123.9	43.6584	43.6600	0.0016	0.0010	**0.0006**	
	Probe Rinse (Acetone FH)	102.3	43.4925	43.4933	0.0008	0.0009	**0.0000**	
	Filter	Q75	0.4725	0.4722	-0.0003		**0.0000**	
	CPM Inorganics (Water)	407	43.4782	43.4809	0.0027	0.0011	**0.0016**	
	CPM Organics (Hexane BH)	80.5	51.6541	51.6551	0.0010	0.0000	**0.0010**	
	Impinger H_2O Gain, mls		200	239.2	39.2			
						Filterable PM (g)	**0.0000**	
						Total PM (g)	**0.0032**	**ND**
2	CPM Organics (Acetone BH)	126.9	51.3775	51.3809	0.0034	0.0011	**0.0023**	
	Probe Rinse (Acetone FH)	83.7	45.5955	45.5969	0.0014	0.0007	**0.0007**	
	Filter	Q76	0.4686	0.4683	-0.0003		**0.0000**	
	CPM Inorganics (Water)	420	44.8043	44.8043	0.0000	0.0011	**0.0000**	
	CPM Organics (Hexane BH)	86.3	44.8120	44.8137	0.0017	0.0000	**0.0017**	
	Impinger H_2O Gain, mls		200	235	34.5			
						Filterable PM (g)	**0.0007**	
						Total PM (g)	**0.0047**	**ND**
3	CPM Organics (Acetone BH)	118.7	50.4816	50.4810	-0.0006	0.0010	**0.0000**	
	Probe Rinse (Acetone FH)	111.5	48.6983	48.6995	0.0012	0.0009	**0.0003**	
	Filter	Q77	0.4726	0.4721	-0.0005		**0.0000**	
	CPM Inorganics (Water)	418	51.7155	51.7171	0.0016	0.0011	**0.0005**	
	CPM Organics (Hexane BH)	79.6	45.2814	45.2821	0.0007	0.0000	**0.0007**	
	Impinger H_2O Gain, mls		200	226	25.8			
						Filterable PM (g)	**0.0003**	
						Total PM (g)	**0.0015**	**ND**
	Acetone Blank	190.1	54.7478	54.7494	0.0016	8.42E-06	g/g	
	Water Blank	231.6	43.9987	43.9993	0.0006	2.59E-06	g/g	
	Hexane Blank	216.2	41.8344	41.8343	-0.0001	0.00E+00	g/g	

ND - Non-detect. Value is below the ODEQ Method 5 analytical detection limit specified in the ODEQ Source Sampling Manual (7 mg).

Bison Engineering, Inc.
Gravimetric Information

Client: Hollingsworth & Vose Fiber Company
Location: Corvallis, OR
Project Number: HAV222921
Test Date: 11/2/2022

Filters:

Sample Identification	Filter #	Date	Tare 1 (g)	Date	Tare 2 (g)	CHECK	Average	Filter #	Date	Final 1 (g)	Date	Final 2 (g)	CHECK	Average	Gain
HAV222921 CFU112 M5 Run1	Q75	9/16/2022	0.4726	9/21/2022	0.4724	-0.0002	0.4725	Q75	11/14/2022	0.4722	11/16/2022	0.4721	-0.0001	0.4722	-0.0003
HAV222921 CFU112 M5 Run2	Q76	9/16/2022	0.4685	9/21/2022	0.4687	0.0002	0.4686	Q76	11/14/2022	0.4682	11/16/2022	0.4683	0.0001	0.4683	-0.0003
HAV222921 CFU112 M5 Run3	Q77	9/16/2022	0.4726	9/21/2022	0.4726	0.0000	0.4726	Q77	11/14/2022	0.4721	11/16/2022	0.4720	-0.0001	0.4721	-0.0005

Liquid Fractions:

Wt (g)	Sample Identification	Dish #	Date	Tare 1 (g)	Date	Tare 2 (g)	CHECK	Average	Dish #	Date	Final 1 (g)	Date	Final 2 (g)	CHECK	Average	Gain
102.3	HAV222921 CFU 112 Probe Rinse R1	60	10/19/2022	43.4925	10/20/2022	43.4924	-0.0001	43.4925	60	11/22/2022	43.4932	11/23/2022	43.4934	0.0002	43.4933	0.0008
83.7	HAV222921 CFU 112 Probe Rinse R2	61	10/19/2022	45.5955	10/20/2022	45.5954	-0.0001	45.5955	61	11/22/2022	45.5971	11/23/2022	45.5966	-0.0005	45.5969	0.0014
111.5	HAV222921 CFU 112 Probe Rinse R3	62	10/19/2022	48.6983	10/20/2022	48.6983	0.0000	48.6983	62	11/22/2022	48.6995	11/23/2022	48.6995	0.0000	48.6995	0.0012
123.9	HAV222921 CFU 112 Organic Run 1	63	10/19/2022	43.6581	10/20/2022	43.6586	0.0005	43.6584	63	11/22/2022	43.6601	11/23/2022	43.6598	-0.0003	43.6600	0.0016
126.9	HAV222921 CFU 112 Organic Run 2	64	10/28/2022	51.3776	11/1/2022	51.3773	-0.0003	51.3775	64	11/22/2022	51.3806	11/23/2022	51.3811	0.0005	51.3809	0.0034
118.7	HAV222921 CFU 112 Organic Run 3	65	10/28/2022	50.4816	11/1/2022	50.4816	0.0000	50.4816	65	11/23/2022	50.4808	11/28/2022	50.4811	0.0003	50.4810	-0.0006
80.5	HAV222921 CFU 112 Cont #6 Run 1	66	10/28/2022	51.6542	11/1/2022	51.6540	-0.0002	51.6541	66	11/23/2022	51.6553	11/28/2022	51.6548	-0.0005	51.6551	0.0010
86.3	HAV222921 CFU 112 Cont #6 Run 2	67	10/28/2022	44.8118	11/1/2022	44.8121	0.0003	44.8120	67	11/23/2022	44.8138	11/28/2022	44.8135	-0.0003	44.8137	0.0017
79.6	HAV222921 CFU 112 Cont #6 Run 3	68	10/28/2022	45.2813	11/1/2022	45.2814	0.0001	45.2814	68	11/23/2022	45.2818	11/28/2022	45.2823	0.0005	45.2821	0.0007
446	HAV222921 CFU 112 Inorganic Run 1	1	11/18/2022	43.4783	11/21/2022	43.4781	-0.0002	43.4782	1	12/2/2022	43.4811	12/5/2022	43.4806	-0.0005	43.4809	0.0027
454.2	HAV222921 CFU 112 Inorganic Run 2	2	11/18/2022	44.8043	11/21/2022	44.8043	0.0000	44.8043	2	12/2/2022	44.8042	12/5/2022	44.8043	0.0001	44.8043	0.0000
444	HAV222921 CFU 112 Inorganic Run 3	3	11/15/2022	51.7157	11/16/2022	51.7152	-0.0005	51.7155	3	12/2/2022	51.7170	12/5/2022	51.7171	0.0001	51.7171	0.0016
190.1	HAV222921 Acetone Blank	96	11/14/2022	54.7476	11/18/2022	54.7479	0.0003	54.7478	96	11/29/2022	54.7492	11/30/2022	54.7496	0.0004	54.7494	0.0016
216.2	HAV222921 Hexane Blank	97	11/18/2022	41.8346	11/21/2022	41.8341	-0.0005	41.8344	97	11/29/2022	41.8341	11/30/2022	41.8345	0.0004	41.8343	-0.0001
231.6	HAV222921 HPLC Blank	13	11/21/2022	43.9988	11/22/2022	43.9985	-0.0003	43.9987	13	12/2/2022	43.9990	12/5/2022	43.9995	0.0005	43.9993	0.0006

BISON ENGINEERING, INC.

COMPANY	**Hollingsworth and Vose**
FACILITY	**Glass Plant 1**
LOCATION	**Corvallis OR**
SOURCE	**CFU108**
DATE	**11/03/22**
METHOD	**Modified Method 5**
POLLUTANT	**PM**

Pre-Test Traverse

Client: **Hollingsworth and Vose**
Location: **Corvallis OR**
Source: **CFU108**

Stack Temp: 220 °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	1.10	0
2	1.10	0
3	1.30	0
4	1.30	5
5	1.50	0
6	1.60	0
7	1.20	0
8	1.10	2
9	1.10	0
10	1.20	0
11	1.50	2
12	1.50	0
13	1.60	0
14	1.60	2
15	1.20	0
16	1.10	2
17		
18		
19		
20		
21		
22		
23		
24		
Average:	1.31	1

Flow is found to be: Non-cyclonic

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth and Vose**		**Run:** **1**
Location:	**Corvallis OR**		**Start Time:** **7:35**
Source:	**CFU108**		**End Time:** **10:40**
EPA Method:	**Modified Method 5**	**Environmental Conditions/Test Notes:**	**Date:** **11/3/2022**
Box Operator:	**JK**	Foggy 36F no wind	
Technician(s):	**CMF**		

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box 12	Probe ID	4C	Liner type	Glass		
Y factor	1.0313	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.84	Hot box ID	B4	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	4C	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	4				

Source Information:

Barometric Pressure	30.06	"Hg	O_2	19.88	%
Static Pressure	-0.3	"H_2O	CO_2	0.60	%
Ave. ΔP	1.3	"H_2O	Rec. Nz.	0.203	inches
Stack Temperature	220	°F			
Assumed moisture	1.50	%			
Assumed meter temp.	69	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	8

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	WS2	

Post Test Calculations:

Sample volume	154.749	dcf	Ave. ΔP	1.191	"H_2O
Wet mol. weight	28.78	M_s (actual)	Ave. √ΔP	1.09	"H_2O
Actual H_2O	1.04	%	Ave. ΔH	2.654	"H_2O
Std. meter vol.	160.831	dscf	Ave. T_s	208.6	°F
Isokinetic Average	99.9	%	Ave. T_m	69.8	°F

Moisture/Lab:

Filter, #	PTFE 4		
	Initial	Final	Gain
Impingers, g	2,279.4	2,290.7	11.3
Silica gel, g	926.1	950.8	24.7
		Total water gain, g:	36.0

Traverse Point	Time (min.)	Meter Volume (dcf) 0.000	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
1	7.5	6.070	1.10	208	62	2.42	2.40	2	245	39
2	15.0	12.140	1.10	209	62	2.41	2.40	2	250	39
3	22.5	18.230	1.10	209	64	2.42	2.40	2	253	41
4	30.0	24.750	1.20	208	66	2.66	2.70	2.5	255	45
5	37.5	31.300	1.20	211	67	2.65	2.70	2.5	253	48
6	45.0	37.890	1.20	211	69	2.66	2.70	2.5	246	52
7	52.5	44.150	1.10	211	69	2.44	2.40	2.5	248	54
8	60.0	50.400	1.10	211	70	2.44	2.40	2.5	249	53
9	67.5	56.630	1.10	212	70	2.44	2.40	2.5	251	54
10	75.0	63.720	1.40	210	71	3.12	3.10	3	243	56
11	82.5	71.150	1.50	209	71	3.35	3.40	3	248	59
12	90.0	77.800	1.30	209	71	2.90	2.90	2.5	247	59
13	97.5	83.260	0.99	208	71	2.21	2.20	2.5	248	59
14	105.0	89.620	1.10	207	72	2.47	2.50	2.5	248	60
15	112.5	96.000	1.10	206	72	2.47	2.50	2.5	247	59
16	120.0	102.170	1.00	206	72	2.25	2.20	2.5	249	59
17	127.5	108.400	1.10	206	71	2.47	2.50	2.5	254	56
18	135.0	114.970	1.20	208	72	2.69	2.70	3	251	57
19	142.5	121.480	1.20	207	72	2.69	2.70	3	249	56
20	150.0	127.890	1.20	207	72	2.69	2.70	2.5	246	56
21	157.5	134.700	1.30	207	72	2.92	2.90	2.5	246	56
22	165.0	140.590	1.30	209	72	2.91	2.90	3	257	57
23	172.5	147.600	1.30	209	72	2.91	2.90	3	252	57
24	180.0	154.749	1.40	209	72	3.13	3.10	3.1	252	57

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth and Vose**		**Run:** **2**
Location:	**Corvallis OR**		**Start Time:** **11:10**
Source:	**CFU108**		**End Time:** **14:15**
EPA Method:	**Modified Method 5**	**Environmental Conditions/Test Notes:**	**Date:** **11/3/2022**
Box Operator:	**JK**	Foggy 36F no wind	
Technician(s):	**CMF**		

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box 12	Probe ID	4C	Liner type	Glass		
Y factor	1.0313	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.84	Hot box ID	B4	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	4C	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	4				

Source Information:

Barometric Pressure	30.1	"Hg	O_2	19.88	%
Static Pressure	-0.3	"H_2O	CO_2	0.60	%
Ave. ΔP	1.3	"H_2O	Rec. Nz.	0.203	inches
Stack Temperature	220	°F			
Assumed moisture	1.04	%			
Assumed meter temp.	69.8	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	14

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	WS2	

Post Test Calculations:

Sample volume	161.346	dcf	Ave. ΔP	1.242	"H_2O
Wet mol. weight	28.71	M_s (actual)	Ave. √ΔP	1.112	"H_2O
Actual H_2O	1.63	%	Ave. ΔH	2.875	"H_2O
Std. meter vol.	166.707	dscf	Ave. T_s	202.6	°F
Isokinetic Average	101.5	%	Ave. T_m	73.9	°F

Moisture/Lab:

Filter, #	PTFE 5		
	Initial	Final	Gain
Impingers, g	2,307.5	2,332.2	24.7
Silica gel, g	896.1	930.0	33.9
		Total water gain:	58.6

Traverse Point	Time (min.)	Meter Volume (dcf) 0.000	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
1	7.5	5.910	1.00	203	70	2.27	2.30	4.5	256	49
2	15.0	12.170	1.10	202	71	2.50	2.50	5.5	245	46
3	22.5	18.540	1.20	201	72	2.74	2.70	6	246	49
4	30.0	25.010	1.20	201	72	2.74	2.70	6	252	51
5	37.5	31.360	1.10	200	73	2.52	2.50	6.5	247	52
6	45.0	38.070	1.30	198	74	2.99	3.00	7	254	53
7	52.5	44.930	1.30	198	74	2.99	3.00	7	245	55
8	60.0	51.610	1.20	203	73	2.73	2.70	7	246	56
9	67.5	58.400	1.30	197	75	3.00	3.00	7.5	255	57
10	75.0	65.740	1.50	200	75	3.45	3.50	8.5	255	57
11	82.5	73.150	1.50	203	73	3.42	3.40	8.5	258	58
12	90.0	80.480	1.40	203	72	3.18	3.20	8	258	57
13	97.5	86.704	1.10	203	75	2.52	3.40	9	245	59
14	105.0	92.560	1.00	201	75	2.29	2.30	7	249	57
15	112.5	99.320	1.20	200	75	2.76	2.80	7	254	58
16	120.0	105.700	1.10	203	75	2.52	2.50	6	236	55
17	127.5	112.120	1.10	204	75	2.51	2.50	6	245	56
18	135.0	119.250	1.40	204	75	3.20	3.20	8	246	57
19	142.5	126.400	1.40	207	73	3.17	3.20	8	245	57
20	150.0	133.600	1.30	204	76	2.97	3.00	8	248	59
21	157.5	140.500	1.30	205	76	2.97	3.00	8	253	60
22	165.0	147.540	1.30	209	74	2.94	2.90	8	253	52
23	172.5	154.440	1.20	206	76	2.74	2.70	8	248	61
24	180.0	161.346	1.30	207	74	2.95	3.00	8	250	52

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth and Vose**		**Run:** **3**
Location:	**Corvallis OR**		**Start Time:** **14:35**
Source:	**CFU108**		**End Time:** **17:40**
EPA Method:	**Modified Method 5**	**Environmental Conditions/Test Notes:**	**Date:** **11/3/2022**
Box Operator:	**JK**	Foggy 36F no wind	
Technician(s):	**CMF**		

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box 12	Probe ID	4C	Liner type	Glass		
Y factor	1.0313	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.84	Hot box ID	B4	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	4C	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	4				

Source Information:

Barometric Pressure	30.04	"Hg	O_2	19.88	%
Static Pressure	-0.3	"H_2O	CO_2	0.60	%
Ave. ΔP	1.3	"H_2O	Rec. Nz.	0.202	inches
Stack Temperature	220	°F			
Assumed moisture	1.63	%			
Assumed meter temp.	73.9	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	11

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	WS2	

Post Test Calculations:

Sample volume	160.410	dcf	Ave. ΔP	1.225	"H_2O
Wet mol. weight	28.71	M_s (actual)	Ave. √ΔP	1.105	"H_2O
Actual H_2O	1.69	%	Ave. ΔH	2.792	"H_2O
Std. meter vol.	164.118	dscf	Ave. T_s	206.8	°F
Isokinetic Average	101.0	%	Ave. T_m	78.0	°F

Moisture/Lab:

Filter, #	PTFE 6		
	Initial	Final	Gain
Impingers, g	2,261.1	2,282.1	21.0
Silica gel, g	896.0	935.0	39.0
		Total water gain:	60.0

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		0.000								
1	7.5	6.125	1.10	206	73	2.47	2.50	4	249	53
2	15.0	12.110	1.10	206	75	2.48	2.50	4	243	51
3	22.5	18.230	1.00	206	75	2.25	2.30	4	249	58
4	30.0	24.440	1.10	206	76	2.48	2.50	5	260	61
5	37.5	30.720	1.20	205	76	2.71	2.70	5	254	64
6	45.0	37.550	1.30	204	76	2.95	3.00	5	256	65
7	52.5	44.460	1.30	204	77	2.95	3.00	6	249	64
8	60.0	51.500	1.40	208	77	3.16	3.20	6	251	67
9	67.5	58.400	1.30	208	78	2.94	2.90	6	251	58
10	75.0	65.510	1.40	208	79	3.17	3.20	6	258	57
11	82.5	72.600	1.30	208	78	2.94	3.00	6	259	57
12	90.0	79.800	1.40	207	79	3.18	3.20	6	251	57
13	97.5	86.300	1.00	207	79	2.27	2.30	5	245	58
14	105.0	92.470	1.10	207	79	2.49	2.50	5	250	56
15	112.5	98.990	1.20	207	79	2.72	2.70	6	249	57
16	120.0	105.540	1.20	207	79	2.72	2.70	6	247	55
17	127.5	111.940	1.10	207	79	2.49	2.50	6	247	54
18	135.0	118.620	1.30	206	79	2.95	3.00	6	255	54
19	142.5	126.000	1.40	207	79	3.18	3.20	6	244	54
20	150.0	132.980	1.30	207	80	2.95	3.00	6	254	54
21	157.5	139.950	1.40	207	80	3.18	3.20	6	251	54
22	165.0	146.770	1.20	208	79	2.72	2.70	6	242	56
23	172.5	153.400	1.10	209	80	2.49	2.50	6	251	56
24	180.0	160.410	1.20	209	80	2.72	2.70	6	253	57

EPA Method 4
Impinger Weights Summary

Client:	**Hollingsworth and Vose**
Location:	**Corvallis OR**
Source:	**CFU108**
EPA Method:	**Modified Method 5**
Box Operator:	**JK**
Technician(s):	**CMF**

Run 1
Impinger gain by weight (g):

#	Initial	Final	Gain
1	784.1	710.0	-74.1
2	818.3	872.3	54.0
3	677.0	708.4	31.4
4			
5			
6			
Totals:	2,279.4	2,290.7	11.3

Run 2
Impinger gain by weight (g):

#	Initial	Final	Gain
1	802.9	762.1	-40.8
2	840.1	890.1	50.0
3	664.5	680.0	15.5
4			
5			
6			
Totals:	2,307.5	2,332.2	24.7

Run 3
Impinger gain by weight (g):

#	Initial	Final	Gain
1	804.0	766.9	-37.1
2	778.3	821.8	43.5
3	678.8	693.4	14.6
4			
5			
6			
Totals:	2,261.1	2,282.1	21.0

BISON ENGINEERING, INC.

COMPANY	**Hollingsworth & Vose Fiber Company**
FACILITY	**Glass Plant 1**
LOCATION	**Corvallis OR**
SOURCE	**CFU108**
DATE	**11/03/22**
METHOD	**ODEQ Method 5**
POLLUTANT	**Particulate Matter**

EPA Method 1
Stack Parameters and Traverse Points

Client: **Hollingsworth & Vose Fiber Company**
Location: **Corvallis OR**
Source: **CFU108**
Facility: **Glass Plant 1**

Type of Testing: P (P for Particulate; V for Velocity/Nonparticulate)
Type of Duct: C (C for circular; R for rectangular)

Number of ports available:	2	
Number of ports to be used:	2	
Port diameter:	5	inches
Sampling location height (approx.):		feet
Stack height (approx.):		feet
Circular ID (Rectangular Depth):	30.00	inches
Port depth and/or wall thickness:	6.00	inches
Stack width (Rectangular only):		inches

Equivalent Diameter
If rectangular = $\frac{2*Depth*Width}{Depth + Width}$ = 30.00 inches (If circular = duct ID)

Stack/duct area = 4.909 sq.feet 706.9 sq. inches

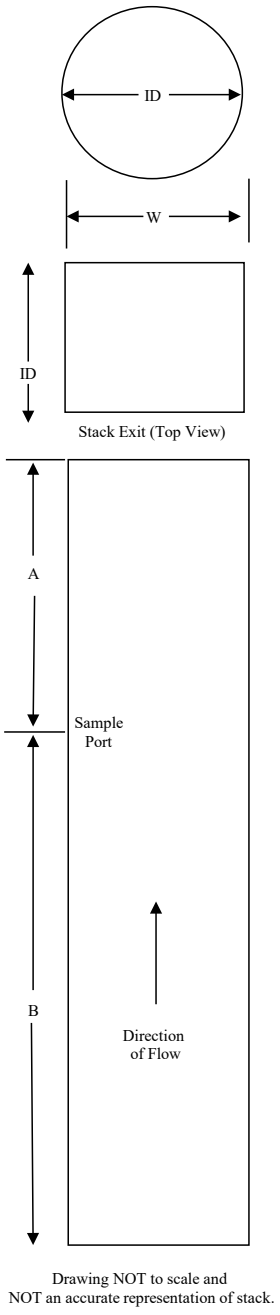
Sample Port Location:	Downstream flow disturbance from process B	Upstream flow disturbance toward exit A
Number of Inches:	128.00	102.00
Number of Diameters:	4.27	3.40

Minimum Number of Traverse Points: 24

Traverse points less than 1.0 inch from the stack wall are relocated to a distance of 1.0 inch.

Points	% of diameter	Distance from inside wall (in.)	Distance including port (in.)
1	2.1	0.63	6 5/8
2	6.7	2.01	8
3	11.8	3.54	9 1/2
4	17.7	5.31	11 1/4
5	25.0	7.50	13 1/2
6	35.6	10.68	16 5/8
7	64.4	19.32	25 3/8
8	75.0	22.50	28 1/2
9	82.3	24.69	30 3/4
10	88.2	26.46	32 1/2
11	93.3	27.99	34
12	97.9	29.37	35 3/8

Reference Diagram



Pre-Test Traverse

Client: **Hollingsworth & Vose Fiber Company**
Location: **Corvallis OR**
Source: **CFU108**

Stack Temp: 220 °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	1.10	0
2	1.10	0
3	1.30	0
4	1.30	5
5	1.50	0
6	1.60	0
7	1.20	0
8	1.10	2
9	1.10	0
10	1.20	0
11	1.50	2
12	1.50	0
13	1.60	0
14	1.60	2
15	1.20	0
16	1.10	2
17		
18		
19		
20		
21		
22		
23		
24		

Average: 1.31 1

Flow is found to be: Non-cyclonic

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**1**
Location:	**Corvallis OR**	**Start Time:**	**7:35**
Source:	**CFU108**	**End Time:**	**10:40**
EPA Method:	**ODEQ Method 5**	**Environmental Conditions/Test Notes:**	**Date:** **11/3/2022**
Box Operator:	**MK**	Foggy 36F no wind	
Technician(s):	**CMF**		

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box SB-2	Probe ID	1005200	Liner type	Glass		
Y factor	1.001	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.737	Hot box ID	HHB8	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	1005200	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	6				

Source Information:

Barometric Pressure	30.06	"Hg	O_2	19.88	%
Static Pressure	-0.3	"H_2O	CO_2	0.60	%
Ave. ΔP	1.3	"H_2O	Rec. Nz.	0.203	inches
Stack Temperature	220	°F			
Assumed moisture	1.50	%			
Assumed meter temp.	69	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	15

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	WS2	

Post Test Calculations:

Sample volume	161.130	dcf	Ave. ΔP	1.150	"H_2O
Wet mol. weight	28.75	M_s (actual)	Ave. √ΔP	1.071	"H_2O
Actual H_2O	1.27	%	Ave. ΔH	2.4	"H_2O
Std. meter vol.	162.809	dscf	Ave. T_s	211.4	°F
Isokinetic Average	103.4	%	Ave. T_m	68.6	°F

Moisture/Lab:

Filter, #	Q78		
	Initial	Final	Gain
Impingers, g	2,254.2	2,271.4	17.2
Silica gel, g	969.0	996.1	27.1
		Total water gain, g:	44.3

Traverse Point	Time (min.)	Meter Volume (dcf) 875.510	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
1	7.5	881.490	1.00	214	64	2.06	2.10	0.5	251	41
2	15.0	887.720	1.10	215	64	2.27	2.30	0.5	250	41
3	22.5	893.710	1.00	214	65	2.07	2.10	0.5	251	43
4	30.0	900.110	1.10	214	66	2.28	2.30	0.5	251	45
5	37.5	906.620	1.20	213	67	2.49	2.50	0.5	250	46
6	45.0	913.230	1.20	213	67	2.49	2.50	0.5	251	48
7	52.5	919.650	1.10	213	68	2.29	2.30	0.5	250	49
8	60.0	926.350	1.10	213	69	2.30	2.30	0.5	251	50
9	67.5	933.280	1.30	213	69	2.71	2.70	1	252	53
10	75.0	940.090	1.30	212	69	2.72	2.70	1	250	53
11	82.5	947.140	1.40	212	69	2.93	2.90	2	250	54
12	90.0	953.820	1.10	211	69	2.30	2.30	1	252	55
13	97.5	959.930	1.00	211	70	2.10	2.10	1	250	56
14	105.0	966.080	0.99	211	70	2.08	2.10	1	250	56
15	112.5	972.260	1.00	211	70	2.10	2.10	1	250	55
16	120.0	978.350	1.10	210	70	2.31	2.30	1	250	56
17	127.5	984.850	1.10	211	70	2.31	2.30	1	250	53
18	135.0	991.900	1.30	209	70	2.73	2.70	2	251	55
19	142.5	998.300	1.10	209	70	2.31	2.30	2	251	55
20	150.0	1005.300	1.30	209	70	2.73	2.70	2	251	53
21	157.5	1012.300	1.30	208	70	2.74	2.70	2	249	54
22	165.0	1019.630	1.40	209	70	2.94	2.90	2	250	53
23	172.5	1026.240	1.10	209	70	2.31	2.30	1	251	53
24	180.0	1036.640	1.00	209	71	2.11	2.11	1	251	53

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth & Vose Fiber Company**			**Run:**	**2**
Location:	**Corvallis OR**			**Start Time:**	**11:10**
Source:	**CFU108**			**End Time:**	**14:15**
EPA Method:	**ODEQ Method 5**	**Environmental Conditions/Test Notes:**		**Date:**	**11/3/2022**
Box Operator:	**MK**	Foggy 36F no wind			
Technician(s):	**CMF**				

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box SB-2	Probe ID	1005200	Liner type	Glass		
Y factor	1.001	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.737	Hot box ID	HHB8	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	1005200	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	6				

Source Information:

Barometric Pressure	30.1	"Hg	O_2	19.88	%
Static Pressure	-0.3	"H_2O	CO_2	0.60	%
Ave. ΔP	1.3	"H_2O	Rec. Nz.	0.203	inches
Stack Temperature	220	°F			
Assumed moisture	1.27	%			
Assumed meter temp.	68.6	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	13

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	WS2	

Post Test Calculations:

Sample volume	166.625	dcf	Ave. ΔP	1.263	"H_2O
Wet mol. weight	28.75	M_s (actual)	Ave. √ΔP	1.121	"H_2O
Actual H_2O	1.31	%	Ave. ΔH	2.738	"H_2O
Std. meter vol.	167.424	dscf	Ave. T_s	205.8	°F
Isokinetic Average	101.1	%	Ave. T_m	72.7	°F

Moisture/Lab:

Filter, #	Q79		
	Initial	Final	Gain
Impingers, g	2,171.9	2,205.7	33.8
Silica gel, g	974.0	987.3	13.3
		Total water gain:	47.1

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		34.190								
1	7.5	40.210	1.00	208	70	2.11	2.10	0.5	251	52
2	15.0	46.100	1.00	208	71	2.12	2.10	0.5	251	51
3	22.5	52.610	1.10	206	71	2.34	2.30	0.5	251	48
4	30.0	59.280	1.20	205	71	2.55	2.60	0.5	250	49
5	37.5	66.170	1.20	205	72	2.56	2.60	0.5	251	48
6	45.0	72.950	1.30	204	71	2.77	2.80	0.5	251	48
7	52.5	79.530	1.10	204	72	2.35	2.40	0.5	250	48
8	60.0	86.770	1.40	203	73	3.00	3.00	0.5	250	48
9	67.5	93.860	1.30	203	73	2.79	2.80	0.5	253	48
10	75.0	101.150	1.40	202	73	3.00	3.00	0.5	250	48
11	82.5	108.290	1.30	203	74	2.79	2.70	0.5	250	48
12	90.0	115.420	1.30	204	73	2.78	2.80	0.5	250	49
13	97.5	121.600	1.00	206	73	2.13	3.00	0.5	251	49
14	105.0	128.450	1.10	206	73	2.35	2.40	0.5	251	49
15	112.5	135.290	1.20	204	73	2.57	2.60	0.5	251	49
16	120.0	142.400	1.30	205	73	2.78	2.80	0.5	250	49
17	127.5	149.440	1.30	205	73	2.78	2.80	0.5	250	49
18	135.0	157.160	1.50	207	73	3.19	3.20	0.5	250	49
19	142.5	164.730	1.50	205	75	3.22	3.20	0.5	247	49
20	150.0	172.300	1.50	208	73	3.19	3.20	0.5	250	52
21	157.5	179.820	1.50	209	73	3.19	3.20	0.5	251	52
22	165.0	187.300	1.40	210	74	2.97	3.00	0.5	252	52
23	172.5	194.620	1.40	210	74	2.97	3.00	0.5	251	52
24	180.0	200.815	1.00	210	74	2.12	2.10	0.5	251	52

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**3**
Location:	**Corvallis OR**	**Start Time:**	**14:35**
Source:	**CFU108**	**End Time:**	**17:40**
EPA Method:	**ODEQ Method 5**	**Date:**	**11/3/2022**
Box Operator:	**MK**		
Technician(s):	**CMF**		

Environmental Conditions/Test Notes:
Foggy 36F no wind

Stack Dimensional Data:

Circular			
Diameter	30.000	in	
Rectangular			
Width		in	
Length		in	
Stack Area	4.909	sq.ft.	

Equipment:

Meterbox ID	Box SB-2	Probe ID	1005200	Liner type	Glass		
Y factor	1.001	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.737	Hot box ID	HHB8	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	1005200	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	6				

Source Information:

Barometric Pressure	30.04	"Hg	O_2	19.88	%
Static Pressure	-0.3	"H_2O	CO_2	0.60	%
Ave. ΔP	1.3	"H_2O	Rec. Nz.	0.202	inches
Stack Temperature	220	°F			
Assumed moisture	1.31	%			
Assumed meter temp.	72.7	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	12

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	WS2	

Post Test Calculations:

Sample volume	169.485	dcf	Ave. ΔP	1.275	"H_2O
Wet mol. weight	28.7	M_s (actual)	Ave. √ΔP	1.128	"H_2O
Actual H_2O	1.78	%	Ave. ΔH	2.725	"H_2O
Std. meter vol.	168.751	dscf	Ave. T_s	210.0	°F
Isokinetic Average	102.1	%	Ave. T_m	76.5	°F

Moisture/Lab:

Filter, #	Q80		
	Initial	Final	Gain
Impingers, g	2,224.5	2,253.0	28.5
Silica gel, g	915.6	952.0	36.4
		Total water gain:	64.9

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		200.250								
1	7.5	206.750	1.00	205	75	2.14	2.10	0.5	249	53
2	15.0	213.560	1.10	211	73	2.33	2.30	0.5	248	52
3	22.5	220.400	1.10	211	74	2.33	2.30	0.5	250	56
4	30.0	227.220	1.30	212	74	2.75	2.80	0.5	253	58
5	37.5	234.070	1.20	212	75	2.54	2.50	0.5	250	59
6	45.0	240.660	1.30	209	75	2.77	2.80	0.5	250	59
7	52.5	247.690	1.40	209	75	2.98	3.00	0.5	253	61
8	60.0	255.290	1.30	210	76	2.77	2.80	0.5	250	62
9	67.5	262.380	1.30	210	76	2.77	2.80	0.5	251	59
10	75.0	269.280	1.20	210	77	2.56	2.60	0.5	250	57
11	82.5	275.700	1.20	210	77	2.56	2.60	0.5	250	54
12	90.0	282.330	1.10	209	77	2.35	2.40	0.5	250	54
13	97.5	289.000	1.20	210	77	2.56	2.40	0.5	250	54
14	105.0	295.810	1.10	210	77	2.35	2.40	0.5	251	54
15	112.5	302.820	1.30	210	77	2.77	2.80	0.5	253	53
16	120.0	310.270	1.40	209	77	2.99	3.00	0.5	251	51
17	127.5	317.850	1.40	209	77	2.99	3.00	0.5	251	51
18	135.0	325.580	1.50	209	78	3.21	3.20	0.5	250	55
19	142.5	332.840	1.40	210	78	2.99	3.00	0.5	249	56
20	150.0	340.690	1.40	210	78	2.99	3.00	0.5	250	56
21	157.5	347.890	1.30	210	78	2.78	2.80	0.5	251	56
22	165.0	355.420	1.50	211	78	3.20	3.20	0.5	250	56
23	172.5	362.780	1.30	211	78	2.78	2.80	0.5	252	57
24	180.0	369.735	1.30	212	78	2.77	2.80	0.5	252	57

EPA Method 4
Impinger Weights Summary

Client: **Hollingsworth & Vose Fiber Company**
Location: **Corvallis OR**
Source: **CFU108**
EPA Method: **ODEQ Method 5**
Box Operator: **MK**
Technician(s): **CMF**

Run 1
Impinger gain by weight (g):

#	Initial	Final	Gain
1	784.9	732.0	-52.9
2	773.3	818.5	45.2
3	696.0	720.9	24.9
4			
5			
6			
Totals:	2,254.2	2,271.4	17.2

Run 2
Impinger gain by weight (g):

#	Initial	Final	Gain
1	764.0	756.0	-8.0
2	783.3	815.9	32.6
3	624.6	633.8	9.2
4			
5			
6			
Totals:	2,171.9	2,205.7	33.8

Run 3
Impinger gain by weight (g):

#	Initial	Final	Gain
1	755.1	739.4	-15.7
2	774.0	806.9	32.9
3	695.4	706.7	11.3
4			
5			
6			
Totals:	2,224.5	2,253.0	28.5

Oregon Methods 1-5
Filterable and Condensable Particulate
Results Summary

Client: **Hollingsworth & Vose Fiber Company**
Source: **CFU108**
Location: **Corvallis OR**

Run			1	2	3	
Date			11/3/2022	11/3/2022	11/3/2022	
Run Start Time			7:35	11:10	14:35	
Run End Time			10:40	14:15	17:40	
Duration, min.			180	180	180	Average
Barometric Pressure, "Hg			30.06	30.10	30.04	**30.07**
Nozzle Dia., in.			0.225	0.225	0.225	**0.225**
Isokinetic Average, %			103.4	101.1	102.1	**102.2**
Sample Volume, dscf			162.809	167.424	168.751	**166.328**
Sample Volume, dscm			4.610	4.741	4.778	**4.710**
Stack Diameter, in.			30.00	30.00	30.00	**30.00**
Stack Area, sq.ft.			4.909	4.909	4.909	**4.909**
CO_2 %vd			0.60	0.60	0.60	**0.60**
O_2 %vd			19.88	19.88	19.88	**19.88**
Static Press., "H_2O			-0.30	-0.30	-0.30	**-0.30**
H_2O %v			1.27	1.31	1.78	**1.45**
Wet Molecular Weight, lb/lb-mole			28.75	28.75	28.70	**28.73**
Velocity, FPS			67.80	70.62	71.42	**69.95**
ADCFM			19,716	20,528	20,662	**20,302**
ACFM			19,970	20,800	21,036	**20,602**
DSCFM			15,564	16,363	16,334	**16,087**
Stack Temperature, °F			211.4	205.8	210.0	**209.1**
Filterable Particulate	Concentration, C_s	gr/dscf	0.00E+00	1.80E-04	0.00E+00	**6.00E-05**
		µg/dscm	0.0	411.7	0.0	**137.2**
	Mass	lb/hr	0.00E+00	2.52E-02	0.00E+00	**8.41E-03**
		lb/lb glass	0.00E+00	6.63E-05	0.00E+00	**2.21E-05**
Inorganic CPM	Concentration, C_s	gr/dscf	9.72E-05	7.55E-05	8.38E-05	**8.55E-05**
		µg/dscm	222.5	172.9	191.8	**195.7**
	Mass	lb/hr	1.30E-02	1.06E-02	1.17E-02	**1.18E-02**
		lb/lb glass	3.33E-05	2.79E-05	2.99E-05	**3.04E-05**
Organic CPM	Concentration, C_s	gr/dscf	2.41E-05	3.08E-05	0.00E+00	**1.83E-05**
		µg/dscm	55.2	70.5	0.0	**41.9**
	Mass	lb/hr	3.22E-03	4.32E-03	0.00E+00	**2.51E-03**
		lb/lb glass	8.27E-06	1.14E-05	0.00E+00	**6.55E-06**
Total PM Filterable + Condensable	Concentration, C_s	gr/dscf	ND 1.21E-04	ND 2.86E-04	ND 8.38E-05	ND **1.64E-04**
		µg/dscm	ND 277.8	ND 655.1	ND 191.8	ND **374.9**
	Mass	lb/hr	ND 1.62E-02	ND 4.01E-02	ND 1.17E-02	ND **2.27E-02**
		lb/lb glass	ND 4.16E-05	ND 1.06E-04	ND 2.99E-05	ND **5.90E-05**
Production Data	Glass Fiber Pull Rate	lb/hr	389.1	380.3	391.8	**387.1**

ND - Non-detect. Measured total PM was less than the ODEQ Method 5 analytical detection limit specified in the ODEQ Source Sampling Manual.

