SOURCE TESTING AUDIT REPORT: CERTIFICATION FORM

Facility: Hollingsworth & Vose **Permit #:** 02-2173-ST-01 **Test Date:** 12/13-15/2022

Emission Unit: CFU 108, 112, 113, 115, 118 **Sampling Location:** Corvallis, OR

SECTION 1: TESTING PROGRAM CERTIFICATION INFORMATION

ITEM OF INQUIRY	Yes	No	EXPLANATION
A. Is the purpose(s) for the testing clearly defined within the test report?	X		
B. Did testing include all pollutants specified within the Source Test Plan (STP)?	X		
C. Were all issues within the Department's response to the STP fully addressed?	X		
D. Was the source operating within ±10% of normal maximum capacity?	X		
E. Are all appropriate operating conditions documented?	X		
F. Were there any test interruptions?		X	
G. Were there any variances or modifications to the STP? (if Yes; reply to i & ii)		X	
i. Were the variances or modifications approved by the Department?			
ii. Does the report include an evaluation of the impact the variances or modifications had on the test data?			

SECTION 2: SOURCE SAMPLING REPORT AUDITOR CERTIFICATION:

I hereby certify that to the best of my knowledge, the information provided within this source sampling audit report is complete and factual.

Name: Jacob Rankin Title: Helena Source Team Lead

Signature: Jacob Rankin Date: 02/03/2023

SECTION 3: PERMITTEE REPRESENTATIVE CERTIFICATION:

I hereby certify that to the best of my knowledge, the information provided within this source sampling audit report is complete and factual.

Name: Anita Ragan Title: EHS Manager

Signature: _____ Date: 02/03/2023

SECTION 4: DEPARTMENT REPRESENTATIVE:

The Oregon Department of Environmental Quality has evaluated the Source Sampling Audit Report and has determined that the information provided is sufficient for accepting the results originating from the testing program. Although no deficiencies were exposed by the Source Sampling Audit Report, additional errors and/or inconsistencies may be detected through additional Departmental review at a later date, which may lead to a retest or an enforcement action against the permittee.

Name: _____ Title: _____

Signature: _____ Date: _____

EMISSIONS TEST REPORT

HOLLINGSWORTH & VOSE GLASS FIBER MANUFACTURING PLANT

CFUs EMISSION FACTOR VERIFICATION AND MATERIALS HANDLING AREA VERIFICATION OF PERMANENT TOTAL ENCLOSURE

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

Prepared for:

Hollingsworth & Vose Fiber Company
1115 SE Crystal Lake Drive
Corvallis, OR 97333

Prepared by:

Bison Engineering, Inc.
3143 E. Lyndale Avenue
Helena, MT 59601
(406) 442-5768
www.bison-eng.com

Project Number: HAV222965
Test Dates: December 13-15, 2022
Report Issued: February 3, 2023

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

EXECUTIVE SUMMARY

Hollingsworth & Vose Fiber Company contracted Bison Engineering, Inc. to perform emissions tests on the rotary coarse, ultra-rotary coarse, glass furnace, flameblown, and rotary fine ceramic filtration units (CFU 108, 112, 113, 115, and 118 respectively) for emission factor verification, and to conduct a permanent total enclosure verification on the raw materials handling area at the Hollingsworth & Vose facility in Corvallis, Oregon. This facility is subject to the provisions of Oregon Department of Environmental Quality permit number 02-2173-ST-01. All testing was 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 the protocol, and the Oregon Department of Environmental Quality Source Sampling Manual. Table 1 summarizes the results for the emission factor verification. Table 2 provides the average results for facial velocity measurements via the differential pressure approach for permanent total enclosure verification of the raw materials handling area.

Table 1 CFU Emission Factor Verification Results Summary

Analyte	CFU 108	CFU 112	CFU 113	CFU 115	CFU 118
	lb/ton glass				
Dichlorodifluoromethane	<8.82E-04	<4.70E-04	<4.05E-05	<5.72E-03	<2.99E-03
Chloromethane	<3.68E-04	1.96E-04	1.69E-05	4.08E-02	3.84E-03
Freon 114	<1.25E-03	<6.64E-04	<5.72E-05	<8.09E-03	<4.22E-03
Vinyl chloride	<4.56E-04	<2.43E-04	<2.09E-05	<2.96E-03	<1.54E-03
1,3-Butadiene	<3.95E-04	<2.21E-04	5.79E-04	<2.56E-03	<1.34E-03
Bromomethane	<6.93E-04	<3.69E-04	<3.18E-05	<4.49E-03	<2.35E-03
Chloroethane	<4.71E-04	<2.51E-04	<2.16E-05	<3.05E-03	<1.59E-03
Freon 11	<1.00E-03	<5.34E-04	<4.60E-05	<6.50E-03	<3.39E-03
Freon 113	<1.37E-03	<7.28E-04	<6.27E-05	<8.87E-03	<4.63E-03
1,1-Dichloroethene	<7.07E-04	<3.77E-04	<3.25E-05	<4.59E-03	<2.40E-03
Acetone	1.24E-02	1.92E-02	5.48E-03	4.31E-01	4.97E-02
Carbon disulfide	<5.56E-04	<2.96E-04	3.82E-05	<3.60E-03	<1.88E-03
Methylene chloride	<6.20E-04	<3.30E-04	<2.84E-05	<4.02E-03	<2.10E-03
trans-1,2-Dichloroethene	<7.07E-04	<3.77E-04	<3.25E-05	<4.59E-03	<2.40E-03
Methyl t-butyl ether	<6.43E-04	<3.42E-04	<2.95E-05	<4.17E-03	<2.18E-03
Vinyl acetate	<6.28E-04	<3.34E-04	<2.88E-05	<4.07E-03	<2.13E-03
2-Butanone	<5.71E-04	<7.83E-04	7.24E-05	1.37E-02	<1.88E-03
cis-1,2-Dichloroethene	<7.07E-04	<3.77E-04	<3.25E-05	<4.59E-03	<2.40E-03
1,1-Dichloroethane	<7.22E-04	<3.84E-04	<3.31E-05	<4.68E-03	<2.45E-03
Ethyl acetate	<1.29E-03	<6.85E-04	<5.90E-05	<8.34E-03	<4.35E-03
Hexane	2.00E-03	1.64E-02	7.89E-04	6.25E-01	4.86E-02
Chloroform	<8.71E-04	<4.64E-04	<4.00E-05	<5.65E-03	<2.95E-03
Tetrahydrofuran	<5.26E-04	<2.80E-04	<2.41E-05	<3.41E-03	<1.78E-03

Analyte	CFU 108	CFU 112	CFU 113	CFU 115	CFU 118
	lb/ton glass				
1,2-Dichloroethane	<7.22E-04	<3.84E-04	<3.31E-05	<4.68E-03	<2.45E-03
1,1,1-Trichloroethane	<9.73E-04	<5.18E-04	<4.47E-05	<6.31E-03	<3.30E-03
Carbon tetrachloride	<1.12E-03	<5.98E-04	<5.15E-05	<7.28E-03	<3.80E-03
Benzene	1.10E-03	4.24E-03	1.31E-03	1.08E-01	9.88E-03
Cyclohexane	<6.14E-04	<3.27E-04	<2.82E-05	<6.65E-03	<2.08E-03
Trichloroethene	<9.59E-04	<5.10E-04	<4.40E-05	<6.22E-03	<3.25E-03
1,2-Dichloropropane	<8.24E-04	<4.39E-04	<3.78E-05	<5.35E-03	<2.79E-03
Bromodichloromethane	<1.20E-03	<6.36E-04	<5.49E-05	<7.75E-03	<4.05E-03
Heptane	<7.31E-04	1.59E-03	<5.53E-05	4.16E-02	7.84E-03
cis-1,3-Dichloropropene	<8.10E-04	<4.31E-04	<3.72E-05	<5.25E-03	<2.74E-03
4-Methyl-2-pentanone	<7.31E-04	<3.89E-04	<3.35E-05	<4.99E-03	<2.47E-03
trans-1,3-Dichloropropene	<8.10E-04	<4.31E-04	<3.72E-05	<5.25E-03	<2.74E-03
1,1,2-Trichloroethane	<9.73E-04	<5.18E-04	<4.47E-05	<6.31E-03	<3.30E-03
Toluene	5.14E-03	1.26E-02	3.28E-04	1.09E-01	2.34E-02
2-Hexanone	<1.46E-03	<7.78E-04	<6.71E-05	<9.48E-03	<4.95E-03
Tetrachloroethene	<1.21E-03	<6.44E-04	<5.55E-05	<7.85E-03	<4.10E-03
Dibromochloromethane	<1.52E-03	<8.09E-04	<6.97E-05	<9.86E-03	<5.15E-03
1,2-Dibromoethane	<1.37E-03	<7.30E-04	<6.29E-05	<8.89E-03	<4.64E-03
Chlorobenzene	<8.21E-04	<4.37E-04	<3.77E-05	<5.33E-03	<2.78E-03
Ethyl benzene	<8.85E-04	<4.62E-04	<3.56E-05	<5.66E-03	<2.62E-03
m,p-Xylene	<2.10E-03	<8.25E-04	<7.11E-05	<1.17E-02	<5.25E-03
o-Xylene	<9.96E-04	<4.12E-04	<3.56E-05	<5.02E-03	<2.62E-03
Styrene	<1.52E-03	<8.09E-04	<6.98E-05	<9.86E-03	<5.15E-03
Bromoform	<3.69E-03	<1.96E-03	<1.69E-04	<2.39E-02	<1.25E-02
1,1,2,2-Tetrachloroethane	<1.22E-03	<6.52E-04	<5.62E-05	<7.94E-03	<4.15E-03
4-Ethyl toluene	<1.75E-03	<9.34E-04	<8.05E-05	<1.14E-02	<5.94E-03
1,3,5-Trimethylbenzene	<1.75E-03	<9.34E-04	<8.05E-05	<1.14E-02	<5.94E-03
1,2,4-Trimethylbenzene	<1.75E-03	<9.34E-04	<8.05E-05	<1.14E-02	<5.94E-03
1,3-Dichlorobenzene	<2.15E-03	<1.14E-03	<9.85E-05	<1.39E-02	<7.26E-03
1,4-Dichlorobenzene	<2.15E-03	<1.14E-03	<9.85E-05	<1.39E-02	<7.26E-03
Benzyl chloride	<1.85E-03	<9.84E-04	<8.48E-05	<1.20E-02	<6.26E-03
1,2-Dichlorobenzene	<2.15E-03	<1.14E-03	<9.85E-05	<1.39E-02	<7.26E-03
1,2,4-Trichlorobenzene	<2.65E-03	<1.41E-03	<1.22E-04	<1.72E-02	<8.97E-03
Hexachloro-1,3-butadiene	<3.81E-03	<2.03E-03	<1.75E-04	<2.47E-02	<1.29E-02

Note The symbol '<' indicates that the actual result is less than the numerical value listed. The value shown was calculated using the reporting limit (RL) for lab results that are less than the RL.
CFU – ceramic filtration unit
lb/ton-glass – pounds per ton of glass pulled

Table 2 Raw Materials Handling Permanent Total Enclosure Evaluation Summary

Parameter	Units	Test Result	Limit	Pass/Fail
NEAR Ratio	NA	No NDOs	≤ 0.05	NA
Facial velocity (via differential pressure measurement approach)	inH_2O	All readings were below -0.007.	≤ -0.007	Pass
Distance to any NDO from each emission point	Equivalent opening diameters	No NDOs	≥ 4	NA
Inward direction of airflow	NA	No NDOs	NA	NA

NEAR – natural draft opening to enclosure area ratio
inH_2O – inches of water
NDO – natural draft opening
NA – not applicable

Note Please see Section 3.1.2 for full discussion of permanent total enclosure evaluation and Table 9 for all differential pressure measurements.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

CERTIFICATION FROM RESPONSIBLE OFFICIAL

I have reviewed the information being submitted in its entirety. 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.

02/03/2023

Signature

Date

Anita Ragan

Name (printed)

EHS Manager

Title

Hollingsworth & Vose

Company

REVIEW AND CERTIFICATION

All work, calculations, other activities, and tasks performed and documented in this report were carried out under my direction and supervision. This test project conforms to the requirements of Bison Engineering, Inc.'s quality manual and American Society for Testing and Materials (ASTM) D7036-04.

Project Manager: Jacob Rankin, QSTI, EIT

Title: Helena Source Team Lead

Signature: Jacob Rankin

Date: 2/3/2023

I have reviewed all testing details, calculations, results, conclusions and other appropriate written material contained herein, and hereby certify that the presented material is authentic and accurate.

Reviewer: Jennifer Kessler, QI

Title: Quality Manager / Environmental Scientist

Signature: Jennifer Kessler

Date: 2/3/2023

1.0 INTRODUCTION

1.1 Project Summary and Objectives

Hollingsworth & Vose Fiber Company (H&V) contracted Bison Engineering, Inc. (Bison) to perform emissions testing on the rotary coarse, ultra rotary coarse, glass furnace, flameblown, and rotary fine CFUs (108, 112, 113, 115, and 118 respectively), and permanent total enclosure verification on the raw materials handling area at the H&V facility in Corvallis, Oregon. Bison performed the testing in accordance with the pre-test protocol dated November 13, 2022, that was submitted to the Oregon Department of Environmental Quality (ODEQ). Testing was performed pursuant to ODEQ Air Contaminant Discharge Permit #02-2173-ST-01. Bison employed U.S. Environmental Protection Agency (EPA) test methods as described in Title 40 Code of Federal Regulations, Part 60 (40 CFR 60), Appendix A. The pollutants measured include speciated organic toxic air contaminants (TAC). In addition, carbon dioxide (CO_2), oxygen (O_2), stack flow rate and moisture were measured for mass emission rate determinations. Table 3 summarizes the test methods used during the test campaign.

Table 3 Project Matrix

Source	EPA Method	Parameter	Test Plan and Comments
CFU 108 CFU 112 CFU 113 CFU 115 CFU 118	1	Sampling location and traverse points	Once per source, prior to testing.
	2	Velocity/flow rate	One traverse per run in addition to a cyclonic flow check prior to testing.
	3A	O_2, CO_2, molecular weight	Three, 60-minute test runs concurrently with TO-15.
	4	Moisture	
	TO-15	Speciated Organic TAC	Three, 60-minute test runs.
Raw Materials Handling Area	204	Verification of PTE	Three rounds of five differential pressure measurements at potential NDOs*

PTE – permanent total enclosure
NDO – natural draft opening
CFU-108 Rotary Coarse - Glass Plant 1 (GP 1)
CFU-112 Ultra-Rotary Coarse - Glass Plant 1 (GP 1)
CFU-113 Glass Furnace - Glass Plant 1 (GP 1)
CFU-115 Flameblown - Glass Plant 1 (GP 2)
CFU-118 Rotary Fine - Glass Plant 1 (GP 2)
*No true NDOs were visible.

1.2 Project Contacts

Facility:	**Hollingsworth & Vose Fiber Company**
Address:	1115 SE Crystal Lake Drive Corvallis, OR 97333
Contact:	Anita Ragan
Phone:	(541) 738-5382
Email:	anita.ragan@hovo.com

Consultant:	**Bison Engineering, Inc.**
Address:	3143 E. Lyndale Avenue Helena, MT 59601
Contact:	Conor Fox
Phone:	(406) 442-5768
Email:	cfox@bison-eng.com

Consultant:	**Bison Engineering, Inc.**
Address:	3143 E. Lyndale Avenue Helena, MT 59601
Contact:	Jacob Rankin
Phone:	(406) 442-5768
Email:	jrankin@bison-eng.com

State Authority:	**Oregon Department of Environmental Quality**
Address:	4026 Fairview Industrial Dr. SE Salem, OR 97302
Contact:	Julia DeGagné
Phone:	(503) 866-9643
Email:	julia.degagne@deq.oregon.gov

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

1.3 Testing Personnel

The Bison on-site testing team was led by Conor Fox, Qualified Source Testing Individual (QSTI), Project Scientist. He was assisted during field testing by Matt Kruger, Qualified Individual (QI), Environmental Scientist. Mr. Fox served as project manager during the field operations. Jacob Rankin, QSTI, Environmental Engineer, assumed project manager responsibilities for the remainder of the project following Mr. Fox's departure from Bison. Joanne Sufi, QSTI, Environmental Engineer, processed the test data and authored this report. Jennifer Kessler, QI, Environmental Scientist/Quality Manager, performed a final quality assurance review of the data and test report.

