EMISSIONS TEST PROTOCOL

HOLLINGSWORTH & VOSE FIBERGLASS MANUFACTURING PLANT

EMISSION FACTOR VERIFICATION TESTING ON CFU'S AND MATERIALS HANDLING AREA VERIFICATION OF PERMANENT TOTAL ENCLOSURE

Oregon Department of Environmental Quality
Air Contaminant Discharge Permit: 02-2173-ST-01

Prepared for:

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Project Number: HAV222965
Protocol Prepared: November 13, 2022

STAC STACK TESTING ACCREDITATION COUNCIL
ACCREDITED TO ASTM D7036 ONLY CERT #4675.01
BISON ENGINEERING, INC.

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PLANT REPRESENTATIVE ENDORSEMENT

I have reviewed the information being submitted in its entirety and, based on information and belief formed after reasonable inquiry, I certify that the statements and information contained in this submittal are true, accurate, and complete.

Plant Official: Anita Ragan

Title: EHS Manager

Signature: 

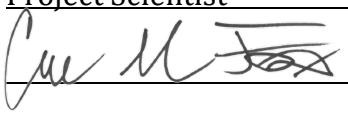
Date: 11/13/22

PROTOCOL ENDORSEMENT

Bison Engineering, Inc. certifies that emissions testing will be conducted as described in this protocol. Every effort will be made to obtain reliable, repeatable, and representative data using approved test methods and following procedures listed in Bison Engineering, Inc.'s quality manual and American Society for Testing and Materials (ASTM) D7036-04.

Project Manager: Conor Fox, QI

Title: Project Scientist

Signature: 

Date: 11/13/2022

1.0 INTRODUCTION

Hollingsworth & Vose Fiber Company (H&V) has contracted Bison Engineering, Inc. (Bison) to perform emission tests for emission factor verification testing on ceramic filter units (CFU) 108, 112, 113, 115, and 118 and permanent total enclosure (PTE) verification on the raw materials handling area at the H&V facility in Corvallis, OR. Testing will be conducted to determine speciated organic compounds. This facility is subject to the provisions of Oregon Department of Environmental Quality (ODEQ) permit number 02-2173-ST-01. All testing will be performed in accordance with the Environmental Protection Agency (EPA) testing methodology in Title 40 Code of Federal Regulations, Part 60 (40 CFR 60) Appendix A as outlined in this protocol. Testing will also be performed in accordance with the ODEQ Source Sampling Manual. Table 1 presents applicable emission factor units.

Table 1 H&V CFUS Emission Factor Units

Source	Pollutant	Units
Rotary Fine [GP 2, CFU 118] Rotary Corse [GP 1, CFU 108] Ultra-Rotary Coarse [GP 1, CFU 112] Glass Furnace [GP1, CFU 113] Flameblown [GP 2, CFU 115]	Speciated Organic Toxic Air Contaminants (TAC)	ppbv
		ppmv
		lb/hr
		lb/ton-glass

GP- glass plant
CFU – ceramic filtration unit
ppbv – parts per billion by volume
ppmv – parts per million by volume
lb/hr – pounds per hour
lb/ton-glass – pounds per ton glass produced

2.0 KEY PERSONNEL AND CONTACT INFORMATION

The H&V emission verification and PTE verification will be performed by Bison's Helena, Montana-based source testing team. Conor Fox, Qualified Individual (QI), Environmental Scientist, will serve as project manager, facilitate communications and will lead on-site testing. One additional member of the source team will assist Mr. Fox on-site. Mr. Fox will process the test data and draft the test report. A member of Bison's quality management team will perform a final quality assurance review of all test data and the report. Mr. Fox will perform the project manager's review and submit the final report.

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Contact:	Suzanne Blackburn
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Contract Laboratory:	**ALS Environmental**
Address:	960 Levoy Dr. Salt Lake City, UT 84123
Contact:	Paul Pope
Phone:	(801) 266-7700
Website:	www.alsglobal.com

3.0 SUMMARY OF TEST PROGRAM

3.1 Facility Description

H&V operates a glass fiber manufacturing facility located in Corvallis, Oregon. The glass plants generally operate 24 hours per day throughout the year.

3.2 Process Information

The first stage of manufacturing the glass fiber produced by H&V is achieved by melting solid raw materials in an electrically heated melting furnace. The molten glass is then delivered via 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 fiberizers are classified as rotary fine, rotary coarse, rotary ultra-coarse, or flameblown. The following is a description of the manufacturing processes specific to glass melting and fiberizing.

3.2.1 Glass Melt Furnaces

There are two electrically-heated glass melt furnaces (Line 1 and Line 2) that vent to a common control device and emission point. Inside the furnaces, fresh processed material of a specific recipe is added to the surface of the molten glass already present, thereby ensuring a continuous homogeneous mixture. All glass melting furnaces are electrically heated. Gaseous emissions resulting from the melting of the bulk materials in the two furnaces at GP1 are vented to ceramic filtration unit 113.