Isokinetic Field Data
Field Data and Calculations
Particulate Emissions and Gas Stream Characteristics

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**1**
Source:	**CFU108**	**Date:**	**11/3/2022**
Location:	**Corvallis OR**	**Start Time:**	**7:35**
Method:	**ODEQ 5**	**End Time:**	**10:40**

Sampling Data				Traverse Data			
Time	**Meter**	**ΔH**	**Meter**	**Traverse**	**Dp**	**Stack**	
min.	**ft^3**	**"H_2O**	**T_m °F**	**Point**	**"H_2O**	**T_s °F**	**√Dp**
	875.510						
8	881.490	2.10	64	1	1.00	214	1.000
15	887.720	2.30	64	2	1.10	215	1.049
23	893.710	2.10	65	3	1.00	214	1.000
30	900.110	2.30	66	4	1.10	214	1.049
38	906.620	2.50	67	5	1.20	213	1.095
45	913.230	2.50	67	6	1.20	213	1.095
53	919.650	2.30	68	7	1.10	213	1.049
60	926.350	2.30	69	8	1.10	213	1.049
68	933.280	2.70	69	9	1.30	213	1.140
75	940.090	2.70	69	10	1.30	212	1.140
83	947.140	2.90	69	11	1.40	212	1.183
90	953.820	2.30	69	12	1.10	211	1.049
98	959.930	2.10	70	13	1.00	211	1.000
105	966.080	2.10	70	14	0.99	211	0.995
113	972.260	2.10	70	15	1.00	211	1.000
120	978.350	2.30	70	16	1.10	210	1.049
128	984.850	2.30	70	17	1.10	211	1.049
135	991.900	2.70	70	18	1.30	209	1.140
143	998.300	2.30	70	19	1.10	209	1.049
150	1005.300	2.70	70	20	1.30	209	1.140
158	1012.300	2.70	70	21	1.30	208	1.140
165	1019.630	2.90	70	22	1.40	209	1.183
173	1026.240	2.30	70	23	1.10	209	1.049
180	1036.640	2.10	71	24	1.00	209	1.000

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**1**
Source:	**CFU108**	**Date:**	**11/03/22**

Field Data Input Continued

Moisture Data			Stack Dimensional Data:		
Total Test Time	180.0	min	Circular		
Sample Time Interval	7.5	min	Diameter	30.000	in
Meter Volume, V_m	161.130	dcf	Rectangular		
Water Weight	44.3	g	Width		in
Nozzle Diameter, N_z	0.225	in.	Length		in
Nozzle Area	0.000276	sq.ft.	Stack Area	4.909	sq.ft.
Traverse Data			Molecular Weight:		
Barometric Pressure, P_b	30.06	"Hg	CO_2 Average	0.60	%vd
Static Pressure	-0.30	"H_2O	O_2 Average	19.88	%vd
Pitot Factor, C_p	0.84				
Meter Cal Factor	1.0010	Y			

Field Data Averages

Meter			Stack		
ΔH	2.400	"H_2O	√Dp	1.071	"H_2O
Temperature, T_m	68.6	^oF	Temperature, T_s	211.4	^oF
Temperature, T_m	528.3	^oA (^oR)	Temperature, T_s	671.1	^oA (R)
Pressure Meter, P_m	30.236	"Hg	Pressure Stack, P_s	30.038	"Hg

Field Data Calculations

Meter Box Capture			EPA Method 2 Stack Gas Flowrate:		
Standard Volume, $V_{m(std)}$	162.809	dscf	Velocity, V_s	67.80	fps
	4.610	dscm	Volume (actual)	19,970	acfm
Actual Volume, $V_{m(actual)}$	208.894	awcf		19,716	adcfm
Gas Stream Moisture			Volume (standard)	945,865	wscf/hr
Moisture Vapor, $V_{w(std)}$	2.089	scf		933,853	dscf/hr
Moisture, B_{ws}	0.0127			15,564	dscf/min
Moisture EPA M4	1.27	%v		15,764	wscf/min
Moisture @ Saturation	98.44	%v (for T_s < 212°F)			
EPA Method 3 Gas Density					
Dry, M_d	28.89	lb/lb-mole			
Wet, M_s	28.75	lb/lb-mole			
Percent Isokinetic	103.4	%			

Laboratory Results

EPA Method 5					
Filterable PM	0.0000	grams			
Emissions:					
Concentration, C_s	0.00E+00	gr/dscf			
	0.0	µg/dscm			
Mass Emissions	0.00E+00	lb/hr			
Back Half:					
Inorganic CPM	0.0010	grams	Organic CPM	0.0003	grams
Inorganic CPM, C_s	9.72E-05	gr/dscf	Organic CPM, C_s	2.41E-05	gr/dscf
	222.5	µg/dscm		55.2	µg/dscm
Mass Emissions	1.30E-02	lb/hr	Mass Emissions	3.22E-03	lb/hr

Isokinetic Field Data
Field Data and Calculations
Particulate Emissions and Gas Stream Characteristics

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**2**
Source:	**CFU108**	**Date:**	**11/3/2022**
Location:	**Corvallis OR**	**Start Time:**	**11:10**
Method:	**ODEQ 5**	**End Time:**	**14:15**

Sampling Data				Traverse Data			
Time	**Meter**	**ΔH**	**Meter**	**Traverse**	**Dp**	**Stack**	
min.	**ft^3**	**"H_2O**	**T_m °F**	**Point**	**"H_2O**	**T_s °F**	**√Dp**
	34.190						
8	40.210	2.10	70	1	1.00	208	1.000
15	46.100	2.10	71	2	1.00	208	1.000
23	52.610	2.30	71	3	1.10	206	1.049
30	59.280	2.60	71	4	1.20	205	1.095
38	66.170	2.60	72	5	1.20	205	1.095
45	72.950	2.80	71	6	1.30	204	1.140
53	79.530	2.40	72	7	1.10	204	1.049
60	86.770	3.00	73	8	1.40	203	1.183
68	93.860	2.80	73	9	1.30	203	1.140
75	101.150	3.00	73	10	1.40	202	1.183
83	108.290	2.70	74	11	1.30	203	1.140
90	115.420	2.80	73	12	1.30	204	1.140
98	121.600	3.00	73	13	1.00	206	1.000
105	128.450	2.40	73	14	1.10	206	1.049
113	135.290	2.60	73	15	1.20	204	1.095
120	142.400	2.80	73	16	1.30	205	1.140
128	149.440	2.80	73	17	1.30	205	1.140
135	157.160	3.20	73	18	1.50	207	1.225
143	164.730	3.20	75	19	1.50	205	1.225
150	172.300	3.20	73	20	1.50	208	1.225
158	179.820	3.20	73	21	1.50	209	1.225
165	187.300	3.00	74	22	1.40	210	1.183
173	194.620	3.00	74	23	1.40	210	1.183
180	200.815	2.10	74	24	1.00	210	1.000

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**2**
Source:	**CFU108**	**Date:**	**11/03/22**

Field Data Input Continued

Moisture Data			Stack Dimensional Data:		
Total Test Time	180.0	min	Circular		
Sample Time Interval	7.5	min	Diameter	30.000	in
Meter Volume, V_m	166.625	dcf	Rectangular		
Water Weight	47.1	g	Width		in
Nozzle Diameter, N_z	0.225	in.	Length		in
Nozzle Area	0.000276	sq.ft.	Stack Area	4.909	sq.ft.
Traverse Data			Molecular Weight:		
Barometric Pressure, P_b	30.10	"Hg	CO_2 Average	0.60	%vd
Static Pressure	-0.30	"H_2O	O_2 Average	19.88	%vd
Pitot Factor, C_p	0.84				
Meter Cal Factor	1.0010	Y			

Field Data Averages

Meter			Stack		
ΔH	2.738	"H_2O	√Dp	1.121	"H_2O
Temperature, T_m	72.7	^oF	Temperature, T_s	205.8	^oF
Temperature, T_m	532.4	^oA (^oR)	Temperature, T_s	665.5	^oA (R)
Pressure Meter, P_m	30.301	"Hg	Pressure Stack, P_s	30.078	"Hg

Field Data Calculations

Meter Box Capture			EPA Method 2 Stack Gas Flowrate:		
Standard Volume, $V_{m(std)}$	167.424	dscf	Velocity, V_s	70.62	fps
	4.741	dscm	Volume (actual)	20,800	acfm
Actual Volume, $V_{m(actual)}$	212.826	awcf		20,528	adcfm
Gas Stream Moisture			Volume (standard)	994,820	wscf/hr
Moisture Vapor, $V_{w(std)}$	2.221	scf		981,788	dscf/hr
Moisture, B_{ws}	0.0131			16,363	dscf/min
Moisture EPA M4	1.31	%v		16,580	wscf/min
Moisture @ Saturation	87.83	%v (for T_s < 212°F)			
EPA Method 3 Gas Density					
Dry, M_d	28.89	lb/lb-mole			
Wet, M_s	28.75	lb/lb-mole			
Percent Isokinetic	101.1	%			

Laboratory Results

Front Half:					
Filterable PM	0.0020	grams			
Emissions:					
Concentration, C_s	1.80E-04	gr/dscf			
	411.7	µg/dscm			
Mass Emissions	2.52E-02	lb/hr			
Back Half:					
Inorganic CPM	0.0008	grams	Organic CPM	0.0003	grams
Inorganic CPM, C_s	7.55E-05	gr/dscf	Organic CPM, C_s	3.08E-05	gr/dscf
	172.9	µg/dscm		70.5	µg/dscm
Mass Emissions	1.06E-02	lb/hr	Mass Emissions	4.32E-03	lb/hr

Isokinetic Field Data
Field Data and Calculations
Particulate Emissions and Gas Stream Characteristics

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**3**
Source:	**CFU108**	**Date:**	**11/3/2022**
Location:	**Corvallis OR**	**Start Time:**	**14:35**
Method:	**ODEQ 5**	**End Time:**	**17:40**

Sampling Data				Traverse Data			
Time	**Meter**	**ΔH**	**Meter**	**Traverse**	**Dp**	**Stack**	
min.	**ft^3**	**"H_2O**	**T_m ^oF**	**Point**	**"H_2O**	**T_s ^oF**	**√Dp**
	200.250						
8	206.750	2.10	75	1	1.00	205	1.000
15	213.560	2.30	73	2	1.10	211	1.049
23	220.400	2.30	74	3	1.10	211	1.049
30	227.220	2.80	74	4	1.30	212	1.140
38	234.070	2.50	75	5	1.20	212	1.095
45	240.660	2.80	75	6	1.30	209	1.140
53	247.690	3.00	75	7	1.40	209	1.183
60	255.290	2.80	76	8	1.30	210	1.140
68	262.380	2.80	76	9	1.30	210	1.140
75	269.280	2.60	77	10	1.20	210	1.095
83	275.700	2.60	77	11	1.20	210	1.095
90	282.330	2.40	77	12	1.10	209	1.049
98	289.000	2.40	77	13	1.20	210	1.095
105	295.810	2.40	77	14	1.10	210	1.049
113	302.820	2.80	77	15	1.30	210	1.140
120	310.270	3.00	77	16	1.40	209	1.183
128	317.850	3.00	77	17	1.40	209	1.183
135	325.580	3.20	78	18	1.50	209	1.225
143	332.840	3.00	78	19	1.40	210	1.183
150	340.690	3.00	78	20	1.40	210	1.183
158	347.890	2.80	78	21	1.30	210	1.140
165	355.420	3.20	78	22	1.50	211	1.225
173	362.780	2.80	78	23	1.30	211	1.140
180	369.735	2.80	78	24	1.30	212	1.140

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**3**
Source:	**CFU108**	**Date:**	**11/03/22**

Field Data Input Continued

Moisture Data			Stack Dimensional Data:		
Total Test Time	180.0	min	Circular		
Sample Time Interval	7.5	min	Diameter	30.000	in
Meter Volume, V_m	169.485	dcf	Rectangular		
Water Weight	64.9	g	Width		in
Nozzle Diameter, N_z	0.225	in.	Length		in
Nozzle Area	0.000276	sq.ft.	Stack Area	4.909	sq.ft.
Traverse Data			Molecular Weight:		
Barometric Pressure, P_b	30.04	"Hg	CO_2 Average	0.60	%vd
Static Pressure	-0.30	"H_2O	O_2 Average	19.88	%vd
Pitot Factor, C_p	0.84				
Meter Cal Factor	1.0010	Y			

Field Data Averages

Meter			Stack		
ΔH	2.725	"H_2O	√Dp	1.128	"H_2O
Temperature, T_m	76.5	^oF	Temperature, T_s	210.0	^oF
Temperature, T_m	536.2	^oA (^oR)	Temperature, T_s	669.7	^oA (R)
Pressure Meter, P_m	30.240	"Hg	Pressure Stack, P_s	30.018	"Hg

Field Data Calculations

Meter Box Capture			EPA Method 2 Stack Gas Flowrate:		
Standard Volume, $V_{m(std)}$	168.751	dscf	Velocity, V_s	71.42	fps
	4.778	dscm	Volume (actual)	21,036	acfm
Actual Volume, $V_{m(actual)}$	217.332	awcf		20,662	adcfm
Gas Stream Moisture			Volume (standard)	997,785	wscf/hr
Moisture Vapor, $V_{w(std)}$	3.061	scf		980,024	dscf/hr
Moisture, B_{ws}	0.0178			16,334	dscf/min
Moisture EPA M4	1.78	%v		16,630	wscf/min
Moisture @ Saturation	95.79	%v (for T_s < 212°F)			
EPA Method 3 Gas Density					
Dry, M_d	28.89	lb/lb-mole			
Wet, M_s	28.70	lb/lb-mole			
Percent Isokinetic	102.1	%			

Laboratory Results

Front Half:					
Filterable PM	0.0000	grams			
Emissions:					
Concentration, C_s	0.00E+00	gr/dscf			
	0.0	µg/dscm			
Mass Emissions	0.00E+00	lb/hr			
Back Half:					
Inorganic CPM	0.0009	grams	Organic CPM	0.0000	grams
Inorganic CPM, C_s	8.38E-05	gr/dscf	Organic CPM, C_s	0.00E+00	gr/dscf
	191.8	µg/dscm		0.0	µg/dscm
Mass Emissions	1.17E-02	lb/hr	Mass Emissions	0.00E+00	lb/hr

Oregon Method 5
Filterable and Condensable Particulate
Laboratory Gravimetric Data

Client: **Hollingsworth & Vose Fiber Company**
Source: **CFU108**
Location: **Corvallis, OR**

Run	Sample Description	g, #	Initial (grams)	Final (grams)	Net Gain	Blank Correction	Corrected Gain (grams)	
1	CPM Organics (Acetone BH)	124.2	44.4722	44.4733	0.0011	0.0010	**0.0001**	
	Probe Rinse (Acetone FH)	88.1	45.0216	45.0202	-0.0014	0.0007	**0.0000**	
	Filter	Q78	0.4414	0.4408	-0.0006		**0.0000**	
	CPM Inorganics (Water)	453.2	52.6267	52.6289	0.0022	0.0012	**0.0010**	
	CPM Organics (Hexane BH)	84.1	49.3649	49.3651	0.0002	0.0000	**0.0002**	
	Impinger H_2O Gain, mls		200.0	217.2	17.2			
						Filterable PM (g)	**0.0000**	
						Total PM (g)	**0.0013**	**ND**
2	CPM Organics (Acetone BH)	138.5	43.3169	43.3184	0.0015	0.0012	**0.0003**	
	Probe Rinse (Acetone FH)	77.0	47.1566	47.1592	0.0026	0.0006	**0.0020**	
	Filter	Q79	0.4432	0.4425	-0.0007		**0.0000**	
	CPM Inorganics (Water)	417.0	45.6558	45.6577	0.0019	0.0011	**0.0008**	
	CPM Organics (Hexane BH)	81.7	47.0375	47.0372	-0.0003	0.0000	**0.0000**	
	Impinger H_2O Gain, mls		200.0	233.8	33.8			
						Filterable PM (g)	**0.0020**	
						Total PM (g)	**0.0031**	**ND**
3	CPM Organics (Acetone BH)	136.0	49.4753	49.4762	0.0009	0.0011	**0.0000**	
	Probe Rinse (Acetone FH)	78.4	52.3951	52.3900	-0.0051	0.0007	**0.0000**	
	Filter	Q80	0.4341	0.4338	-0.0003		**0.0000**	
	CPM Inorganics (Water)	456.9	47.8441	47.8462	0.0021	0.0012	**0.0009**	
	CPM Organics (Hexane BH)	83.8	51.4581	51.4581	0.0000	0.0000	**0.0000**	
	Impinger H_2O Gain, mls		200.0	228.5	28.5			
						Filterable PM (g)	**0.0000**	
						Total PM (g)	**0.0009**	**ND**
	Acetone Blank	190.1	54.7478	54.7494	0.0016	8.42E-06	g/g	
	Water Blank	231.6	43.9987	43.9993	0.0006	2.59E-06	g/g	
	Hexane Blank	216.2	41.8344	41.8343	-0.0001	0.00E+00	g/g	

ND - Non-detect. Value is below the ODEQ Method 5 analytical detection limit specified in the ODEQ Source Sampling Manual (7 mg).

Oregon Methods 1-5
Example Calculations

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**1**
Source:	**CFU108**	**Date:**	**11/3/2022**
Location:	**Corvallis OR**	**Start Time:**	**7:35**
Method:	**ODEQ 5**	**End Time:**	**10:40**

EPA Methods 1-4:

1) $P_m = P_b + (\Delta H/13.6)$ = 30.236 "Hg

where P_b:	30.06	"Hg
ΔH:	2.400	"H_2O

2) $P_s = P_b + (\text{Static Press.}/13.6)$ = 30.038 "Hg

where P_b:	30.06	"Hg
Static Press.:	-0.30	"H_2O

3) $V_{m(std)} = V_m(\frac{Tstd}{Pstd})(Y)(\frac{Pm}{Tm})$ = 162.809 dscf

where V_m:	161.130	dcf
Y:	1.0010	
P_m:	30.236	"Hg
T_m:	528.3	°A
T_{std}:	527.67	°R
P_{std}:	29.92	"Hg

4) $V_{w(std)} = V_{H20}(\frac{\rho w * R * Tstd}{Pstd * Mw})$ = 2.089 scf

where H_2O:	44.30	g
ρ_w:	2.2046E-03	lb/mol
R:	21.85	"Hg ft^3/lb-mol °R
T_{std}:	527.67	°R
P_{std}:	29.92	"Hg
M_w:	18.015	lb/lb-mol

5) $B_{ws} = \left(\frac{Vw(std)}{Vw(std)+Vm(std)}\right)$ = 0.0127

where $V_{w(std)}$:	2.089	scf
$V_{m(std)}$:	162.809	dscf

6) % $H_2O = B_{ws}$ x 100 = 1.27 %v

Client: **Hollingsworth & Vose Fiber Company** **Run:** **1**
Source: **CFU108** **Date:** **11/3/2022**

7) $V_m(\text{actual}) = \left(\frac{Y \times Vm}{(1-Bws)}\right)\left(\frac{Ts}{Tm}\right)\left(\frac{Pm}{Ps}\right) =$ 208.894 awcf

where Y:	1.0010	
V_m:	161.1300	dcf
B_{ws}:	0.0127	
T_s:	671.1	°A
T_m:	528.3	°A
P_m:	30.236	"Hg
P_s:	30.038	"Hg

8) $M_d = 0.44(CO_2) + 0.32(O_2) + 0.28(N_2 + CO) =$ 28.89 lb/lb-mole

where CO_2:	0.60	%vd
O_2	19.88	%vd
N_2+CO= (100-(O_2+CO_2):	79.52	%vd

9) $M_s = M_d(1 - Bws) + (18 \times Bws) =$ 28.75 lb/lb-mole

where M_d:	28.89	lb/lb-mole
B_{ws}:	0.0127	

10) $\text{Stack Area(cir.)} = \text{PI* (stack diameter/24)}^2 =$ 4.909 sq. ft.

where Stack ID:	30	inches

Stack Area(rect.) = stack width/12 x stack length/12 = NA sq. ft.

where Stack Width:	0.000	inches
Stack Length:	0.000	inches

11) Velocity, $V_s = 85.49(Cp)(\text{Ave. Sqrt } \Delta P)\left(\sqrt{\frac{Ts}{(Ps \times Ms)}}\right) =$ 67.80 fps

where C_p:	0.84	
Ave. Sqrt ΔP:	1.071	
T_s:	671.1	°A
P_s:	30.038	"Hg
M_s:	28.75	lb/lb-mole

12) ACFM = (V_s)(stack area)(60 sec/min) = 19,970 ACFM

where V_s:	67.80	ft/sec
Stack Area:	4.909	sq. ft

13) ADCFM = (ACFM)(1-B_ws) = 19,716 ADCFM

where ACFM:	19,970	
B_{ws}:	0.0127	

14) $Q_{sw} = 3600(V_s)(\text{stack area})\left(\frac{527.67°A}{Ts}\right)\left(\frac{Ps}{29.92\ "Hg}\right)$ 945,865 wscf/hr

where V_s:	67.80	ft/sec
Stack Area:	4.9090	sq. ft.
T_s:	671.1	°A
P_s:	30.038	"Hg

Client: **Hollingsworth & Vose Fiber Company** **Run:** **1**
Source: **CFU108** **Date:** **11/3/2022**

15) Q_{sd} = (wscf/hr)(1-B_{ws}) = 933,853 dscf/hr
where wscf/hr: 945,865
B_{ws}: 0.0127

16) DSCFM= (dscf/hr)/60 mins/hr = 15,564 DSCFM
where dscf/hr: 933,853

17) Nozzle Area = 3.1416 (Nozzle Size/24)^2 = 0.000276 sq. ft.
where Nozzle Size: 0.225 inches

18) Isokinetic % = $\left(\frac{0.0945(Ts)(Vm(std))}{Ps(V_s)(nozzle\ area)(sampling\ time)(1-Bws)}\right)$ = 103.4 %

where T_s: 671.1 °A
$V_{m(Std)}$: 162.809 dscf
P_s: 30.038 "Hg
V_s 67.80 ft/sec
Nozzle Area: 0.000276 sq. ft.
Sampling Time: 180 min.
B_{ws}: 0.0127

ODEQ Method 5 (Run 2):

Front Half:

19) Filterable PM = filter gain + probe rinse gain = 0.0020 grams
where Filter Gain: 0.0000 grams
Probe Rinse: 0.0020 grams

20) C_s = (Sample grams/$V_{m(Std)}$)(15.43grains/gram) = 1.80E-04 gr/dscf
where Sample: 0.0020 grams
$V_{m(std)}$: 167.424 dscf

21) C_s = (Sample grams*1,000,000 µg/gram)/$V_{m(std)}$ = 4.12E+02 µg/dscm
where Sample: 0.0020 grams
$V_{m(std)}$: 4.741 dscm

22) Mass Emission Rate = (C_s)(Stack flow)/7000gr/lb = 2.52E-02 lb/hr
where C_s: 1.80E-04 gr/dscf
Stack Flow: 981,788 dscf/hr

Back Half:

23) Inorganic CPM = water fraction = 0.0008 grams
Organic CPM = acetone BH + hexane BH = 0.0003 grams

Back-half concentrations and mass rates are calculated as front-half examples.

Bison Engineering, Inc.
Gravimetric Information

Client: Hollingsworth & Vose Fiber Company
Location: Corvallis, OR
Project Number: HAV222921
Test Date: 11/3/2022

Filters:

Sample Identification	Filter #	Date	Tare 1 (g)	Date	Tare 2 (g)	CHECK	Average	Filter #	Date	Final 1 (g)	Date	Final 2 (g)	CHECK	Average	Gain
HAV222921 CFU 108 M5 Run 1	Q78	9/16/2022	0.4414	9/21/2022	0.4413	-0.0001	0.4414	Q78	11/14/2022	0.4408	11/16/2022	0.4408	0.0000	0.4408	-0.0006
HAV222921 CFU 108 M5 Run 2	Q79	9/16/2022	0.4433	9/21/2022	0.4431	-0.0002	0.4432	Q79	11/14/2022	0.4425	11/16/2022	0.4425	0.0000	0.4425	-0.0007
HAV222921 CFU 108 M5 Run 3	Q80	9/16/2022	0.4341	9/21/2022	0.4341	0.0000	0.4341	Q80	11/14/2022	0.4337	11/16/2022	0.4338	0.0001	0.4338	-0.0003

Liquid Fractions:

Wt (g)	Sample Identification	Dish #	Date	Tare 1 (g)	Date	Tare 2 (g)	CHECK	Average	Dish #	Date	Final 1 (g)	Date	Final 2 (g)	CHECK	Average	Gain
88.1	HAV222921 CFU 108 Probe Rinse R1	69	10/28/2022	45.0214	11/1/2022	45.0217	0.0003	45.0216	69	11/23/2022	45.0199	11/28/2022	45.0204	0.0005	45.0202	-0.0014
77	HAV222921 CFU 108 Probe Rinse R2	70	10/28/2022	47.1568	11/1/2022	47.1563	-0.0005	47.1566	70	11/23/2022	47.1594	11/28/2022	47.1589	-0.0005	47.1592	0.0026
78.4	HAV222921 CFU 108 Probe Rinse R3	71	10/28/2022	52.3950	11/1/2022	52.3951	0.0001	52.3951	71	11/23/2022	52.3901	11/28/2022	52.3899	-0.0002	52.3900	-0.0051
124.2	HAV222921 CFU 108 Organic Run 1	72	10/28/2022	44.4722	11/1/2022	44.4722	0.0000	44.4722	72	11/23/2022	44.4731	11/28/2022	44.4734	0.0003	44.4733	0.0011
138.5	HAV222921 CFU 108 Organic Run 2	73	10/28/2022	43.3168	11/1/2022	43.3169	0.0001	43.3169	73	11/23/2022	43.3186	11/28/2022	43.3181	-0.0005	43.3184	0.0015
136	HAV222921 CFU 108 Organic Run 3	74	10/28/2022	49.4750	11/1/2022	49.4755	0.0005	49.4753	74	11/23/2022	49.4761	11/28/2022	49.4763	0.0002	49.4762	0.0009
84.1	HAV222921 CFU 108 Cont #6 Run 1	75	10/28/2022	49.3651	11/1/2022	49.3647	-0.0004	49.3649	75	11/23/2022	49.3653	11/28/2022	49.3649	-0.0004	49.3651	0.0002
81.7	HAV222921 CFU 108 Cont #6 Run 2	76	10/28/2022	47.0373	11/1/2022	47.0376	0.0003	47.0375	76	11/23/2022	47.0369	11/28/2022	47.0374	0.0005	47.0372	-0.0003
83.8	HAV222921 CFU 108 Cont #6 Run 3	77	10/28/2022	51.4579	11/1/2022	51.4583	0.0004	51.4581	77	11/23/2022	51.4578	11/28/2022	51.4583	0.0005	51.4581	0.0000
470.4	HAV222921 CFU 108 Inorganic Run 1	4	11/15/2022	52.6269	11/16/2022	52.6265	-0.0004	52.6267	4	12/2/2022	52.6288	12/5/2022	52.6289	0.0001	52.6289	0.0022
450.8	HAV222921 CFU 108 Inorganic Run 2	5	11/21/2022	45.6556	11/22/2022	45.6560	0.0004	45.6558	5	12/2/2022	45.6577	12/5/2022	45.6577	0.0000	45.6577	0.0019
485.4	HAV222921 CFU 108 Inorganic Run 3	6	11/21/2022	47.8443	11/22/2022	47.8439	-0.0004	47.8441	6	12/2/2022	47.8462	12/5/2022	47.8462	0.0000	47.8462	0.0021
190.1	HAV222921 Acetone Blank	96	11/14/2022	54.7476	11/18/2022	54.7479	0.0003	54.7478	96	11/29/2022	54.7492	11/30/2022	54.7496	0.0004	54.7494	0.0016
216.2	HAV222921 Hexane Blank	97	11/18/2022	41.8346	11/21/2022	41.8341	-0.0005	41.8344	97	11/29/2022	41.8341	11/30/2022	41.8345	0.0004	41.8343	-0.0001
231.6	HAV222921 HPLC Blank	13	11/21/2022	43.9988	11/22/2022	43.9985	-0.0003	43.9987	13	12/2/2022	43.9990	12/5/2022	43.9995	0.0005	43.9993	0.0006

BISON ENGINEERING, INC.

COMPANY	**Hollingsworth and Vose**
FACILITY	**Glass Plant 2**
LOCATION	**Corvallis OR**
SOURCE	**CFU118**
DATE	**11/04/22**
METHOD	**Modified Method 5**
POLLUTANT	**PM**

Pre-Test Traverse

Client: **Hollingsworth and Vose**
Location: **Corvallis OR**
Source: **CFU118**

Stack Temp: 22 °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	1.30	0
2	1.40	2
3	1.60	0
4	1.90	0
5	1.90	0
6	1.80	2
7	2.00	0
8	1.50	2
9	1.60	0
10	1.30	0
11	1.20	5
12	1.10	0
13	1.90	0
14	1.90	5
15	1.90	0
16	1.80	0
17	1.80	1
18	1.70	0
19	1.80	0
20	2.00	1
21	1.90	0
22	1.60	1
23	1.60	10
24	1.50	5
Average:	1.67	1

Flow is found to be: Non-cyclonic

EPA Method 1
Stack Parameters and Traverse Points

Client: **Hollingsworth and Vose**
Location: **Corvallis OR**
Source: **CFU118**
Facility: **Glass Plant 2**

Type of Testing: V (P for Particulate; V for Velocity/Nonparticulate)
Type of Duct: D (C for circular; R for rectangular)

Number of ports available:	2	
Number of ports to be used:	2	
Port diameter:	6	inches
Sampling location height (approx.):		feet
Stack height (approx.):		feet
Circular ID (Rectangular Depth):	30.00	inches
Port depth and/or wall thickness:	6.00	inches
Stack width (Rectangular only):		inches

Equivalent Diameter
If rectangular = $\frac{2*Depth*Width}{Depth + Width}$ = 30.00 inches (If circular = duct ID)

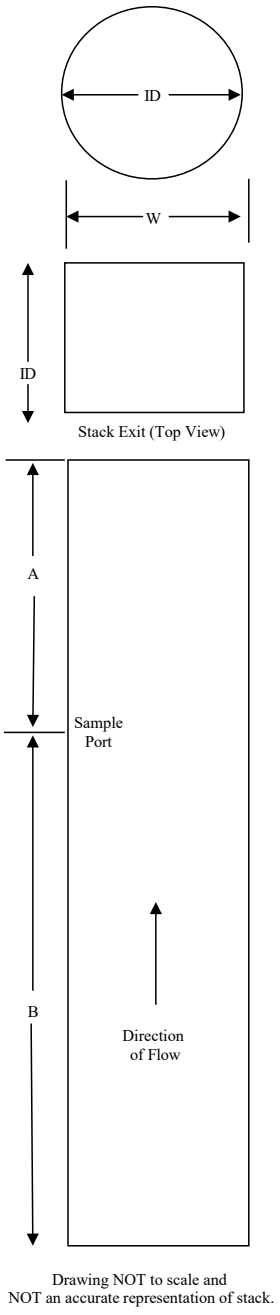
Stack/duct area = 4.909 sq.feet 706.9 sq. inches

Sample Port Location:	Downstream flow disturbance from process B	Upstream flow disturbance toward exit A
Number of Inches:	142.00	52.00
Number of Diameters:	4.73	1.73

Minimum Number of Traverse Points: 24

Points	% of diameter	Distance from inside wall (in.)	Distance including port (in.)
1	2.1	0.63	6 5/8
2	6.7	2.01	8
3	11.8	3.54	9 1/2
4	17.7	5.31	11 1/4
5	25.0	7.50	13 1/2
6	35.6	10.68	16 5/8
7	64.4	19.32	25 3/8
8	75.0	22.50	28 1/2
9	82.3	24.69	30 3/4
10	88.2	26.46	32 1/2
11	93.3	27.99	34
12	97.9	29.37	35 3/8

Reference Diagram



Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth and Vose**		**Run:** **1**
Location:	**Corvallis OR**		**Start Time:** **7:55**
Source:	**CFU118**		**End Time:** **11:00**
EPA Method:	**Modified Method 5**	**Environmental Conditions/Test Notes:**	**Date:** **11/4/2022**
Box Operator:	**MK**	Overcast Sprinkle 48F 4-6 mph out of the southwest	
Technician(s):	**CMF**		

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box 12	Probe ID	4C	Liner type	Glass		
Y factor	1.0313	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.84	Hot box ID	B4	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	4C	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	4				

Source Information:

Barometric Pressure	29.85	"Hg	O_2	20.08	%
Static Pressure	0.82	"H_2O	CO_2	0.48	%
Ave. ΔP	1.69	"H_2O	Rec. Nz.	0.192	inches
Stack Temperature	220	°F			
Assumed moisture	1.90	%			
Assumed meter temp.	60	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	15

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	ws2	

Post Test Calculations:

Sample volume	166.743	dcf	Ave. ΔP	1.471	"H_2O
Wet mol. weight	28.69	M_s (actual)	Ave. √ΔP	1.212	"H_2O
Actual H_2O	1.75	%	Ave. ΔH	3.025	"H_2O
Std. meter vol.	171.988	dscf	Ave. T_s	261.0	°F
Isokinetic Average	100.6	%	Ave. T_m	70.6	°F

Moisture/Lab:

Filter, #	PTFE 7		
	Initial	Final	Gain
Impingers, g	2,195.8	2,240.6	44.8
Silica gel, g	930.4	950.6	20.2
		Total water gain, g:	65.0

Traverse Point	Time (min.)	Meter Volume (dcf) 0.000	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
1	7.5	6.340	1.40	253	52	2.82	2.80	5.5	252	44
2	15.0	13.030	1.50	255	54	3.02	3.00	6	247	43
3	22.5	19.860	1.50	257	56	3.02	3.00	6	250	45
4	30.0	26.650	1.50	258	58	3.03	3.00	6	249	47
5	37.5	33.590	1.50	260	63	3.05	3.10	6.5	245	49
6	45.0	40.740	1.60	260	65	3.27	3.30	6.5	251	50
7	52.5	47.890	1.60	262	67	3.27	3.30	6.5	248	51
8	60.0	54.830	1.50	259	69	3.09	3.10	6.5	250	52
9	67.5	61.740	1.40	260	70	2.89	2.90	6	250	52
10	75.0	69.340	1.70	260	71	3.51	3.50	7.5	249	52
11	82.5	76.620	1.60	261	72	3.31	3.30	7	249	52
12	90.0	83.720	1.60	260	73	3.32	3.30	7	251	52
13	97.5	91.250	1.50	261	74	3.11	3.10	7	251	52
14	105.0	97.890	1.30	261	74	2.70	2.70	5.5	249	51
15	112.5	104.650	1.40	261	75	2.91	2.90	6	250	51
16	120.0	111.550	1.40	261	75	2.91	2.90	6	247	51
17	127.5	118.600	1.50	262	76	3.12	3.10	6	250	51
18	135.0	125.480	1.40	262	77	2.92	2.90	6	250	51
19	142.5	132.470	1.50	264	77	3.12	3.10	6.5	250	51
20	150.0	139.370	1.40	264	78	2.91	2.90	7	251	51
21	157.5	146.260	1.40	264	79	2.92	2.90	7	250	51
22	165.0	153.020	1.30	266	79	2.70	2.70	6	251	51
23	172.5	160.000	1.40	267	80	2.91	2.90	7	251	52
24	180.0	166.743	1.40	267	80	2.91	2.90	6	250	53

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth and Vose**		**Run:** **2**
Location:	**Corvallis OR**		**Start Time:** **11:35**
Source:	**CFU118**		**End Time:** **14:40**
EPA Method:	**Modified Method 5**	**Environmental Conditions/Test Notes:**	**Date:** **11/4/2022**
Box Operator:	**MK**	Overcast Sprinkle 48F 4-6 mph out of the southwest	
Technician(s):	**CMF**		

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box 12	Probe ID	4C	Liner type	Glass		
Y factor	1.0313	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.84	Hot box ID	B4	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	4C	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	4				

Source Information:

Barometric Pressure	29.85	"Hg	O_2	20.08	%
Static Pressure	0.82	"H_2O	CO_2	0.48	%
Ave. ΔP	1.69	"H_2O	Rec. Nz.	0.190	inches
Stack Temperature	220	°F			
Assumed moisture	1.75	%			
Assumed meter temp.	70.6	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	16

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	ws2	

Post Test Calculations:

Sample volume	167.110	dcf	Ave. ΔP	1.471	"H_2O
Wet mol. weight	28.7	M_s (actual)	Ave. √ΔP	1.212	"H_2O
Actual H_2O	1.70	%	Ave. ΔH	3.058	"H_2O
Std. meter vol.	170.328	dscf	Ave. T_s	267.8	°F
Isokinetic Average	100.1	%	Ave. T_m	77.0	°F

Moisture/Lab:

Filter, #	PTFE 8		
	Initial	Final	Gain
Impingers, g	2,267.9	2,306.2	38.3
Silica gel, g	935.1	959.2	24.1
		Total water gain:	62.4

Traverse Point	Time (min.)	Meter Volume (dcf) 0.000	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
1	7.5	6.650	1.40	265	74	2.90	2.90	5	253	53
2	15.0	13.390	1.50	263	75	3.12	3.10	6	255	53
3	22.5	20.290	1.40	262	76	2.92	2.90	6	248	56
4	30.0	27.160	1.50	263	76	3.12	3.10	6	251	57
5	37.5	34.450	1.60	260	77	3.35	3.40	7	249	58
6	45.0	41.680	1.50	259	77	3.15	3.20	7	252	59
7	52.5	48.920	1.50	259	78	3.15	3.20	6	251	59
8	60.0	56.030	1.60	260	61	3.25	3.30	7	250	59
9	67.5	63.610	1.70	263	78	3.55	3.60	7	250	59
10	75.0	70.600	1.50	266	78	3.12	3.10	7	258	59
11	82.5	77.650	1.40	270	78	2.90	2.90	7	253	61
12	90.0	84.300	1.40	271	79	2.90	2.90	7	247	61
13	97.5	90.920	1.30	273	79	2.68	2.70	7	251	62
14	105.0	97.840	1.50	273	79	3.10	3.10	7	252	63
15	112.5	104.760	1.40	274	79	2.89	2.90	7	252	64
16	120.0	111.920	1.50	274	79	3.09	3.10	7	255	65
17	127.5	119.240	1.60	275	78	3.29	3.30	7	257	64
18	135.0	126.110	1.50	273	78	3.09	3.10	7	254	64
19	142.5	133.350	1.50	271	78	3.10	3.10	7	256	64
20	150.0	139.770	1.40	271	78	2.89	2.90	7	251	64
21	157.5	146.670	1.40	272	78	2.89	2.90	7	252	64
22	165.0	153.560	1.50	269	78	3.11	3.10	7	252	63
23	172.5	160.390	1.40	269	78	2.90	2.90	7	250	63
24	180.0	167.110	1.30	271	78	2.69	2.70	7	250	62

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth and Vose**		**Run:** **3**
Location:	**Corvallis OR**		**Start Time:** **15:50**
Source:	**CFU118**		**End Time:** **18:55**
EPA Method:	**Modified Method 5**	**Environmental Conditions/Test Notes:**	**Date:** **11/4/2022**
Box Operator:	**MK**	Overcast Sprinkle 48F 4-6 mph out of the southwest	
Technician(s):	**CMF**		

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box 12	Probe ID	4C	Liner type	Glass		
Y factor	1.0313	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.84	Hot box ID	B4	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	4C	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	4				

Source Information:

Barometric Pressure	29.8	"Hg	O_2	20.08	%
Static Pressure	0.82	"H_2O	CO_2	0.48	%
Ave. ΔP	1.69	"H_2O	Rec. Nz.	0.188	inches
Stack Temperature	220	°F			
Assumed moisture	1.70	%			
Assumed meter temp.	77	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	13

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	ws2	

Post Test Calculations:

Sample volume	165.195	dcf	Ave. ΔP	1.371	"H_2O
Wet mol. weight	28.65	M_s (actual)	Ave. √ΔP	1.17	"H_2O
Actual H_2O	2.15	%	Ave. ΔH	2.946	"H_2O
Std. meter vol.	168.365	dscf	Ave. T_s	245.1	°F
Isokinetic Average	101.3	%	Ave. T_m	76.0	°F

Moisture/Lab:

Filter, #	PTFE 9		
	Initial	Final	Gain
Impingers, g	2,184.2	2,226.6	42.4
Silica gel, g	951.9	987.8	35.9
		Total water gain:	78.3

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		0.000								
1	7.5	6.780	1.40	220	70	3.07	3.10	4	252	54
2	15.0	13.660	1.40	232	70	3.01	3.00	4	253	53
3	22.5	20.790	1.50	238	71	3.21	3.20	4	251	58
4	30.0	27.820	1.50	241	72	3.20	3.20	4	245	61
5	37.5	34.710	1.40	244	73	2.98	3.00	4	252	63
6	45.0	41.940	1.50	244	74	3.20	3.20	4	253	64
7	52.5	48.700	1.40	245	75	2.99	3.00	4	247	62
8	60.0	55.780	1.40	244	75	2.99	3.00	4	249	60
9	67.5	62.740	1.30	246	75	2.77	2.80	4	249	59
10	75.0	69.860	1.40	247	75	2.98	3.00	4	248	60
11	82.5	76.700	1.40	247	75	2.98	3.00	4	255	60
12	90.0	83.645	1.30	247	75	2.76	2.80	4	248	60
13	97.5	90.210	1.30	246	75	2.77	2.80	4	253	60
14	105.0	97.110	1.40	247	76	2.98	3.00	4	254	60
15	112.5	103.850	1.40	248	77	2.98	3.00	4	250	61
16	120.0	110.500	1.30	247	77	2.77	2.80	4	247	60
17	127.5	117.440	1.40	247	78	2.99	3.00	4	258	62
18	135.0	124.370	1.40	250	78	2.98	3.00	4	251	62
19	142.5	131.320	1.40	247	79	3.00	3.00	4	246	63
20	150.0	138.260	1.30	250	80	2.78	2.80	4	249	64
21	157.5	144.860	1.20	251	81	2.57	2.60	4	251	63
22	165.0	151.490	1.20	251	80	2.56	2.60	4	255	63
23	172.5	158.440	1.40	251	81	2.99	3.00	4	248	64
24	180.0	165.195	1.30	252	81	2.78	2.80	4	254	65

EPA Method 4
Impinger Weights Summary

Client:	**Hollingsworth and Vose**
Location:	**Corvallis OR**
Source:	**CFU118**
EPA Method:	**Modified Method 5**
Box Operator:	**MK**
Technician(s):	**CMF**

Run 1
Impinger gain by weight (g):

#	Initial	Final	Gain
1	762.2	736.1	-26.1
2	769.6	824.1	54.5
3	664.0	680.4	16.4
4			
5			
6			
Totals:	2,195.8	2,240.6	44.8

Run 2
Impinger gain by weight (g):

#	Initial	Final	Gain
1	767.3	753.2	-14.1
2	821.7	861.0	39.3
3	678.9	692.0	13.1
4			
5			
6			
Totals:	2,267.9	2,306.2	38.3

Run 3
Impinger gain by weight (g):

#	Initial	Final	Gain
1	736.3	730.0	-6.3
2	824.3	860.4	36.1
3	623.6	636.2	12.6
4			
5			
6			
Totals:	2,184.2	2,226.6	42.4

BISON ENGINEERING, INC.