Anita Ragan, Environmental Health & Safety Manager, was the primary contact for H&V. Ms. Ragan was on-site during testing. H&V staff members were responsible for monitoring process parameters during testing.

Julia DeGagné and Mike Eisley from ODEQ were on-site during the test campaign and observed a portion of the testing.

2.0 SOURCE DESCRIPTION

2.1 Facility Description

H&V operates a glass fiber manufacturing facility in Corvallis, Oregon, consisting of two glass plants. The glass plants generally operate 24 hours per day throughout the year. H&V melts raw materials to produce molten glass in two electrically heated furnaces. The molten glass is used to produce glass fiber in four different size/manufacturing classifications: rotary fine, rotary coarse, ultra-rotary coarse, and flameblown. The emissions from all fiberizers and the glass furnaces are controlled by ceramic filtration units (CFUs)

2.2 Emission Source Description

Emission factor verification was 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) units. These CFUs represent emission points from the four types/sizes of glass fiber manufactured at the facility.

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 utilized are accessible via stairs and a platform for all sources.

While on-site, Bison verified each exhaust stack meets EPA Method 1 specifications; detailed Method 1 information is included in the appendices to this report.

3.0 EMISSION TEST RESULTS

3.1 Summary of Results

3.1.1 Emission Factor Verification Results

Test results for CFUs 108, 112, 113, 115, and 118 were presented in the executive summary. In addition to the TACs identified, compounds were listed in the lab report labeled Tentatively Identified Compounds (TIC). Bison has elected not to include these compounds with the total TACs as the EPA states that due to the uncertainty of the identification of the TIC, the interpretation of these results is difficult. Complete results for both TACs and TICs have been included in the report appendices.

Tables 4 through 8 present the testing parameters measured. These parameters are used in the calculation of mass flow rates. On December 14, 2022, three test runs were performed on CFU 115, then at the request of ODEQ, three additional runs were performed using a heated sample line. A total of six test runs were performed on CFU 115; test runs one through three are used for informational purposes and are not included in final calculations. All CFU 115 data is included in the appendices and runs four through six are presented in Table 7. Additional supporting material, including raw data, plant data, example calculations and calibration records, can be found in the appendices to this report.

Table 4 CFU 113 Gas Stream Characteristics

Run	**1**	**2**	**3**	**Average**
Date	12/13/2022			
Run Start Time	6:55	8:05	9:20	
Run End Time	7:54	9:04	10:19	
Duration, min.	61	61	61	
Stack Diameter, in.	20.00	20.00	20.00	
Stack Area, sq.ft.	2.182	2.182	2.182	
Barometric Pressure, "Hg	30.00	30.01	30.00	30.00
Static Pressure, "H_2O	0.70	0.70	0.70	0.70
Stack Temperature, °F	125	128	122	125
CO_2, %vd	0.77	0.77	0.82	0.79
O_2, %vd	20.53	20.52	20.54	20.53
H_2O, %v	1.44	1.65	1.68	1.59
Wet Molecular Weight, lb/lb-mole	28.78	28.76	28.77	28.77
Velocity, FPS	78.54	72.06	73.35	74.65
WSCFM	9,317	8,509	8,745	8,857
DSCFM	9,183	8,368	8,598	8,716
Production Data, lb/hr	3,959.3	4,143.4	4,077.5	4,060.1

Table 5 CFU 112 Gas Stream Characteristics

Run	1	2	3	Average
Date	12/13/2022			
Run Start Time	10:35	11:45	13:00	
Run End Time	11:34	12:44	13:59	
Duration, min.	60	60	60	
Stack Diameter, in.	30.00	30.00	30.00	
Stack Area, sq.ft.	4.909	4.909	4.909	
Barometric Pressure, "Hg	30.02	30.02	30.02	30.02
Static Pressure, "H_2O	0.92	0.92	0.92	0.92
Stack Temperature, °F	188	191	191	190
CO_2, %vd	0.46	0.46	0.46	0.46
O_2, %vd	20.41	20.39	20.41	20.40
H_2O, %v	1.38	1.51	1.56	1.48
Wet Molecular Weight, lb/lb-mole	28.74	28.73	28.72	28.73
Velocity, FPS	73.76	71.63	74.83	73.41
WSCFM	17,803	17,214	17,978	17,665
DSCFM	17,558	16,954	17,698	17,403
Production Data, lb/hr	700.8	692.8	700.0	697.9

Table 6 CFU 108 Gas Stream Characteristics

Run	1	2	3	Average
Date	12/13/2022			
Run Start Time	14:30	15:40	16:50	
Run End Time	15:29	16:39	17:49	
Duration, min.	60	60	60	
Stack Diameter, in.	30.00	30.00	30.00	
Stack Area, sq.ft.	4.909	4.909	4.909	
Barometric Pressure, "Hg	30.00	30.00	30.00	30.00
Static Pressure, "H_2O	0.55	0.55	0.55	0.55
Stack Temperature, °F	194	208	209	204
CO_2, %vd	0.58	0.57	0.58	0.58
O_2, %vd	20.12	20.13	20.12	20.12
H_2O, %v	3.14	1.30	1.50	1.98
Wet Molecular Weight, lb/lb-mole	28.56	28.76	28.74	28.69
Velocity, FPS	76.17	79.89	78.76	78.27
WSCFM	18,178	18,684	18,372	18,411
DSCFM	17,607	18,441	18,097	18,048
Production Data, lb/hr	385.7	390.4	380.1	385.4

Table 7 CFU 115 Gas Stream Characteristics

Run	**4**	**5**	**6**	**Average**
Date	12/14/2022			
Run Start Time	13:05	14:15	15:25	
Run End Time	14:04	15:14	16:24	
Duration, min.	60	60	60	
Stack Diameter, in.	36.00	36.00	36.00	
Stack Area, sq.ft.	7.069	7.069	7.069	
Barometric Pressure, "Hg	30.15	30.15	30.15	30.15
Static Pressure, "H_2O	-0.72	-0.72	-0.72	-0.72
Stack Temperature, °F	272	269	272	271
CO_2, %vd	0.64	0.64	0.63	0.63
O_2, %vd	20.04	20.04	20.04	20.04
H_2O, %v	1.96	2.08	1.78	1.94
Wet Molecular Weight, lb/lb-mole	28.69	28.67	28.71	28.69
Velocity, FPS	63.73	63.41	62.82	63.32
WSCFM	19,603	19,595	19,341	19,513
DSCFM	19,219	19,187	18,996	19,134
Production Data, lb/hr	63.0	63.0	63.0	63.0

Note CFU 115 Runs 1-3 are presented in the appendices to this report.

Table 8 CFU 118 Gas Stream Characteristics

Run	**1**	**2**	**3**	**Average**
Date	12/15/2022			
Run Start Time	8:20	9:30	10:40	
Run End Time	9:19	10:29	11:39	
Duration, min.	60	60	60	
Stack Diameter, in.	30.00	30.00	30.00	
Stack Area, sq.ft.	4.909	4.909	4.909	
Barometric Pressure, "Hg	30.21	30.21	30.21	30.21
Static Pressure, "H_2O	-0.73	-0.73	-0.73	-0.73
Stack Temperature, °F	222	225	226	224
CO_2, %vd	0.54	0.55	0.54	0.54
O_2, %vd	20.19	20.21	20.23	20.21
H_2O, %v	1.13	1.39	1.17	1.23
Wet Molecular Weight, lb/lb-mole	28.77	28.75	28.76	28.76
Velocity, FPS	75.52	79.33	76.08	76.97
WSCFM	17,342	18,147	17,392	17,627
DSCFM	17,146	17,895	17,188	17,410
Production Data, lb/hr	108.7	110.3	110.3	109.8

3.1.2 PTE Verification Results

Bison followed EPA Method 204 to assess whether the raw materials handling area meets the criteria for a PTE. The building did not have any true NDOs visible. For the purposes of Method 204 verification, differential pressure measurements were taken from 5 potential NDOs, all of which are normally closed during regular operations. Drawings identifying the location of potential NDO's are included in the report appendices. All potential NDO's were sealed off with plastic and a small opening of approximately one inch was used to measure the differential pressure. Field personnel did not measure the area of the potential NDO's, and a NEAR value was not calculated because every potential NDO was confirmed to be fully sealed by the plastic. It is Bison's understanding that H&V intends to install high-speed roll up doors to ensure the enclosure envelope remains sealed. Inward direction of air flow was not shown with photographic evidence because the average FV was greater than 500 fpm, and there were no true NDOs.

Direct measurements of differential pressure were used in lieu of a calculated FV following Method 204, eq. 204-3. Pressure differential at all measurement locations were greater than -0.007 inches H_2O. Table 9 summarizes the differential pressure measurements. All direct measurements of differential pressure were 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 measurements were recorded in a series of three rounds; during each round, five measurements were recorded per location.

Table 9 Differential Pressure Measurement Summary

Measurement Location	Units	Round 1 Average	Round 2 Average	Round 3 Average	Overall Average
North Man Door	in H_2O	-0.0388	-0.0181	-0.0257	-0.0275
NE Load In/Out Door	in H_2O	-0.0135	-0.0238	-0.0193	-0.0189
SE Load In/Out Door	in H_2O	-0.0171	-0.0200	-0.0121	-0.0164
Second Floor Load In/Out Door	in H_2O	-0.0362	-0.0312	-0.0138	-0.0271
Second Floor Man Door	in H_2O	-0.3050	-0.0851	-0.6055	-0.3319

in H_2O – inches of water

3.2 Operating Conditions

H&V personnel compiled the raw process data and details of plant operations during testing and provided them to Bison for use in this report. Process data is presented in the report appendices and was used to calculate lb/ton glass.

3.3 Field Observations

Testing was performed as outlined in the test protocol. No adverse or unusual environmental conditions were noted that are known to have influenced the outcome of these tests.

Six test runs were conducted on CFU 115 on December 14, 2022. All data from these runs is presented in the appendices to this report, however, only runs 4 through 6 are used to calculate emissions in lb/ton of glass.

Field personnel did not perform stratification checks on all the CFUs. Bison has sampled from these sources multiple instances preceding this test campaign and has verified they were previously not stratified. No major process changes were noted that would change the overall flow profile or gas composition of the exhaust stream which would trigger the necessity to perform a stratification test.

The large time difference from the completion of the calibrations for CFU 118 to the beginning of the stratification test can be attributed to the field personnel finishing the instrument calibration procedure first and then finishing the setup of the moisture and TAC sampling equipment.

3.4 Method 18 Acknowledgement

Bison would like to acknowledge ODEQ's Test Method Specific Comments, 1. c. in the protocol approval letter dated November 23, 2022, "For organic TACs detected at concentrations greater than 1 part per million by volume (ppmv) using TO-15, DEQ may require quantification using an approvable stack test method such as EPA Method 18."

Method 18 samples were collected, but were not analyzed, since no TACs were detected at concentrations greater than 1 ppmv.

4.0 EMISSION TEST METHODS AND PROCEDURES

4.1 Testing Methods and Procedures

Bison testing personnel performed the following EPA methods as described in 40 CFR 60, Appendix A. 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.

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 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.

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.

4.2 Sample Handling and Analytical Procedures

Sampling procedures are cited in the appropriate methods and there was no deviation from those methods. Bison's project manager retained custody of the samples until relinquishing them to Bison's Helena, Montana qualified lab personnel to be shipped to ALS Environmental for TO-15 analysis. A chain of custody is included in the appendices.

4.3 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).

APPENDIX A: CFU 113 TEST DATA

Hollingsworth & Vose
Corvallis, OR
CFU 113 Speciated Organic Toxic Air Contaminants (TAC)

Run Number	1	2	3
Sample Collection Date	12/13/2022	12/13/2022	12/13/2022
Glass Production Rate Supplied by H&V (lb/hr)	3,959.3	4,143.4	4,077.5
Volumetric Flow Rate Measured by Bison (dscfm)	9,183	8,368	8,600