3.2.2 Forehearths

Each glass melting furnace is serviced by a forehearth that receives molten glass at high temperatures and delivers it to the fiberizers. The forehearths, unlike the glass melting furnaces, are heated by natural gas combustion. Natural gas combustion emissions from each forehearth are captured by suspended rectangular hoods and conveyed through ductwork to vent with the furnace emissions.

The forehearths can also deliver molten glass to a glass patty former or to a station that produces glass cullet. Glass patties and cullet are glass that has hardened but can be liquefied later in a remelt unit upstream of a fiberizer when needed. No furnaces are located in the GP2 building, and there are no forehearths in that building. All fiberizers in GP2 are fed by remelt units that use cullet or glass patties.

3.2.3 Fiberizers (Rotary and Flameblown)

Rotary fiberizers receive molten glass from the forehearths (in Glass Plant 1 - GP1) or electric remelt units (in GP1 and Glass Plant 2 - GP2). The molten glass is fed to a rotary spinner disk which utilizes centrifugal forces to force the molten glass to flow outward through small holes in the rotary fiberizers. Flame attenuation results in thin glass fibers. The newly formed glass fibers are pneumatically conveyed to collection drums (in GP1 and GP2) or a former (in GP1) for capture and packaging.

H&V also utilizes four flameblown fiberizers. Flameblown fiberizers receive molten glass from electric remelt units in GP2. Molten glass flows by gravity through numerous small orifices to create threads that are then attenuated (stretched to the point of breaking) by high velocity hot air and flame. The newly formed glass fibers are pneumatically conveyed to drums for capture and packaging.

3.2.4 Emission Control

The glass melting furnaces and all fiberizers currently installed at the H&V facility are controlled by CFUs.

3.3 Emission Source Description

Emission factor verification will be performed on the Rotary Fine (CFU 118), Rotary Coarse (CFU 108), Ultra Rotary Coarse (CFU 112), Glass Furnace (CFU 113), and the Flameblown (CFU 115).

CFUs 108, 112, and 118 exhaust stacks are 30 inches inner diameter. The CFU 115 exhaust stack is 36 inches inner diameter. The CFU 113 exhaust stack is 20 inches inner diameter. Purpose-built sampling ports to be utilized are accessible via stairs and a platform for all sources.

3.4 Test Plan

3.4.1 Emission Factor Verification

All testing will be performed in accordance with EPA test methods and according to the ODEQ Source Sampling Manual. Emissions testing will be conducted following the methods listed in Table 2.

Bison proposes to use TO-15 in lieu of Method 18. It is our belief that TO-15 will provide a higher level of confidence in the results and the integrity of the samples arriving at the lab, which cannot be achieved with Method 18 Tedlar Bag samples. Method TO-15 sampling media is more robust for transport and allows the lab to check to see if any leakage has occurred based on pressure changes post testing. TO-15 will be able to get a similar and perhaps longer analyte list with greater accuracy. A list of TO-15 analytes is in Appendix B.

Table 2 H&V CFUs Test Matrix

Source	EPA Method	Parameter	Test Plan and Comments
Rotary Coarse GP 1, CFU 108	1	Sampling location and traverse points	Once per source prior to testing. Check for cyclonic flow.
Rotary Fine GP 2; CFU 118	2	Velocity/flow	One traverse per run.
	3A	O_2, CO_2, molecular weight	Concurrent to TO-15 runs.
Ultra Rotary Coarse GP 1; CFU 112	4	Moisture	Three 60-minute test runs concurrent with TO-15
Glass Furnace GP1; CFU 113 Flameblown GP 2; CFU 115	TO-15	Speciated Organic TAC	Three 60-minute test runs

3.4.2 Raw Materials Handling PTE Verification

Bison will follow EPA Method 204 to determine whether the raw materials handling area meets criteria to qualify as a PTE. If the criteria are met, and if all fugitive emissions are ducted to a control device, then the capture efficiency (CE) can be assumed to be 100% and CE need not be measured. Table 3 summarizes the Method 204 criteria that will be used to evaluate the raw materials handling area PTE status. Table 4 describes the test methods that will be used to perform the verification testing.

Table 3 PTE Evaluation Criteria

NEAR – natural draft opening to enclosure area ratio

Parameter	Units	Limit
NEAR Ratio	%	≤ 5
FV (via differential pressure measurement approach)*	Inches water	≤ -0.007
Distances to NDO	Feet	At least four equivalent opening diameters from each PM emitting point to any NDO.
Inward direction of airflow	NA	If the FV is less than 500 fpm, the inward direction of flow will be monitored for at least one hour. This verification will be documented photographically using streamers at 10-minute intervals.