COMPANY	**Hollingsworth & Vose Fiber Company**
FACILITY	**Glass Plant 2**
LOCATION	**Corvallis OR**
SOURCE	**CFU118**
DATE	**11/04/22**
METHOD	**ODEQ Method 5**
POLLUTANT	**Particulate Matter**

EPA Method 1
Stack Parameters and Traverse Points

Client: **Hollingsworth & Vose Fiber Company**
Location: **Corvallis OR**
Source: **CFU118**
Facility: **Glass Plant 2**

Type of Testing: V (P for Particulate; V for Velocity/Nonparticulate)
Type of Duct: D (C for circular; R for rectangular)

Number of ports available:	2	
Number of ports to be used:	2	
Port diameter:	6	inches
Sampling location height (approx.):		feet
Stack height (approx.):		feet
Circular ID (Rectangular Depth):	30.00	inches
Port depth and/or wall thickness:	6.00	inches
Stack width (Rectangular only):		inches

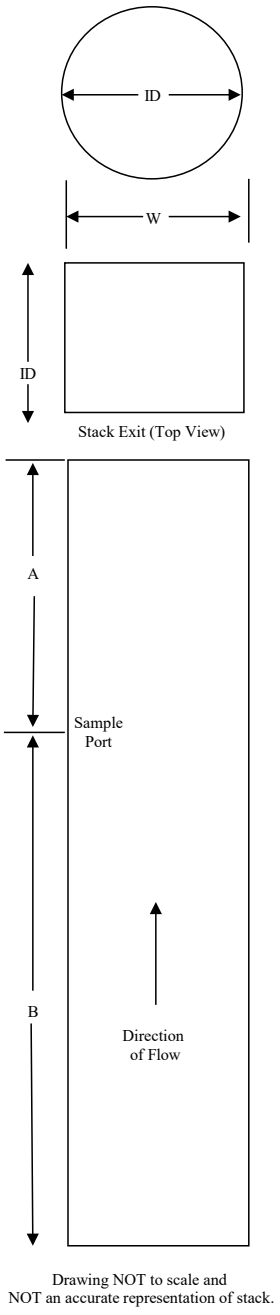
Equivalent Diameter
If rectangular = $\frac{2*Depth*Width}{Depth + Width}$ = 30.00 inches (If circular = duct ID)
Stack/duct area = 4.909 sq.feet 706.9 sq. inches

Sample Port Location:	Downstream flow disturbance from process B	Upstream flow disturbance toward exit A
Number of Inches:	142.00	52.00
Number of Diameters:	4.73	1.73

Minimum Number of Traverse Points: 24

Points	% of diameter	Distance from inside wall (in.)	Distance including port (in.)
1	2.1	0.63	6 5/8
2	6.7	2.01	8
3	11.8	3.54	9 1/2
4	17.7	5.31	11 1/4
5	25.0	7.50	13 1/2
6	35.6	10.68	16 5/8
7	64.4	19.32	25 3/8
8	75.0	22.50	28 1/2
9	82.3	24.69	30 3/4
10	88.2	26.46	32 1/2
11	93.3	27.99	34
12	97.9	29.37	35 3/8

Reference Diagram



Pre-Test Traverse

Client: **Hollingsworth & Vose Fiber Company**
Location: **Corvallis OR**
Source: **CFU118**

Stack Temp: 22 °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	1.30	0
2	1.40	2
3	1.60	0
4	1.90	0
5	1.90	0
6	1.80	2
7	2.00	0
8	1.50	2
9	1.60	0
10	1.30	0
11	1.20	5
12	1.10	0
13	1.90	0
14	1.90	5
15	1.90	0
16	1.80	0
17	1.80	1
18	1.70	0
19	1.80	0
20	2.00	1
21	1.90	0
22	1.60	1
23	1.60	10
24	1.50	5
Average:	1.67	1

Flow is found to be: Non-cyclonic

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**1**
Location:	**Corvallis OR**	**Start Time:**	**7:55**
Source:	**CFU118**	**End Time:**	**11:00**
EPA Method:	**ODEQ Method 5**	**Date:**	**11/4/2022**
Box Operator:	**MK**		
Technician(s):	**CMF**		

Environmental Conditions/Test Notes:
Overcast Sprinkle 48F 4-6 mph out of the southwest

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box SB-2	Probe ID	1005200	Liner type	Glass		
Y factor	1.0010	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.737	Hot box ID	HHB8	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	1005200	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	6				

Source Information:

Barometric Pressure	29.85	"Hg	O_2	20.08	%
Static Pressure	0.82	"H_2O	CO_2	0.48	%
Ave. ΔP	1.69	"H_2O	Rec. Nz.	0.192	inches
Stack Temperature	220	°F			
Assumed moisture	1.90	%			
Assumed meter temp.	60	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	15

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	ws2	

Post Test Calculations:

Sample volume	169.475	dcf	Ave. ΔP	1.433	"H_2O
Wet mol. weight	28.64	M_s (actual)	Ave. √ΔP	1.196	"H_2O
Actual H_2O	2.18	%	Ave. ΔH	2.767	"H_2O
Std. meter vol.	170.044	dscf	Ave. T_s	263.7	°F
Isokinetic Average	101.3	%	Ave. T_m	69.1	°F

Moisture/Lab:

Filter, #	Q81		
	Initial	Final	Gain
Impingers, g	2,136.1	2,181.9	45.8
Silica gel, g	887.7	922.4	34.7
		Total water gain, g:	80.5

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		370.085								
1	7.5	376.650	1.30	256	53	2.46	2.50	0.5	242	43
2	15.0	383.410	1.40	257	54	2.65	2.70	0.5	246	44
3	22.5	390.210	1.40	259	56	2.66	2.70	0.5	255	48
4	30.0	397.370	1.50	260	58	2.85	2.90	0.5	249	50
5	37.5	404.350	1.40	262	62	2.68	2.70	0.5	244	53
6	45.0	411.350	1.50	262	63	2.87	2.90	0.5	250	53
7	52.5	418.710	1.60	263	65	3.07	3.10	0.5	259	54
8	60.0	425.970	1.50	262	66	2.89	2.90	0.5	255	55
9	67.5	432.570	1.30	261	67	2.51	2.50	0.5	245	55
10	75.0	439.580	1.40	263	69	2.71	2.70	0.5	249	50
11	82.5	446.500	1.40	264	69	2.71	2.70	0.5	246	50
12	90.0	453.860	1.50	263	71	2.91	2.90	0.5	245	50
13	97.5	460.650	1.30	263	71	2.53	2.50	0.5	248	50
14	105.0	467.900	1.50	263	72	2.92	2.90	0.5	253	50
15	112.5	474.900	1.50	263	73	2.92	2.90	0.5	248	50
16	120.0	482.410	1.60	263	74	3.13	3.10	0.5	251	50
17	127.5	489.950	1.60	264	74	3.12	3.10	0.5	253	51
18	135.0	497.360	1.50	265	75	2.93	2.90	0.5	246	52
19	142.5	504.920	1.50	267	76	2.93	2.90	0.5	253	53
20	150.0	512.110	1.50	268	77	2.93	2.90	0.5	246	52
21	157.5	519.120	1.30	268	77	2.54	2.50	0.5	246	52
22	165.0	526.300	1.40	270	78	2.73	2.70	0.5	251	51
23	172.5	532.930	1.30	271	79	2.54	2.50	0.5	258	52
24	180.0	539.560	1.20	271	79	2.34	2.30	0.5	252	52

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth & Vose Fiber Company**			**Run:**	**2**
Location:	**Corvallis OR**			**Start Time:**	**11:35**
Source:	**CFU118**			**End Time:**	**14:40**
EPA Method:	**ODEQ Method 5**	**Environmental Conditions/Test Notes:**		**Date:**	**11/4/2022**
Box Operator:	**MK**	Overcast Sprinkle 48F 4-6 mph out of the southwest			
Technician(s):	**CMF**				

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box SB-2	Probe ID	1005200	Liner type	Glass		
Y factor	1.0010	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.737	Hot box ID	HHB8	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	1005200	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	6				

Source Information:

Barometric Pressure	29.85	"Hg	O_2	20.08	%
Static Pressure	0.82	"H_2O	CO_2	0.48	%
Ave. ΔP	1.69	"H_2O	Rec. Nz.	0.190	inches
Stack Temperature	220	°F			
Assumed moisture	2.18	%			
Assumed meter temp.	69.1	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	8

.

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	ws2	

Post Test Calculations:

Sample volume	168.080	dcf	Ave. ΔP	1.404	"H_2O
Wet mol. weight	28.67	M_s (actual)	Ave. √ΔP	1.184	"H_2O
Actual H_2O	1.90	%	Ave. ΔH	2.667	"H_2O
Std. meter vol.	166.901	dscf	Ave. T_s	273.2	°F
Isokinetic Average	100.9	%	Ave. T_m	74.5	°F

Moisture/Lab:

Filter, #	Q82		
	Initial	Final	Gain
Impingers, g	2,216.7	2,263.2	46.5
Silica gel, g	952.1	974.1	22.0
		Total water gain:	68.5

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		539.815								
1	7.5	546.900	1.40	271	74	2.69	2.70	1	254	54
2	15.0	553.720	1.30	271	74	2.50	2.50	1	249	56
3	22.5	560.780	1.40	270	74	2.70	2.70	2	251	57
4	30.0	568.100	1.40	270	74	2.70	2.70	2	238	58
5	37.5	575.200	1.50	270	74	2.89	2.90	2	251	59
6	45.0	581.800	1.30	268	74	2.51	2.50	2	248	58
7	52.5	589.100	1.50	267	75	2.91	2.90	2	249	58
8	60.0	596.000	1.50	265	75	2.91	2.90	2	250	58
9	67.5	603.625	1.60	266	75	3.10	3.10	2	245	58
10	75.0	610.990	1.50	274	75	2.88	2.90	2	248	59
11	82.5	618.400	1.50	274	75	2.88	2.90	2	241	59
12	90.0	625.000	1.30	275	75	2.49	2.50	2	248	59
13	97.5	631.400	1.20	277	75	2.29	2.30	2	246	59
14	105.0	638.550	1.40	277	75	2.68	2.70	2	247	60
15	112.5	645.420	1.40	278	75	2.67	1.70	2	247	60
16	120.0	652.710	1.50	277	75	2.87	2.90	2	248	60
17	127.5	660.000	1.50	278	75	2.86	2.90	2	248	60
18	135.0	666.890	1.40	276	74	2.67	2.70	2	245	61
19	142.5	674.000	1.50	275	74	2.87	2.90	2	240	61
20	150.0	680.450	1.40	276	74	2.67	2.70	2	247	61
21	157.5	687.350	1.30	277	74	2.48	2.50	2	250	62
22	165.0	694.500	1.40	275	74	2.68	2.70	2	252	61
23	172.5	701.410	1.30	274	74	2.49	2.50	2	253	61
24	180.0	707.895	1.20	275	74	2.30	2.30	2	244	62

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**3**
Location:	**Corvallis OR**	**Start Time:**	**15:50**
Source:	**CFU118**	**End Time:**	**18:55**
EPA Method:	**ODEQ Method 5**	**Date:**	**11/4/2022**
Box Operator:	**MK**		
Technician(s):	**CMF**		

Environmental Conditions/Test Notes:
Overcast Sprinkle 48F 4-6 mph out of the southwest

Stack Dimensional Data:

Circular		
Diameter	30.000	in
Rectangular		
Width		in
Length		in
Stack Area	4.909	sq.ft.

Equipment:

Meterbox ID	Box SB-2	Probe ID	1005200	Liner type	Glass		
Y factor	1.0010	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.737	Hot box ID	HHB8	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	1005200	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	6				

Source Information:

Barometric Pressure	29.8	"Hg	O_2	20.08	%
Static Pressure	0.82	"H_2O	CO_2	0.48	%
Ave. ΔP	1.69	"H_2O	Rec. Nz.	0.189	inches
Stack Temperature	220	°F			
Assumed moisture	1.90	%			
Assumed meter temp.	74.5	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	15

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	ws2	

Post Test Calculations:

Sample volume	170.390	dcf	Ave. ΔP	1.363	"H_2O
Wet mol. weight	28.67	M_s (actual)	Ave. √ΔP	1.167	"H_2O
Actual H_2O	1.93	%	Ave. ΔH	2.729	"H_2O
Std. meter vol.	169.290	dscf	Ave. T_s	248.8	°F
Isokinetic Average	102.2	%	Ave. T_m	73.4	°F

Moisture/Lab:

Filter, #	Q83		
	Initial	Final	Gain
Impingers, g	2,155.8	2,191.1	35.3
Silica gel, g	905.6	940.9	35.3
		Total water gain:	70.6

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		708.285								
1	7.5	715.160	1.30	222	70	2.67	2.70	1	249	50
2	15.0	722.200	1.40	235	71	2.83	2.80	1	246	50
3	22.5	729.150	1.30	241	71	2.60	2.60	1	250	53
4	30.0	735.990	1.30	245	71	2.59	2.60	1	240	53
5	37.5	743.150	1.40	247	71	2.78	2.80	1	252	54
6	45.0	749.990	1.30	249	71	2.58	2.60	1	244	55
7	52.5	757.000	1.30	250	67	2.55	2.60	1	236	55
8	60.0	764.510	1.40	249	71	2.77	2.80	1	259	55
9	67.5	771.210	1.30	249	71	2.58	2.60	1	245	56
10	75.0	778.260	1.30	250	71	2.57	2.60	1	252	57
11	82.5	785.760	1.50	250	71	2.97	3.00	1	240	58
12	90.0	792.780	1.40	250	71	2.77	2.80	1	246	59
13	97.5	799.770	1.40	250	72	2.77	2.80	1	257	60
14	105.0	807.100	1.50	251	73	2.97	3.00	1	249	60
15	112.5	814.760	1.50	252	74	2.98	3.00	1	246	62
16	120.0	821.800	1.30	252	75	2.58	2.60	1	252	62
17	127.5	828.870	1.40	252	75	2.78	2.80	1	249	63
18	135.0	835.990	1.40	253	76	2.78	2.80	1	247	63
19	142.5	843.450	1.50	252	78	3.00	3.00	1	248	63
20	150.0	850.590	1.30	254	77	2.59	2.60	1	253	62
21	157.5	858.000	1.30	255	78	2.59	2.60	1	242	65
22	165.0	865.460	1.40	255	79	2.79	2.80	1	245	65
23	172.5	872.050	1.20	253	79	2.40	2.40	1	242	65
24	180.0	878.675	1.30	255	79	2.59	2.60	1	250	64

EPA Method 4
Impinger Weights Summary

Client: **Hollingsworth & Vose Fiber Company**
Location: **Corvallis OR**
Source: **CFU118**
EPA Method: **ODEQ Method 5**
Box Operator: **MK**
Technician(s): **CMF**

Run 1
Impinger gain by weight (g):

#	Initial	Final	Gain
1	769.9	749.3	-20.6
2	743.4	793.3	49.9
3	622.8	639.3	16.5
4			
5			
6			
Totals:	2,136.1	2,181.9	45.8

Run 2
Impinger gain by weight (g):

#	Initial	Final	Gain
1	780.0	774.8	-5.2
2	742.2	780.7	38.5
3	694.5	707.7	13.2
4			
5			
6			
Totals:	2,216.7	2,263.2	46.5

Run 3
Impinger gain by weight (g):

#	Initial	Final	Gain
1	745.9	739.7	-6.2
2	744.7	777.1	32.4
3	665.2	674.3	9.1
4			
5			
6			
Totals:	2,155.8	2,191.1	35.3

Oregon Methods 1-5
Filterable and Condensable Particulate
Results Summary

Client: **Hollingsworth & Vose Fiber Company**
Source: **CFU118**
Location: **Corvallis, OR**

Run			1	2	3	
Date			11/4/2022	11/4/2022	11/4/2022	
Run Start Time			7:55	11:35	15:50	
Run End Time			11:00	14:40	18:55	
Duration, min.			180	180	180	Average
Barometric Pressure, "Hg			29.85	29.85	29.80	**29.83**
Nozzle Dia., in.			0.225	0.225	0.225	**0.225**
Isokinetic Average, %			101.3	100.9	102.2	**101.5**
Sample Volume, dscf			170.044	166.901	169.290	**168.745**
Sample Volume, dscm			4.815	4.726	4.794	**4.778**
Stack Diameter, in.			30.00	30.00	30.00	**30.00**
Stack Area, sq.ft.			4.909	4.909	4.909	**4.909**
CO_2 %vd			0.48	0.48	0.48	**0.48**
O_2 %vd			20.08	20.08	20.08	**20.08**
Static Press., "H_2O			0.82	0.82	0.82	**0.82**
H_2O %v			2.18	1.90	1.93	**2.00**
Wet Molecular Weight, lb/lb-mole			28.64	28.67	28.67	**28.66**
Velocity, FPS			78.92	78.60	76.24	**77.92**
ADCFM			22,738	22,711	22,023	**22,491**
ACFM			23,245	23,151	22,456	**22,951**
DSCFM			16,581	16,347	16,369	**16,432**
Stack Temperature, ^0F			263.7	273.2	248.8	**261.9**
Filterable Particulate	Concentration, C_s	gr/dscf	0.00E+00	9.12E-05	3.32E-04	**1.41E-04**
		µg/dscm	0.0	208.7	759.7	**322.8**
	Mass	lb/hr	0.00E+00	1.28E-02	4.66E-02	**1.98E-02**
		lb/lb glass	0.00E+00	1.13E-04	4.32E-04	**1.82E-04**
Inorganic CPM	Concentration, C_s	gr/dscf	2.68E-04	0.00E+00	1.41E-04	**1.36E-04**
		µg/dscm	612.6	0.0	322.8	**311.8**
	Mass	lb/hr	3.80E-02	0.00E+00	1.98E-02	**1.93E-02**
		lb/lb glass	3.33E-04	0.00E+00	1.83E-04	**1.72E-04**
Organic CPM	Concentration, C_s	gr/dscf	1.50E-04	3.88E-04	2.10E-04	**2.49E-04**
		µg/dscm	344.3	888.7	479.8	**570.9**
	Mass	lb/hr	2.14E-02	5.44E-02	2.94E-02	**3.51E-02**
		lb/lb glass	1.87E-04	4.83E-04	2.73E-04	**3.14E-04**
Total PM Filterable + Condensable	Concentration, C_s	gr/dscf	ND 4.18E-04	ND 4.79E-04	6.83E-04	DLL **5.27E-04**
		µg/dscm	ND 957.0	ND 1097.4	1562.3	DLL **1205.5**
	Mass	lb/hr	ND 5.94E-02	ND 6.72E-02	9.58E-02	DLL **7.41E-02**
		lb/lb glass	ND 5.20E-04	ND 5.96E-04	8.88E-04	DLL **6.68E-04**
Production Data	Glass Fiber Pull Rate	lb/hr	114.3	112.7	107.9	**111.6**

ND - Non-detect. Measured total PM was less than the ODEQ Method 5 analytical detection limit specified in the ODEQ Source Sampling Manual.
DLL - Detection limit limited. Value is the average of two runs with ND results and one run with results above the analytical detection limit.

Isokinetic Field Data
Field Data and Calculations
Particulate Emissions and Gas Stream Characteristics

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**1**
Source:	**CFU118**	**Date:**	**11/4/2022**
Location:	**Corvallis, OR**	**Start Time:**	**7:55**
Method:	**ODEQ 5**	**End Time:**	**11:00**

Sampling Data				Traverse Data			
Time	**Meter**	**ΔH**	**Meter**	**Traverse**	**Dp**	**Stack**	
min.	**ft^3**	**"H_2O**	**T_m °F**	**Point**	**"H_2O**	**T_s °F**	**√Dp**
	370.085						
8	376.650	2.50	53	1	1.30	256	1.140
15	383.410	2.70	54	2	1.40	257	1.183
23	390.210	2.70	56	3	1.40	259	1.183
30	397.370	2.90	58	4	1.50	260	1.225
38	404.350	2.70	62	5	1.40	262	1.183
45	411.350	2.90	63	6	1.50	262	1.225
53	418.710	3.10	65	7	1.60	263	1.265
60	425.970	2.90	66	8	1.50	262	1.225
68	432.570	2.50	67	9	1.30	261	1.140
75	439.580	2.70	69	10	1.40	263	1.183
83	446.500	2.70	69	11	1.40	264	1.183
90	453.860	2.90	71	12	1.50	263	1.225
98	460.650	2.50	71	13	1.30	263	1.140
105	467.900	2.90	72	14	1.50	263	1.225
113	474.900	2.90	73	15	1.50	263	1.225
120	482.410	3.10	74	16	1.60	263	1.265
128	489.950	3.10	74	17	1.60	264	1.265
135	497.360	2.90	75	18	1.50	265	1.225
143	504.920	2.90	76	19	1.50	267	1.225
150	512.110	2.90	77	20	1.50	268	1.225
158	519.120	2.50	77	21	1.30	268	1.140
165	526.300	2.70	78	22	1.40	270	1.183
173	532.930	2.50	79	23	1.30	271	1.140
180	539.560	2.30	79	24	1.20	271	1.095

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**1**
Source:	**Corvallis, OR**	**Date:**	**11/04/22**

Field Data Input Continued

Moisture Data			Stack Dimensional Data:		
Total Test Time	180.0	min	Circular		
Sample Time Interval	7.5	min	Diameter	30.000	in
Meter Volume, V_m	169.475	dcf	Rectangular		
Water Weight	80.5	g	Width		in
Nozzle Diameter, N_z	0.225	in.	Length		in
Nozzle Area	0.000276	sq.ft.	Stack Area	4.909	sq.ft.
Traverse Data			Molecular Weight:		
Barometric Pressure, P_b	29.85	"Hg	CO_2 Average	0.48	%vd
Static Pressure	0.82	"H_2O	O_2 Average	20.08	%vd
Pitot Factor, C_p	0.84				
Meter Cal Factor	1.0010	Y			

Field Data Averages

Meter			Stack		
ΔH	2.767	"H_2O	√Dp	1.196	"H_2O
Temperature, T_m	69.1	^oF	Temperature, T_s	263.7	^oF
Temperature, T_m	528.8	^oA (^oR)	Temperature, T_s	723.4	^oA (R)
Pressure Meter, P_m	30.053	"Hg	Pressure Stack, P_s	29.910	"Hg

Field Data Calculations

Meter Box Capture			EPA Method 2 Stack Gas Flowrate:		
Standard Volume, $V_{m(std)}$	170.044	dscf	Velocity, V_s	78.92	fps
	4.815	dscm	Volume (actual)	23,245	acfm
Actual Volume, $V_{m(actual)}$	238.384	awcf		22,738	adcfm
Gas Stream Moisture			Volume (standard)	1,017,043	wscf/hr
Moisture Vapor, $V_{w(std)}$	3.796	scf		994,871	dscf/hr
Moisture, B_{ws}	0.0218			16,581	dscf/min
Moisture EPA M4	2.18	%v		16,951	wscf/min
Moisture @ Saturation	NA	%v (for T_s < 212°F)			
EPA Method 3 Gas Density					
Dry, M_d	28.88	lb/lb-mole			
Wet, M_s	28.64	lb/lb-mole			
Percent Isokinetic	101.3	%			

Laboratory Results

EPA Method 5					
Filterable PM	0.0000	grams			
Emissions:					
Concentration, C_s	0.00E+00	gr/dscf			
	0.0	µg/dscm			
Mass Emissions	0.00E+00	lb/hr			
Back Half:					
Inorganic CPM	0.0029	grams	Organic CPM	0.0017	grams
Inorganic CPM, C_s	2.68E-04	gr/dscf	Organic CPM, C_s	1.50E-04	gr/dscf
	612.6	µg/dscm		344.3	µg/dscm
Mass Emissions	3.80E-02	lb/hr	Mass Emissions	2.14E-02	lb/hr

Isokinetic Field Data
Field Data and Calculations
Particulate Emissions and Gas Stream Characteristics

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**2**
Source:	**CFU118**	**Date:**	**11/4/2022**
Location:	**Corvallis, OR**	**Start Time:**	**11:35**
Method:	**ODEQ 5**	**End Time:**	**14:40**

Sampling Data				Traverse Data			
Time	**Meter**	**ΔH**	**Meter**	**Traverse**	**Dp**	**Stack**	
min.	**ft^3**	**"H_2O**	**T_m °F**	**Point**	**"H_2O**	**T_s °F**	**√Dp**
	539.815						
8	546.900	2.70	74	1	1.40	271	1.183
15	553.720	2.50	74	2	1.30	271	1.140
23	560.780	2.70	74	3	1.40	270	1.183
30	568.100	2.70	74	4	1.40	270	1.183
38	575.200	2.90	74	5	1.50	270	1.225
45	581.800	2.50	74	6	1.30	268	1.140
53	589.100	2.90	75	7	1.50	267	1.225
60	596.000	2.90	75	8	1.50	265	1.225
68	603.625	3.10	75	9	1.60	266	1.265
75	610.990	2.90	75	10	1.50	274	1.225
83	618.400	2.90	75	11	1.50	274	1.225
90	625.000	2.50	75	12	1.30	275	1.140
98	631.400	2.30	75	13	1.20	277	1.095
105	638.550	2.70	75	14	1.40	277	1.183
113	645.420	1.70	75	15	1.40	278	1.183
120	652.710	2.90	75	16	1.50	277	1.225
128	660.000	2.90	75	17	1.50	278	1.225
135	666.890	2.70	74	18	1.40	276	1.183
143	674.000	2.90	74	19	1.50	275	1.225
150	680.450	2.70	74	20	1.40	276	1.183
158	687.350	2.50	74	21	1.30	277	1.140
165	694.500	2.70	74	22	1.40	275	1.183
173	701.410	2.50	74	23	1.30	274	1.140
180	707.895	2.30	74	24	1.20	275	1.095

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**2**
Source:	**Corvallis, OR**	**Date:**	**11/04/22**

Field Data Input Continued

Moisture Data			Stack Dimensional Data:		
Total Test Time	180.0	min	Circular		
Sample Time Interval	7.5	min	Diameter	30.000	in
Meter Volume, V_m	168.080	dcf	Rectangular		
Water Weight	68.5	g	Width		in
Nozzle Diameter, N_z	0.225	in.	Length		in
Nozzle Area	0.000276	sq.ft.	Stack Area	4.909	sq.ft.
Traverse Data			Molecular Weight:		
Barometric Pressure, P_b	29.85	"Hg	CO_2 Average	0.48	%vd
Static Pressure	0.82	"H_2O	O_2 Average	20.08	%vd
Pitot Factor, C_p	0.84				
Meter Cal Factor	1.0010	Y			

Field Data Averages

Meter			Stack		
ΔH	2.667	"H_2O	√Dp	1.184	"H_2O
Temperature, T_m	74.5	^oF	Temperature, T_s	273.2	^oF
Temperature, T_m	534.2	^oA (^oR)	Temperature, T_s	732.9	^oA (R)
Pressure Meter, P_m	30.046	"Hg	Pressure Stack, P_s	29.910	"Hg

Field Data Calculations

Meter Box Capture			EPA Method 2 Stack Gas Flowrate:		
Standard Volume, $V_{m(std)}$	166.901	dscf	Velocity, V_s	78.60	fps
	4.726	dscm	Volume (actual)	23,151	acfm
Actual Volume, $V_{m(actual)}$	236.374	awcf		22,711	adcfm
Gas Stream Moisture			Volume (standard)	999,789	wscf/hr
Moisture Vapor, $V_{w(std)}$	3.230	scf		980,793	dscf/hr
Moisture, B_{ws}	0.0190			16,347	dscf/min
Moisture EPA M4	1.90	%v		16,663	wscf/min
Moisture @ Saturation	NA	%v (for T_s < 212°F)			
EPA Method 3 Gas Density					
Dry, M_d	28.88	lb/lb-mole			
Wet, M_s	28.67	lb/lb-mole			
Percent Isokinetic	100.9	%			

Laboratory Results

Front Half:					
Filterable PM	0.0010	grams			
Emissions:					
Concentration, C_s	9.12E-05	gr/dscf			
	208.7	µg/dscm			
Mass Emissions	1.28E-02	lb/hr			
Back Half:					
Inorganic CPM	0.0000	grams	Organic CPM	0.0042	grams
Inorganic CPM, C_s	0.00E+00	gr/dscf	Organic CPM, C_s	3.88E-04	gr/dscf
	0.0	µg/dscm		888.7	µg/dscm
Mass Emissions	0.00E+00	lb/hr	Mass Emissions	5.44E-02	lb/hr

Isokinetic Field Data
Field Data and Calculations
Particulate Emissions and Gas Stream Characteristics

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**3**
Source:	**CFU118**	**Date:**	**11/4/2022**
Location:	**Corvallis, OR**	**Start Time:**	**15:50**
Method:	**ODEQ 5**	**End Time:**	**18:55**

Sampling Data				Traverse Data			
Time	**Meter**	**ΔH**	**Meter**	**Traverse**	**Dp**	**Stack**	
min.	**ft^3**	**"H_2O**	**T_m °F**	**Point**	**"H_2O**	**T_s °F**	**√Dp**
	708.285						
8	715.160	2.70	70	1	1.30	222	1.140
15	722.200	2.80	71	2	1.40	235	1.183
23	729.150	2.60	71	3	1.30	241	1.140
30	735.990	2.60	71	4	1.30	245	1.140
38	743.150	2.80	71	5	1.40	247	1.183
45	749.990	2.60	71	6	1.30	249	1.140
53	757.000	2.60	67	7	1.30	250	1.140
60	764.510	2.80	71	8	1.40	249	1.183
68	771.210	2.60	71	9	1.30	249	1.140
75	778.260	2.60	71	10	1.30	250	1.140
83	785.760	3.00	71	11	1.50	250	1.225
90	792.780	2.80	71	12	1.40	250	1.183
98	799.770	2.80	72	13	1.40	250	1.183
105	807.100	3.00	73	14	1.50	251	1.225
113	814.760	3.00	74	15	1.50	252	1.225
120	821.800	2.60	75	16	1.30	252	1.140
128	828.870	2.80	75	17	1.40	252	1.183
135	835.990	2.80	76	18	1.40	253	1.183
143	843.450	3.00	78	19	1.50	252	1.225
150	850.590	2.60	77	20	1.30	254	1.140
158	858.000	2.60	78	21	1.30	255	1.140
165	865.460	2.80	79	22	1.40	255	1.183
173	872.050	2.40	79	23	1.20	253	1.095
180	878.675	2.60	79	24	1.30	255	1.140

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**3**
Source:	**Corvallis, OR**	**Date:**	**11/04/22**

Field Data Input Continued

Moisture Data			Stack Dimensional Data:		
Total Test Time	180.0	min	Circular		
Sample Time Interval	7.5	min	Diameter	30.000	in
Meter Volume, V_m	170.390	dcf	Rectangular		
Water Weight	70.6	g	Width		in
Nozzle Diameter, N_z	0.225	in.	Length		in
Nozzle Area	0.000276	sq.ft.	Stack Area	4.909	sq.ft.
Traverse Data			Molecular Weight:		
Barometric Pressure, P_b	29.80	"Hg	CO_2 Average	0.48	%vd
Static Pressure	0.82	"H_2O	O_2 Average	20.08	%vd
Pitot Factor, C_p	0.84				
Meter Cal Factor	1.0010	Y			

Field Data Averages

Meter			Stack		
ΔH	2.729	"H_2O	√Dp	1.167	"H_2O
Temperature, T_m	73.4	^oF	Temperature, T_s	248.8	^oF
Temperature, T_m	533.1	^oA (^oR)	Temperature, T_s	708.5	^oA (R)
Pressure Meter, P_m	30.001	"Hg	Pressure Stack, P_s	29.860	"Hg

Field Data Calculations

Meter Box Capture			EPA Method 2 Stack Gas Flowrate:		
Standard Volume, $V_{m(std)}$	169.290	dscf	Velocity, V_s	76.24	fps
	4.794	dscm	Volume (actual)	22,456	acfm
Actual Volume, $V_{m(actual)}$	232.234	awcf		22,023	adcfm
Gas Stream Moisture			Volume (standard)	1,001,492	wscf/hr
Moisture Vapor, $V_{w(std)}$	3.329	scf		982,163	dscf/hr
Moisture, B_{ws}	0.0193			16,369	dscf/min
Moisture EPA M4	1.93	%v		16,692	wscf/min
Moisture @ Saturation	NA	%v (for $T_s < 212°F$)			
EPA Method 3 Gas Density					
Dry, M_d	28.88	lb/lb-mole			
Wet, M_s	28.67	lb/lb-mole			
Percent Isokinetic	102.2	%			

Laboratory Results

Front Half:					
Filterable PM	0.0036	grams			
Emissions:					
Concentration, C_s	3.32E-04	gr/dscf			
	759.7	µg/dscm			
Mass Emissions	4.66E-02	lb/hr			
Back Half:					
Inorganic CPM	0.0015	grams	Organic CPM	0.0023	grams
Inorganic CPM, C_s	1.41E-04	gr/dscf	Organic CPM, C_s	2.10E-04	gr/dscf
	322.8	µg/dscm		479.8	µg/dscm
Mass Emissions	1.98E-02	lb/hr	Mass Emissions	2.94E-02	lb/hr

Oregon Method 5
Filterable and Condensable Particulate
Laboratory Gravimetric Data

Client: **Hollingsworth & Vose Fiber Company**
Source: **CFU118**
Location: **Corvallis, OR**

Run	Sample Description	g, #	Initial (grams)	Final (grams)	Net Gain	Blank Correction	Corrected Gain (grams)	
1	CPM Organics (Acetone BH)	123.8	50.0096	50.0120	0.0024	0.0010	**0.0014**	
	Probe Rinse (Acetone FH)	109.5	54.4723	54.4687	-0.0036	0.0009	**0.0000**	
	Filter	Q81	0.4538	0.4533	-0.0005		**0.0000**	
	CPM Inorganics (Water)	405.4	48.6108	48.6148	0.0040	0.0011	**0.0029**	
	CPM Organics (Hexane BH)	78.9	48.0987	48.0990	0.0003	0.0000	**0.0003**	
	Impinger H_2O Gain, mls		200.0	245.8	45.8			
						Filterable PM (g)	**0.0000**	
						Total PM (g)	**0.0046**	**ND**
2	CPM Organics (Acetone BH)	134.0	51.5078	51.5085	0.0007	0.0011	**0.0000**	
	Probe Rinse (Acetone FH)	156.1	44.4171	44.4194	0.0023	0.0013	**0.0010**	
	Filter	Q82	0.4415	0.4414	-0.0001		**0.0000**	
	CPM Inorganics (Water)	429.9	45.9371	45.9378	0.0007	0.0011	**0.0000**	
	CPM Organics (Hexane BH)	80.3	43.1711	43.1753	0.0042	0.0000	**0.0042**	
	Impinger H_2O Gain, mls		200.0	246.5	46.5			
						Filterable PM (g)	**0.0010**	
						Total PM (g)	**0.0052**	**ND**
3	CPM Organics (Acetone BH)	148.8	49.2392	49.2404	0.0012	0.0013	**0.0000**	
	Probe Rinse (Acetone FH)	185.1	46.5206	46.5258	0.0052	0.0016	**0.0036**	
	Filter	Q83	0.4445	0.4442	-0.0003		**0.0000**	
	CPM Inorganics (Water)	444.9	49.6739	49.6766	0.0027	0.0012	**0.0015**	
	CPM Organics (Hexane BH)	82.0	51.5290	51.5313	0.0023	0.0000	**0.0023**	
	Impinger H_2O Gain, mls		200.0	235.3	35.3			
						Filterable PM (g)	**0.0036**	
						Total PM (g)	**0.0075**	
	Acetone Blank	190.1	54.7478	54.7494	0.0016	8.42E-06	g/g	
	Water Blank	231.6	43.9987	43.9993	0.0006	2.59E-06	g/g	
	Hexane Blank	216.2	41.8344	41.8343	-0.0001	0.00E+00	g/g	

ND - Non-detect. Value is below the ODEQ Method 5 analytical detection limit specified in the ODEQ Source Sampling Manual (7 mg).