Analyte	Molecular Weight	CFU 113-1				CFU 113-2				CFU 113-3				CFU 113 Averages			
	g/mol	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass
Dichlorodifluoromethane	120.9129	< 0.5	< 5.0E-04	< 8.65E-05	< 4.37E-05	< 0.5	< 5.0E-04	< 7.88E-05	< 3.80E-05	< 0.5	< 5.0E-04	< 8.10E-05	< 3.97E-05	< 0.50	< 5.0E-04	< 8.21E-05	< 4.05E-05
Chloromethane	50.4872	< 0.5	< 5.0E-04	< 3.61E-05	< 1.82E-05	< 0.5	< 5.0E-04	< 3.29E-05	< 1.59E-05	< 0.5	< 5.0E-04	< 3.38E-05	< 1.66E-05	< 0.50	< 5.0E-04	< 3.43E-05	< 1.69E-05
Freon 114	170.92	< 0.5	< 5.0E-04	< 1.22E-04	< 6.18E-05	< 0.5	< 5.0E-04	< 1.11E-04	< 5.38E-05	< 0.5	< 5.0E-04	< 1.15E-04	< 5.62E-05	< 0.50	< 5.0E-04	< 1.16E-04	< 5.72E-05
Vinyl chloride	62.50	< 0.5	< 5.0E-04	< 4.47E-05	< 2.26E-05	< 0.5	< 5.0E-04	< 4.07E-05	< 1.97E-05	< 0.5	< 5.0E-04	< 4.19E-05	< 2.05E-05	< 0.50	< 5.0E-04	< 4.24E-05	< 2.09E-05
1,3-Butadiene	54.0904	**16**	**1.6E-02**	**1.24E-03**	**6.25E-04**	**17**	**1.7E-02**	**1.20E-03**	**5.79E-04**	**15**	**1.5E-02**	**1.09E-03**	**5.33E-04**	**16.00**	**1.6E-02**	**1.17E-03**	**5.79E-04**
Bromomethane	94.94	< 0.5	< 5.0E-04	< 6.79E-05	< 3.43E-05	< 0.5	< 5.0E-04	< 6.19E-05	< 2.99E-05	< 0.5	< 5.0E-04	< 6.36E-05	< 3.12E-05	< 0.50	< 5.0E-04	< 6.45E-05	< 3.18E-05
Chloroethane	64.51	< 0.5	< 5.0E-04	< 4.61E-05	< 2.33E-05	< 0.5	< 5.0E-04	< 4.21E-05	< 2.03E-05	< 0.5	< 5.0E-04	< 4.32E-05	< 2.12E-05	< 0.50	< 5.0E-04	< 4.38E-05	< 2.16E-05
Freon 11	137.3672	< 0.5	< 5.0E-04	< 9.83E-05	< 4.96E-05	< 0.5	< 5.0E-04	< 8.95E-05	< 4.32E-05	< 0.5	< 5.0E-04	< 9.20E-05	< 4.51E-05	< 0.50	< 5.0E-04	< 9.33E-05	< 4.60E-05
Freon 113	187.38	< 0.5	< 5.0E-04	< 1.34E-04	< 6.77E-05	< 0.5	< 5.0E-04	< 1.22E-04	< 5.90E-05	< 0.5	< 5.0E-04	< 1.26E-04	< 6.16E-05	< 0.50	< 5.0E-04	< 1.27E-04	< 6.27E-05
1,1-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 6.93E-05	< 3.50E-05	< 0.5	< 5.0E-04	< 6.32E-05	< 3.05E-05	< 0.5	< 5.0E-04	< 6.49E-05	< 3.19E-05	< 0.50	< 5.0E-04	< 6.58E-05	< 3.25E-05
Acetone	58.08	**250**	**2.5E-01**	**2.08E-02**	**1.05E-02**	**94**	**9.4E-02**	**7.12E-03**	**3.44E-03**	**66**	**6.6E-02**	**5.14E-03**	**2.52E-03**	**136.67**	**1.4E-01**	**1.10E-02**	**5.48E-03**
Carbon disulfide	76.143	**0.77**	**7.7E-04**	**8.39E-05**	**4.24E-05**	**0.8**	**8.0E-04**	**7.94E-05**	**3.83E-05**	**0.68**	**6.8E-04**	**6.94E-05**	**3.40E-05**	**0.75**	**7.5E-04**	**7.76E-05**	**3.82E-05**
Methylene chloride	84.9320	< 0.5	< 5.0E-04	< 6.08E-05	< 3.07E-05	< 0.5	< 5.0E-04	< 5.54E-05	< 2.67E-05	< 0.5	< 5.0E-04	< 5.69E-05	< 2.79E-05	< 0.50	< 5.0E-04	< 5.77E-05	< 2.84E-05
trans-1,2-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 6.93E-05	< 3.50E-05	< 0.5	< 5.0E-04	< 6.32E-05	< 3.05E-05	< 0.5	< 5.0E-04	< 6.49E-05	< 3.19E-05	< 0.50	< 5.0E-04	< 6.58E-05	< 3.25E-05
Methyl t-butyl ether	88.1482	< 0.5	< 5.0E-04	< 6.31E-05	< 3.19E-05	< 0.5	< 5.0E-04	< 5.75E-05	< 2.77E-05	< 0.5	< 5.0E-04	< 5.91E-05	< 2.90E-05	< 0.50	< 5.0E-04	< 5.99E-05	< 2.95E-05
Vinyl acetate	86.0892	< 0.5	< 5.0E-04	< 6.16E-05	< 3.11E-05	< 0.5	< 5.0E-04	< 5.61E-05	< 2.71E-05	< 0.5	< 5.0E-04	< 5.77E-05	< 2.83E-05	< 0.50	< 5.0E-04	< 5.85E-05	< 2.88E-05
2-Butanone	72.1057	**0.87**	**8.7E-04**	**8.98E-05**	**4.53E-05**	**1.7**	**1.7E-03**	**1.60E-04**	**7.71E-05**	**2.0**	**2.0E-03**	**1.93E-04**	**9.48E-05**	**1.52**	**1.5E-03**	**1.48E-04**	**7.24E-05**
cis-1,2-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 6.93E-05	< 3.50E-05	< 0.5	< 5.0E-04	< 6.32E-05	< 3.05E-05	< 0.5	< 5.0E-04	< 6.49E-05	< 3.19E-05	< 0.50	< 5.0E-04	< 6.58E-05	< 3.25E-05
1,1-Dichloroethane	98.9586	< 0.5	< 5.0E-04	< 7.08E-05	< 3.58E-05	< 0.5	< 5.0E-04	< 6.45E-05	< 3.11E-05	< 0.5	< 5.0E-04	< 6.63E-05	< 3.25E-05	< 0.50	< 5.0E-04	< 6.72E-05	< 3.31E-05
Ethyl acetate	88.1051	< 1.0	< 1.0E-03	< 1.26E-04	< 6.37E-05	< 1.0	< 1.0E-03	< 1.15E-04	< 5.54E-05	< 1.0	< 1.0E-03	< 1.18E-04	< 5.79E-05	< 1.00	< 1.0E-03	< 1.20E-04	< 5.90E-05
Hexane	86.1754	**20**	**2.0E-02**	**2.47E-03**	**1.25E-03**	**12**	**1.2E-02**	**1.35E-03**	**6.51E-04**	**8.3**	**8.3E-03**	**9.58E-04**	**4.70E-04**	**13.43**	**1.3E-02**	**1.59E-03**	**7.89E-04**
Chloroform	119.3767	< 0.5	< 5.0E-04	< 8.54E-05	< 4.31E-05	< 0.5	< 5.0E-04	< 7.78E-05	< 3.76E-05	< 0.5	< 5.0E-04	< 8.00E-05	< 3.92E-05	< 0.50	< 5.0E-04	< 8.11E-05	< 4.00E-05
Tetrahydrofuran	72.1057	< 0.5	< 5.0E-04	< 5.16E-05	< 2.61E-05	< 0.5	< 5.0E-04	< 4.70E-05	< 2.27E-05	< 0.5	< 5.0E-04	< 4.83E-05	< 2.37E-05	< 0.50	< 5.0E-04	< 4.90E-05	< 2.41E-05
1,2-Dichloroethane	98.9586	< 0.5	< 5.0E-04	< 7.08E-05	< 3.58E-05	< 0.5	< 5.0E-04	< 6.45E-05	< 3.11E-05	< 0.5	< 5.0E-04	< 6.63E-05	< 3.25E-05	< 0.50	< 5.0E-04	< 6.72E-05	< 3.31E-05
1,1,1-Trichloroethane	133.4033	< 0.5	< 5.0E-04	< 9.54E-05	< 4.82E-05	< 0.5	< 5.0E-04	< 8.70E-05	< 4.20E-05	< 0.5	< 5.0E-04	< 8.94E-05	< 4.38E-05	< 0.50	< 5.0E-04	< 9.06E-05	< 4.47E-05
Carbon tetrachloride	153.8215	< 0.5	< 5.0E-04	< 1.10E-04	< 5.56E-05	< 0.5	< 5.0E-04	< 1.00E-04	< 4.84E-05	< 0.5	< 5.0E-04	< 1.03E-04	< 5.05E-05	< 0.50	< 5.0E-04	< 1.04E-04	< 5.15E-05
Benzene	78.1118	**18**	**1.8E-02**	**2.01E-03**	**1.02E-03**	**28**	**2.8E-02**	**2.85E-03**	**1.38E-03**	**30**	**3.0E-02**	**3.14E-03**	**1.54E-03**	**25.33**	**2.5E-02**	**2.67E-03**	**1.31E-03**
Cyclohexane	84.1595	< 0.5	< 5.0E-04	< 6.02E-05	< 3.04E-05	< 0.5	< 5.0E-04	< 5.49E-05	< 2.65E-05	< 0.5	< 5.0E-04	< 5.64E-05	< 2.77E-05	< 0.50	< 5.0E-04	< 5.71E-05	< 2.82E-05
Trichloroethene	131.3874	< 0.5	< 5.0E-04	< 9.40E-05	< 4.75E-05	< 0.5	< 5.0E-04	< 8.56E-05	< 4.13E-05	< 0.5	< 5.0E-04	< 8.80E-05	< 4.32E-05	< 0.50	< 5.0E-04	< 8.92E-05	< 4.40E-05
1,2-Dichloropropane	112.9851	< 0.5	< 5.0E-04	< 8.08E-05	< 4.08E-05	< 0.5	< 5.0E-04	< 7.37E-05	< 3.56E-05	< 0.5	< 5.0E-04	< 7.57E-05	< 3.71E-05	< 0.50	< 5.0E-04	< 7.67E-05	< 3.78E-05
Bromodichloromethane	163.828	< 0.5	< 5.0E-04	< 1.17E-04	< 5.92E-05	< 0.5	< 5.0E-04	< 1.07E-04	< 5.15E-05	< 0.5	< 5.0E-04	< 1.10E-04	< 5.38E-05	< 0.50	< 5.0E-04	< 1.11E-04	< 5.49E-05
Heptane	100.2019	< 0.5	< 5.0E-04	< 7.17E-05	< 3.62E-05	**0.7**	**7.0E-04**	**9.14E-05**	**4.41E-05**	**1.3**	**1.3E-03**	**1.75E-04**	**8.56E-05**	< **0.83**	< **8.3E-04**	< **1.13E-04**	< **5.53E-05**
cis-1,3-Dichloropropene	110.9693	< 0.5	< 5.0E-04	< 7.94E-05	< 4.01E-05	< 0.5	< 5.0E-04	< 7.23E-05	< 3.49E-05	< 0.5	< 5.0E-04	< 7.43E-05	< 3.65E-05	< 0.50	< 5.0E-04	< 7.54E-05	< 3.72E-05
4-Methyl-2-pentanone	100.1589	< 0.5	< 5.0E-04	< 7.16E-05	< 3.62E-05	< 0.5	< 5.0E-04	< 6.53E-05	< 3.15E-05	< 0.5	< 5.0E-04	< 6.71E-05	< 3.29E-05	< 0.50	< 5.0E-04	< 6.80E-05	< 3.35E-05
trans-1,3-Dichloropropene	110.9693	< 0.5	< 5.0E-04	< 7.94E-05	< 4.01E-05	< 0.5	< 5.0E-04	< 7.23E-05	< 3.49E-05	< 0.5	< 5.0E-04	< 7.43E-05	< 3.65E-05	< 0.50	< 5.0E-04	< 7.54E-05	< 3.72E-05
1,1,2-Trichloroethane	133.4033	< 0.5	< 5.0E-04	< 9.54E-05	< 4.82E-05	< 0.5	< 5.0E-04	< 8.70E-05	< 4.20E-05	< 0.5	< 5.0E-04	< 8.94E-05	< 4.38E-05	< 0.50	< 5.0E-04	< 9.06E-05	< 4.47E-05
Toluene	92.1384	**0.96**	**9.6E-04**	**1.27E-04**	**6.39E-05**	**4.4**	**4.4E-03**	**5.29E-04**	**2.55E-04**	**11**	**1.1E-02**	**1.36E-03**	**6.66E-04**	**5.45**	**5.5E-03**	**6.71E-04**	**3.28E-04**
2-Hexanone	100.1589	< 1.0	< 1.0E-03	< 1.43E-04	< 7.24E-05	< 1.0	< 1.0E-03	< 1.31E-04	< 6.30E-05	< 1.0	< 1.0E-03	< 1.34E-04	< 6.58E-05	< 1.00	< 1.0E-03	< 1.36E-04	< 6.71E-05
Tetrachloroethene	165.833	< 0.5	< 5.0E-04	< 1.19E-04	< 5.99E-05	< 0.5	< 5.0E-04	< 1.08E-04	< 5.22E-05	< 0.5	< 5.0E-04	< 1.11E-04	< 5.45E-05	< 0.50	< 5.0E-04	< 1.13E-04	< 5.55E-05
Dibromochloromethane	208.279	< 0.5	< 5.0E-04	< 1.49E-04	< 7.53E-05	< 0.5	< 5.0E-04	< 1.36E-04	< 6.55E-05	< 0.5	< 5.0E-04	< 1.40E-04	< 6.84E-05	< 0.50	< 5.0E-04	< 1.41E-04	< 6.97E-05
1,2-Dibromoethane	187.861	< 0.5	< 5.0E-04	< 1.34E-04	< 6.79E-05	< 0.5	< 5.0E-04	< 1.22E-04	< 5.91E-05	< 0.5	< 5.0E-04	< 1.26E-04	< 6.17E-05	< 0.50	< 5.0E-04	< 1.28E-04	< 6.29E-05
Chlorobenzene	112.5566	< 0.5	< 5.0E-04	< 8.05E-05	< 4.07E-05	< 0.5	< 5.0E-04	< 7.34E-05	< 3.54E-05	< 0.5	< 5.0E-04	< 7.54E-05	< 3.70E-05	< 0.50	< 5.0E-04	< 7.64E-05	< 3.77E-05
Ethyl benzene	106.1650	< 0.5	< 5.0E-04	< 7.59E-05	< 3.84E-05	< 0.5	< 5.0E-04	< 6.92E-05	< 3.34E-05	< 0.5	< 5.0E-04	< 7.11E-05	< 3.49E-05	< 0.50	< 5.0E-04	< 7.21E-05	< 3.56E-05
m,p-Xylene	106.1650	< 1.0	< 1.0E-03	< 1.52E-04	< 7.67E-05	< 1.0	< 1.0E-03	< 1.38E-04	< 6.68E-05	< 1.0	< 1.0E-03	< 1.42E-04	< 6.98E-05	< 1.00	< 1.0E-03	< 1.44E-04	< 7.11E-05
o-Xylene	106.1650	< 0.5	< 5.0E-04	< 7.59E-05	< 3.84E-05	< 0.5	< 5.0E-04	< 6.92E-05	< 3.34E-05	< 0.5	< 5.0E-04	< 7.11E-05	< 3.49E-05	< 0.50	< 5.0E-04	< 7.21E-05	< 3.56E-05
Styrene	104.1491	< 1.0	< 1.0E-03	< 1.49E-04	< 7.53E-05	< 1.0	< 1.0E-03	< 1.36E-04	< 6.55E-05	< 1.0	< 1.0E-03	< 1.40E-04	< 6.84E-05	< 1.00	< 1.0E-03	< 1.41E-04	< 6.98E-05
Bromoform	252.731	< 1.0	< 1.0E-03	< 3.62E-04	< 1.83E-04	< 1.0	< 1.0E-03	< 3.29E-04	< 1.59E-04	< 1.0	< 1.0E-03	< 3.39E-04	< 1.66E-04	< 1.00	< 1.0E-03	< 3.43E-04	< 1.69E-04
1,1,2,2-Tetrachloroethane	167.8481	< 0.5	< 5.0E-04	< 1.20E-04	< 6.07E-05	< 0.5	< 5.0E-04	< 1.09E-04	< 5.28E-05	< 0.5	< 5.0E-04	< 1.12E-04	< 5.52E-05	< 0.50	< 5.0E-04	< 1.14E-04	< 5.62E-05
4-Ethyl toluene	120.1916	< 1.0	< 1.0E-03	< 1.72E-04	< 8.69E-05	< 1.0	< 1.0E-03	< 1.57E-04	< 7.56E-05	< 1.0	< 1.0E-03	< 1.61E-04	< 7.90E-05	< 1.00	< 1.0E-03	< 1.63E-04	< 8.05E-05
1,3,5-Trimethylbenzene	120.1916	< 1.0	< 1.0E-03	< 1.72E-04	< 8.69E-05	< 1.0	< 1.0E-03	< 1.57E-04	< 7.56E-05	< 1.0	< 1.0E-03	< 1.61E-04	< 7.90E-05	< 1.00	< 1.0E-03	< 1.63E-04	< 8.05E-05
1,2,4-Trimethylbenzene	120.195	< 1.0	< 1.0E-03	< 1.72E-04	< 8.69E-05	< 1.0	< 1.0E-03	< 1.57E-04	< 7.56E-05	< 1.0	< 1.0E-03	< 1.61E-04	< 7.90E-05	< 1.00	< 1.0E-03	< 1.63E-04	< 8.05E-05
1,3-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 2.10E-04	< 1.06E-04	< 1.0	< 1.0E-03	< 1.92E-04	< 9.25E-05	< 1.0	< 1.0E-03	< 1.97E-04	< 9.66E-05	< 1.00	< 1.0E-03	< 2.00E-04	< 9.85E-05
1,4-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 2.10E-04	< 1.06E-04	< 1.0	< 1.0E-03	< 1.92E-04	< 9.25E-05	< 1.0	< 1.0E-03	< 1.97E-04	< 9.66E-05	< 1.00	< 1.0E-03	< 2.00E-04	< 9.85E-05
Benzyl chloride	126.5832	< 1.0	< 1.0E-03	< 1.81E-04	< 9.15E-05	< 1.0	< 1.0E-03	< 1.65E-04	< 7.97E-05	< 1.0	< 1.0E-03	< 1.70E-04	< 8.32E-05	< 1.00	< 1.0E-03	< 1.72E-04	< 8.48E-05
1,2-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 2.10E-04	< 1.06E-04	< 1.0	< 1.0E-03	< 1.92E-04	< 9.25E-05	< 1.0	< 1.0E-03	< 1.97E-04	< 9.66E-05	< 1.00	< 1.0E-03	< 2.00E-04	< 9.85E-05
1,2,4-Trichlorobenzene	181.4461	< 1.0	< 1.0E-03	< 2.60E-04	< 1.31E-04	< 1.0	< 1.0E-03	< 2.37E-04	< 1.14E-04	< 1.0	< 1.0E-03	< 2.43E-04	< 1.19E-04	< 1.00	< 1.0E-03	< 2.46E-04	< 1.22E-04
Hexachloro-1,3-butadiene	260.7590	< 1.0	< 1.0E-03	< 3.73E-04	< 1.88E-04	< 1.0	< 1.0E-03	< 3.40E-04	< 1.64E-04	< 1.0	< 1.0E-03	< 3.49E-04	< 1.71E-04	< 1.00	< 1.0E-03	< 3.54E-04	< 1.75E-04

Italized compounds are on the Oregon Ambient Benchmark Concentration list
Bold compounds are on the Oregon Air Toxics list
Blue text indicates results measured above the reporting limit (RL).
The symbol '<' indicates that the actual result is less than the numerical value listed. For laboratory results (ppb) the value listed is the RL and is used in all subsequent calculations.
Concentrations and emission rates calculated from '<' lab results are also identified with a '<' symbol.