FV – facial velocity
NDO – natural draft opening
fpm – feet per minute
NA – not applicable
*EPA Method 204, Section 8.3, states that FV shall be at least 3,600 meters/hour (m/hr) which is equivalent to 200 feet per minute (fpm). Alternatively, pressure differential across the enclosure may be measured. A pressure drop of 0.013 millimeters mercury (0.007 inches water) corresponds to a FV of 3,600 m/hr (200 fpm).

Table 4 Verification of PTE Test Matrix

Source	EPA Method	Parameter	Testing notes
Raw Materials Handling Area	204	Verification of PTE	Distances from PM emitting points to all NDOs. Differential pressure measurements and air flow direction.

All direct measurements of differential pressure will be made using a Shortridge ADM-850L micromanometer with a four decimal place display and current calibration certificate demonstrating instrument accuracy to differential pressures as low as 0.0100 inches of water. Differential pressure will be measured at least 15 times per location. Measurement will be recorded in a series of three rounds; during each round, five measurements will be recorded per location. 100% of all measurements must indicate a pressure drop of at least 0.007 inches of water to demonstrate containment.

Emission factor verification and PTE verification testing is scheduled to take place the week of December 12, 2022. Testing is expected to follow a schedule similar to the one in Table 5.

Table 5 Proposed Test Schedule

Date	Source	Details
12/12	N/A	Travel from Helena, MT to Corvallis, OR
12/13	CFU 112 & CFU 113	Three 60-minute test runs on each CFU
12/14	CFU 108 & CFU 118	
12/15	CFU 115 & Raw Materials Handling Area	Three 60-minute test runs on CFU and PTE verification
12/16	N/A	Return travel from Corvallis, OR to Helena, MT

The schedule above assumes that testing proceeds as planned with minimal interruptions or process downtime. Bison or H&V will inform ODEQ of any changes to the schedule ahead of testing. A final test report will be submitted to ODEQ on or before 45 days after the conclusion of testing.

3.5 Responsibilities of Plant

Hollingsworth & Vose will be responsible for*:*

- Assuring availability of the manufacturing processes during the scheduled test day as needed to facilitate the test program.
- Providing safe and secure access to the sampling ports.
- Recording pertinent process details at 15-minute intervals during the test program.
- Ensuring production is at least 90% of the normal operating rate during testing.

- Sampling replicate(s) will not be accepted if separated by duration of twenty-four (24) hours or more unless prior authorization is granted by ODEQ.
- Glass production rate (tons/hour)
- CFU pressure drop (inches of water)
- Natural gas usage, where applicable (cf/hr)
- Product type

Only regular operating staff may adjust the production process and emission control parameters during the source performance tests and within two hours prior to the tests. Any operating adjustments made during the source performance tests, which are a result of consultation during the tests with source testing personnel, equipment vendors or consultants, may render the source performance test invalid.

3.6 Plant Entry and Safety Requirements

Bison personnel receive annual training on and will adhere to Bison's Health, Safety and Environmental Management System (HSEMS). They will also comply with all facility safety requirements and will attend H&V's standard safety briefing for visitors. Bison crew members will complete an on-site job safety analysis prior to the start of work and provide their own personal protective equipment, including hard hats, gloves, long sleeves, steel toe boots, safety glasses, and hearing protection.

4.0 EMISSION TEST METHODS AND PROCEDURES

4.1 Instrumentation and Equipment

Instrumental analyzers used by Bison to measure pollutant and diluent concentrations in stack gas are purpose-built by reputable companies and have been subjected to comprehensive interference response test procedures by their respective manufacturers. Further documentation regarding interferences for individual analyzers can be provided upon request.

4.2 Test Methods and Descriptions

Testing will be performed using the following EPA test methods as described in 40 CFR 60, and as approved and adopted by the appropriate regulatory agency.

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 appendices.

EPA Reference Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type-S Pitot Tube)." 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 3A, "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)." The objective of Method 3A is to determine the O_2 and CO_2 concentrations in the stack gas stream.

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.

EPA TO-15, "Determination of Volatile Organic Compounds (VOC) in Air Collected in Specially-prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)." The objective of TO-15 is to determine speciated organic TAC analytes from a source.

EPA Reference Method 204, "Criteria for and Verification of a Permanent or Temporary Total Enclosure." The objective of Method 204 is to determine whether a permanent or temporary enclosure meets the criteria for being considered a total enclosure. If all the criteria are met, then the volatile organic compound capture efficiency (CE) is assumed to be 100 percent.