Bison Engineering, Inc.
Gravimetric Information

Client: Hollingsworth & Vose Fiber Company
Location: Corvallis, OR
Project Number: HAV222921
Test Date: 11/4/2022

Filters:

Sample Identification	Filter #	Date	Tare 1 (g)	Date	Tare 2 (g)	CHECK	Average	Filter #	Date	Final 1 (g)	Date	Final 2 (g)	CHECK	Average	Gain
HAV222921 CFU 118 M5 Run 1	Q81	9/16/2022	0.4538	9/21/2022	0.4537	-0.0001	0.4538	Q81	11/14/2022	0.4533	11/16/2022	0.4532	-0.0001	0.4533	-0.0005
HAV222921 CFU 118 M5 Run 2	Q82	9/16/2022	0.4415	9/21/2022	0.4414	-0.0001	0.4415	Q82	11/14/2022	0.4414	11/16/2022	0.4413	-0.0001	0.4414	-0.0001
HAV222921 CFU 118 M5 Run 3	Q83	9/16/2022	0.4446	9/21/2022	0.4444	-0.0002	0.4445	Q83	11/14/2022	0.4442	11/16/2022	0.4441	-0.0001	0.4442	-0.0003

Liquid Fractions:

Wt (g)	Sample Identification	Dish #	Date	Tare 1 (g)	Date	Tare 2 (g)	CHECK	Average	Dish #	Date	Final 1 (g)	Date	Final 2 (g)	CHECK	Average	Gain
109.5	HAV222921 CFU 118 Probe Rinse R1	78	10/28/2022	54.4725	11/1/2022	54.4721	0.0004	54.4723	78	11/23/2022	54.4685	11/28/2022	54.4689	0.0004	54.4687	-0.0036
156.1	HAV222921 CFU 118 Probe Rinse R2	79	10/28/2022	44.417	11/1/2022	44.4171	-0.0001	44.4171	79	11/23/2022	44.4193	11/28/2022	44.4195	0.0002	44.4194	0.0023
185.1	HAV222921 CFU 118 Probe Rinse R3	80	10/28/2022	46.5206	11/1/2022	46.5206	0.0000	46.5206	80	11/23/2022	46.526	11/28/2022	46.5255	-0.0005	46.5258	0.0052
123.8	HAV222921 CFU 118 Organics Run 1	81	10/28/2022	50.0095	11/1/2022	50.0097	-0.0002	50.0096	81	11/23/2022	50.0118	11/28/2022	50.0122	0.0004	50.0120	0.0024
134	HAV222921 CFU 118 Organics Run 2	82	10/28/2022	51.5075	11/1/2022	51.508	-0.0005	51.5078	82	11/28/2022	51.5084	11/29/2022	51.5086	0.0002	51.5085	0.0007
148.8	HAV222921 CFU 118 Organics Run 3	83	10/28/2022	49.2391	11/1/2022	49.2392	-0.0001	49.2392	83	11/29/2022	49.2403	11/30/2022	49.2405	0.0002	49.2404	0.0012
78.9	HAV222921 CFU 118 Cont #6 Run 1	84	11/14/2022	48.0986	11/15/2022	48.0988	-0.0002	48.0987	84	11/29/2022	48.0988	11/30/2022	48.0991	0.0003	48.0990	0.0003
80.3	HAV222921 CFU 118 Cont #6 Run 2	85	11/14/2022	43.1711	11/15/2022	43.1711	0.0000	43.1711	85	11/29/2022	43.1752	11/30/2022	43.1754	0.0002	43.1753	0.0042
82	HAV222921 CFU 118 Cont #6 Run 3	86	11/14/2022	51.529	11/15/2022	51.5289	0.0001	51.5290	86	11/29/2022	51.531	11/30/2022	51.5315	0.0005	51.5313	0.0023
451.2	HAV222921 CFU 118 Inorganic Run1	98	11/18/2022	48.6106	11/21/2022	48.6109	-0.0003	48.6108	98	12/2/2022	48.6145	12/5/2022	48.615	0.0005	48.6148	0.0040
476.4	HAV222921 CFU 118 Inorganic Run2	99	11/18/2022	45.9373	11/21/2022	45.9369	0.0004	45.9371	99	12/2/2022	45.9375	12/5/2022	45.938	0.0005	45.9378	0.0007
480.2	HAV222921 CFU 118 Inorganic Run3	100	11/18/2022	49.6737	11/21/2022	49.6741	-0.0004	49.6739	100	12/2/2022	49.6765	12/5/2022	49.6766	0.0001	49.6766	0.0027
190.1	HAV222921 Acetone Blank	96	11/14/2022	54.7476	11/18/2022	54.7479	0.0003	54.7478	96	11/29/2022	54.7492	11/30/2022	54.7496	0.0004	54.7494	0.0016
216.2	HAV222921 Hexane Blank	97	11/18/2022	41.8346	11/21/2022	41.8341	-0.0005	41.8344	97	11/29/2022	41.8341	11/30/2022	41.8345	0.0004	41.8343	-0.0001
231.6	HAV222921 HPLC Blank	13	11/21/2022	43.9988	11/22/2022	43.9985	-0.0003	43.9987	13	12/2/2022	43.9990	12/5/2022	43.9995	0.0005	43.9993	0.0006

BISON ENGINEERING, INC.

COMPANY	**Hollingsworth and Vose**
FACILITY	**Glass Plant 2**
LOCATION	**Corvallis OR**
SOURCE	**CFU115**
DATE	**11/05/22**
METHOD	**Modified Method 5**
POLLUTANT	**PM**

Pre-Test Traverse

Client: **Hollingsworth and Vose**
Location: **Corvallis OR**
Source: **CFU115**

Stack Temp: 286 °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	1.10	5
2	1.10	0
3	1.20	0
4	0.98	5
5	0.89	0
6	0.88	5
7	1.00	0
8	1.00	0
9	1.10	5
10	1.20	0
11	1.20	0
12	1.30	5
13	1.40	0
14	1.20	5
15	1.10	0
16	1.10	5
17	0.89	0
18	0.90	5
19	0.95	0
20	0.99	5
21	1.10	0
22	1.30	5
23	1.10	0
24	1.20	5
Average:	1.09	2

Flow is found to be: Non-cyclonic

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth and Vose**			**Run:**	**1**
Location:	**Corvallis OR**			**Start Time:**	**8:00**
Source:	**CFU115**			**End Time:**	**11:05**
EPA Method:	**Modified Method 5**	**Environmental Conditions/Test Notes:**		**Date:**	**11/5/2022**
Box Operator:	**MK**	43 °F, cloudy			
Technician(s):	**CMF**				

Stack Dimensional Data:

Circular		
Diameter	32.000	in
Rectangular		
Width		in
Length		in
Stack Area	5.585	sq.ft.

Equipment:

Meterbox ID	Box 12	Probe ID	4C	Liner type	Glass		
Y factor	1.0313	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.84	Hot box ID	B4	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	4C	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	4				

Source Information:

Barometric Pressure	29.82	"Hg	O_2	19.76	%
Static Pressure	0.25	"H_2O	CO_2	0.60	%
Ave. ΔP	1.1	"H_2O	Rec. Nz.	0.218	inches
Stack Temperature	304	°F			
Assumed moisture	1.80	%			
Assumed meter temp.	69	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	X
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	17	15

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	ws2	

Post Test Calculations:

Sample volume	143.939	dcf	Ave. ΔP	1.175	"H_2O
Wet mol. weight	28.67	M_s (actual)	Ave. √ΔP	1.083	"H_2O
Actual H_2O	2.03	%	Ave. ΔH	2.3	"H_2O
Std. meter vol.	148.477	dscf	Ave. T_s	300.4	°F
Isokinetic Average	100.2	%	Ave. T_m	69.1	°F

Moisture/Lab:

Filter, #	PTFE 10		
	Initial	Final	Gain
Impingers, g	2,292.5	2,313.5	21.0
Silica gel, g	946.4	990.8	44.4
		Total water gain, g:	65.4

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		0.000								
1	7.5	6.048	1.20	300	65	2.32	2.30	5	248	51
2	15.0	12.290	1.30	302	65	2.51	2.50	5	251	48
3	22.5	18.260	1.30	302	64	2.51	2.50	5	251	56
4	30.0	24.600	1.30	302	65	2.51	2.50	5	249	65
5	37.5	30.580	1.20	302	66	2.32	2.30	5	250	63
6	45.0	36.530	1.30	300	66	2.52	2.50	5	250	63
7	52.5	42.640	1.20	301	66	2.32	2.30	5	252	64
8	60.0	48.540	1.20	300	66	2.33	2.30	5	251	64
9	67.5	54.290	1.20	300	66	2.33	2.30	5	250	63
10	75.0	60.480	1.30	301	67	2.52	2.50	5	249	61
11	82.5	66.860	1.30	300	68	2.53	2.50	5	251	65
12	90.0	72.710	1.20	304	69	2.33	2.30	5	251	64
13	97.5	78.640	1.10	300	69	2.15	2.20	4	249	62
14	105.0	84.550	1.10	300	70	2.15	2.20	4	251	60
15	112.5	90.470	1.10	300	70	2.15	2.20	4	250	59
16	120.0	96.160	1.00	300	71	1.96	2.00	4	250	58
17	127.5	101.980	1.10	299	72	2.16	2.20	4	249	57
18	135.0	108.200	1.20	299	73	2.36	2.40	4	250	58
19	142.5	114.100	1.20	300	73	2.36	2.40	4	250	58
20	150.0	120.120	1.10	300	73	2.16	2.20	4	250	58
21	157.5	126.040	1.10	300	73	2.16	2.20	4	250	59
22	165.0	131.830	1.00	299	74	1.97	2.00	4	249	59
23	172.5	137.800	1.10	299	74	2.17	2.20	4	252	59
24	180.0	143.939	1.10	299	74	2.17	2.20	4	252	59

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth and Vose**		**Run:** **2**
Location:	**Corvallis OR**		**Start Time:** **11:40**
Source:	**CFU115**		**End Time:** **14:45**
EPA Method:	**Modified Method 5**	**Environmental Conditions/Test Notes:**	**Date:** **11/5/2022**
Box Operator:	**MK**	43 oF, cloudy	
Technician(s):	**CMF**		

Stack Dimensional Data:

Circular		
Diameter	32.000	in
Rectangular		
Width		in
Length		in
Stack Area	5.585	sq.ft.

Equipment:

Meterbox ID	Box 12	Probe ID	4C	Liner type	Glass		
Y factor	1.031	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.84	Hot box ID	B4	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	4C	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	4				

Source Information:

Barometric Pressure	29.88	"Hg	O_2	19.76	%
Static Pressure	0.25	"H_2O	CO_2	0.60	%
Ave. ΔP	1.1	"H_2O	Rec. Nz.	0.218	inches
Stack Temperature	304	°F			
Assumed moisture	2.03	%			
Assumed meter temp.	69.1	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	10

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	ws2	

Post Test Calculations:

Sample volume	143.424	dcf	Ave. ΔP	1.098	"H_2O
Wet mol. weight	28.66	M_s (actual)	Ave. √ΔP	1.047	"H_2O
Actual H_2O	2.15	%	Ave. ΔH	2.196	"H_2O
Std. meter vol.	145.776	dscf	Ave. T_s	300.5	°F
Isokinetic Average	101.7	%	Ave. T_m	77.9	°F

Moisture/Lab:

Filter, #	PTFE 11		
	Initial	Final	Gain
Impingers, g	2,146.0	2,180.5	34.5
Silica gel, g	923.2	956.7	33.5
		Total water gain:	68.0

Traverse Point	Time (min.)	Meter Volume (dcf) 0.000	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
1	7.5	5.920	1.10	299	73	2.16	2.20	3	259	54
2	15.0	12.430	1.20	299	75	2.36	2.40	3	250	53
3	22.5	18.990	1.30	299	76	2.56	2.60	3	248	55
4	30.0	25.040	1.20	299	76	2.37	2.40	3	251	60
5	37.5	31.000	1.20	300	77	2.37	2.40	3	247	62
6	45.0	37.040	1.10	302	79	2.17	2.20	3	249	64
7	52.5	43.160	1.20	299	78	2.37	2.40	3	253	64
8	60.0	49.320	1.10	299	78	2.18	2.20	3	250	63
9	67.5	55.360	1.10	299	78	2.18	2.20	3	252	63
10	75.0	61.620	1.20	300	79	2.38	2.40	3	249	64
11	82.5	67.800	1.00	300	79	1.98	2.00	3	252	64
12	90.0	73.590	0.99	303	79	1.95	2.00	3	263	64
13	97.5	79.200	0.99	300	79	1.96	2.00	3	248	63
14	105.0	85.120	1.20	301	79	2.37	2.40	3	261	64
15	112.5	90.920	1.20	302	78	2.36	2.40	3	249	65
16	120.0	97.210	1.20	302	79	2.37	2.40	3	254	64
17	127.5	103.300	1.10	302	79	2.17	2.20	3	255	63
18	135.0	109.060	1.00	302	79	1.97	2.00	3	251	63
19	142.5	114.800	0.98	301	79	1.94	1.90	3	253	62
20	150.0	120.250	1.00	299	79	1.98	2.00	3	252	61
21	157.5	126.120	1.00	300	78	1.98	2.00	3	256	60
22	165.0	131.800	0.99	301	78	1.95	2.00	3	251	62
23	172.5	137.610	1.00	302	78	1.97	2.00	3	252	65
24	180.0	143.424	1.00	303	78	1.97	2.00	3	254	67

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth and Vose**		**Run:** **3**
Location:	**Corvallis OR**		**Start Time:** **15:25**
Source:	**CFU115**		**End Time:** **18:42**
EPA Method:	**Modified Method 5**	**Environmental Conditions/Test Notes:**	**Date:** **11/5/2022**
Box Operator:	**MK**	43 oF, cloudy	
Technician(s):	**CMF**		

Stack Dimensional Data:

Circular		
Diameter	32.000	in
Rectangular		
Width		in
Length		in
Stack Area	5.585	sq.ft.

Equipment:

Meterbox ID	Box 12	Probe ID	4C	Liner type	Glass		
Y factor	1.031	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.84	Hot box ID	B4	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	4C	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	4				

Source Information:

Barometric Pressure	29.88	"Hg	O_2	19.76	%
Static Pressure	0.25	"H_2O	CO_2	0.60	%
Ave. ΔP	1.1	"H_2O	Rec. Nz.	0.216	inches
Stack Temperature	304	°F			
Assumed moisture	2.15	%			
Assumed meter temp.	77.9	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	X
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	17	16

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	ws2	

Post Test Calculations:

Sample volume	143.800	dcf	Ave. ΔP	1.125	"H_2O
Wet mol. weight	28.66	M_s (actual)	Ave. √ΔP	1.059	"H_2O
Actual H_2O	2.10	%	Ave. ΔH	2.225	"H_2O
Std. meter vol.	147.241	dscf	Ave. T_s	296.2	°F
Isokinetic Average	101.3	%	Ave. T_m	74.0	°F

Moisture/Lab:

Filter, #	PTFE 12		
	Initial	Final	Gain
Impingers, g	2,184.5	2,220.4	35.9
Silica gel, g	987.9	1,019.1	31.2
		Total water gain:	67.1

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		0.000								
1	7.5	6.010	1.30	302	74	2.54	2.50	4	254	50
2	15.0	12.320	1.30	302	74	2.54	2.50	4	253	49
3	22.5	18.580	1.20	301	74	2.35	2.40	4	248	51
4	30.0	24.850	1.30	301	74	2.54	2.50	4	251	53
5	37.5	31.190	1.30	302	74	2.54	2.50	4	249	53
6	45.0	37.390	1.20	302	75	2.35	2.40	4	250	55
7	52.5	43.660	1.30	302	75	2.54	2.50	4	250	55
8	60.0	49.810	1.20	301	74	2.35	2.40	4	249	57
9	67.5	55.770	1.10	301	75	2.15	2.20	4	252	57
10	75.0	61.590	1.00	301	74	1.95	2.00	4	248	58
11	82.5	67.430	1.00	296	74	1.97	2.00	4	249	59
12	90.0	73.260	1.00	267	73	2.04	2.00	4	251	59
13	97.5	78.960	1.10	279	73	2.21	2.20	4	250	61
14	105.0	85.170	1.20	283	74	2.40	2.40	4	250	64
15	112.5	91.370	1.10	288	74	2.19	2.20	4	250	67
16	120.0	97.420	1.10	290	74	2.18	2.20	4	251	66
17	127.5	103.180	1.00	294	74	1.97	2.00	4	250	67
18	135.0	108.800	1.00	296	74	1.97	2.00	4	251	65
19	142.5	114.700	1.10	297	74	2.16	2.20	4	250	66
20	150.0	120.350	1.00	298	74	1.96	2.00	4	250	64
21	157.5	125.800	0.99	299	74	1.94	1.90	4	250	63
22	165.0	131.920	1.10	302	74	2.15	2.20	4	250	64
23	172.5	138.200	1.10	302	74	2.15	2.20	4	255	64
24	180.0	143.800	1.00	303	74	1.95	2.00	4	249	64

EPA Method 4
Impinger Weights Summary

Client:	**Hollingsworth and Vose**
Location:	**Corvallis OR**
Source:	**CFU115**
EPA Method:	**Modified Method 5**
Box Operator:	**MK**
Technician(s):	**CMF**

Run 1
Impinger gain by weight (g):

#	Initial	Final	Gain
1	752.4	718.2	-34.2
2	860.1	896.8	36.7
3	680.0	698.5	18.5
4			
5			
6			
Totals:	2,292.5	2,313.5	21.0

Run 2
Impinger gain by weight (g):

#	Initial	Final	Gain
1	730.0	720.1	-9.9
2	792.8	827.2	34.4
3	623.2	633.2	10.0
4			
5			
6			
Totals:	2,146.0	2,180.5	34.5

Run 3
Impinger gain by weight (g):

#	Initial	Final	Gain
1	718.2	707.9	-10.3
2	789.4	833.1	43.7
3	676.9	679.4	2.5
4			
5			
6			
Totals:	2,184.5	2,220.4	35.9

BISON ENGINEERING, INC.

COMPANY	**Hollingsworth & Vose Fiber Company**
FACILITY	**Glass Plant 2**
LOCATION	**Corvallis OR**
SOURCE	**CFU115**
DATE	**11/05/22**
METHOD	**ODEQ Method 5**
POLLUTANT	**Particulate Matter**

EPA Method 1
Stack Parameters and Traverse Points

Client: **Hollingsworth & Vose Fiber Company**
Location: **Corvallis OR**
Source: **CFU115**
Facility: **Glass Plant 2**

Type of Testing: P (P for Particulate; V for Velocity/Nonparticulate)
Type of Duct: C (C for circular; R for rectangular)

Number of ports available:	2	
Number of ports to be used:	2	
Port diameter:	5	inches
Sampling location height (approx.):		feet
Stack height (approx.):		feet
Circular ID (Rectangular Depth):	36.00	inches
Port depth and/or wall thickness:	5.00	inches
Stack width (Rectangular only):		inches

Equivalent Diameter
If rectangular = $\frac{2*Depth*Width}{Depth + Width}$ = 36.00 inches (If circular = duct ID)

Stack/duct area = 7.069 sq.feet 1017.9 sq. inches

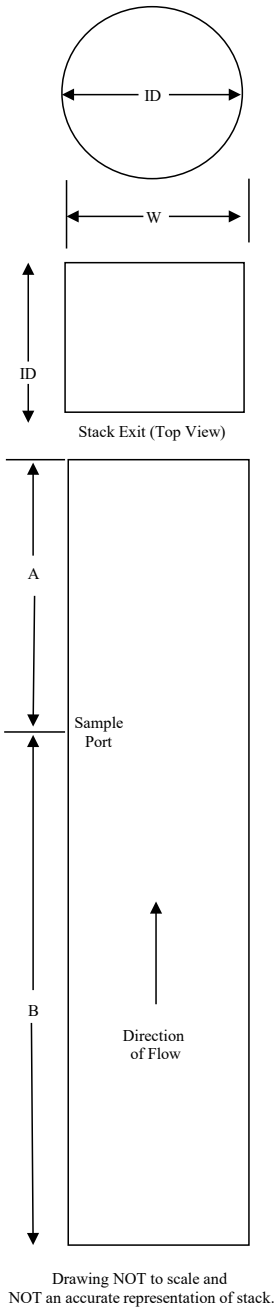
Sample Port Location:	Downstream flow disturbance from process B	Upstream flow disturbance toward exit A
Number of Inches:	134.00	45.00
Number of Diameters:	3.72	1.25

Minimum Number of Traverse Points: 24

Traverse points less than 1.0 inch from the stack wall are relocated to a distance of 1.0 inch.

Points	% of diameter	Distance from inside wall (in.)	Distance including port (in.)
1	2.1	0.76	5 3/4
2	6.7	2.41	7 3/8
3	11.8	4.25	9 1/4
4	17.7	6.37	11 3/8
5	25.0	9.00	14
6	35.6	12.82	17 7/8
7	64.4	23.18	28 1/8
8	75.0	27.00	32
9	82.3	29.63	34 5/8
10	88.2	31.75	36 3/4
11	93.3	33.59	38 5/8
12	97.9	35.24	40 1/4

Reference Diagram



Pre-Test Traverse

Client: **Hollingsworth & Vose Fiber Company**
Location: **Corvallis OR**
Source: **CFU115**

Stack Temp: 286 °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	1.10	5
2	1.10	0
3	1.20	0
4	0.98	5
5	0.89	0
6	0.88	5
7	1.00	0
8	1.00	0
9	1.10	5
10	1.20	0
11	1.20	0
12	1.30	5
13	1.40	0
14	1.20	5
15	1.10	0
16	1.10	5
17	0.89	0
18	0.90	5
19	0.95	0
20	0.99	5
21	1.10	0
22	1.30	5
23	1.10	0
24	1.20	5
Average:	1.09	2

Flow is found to be: Non-cyclonic

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**1**
Location:	**Corvallis OR**	**Start Time:**	**8:00**
Source:	**CFU115**	**End Time:**	**11:05**
EPA Method:	**ODEQ Method 5**	**Environmental Conditions/Test Notes:**	**Date:** **11/5/2022**
Box Operator:	**MK**	43 °F, cloudy	
Technician(s):	**CMF**		

Stack Dimensional Data:

Circular		
Diameter	32.000	in
Rectangular		
Width		in
Length		in
Stack Area	5.585	sq.ft.

Equipment:

Meterbox ID	Box SB-2	Probe ID	1005200	Liner type	Glass		
Y factor	1.001	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.737	Hot box ID	HHB8	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	1005200	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	6				

Source Information:

Barometric Pressure	29.82	"Hg	O_2	19.76	%
Static Pressure	0.25	"H_2O	CO_2	0.60	%
Ave. ΔP	1.1	"H_2O	Rec. Nz.	0.218	inches
Stack Temperature	304	°F			
Assumed moisture	1.80	%			
Assumed meter temp.	69	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	19	13

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	ws2	

Post Test Calculations:

Sample volume	147.400	dcf	Ave. ΔP	1.150	"H_2O
Wet mol. weight	28.71	M_s (actual)	Ave. √ΔP	1.071	"H_2O
Actual H_2O	1.63	%	Ave. ΔH	2.108	"H_2O
Std. meter vol.	147.344	dscf	Ave. T_s	304.3	°F
Isokinetic Average	100.4	%	Ave. T_m	69.7	°F

Moisture/Lab:

Filter, #	Q85		
	Initial	Final	Gain
Impingers, g	2,205.5	2,228.5	23.0
Silica gel, g	974.0	1,002.9	28.9
		Total water gain, g:	51.9

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		881.240								
1	7.5	887.210	1.10	300	63	2.00	2.00	0.5	249	46
2	15.0	893.220	1.10	304	65	2.00	2.00	0.5	248	45
3	22.5	899.510	1.20	305	65	2.18	2.20	0.5	249	49
4	30.0	905.920	1.30	304	65	2.36	2.40	0.5	248	52
5	37.5	911.760	1.10	304	66	2.00	2.00	0.5	252	52
6	45.0	918.110	1.30	303	66	2.37	2.40	0.5	251	53
7	52.5	924.120	1.10	303	66	2.01	2.00	0.5	249	54
8	60.0	930.420	1.20	303	66	2.19	2.20	0.5	247	52
9	67.5	936.000	1.10	304	66	2.00	2.00	0.5	249	51
10	75.0	942.280	1.20	305	67	2.19	2.20	0.5	248	51
11	82.5	948.320	1.10	304	68	2.01	2.00	0.5	246	51
12	90.0	954.400	1.10	304	68	2.01	2.00	0.5	249	51
13	97.5	960.320	1.10	306	70	2.01	2.00	0.5	251	51
14	105.0	965.920	1.00	306	70	1.83	1.80	0.5	250	51
15	112.5	971.670	1.00	306	71	1.83	1.80	0.5	249	50
16	120.0	977.830	1.20	306	72	2.20	2.20	0.5	249	50
17	127.5	983.910	1.10	305	73	2.03	2.00	0.5	252	50
18	135.0	990.520	1.30	303	74	2.41	2.40	0.5	252	50
19	142.5	997.170	1.30	304	74	2.40	2.40	0.5	251	51
20	150.0	1004.120	1.30	304	75	2.41	2.40	0.5	252	52
21	157.5	1010.570	1.30	304	75	2.41	2.40	0.5	248	53
22	165.0	1016.850	1.10	305	76	2.04	2.00	0.5	248	53
23	172.5	1022.600	1.00	305	76	1.85	1.90	0.5	253	53
24	180.0	1028.640	1.00	305	76	1.85	1.90	0.5	247	53

Isokinetic Field Data
Field Data Entry

29.48

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**2**
Location:	**Corvallis OR**	**Start Time:**	**11:40**
Source:	**CFU115**	**End Time:**	**14:45**
EPA Method:	**ODEQ Method 5**	**Date:**	**11/5/2022**
Box Operator:	**MK**		
Technician(s):	**CMF**		

Environmental Conditions/Test Notes: 43 oF, cloudy

Stack Dimensional Data:

Circular		
Diameter	32.000	in
Rectangular		
Width		in
Length		in
Stack Area	5.585	sq.ft.

Equipment:

Meterbox ID	Box SB-2	Probe ID	1005200	Liner type	Glass		
Y factor	1.001	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.737	Hot box ID	HHB8	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	1005200	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	6				

Source Information:

Barometric Pressure	29.88	"Hg	O_2	19.76	%
Static Pressure	0.25	"H_2O	CO_2	0.60	%
Ave. ΔP	1.1	"H_2O	Rec. Nz.	0.218	inches
Stack Temperature	304	°F			
Assumed moisture	1.63	%			
Assumed meter temp.	69.7	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	16	12

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	ws2	

Post Test Calculations:

Sample volume	147.800	dcf	Ave. ΔP	1.098	"H_2O
Wet mol. weight	28.64	M_s (actual)	Ave. √ΔP	1.047	"H_2O
Actual H_2O	2.27	%	Ave. ΔH	2.071	"H_2O
Std. meter vol.	145.550	dscf	Ave. T_s	304.1	°F
Isokinetic Average	101.9	%	Ave. T_m	78.7	°F

Moisture/Lab:

Filter, #	Q86		
	Initial	Final	Gain
Impingers, g	2,162.0	2,202.6	40.6
Silica gel, g	878.3	909.5	31.2
		Total water gain:	71.8

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		29.485								
1	7.5	35.480	1.20	302	79	2.25	2.20	0.5	250	50
2	15.0	41.910	1.10	302	78	2.06	2.10	0.5	248	47
3	22.5	47.890	1.00	302	78	1.87	1.90	0.5	246	50
4	30.0	54.310	1.20	302	78	2.25	2.20	0.5	255	52
5	37.5	60.430	1.10	302	79	2.06	2.10	0.5	255	52
6	45.0	66.420	1.20	300	78	2.25	2.30	0.5	256	53
7	52.5	72.270	1.10	302	79	2.06	2.10	0.5	247	53
8	60.0	78.620	1.10	302	79	2.06	2.10	0.5	246	53
9	67.5	85.070	1.20	302	79	2.25	2.30	0.5	247	53
10	75.0	91.720	1.20	302	79	2.25	2.30	0.5	245	51
11	82.5	97.750	1.00	303	79	1.87	1.90	0.5	250	53
12	90.0	103.850	1.00	303	79	1.87	1.90	0.5	258	53
13	97.5	109.470	0.96	303	79	1.80	1.80	0.5	250	55
14	105.0	115.660	1.10	305	79	2.06	2.10	0.5	250	53
15	112.5	121.990	1.10	307	79	2.05	2.10	0.5	250	51
16	120.0	128.420	1.20	307	79	2.24	2.20	0.5	254	50
17	127.5	134.710	1.10	305	78	2.05	2.10	0.5	250	51
18	135.0	141.500	1.30	307	79	2.42	2.40	0.5	251	51
19	142.5	147.350	1.10	306	79	2.05	2.00	0.5	240	51
20	150.0	153.250	1.00	306	79	1.87	1.90	0.5	249	52
21	157.5	159.000	1.00	306	79	1.87	1.90	0.5	249	49
22	165.0	165.120	1.00	307	79	1.86	1.90	0.5	252	50
23	172.5	171.260	1.10	308	78	2.04	2.00	0.5	250	50
24	180.0	177.285	1.00	308	78	1.86	1.90	0.5	248	51

Isokinetic Field Data
Field Data Entry

Client:	**Hollingsworth & Vose Fiber Company**	**Run:**	**3**
Location:	**Corvallis OR**	**Start Time:**	**15:25**
Source:	**CFU115**	**End Time:**	**18:42**
EPA Method:	**ODEQ Method 5**	**Date:**	**11/5/2022**
Box Operator:	**MK**		
Technician(s):	**CMF**		

Environmental Conditions/Test Notes:
43 oF, cloudy

Stack Dimensional Data:

Circular		
Diameter	32.000	in
Rectangular		
Width		in
Length		in
Stack Area	5.585	sq.ft.

Equipment:

Meterbox ID	Box SB-2	Probe ID	1005200	Liner type	Glass		
Y factor	1.001	Nozzle ID	Glass	Nozzle size	0.225	inches	
ΔH@	1.737	Hot box ID	HHB8	Nozzle area	0.000276	sq.ft.	
Bp ID	TS4	Pitot Cp	0.84	Probe heat	248	°F	
Balance ID	FB1	Pitot ID	1005200	Filter heat	248	°F	
Weights ID	FW1	Probe Length, ft	6				

Source Information:

Barometric Pressure	29.88	"Hg	O_2	19.76	%
Static Pressure	0.25	"H_2O	CO_2	0.60	%
Ave. ΔP	1.1	"H_2O	Rec. Nz.	0.216	inches
Stack Temperature	304	°F			
Assumed moisture	2.27	%			
Assumed meter temp.	78.7	°F			
Total number of points	24				
Time per point	7.5	min.			
Total run time	180	min.			

Leak Checks:

	Pre-test	Post-test
Pitot	x	x
Leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	14	15

Nozzle check for roundness:

1	2	3	
0.225	0.225	0.225	inches
	Caliper ID	ws2	

Post Test Calculations:

Sample volume	148.367	dcf	Ave. ΔP	1.142	"H_2O
Wet mol. weight	28.68	M_s (actual)	Ave. √ΔP	1.068	"H_2O
Actual H_2O	1.93	%	Ave. ΔH	2.113	"H_2O
Std. meter vol.	146.969	dscf	Ave. T_s	298.6	°F
Isokinetic Average	100.2	%	Ave. T_m	75.6	°F

Moisture/Lab:

Filter, #	Q87		
	Initial	Final	Gain
Impingers, g	2,223.0	2,251.4	28.4
Silica gel, g	979.5	1,012.3	32.8
		Total water gain:	61.2

Traverse Point	Time (min.)	Meter Volume (dcf)	Velocity ΔP ("H_2O)	Stack Temp. (°F)	Meter Temp. (°F)	Calc. ΔH	Run ΔH	Vacuum ("Hg)	Filter Box (°F)	Condenser Temp (≤68°F)
		177.884								
1	7.5	184.310	1.20	305	75	2.20	2.20	0.5	246	53
2	15.0	190.590	1.10	305	75	2.02	2.00	0.5	248	51
3	22.5	196.900	1.20	304	75	2.21	2.20	0.5	246	52
4	30.0	202.960	1.20	304	75	2.21	2.20	0.5	246	52
5	37.5	209.500	1.30	305	75	2.39	2.40	0.5	250	53
6	45.0	215.800	1.20	304	75	2.21	2.20	0.5	250	54
7	52.5	222.090	1.20	305	75	2.20	2.20	0.5	248	55
8	60.0	228.260	1.20	304	75	2.21	2.20	0.5	249	55
9	67.5	234.430	1.10	302	75	2.03	2.10	0.5	247	55
10	75.0	240.640	1.10	304	75	2.02	2.00	0.5	251	55
11	82.5	246.400	1.00	299	76	1.85	1.90	0.5	247	55
12	90.0	252.560	1.10	271	76	2.12	2.10	0.5	246	52
13	97.5	258.730	1.10	282	76	2.09	2.10	0.5	253	54
14	105.0	265.080	1.30	286	76	2.45	2.40	0.5	250	55
15	112.5	271.830	1.30	290	76	2.44	2.40	0.5	251	55
16	120.0	278.380	1.20	291	76	2.25	2.30	0.5	247	57
17	127.5	284.480	1.10	297	76	2.04	2.00	0.5	250	57
18	135.0	290.540	1.10	298	76	2.04	2.00	0.5	247	56
19	142.5	296.610	1.10	300	76	2.04	2.00	0.5	248	56
20	150.0	302.940	1.20	300	76	2.22	2.20	0.5	250	57
21	157.5	309.000	1.10	302	77	2.03	2.00	0.5	247	58
22	165.0	314.750	1.00	305	76	1.84	1.80	0.5	247	59
23	172.5	320.520	1.00	302	76	1.85	1.90	0.5	248	59
24	180.0	326.251	1.00	302	76	1.85	1.90	0.5	248	59

EPA Method 4
Impinger Weights Summary

Client: **Hollingsworth & Vose Fiber Company**
Location: **Corvallis OR**
Source: **CFU115**
EPA Method: **ODEQ Method 5**
Box Operator: **MK**
Technician(s): **CMF**

Run 1
Impinger gain by weight (g):

#	Initial	Final	Gain
1	759.5	730.0	-29.5
2	750.0	785.6	35.6
3	696.0	712.9	16.9
4			
5			
6			
Totals:	2,205.5	2,228.5	23.0

Run 2
Impinger gain by weight (g):

#	Initial	Final	Gain
1	756.5	764.7	8.2
2	741.8	765.0	23.2
3	663.7	672.9	9.2
4			
5			
6			
Totals:	2,162.0	2,202.6	40.6

Run 3
Impinger gain by weight (g):

#	Initial	Final	Gain
1	775.1	781.9	6.8
2	752.5	773.2	20.7
3	695.4	696.3	0.9
4			
5			
6			
Totals:	2,223.0	2,251.4	28.4

Oregon Methods 1-5
Filterable and Condensable Particulate
Results Summary

Client: **Hollingsworth &Vose Fiber Company**
Source: **CFU115**
Location: **Corvallis, OR**

Run			1	2	3	
Date			11/5/2022	11/5/2022	11/5/2022	
Run Start Time			8:00	11:40	15:25	
Run End Time			11:05	14:45	18:42	
Duration, min.			180	180	180	Average
Barometric Pressure, "Hg			29.82	29.88	29.88	**29.86**
Nozzle Dia., in.			0.225	0.225	0.225	**0.225**
Isokinetic Average, %			100.4	101.9	100.2	**100.8**
Sample Volume, dscf			147.344	145.550	146.969	**146.621**
Sample Volume, dscm			4.172	4.122	4.162	**4.152**
Stack Diameter, in.			32.00	32.00	32.00	**32.00**
Stack Area, sq.ft.			5.585	5.585	5.585	**5.585**
CO_2 %vd			0.60	0.60	0.60	**0.60**
O_2 %vd			19.76	19.76	19.76	**19.76**
Static Press., "H_2O			0.25	0.25	0.25	**0.25**
H_2O %v			1.63	2.27	1.93	**1.94**
Wet Molecular Weight, lb/lb-mole			28.71	28.64	28.68	**28.68**
Velocity, FPS			72.63	71.01	72.12	**71.92**
ADCFM			23,941	23,255	23,701	**23,632**
ACFM			24,338	23,795	24,167	**24,100**
DSCFM			16,491	16,055	16,481	**16,342**
Stack Temperature, ^{o}F			304.3	304.1	298.6	**302.3**
Filterable Particulate	Concentration, C_s	gr/dscf	2.20E-04	8.88E-05	6.57E-05	**1.25E-04**
		µg/dscm	504.6	203.3	150.3	**286.1**
	Mass	lb/hr	3.12E-02	1.22E-02	9.28E-03	**1.76E-02**
		lb/lb glass	5.11E-04	2.00E-04	1.52E-04	**2.88E-04**
Inorganic CPM	Concentration, C_s	gr/dscf	7.65E-05	2.00E-04	1.43E-04	**1.40E-04**
		µg/dscm	175.2	457.2	326.7	**319.7**
	Mass	lb/hr	1.08E-02	2.75E-02	2.02E-02	**1.95E-02**
		lb/lb glass	1.77E-04	4.51E-04	3.31E-04	**3.20E-04**
Organic CPM	Concentration, C_s	gr/dscf	3.19E-04	6.12E-06	2.50E-04	**1.92E-04**
		µg/dscm	729.8	14.0	572.9	**438.9**
	Mass	lb/hr	4.51E-02	8.42E-04	3.54E-02	**2.71E-02**
		lb/lb glass	7.39E-04	1.38E-05	5.80E-04	**4.44E-04**
Total PM Filterable + Condensable	Concentration, C_s	gr/dscf	ND 6.16E-04	ND 2.95E-04	ND 4.59E-04	ND **4.56E-04**
		µg/dscm	ND 1409.7	ND 674.5	ND 1049.9	ND **1044.7**
	Mass	lb/hr	ND 8.71E-02	ND 4.06E-02	ND 6.48E-02	ND **6.41E-02**
		lb/lb glass	ND 1.43E-03	ND 6.65E-04	ND 1.06E-03	ND **1.05E-03**
Production Data	Glass Fiber Pull Rate	lb/hr	61.0	61.0	61.0	**61.0**

ND - Non-detect. Measured total PM was less than the ODEQ Method 5 analytical detection limit specified in the ODEQ Source Sampling Manual.