Hollingsworth & Vose
Corvallis, OR
CFU 113 Tentatively Identified Compounds (TIC)

Run Number	1	2	3
Sample Collection Date	12/13/2022	12/13/2022	12/13/2022
Glass Production Rate Supplied by H&V (lb/hr)	3,959.3	4,143.4	4,077.5
Volumetric Flow Rate measured by Bison (dscfm)	9,183	8,368	8,600

Analyte	Molecular Weight	CFU 113-1				CFU 113-2				CFU 113-3				CFU 113 Averages			
	g/mol	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass
Propene	42.08	81	8.1E-02	4.88E-03	2.46E-03	88	8.8E-02	4.83E-03	2.33E-03	83	8.3E-02	4.68E-03	2.30E-03	84.00	8.4E-02	4.79E-03	2.36E-03
Acetaldehyde	44.053	31	3.1E-02	1.95E-03	9.87E-04	34	3.4E-02	1.95E-03	9.43E-04	36	3.6E-02	2.12E-03	1.04E-03	33.67	3.4E-02	2.01E-03	9.91E-04
2-Butene	56.1063	40	4.0E-02	3.21E-03	1.62E-03	41	4.1E-02	3.00E-03	1.45E-03					40.50	4.1E-02	3.10E-03	1.53E-03
Butane	58.12	10	1.0E-02	8.32E-04	4.20E-04	12	1.2E-02	9.09E-04	4.39E-04	10	1.0E-02	7.79E-04	3.82E-04	10.67	1.1E-02	8.40E-04	4.14E-04
Cyclopropane, ethyl-	42.0800	12	1.2E-02	7.22E-04	3.65E-04	13	1.3E-02	7.13E-04	3.44E-04	11	1.1E-02	6.20E-04	3.04E-04	12.00	1.2E-02	6.85E-04	3.38E-04
Pentane	72.150	8.4	8.4E-03	8.67E-04	4.38E-04	8.1	8.1E-03	7.62E-04	3.68E-04	5.2	5.2E-03	5.03E-04	2.47E-04	7.23	7.2E-03	7.11E-04	3.51E-04
3-Penten-1-yne	66.101					14	1.4E-02	1.21E-03	5.82E-04					14.00	1.4E-02	1.21E-03	5.82E-04
3-Penten-1-yne, (E)-	66.101	12	1.2E-02	1.13E-03	5.73E-04									12.00	1.2E-02	1.13E-03	5.73E-04
1-Hexene	84.1600	19	1.9E-02	2.29E-03	1.16E-03					22	2.2E-02	2.48E-03	1.22E-03	20.50	2.1E-02	2.38E-03	1.19E-03
Pentane, 2,4-dimethyl-	100.20	8.4	8.4E-03	1.20E-03	6.08E-04									8.40	8.4E-03	1.20E-03	6.08E-04
Butane, 2,2,3,3-tetramethyl-	114.2285	19	1.9E-02	3.11E-03	1.57E-03									19.00	1.9E-02	3.11E-03	1.57E-03
*1-Propene, 2-methyl-	56.1063					5.8	5.8E-03	4.24E-04	2.05E-04	35	3.5E-02	2.63E-03	1.29E-03	20.40	2.0E-02	1.53E-03	7.48E-04
1,2-Pentadiene	68.1170					7.1	7.1E-03	6.31E-04	3.04E-04					7.10	7.1E-03	6.31E-04	3.04E-04
1-Butene	68.1170									5.8	5.8E-03	5.29E-04	2.60E-04	5.80	5.8E-03	5.29E-04	2.60E-04
1-Heptene	98.1861									7	7.0E-03	9.21E-04	4.52E-04	7.00	7.0E-03	9.21E-04	4.52E-04
*1-Propene, 2-methyl-	56.1063					24	2.4E-02	1.76E-03	8.47E-04	5.2					2.4E-02	1.76E-03	8.47E-04

* This TIC has two separate results in the ALS analytical report. Both are presented here.
Note: Concentrations listed for all TICs are estimated values.

Bison Engineering, Inc
TO-15 Example Calculations

Client:	**Hollingsworth & Vose**	**Run:**	1
Location:	**Corvallis, OR**	**Start Time:**	6:55
Source:	**CFU 113**	**End Time:**	7:54
Method:	**TO-15**	**Date:**	12/13/2022

Ex. Run 1 1,3-Butadiene

1.) Laboratory results = 16 ppbvd

2.) ppmvd = ppbvd/1,000 = 0.016 ppmvd

3.) lb/hr = (ppmvd*dscfm*MW*1.558E-07) = 1.24E-03 lb/hr

where MW:	54.0904	
flow rate:	9,183	dscfm
ppmvd:	0.016	
Conversion Factor:	1.558E-07	

4.) lb/ton glass = lb/hr / (Production rate/2,000) = 6.25E-04 lb/ton glass

where lb/hr:	1.24E-03	
Production Rate:	3,959.3	lb/hr glass produced

Bison Engineering, Inc.
Gaseous Testing Summary

Client:	**Hollingsworth & Vose**	Source:	**CFU 113**
Facility:	**Glass Plant 1**	Test Date:	**December 13, 2022**
Location:	**Corvallis, OR**		

Environmental Conditions / Test Notes: 40 °F and Foggy

Run		1	2	3	Average
Date		12/13/2022	12/13/2022	12/13/2022	
Run Start Time		6:55	8:05	9:20	
Run End Time		7:54	9:04	10:19	
Duration, min.		61	61	61	
Stack Diameter, in.		20.00	20.00	20.00	
Stack Area, sq.ft.		2.182	2.182	2.182	
Barometric Pressure, "Hg		30.00	30.01	30.01	30.01
Static Pressure, "H_2O		0.70	0.70	0.70	0.70
Stack Temperature, °F		125	128	122	125
CO_2, %vd		0.77	0.77	0.82	0.79
O_2, %vd		20.53	20.52	20.54	20.53
H_2O, %v		1.44	1.65	1.68	1.59
Wet Molecular Weight, lb/lb-mole		28.78	28.76	28.77	28.77
Velocity, FPS		78.54	72.06	73.34	74.64
WSCFM		9,317	8,509	8,747	8,858
DSCFM		9,183	8,368	8,600	8,717
Production Data, Total Glass Melt	lb/hr	3,959.3	4,143.4	4,077.5	4,060.0
Production Data, L1	lb/hr	2095.9	2107.0	2057.0	2,086.6
Production Data, L2	lb/hr	1863.4	2036.4	2020.5	1,973.4

Note: Negative concentrations are reported as zero.

Bison Engineering, Inc.
Pre-Test Traverse

Client: **Hollingsworth & Vose**
Location: **Corvallis, OR**
Source: **CFU 113**

Stack Temp: NA °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	NA	2
2	NA	3
3	NA	0
4	NA	1
5	NA	0
6	NA	2
7	NA	1
8	NA	0

Average: NA 1
Flow is found to be: Non-cyclonic

No nozzle was needed for flow measurements, therefore no pre-velocity measurements or stack temperature was recorded prior to testing.

Bison Engineering, Inc.
EPA Method 1
Stack Parameters and Traverse Points

Client: **Hollingsworth & Vose**
Location: **Corvallis, OR**
Source: **CFU 113**
Facility: **Glass Plant 1**

Type of Testing: V 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.):	40.00	feet
Stack height (approx.):	7.00	feet
Circular ID (Rectangular Depth):	20.00	inches
Port depth and/or wall thickness:	6.00	inches
Stack width (Rectangular only):		inches

Equivalent Diameter
If rectangular = $\frac{2*Depth*Width}{Depth + Width}$ = 20.00 inches (If circular = duct ID)

Stack/duct area = 2.182 sq. feet 314.2 sq. inches

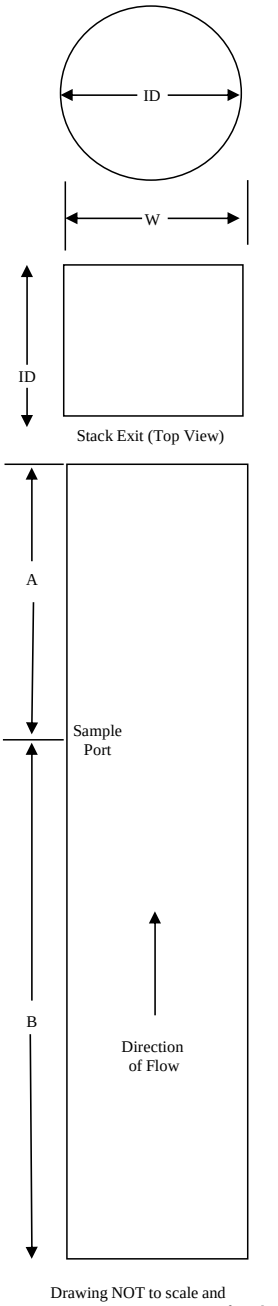
Sample Port Location:	Downstream flow disturbance from process B	Upstream flow disturbance toward exit A
Number of Inches:	165.00	96.00
Number of Diameters:	8.25	4.80

Minimum Number of Traverse Points: 8

Traverse points less than 0.50 inch from the stack wall are relocated to a distance of 0.50 inch.

Points	% of diameter	Distance from inside wall (in.)	Distance including port (in.)
1	6.7	1.34	7 3/8
2	25.0	5.00	11
3	75.0	15.00	21
4	93.3	18.66	24 5/8

Reference Diagram



Drawing NOT to scale and
NOT an accurate representation of stack.

Bison Engineering, Inc.
Method 2
Stack Gas Velocity and Volumetric Flow Rate

Client:	**Hollingsworth & Vose**	**Source:**	**CFU 113**
Facility:	**Glass Plant 1**	**Test Date:**	**12/13/22**
Location:	**Corvallis, OR**		

Molecular Weight		
Choose One by "x" below		
Measured	Ambient	Combustion
x		

Pitot ID	4E

Leak Checks:	Run 1		Run 2		Run 3	
	Pre	Post	Pre	Post	Pre	Post
Pitot	x	x	x	x	x	x
Barometric Pressure ("Hg)	30.00		30.01		30.01	

		Run 1		Run 2		Run 3	
Traverse	Sample Point	Velocity ΔP ("H_2O)	Stack Temperature (°F)	Velocity ΔP ("H_2O)	Stack Temperature (°F)	Velocity ΔP ("H_2O)	Stack Temperature (°F)
A	1	1.90	125	1.60	127	1.50	120
	2	2.00	124	1.70	128	1.60	122
	3	2.00	126	1.70	129	1.60	123
	4	1.80	125	1.40	129	1.40	123
B	1	1.70	124	1.50	126	1.60	121
	2	1.80	125	1.50	128	1.60	123
	3	1.60	126	1.40	128	1.50	123
	4	1.40	126	1.10	129	1.60	123
Method 2 -Flow Calculations							
Static Pressure, "H_2O			0.70		0.70		0.70
Pitot tube cp			0.84		0.84		0.84
Stack Area, ft^3			2.182		2.182		2.182
H_2O, %v			1.44		1.65		1.68
Average √ΔP			1.330		1.217		1.245
Average Absolute Temp. (°R)			584.8		587.7		581.9
Stack Pressure (in. Hg)			30.05		30.06		30.06
Stack Velocity (ft/sec)			78.54		72.06		73.34
Actual Flow Rate (acfm)			10,280		9,432		9,600
Standard Flow Rate (wscf/hr)			559,007		510,511		524,791
Dry Standard Flow Rate (dscf/hr)			550,957		502,088		515,975
Dry Standard Flow Rate (dscfm)			9,183		8,368		8,600

	O_2	CO_2	Calculated N_2
Run 1	20.53	0.77	78.70
Run 2	20.52	0.77	78.70
Run 3	20.54	0.82	78.64

	Molecular Weight (lb/lb-mole)					
	Calculated		Ambient		Combustion	
Run1	M_d	28.94	M_d		M_d	
	M_s	28.78	M_s		M_s	
Run 2	M_d	28.94	M_d		M_d	
	M_s	28.76	M_s		M_s	
Run 3	M_d	28.95	M_d		M_d	
	M_s	28.77	M_s		M_s	

Bison Engineering, Inc.
Moisture Field Data

Client:	**Hollingsworth & Vose**	**Meterbox ID:**	Box 11
Facility:	**Glass Plant 1**	**Meter "Y"-Factor**	0.9690
Location:	**Corvallis, OR**		
Source:	**CFU 113**		
Test date:	**12/13/2022**		

Moisture Field Data Entry

Run 1

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	16	7
Start Time	6:55	
End Time	7:55	
Bp, "Hg	30.00	

Minutes	Meter Volume	Meter °F	Condenser °F	Delta H
	170.350			
5	174.180	40	41	1.800
10	177.970	40	41	1.800
15	181.760	40	44	1.800
20	185.530	40	44	1.800
25	189.310	41	44	1.800
30	192.980	41	46	1.800
35	196.990	42	46	1.800
40	200.620	42	46	1.800
45	204.400	42	46	1.800
50	208.190	43	48	1.800
55	211.980	43	47	1.800
60	215.760	44	48	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	779.7	784.5	4.8
2	767.5	768.9	1.4
3	695.9	696.5	0.6
Silica Gel	976.1	983.8	7.7
Impinger Totals:	2,243.1	3,233.7	6.8

Moisture Field Data Entry

Run 2

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	5
Start Time	8:05	
End Time	9:05	
Bp, "Hg	30.01	

Meter Volume	Meter °F	Condenser °F	Delta H
216.205			
219.970	43	37	1.800
223.600	44	40	1.800
227.430	44	42	1.800
231.190	44	44	1.800
235.120	45	44	1.800
238.680	44	45	1.800
242.510	44	46	1.800
246.250	44	46	1.800
249.878	44	48	1.800
253.600	44	48	1.800
257.340	44	46	1.800
259.990	45	47	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	747.9	754.2	6.3
2	774.4	775.9	1.5
3	613.9	614.8	0.9
Silica Gel	871.6	878.8	7.2
Impinger Totals:	3,007.8	3,023.7	8.7

Moisture Field Data Entry

Run 3

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	17	7
Start Time	9:20	
End Time	10:20	
Bp, "Hg	30.01	