4.3 Analytical Methods

Sampling procedures are cited in the appropriate methods and there will be no deviation from those methods. TO-15 summa canisters will be shipped to ALS Environmental in Salt Lake City, UT for analysis.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

5.1 Sampling Protocol and Collection Procedures

All testing will be performed in accordance with the specified test methods and their prescribed quality control procedures.

Chain of custody forms will accompany the TO-15 Summa canister samples from the field to the analytical laboratory.

Test data will be recorded electronically using a data acquisition system. Field data, such as flow measurements, temperatures, and volumes, will be entered directly into spreadsheets for subsequent calculations. The data can also be recorded on hand-written datasheets if requested by the client or the regulatory agency.

5.2 Equipment and Instrument Calibration, Audits and Maintenance

Ongoing calibrations and audits of the testing equipment comprise a preventive maintenance program. Bison personnel calibrate equipment and instruments according to a set schedule and with standards traceable to the National Institute of Standards and Technology (NIST) All equipment requiring calibration will be calibrated according to the criteria specified in the proposed test methods. Equipment and instrument calibration results will be included in an appendix to the final test report.

5.3 Data Collection, Reduction and Validation

Emissions test data is subject to multiple levels of validation. Bison has self-auditing spreadsheets that alert the field technician when data may be entered incorrectly by flagging calculation results that are outside of expected or reasonable values. Data is also audited during data processing and report generation. Quality assurance and quality control checks associated with testing (such as on-site analyzer calibrations, spikes and pre- or post-test equipment certifications) are audited during the review process.

A final draft of the test report is reviewed for technical content by a member of Bison's quality management team and the project manager. All field data and spreadsheets will be supplied in an appendix to the test report.

5.4 Internal Audits and Corrective Action

When departures from policies or procedures in Bison's quality system or technical operations are identified, Bison's quality management team meets with the personnel involved to evaluate the significance of the non-conforming work and discuss appropriate corrective action. Corrective actions are given the highest priority and determined immediately after identifying non-conforming work. The format for implementing corrective action follows ASTM D7036-04.

5.5 Documentation, Tracking and Certifications

Bison has assigned this project a unique number for document control and record keeping. The tracking number for this project is **HAV222965**.

Electronic project records are maintained on Bison's server for a minimum of five years. The project manager and a member of the quality management team will sign a certification page to document and authenticate that testing was performed according to the appropriate methods, applicable regulatory requirements and Bison's quality manual. This certification page will accompany the final report.

Should a situation arise that warrants a deviation from the approved protocol, it will be discussed with the client and/or regulatory agency. If necessary, approval to modify the test plan will be obtained from the regulatory agency. Any modification to the test plan or deviation from approved test methods will be documented in the final test report.

5.6 Audit Samples

The stationary source audit program (SSAP) is effectively suspended as of March 2022 because there are currently no independent accredited audit sample providers (AASP). Bison maintains an ERA audit filter for laboratory balance verification.

APPENDIX A: EXAMPLE TEST REPORT FORMAT

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APPENDIX B: TO-15 Analyte List

Analyte	ppbvd	g/mol	ppmvd	lb/hr
Dichlorodifluoromethane				
Chloromethane				
Freon 114				
Vinyl chloride				
1,3-Butadiene				
Bromomethane				
Ethyl chloride				
Freon 11				
Freon 113				
1,1-Dichloroethene				
Acetone				
Carbon disulfide				
Methylene chloride				
trans-1,2-Dichloroethene				
Methyl t-butyl ether				
Vinyl acetate				
2-Butanone				
cis-1,2-Dichloroethene				
1,1-Dichloroethane				
Ethyl acetate				
n-Hexane				
Chloroform				
Tetrahydrofuran				
1,2-Dichloroethane				
1,1,1-Trichloroethane				
Carbon tetrachloride				
Benzene				
Cyclohexane				
Trichloroethene				
1,2-Dichloropropane				
Bromodichloromethane				
Heptane				
cis-1,3-Dichloropropene				
4-Methyl-2-pentanone				
trans-1,3-Dichloropropene				
1,1,2-Trichloroethane				
Toluene				
2-Hexanone				
Tetrachloroethene				
Dibromochloromethane				
1,2-Dibromoethane				
Chlorobenzene				
Ethyl benzene				
m,p-Xylene				
o-Xylene				
Styrene				
Bromoform				
1,1,2,2-Tetrachloroethane				
4-Ethyl toluene				
1,3,5-Trimethylbenzene				
1,2,4-Trimethylbenzene				
1,3-Dichlorobenzene				
1,4-Dichlorobenzene				
Benzyl chloride				
1,2-Dichlorobenzene				
1,2,4-Trichlorobenzene				
Hexachloro-1,3-butadiene				
Propane				
Isobutane				
Acetaldehyde				
Ethanol				
Acrolein				
Furfural				
4-Bromofluorobenzene				

This is the last page of the protocol.