Isokinetic Field Data
Field Data and Calculations
Particulate Emissions and Gas Stream Characteristics

Client:	**Hollingsworth &Vose Fiber Company**	**Run:**	**1**
Source:	**CFU115**	**Date:**	**11/5/2022**
Location:	**Corvallis, OR**	**Start Time:**	**8:00**
Method:	**ODEQ 5**	**End Time:**	**11:05**

Sampling Data				Traverse Data			
Time	**Meter**	**ΔH**	**Meter**	**Traverse**	**Dp**	**Stack**	
min.	**ft^3**	**"H_2O**	**T_m ^oF**	**Point**	**"H_2O**	**T_s ^oF**	**√Dp**
	881.240						
8	887.210	2.00	63	1	1.10	300	1.049
15	893.220	2.00	65	2	1.10	304	1.049
23	899.510	2.20	65	3	1.20	305	1.095
30	905.920	2.40	65	4	1.30	304	1.140
38	911.760	2.00	66	5	1.10	304	1.049
45	918.110	2.40	66	6	1.30	303	1.140
53	924.120	2.00	66	7	1.10	303	1.049
60	930.420	2.20	66	8	1.20	303	1.095
68	936.000	2.00	66	9	1.10	304	1.049
75	942.280	2.20	67	10	1.20	305	1.095
83	948.320	2.00	68	11	1.10	304	1.049
90	954.400	2.00	68	12	1.10	304	1.049
98	960.320	2.00	70	13	1.10	306	1.049
105	965.920	1.80	70	14	1.00	306	1.000
113	971.670	1.80	71	15	1.00	306	1.000
120	977.830	2.20	72	16	1.20	306	1.095
128	983.910	2.00	73	17	1.10	305	1.049
135	990.520	2.40	74	18	1.30	303	1.140
143	997.170	2.40	74	19	1.30	304	1.140
150	1004.120	2.40	75	20	1.30	304	1.140
158	1010.570	2.40	75	21	1.30	304	1.140
165	1016.850	2.00	76	22	1.10	305	1.049
173	1022.600	1.90	76	23	1.00	305	1.000
180	1028.640	1.90	76	24	1.00	305	1.000

Client:	**Hollingsworth &Vose Fiber Company**	**Run:**	**1**
Source:	**Corvallis, OR**	**Date:**	**11/05/22**

Field Data Input Continued

Moisture Data			Stack Dimensional Data:		
Total Test Time	180.0	min	Circular		
Sample Time Interval	7.5	min	Diameter	32.000	in
Meter Volume, V_m	147.400	dcf	Rectangular		
Water Weight	51.9	g	Width		in
Nozzle Diameter, N_z	0.225	in.	Length		in
Nozzle Area	0.000276	sq.ft.	Stack Area	5.585	sq.ft.
Traverse Data			Molecular Weight:		
Barometric Pressure, P_b	29.82	"Hg	CO_2 Average	0.60	%vd
Static Pressure	0.25	"H_2O	O_2 Average	19.76	%vd
Pitot Factor, C_p	0.84				
Meter Cal Factor	1.0010	Y			

Field Data Averages

Meter			Stack		
ΔH	2.108	"H_2O	√Dp	1.071	"H_2O
Temperature, T_m	69.7	^oF	Temperature, T_s	304.3	^oF
Temperature, T_m	529.4	^oA (^oR)	Temperature, T_s	764.0	^oA (R)
Pressure Meter, P_m	29.975	"Hg	Pressure Stack, P_s	29.838	"Hg

Field Data Calculations

Meter Box Capture			EPA Method 2 Stack Gas Flowrate:		
Standard Volume, $V_{m(std)}$	147.344	dscf	Velocity, V_s	72.63	fps
	4.172	dscm	Volume (actual)	24,338	acfm
Actual Volume, $V_{m(actual)}$	217.458	awcf		23,941	adcfm
Gas Stream Moisture			Volume (standard)	1,005,856	wscf/hr
Moisture Vapor, $V_{w(std)}$	2.447	scf		989,461	dscf/hr
Moisture, B_{ws}	0.0163			16,491	dscf/min
Moisture EPA M4	1.63	%v		16,764	wscf/min
Moisture @ Saturation	NA	%v (for $T_s < 212°F$)			
EPA Method 3 Gas Density					
Dry, M_d	28.89	lb/lb-mole			
Wet, M_s	28.71	lb/lb-mole			
Percent Isokinetic	100.4	%			

Laboratory Results

EPA Method 5					
Filterable PM	0.0021	grams			
Emissions:					
Concentration, C_s	2.20E-04	gr/dscf			
	504.6	µg/dscm			
Mass Emissions	3.12E-02	lb/hr			
Back Half:					
Inorganic CPM	0.0007	grams	Organic CPM	0.0030	grams
Inorganic CPM, C_s	7.65E-05	gr/dscf	Organic CPM, C_s	3.19E-04	gr/dscf
	175.2	µg/dscm		729.8	µg/dscm
Mass Emissions	1.08E-02	lb/hr	Mass Emissions	4.51E-02	lb/hr

Isokinetic Field Data
Field Data and Calculations
Particulate Emissions and Gas Stream Characteristics

Client:	**Hollingsworth &Vose Fiber Company**	**Run:**	**2**
Source:	**CFU115**	**Date:**	**11/5/2022**
Location:	**Corvallis, OR**	**Start Time:**	**11:40**
Method:	**ODEQ 5**	**End Time:**	**14:45**

Sampling Data				Traverse Data			
Time	**Meter**	**ΔH**	**Meter**	**Traverse**	**Dp**	**Stack**	
min.	**ft^3**	**"H_2O**	**T_m °F**	**Point**	**"H_2O**	**T_s °F**	**√Dp**
	29.485						
8	35.480	2.20	79	1	1.20	302	1.095
15	41.910	2.10	78	2	1.10	302	1.049
23	47.890	1.90	78	3	1.00	302	1.000
30	54.310	2.20	78	4	1.20	302	1.095
38	60.430	2.10	79	5	1.10	302	1.049
45	66.420	2.30	78	6	1.20	300	1.095
53	72.270	2.10	79	7	1.10	302	1.049
60	78.620	2.10	79	8	1.10	302	1.049
68	85.070	2.30	79	9	1.20	302	1.095
75	91.720	2.30	79	10	1.20	302	1.095
83	97.750	1.90	79	11	1.00	303	1.000
90	103.850	1.90	79	12	1.00	303	1.000
98	109.470	1.80	79	13	0.96	303	0.980
105	115.660	2.10	79	14	1.10	305	1.049
113	121.990	2.10	79	15	1.10	307	1.049
120	128.420	2.20	79	16	1.20	307	1.095
128	134.710	2.10	78	17	1.10	305	1.049
135	141.500	2.40	79	18	1.30	307	1.140
143	147.350	2.00	79	19	1.10	306	1.049
150	153.250	1.90	79	20	1.00	306	1.000
158	159.000	1.90	79	21	1.00	306	1.000
165	165.120	1.90	79	22	1.00	307	1.000
173	171.260	2.00	78	23	1.10	308	1.049
180	177.285	1.90	78	24	1.00	308	1.000

Client:	**Hollingsworth &Vose Fiber Company**	**Run:**	**2**
Source:	**Corvallis, OR**	**Date:**	**11/05/22**

Field Data Input Continued

Moisture Data			Stack Dimensional Data:		
Total Test Time	180.0	min	Circular		
Sample Time Interval	7.5	min	Diameter	32.000	in
Meter Volume, V_m	147.800	dcf	Rectangular		
Water Weight	71.8	g	Width		in
Nozzle Diameter, N_z	0.225	in.	Length		in
Nozzle Area	0.000276	sq.ft.	Stack Area	5.585	sq.ft.
Traverse Data			Molecular Weight:		
Barometric Pressure, P_b	29.88	"Hg	CO_2 Average	0.60	%vd
Static Pressure	0.25	"H_2O	O_2 Average	19.76	%vd
Pitot Factor, C_p	0.84				
Meter Cal Factor	1.0010	Y			

Field Data Averages

Meter			Stack		
ΔH	2.071	"H_2O	√Dp	1.047	"H_2O
Temperature, T_m	78.7	^oF	Temperature, T_s	304.1	^oF
Temperature, T_m	538.4	^oA (^oR)	Temperature, T_s	763.8	^oA (R)
Pressure Meter, P_m	30.032	"Hg	Pressure Stack, P_s	29.898	"Hg

Field Data Calculations

Meter Box Capture			EPA Method 2 Stack Gas Flowrate:		
Standard Volume, $V_{m(std)}$	145.550	dscf	Velocity, V_s	71.01	fps
	4.122	dscm	Volume (actual)	23,795	acfm
Actual Volume, $V_{m(actual)}$	215.727	awcf		23,255	adcfm
Gas Stream Moisture			Volume (standard)	985,656	wscf/hr
Moisture Vapor, $V_{w(std)}$	3.386	scf		963,282	dscf/hr
Moisture, B_{ws}	0.0227			16,055	dscf/min
Moisture EPA M4	2.27	%v		16,428	wscf/min
Moisture @ Saturation	NA	%v (for T_s < 212°F)			
EPA Method 3 Gas Density					
Dry, M_d	28.89	lb/lb-mole			
Wet, M_s	28.64	lb/lb-mole			
Percent Isokinetic	101.9	%			

Laboratory Results

Front Half:					
Filterable PM	0.0008	grams			
Emissions:					
Concentration, C_s	8.88E-05	gr/dscf			
	203.3	µg/dscm			
Mass Emissions	1.22E-02	lb/hr			
Back Half:					
Inorganic CPM	0.0019	grams	Organic CPM	0.0001	grams
Inorganic CPM, C_s	2.00E-04	gr/dscf	Organic CPM, C_s	6.12E-06	gr/dscf
	457.2	µg/dscm		14.0	µg/dscm
Mass Emissions	2.75E-02	lb/hr	Mass Emissions	8.42E-04	lb/hr

Isokinetic Field Data
Field Data and Calculations
Particulate Emissions and Gas Stream Characteristics

Client:	**Hollingsworth &Vose Fiber Company**	**Run:**	**3**
Source:	**CFU115**	**Date:**	**11/5/2022**
Location:	**Corvallis, OR**	**Start Time:**	**15:25**
Method:	**ODEQ 5**	**End Time:**	**18:42**

Sampling Data				Traverse Data			
Time	**Meter**	**ΔH**	**Meter**	**Traverse**	**Dp**	**Stack**	
min.	**ft^3**	**"H_2O**	**T_m ^oF**	**Point**	**"H_2O**	**T_s ^oF**	**√Dp**
	177.884						
8	184.310	2.20	75	1	1.20	305	1.095
15	190.590	2.00	75	2	1.10	305	1.049
23	196.900	2.20	75	3	1.20	304	1.095
30	202.960	2.20	75	4	1.20	304	1.095
38	209.500	2.40	75	5	1.30	305	1.140
45	215.800	2.20	75	6	1.20	304	1.095
53	222.090	2.20	75	7	1.20	305	1.095
60	228.260	2.20	75	8	1.20	304	1.095
68	234.430	2.10	75	9	1.10	302	1.049
75	240.640	2.00	75	10	1.10	304	1.049
83	246.400	1.90	76	11	1.00	299	1.000
90	252.560	2.10	76	12	1.10	271	1.049
98	258.730	2.10	76	13	1.10	282	1.049
105	265.080	2.40	76	14	1.30	286	1.140
113	271.830	2.40	76	15	1.30	290	1.140
120	278.380	2.30	76	16	1.20	291	1.095
128	284.480	2.00	76	17	1.10	297	1.049
135	290.540	2.00	76	18	1.10	298	1.049
143	296.610	2.00	76	19	1.10	300	1.049
150	302.940	2.20	76	20	1.20	300	1.095
158	309.000	2.00	77	21	1.10	302	1.049
165	314.750	1.80	76	22	1.00	305	1.000
173	320.520	1.90	76	23	1.00	302	1.000
180	326.251	1.90	76	24	1.00	302	1.000

Client:	**Hollingsworth &Vose Fiber Company**	**Run:**	**3**
Source:	**Corvallis, OR**	**Date:**	**11/05/22**

Field Data Input Continued

Moisture Data			Stack Dimensional Data:		
Total Test Time	180.0	min	Circular		
Sample Time Interval	7.5	min	Diameter	32.000	in
Meter Volume, V_m	148.367	dcf	Rectangular		
Water Weight	61.2	g	Width		in
Nozzle Diameter, N_z	0.225	in.	Length		in
Nozzle Area	0.000276	sq.ft.	Stack Area	5.585	sq.ft.
Traverse Data			Molecular Weight:		
Barometric Pressure, P_b	29.88	"Hg	CO_2 Average	0.60	%vd
Static Pressure	0.25	"H_2O	O_2 Average	19.76	%vd
Pitot Factor, C_p	0.84				
Meter Cal Factor	1.0010	Y			

Field Data Averages

Meter			Stack		
ΔH	2.113	"H_2O	√Dp	1.068	"H_2O
Temperature, T_m	75.6	^oF	Temperature, T_s	298.6	^oF
Temperature, T_m	535.3	^oA (^oR)	Temperature, T_s	758.3	^oA (R)
Pressure Meter, P_m	30.035	"Hg	Pressure Stack, P_s	29.898	"Hg

Field Data Calculations

Meter Box Capture			EPA Method 2 Stack Gas Flowrate:		
Standard Volume, $V_{m(std)}$	146.969	dscf	Velocity, V_s	72.12	fps
	4.162	dscm	Volume (actual)	24,167	acfm
Actual Volume, $V_{m(actual)}$	215.512	awcf		23,701	adcfm
Gas Stream Moisture			Volume (standard)	1,008,325	wscf/hr
Moisture Vapor, $V_{w(std)}$	2.886	scf		988,864	dscf/hr
Moisture, B_{ws}	0.0193			16,481	dscf/min
Moisture EPA M4	1.93	%v		16,805	wscf/min
Moisture @ Saturation	NA	%v (for $T_s < 212°F$)			
EPA Method 3 Gas Density					
Dry, M_d	28.89	lb/lb-mole			
Wet, M_s	28.68	lb/lb-mole			
Percent Isokinetic	100.2	%			

Laboratory Results

Front Half:					
Filterable PM	0.0006	grams			
Emissions:					
Concentration, C_s	6.57E-05	gr/dscf			
	150.3	µg/dscm			
Mass Emissions	9.28E-03	lb/hr			
Back Half:					
Inorganic CPM	0.0014	grams	Organic CPM	0.0024	grams
Inorganic CPM, C_s	1.43E-04	gr/dscf	Organic CPM, C_s	2.50E-04	gr/dscf
	326.7	µg/dscm		572.9	µg/dscm
Mass Emissions	2.02E-02	lb/hr	Mass Emissions	3.54E-02	lb/hr

Oregon Method 5
Filterable and Condensable Particulate
Laboratory Gravimetric Data

Client: **Hollingsworth &Vose Fiber Company**
Source: **CFU115**
Location: **Corvallis, OR**

Run	Sample Description	g, #	Initial (grams)	Final (grams)	Net Gain	Blank Correction	Corrected Gain (grams)	
1	CPM Organics (Acetone BH)	161.0	47.9858	47.9892	0.0034	0.0014	**0.0020**	
	Probe Rinse (Acetone FH)	165.7	44.9258	44.9293	0.0035	0.0014	**0.0021**	
	Filter	Q85	0.4408	0.4401	-0.0007		**0.0000**	
	CPM Inorganics (Water)	451.3	50.2927	50.2946	0.0019	0.0012	**0.0007**	
	CPM Organics (Hexane BH)	90.9	46.5510	46.5520	0.0010	0.0000	**0.0010**	
	Impinger H_2O Gain, mls		200.0	223.0	23.0			
						Filterable PM (g)	**0.0021**	
						Total PM (g)	**0.0059**	**ND**
2	CPM Organics (Acetone BH)	147.6	45.6934	45.6947	0.0013	0.0012	**0.0001**	
	Probe Rinse (Acetone FH)	114.3	43.6664	43.6682	0.0018	0.0010	**0.0008**	
	Filter	Q86	0.4640	0.4639	-0.0001		**0.0000**	
	CPM Inorganics (Water)	430.6	42.7532	42.7562	0.0030	0.0011	**0.0019**	
	CPM Organics (Hexane BH)	85.5	47.3804	47.3802	-0.0002	0.0000	**0.0000**	
	Impinger H_2O Gain, mls		200.0	240.6	40.6			
						Filterable PM (g)	**0.0008**	
						Total PM (g)	**0.0028**	**ND**
3	CPM Organics (Acetone BH)	156.3	55.5992	55.6021	0.0029	0.0013	**0.0016**	
	Probe Rinse (Acetone FH)	103.9	46.0055	46.0070	0.0015	0.0009	**0.0006**	
	Filter	Q87	0.4411	0.4410	-0.0001		**0.0000**	
	CPM Inorganics (Water)	440.2	47.6437	47.6462	0.0025	0.0011	**0.0014**	
	CPM Organics (Hexane BH)	80.3	50.5030	50.5038	0.0008	0.0000	**0.0008**	
	Impinger H_2O Gain, mls		200.0	228.4	28.4			
						Filterable PM (g)	**0.0006**	
						Total PM (g)	**0.0044**	**ND**
	Acetone Blank	190.1	54.7478	54.7494	0.0016	8.42E-06	g/g	
	Water Blank	231.6	43.9987	43.9993	0.0006	2.59E-06	g/g	
	Hexane Blank	216.2	41.834	41.8343	-0.0001	0.00E+00	g/g	

Bison Engineering, Inc.
Gravimetric Information

Client: Hollingsworth & Vose Fiber Company
Location: Corvallis, OR
Project Number: HAV222921
Test Date: 11/4/2022

Filters:

Sample Identification	Filter #	Date	Tare 1 (g)	Date	Tare 2 (g)	CHECK	Average	Filter #	Date	Final 1 (g)	Date	Final 2 (g)	CHECK	Average	Gain
HAV222921 CFU 115 M5 Run 1	Q85	9/16/2022	0.4410	9/21/2022	0.4406	-0.0004	0.4408	Q85	11/14/2022	0.4400	11/16/2022	0.4401	0.0001	0.4401	-0.0007
HAV222921 CFU 115 M5 Run 2	Q86	9/16/2022	0.4640	9/21/2022	0.4640	0.0000	0.4640	Q86	11/14/2022	0.4638	11/16/2022	0.4640	0.0002	0.4639	-0.0001
HAV222921 CFU 115 M5 Run 3	Q87	9/16/2022	0.4410	9/21/2022	0.4411	0.0001	0.4411	Q87	11/14/2022	0.4409	11/16/2022	0.4411	0.0002	0.4410	-0.0001

Liquid Fractions:

Wt (g)	Sample Identification	Dish #	Date	Tare 1 (g)	Date	Tare 2 (g)	CHECK	Average	Dish #	Date	Final 1 (g)	Date	Final 2 (g)	CHECK	Average	Gain
165.7	HAV222921 CFU 115 Probe Rinse Run1	87	11/14/2022	44.9260	11/15/2022	44.9256	-0.0004	44.9258	87	11/29/2022	44.9295	11/30/2022	44.9291	-0.0004	44.9293	0.0035
114.3	HAV222921 CFU 115 Probe Rinse Run2	88	11/14/2022	43.6663	11/15/2022	43.6665	0.0002	43.6664	88	11/29/2022	43.6683	11/30/2022	43.6681	-0.0002	43.6682	0.0018
103.9	HAV222921 CFU 115 Probe Rinse Run3	89	11/14/2022	46.0053	11/15/2022	46.0057	0.0004	46.0055	89	11/29/2022	46.0067	11/30/2022	46.0072	0.0005	46.0070	0.0015
161	HAV222921 CFU 115 Organics Run 1	90	11/14/2022	47.9856	11/15/2022	47.9860	0.0004	47.9858	90	11/29/2022	47.9892	11/30/2022	47.9892	0.0000	47.9892	0.0034
147.6	HAV222921 CFU 115 Organics Run 2	91	11/14/2022	45.6934	11/15/2022	45.6933	-0.0001	45.6934	91	11/29/2022	45.6944	11/30/2022	45.6949	0.0005	45.6947	0.0013
156.3	HAV222921 CFU 115 Organics Run 3	92	11/14/2022	55.5993	11/15/2022	55.5991	-0.0002	55.5992	92	11/29/2022	55.6018	11/30/2022	55.6023	0.0005	55.6021	0.0029
90.9	HAV222921 CFU 115 Cont #6 Run 1	93	11/14/2022	46.5511	11/15/2022	46.5508	-0.0003	46.5510	93	11/29/2022	46.5518	11/30/2022	46.5522	0.0004	46.5520	0.0010
85.5	HAV222921 CFU 115 Cont #6 Run 2	94	11/14/2022	47.3801	11/18/2022	47.3806	0.0005	47.3804	94	11/29/2022	47.3804	11/30/2022	47.3799	-0.0005	47.3802	-0.0002
80.3	HAV222921 CFU 115 Cont #6 Run 3	95	11/14/2022	50.5030	11/15/2022	50.5030	0.0000	50.5030	95	11/29/2022	50.5040	11/30/2022	50.5036	-0.0004	50.5038	0.0008
474.3	HAV222921 CFU 115 Inorganics Run 1	9	11/21/2022	50.2926	11/22/2022	50.2928	0.0002	50.2927	9	12/2/2022	50.2948	12/5/2022	50.2943	-0.0005	50.2946	0.0019
471.2	HAV222921 CFU 115 Inorganics Run 2	10	11/21/2022	42.7531	11/22/2022	42.7532	0.0001	42.7532	10	12/2/2022	42.7559	12/5/2022	42.7564	0.0005	42.7562	0.0030
468.6	HAV222921 CFU 115 Inorganics Run 3	11	11/21/2022	47.6435	11/22/2022	47.6439	0.0004	47.6437	11	12/2/2022	47.6459	12/5/2022	47.6464	0.0005	47.6462	0.0025
190.1	HAV222921 Acetone Blank	96	11/14/2022	54.7476	11/18/2022	54.7479	0.0003	54.7478	96	11/29/2022	54.7492	11/30/2022	54.7496	0.0004	54.7494	0.0016
216.2	HAV222921 Hexane Blank	97	11/18/2022	41.8346	11/21/2022	41.8341	-0.0005	41.8344	97	11/29/2022	41.8341	11/30/2022	41.8345	0.0004	41.8343	-0.0001
231.6	HAV222921 HPLC Blank	13	11/21/2022	43.9988	11/22/2022	43.9985	-0.0003	43.9987	13	12/2/2022	43.9990	12/5/2022	43.9995	0.0005	43.9993	0.0006

Table 1
November 2022 Engineering Test—Production Data
Hollingsworth & Vose Fiber Company—Corvallis, OR

Source Test	Product Type	Test ID	Test Time [1]	Total Hourly Fiber Pull Rate (lb/hr)												
				CFU-118 [2]			CFU-108 [2]			CFU-115 [3]			CFU-112 [2]			
				L4R8	L4R9	Total	L1R5	L1R6	Total	L4R3	L4R4	Total	L2R3	L2R4	L2R9	Total
11/04/2022 CFU-118 Outlet	Rotary Fine (RF)	Run 1	07:55 - 11:00	57.1	57.1	114.3	--	--	--	--	--	--	--	--	--	--
		Run 2	11:35 - 14:40	55.5	57.1	112.7	--	--	--	--	--	--	--	--	--	--
		Run 3	15:50 - 18:55	54.0	54.0	107.9	--	--	--	--	--	--	--	--	--	--
		Average		**55.5**	**56.1**	**111.6**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
11/03/2022 CFU-108 Outlet	Rotary Coarse (RC)	Run 1	07:35 - 10:40	--	--	--	190.7	198.4	389.1	--	--	--	--	--	--	--
		Run 2	11:10 - 14:15	--	--	--	188.7	191.7	380.3	--	--	--	--	--	--	--
		Run 3	14:35 - 17:40	--	--	--	193.9	197.9	391.8	--	--	--	--	--	--	--
		Average		**--**	**--**	**--**	**191.1**	**196.0**	**387.1**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
11/05/2022 CFU-115 Outlet	Flameblown (FB)	Run 1	08:00 - 11:05	--	--	--	--	--	--	30.5	30.5	61.0	--	--	--	--
		Run 2	11:40 - 14:45	--	--	--	--	--	--	30.5	30.5	61.0	--	--	--	--
		Run 3	15:25 - 18:42	--	--	--	--	--	--	30.5	30.5	61.0	--	--	--	--
		Average		**--**	**--**	**--**	**--**	**--**	**--**	**30.5**	**30.5**	**61.0**	**--**	**--**	**--**	**--**
11/02/2022 CFU-112 Outlet	Ultra-Rotary Coarse (URC)	Run 1	07:55 - 11:02	--	--	--	--	--	--	--	--	--	311.7	312.3	307.9	931.9
		Run 2	11:40 - 15:01	--	--	--	--	--	--	--	--	--	299.4	303.0	307.9	910.3
		Run 3	15:45 - 18:50	--	--	--	--	--	--	--	--	--	303.2	308.7	304.2	916.1
		Average		**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**304.7**	**306.7**	**306.7**	**919.4**

NOTES:

CFU = ceramic filtration unit.

REFERENCES:

(1) Information provided by Bison Engineering.

(2) Production data provided by Hollingsworth & Vose Fiber Company. The hourly fiber pull rate represents the average pull rate measured over the test time per run.

(3) Information provided by Hollingsworth & Vose Fiber Company. Assumes an average total pack rate of 61.0 lb/hr.

Table 2
November 2022 Engineering Test—Natural Gas Usage
Hollingsworth & Vose Fiber Company—Corvallis, OR

Source Test	Product Type	Test ID	Test Time [1]	Total Hourly Natural Gas Usage [2] (cf/hr)												
				CFU-118			CFU-108			CFU-115			CFU-112			
				L4R8	L4R9	Total	L1R5	L1R6	Total	L4R3	L4R4	Total	L2R3	L2R4	L2R9	Total
11/04/2022 CFU-118 Outlet	Rotary Fine (RF)	Run 1	07:55 - 11:00	2,836.5	2,832.9	5,669.4	--	--	--	--	--	--	--	--	--	--
		Run 2	11:35 - 14:40	2,837.2	3,074.2	5,911.4	--	--	--	--	--	--	--	--	--	--
		Run 3	15:50 - 18:55	2,838.2	2,503.2	5,341.4	--	--	--	--	--	--	--	--	--	--
		Average		**2,837.3**	**2,803.4**	**5,640.7**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
11/03/2022 CFU-108 Outlet	Rotary Coarse (RC)	Run 1	07:35 - 10:40	--	--	--	2,932.1	2,830.5	5,762.5	--	--	--	--	--	--	--
		Run 2	11:10 - 14:15	--	--	--	2,947.3	2,859.4	5,806.7	--	--	--	--	--	--	--
		Run 3	14:35 - 17:40	--	--	--	2,956.3	2,864.9	5,821.1	--	--	--	--	--	--	--
		Average		**--**	**--**	**--**	**3,722.2**	**3,667.9**	**5,796.8**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
11/05/2022 CFU-115 Outlet	Flameblown (FB)	Run 1	08:00 - 11:05	--	--	--	--	--	--	3,710.7	3,667.1	7,377.8	--	--	--	--
		Run 2	11:40 - 14:45	--	--	--	--	--	--	3,729.2	3,671.9	7,401.1	--	--	--	--
		Run 3	15:25 - 18:42	--	--	--	--	--	--	3,726.8	3,664.7	7,391.5	--	--	--	--
		Average		**--**	**--**	**--**	**--**	**--**	**--**	**3,722.2**	**3,667.9**	**7,390.1**	**--**	**--**	**--**	**--**
11/02/2022 CFU-112 Outlet	Ultra-Rotary Coarse (URC)	Run 1	07:55 - 11:02	--	--	--	--	--	--	--	--	--	2,199.8	2,077.5	2,163.4	6,440.7
		Run 2	11:40 - 15:01	--	--	--	--	--	--	--	--	--	2,212.4	2,082.2	2,159.9	6,454.5
		Run 3	15:45 - 18:50	--	--	--	--	--	--	--	--	--	1,936.3	2,108.4	2,153.1	6,197.9
		Average		**--**	**--**	**--**	--	**--**	**--**	--	**--**	**--**	**2,116.1**	**2,158.8**	**2,158.8**	**6,364.3**

NOTES:

CFU = ceramic filtration unit.

REFERENCES:

(1) Information provided by Bison Engineering.

(2) Information provided by Hollingsworth & Vose Fiber Company. Value represents the natural gas usage measured over the test time.

(3) Information provided by Hollingsworth & Vose Fiber Company. The hourly natural gas usage rate represents the average usage rate measured over the test time per run.

Table 3
November 2022 Engineering Test—Differential Pressure
Hollingsworth & Vose Fiber Company—Corvallis, OR

Source Test	Product Type	Test ID	Test Time [1]	Differential Pressure [1] ("w.c.)
11/04/2022 CFU-118 Outlet	Rotary Fine (RF)	Run 1	07:55 - 08:15	5.17
		Run 2	08:16 - 08:36	5.17
		Run 3	08:37 - 08:57	4.97
		Average		**5.10**
11/03/2022 CFU-108 Outlet	Rotary Coarse (RC)	Run 1	07:30 - 07:50	7.74
		Run 2	07:51 - 08:11	7.55
		Run 3	08:12 - 08:32	7.57
		Average		**7.62**
11/05/2022 CFU-115 Outlet	Flameblown (FB)	Run 1	07:30 - 07:50	4.54
		Run 2	07:51 - 08:11	4.55
		Run 3	08:12 - 08:32	4.56
		Average		**4.55**
11/02/2022 CFU-112 Outlet	Ultra-Rotary Coarse (URC)	Run 1	07:15 - 07:35	4.70
		Run 2	07:36 - 07:56	4.63
		Run 3	07:57 - 08:17	4.65
		Average		**4.66**

NOTES:

" w.c. = inches water column.

CFU = ceramic filtration unit.

REFERENCES:

(1) Information provided by Bison Engineering.

This is the last page of the report.

APPENDIX B

ANALYSIS OF PARTICLES DEPOSITED ON PTFE MEMBRANES- CHEMOPTIX MICROANALYSIS, LLC

March 2, 2023

Thomas Wood, *et al.,*
Stoel Rives LLP
760 SW Ninth Ave. Suite 3000
Portland, OR 97205

Re: Analysis of particles deposited on PTFE membranes (HV222921): *Chemoptix #G-MIC-12305* through -*12316*.

Thomas, *et al*:

The filter samples cited herein have been evaluated in situ on the membranes cited above using incident light (darkfield) microscopy as well as transects across membranes. The scope of this investigation is to determine the contribution of glass wool fibers to masses detected gravimetrically on these filter membranes. The results should be of interest:

Analysis Summary:

Glass wool appears to be present only at trace levels relative to other particles contributing mass to these membranes. Their total mass is below quantitation. Rather, the predominant particle assemblages appear to represent those produced by scuffing abrasion related to contact with flooring and other eroding surfaces subject to physical contact. Fibers from fabrics and paper/packaging were also seen. Both agitation and flux-condensation aerosols were represented as small particles contributing minor but possibly discernable fractions to the mass balance on this filter set. The flux condensation spheres contain a fraction of vitreous material that may ultimately be related to glass wool fabrication. Glass wool fibers were very poorly represented: only four fibers of any discernable sort were observed on 400 fields of view during high-magnification filter transects; no glass wool fibers were distinguished in the remaining transects. Glass wool fibers thus represent considerably less than <1% of the mass balance on these membranes.

The samples submitted for this analysis are identified as:

HV Sample ID:	*Chemoptix ID:*	*Sample type:*	*Date sampled:*
CFU 112 Run 1	G-MIC-12305	PTFE membrane	11/2/22
CFU 112 Run 2	G-MIC-12306	PTFE membrane	11/2/22
CFU 112 Run 3	G-MIC-12307	PTFE membrane	11/2/22
CFU 108 Run 1	G-MIC-12308	PTFE membrane	11/3/22
CFU 108 Run 2	G-MIC-12309	PTFE membrane	11/3/22
CFU 108 Run 3	G-MIC-12310	PTFE membrane	11/3/22
CFU 118 Run 1	G-MIC-12311	PTFE membrane	11/4/22
CFU 118 Run 2	G-MIC-12312	PTFE membrane	11/4/22
CFU 118 Run 3	G-MIC-12313	PTFE membrane	11/4/22
CFU 115 Run 1	G-MIC-12314	PTFE membrane	11/5/22
CFU 115 Run 2	G-MIC-12315	PTFE membrane	11/5/22
CFU 115 Run 3	G-MIC-12316	PTFE membrane	11/5/22

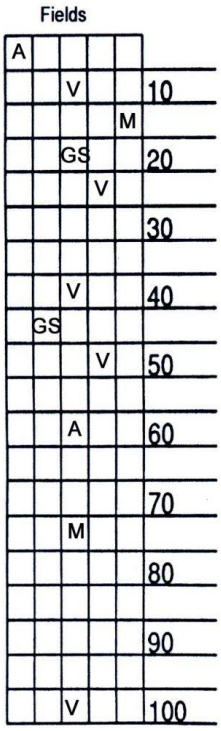
Methods:

Each membrane surface was surveyed using darkfield reflected light via a Zeiss Universal research microscope equipped with calibrated optics. A 100x magnification was employed order to resolve a greater filter surface area with its overall particle assemblages, whereas 500x transects were used to resolve ≥ 5µm fibers for glass wool, defined herein as exhibiting ≥ 3:1 length to width aspect ratios. A total of 100 fields of view were analyzed per membrane for a total of 400 fields of view for glass wool potentially exhibiting these dimensions. Area for high-magnification fields of view was 0.093mm x 0.012mm; these fields of view thus totaled ~6.154 $mm^{2.}$ The 100x magnification transects were used to determine what types of particles were contributing to the weight/weights overall. As this part of the investigation was qualitative, total surface areas was not calculated, but high magnification was used to make particle determinations. Analysis was performed in situ on all these membranes: particle types were distinguished on the bases of color, luster, structure, length-to-width aspect ratios, homogeneity/inclusion arrays, surface relief, translucency, fracture/cleavage and mechanisms responsible for particle release into air space.