Meter Volume	Meter °F	Condenser °F	Delta H
261.415			
265.310	43	35	1.800
269.080	43	36	1.800
273.000	43	35	1.800
277.040	43	42	1.800
280.060	44	42	1.800
284.310	44	42	1.800
288.430	43	44	1.800
292.010	44	43	1.800
296.430	45	45	1.800
299.510	45	45	1.800
303.320	45	45	1.800
307.105	45	44	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	784.5	792.6	8.1
2	768.9	769.9	1.0
3	696.5	696.8	0.3
Silica Gel	983.8	991.3	7.5
Impinger Totals:	3,233.7	3,250.6	9.4

Bison Engineering, Inc.
Method 4 Moisture Calculations

Client: **Hollingsworth & Vose**
Facility: **Glass Plant 1**
Location: **Corvallis, OR**
Source: **CFU 113**
Test date: **12/13/2022**

Method 4 -Moisture Determination					
Run Number	#	1	2	3	
Start Time	hh:mm	6:55	8:05	9:20	
Meter Box Identification	#	Box 11	Box 11	Box 11	
Meter "Y" Factor	Factor	0.9690	0.9690	0.9690	
Barometric Pressure	in Hg	30.00	30.01	30.01	
Sample Duration	hh:mm	1:00	1:00	1:00	
Average Meter Temperature	Deg F	41.5	44.1	43.9	
Average Condenser Temperature	Deg F	45.1	44.4	41.5	
Average Delta H	in H2O	1.800	1.800	1.800	
Average Meter Pressure	in Hg	30.132	30.142	30.142	
Meter Volume Start	dcf	170.350	216.205	261.415	
Meter Volume End	dcf	215.760	259.990	307.105	
Meter Volume	dcf	45.410	43.785	45.690	
Corrected Meter Volume	dscf	46.657	44.772	46.735	
Impinger Gain	g	6.8	8.7	9.4	
Silica Gel Gain	g	7.7	7.2	7.5	Average
Volume of Condensed Water Vapor	scf	0.684	0.750	0.797	0.744
Moisture Calculation	Bws	0.0144	0.0165	0.0168	0.016
Percent Moisture	Bws%	1.44	1.65	1.68	1.59

Bison Engineering, Inc.
Method 3A Oxygen
Calibration Error, System Bias and System Drift

Client:	**Hollingsworth & Vose**	Source:	**CFU 113**	Instrument Make:	**Servomex**
Facility:	**Glass Plant 1**	Date:	**December 13, 2022**	Instrument Model:	**1440**
Location:	**Corvallis, OR**			Instrument Serial #:	**01440D1-5041**

			Initial Values			Final Values								
		Analyzer Cal. Response	System Cal Response	Pre test System Cal. Bias % of span	pass/fail	System Cal Response	Post test System Cal. Bias % of span	pass/fail	System Drift % of span	pass/fail	Analyzer Span	Raw Avg Gas Conc	Corrected Gas Conc	Instrument Cal. Reference Gas
Run 1	zero	-0.02	0.08	0.46	pass	0.09	0.50	pass	0.05	pass				
	upscale	10.01	9.98	-0.14	pass	10.08	0.32	pass	0.46	pass	21.94	20.40	20.53	10.05
Run 2	zero	-0.02	0.09	0.50	pass	0.09	0.50	pass	0.00	pass				
	upscale	10.01	10.08	0.32	pass	10.08	0.32	pass	0.00	pass	21.94	20.49	20.52	10.05
Run 3	zero	-0.02	0.09	0.50	pass	0.09	0.50	pass	0.00	pass				
	upscale	10.01	10.08	0.32	pass	10.08	0.32	pass	0.00	pass	21.94	20.51	20.54	10.05
				< 5%*			**< 5%***		**< 3%***					

Analyzer Calibration Error	**Zero**	**Mid**	**High**
Calibration Gas Standards	0	10.05	21.94
Cylinder Number		CC503830	SA20406
Calibration Gas Analyzer Response	-0.02	10.01	22.00
Analyzer Calibration Error	-0.09	-0.18	0.27
Analyzer Calibration Error < 2%*	pass	pass	pass

System Response Time	
31	seconds

System Leak Check		
	Completed	**Pass/Fail**
Pre-test	Yes	Pass
Post-test	Yes	Pass

Note: All units are in %
*Or < 0.5 % absolute difference

Bison Engineering, Inc.
Method 3A CO_2
Calibration Error, System Bias and System Drift

Client:	**Hollingsworth & Vose**	Source:	**CFU 113**	Instrument Make:	**Servomex**
Facility:	**Glass Plant 1**	Date:	**December 13, 2022**	Instrument Model:	**1440**
Location:	**Corvallis, OR**			Instrument Serial #:	**01440D1-5041**

			Initial Values			Final Values								
		Analyzer Cal. Response	System Cal Response	Pre test System Cal. Bias % of span	pass/fail	System Cal Response	Post test System Cal. Bias % of span	pass/fail	System Drift % of span	pass/fail	Analyzer Span	Raw Avg Gas Conc	Corrected Gas Conc	Instrument Cal. Reference Gas
Run 1	zero	-0.01	0.03	0.18	pass	0.02	0.14	pass	0.05	pass				
	upscale	9.82	9.92	0.46	pass	9.83	0.05	pass	0.41	pass	21.70	0.79	0.77	9.951
Run 2	zero	-0.01	0.02	0.14	pass	0.04	0.23	pass	0.09	pass				
	upscale	9.82	9.83	0.05	pass	10.03	0.97	pass	0.92	pass	21.70	0.80	0.77	9.951
Run 3	zero	-0.01	0.04	0.23	pass	0.02	0.14	pass	0.09	pass				
	upscale	9.82	10.03	0.97	pass	10.01	0.88	pass	0.09	pass	21.70	0.85	0.82	9.951
				< 5%*			**< 5%***		**< 3%***					

Analyzer Calibration Error	Zero	Mid	High
Calibration Gas Standards	0	9.951	21.70
Cylinder Number		CC503830	SA20406
Calibration Gas Analyzer Response	-0.01	9.82	21.89
Analyzer Calibration Error	-0.05	-0.60	0.88
Analyzer Calibration Error < 2%*	pass	pass	pass

System Response Time	
29	seconds

System Leak Check		
	Completed	**Pass/Fail**
Pre-test	Yes	Pass
Post-test	Yes	Pass

Note: All units are in %
*Or < 0.5 % absolute difference

Bison Engineering, Inc.
EPA Method 2-4
Example Calculations

Client:	**Hollingsworth & Vose**	Run:	**1**
Location:	**Corvallis, OR**	Start Time:	**6:55**
Source:	**CFU 113**	End Time:	**7:54**
		Date:	**12/13/2022**

EPA Methods 2-4:

1) P_m . $P_b + (\Delta H/13.6)$ = 32.206 "Hg

where P_b:	30.00	"Hg
ΔH:	30.000	"H_2O

2) $P_s = P_b$ + (Static Press./13.6) = 30.051 "Hg

where P_b:	30.00	"Hg
Static Press.:	0.70	"H_2O

3) $V_m(std) = V_m(Tstd/Pstd)(Y)\left(\frac{P_m}{T_m}\right)$ = 46.657 dscf

where Vm:	45.410	dcf
Y:	0.9690	
P_m:	30.132	"Hg
P_{std}:	29.92	"Hg
T_{std}:	527.67	°R
T_m:	41.5	°F

4) $V_w(std) = V_{lc}\frac{(R)(Tstd)(H2O\ Conv.)}{(M_w)(P_{std})}$ = 0.684 scf

where V_{lc}:	14.50	g
R:	21.85	("Hg)(ft^3)/(°R)(lb/-mole)
T_{std}:	527.67	°R
M_w:	18.015	lb/lb-mol
P_{std}:	29.92	"Hg
water conversion:	0.0022046	lb/gram water

5) $B_{ws} = \left(\frac{Vw(std)}{Vw(std)+Vm(std)}\right)$ = 0.0144

where V_w(std):	0.684	scf
V_m(std):	46.657	dscf

6) % H_2O = Bws x 100 = 1.44 %v

7) $V_m(actual) = \left(\frac{Y\ x\ Vm}{(1-Bws)}\right)\left(\frac{T_s}{T_m}\right)\left(\frac{P_m}{Ps}\right)$ = 55.831 awcf

where Y:	0.9690	
V_m:	45.410	dcf
B_{ws}:	0.0144	
T_s:	584.8	°R
T_m:	501.2	°R
P_m:	32.206	"Hg
P_s:	30.051	"Hg

8) $M_d = 0.44(CO_2) + 0.32(O_2) + 0.28(N_2 + CO)$ = 28.94 lb/lb-mole

where CO_2:	0.77	%vd
O_2	20.53	%vd
N_2+CO= (100-(O_2+CO_2):	78.70	%vd

9) $M_s = M_d(1 - Bws) + (18 \text{ x } Bws)$ = 28.78 lb/lb-mole
where M_d: 28.94 lb/lb-mole
B_{ws}: 0.0144

10) $\text{Stack Area(cir.)} = 3.1416 \text{ (stack diameter/24)}^2$ = 2.182 sq. ft.
where Stack ID: 20 inches

11) Velocity, $V_s = 85.49(Cp)(\text{Ave. Sqrt } \Delta P)\left(\sqrt{\frac{Ts}{(Ps \text{ x } Ms)}}\right)$ = 78.54 fps
where Cp: 0.84
Ave. Sqrt ΔP: 1.3300
T_s: 584.8 °R
P_s: 30.051 "Hg
M_s: 28.78 lb/lb-mole

12) $ACFM = (V_s)(\text{stack area})(60 \text{ sec/min})$ = 10,281 ACFM
where V_s: 78.54 ft/sec
Stack Area: 2.182 sq. ft

13) $ADCFM = (ACFM)(1\text{-}B_{ws})$ = 10,133 ADCFM
where ACFM: 10,281
B_{ws}: 0.0144

14) $Q_{sw} = 3600(V_s)(\text{stack area})\left(\frac{527.67°R}{Ts}\right)\left(\frac{Ps}{29.92 \text{ "Hg}}\right)$ = 559,008 wscf/hr
where V_s: 78.54 ft/sec
Stack Area: 2.1817 sq. ft.
T_s: 584.8 °R
P_s: 30.051 "Hg

15) $Q_{sd} = (\text{wscf/hr})(1\text{-Bws})$ = 550,959 dscf/hr
where wscf/hr: 559,008
B_{ws}: 0.0144

16) DSCFM= (dscf/hr)/60 mins/hr = 9,183 DSCFM
where dscf/hr: 550,959

Bison Engineering, Inc.
EPA Method 3A (O_2)
Example Calculations

Client:	**Hollingsworth & Vose**	Run:	**1**
Location:	**Corvallis, OR**	Start Time:	**6:55**
Source:	**CFU 113**	End Time:	**7:54**
		Date:	**12/13/2022**

EPA Method 3A:

Analyzer Calibration Error (Mid)

1) $ACE = \left(\frac{C_{Dir} - CV}{CS}\right) \times 100 =$ -0.18 %v

where C_{Dir}:	10.01 %
C_V:	10.05 %
CS:	21.94 %

System Bias (Upscale)

2) $SB = \left(\frac{C_S - CDir}{CS}\right) \times 100 =$ -0.14 %v

where C_{Dir}:	10.01 %
C_S:	9.98 %
CS:	21.94 %

Drift Assessment (Upscale)

3) $D = | SB_{Final} - SB_i | =$ 0.46 %v

where SB_{Final}:	0.32 %
SB_i:	-0.14 %

Effluent Gas Concentration

4) $C_{Gas} = (C_{Avg} - C_O)\left(\frac{C_{MA}}{C_M - CO}\right) =$ 20.53 %v

where C_{Avg}:	20.40 %
C_O:	0.09 %
C_{MA}:	10.05 %
C_M:	10.03 %

Bison Engineering, Inc.
EPA Method 3A (CO_2)
Example Calculations

Client:	**Hollingsworth & Vose**	Run:	**1**
Location:	**Corvallis, OR**	Start Time:	**6:55**
Source:	**CFU 113**	End Time:	**7:54**
		Date:	**12/13/2022**

EPA Method 3A:

Analyzer Calibration Error (Mid)

1) $ACE = \left(\frac{C_{Dir} - CV}{CS}\right) \times 100 =$ -0.60 %v

where C_{Dir}:	9.82	%
C_V:	9.95	%
CS:	21.70	%

System Bias (Upscale)

2) $SB = \left(\frac{C_S - CDir}{CS}\right) \times 100 =$ 0.46 %v

where C_{Dir}:	9.82	%
C_S:	9.92	%
CS:	21.70	%

Drift Assessment (Upscale)

3) $D = | SB_{Final} - SB_i | =$ 0.41 %v

where SB_{Final}:	0.05	%
SB_i:	0.46	%

Effluent Gas Concentration

4) $C_{Gas} = (C_{Avg} - C_O)\left(\frac{C_{MA}}{C_M - CO}\right) =$ 0.77 %v

where C_{Avg}:	0.79	%
C_O:	0.03	%
C_{MA}:	9.95	%
C_M:	9.88	%

APPENDIX B: CFU 112 TEST DATA

Hollingsworth & Vose
Corvallis, OR
CFU 112 Speciated Organic Toxic Air Contaminants (TAC)

Run Number	1	2	3
Sample Collection Date	12/13/2022	12/13/2022	12/13/2022
Glass Production Rate Supplied by H&V (lb/hr)	700.8	692.8	700.0
Volumetric Flow Rate Measured by Bison (dscfm)	17,558	16,954	17,698