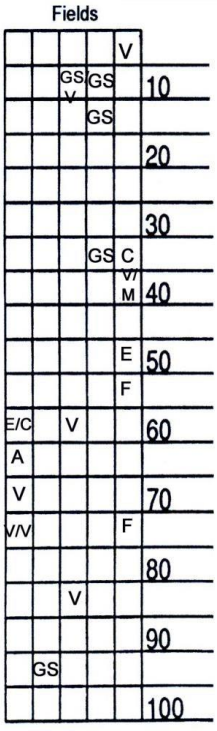
Results:

Tables and annotated photomicrographs are presented below:

Table 1: (high magnification transects)



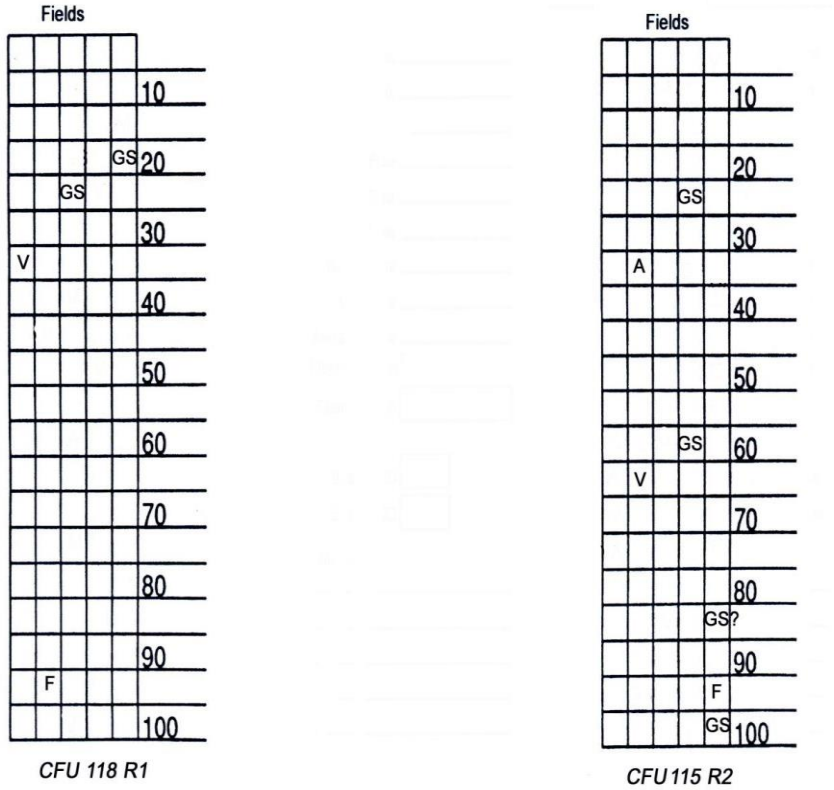
CFU 112 R1



CFU 108 R1

Abbreviations:
GS*= glass shot;* ***M****= metal;* ***C****= carbon;* ***F****= fiber;* ***V****= vitreous non-fibrous;* ***A****= agglomerate;*
E*= epithelial slough*

Table 2: (high magnification transects)



Abbreviations:
GS*= glass shot;* ***M****= metal;* ***C****= carbon;* ***F****= fiber;* ***V****= vitreous non-fibrous;* ***A****= agglomerate;*
E*= epithelial slough*

Discussion:

CFU 115 Run 2 [R2] was used in the high-magnification transect because Run 1 filter's supporting ribs were upside down during sampling: these ribs interfered with the working distance of the microscope's objective lens.

Globular vitreous particles were observed, and may represent extruded glass wool production but as a fluid reverted elastically into non-fibrous globular aerosols before having a chance to solidify. With respect to mass, most particles in these assemblages appear to represent ambient facility-related scuffing abrasion, fabrics, minerals, resins/polymers, epithelial slough and other ambient airborne material.

In broader overview, several other patterns and observations may be noteworthy:

1) The accumulated mass on these filters appear to be related to the facility and ambient air, and not directly to manufacturing processes.

2) Much of this material is related to scuffing abrasion such as floor scuffs; resin-like materials appear to be relatively well represented.

3) Glassine material appears to be mostly restricted to flux-condensation aerosols and other melt-related material that did not form glass fibers.

4) Observed fibers were predominantly cellulose and synthetics related to fabrics, paper and/or packaging. They indicate many different types and sources. Glass wool was present at trace levels, and appear to be below mass quantitation.

5) Iron oxide/hydroxides were observed, and also appear to have formed particles through abrasion, including some in contact with the filter surfaces.

6) Particles were scattered on filter surfaces rather unevenly. The reason(s) are unclear.

7) The high-magnification fiber transect are supported by the lack of glass fiber particles recovered in the larger, lower magnification particle transects.

8) The particles identified here were left intact on these membranes in a nondestructive analysis milieu.

Thank you once again for your considerable patience during our investigation of this interesting material. If you have questions, require other tests or other elaborations, feel free to call (503) 636-9251 or email stancassell@chemoptix.com.

Respectfully Submitted

Stan Cassell
Manager/Microanalyst,
Chemoptix Microanalysis, LLC
2767 Robinwood Way, Suite G
West Linn, OR 97068-1332
503.636.9251 www.chemoptix.com

Attachments:

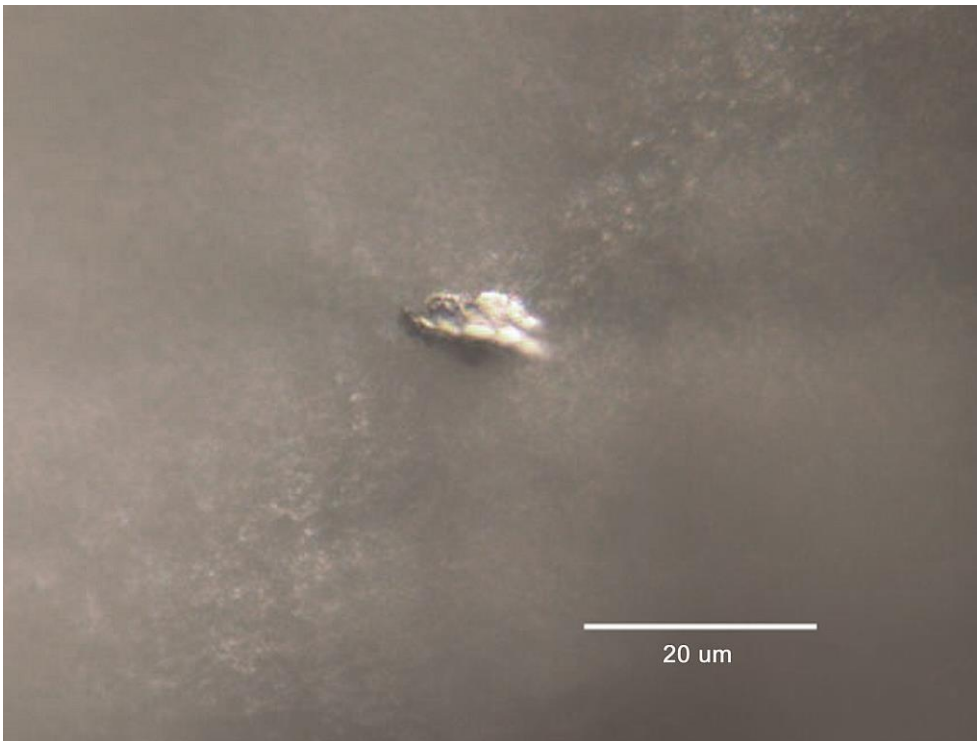


Figure 1: CFU112-R1 ~17 µm wear metal chip.

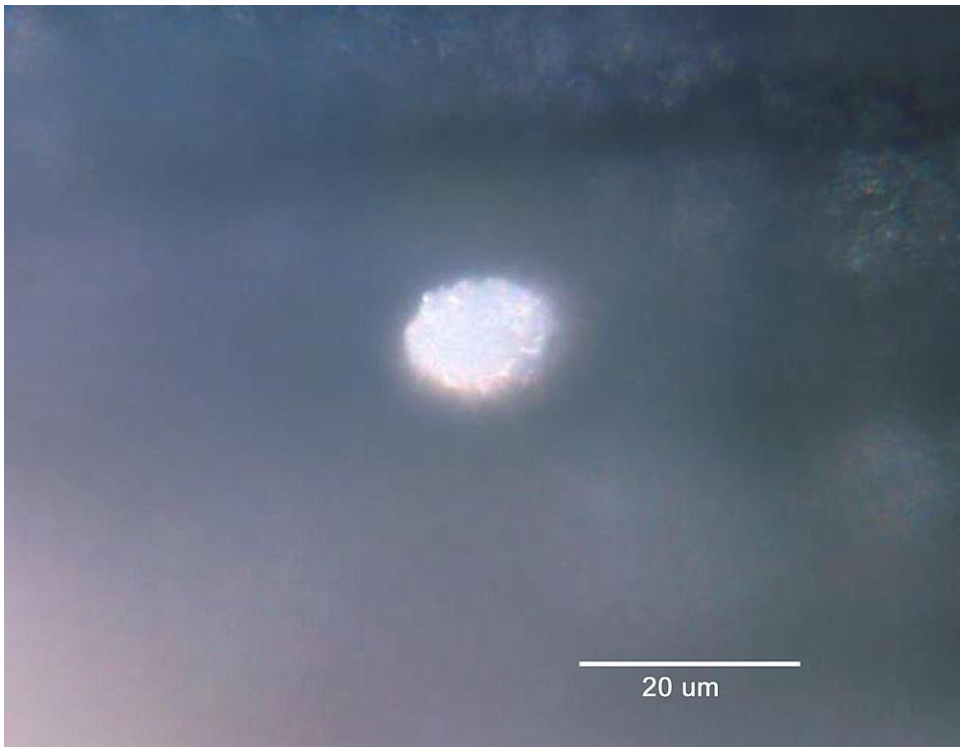


Figure 2: CFU112-R1 ~18 µm agglomerate. Rounding is likely due to agitation.

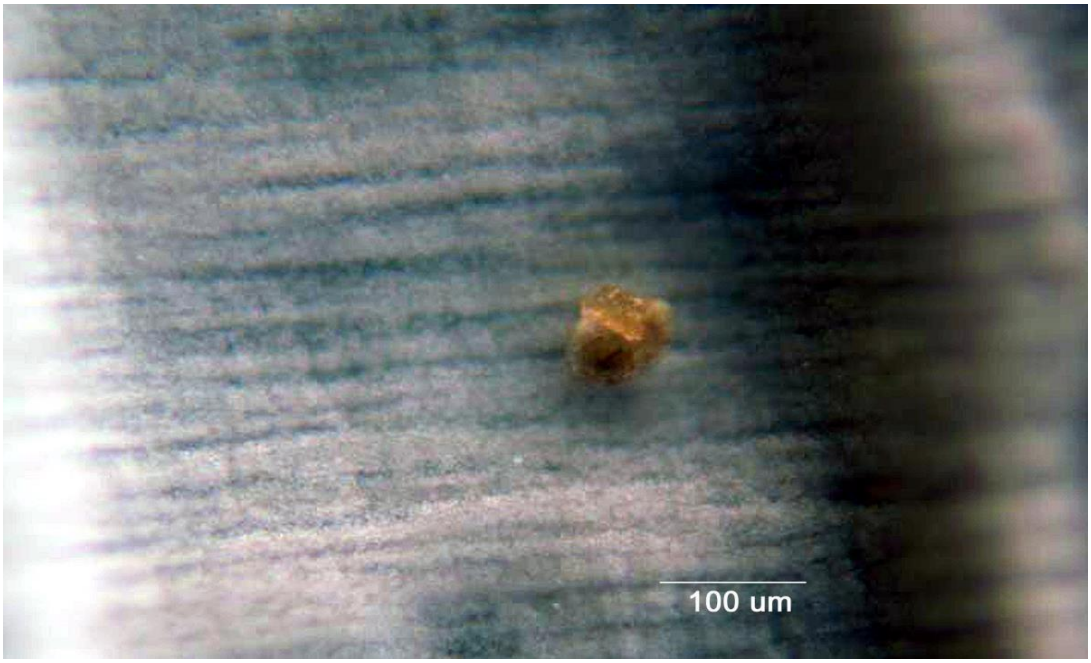


Figure 3: CFU112-R1 ~77 µm resinous agglomerate-like particle.

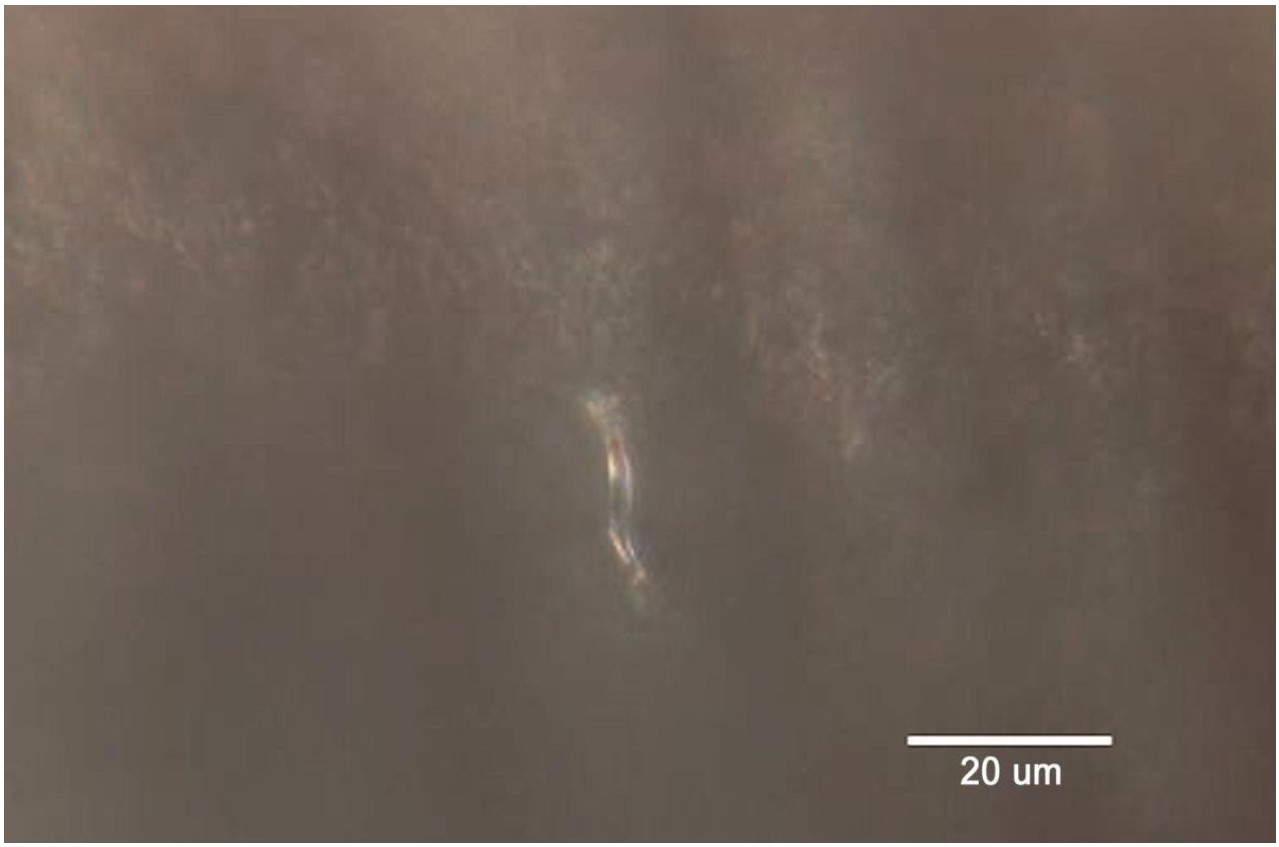


Figure 4: CFU108 -R1 showing an 18 µm vitreous fiber recovered from Field 55 (Table 1).

Figure 5: CFU108 -R1 showing a 30 µm sloughed resinous amalgamate that has incorporated carbonaceous/metallo-oxide flux condensation spheres.

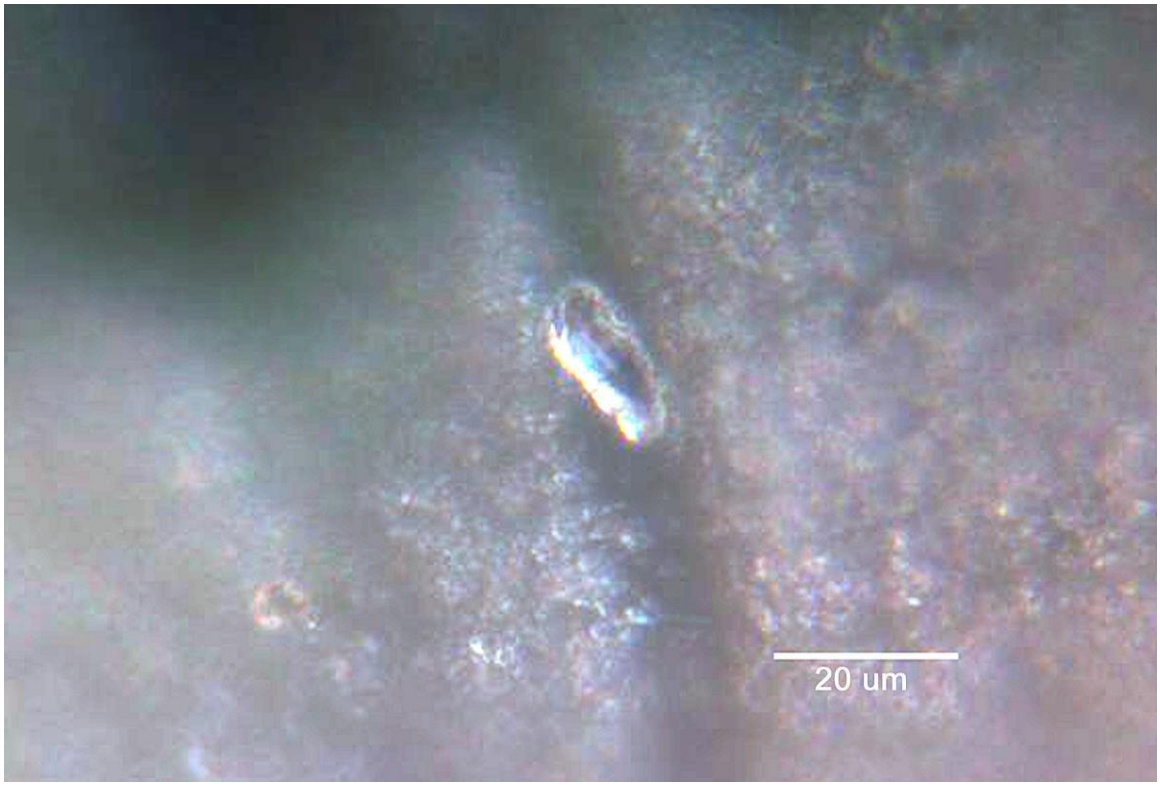


Figure 6: CFU108 -R1 showing a ~20 µm vitreous glass shot-like particle. A second smaller glass shot-like particle is also seen in the lower left.

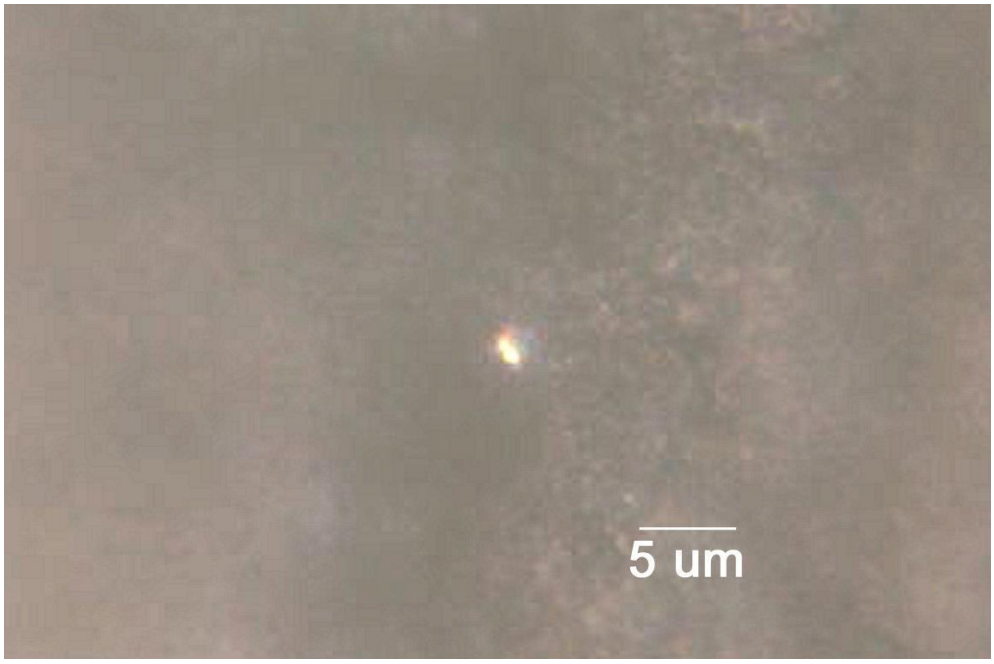


Figure 7: CFU118 -R1 showing a ~2 µm glass shot particle.

Figure 8: CFU118 -R1 showing a ≥100 µm vitreous fiber recovered from Field 92 (Table 2).

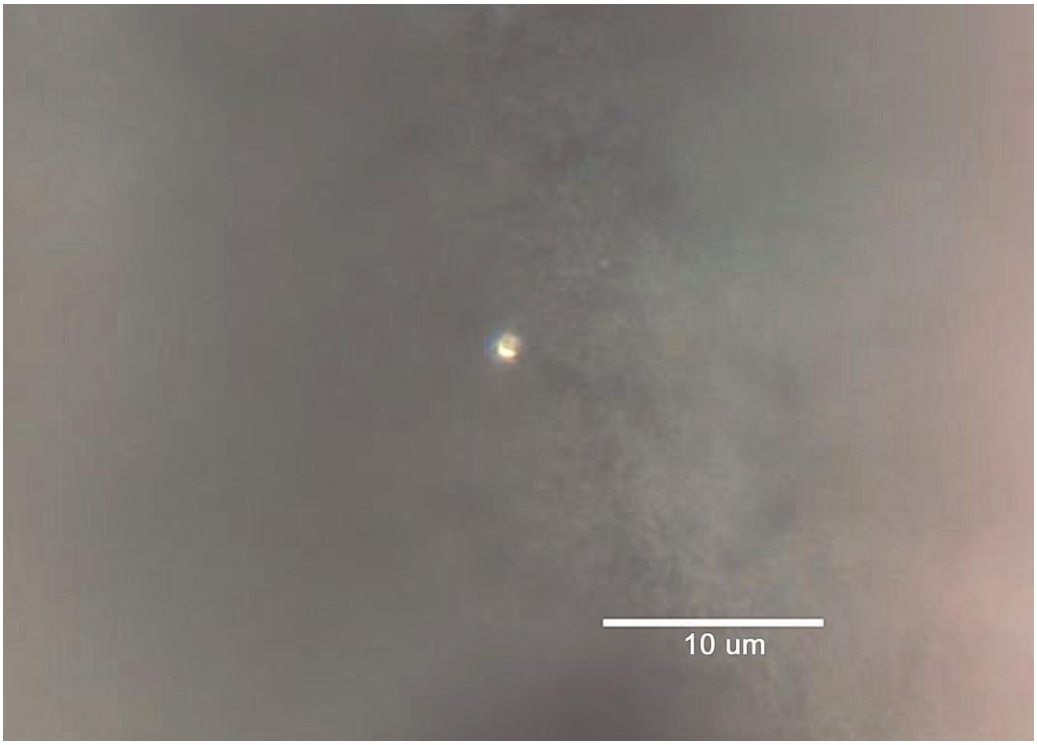


Figure 9: CFU115 –R2 showing a ~2 µm glass shot particle recovered from Field 24 (Table 2).

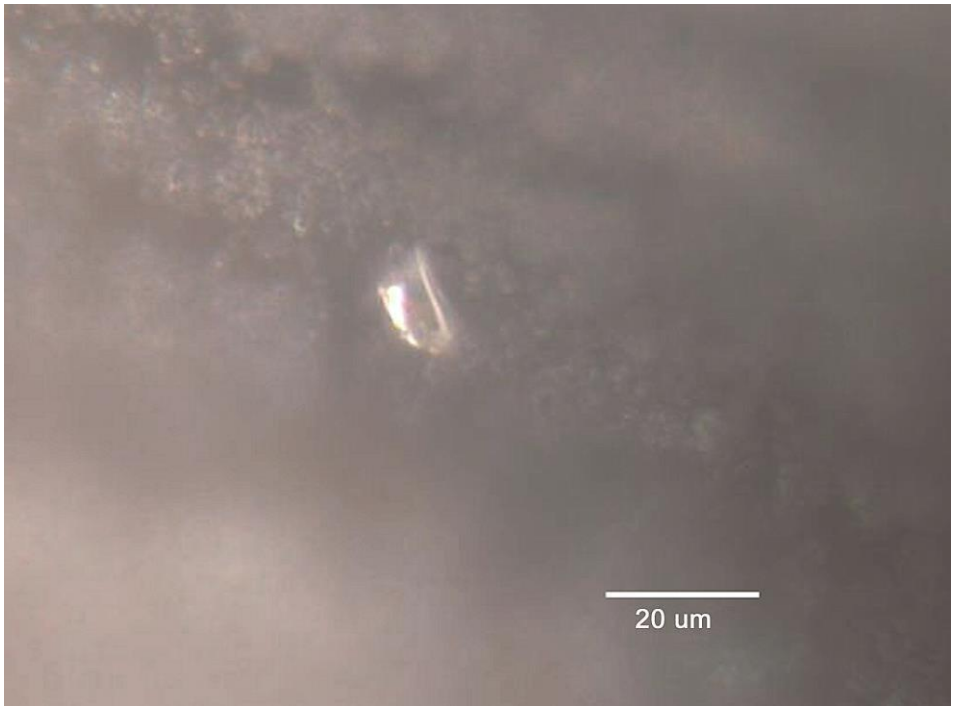


Figure 10: CFU115 –R2 showing a 13 µm fractured vitreous particle recovered from Field 62 (Table 2).

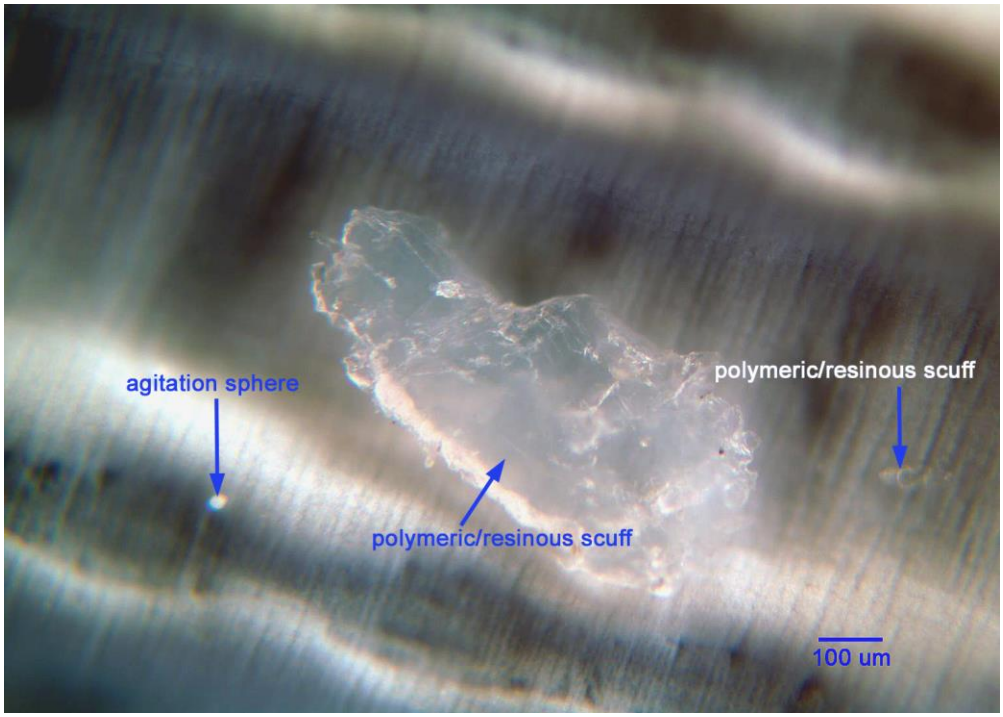


Figure 11: CFU112 Run 1 *particle assemblage. The particle in the center appears to be >1 mm.*