Analyte	Molecular Weight	CFU 112-1				CFU 112-2				CFU 112-3				CFU 112 Averages			
	g/mol	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass
Dichlorodifluoromethane	120.9129	< 0.5	< 5.0E-04	< 1.65E-04	< 4.72E-04	< 0.5	< 5.0E-04	< 1.60E-04	< 4.61E-04	< 0.5	< 5.0E-04	< 1.67E-04	< 4.76E-04	< 0.50	< 5.0E-04	< 1.64E-04	< 4.70E-04
Chloromethane	50.4872	< 0.5	< 5.0E-04	< 6.91E-05	< 1.97E-04	< 0.5	< 5.0E-04	< 6.67E-05	< 1.92E-04	< 0.5	< 5.0E-04	< 6.96E-05	< 1.99E-04	< 0.50	< 5.0E-04	< 6.84E-05	< 1.96E-04
Freon 114	170.92	< 0.5	< 5.0E-04	< 2.34E-04	< 6.67E-04	< 0.5	< 5.0E-04	< 2.26E-04	< 6.52E-04	< 0.5	< 5.0E-04	< 2.36E-04	< 6.73E-04	< 0.50	< 5.0E-04	< 2.32E-04	< 6.64E-04
Vinyl chloride	62.50	< 0.5	< 5.0E-04	< 8.55E-05	< 2.44E-04	< 0.5	< 5.0E-04	< 8.25E-05	< 2.38E-04	< 0.5	< 5.0E-04	< 8.62E-05	< 2.46E-04	< 0.50	< 5.0E-04	< 8.47E-05	< 2.43E-04
1,3-Butadiene	54.0904	**0.58**	**5.8E-04**	**8.58E-05**	**2.45E-04**	< 0.5	< 5.0E-04	< 7.14E-05	< 2.06E-04	< 0.5	< 5.0E-04	< 7.46E-05	< 2.13E-04	< **0.53**	< **5.3E-04**	< **7.73E-05**	< **2.21E-04**
Bromomethane	94.94	< 0.5	< 5.0E-04	< 1.30E-04	< 3.71E-04	< 0.5	< 5.0E-04	< 1.25E-04	< 3.62E-04	< 0.5	< 5.0E-04	< 1.31E-04	< 3.74E-04	< 0.50	< 5.0E-04	< 1.29E-04	< 3.69E-04
Chloroethane	64.51	< 0.5	< 5.0E-04	< 8.82E-05	< 2.52E-04	< 0.5	< 5.0E-04	< 8.52E-05	< 2.46E-04	< 0.5	< 5.0E-04	< 8.89E-05	< 2.54E-04	< 0.50	< 5.0E-04	< 8.75E-05	< 2.51E-04
Freon 11	137.3672	< 0.5	< 5.0E-04	< 1.88E-04	< 5.36E-04	< 0.5	< 5.0E-04	< 1.81E-04	< 5.24E-04	< 0.5	< 5.0E-04	< 1.89E-04	< 5.41E-04	< 0.50	< 5.0E-04	< 1.86E-04	< 5.34E-04
Freon 113	187.38	< 0.5	< 5.0E-04	< 2.56E-04	< 7.31E-04	< 0.5	< 5.0E-04	< 2.47E-04	< 7.14E-04	< 0.5	< 5.0E-04	< 2.58E-04	< 7.38E-04	< 0.50	< 5.0E-04	< 2.54E-04	< 7.28E-04
1,1-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.33E-04	< 3.78E-04	< 0.5	< 5.0E-04	< 1.28E-04	< 3.70E-04	< 0.5	< 5.0E-04	< 1.34E-04	< 3.82E-04	< 0.50	< 5.0E-04	< 1.31E-04	< 3.77E-04
Acetone	58.08	**67**	**6.7E-02**	**1.06E-02**	**3.04E-02**	**46**	**4.6E-02**	**7.06E-03**	**2.04E-02**	**15**	**1.5E-02**	**2.40E-03**	**6.86E-03**	**42.67**	**4.3E-02**	**6.70E-03**	**1.92E-02**
Carbon disulfide	76.143	< 0.5	< 5.0E-04	< 1.04E-04	< 2.97E-04	< 0.5	< 5.0E-04	< 1.01E-04	< 2.90E-04	< 0.5	< 5.0E-04	< 1.05E-04	< 3.00E-04	< 0.50	< 5.0E-04	< 1.03E-04	< 2.96E-04
Methylene chloride	84.9320	< 0.5	< 5.0E-04	< 1.16E-04	< 3.32E-04	< 0.5	< 5.0E-04	< 1.12E-04	< 3.24E-04	< 0.5	< 5.0E-04	< 1.17E-04	< 3.35E-04	< 0.50	< 5.0E-04	< 1.15E-04	< 3.30E-04
trans-1,2-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.33E-04	< 3.78E-04	< 0.5	< 5.0E-04	< 1.28E-04	< 3.70E-04	< 0.5	< 5.0E-04	< 1.34E-04	< 3.82E-04	< 0.50	< 5.0E-04	< 1.31E-04	< 3.77E-04
Methyl t-butyl ether	88.1482	< 0.5	< 5.0E-04	< 1.21E-04	< 3.44E-04	< 0.5	< 5.0E-04	< 1.16E-04	< 3.36E-04	< 0.5	< 5.0E-04	< 1.22E-04	< 3.47E-04	< 0.50	< 5.0E-04	< 1.20E-04	< 3.42E-04
Vinyl acetate	86.0892	< 0.5	< 5.0E-04	< 1.18E-04	< 3.36E-04	< 0.5	< 5.0E-04	< 1.14E-04	< 3.28E-04	< 0.5	< 5.0E-04	< 1.19E-04	< 3.39E-04	< 0.50	< 5.0E-04	< 1.17E-04	< 3.34E-04
2-Butanone	72.1057	**2.3**	**2.3E-03**	**4.54E-04**	**1.29E-03**	**1.4**	**1.4E-03**	**2.67E-04**	**7.70E-04**	< 0.5	< 5.0E-04	< 9.94E-05	< 2.84E-04	< 1.40	< 1.4E-03	< 2.73E-04	< 7.83E-04
cis-1,2-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.33E-04	< 3.78E-04	< 0.5	< 5.0E-04	< 1.28E-04	< 3.70E-04	< 0.5	< 5.0E-04	< 1.34E-04	< 3.82E-04	< 0.50	< 5.0E-04	< 1.31E-04	< 3.77E-04
1,1-Dichloroethane	98.9586	< 0.5	< 5.0E-04	< 1.35E-04	< 3.86E-04	< 0.5	< 5.0E-04	< 1.31E-04	< 3.77E-04	< 0.5	< 5.0E-04	< 1.36E-04	< 3.90E-04	< 0.50	< 5.0E-04	< 1.34E-04	< 3.84E-04
Ethyl acetate	88.1051	< 1.0	< 1.0E-03	< 2.41E-04	< 6.88E-04	< 1.0	< 1.0E-03	< 2.33E-04	< 6.72E-04	< 1.0	< 1.0E-03	< 2.43E-04	< 6.94E-04	< 1.00	< 1.0E-03	< 2.39E-04	< 6.85E-04
Hexane	86.1754	**47**	**4.7E-02**	**1.11E-02**	**3.16E-02**	**22**	**2.2E-02**	**5.01E-03**	**1.45E-02**	**4.8**	**4.8E-03**	**1.14E-03**	**3.26E-03**	**24.60**	**2.5E-02**	**5.74E-03**	**1.64E-02**
Chloroform	119.3767	< 0.5	< 5.0E-04	< 1.63E-04	< 4.66E-04	< 0.5	< 5.0E-04	< 1.58E-04	< 4.55E-04	< 0.5	< 5.0E-04	< 1.65E-04	< 4.70E-04	< 0.50	< 5.0E-04	< 1.62E-04	< 4.64E-04
Tetrahydrofuran	72.1057	< 0.5	< 5.0E-04	< 9.86E-05	< 2.81E-04	< 0.5	< 5.0E-04	< 9.52E-05	< 2.75E-04	< 0.5	< 5.0E-04	< 9.94E-05	< 2.84E-04	< 0.50	< 5.0E-04	< 9.78E-05	< 2.80E-04
1,2-Dichloroethane	98.9586	< 0.5	< 5.0E-04	< 1.35E-04	< 3.86E-04	< 0.5	< 5.0E-04	< 1.31E-04	< 3.77E-04	< 0.5	< 5.0E-04	< 1.36E-04	< 3.90E-04	< 0.50	< 5.0E-04	< 1.34E-04	< 3.84E-04
1,1,1-Trichloroethane	133.4033	< 0.5	< 5.0E-04	< 1.82E-04	< 5.21E-04	< 0.5	< 5.0E-04	< 1.76E-04	< 5.09E-04	< 0.5	< 5.0E-04	< 1.84E-04	< 5.25E-04	< 0.50	< 5.0E-04	< 1.81E-04	< 5.18E-04
Carbon tetrachloride	153.8215	< 0.5	< 5.0E-04	< 2.10E-04	< 6.00E-04	< 0.5	< 5.0E-04	< 2.03E-04	< 5.86E-04	< 0.5	< 5.0E-04	< 2.12E-04	< 6.06E-04	< 0.50	< 5.0E-04	< 2.09E-04	< 5.98E-04
Benzene	78.1118	**12**	**1.2E-02**	**2.56E-03**	**7.32E-03**	**7.3**	**7.3E-03**	**1.51E-03**	**4.35E-03**	**1.7**	**1.7E-03**	**3.66E-04**	**1.05E-03**	**7.00**	**7.0E-03**	**1.48E-03**	**4.24E-03**
Cyclohexane	84.1595	< 0.5	< 5.0E-04	< 1.15E-04	< 3.29E-04	< 0.5	< 5.0E-04	< 1.11E-04	< 3.21E-04	< 0.5	< 5.0E-04	< 1.16E-04	< 3.32E-04	< 0.50	< 5.0E-04	< 1.14E-04	< 3.27E-04
Trichloroethene	131.3874	< 0.5	< 5.0E-04	< 1.80E-04	< 5.13E-04	< 0.5	< 5.0E-04	< 1.74E-04	< 5.01E-04	< 0.5	< 5.0E-04	< 1.81E-04	< 5.18E-04	< 0.50	< 5.0E-04	< 1.78E-04	< 5.10E-04
1,2-Dichloropropane	112.9851	< 0.5	< 5.0E-04	< 1.55E-04	< 4.41E-04	< 0.5	< 5.0E-04	< 1.49E-04	< 4.31E-04	< 0.5	< 5.0E-04	< 1.56E-04	< 4.45E-04	< 0.50	< 5.0E-04	< 1.53E-04	< 4.39E-04
Bromodichloromethane	163.828	< 0.5	< 5.0E-04	< 2.24E-04	< 6.39E-04	< 0.5	< 5.0E-04	< 2.16E-04	< 6.25E-04	< 0.5	< 5.0E-04	< 2.26E-04	< 6.45E-04	< 0.50	< 5.0E-04	< 2.22E-04	< 6.36E-04
Heptane	100.2019	**3.8**	**3.8E-03**	**1.04E-03**	**2.97E-03**	**1.8**	**1.8E-03**	**4.76E-04**	**1.38E-03**	**0.55**	**5.5E-04**	**1.52E-04**	**4.34E-04**	**2.05**	**2.1E-03**	**5.57E-04**	**1.59E-03**
cis-1,3-Dichloropropene	110.9693	< 0.5	< 5.0E-04	< 1.52E-04	< 4.33E-04	< 0.5	< 5.0E-04	< 1.47E-04	< 4.23E-04	< 0.5	< 5.0E-04	< 1.53E-04	< 4.37E-04	< 0.50	< 5.0E-04	< 1.50E-04	< 4.31E-04
4-Methyl-2-pentanone	100.1589	< 0.5	< 5.0E-04	< 1.37E-04	< 3.91E-04	< 0.5	< 5.0E-04	< 1.32E-04	< 3.82E-04	< 0.5	< 5.0E-04	< 1.38E-04	< 3.95E-04	< 0.50	< 5.0E-04	< 1.36E-04	< 3.89E-04
trans-1,3-Dichloropropene	110.9693	< 0.5	< 5.0E-04	< 1.52E-04	< 4.33E-04	< 0.5	< 5.0E-04	< 1.47E-04	< 4.23E-04	< 0.5	< 5.0E-04	< 1.53E-04	< 4.37E-04	< 0.50	< 5.0E-04	< 1.50E-04	< 4.31E-04
1,1,2-Trichloroethane	133.4033	< 0.5	< 5.0E-04	< 1.82E-04	< 5.21E-04	< 0.5	< 5.0E-04	< 1.76E-04	< 5.09E-04	< 0.5	< 5.0E-04	< 1.84E-04	< 5.25E-04	< 0.50	< 5.0E-04	< 1.81E-04	< 5.18E-04
Toluene	92.1384	**31**	**3.1E-02**	**7.81E-03**	**2.23E-02**	**16**	**1.6E-02**	**3.89E-03**	**1.12E-02**	**5.9**	**5.9E-03**	**1.50E-03**	**4.28E-03**	**17.63**	**1.8E-02**	**4.40E-03**	**1.26E-02**
2-Hexanone	100.1589	< 1.0	< 1.0E-03	< 2.74E-04	< 7.82E-04	< 1.0	< 1.0E-03	< 2.65E-04	< 7.64E-04	< 1.0	< 1.0E-03	< 2.76E-04	< 7.89E-04	< 1.00	< 1.0E-03	< 2.72E-04	< 7.78E-04
Tetrachloroethene	165.833	< 0.5	< 5.0E-04	< 2.27E-04	< 6.47E-04	< 0.5	< 5.0E-04	< 2.19E-04	< 6.32E-04	< 0.5	< 5.0E-04	< 2.29E-04	< 6.53E-04	< 0.50	< 5.0E-04	< 2.25E-04	< 6.44E-04
Dibromochloromethane	208.279	< 0.5	< 5.0E-04	< 2.85E-04	< 8.13E-04	< 0.5	< 5.0E-04	< 2.75E-04	< 7.94E-04	< 0.5	< 5.0E-04	< 2.87E-04	< 8.20E-04	< 0.50	< 5.0E-04	< 2.82E-04	< 8.09E-04
1,2-Dibromoethane	187.861	< 0.5	< 5.0E-04	< 2.57E-04	< 7.33E-04	< 0.5	< 5.0E-04	< 2.48E-04	< 7.16E-04	< 0.5	< 5.0E-04	< 2.59E-04	< 7.40E-04	< 0.50	< 5.0E-04	< 2.55E-04	< 7.30E-04
Chlorobenzene	112.5566	< 0.5	< 5.0E-04	< 1.54E-04	< 4.39E-04	< 0.5	< 5.0E-04	< 1.49E-04	< 4.29E-04	< 0.5	< 5.0E-04	< 1.55E-04	< 4.43E-04	< 0.50	< 5.0E-04	< 1.53E-04	< 4.37E-04
Ethyl benzene	106.1650	**0.68**	**6.8E-04**	**1.97E-04**	**5.64E-04**	< 0.5	< 5.0E-04	< 1.40E-04	< 4.05E-04	< 0.5	< 5.0E-04	< 1.46E-04	< 4.18E-04	< **0.56**	< **5.6E-04**	< **1.61E-04**	< **4.62E-04**
m,p-Xylene	106.1650	< 1.0	< 1.0E-03	< 2.90E-04	< 8.29E-04	< 1.0	< 1.0E-03	< 2.80E-04	< 8.10E-04	< 1.0	< 1.0E-03	< 2.93E-04	< 8.36E-04	< 1.00	< 1.0E-03	< 2.88E-04	< 8.25E-04
o-Xylene	106.1650	< 0.5	< 5.0E-04	< 1.45E-04	< 4.14E-04	< 0.5	< 5.0E-04	< 1.40E-04	< 4.05E-04	< 0.5	< 5.0E-04	< 1.46E-04	< 4.18E-04	< 0.50	< 5.0E-04	< 1.44E-04	< 4.12E-04
Styrene	104.1491	< 1.0	< 1.0E-03	< 2.85E-04	< 8.13E-04	< 1.0	< 1.0E-03	< 2.75E-04	< 7.94E-04	< 1.0	< 1.0E-03	< 2.87E-04	< 8.21E-04	< 1.00	< 1.0E-03	< 2.82E-04	< 8.09E-04
Bromoform	252.731	< 1.0	< 1.0E-03	< 6.91E-04	< 1.97E-03	< 1.0	< 1.0E-03	< 6.68E-04	< 1.93E-03	< 1.0	< 1.0E-03	< 6.97E-04	< 1.99E-03	< 1.00	< 1.0E-03	< 6.85E-04	< 1.96E-03
1,1,2,2-Tetrachloroethane	167.8481	< 0.5	< 5.0E-04	< 2.30E-04	< 6.55E-04	< 0.5	< 5.0E-04	< 2.22E-04	< 6.40E-04	< 0.5	< 5.0E-04	< 2.31E-04	< 6.61E-04	< 0.50	< 5.0E-04	< 2.28E-04	< 6.52E-04
4-Ethyl toluene	120.1916	< 1.0	< 1.0E-03	< 3.29E-04	< 9.38E-04	< 1.0	< 1.0E-03	< 3.17E-04	< 9.17E-04	< 1.0	< 1.0E-03	< 3.31E-04	< 9.47E-04	< 1.00	< 1.0E-03	< 3.26E-04	< 9.34E-04
1,3,5-Trimethylbenzene	120.1916	< 1.0	< 1.0E-03	< 3.29E-04	< 9.38E-04	< 1.0	< 1.0E-03	< 3.17E-04	< 9.17E-04	< 1.0	< 1.0E-03	< 3.31E-04	< 9.47E-04	< 1.00	< 1.0E-03	< 3.26E-04	< 9.34E-04
1,2,4-Trimethylbenzene	120.195	< 1.0	< 1.0E-03	< 3.29E-04	< 9.38E-04	< 1.0	< 1.0E-03	< 3.17E-04	< 9.17E-04	< 1.0	< 1.0E-03	< 3.31E-04	< 9.47E-04	< 1.00	< 1.0E-03	< 3.26E-04	< 9.34E-04
1,3-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 4.02E-04	< 1.15E-03	< 1.0	< 1.0E-03	< 3.88E-04	< 1.12E-03	< 1.0	< 1.0E-03	< 4.05E-04	< 1.16E-03	< 1.00	< 1.0E-03	< 3.99E-04	< 1.14E-03
1,4-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 4.02E-04	< 1.15E-03	< 1.0	< 1.0E-03	< 3.88E-04	< 1.12E-03	< 1.0	< 1.0E-03	< 4.05E-04	< 1.16E-03	< 1.00	< 1.0E-03	< 3.99E-04	< 1.14E-03
Benzyl chloride	126.5832	< 1.0	< 1.0E-03	< 3.46E-04	< 9.88E-04	< 1.0	< 1.0E-03	< 3.34E-04	< 9.65E-04	< 1.0	< 1.0E-03	< 3.49E-04	< 9.97E-04	< 1.00	< 1.0E-03	< 3.43E-04	< 9.84E-04
1,2-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 4.02E-04	< 1.15E-03	< 1.0	< 1.0E-03	< 3.88E-04	< 1.12E-03	< 1.0	< 1.0E-03	< 4.05E-04	< 1.16E-03	< 1.00	< 1.0E-03	< 3.99E-04	< 1.14E-03
1,2,4-Trichlorobenzene	181.4461	< 1.0	< 1.0E-03	< 4.96E-04	< 1.42E-03	< 1.0	< 1.0E-03	< 4.79E-04	< 1.38E-03	< 1.0	< 1.0E-03	< 5.00E-04	< 1.43E-03	< 1.00	< 1.0E-03	< 4.92E-04	< 1.41E-03
Hexachloro-1,3-butadiene	260.7590	< 1.0	< 1.0E-03	< 7.13E-04	< 2.04E-03	< 1.0	< 1.0E-03	< 6.89E-04	< 1.99E-03	< 1.0	< 1.0E-03	< 7.19E-04	< 2.05E-03	< 1.00	< 1.0E-03	< 7.07E-04	< 2.03E-03

Italized compounds are on the Oregon Ambient Benchmark Concentration list
Bold compounds are on the Oregon Air Toxics list
Blue text indicates results measured above the reporting limit (RL).
The symbol '<' indicates that the actual result is less than the numerical value listed. For laboratory results (ppb) the value listed is the RL and is used in all subsequent calculations.
Concentrations and emission rates calculated from '<' lab results are also identified with a '<' symbol.