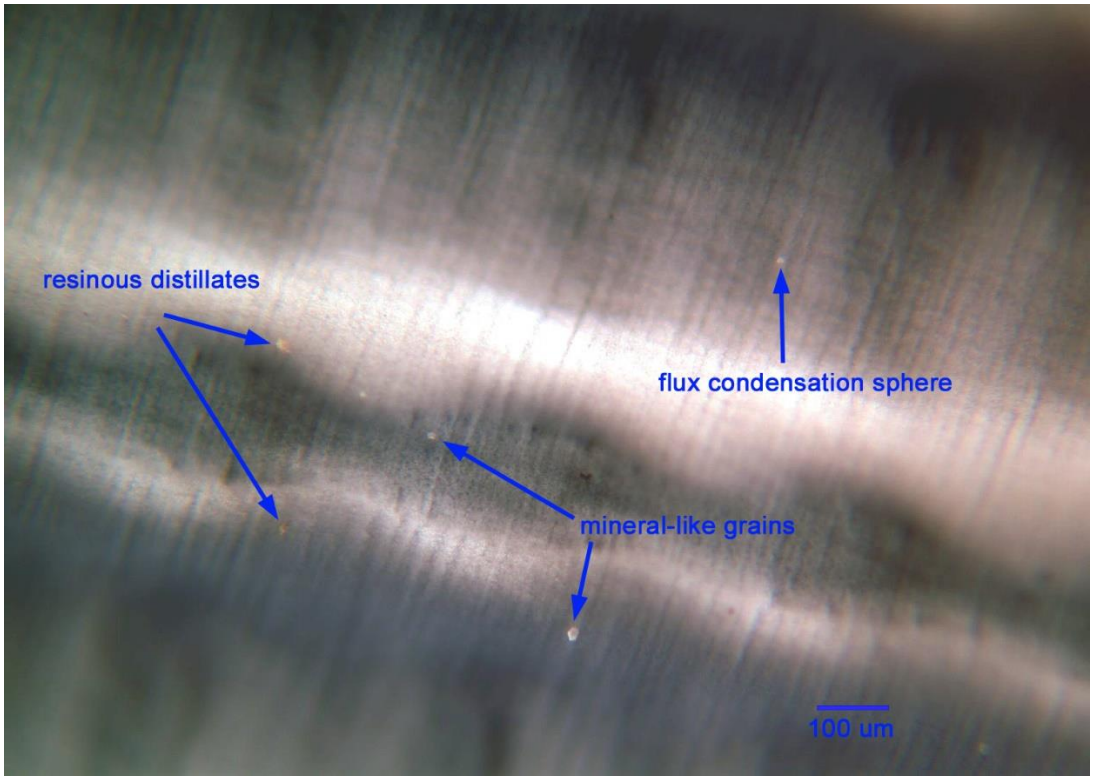


Figure 12: CFU112 Run 1 *particle assemblage.*

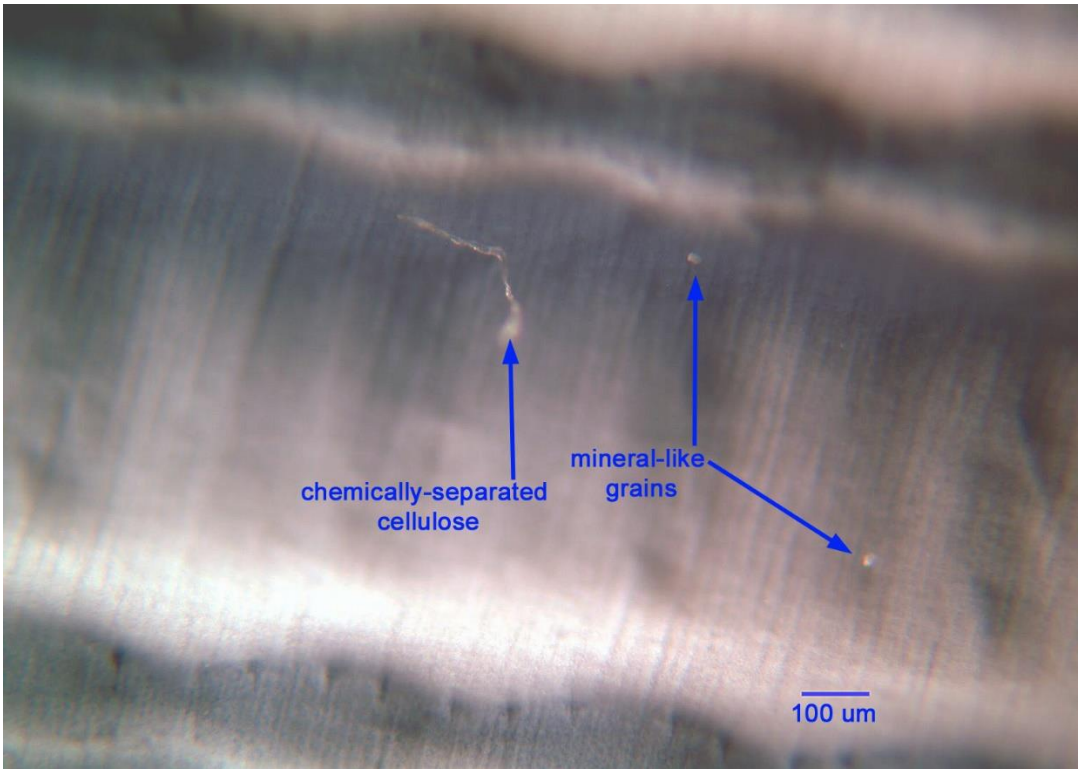


Figure 13: CFU112 Run 1 *particle assemblage.*

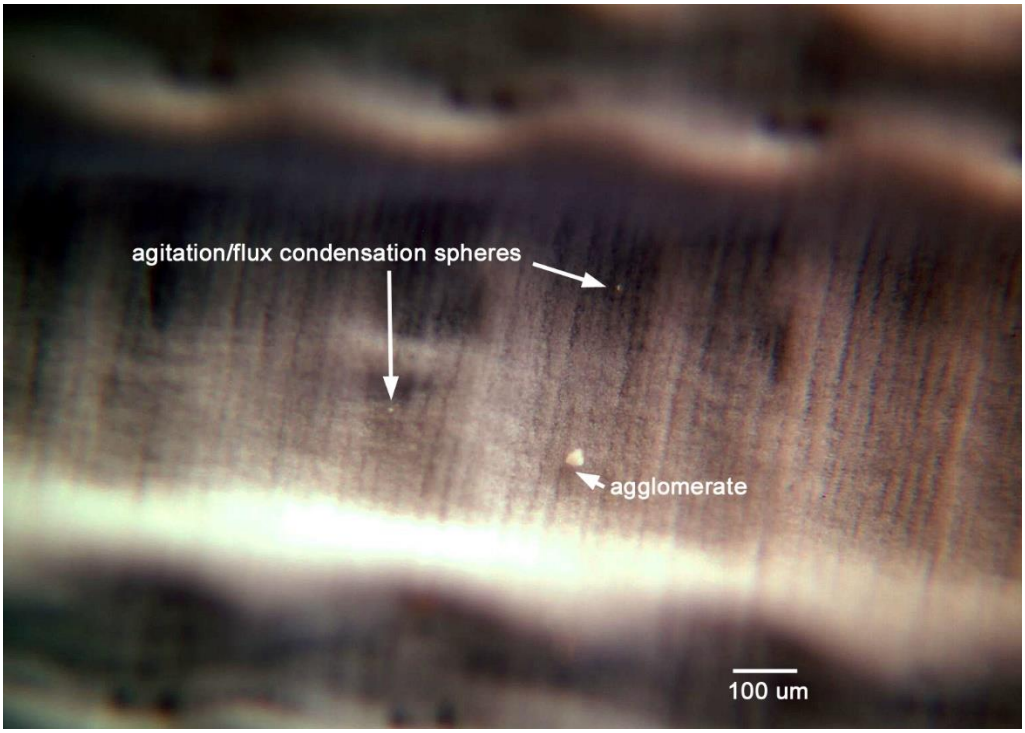


Figure 14: CFU112 Run 1 *particle assemblage.*

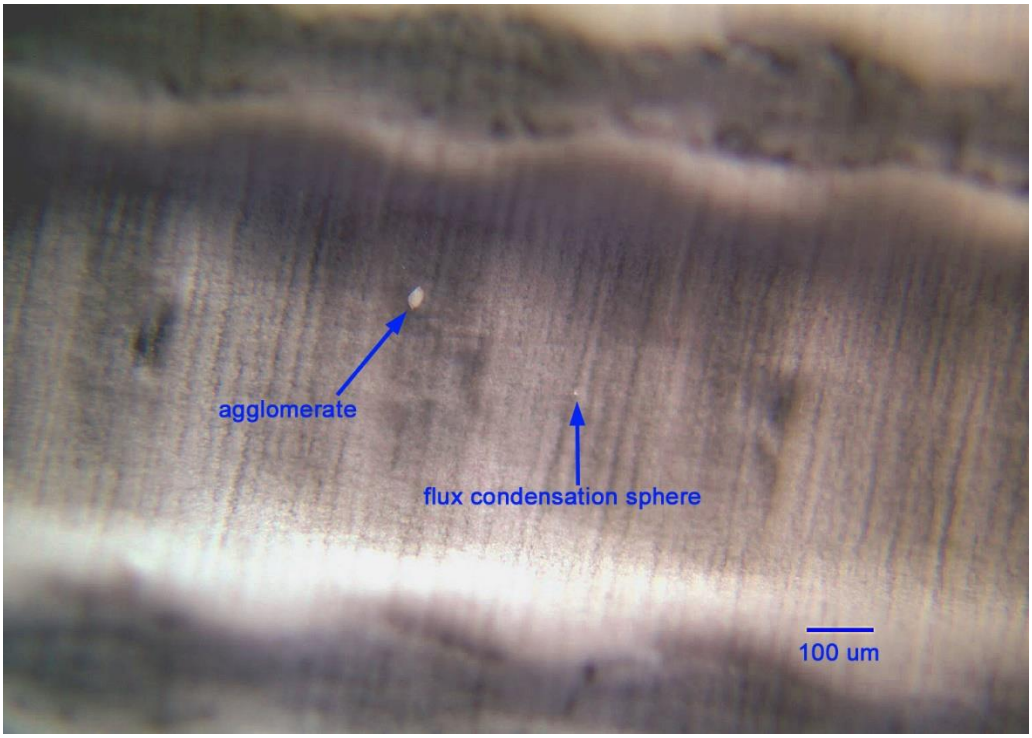


Figure 15: CFU112 Run 1 *particle assemblage.*

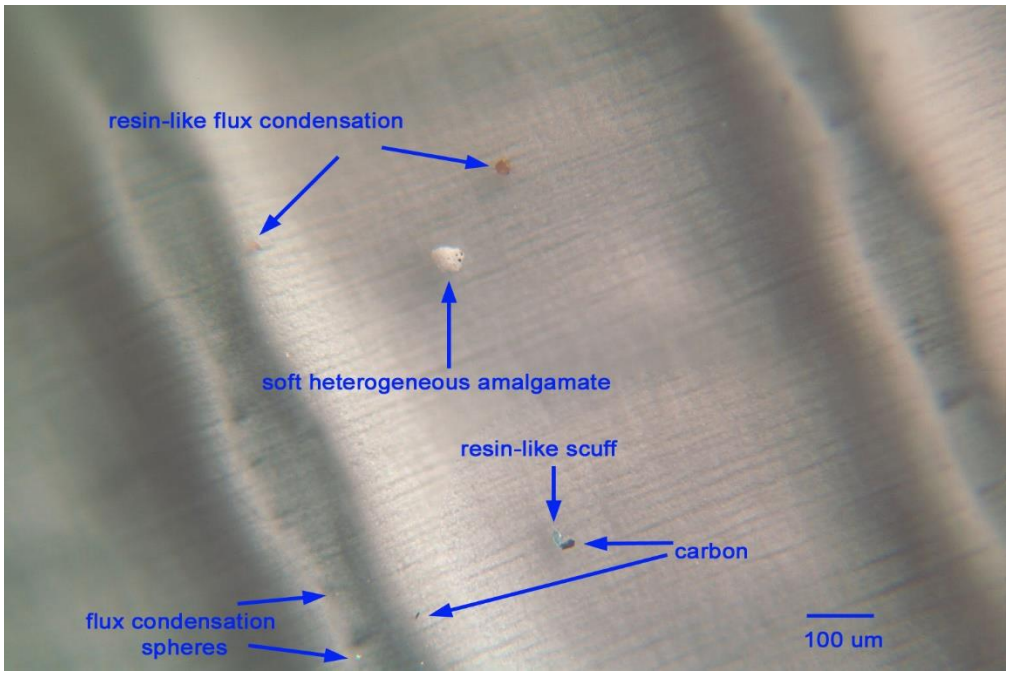


Figure 16: CFU112 Run 2 *particle assemblage.*

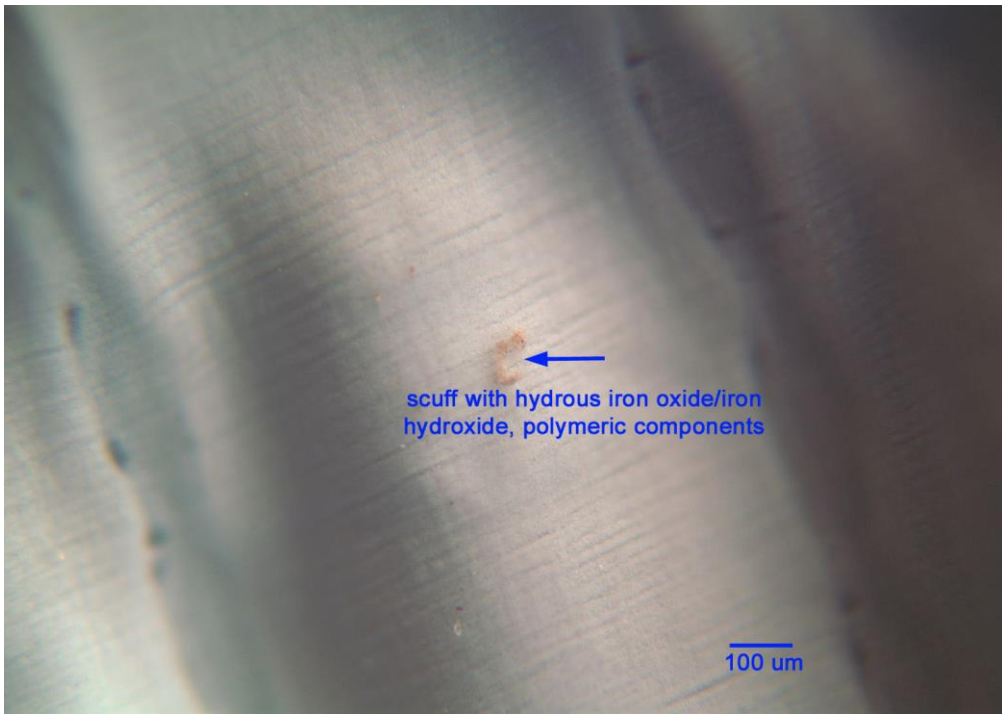


Figure 17: CFU112 Run 2 *particle assemblage.*

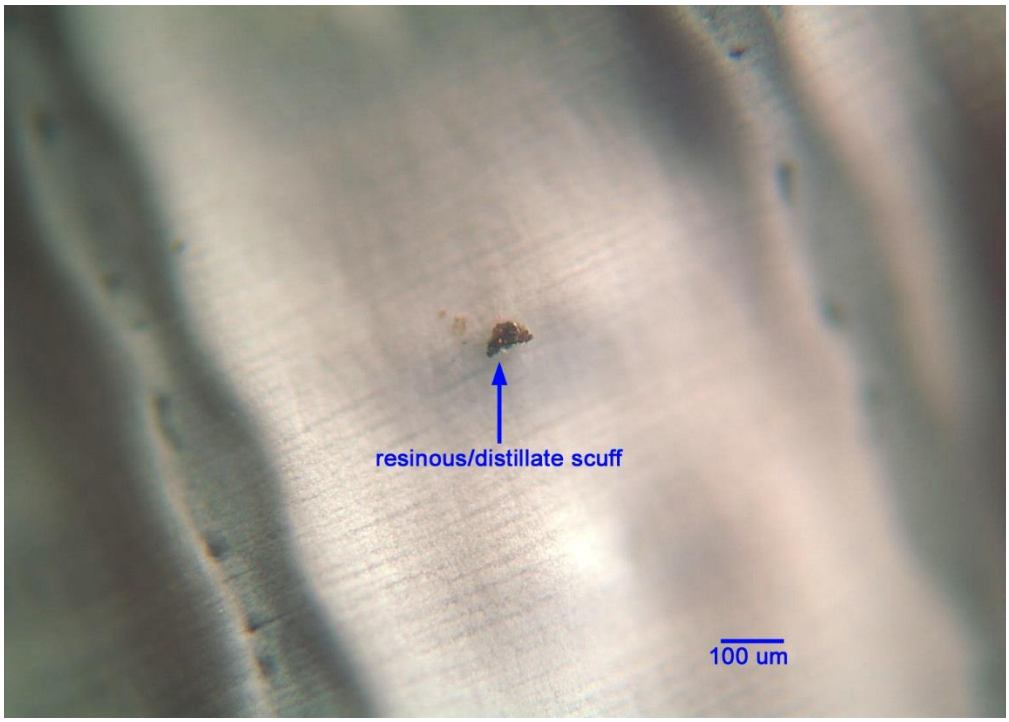


Figure 18: CFU112 Run 2 *particle assemblage.*

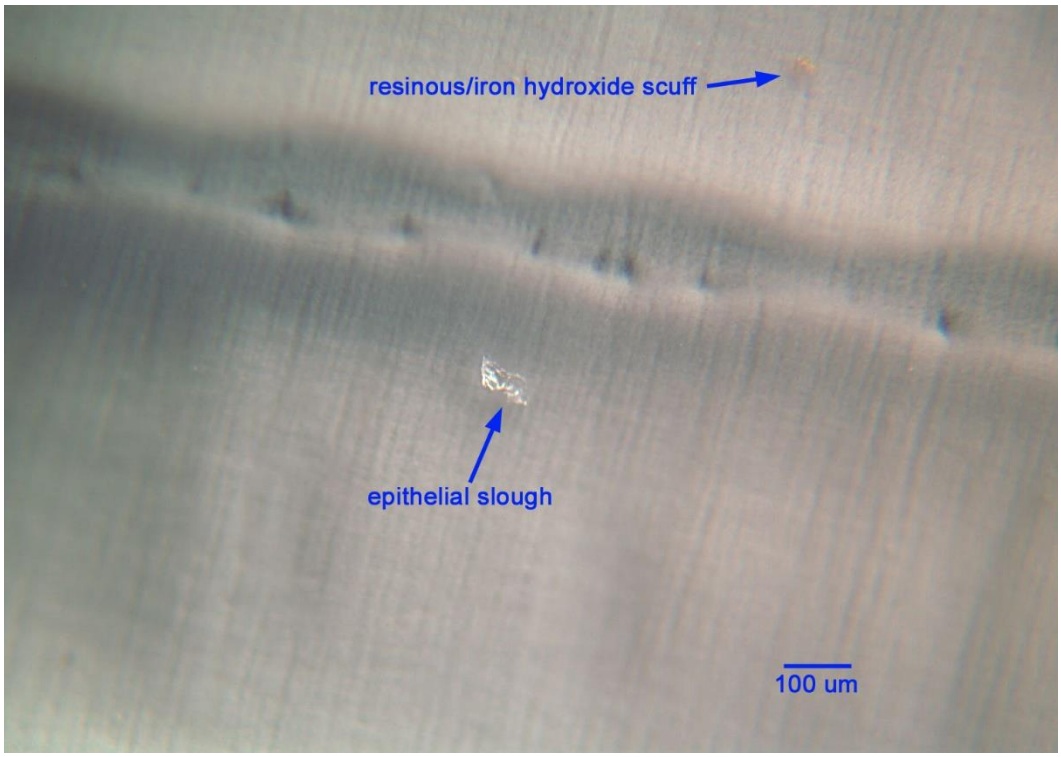


Figure 19: CFU112 Run 3 *particle assemblage.*

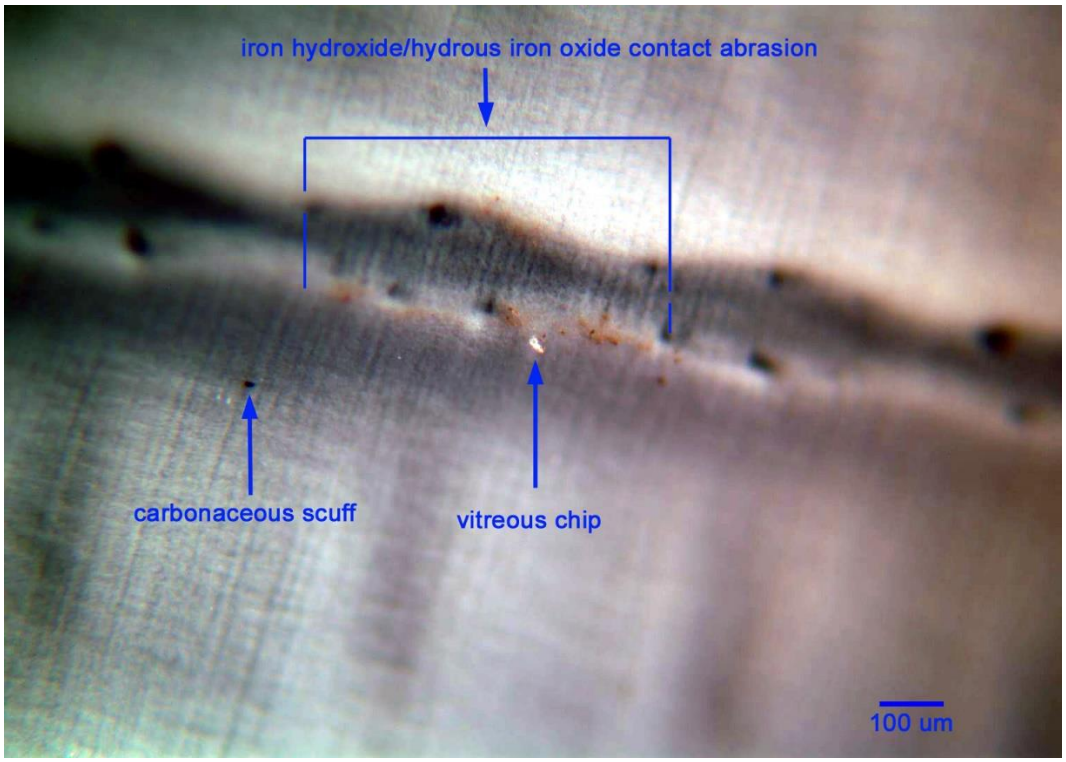


Figure 20: CFU112 Run 3 *particle assemblage. This iron hydroxide assemblage follows a rib along the membrane, thus may represent a sampling method artifact.*

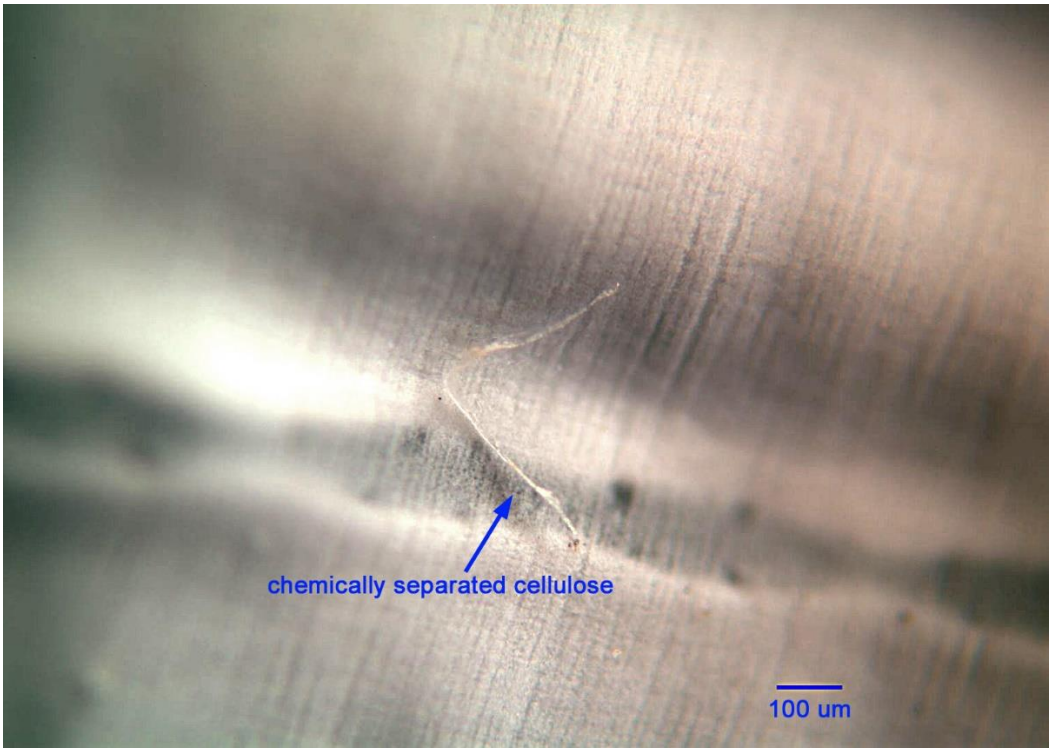


Figure 21: CFU112 Run 3 *particle assemblage.*

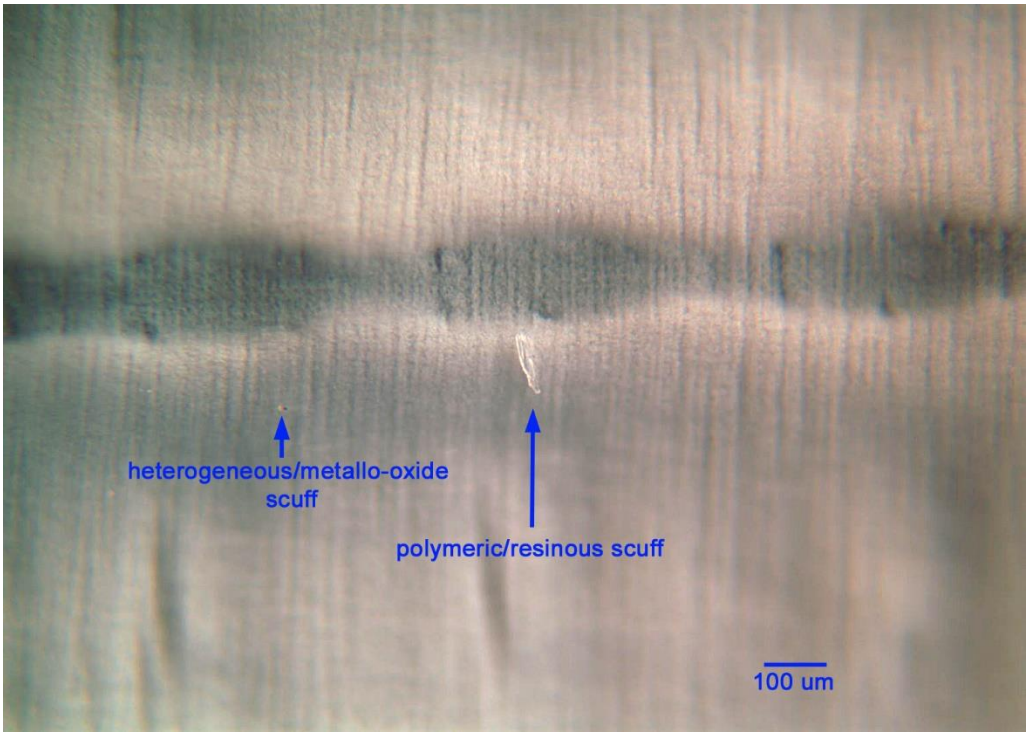


Figure 22: CFU108 Run 1 *particle assemblage.*

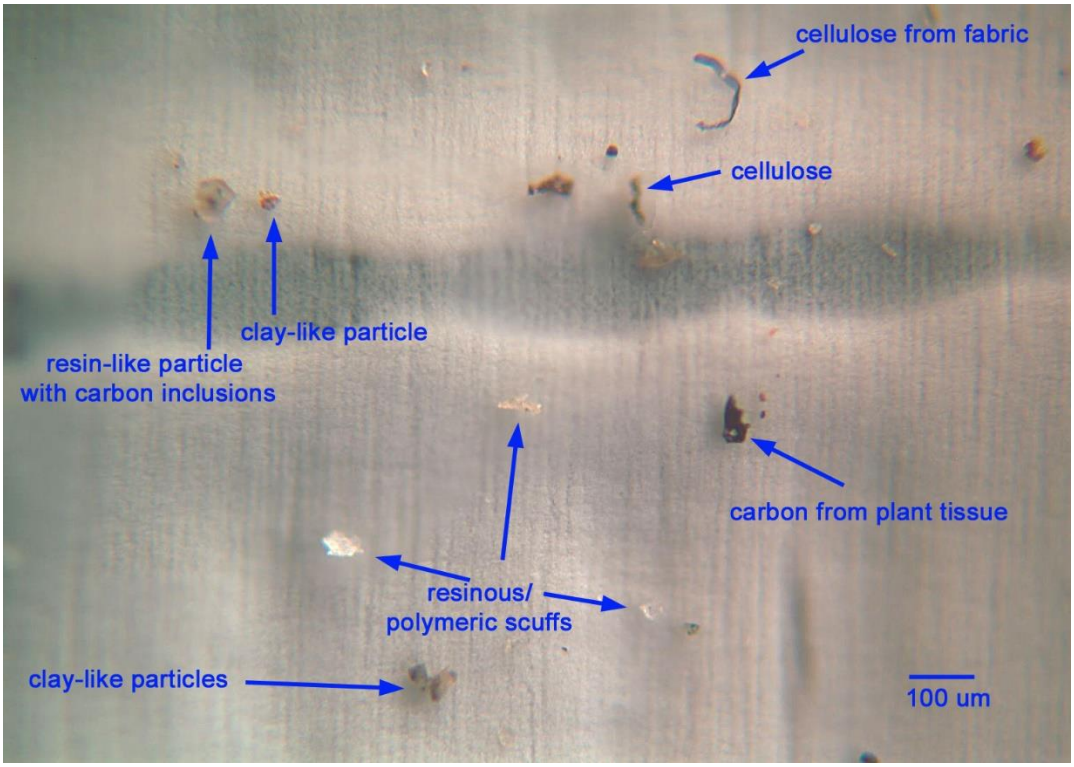


Figure 23: CFU108 Run 1 *debris field particle assemblage.*

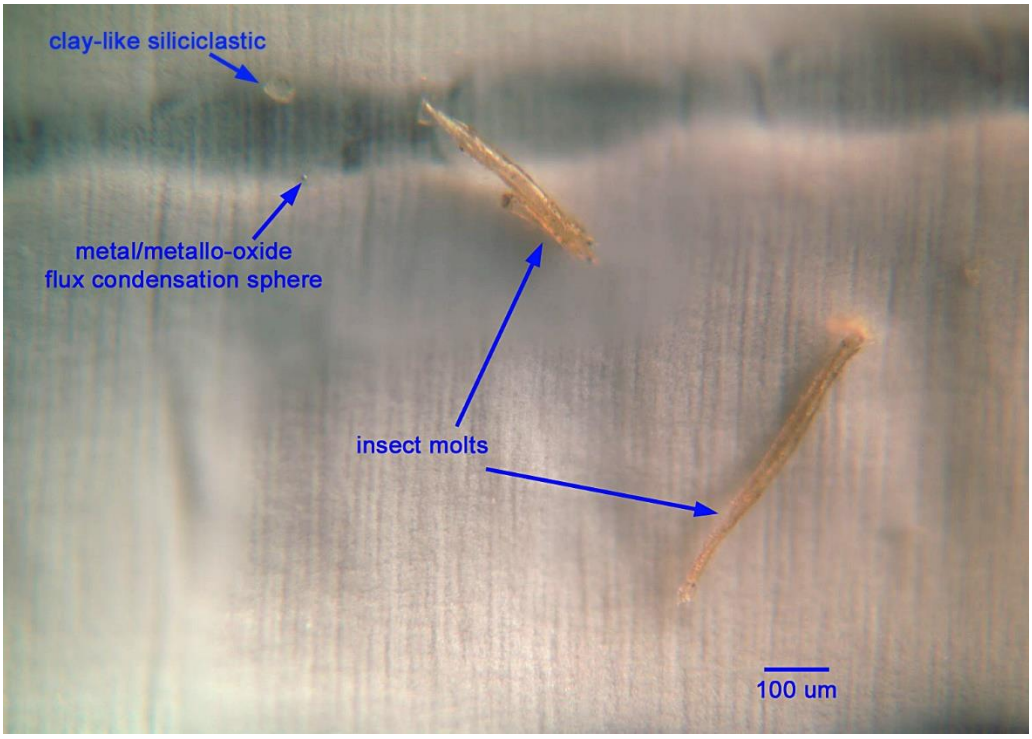


Figure 24: CFU108 Run 1 *debris field particle assemblage.*

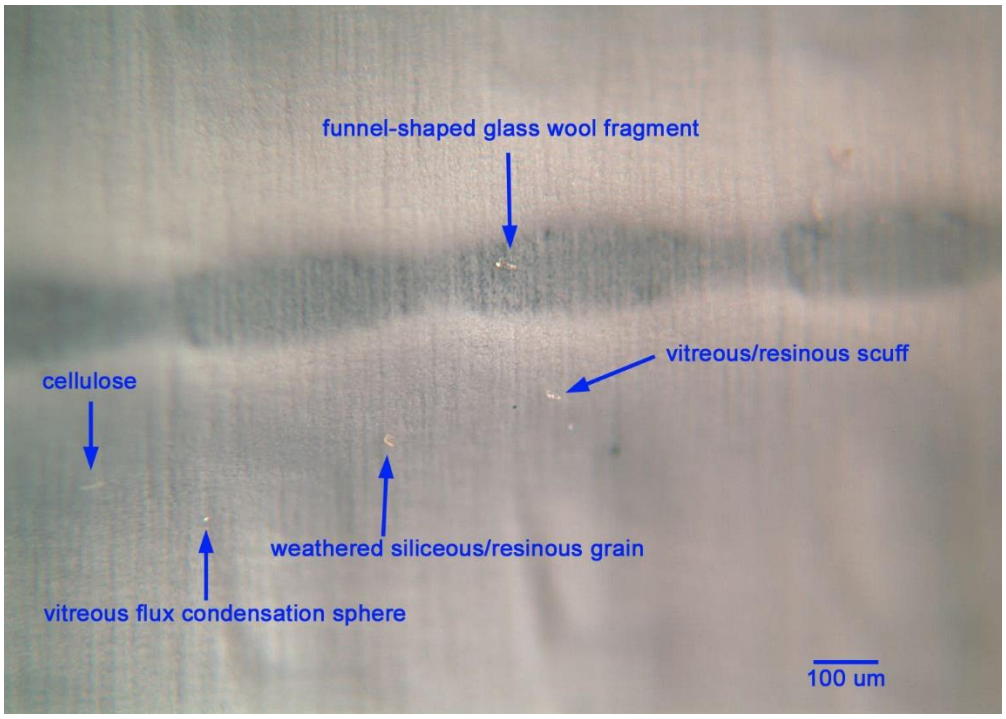


Figure 25: CFU108 Run 1 *particle assemblage.*

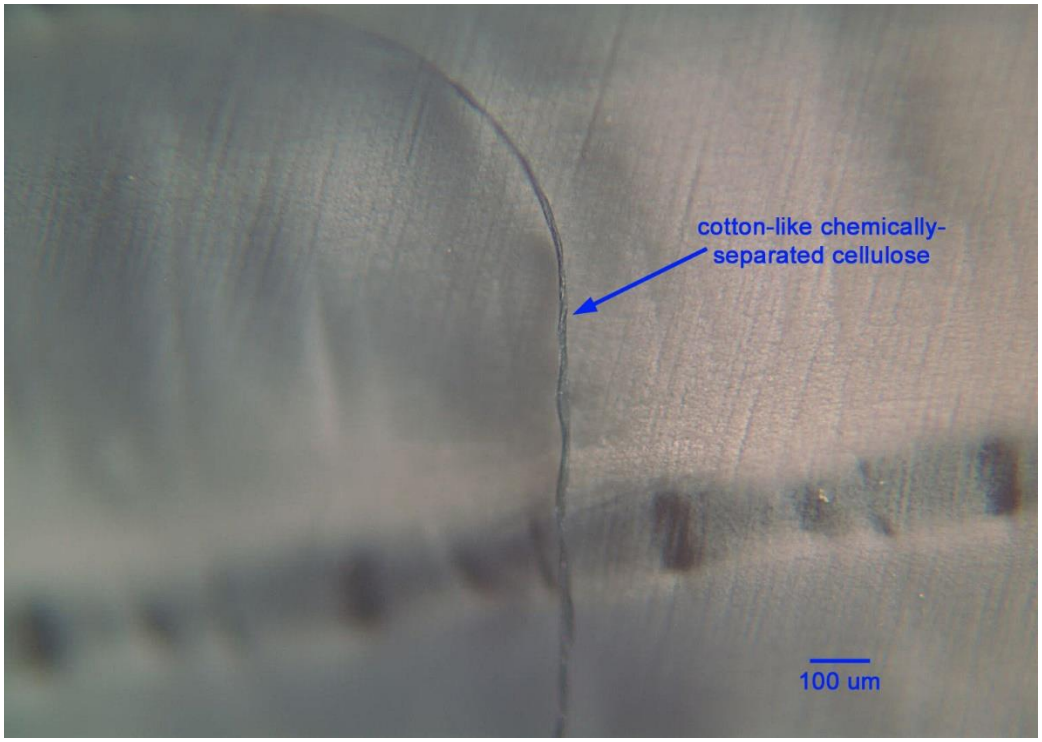


Figure 26: CFU108 Run 2 *fiber from fabric.*

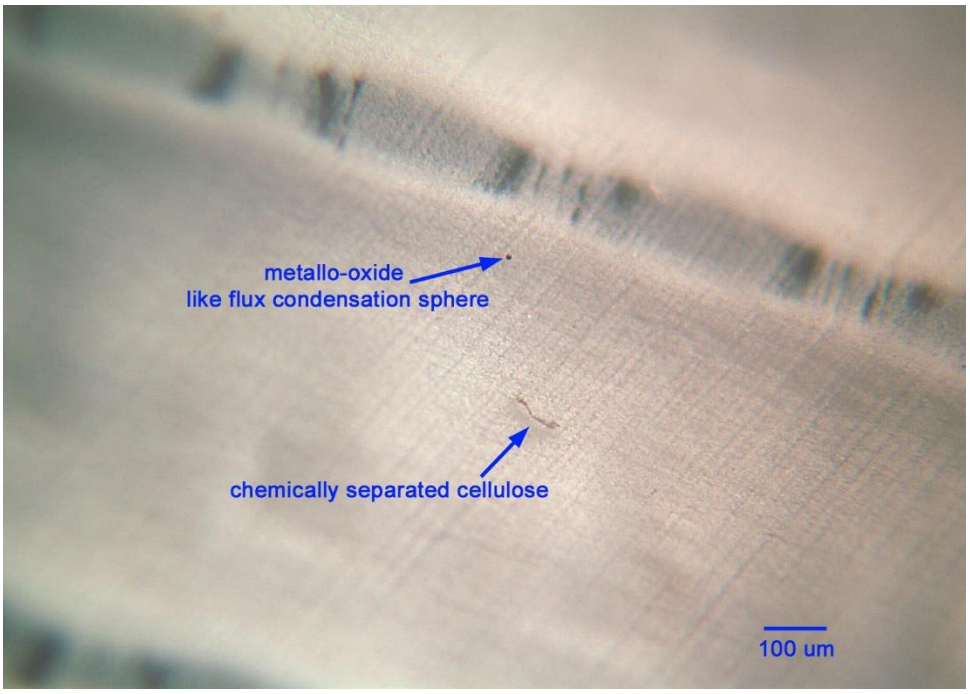


Figure 27: CFU108 Run 2 *particle assemblage.*

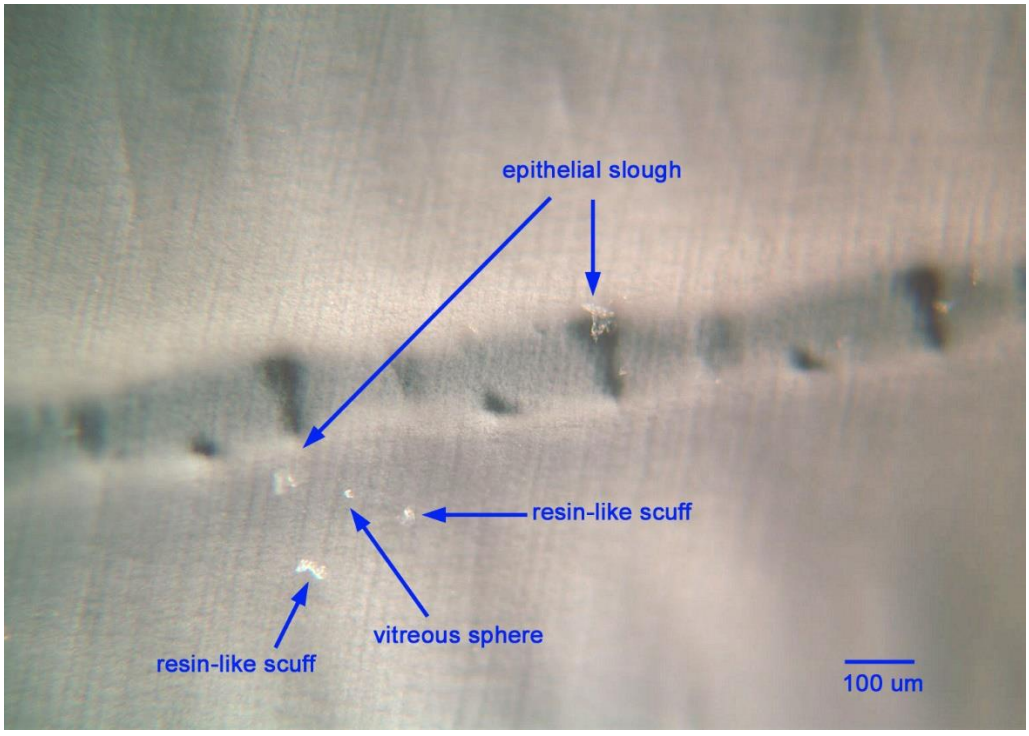


Figure 28: CFU108 Run 2 *particle assemblage.*

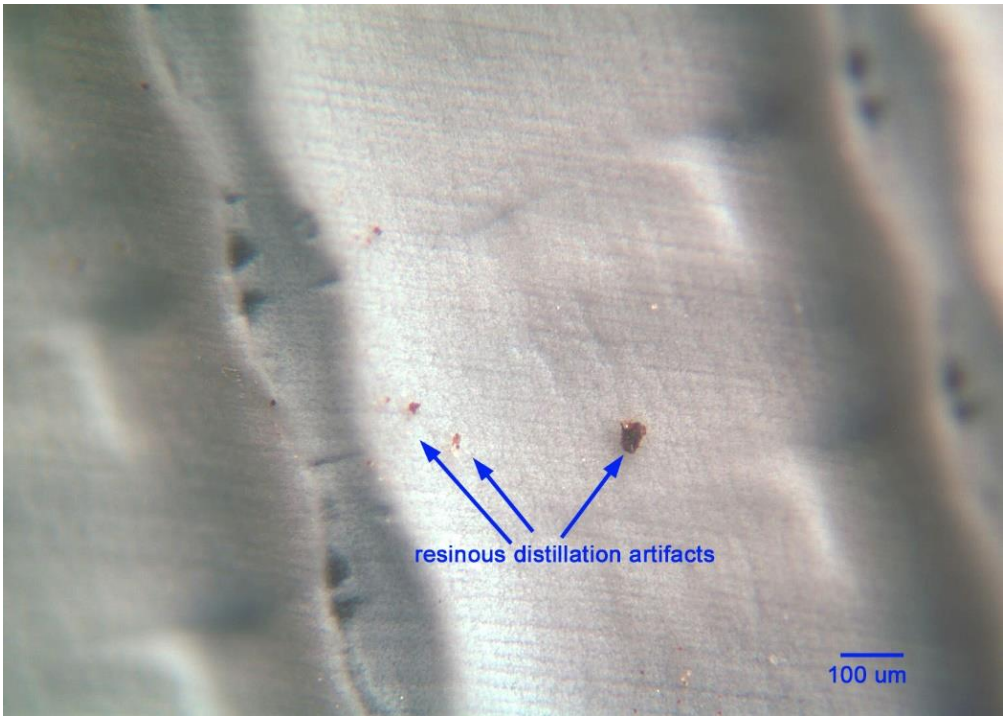


Figure 29: CFU108 Run 3 *particle assemblage. These distillation-like particles may possess iron oxide/hydroxide components.*

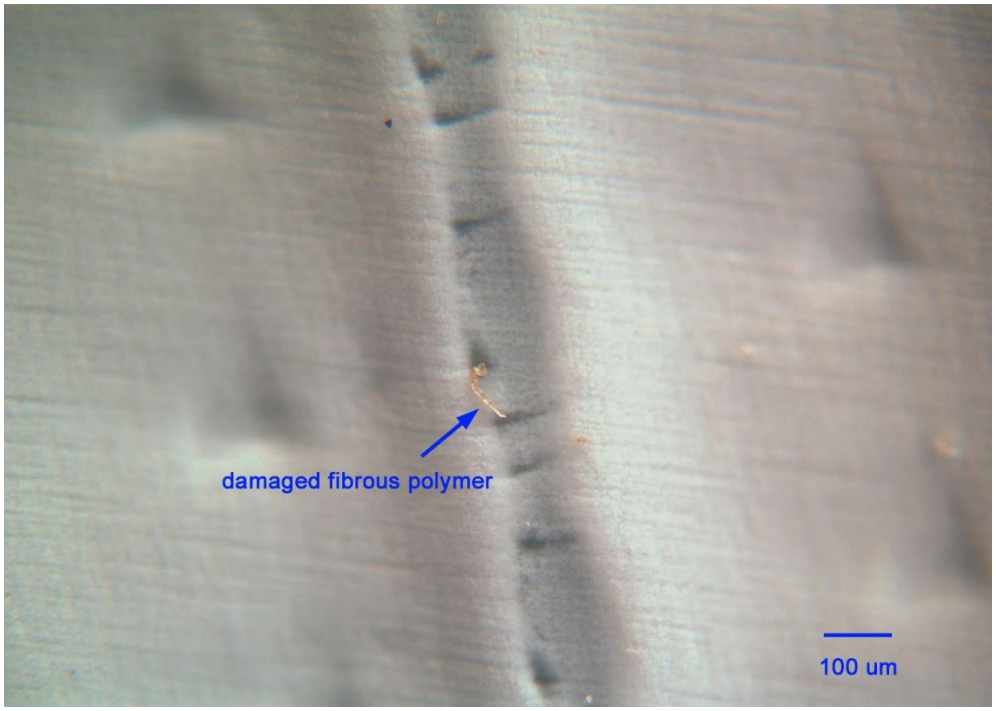


Figure 30: CFU108 Run 3 *fibrous particle.*

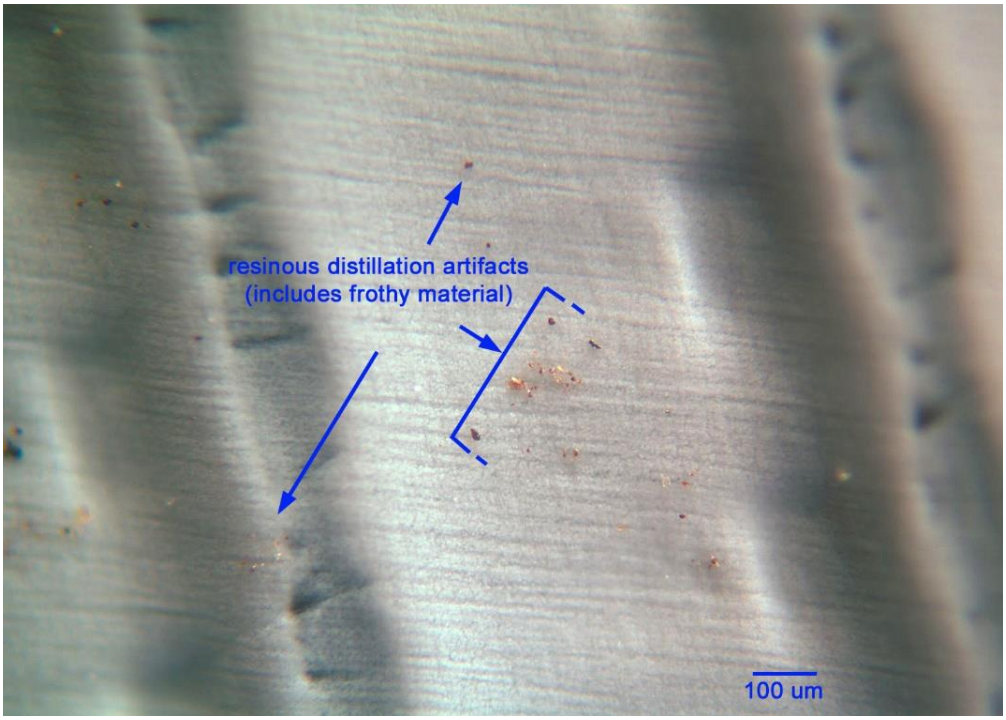


Figure 31: CFU108 Run 3 *particle assemblage. These distillation-like particles may also possess iron oxide/hydroxide components, and may represent corrosion blisters.*

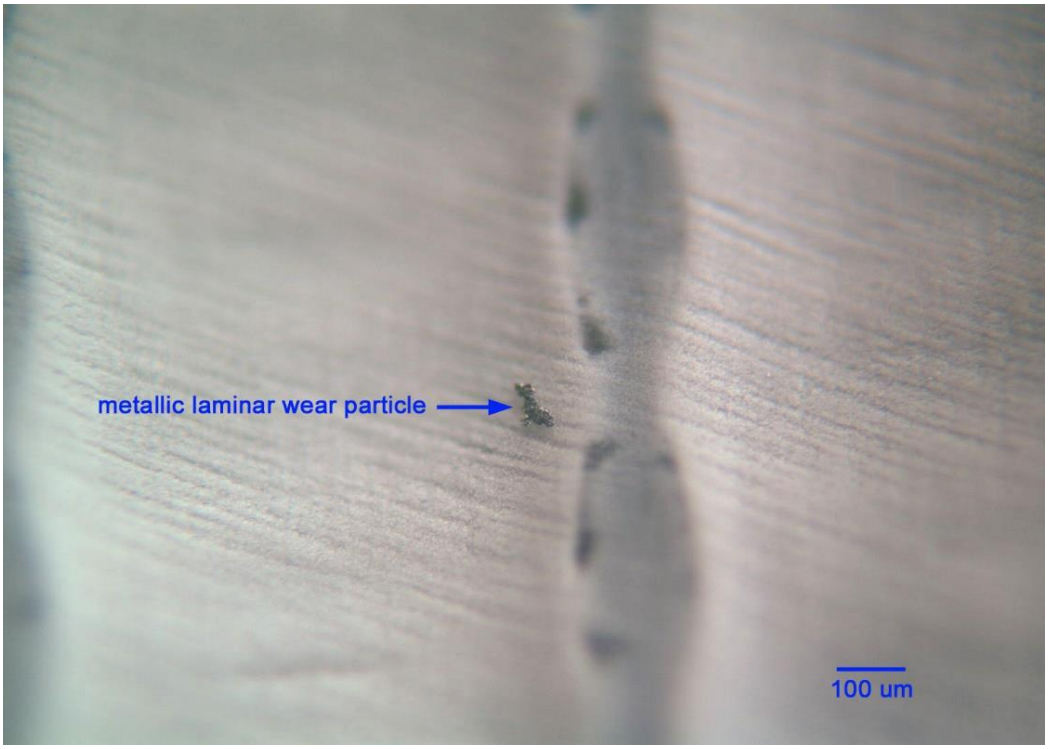


Figure 32: CFU118 Run 1 *metallic wear particle.*

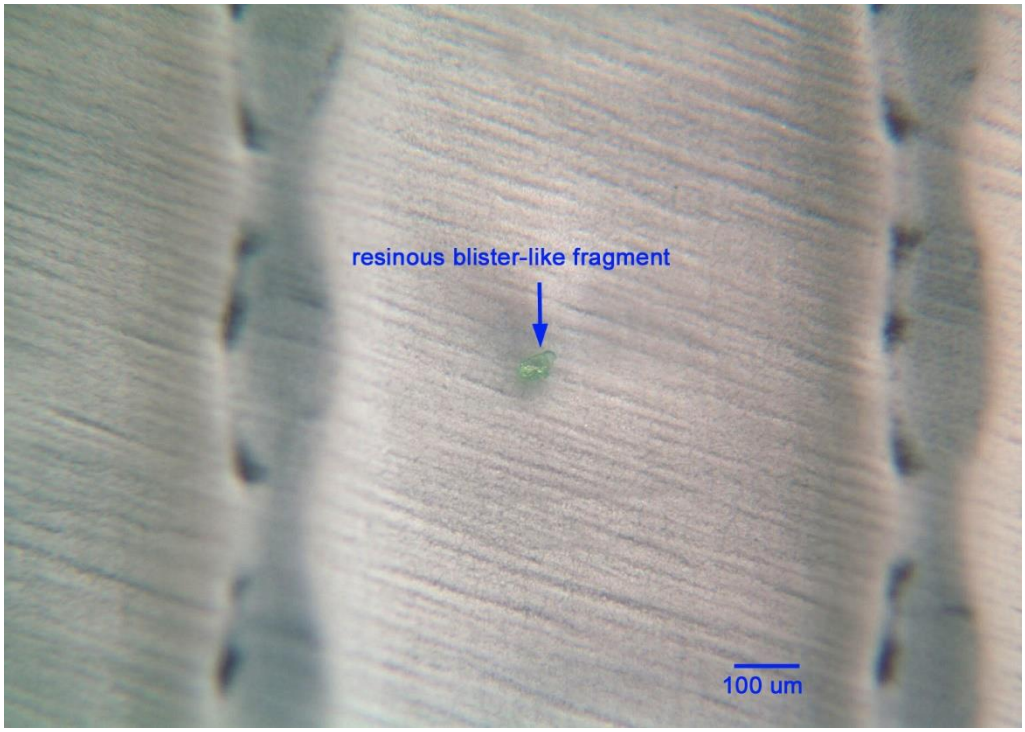


Figure 33: CFU118 Run 1 *resinous particle.*

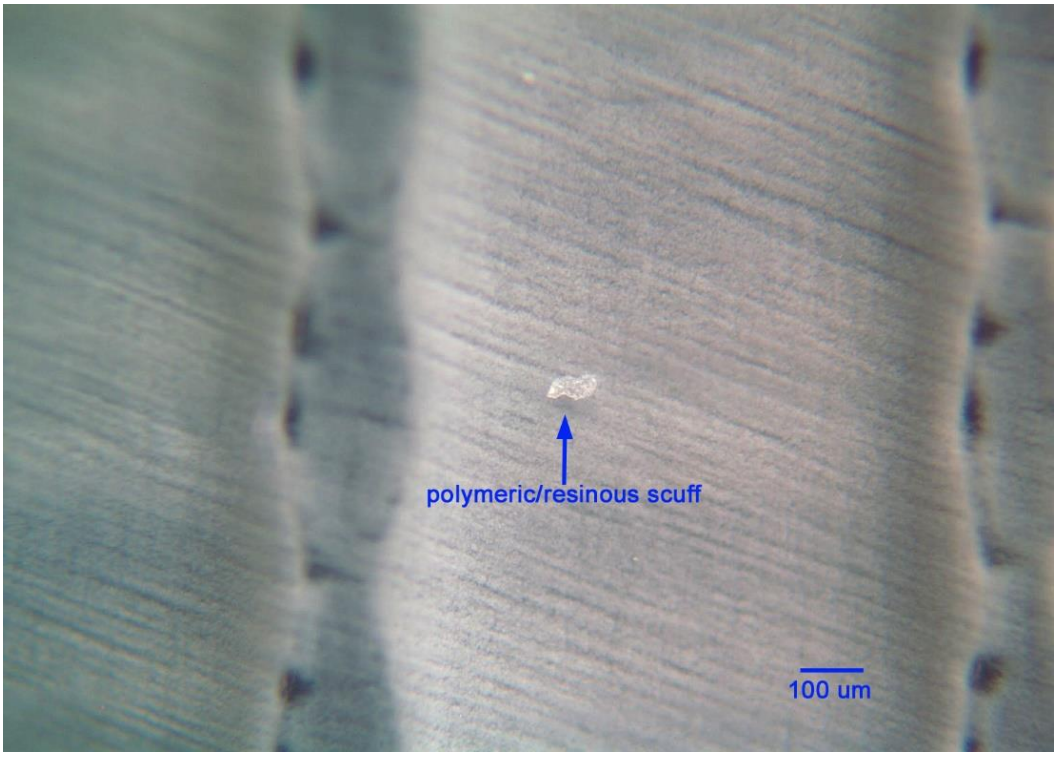


Figure 34: CFU118 Run 1 *scuffing particle.*

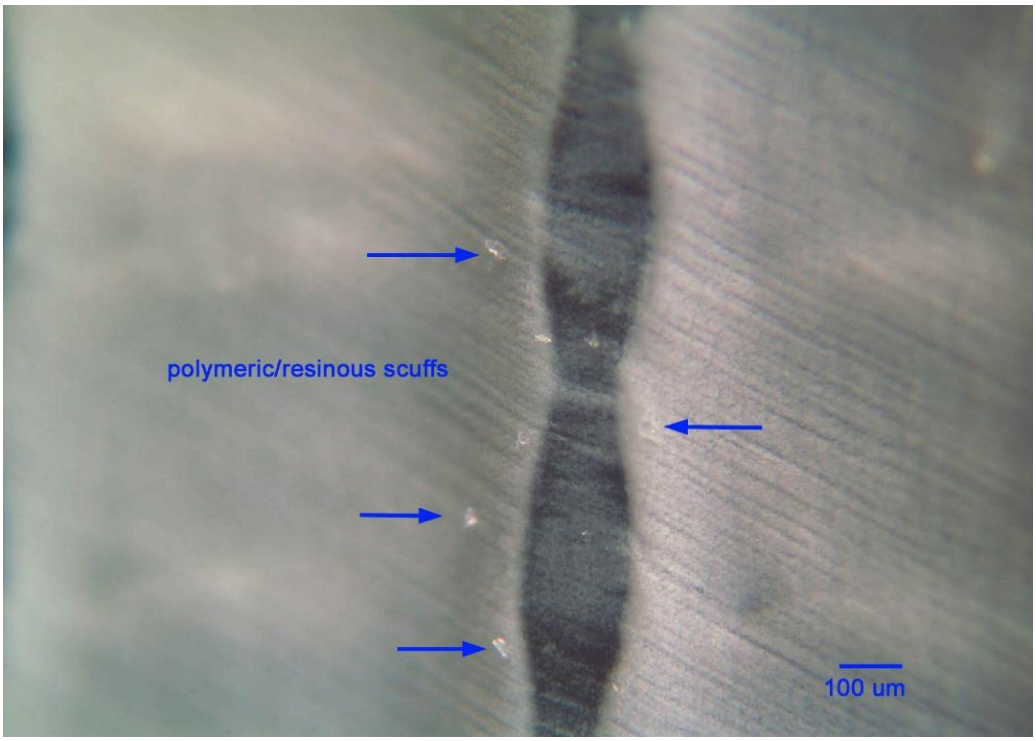


Figure 35: CFU118 Run 1 *particle assemblage.*

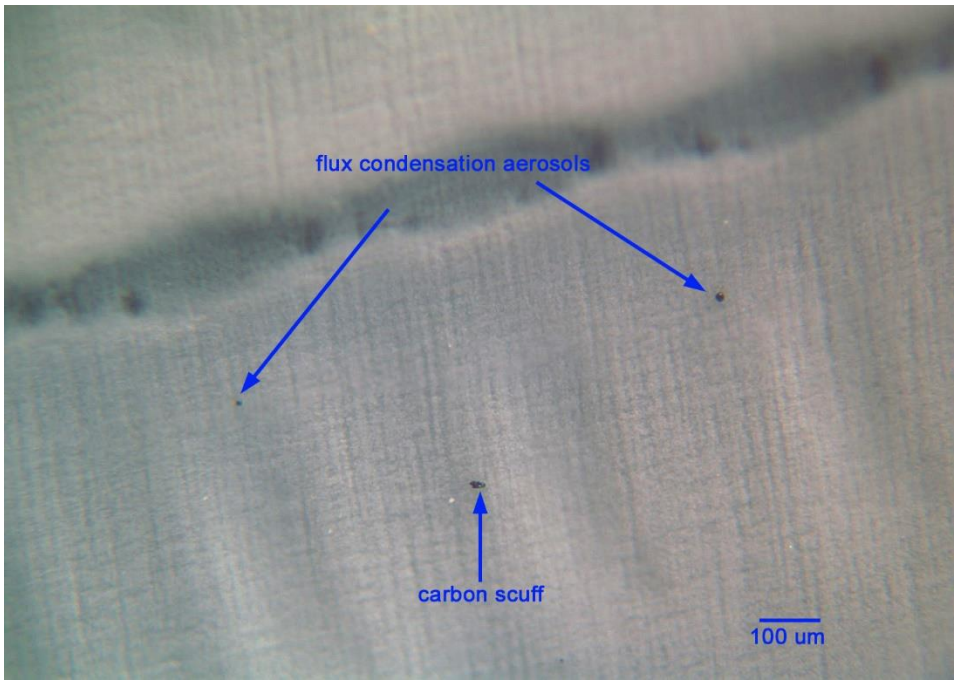


Figure 36: CFU118 Run 2 *particle assemblage.*

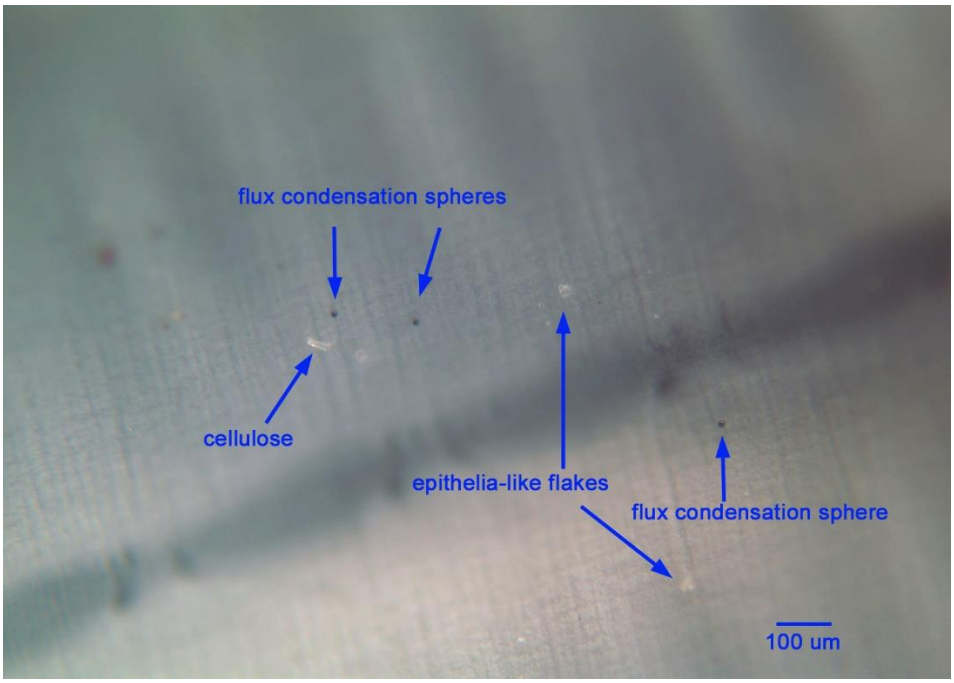


Figure 37: CFU118 Run 2 *particle assemblage.*

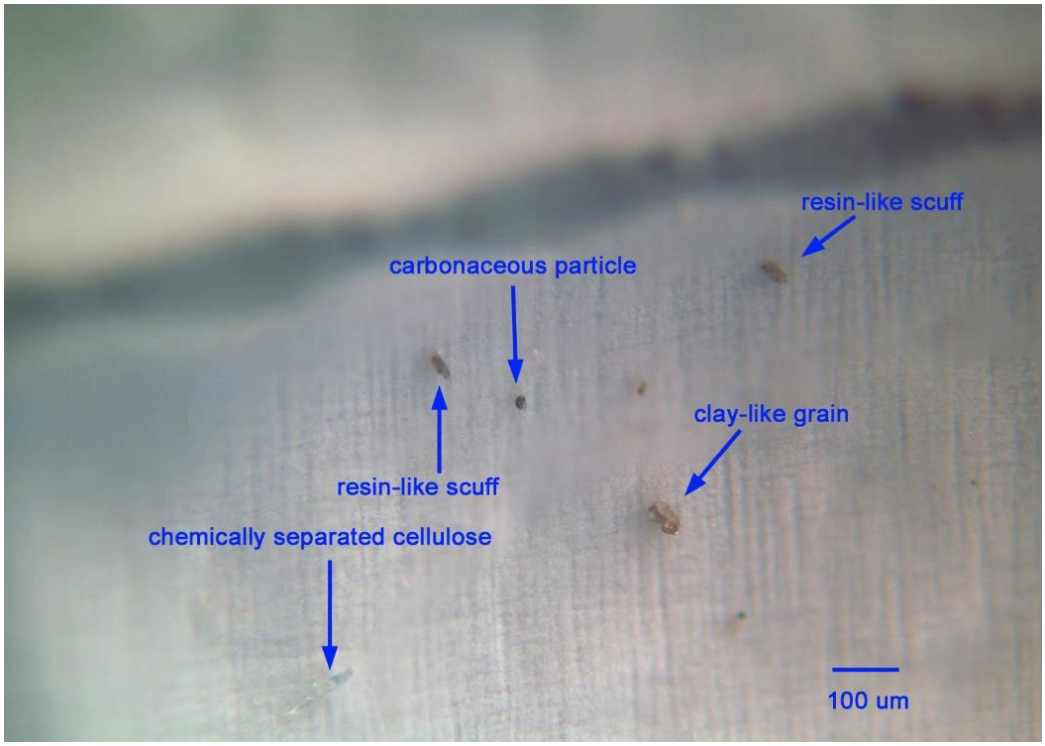


Figure 38: CFU118 Run 3 *particle assemblage.*

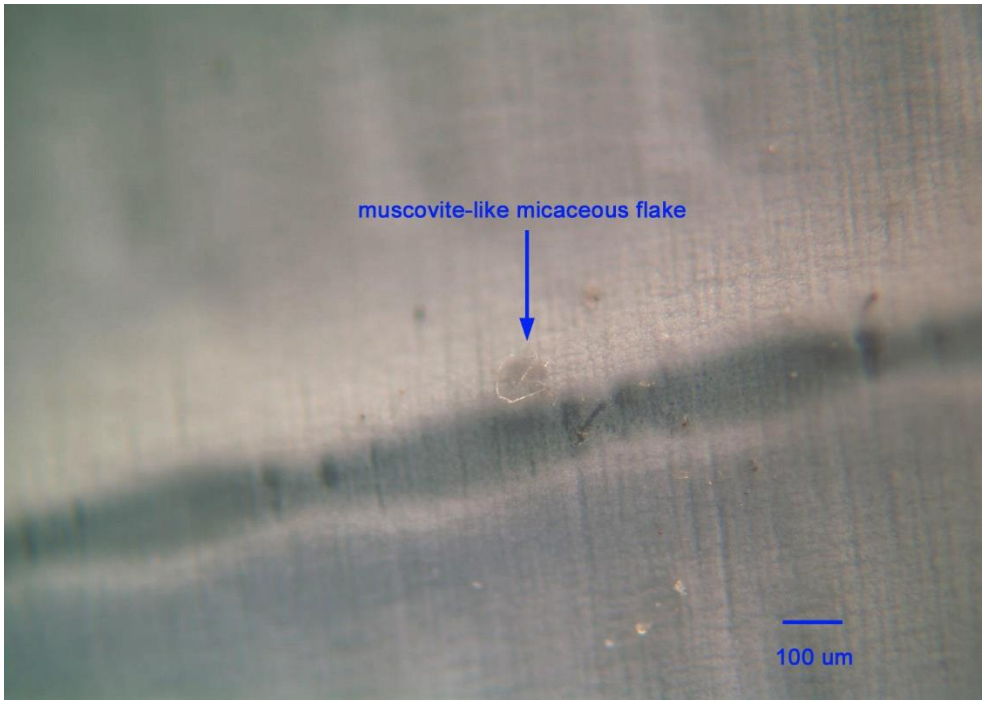


Figure 39: CFU118 Run 3 *particle assemblage.*

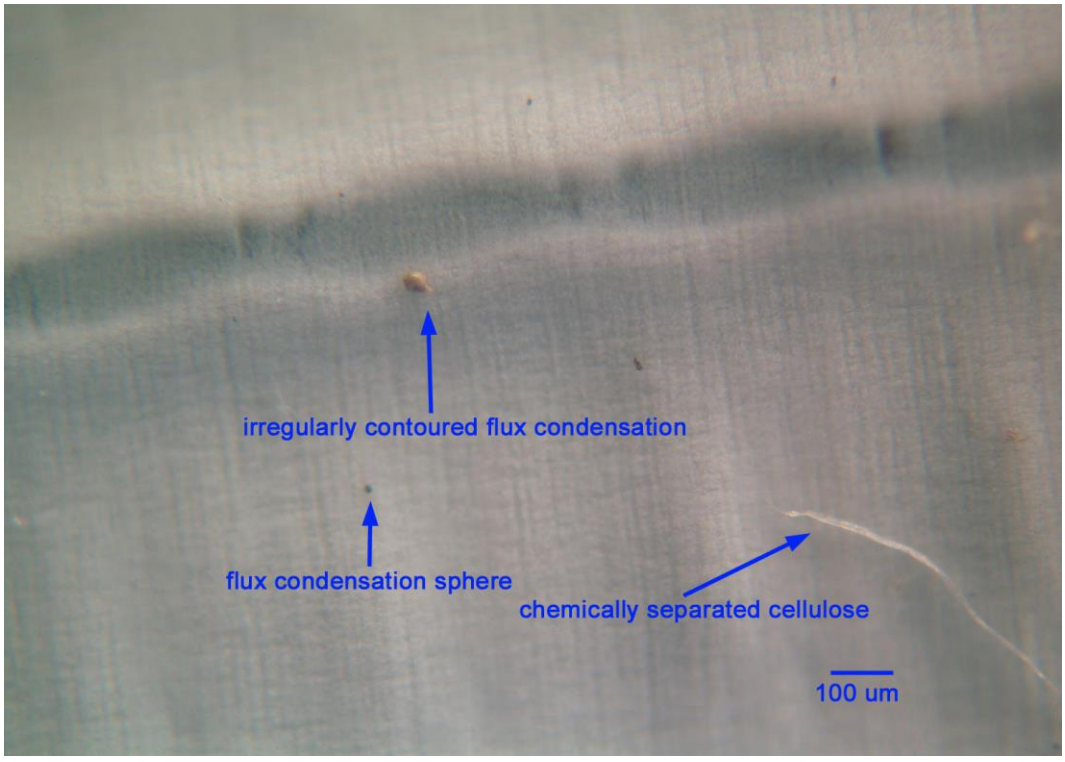


Figure 40: CFU118 Run 3 *particle assemblage.*

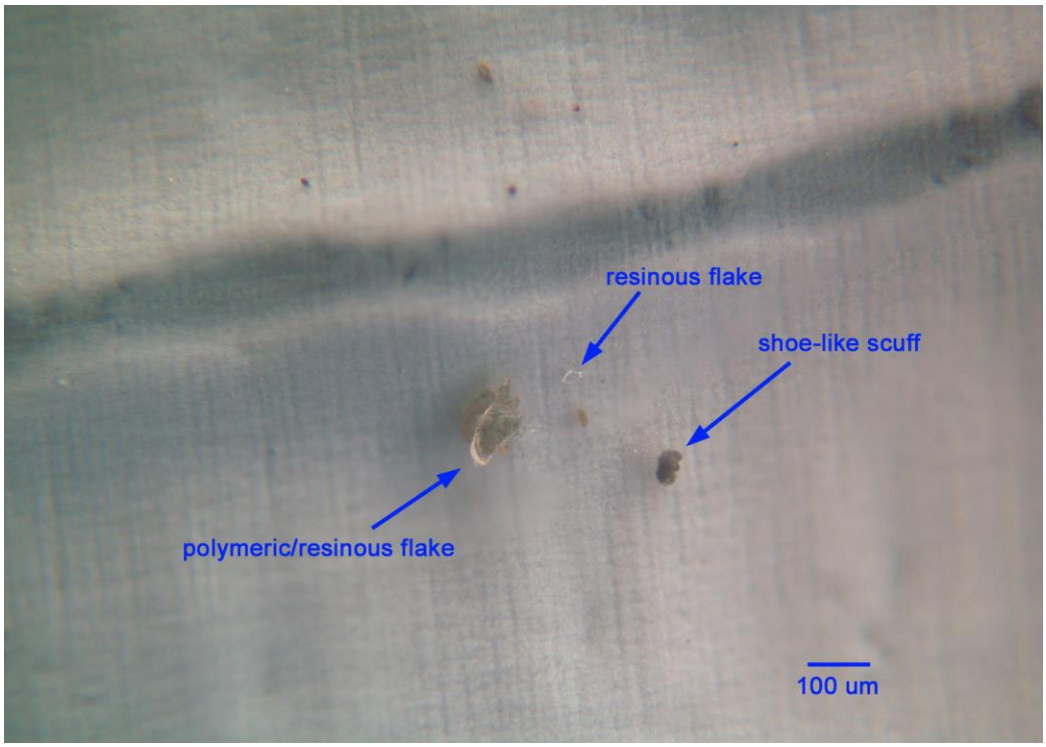


Figure 41: CFU118 Run 3 *particle assemblage.*

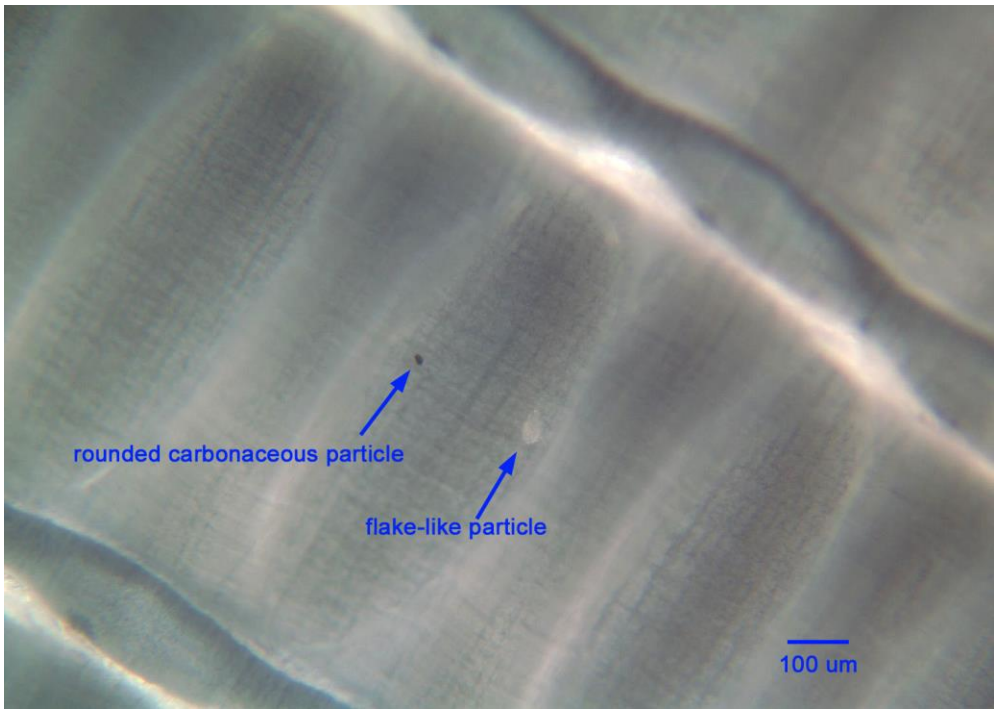


Figure 42: CFU115 Run 1 *particle assemblage. This membrane was positioned upside down during sampling. Particles were rare on this membrane, regardless.*

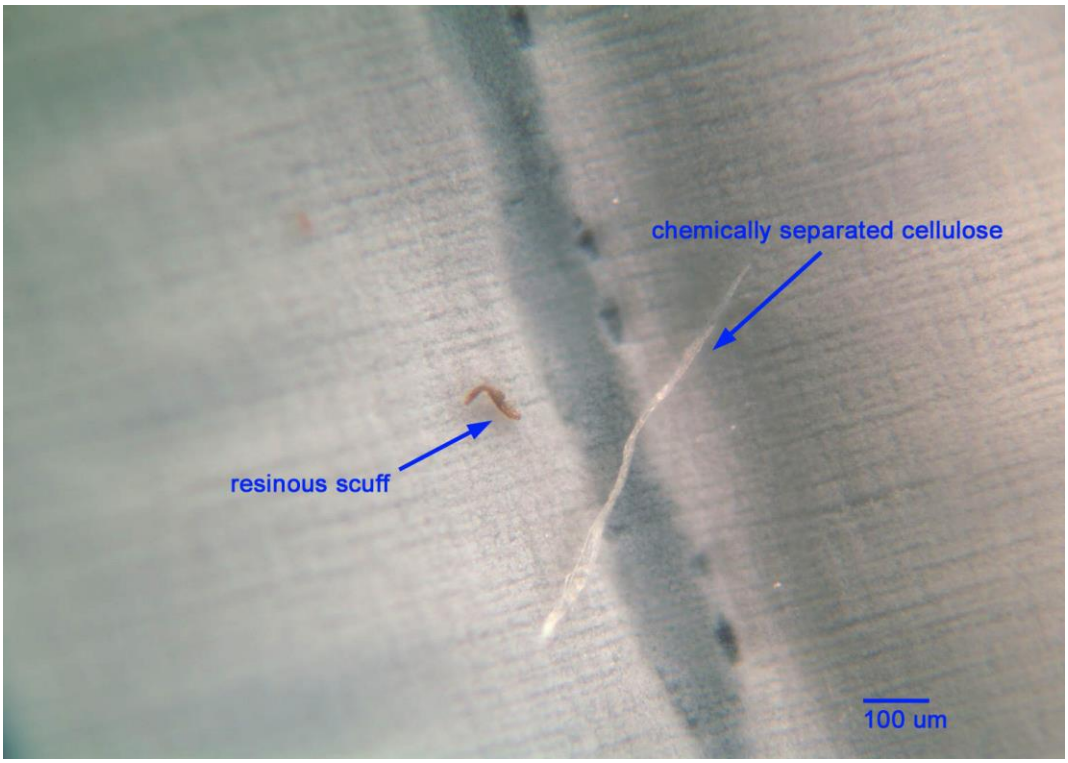


Figure 43: CFU115 Run 2 *particle assemblage.*

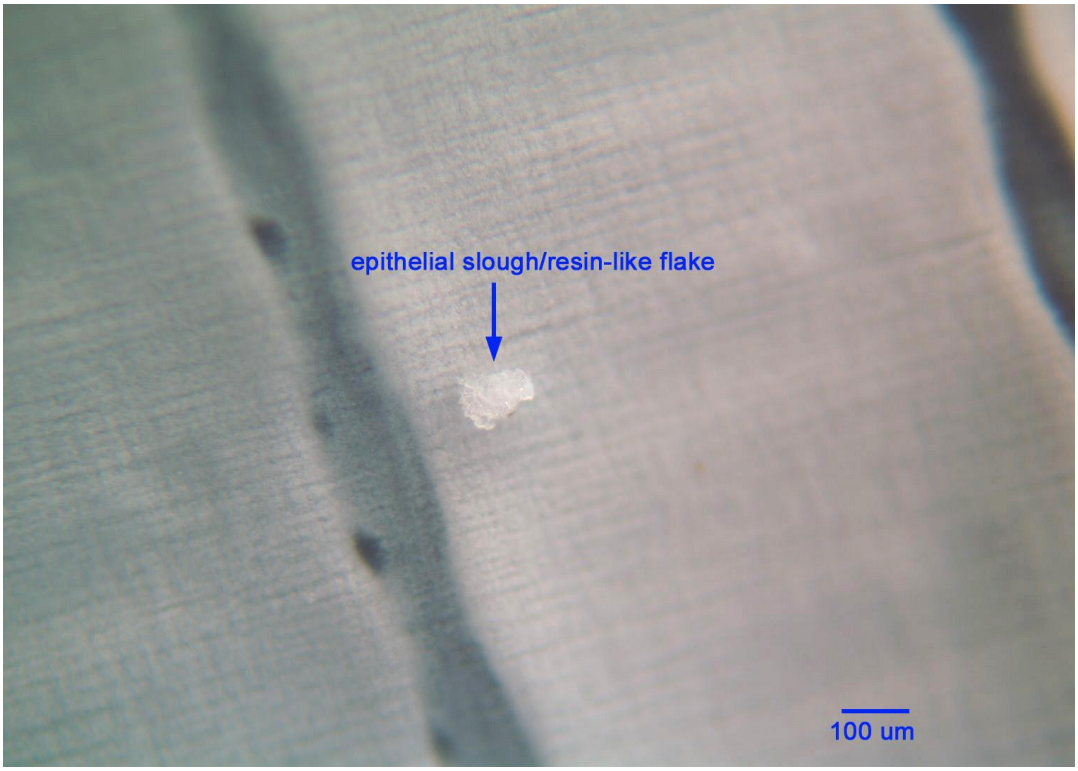


Figure 44: CFU115 Run 2 *slough-like/resinous particle.*

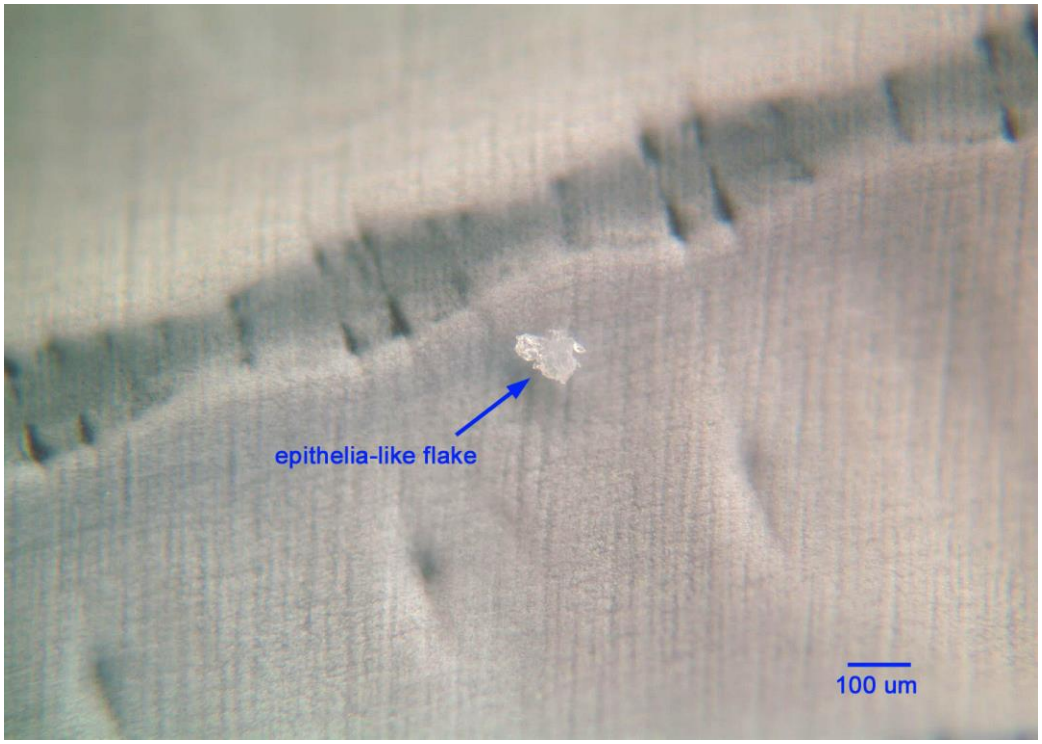


Figure 45: CFU115 Run 3 *slough-like particle.*

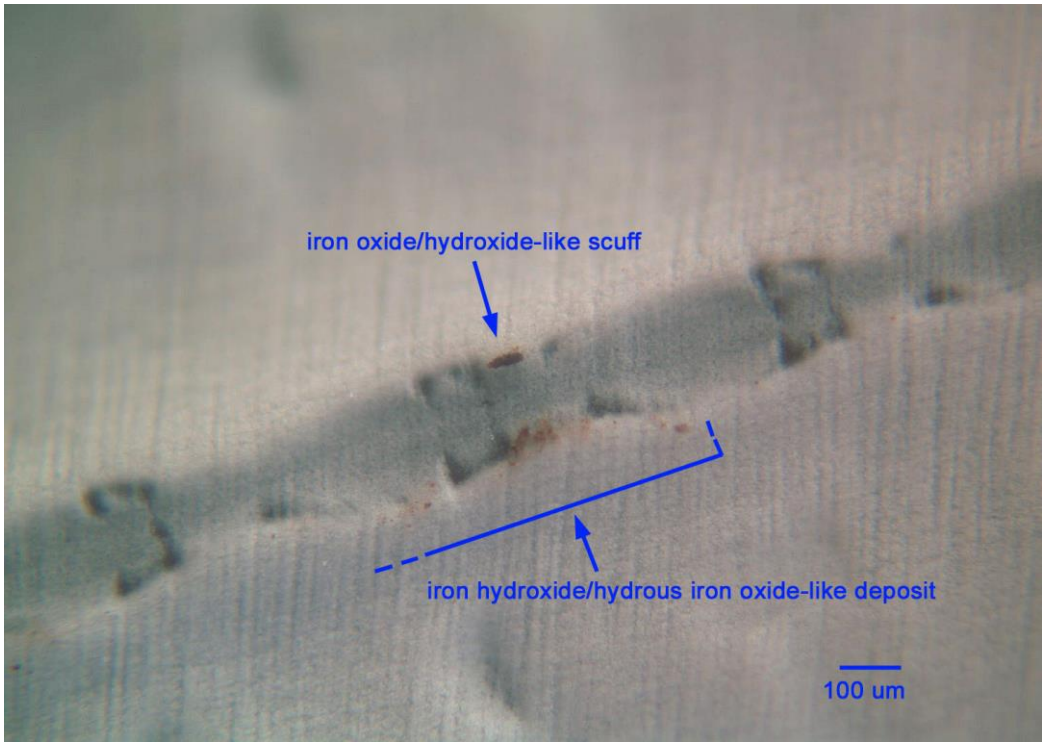


Figure 46: CFU115 Run 3 *iron hydroxide-like particle deposit, also adhering to a rib along the membrane, and again may represent a sampling method artifact.*