Hollingsworth & Vose
Corvallis, OR
CFU 112 Tentatively Identified Compounds (TIC)

Run Number	1	2	3
Sample Collection Date	12/13/2022	12/13/2022	12/13/2022
Glass Production Rate Supplied by H&V (lb/hr)	700.8	692.8	700.0
Volumetric Flow Rate measured by Bison (dscfm)	17,558	16,954	17,698

Analyte	Molecular Weight	CFU 112-1				CFU 112-2				CFU 112-3				CFU 112 Averages			
	g/mol	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass
Propane	44.097	15	1.5E-02	1.81E-03	5.16E-03	11	1.1E-02	1.28E-03	3.70E-03	7.5	7.5E-03	9.12E-04	2.61E-03	11	1.1E-02	1.33E-03	3.82E-03
Isobutane	58.124	11	1.1E-02	1.75E-03	4.99E-03	6.6	6.6E-03	1.01E-03	2.93E-03	4.2	4.2E-03	6.73E-04	1.92E-03	7	7.3E-03	1.15E-03	3.28E-03
Butane	58.12	9	9.0E-03	1.43E-03	4.08E-03	6.5	6.5E-03	9.98E-04	2.88E-03	3.5	3.5E-03	5.61E-04	1.60E-03	6	6.3E-03	9.97E-04	2.86E-03
Pentane	72.150	20	2.0E-02	3.95E-03	1.13E-02	13	1.3E-02	2.48E-03	7.15E-03	3.6	3.6E-03	7.16E-04	2.05E-03	12	1.2E-02	2.38E-03	6.82E-03
2-Pentene, (E)-	70.130	4.2	4.2E-03	8.06E-04	2.30E-03		0.0E+00	0.00E+00	0.00E+00					4	2.1E-03	4.03E-04	1.15E-03
Pentane, 2-methyl-	86.175	7.9	7.9E-03	1.86E-03	5.31E-03	4.6	4.6E-03	1.05E-03	3.02E-03					6	6.3E-03	1.45E-03	4.17E-03
1-Pentene, 4-methyl-	84.160	7.8	7.8E-03	1.80E-03	5.12E-03	4.2	4.2E-03	9.34E-04	2.70E-03					6	6.0E-03	1.36E-03	3.91E-03
Pentane, 2,3-dimethyl-	100.20	5.6	5.6E-03	1.53E-03	4.38E-03	3.6	3.6E-03	9.53E-04	2.75E-03					5	4.6E-03	1.24E-03	3.57E-03
1-Heptene	98.1861	3.9	3.9E-03	1.05E-03	2.99E-03									4	3.9E-03	1.05E-03	2.99E-03
Pentane, 2,2,4-trimethyl-	114.23	7.2	7.2E-03	2.25E-03	6.42E-03									7	7.2E-03	2.25E-03	6.42E-03
Cyclopropane, 1,2-dimethyl-, trans-	70.1329					2.9	2.9E-03	5.37E-04	1.55E-03					3	2.9E-03	5.37E-04	1.55E-03
1-Butene, 3-methyl-	70.13					2.2	2.2E-03	4.08E-04	1.18E-03					2	2.2E-03	4.08E-04	1.18E-03
Butane, 2,2,3,3-tetramethyl-	114.2285					4.2	4.2E-03	1.27E-03	3.66E-03					4	4.2E-03	1.27E-03	3.66E-03

Note: Concentrations listed for all TICs are estimated values.

Bison Engineering, Inc.
Gaseous Testing Summary

Client:	**Hollingsworth & Vose**	Source:	**CFU112**
Facility:	**Glass Plant 1**	Test Date:	**December 13, 2022**
Location:	**Corvallis, OR**		

Environmental Conditions / Test Notes: 40 °F and Foggy

Run		1	2	3	Average
Date		12/13/2022	12/13/2022	12/13/2022	
Run Start Time		10:35	11:45	13:00	
Run End Time		11:34	12:44	13:59	
Duration, min.		60	60	60	
Stack Diameter, in.		30.00	30.00	30.00	
Stack Area, sq.ft.		4.909	4.909	4.909	
Barometric Pressure, "Hg		30.02	30.02	30.02	30.02
Static Pressure, "H_2O		0.92	0.92	0.92	0.92
Stack Temperature, °F		188	191	191	190
CO_2, %vd		0.46	0.46	0.46	0.46
O_2, %vd		20.41	20.39	20.41	20.40
H_2O, %v		1.38	1.51	1.56	1.48
Wet Molecular Weight, lb/lb-mole		28.74	28.73	28.72	28.73
Velocity, FPS		73.76	71.63	74.83	73.41
WSCFM		17,803	17,214	17,978	17,665
DSCFM		17,558	16,954	17,698	17,403
Production Data, Ultra-Rotary Course	lb/hr	700.8	692.8	700.0	697.9
Production Data, L2R4	lb/hr	354.0	341.3	354.7	350.0
Production Data, L2R9	lb/hr	346.8	351.6	345.2	347.9

Note: Negative concentrations are reported as zero.

Bison Engineering, Inc.
Pre-Test Traverse

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

Stack Temp: NA °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	NA	8
2	NA	4
3	NA	13
4	NA	0
5	NA	4
6	NA	5
7	NA	8
8	NA	0
9	NA	1
10	NA	3
11	NA	0
12	NA	0
13	NA	4
14	NA	4
15	NA	3
16	NA	2

Average: NA 4
Flow is found to be: Non-cyclonic

No nozzle was needed for flow measurements, therefore no pre-velocity measurements or stack temperature was recorded prior to testing.

Bison Engineering, Inc.
EPA Method 1
Stack Parameters and Traverse Points

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

Type of Testing:	V	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.):	40.00	feet
Stack height (approx.):	7.00	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

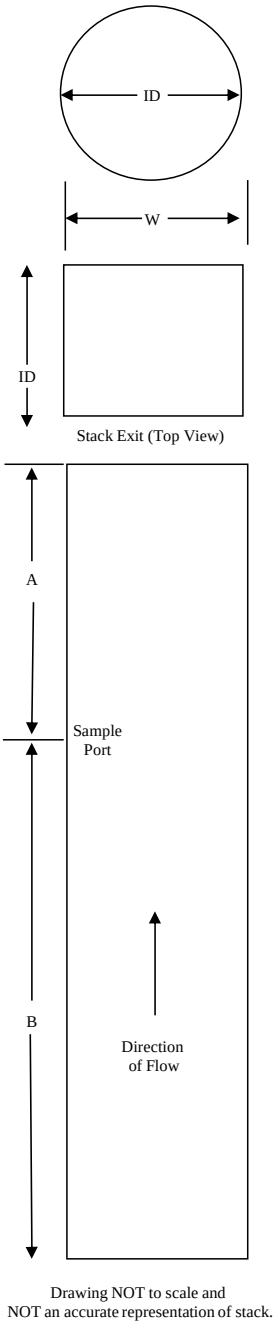
Sample Port Location:	Downstream flow disturbance from process B	Upstream flow disturbance toward exit A
Number of Inches:	145.00	96.00
Number of Diameters:	4.83	3.20

Minimum Number of Traverse Points: 16

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	3.2	0.96	7
2	10.5	3.15	9 1/8
3	19.4	5.82	11 7/8
4	32.3	9.69	15 3/4
5	67.7	20.31	26 1/4
6	80.6	24.18	30 1/8
7	89.5	26.85	32 7/8
8	96.8	29.04	35

Reference Diagram



Drawing NOT to scale and
NOT an accurate representation of stack.

Bison Engineering, Inc.
Method 2
Stack Gas Velocity and Volumetric Flow Rate

Client:	**Hollingsworth & Vose**	**Source:**	**CFU112**
Facility:	**Glass Plant 1**	**Test Date:**	**12/13/22**
Location:	**Corvallis, OR**		

Molecular Weight		
Choose One by "x" below		
Measured	Ambient	Combustion
x		

Pitot ID	4E

Leak Checks:	Run 1		Run 2		Run 3	
	Pre	Post	Pre	Post	Pre	Post
Pitot	x	x	x	x	x	x
Barometric Pressure ("Hg)	30.02		30.02		30.02	

		Run 1		Run 2		Run 3	
Traverse	Sample Point	Velocity ΔP ("H_2O)	Stack Temperature (°F)	Velocity ΔP ("H_2O)	Stack Temperature (°F)	Velocity ΔP ("H_2O)	Stack Temperature (°F)
A	1	1.10	185	1.10	189	1.30	185
	2	1.30	185	1.10	192	1.40	187
	3	1.50	186	1.20	192	1.50	191
	4	1.50	189	1.30	193	1.50	192
	5	1.50	189	1.30	192	1.60	192
	6	1.50	188	1.30	191	1.50	192
	7	1.50	189	1.20	190	1.60	192
	8	1.60	184	1.30	189	1.50	191
B	1	1.20	189	1.40	185	1.30	191
	2	1.50	189	1.30	189	1.40	192
	3	1.50	188	1.40	190	1.40	192
	4	1.40	189	1.50	191	1.50	193
	5	1.40	190	1.40	192	1.50	192
	6	1.40	189	1.50	192	1.40	191
	7	1.40	189	1.50	192	1.50	190
	8	1.30	188	1.40	191	1.20	191
Method 2 -Flow Calculations							
Static Pressure, "H_2O			0.92		0.92		0.92
Pitot tube cp			0.84		0.84		0.84
Stack Area, ft^3			4.909		4.909		4.909
H_2O, %v			1.38		1.51		1.56
Average √ΔP			1.187		1.150		1.201
Average Absolute Temp. (°R)			647.5		650.3		650.5
Stack Pressure (in. Hg)			30.09		30.09		30.09
Stack Velocity (ft/sec)			73.76		71.63		74.83
Actual Flow Rate (acfm)			21,724		21,096		22,039
Standard Flow Rate (wscf/hr)			1,068,198		1,032,851		1,078,686
Dry Standard Flow Rate (dscf/hr)			1,053,457		1,017,255		1,061,858
Dry Standard Flow Rate (dscfm)			17,558		16,954		17,698

	O_2	CO_2	Calculated N_2
Run 1	20.41	0.46	79.14
Run 2	20.39	0.46	79.15
Run 3	20.41	0.46	79.13

	Molecular Weight (lb/lb-mole)					
	Calculated		Ambient		Combustion	
Run1	M_d	28.89	M_d		M_d	
	M_s	28.74	M_s		M_s	
Run 2	M_d	28.89	M_d		M_d	
	M_s	28.73	M_s		M_s	
Run 3	M_d	28.89	M_d		M_d	
	M_s	28.72	M_s		M_s	

Bison Engineering, Inc.
Moisture Field Data

Client:	**Hollingsworth & Vose**	**Meterbox ID:**	Box 11
Facility:	**Glass Plant 1**	**Meter "Y"-Factor**	0.9690
Location:	**Corvallis, OR**		
Source:	**CFU112**		
Test date:	**12/13/2022**		

Moisture Field Data Entry

Run 1

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	16	5
Start Time	10:35	
End Time	11:35	
Bp, "Hg	30.02	

Minutes	**Meter Volume**	**Meter °F**	**Condenser °F**	**Delta H**
	307.720			
5	311.545	45	42	1.800
10	315.360	46	45	1.800
15	319.180	46	50	1.800
20	323.000	46	51	1.800
25	326..83	47	52	1.800
30	330.630	47	55	1.800
35	334.460	48	56	1.800
40	338.270	49	58	1.800
45	342.110	49	59	1.800
50	345.910	50	60	1.800
55	349.730	50	60	1.800
60	353.465	50	61	1.800

Impinger gain by weight (g):

#	**Initial**	**Final**	**Gain**
1	754.2	756.6	2.4
2	775.9	777.3	1.4
3	614.8	615.0	0.2
Silica Gel	878.8	888.6	9.8
Impinger Totals:	2,144.9	3,037.5	4.0

Moisture Field Data Entry

Run 2

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	6
Start Time	11:45	
End Time	12:45	
Bp, "Hg	30.02	

Meter Volume	**Meter °F**	**Condenser °F**	**Delta H**
354.355			
358.020	49	49	1.800
361.900	49	51	1.800
365.720	50	53	1.800
369.410	50	56	1.800
373.210	51	54	1.800
376.930	51	52	1.800
380.740	52	51	1.800
384.560	50	51	1.800
388.380	52	52	1.800
392.200	51	50	1.800
396.210	51	51	1.800
399.835	50	51	1.800

Impinger gain by weight (g):

#	**Initial**	**Final**	**Gain**
1	792.6	796.6	4.0
2	769.9	771.7	1.8
3	696.8	697.9	1.1
Silica Gel	991.3	999.3	8.0
Impinger Totals:	3,250.6	3,265.5	6.9

Moisture Field Data Entry

Run 3

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	18	7
Start Time	13:00	
End Time	14:00	
Bp, "Hg	30.02	

Meter Volume	**Meter °F**	**Condenser °F**	**Delta H**
401.005			
404.980	48	44	1.800
408.650	48	46	1.800
412.460	49	47	1.800
416.270	49	50	1.800
420.070	50	50	1.800
423.890	51	52	1.800
427.690	51	52	1.800
431.510	52	51	1.800
435.350	52	52	1.800
439.180	53	54	1.800
443.210	53	53	1.800
446.830	54	60	1.800

Impinger gain by weight (g):

#	**Initial**	**Final**	**Gain**
1	756.6	760.0	3.4
2	777.3	779.7	2.4
3	615.0	616.1	1.1
Silica Gel	888.6	897.2	8.6
Impinger Totals:	3,037.5	3,053.0	6.9

Bison Engineering, Inc.
Method 4 Moisture Calculations

Client: **Hollingsworth & Vose**
Facility: **Glass Plant 1**
Location: **Corvallis, OR**
Source: **CFU112**
Test date: **12/13/2022**

Method 4 -Moisture Determination					
Run Number	#	1	2	3	
Start Time	hh:mm	10:35	11:45	13:00	
Meter Box Identification	#	Box 11	Box 11	Box 11	
Meter "Y" Factor	Factor	0.9690	0.9690	0.9690	
Barometric Pressure	in Hg	30.02	30.02	30.02	
Sample Duration	hh:mm	1:00	1:00	1:00	
Average Meter Temperature	Deg F	47.8	50.5	50.8	
Average Condenser Temperature	Deg F	54.1	51.8	50.9	
Average Delta H	in H2O	1.800	1.800	1.800	
Average Meter Pressure	in Hg	30.152	30.152	30.152	
Meter Volume Start	dcf	307.720	354.355	401.005	
Meter Volume End	dcf	353.465	399.835	446.830	
Meter Volume	dcf	45.745	45.480	45.825	
Corrected Meter Volume	dscf	46.453	45.935	46.254	
Impinger Gain	g	4.0	6.9	6.9	
Silica Gel Gain	g	9.8	8.0	8.6	Average
Volume of Condensed Water Vapor	scf	0.651	0.703	0.731	0.695
Moisture Calculation	Bws	0.0138	0.0151	0.0156	0.015
Percent Moisture	Bws%	1.38	1.51	1.56	1.48

Bison Engineering, Inc.
Method 3A Oxygen
Calibration Error, System Bias and System Drift

Client:	**Hollingsworth & Vose**	Source:	**CFU112**	Instrument Make:	**Servomex**
Facility:	**Glass Plant 1**	Date:	**December 13, 2022**	Instrument Model:	**1440**
Location:	**Corvallis, OR**			Instrument Serial #:	**01440D1-5041**

			Initial Values			Final Values								
		Analyzer Cal. Response	System Cal Response	Pre test System Cal. Bias % of span	pass/fail	System Cal Response	Post test System Cal. Bias % of span	pass/fail	System Drift % of span	pass/fail	Analyzer Span	Raw Avg Gas Conc	Corrected Gas Conc	Instrument Cal. Reference Gas
Run 1	zero	-0.02	0.09	0.50	pass	0.10	0.55	pass	0.05	pass				
	upscale	10.01	10.08	0.32	pass	10.07	0.27	pass	0.05	pass	21.94	20.36	20.41	10.05
Run 2	zero	-0.02	0.10	0.55	pass	0.08	0.46	pass	0.09	pass				
	upscale	10.01	10.07	0.27	pass	10.07	0.27	pass	0.00	pass	21.94	20.34	20.39	10.05
Run 3	zero	-0.02	0.08	0.46	pass	0.09	0.50	pass	0.05	pass				
	upscale	10.01	10.07	0.27	pass	10.05	0.18	pass	0.09	pass	21.94	20.34	20.41	10.05
				< 5%*			**< 5%***		**< 3%***					

Analyzer Calibration Error	Zero	Mid	High
Calibration Gas Standards	0	10.05	21.94
Cylinder Number		CC503830	SA20406
Calibration Gas Analyzer Response	-0.02	10.01	22.00
Analyzer Calibration Error	-0.09	-0.18	0.27
Analyzer Calibration Error < 2%*	pass	pass	pass

System Response Time	
10.08	seconds

System Leak Check		
	Completed	**Pass/Fail**
Pre-test	Yes	Pass
Post-test	Yes	Pass

Note: All units are in %
*Or < 0.5 % absolute difference

Bison Engineering, Inc.
Method 3A CO_2
Calibration Error, System Bias and System Drift

Client:	**Hollingsworth & Vose**	Source:	**CFU112**	Instrument Make:	**Servomex**
Facility:	**Glass Plant 1**	Date:	**December 13, 2022**	Instrument Model:	**1440**
Location:	**Corvallis, OR**			Instrument Serial #:	**01440D1-5041**

			Initial Values			Final Values								
		Analyzer Cal. Response	System Cal Response	Pre test System Cal. Bias % of span	pass/fail	System Cal Response	Post test System Cal. Bias % of span	pass/fail	System Drift % of span	pass/fail	Analyzer Span	Raw Avg Gas Conc	Corrected Gas Conc	Instrument Cal. Reference Gas
Run 1	zero	-0.01	0.02	0.14	pass	0.02	0.14	pass	0.00	pass				
	upscale	9.82	10.01	0.88	pass	10.06	1.11	pass	0.23	pass	21.70	0.48	0.46	9.951
Run 2	zero	-0.01	0.02	0.14	pass	0.02	0.14	pass	0.00	pass				
	upscale	9.82	10.06	1.11	pass	10.03	0.97	pass	0.14	pass	21.70	0.48	0.46	9.951
Run 3	zero	-0.01	0.02	0.14	pass	0.03	0.18	pass	0.05	pass				
	upscale	9.82	10.03	0.97	pass	10.00	0.83	pass	0.14	pass	21.70	0.49	0.46	9.951
				< 5%*			**< 5%***		**< 3%***					

Analyzer Calibration Error	Zero	Mid	High
Calibration Gas Standards	0	9.951	21.70
Cylinder Number		CC503830	SA20406
Calibration Gas Analyzer Response	-0.01	9.82	21.89
Analyzer Calibration Error	-0.05	-0.60	0.88
Analyzer Calibration Error < 2%*	pass	pass	pass

System Response Time	
10.01	seconds

System Leak Check		
	Completed	**Pass/Fail**
Pre-test	Yes	Pass
Post-test	Yes	Pass

Note: All units are in %
*Or < 0.5 % absolute difference

APPENDIX C: CFU 108 TEST DATA

Hollingsworth & Vose
Corvallis, OR
CFU 108 Speciated Organic Toxic Air Contaminants (TAC)

Run Number	1	2	3
Sample Collection Date	12/13/2022	12/13/2022	12/13/2022
Glass Production Rate Supplied by H&V (lb/hr)	385.7	390.4	380.1
Volumetric Flow Rate Measured by Bison (dscfm)	17,607	18,441	18,097

Analyte	Molecular Weight	CFU 108-1				CFU 108-2				CFU 108-3				CFU 108 Averages			
	g/mol	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass
Dichlorodifluoromethane	120.9129	< 0.5	< 5.0E-04	< 1.66E-04	< 8.60E-04	< 0.5	< 5.0E-04	< 1.74E-04	< 8.90E-04	< 0.5	< 5.0E-04	< 1.70E-04	< 8.97E-04	< 0.50	< 5.0E-04	< 1.70E-04	< 8.82E-04
Chloromethane	50.4872	< 0.5	< 5.0E-04	< 6.92E-05	< 3.59E-04	< 0.5	< 5.0E-04	< 7.25E-05	< 3.72E-04	< 0.5	< 5.0E-04	< 7.12E-05	< 3.75E-04	< 0.50	< 5.0E-04	< 7.10E-05	< 3.68E-04
Freon 114	170.92	< 0.5	< 5.0E-04	< 2.34E-04	< 1.22E-03	< 0.5	< 5.0E-04	< 2.46E-04	< 1.26E-03	< 0.5	< 5.0E-04	< 2.41E-04	< 1.27E-03	< 0.50	< 5.0E-04	< 2.40E-04	< 1.25E-03
Vinyl chloride	62.50	< 0.5	< 5.0E-04	< 8.57E-05	< 4.45E-04	< 0.5	< 5.0E-04	< 8.98E-05	< 4.60E-04	< 0.5	< 5.0E-04	< 8.81E-05	< 4.64E-04	< 0.50	< 5.0E-04	< 8.79E-05	< 4.56E-04
1,3-Butadiene	54.0904	< 0.5	< 5.0E-04	< 7.42E-05	< 3.85E-04	< 0.5	< 5.0E-04	< 7.77E-05	< 3.98E-04	< 0.5	< 5.0E-04	< 7.63E-05	< 4.01E-04	< 0.50	< 5.0E-04	< 7.60E-05	< 3.95E-04
Bromomethane	94.94	< 0.5	< 5.0E-04	< 1.30E-04	< 6.75E-04	< 0.5	< 5.0E-04	< 1.36E-04	< 6.99E-04	< 0.5	< 5.0E-04	< 1.34E-04	< 7.04E-04	< 0.50	< 5.0E-04	< 1.33E-04	< 6.93E-04
Chloroethane	64.51	< 0.5	< 5.0E-04	< 8.85E-05	< 4.59E-04	< 0.5	< 5.0E-04	< 9.27E-05	< 4.75E-04	< 0.5	< 5.0E-04	< 9.09E-05	< 4.79E-04	< 0.50	< 5.0E-04	< 9.07E-05	< 4.71E-04
Freon 11	137.3672	< 0.5	< 5.0E-04	< 1.88E-04	< 9.77E-04	< 0.5	< 5.0E-04	< 1.97E-04	< 1.01E-03	< 0.5	< 5.0E-04	< 1.94E-04	< 1.02E-03	< 0.50	< 5.0E-04	< 1.93E-04	< 1.00E-03
Freon 113	187.38	< 0.5	< 5.0E-04	< 2.57E-04	< 1.33E-03	< 0.5	< 5.0E-04	< 2.69E-04	< 1.38E-03	< 0.5	< 5.0E-04	< 2.64E-04	< 1.39E-03	< 0.50	< 5.0E-04	< 2.63E-04	< 1.37E-03
1,1-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.33E-04	< 6.89E-04	< 0.5	< 5.0E-04	< 1.39E-04	< 7.13E-04	< 0.5	< 5.0E-04	< 1.37E-04	< 7.19E-04	< 0.50	< 5.0E-04	< 1.36E-04	< 7.07E-04
Acetone	58.08	**24**	**2.4E-02**	**3.82E-03**	**1.98E-02**	**11**	**1.1E-02**	**1.84E-03**	**9.40E-03**	**9.3**	**9.3E-03**	**1.52E-03**	**8.01E-03**	**14.77**	**1.5E-02**	**2.39E-03**	**1.24E-02**
Carbon disulfide	76.143	< 0.5	< 5.0E-04	< 1.04E-04	< 5.42E-04	< 0.5	< 5.0E-04	< 1.09E-04	< 5.60E-04	< 0.5	< 5.0E-04	< 1.07E-04	< 5.65E-04	< 0.50	< 5.0E-04	< 1.07E-04	< 5.56E-04
Methylene chloride	84.9320	< 0.5	< 5.0E-04	< 1.16E-04	< 6.04E-04	< 0.5	< 5.0E-04	< 1.22E-04	< 6.25E-04	< 0.5	< 5.0E-04	< 1.20E-04	< 6.30E-04	< 0.50	< 5.0E-04	< 1.19E-04	< 6.20E-04
trans-1,2-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.33E-04	< 6.89E-04	< 0.5	< 5.0E-04	< 1.39E-04	< 7.13E-04	< 0.5	< 5.0E-04	< 1.37E-04	< 7.19E-04	< 0.50	< 5.0E-04	< 1.36E-04	< 7.07E-04
Methyl t-butyl ether	88.1482	< 0.5	< 5.0E-04	< 1.21E-04	< 6.27E-04	< 0.5	< 5.0E-04	< 1.27E-04	< 6.49E-04	< 0.5	< 5.0E-04	< 1.24E-04	< 6.54E-04	< 0.50	< 5.0E-04	< 1.24E-04	< 6.43E-04
Vinyl acetate	86.0892	< 0.5	< 5.0E-04	< 1.18E-04	< 6.12E-04	< 0.5	< 5.0E-04	< 1.24E-04	< 6.34E-04	< 0.5	< 5.0E-04	< 1.21E-04	< 6.39E-04	< 0.50	< 5.0E-04	< 1.21E-04	< 6.28E-04
2-Butanone	72.1057	**0.63**	**6.3E-04**	**1.25E-04**	**6.46E-04**	< 0.5	< 5.0E-04	< 1.04E-04	< 5.31E-04	< 0.5	< 5.0E-04	< 1.02E-04	< 5.35E-04	< 0.54	< 5.4E-04	< 1.10E-04	< 5.71E-04
cis-1,2-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.33E-04	< 6.89E-04	< 0.5	< 5.0E-04	< 1.39E-04	< 7.13E-04	< 0.5	< 5.0E-04	< 1.37E-04	< 7.19E-04	< 0.50	< 5.0E-04	< 1.36E-04	< 7.07E-04
1,1-Dichloroethane	98.9586	< 0.5	< 5.0E-04	< 1.36E-04	< 7.04E-04	< 0.5	< 5.0E-04	< 1.42E-04	< 7.28E-04	< 0.5	< 5.0E-04	< 1.40E-04	< 7.34E-04	< 0.50	< 5.0E-04	< 1.39E-04	< 7.22E-04
Ethyl acetate	88.1051	< 1.0	< 1.0E-03	< 2.42E-04	< 1.25E-03	< 1.0	< 1.0E-03	< 2.53E-04	< 1.30E-03	< 1.0	< 1.0E-03	< 2.48E-04	< 1.31E-03	< 1.00	< 1.0E-03	< 2.48E-04	< 1.29E-03
Hexane	86.1754	**2.8**	**2.8E-03**	**6.62E-04**	**3.43E-03**	**1.3**	**1.3E-03**	**3.22E-04**	**1.65E-03**	**0.71**	**7.1E-04**	**1.73E-04**	**9.08E-04**	**1.60**	**1.6E-03**	**3.85E-04**	**2.00E-03**
Chloroform	119.3767	< 0.5	< 5.0E-04	< 1.64E-04	< 8.49E-04	< 0.5	< 5.0E-04	< 1.71E-04	< 8.79E-04	< 0.5	< 5.0E-04	< 1.68E-04	< 8.86E-04	< 0.50	< 5.0E-04	< 1.68E-04	< 8.71E-04
Tetrahydrofuran	72.1057	< 0.5	< 5.0E-04	< 9.89E-05	< 5.13E-04	< 0.5	< 5.0E-04	< 1.04E-04	< 5.31E-04	< 0.5	< 5.0E-04	< 1.02E-04	< 5.35E-04	< 0.50	< 5.0E-04	< 1.01E-04	< 5.26E-04
1,2-Dichloroethane	98.9586	< 0.5	< 5.0E-04	< 1.36E-04	< 7.04E-04	< 0.5	< 5.0E-04	< 1.42E-04	< 7.28E-04	< 0.5	< 5.0E-04	< 1.40E-04	< 7.34E-04	< 0.50	< 5.0E-04	< 1.39E-04	< 7.22E-04
1,1,1-Trichloroethane	133.4033	< 0.5	< 5.0E-04	< 1.83E-04	< 9.49E-04	< 0.5	< 5.0E-04	< 1.92E-04	< 9.82E-04	< 0.5	< 5.0E-04	< 1.88E-04	< 9.90E-04	< 0.50	< 5.0E-04	< 1.88E-04	< 9.73E-04
Carbon tetrachloride	153.8215	< 0.5	< 5.0E-04	< 2.11E-04	< 1.09E-03	< 0.5	< 5.0E-04	< 2.21E-04	< 1.13E-03	< 0.5	< 5.0E-04	< 2.17E-04	< 1.14E-03	< 0.50	< 5.0E-04	< 2.16E-04	< 1.12E-03
Benzene	78.1118	**1.7**	**1.7E-03**	**3.64E-04**	**1.89E-03**	**0.65**	**6.5E-04**	**1.46E-04**	**7.47E-04**	**0.56**	**5.6E-04**	**1.23E-04**	**6.49E-04**	**0.97**	**9.7E-04**	**2.11E-04**	**1.10E-03**
Cyclohexane	84.1595	< 0.5	< 5.0E-04	< 1.15E-04	< 5.99E-04	< 0.5	< 5.0E-04	< 1.21E-04	< 6.19E-04	< 0.5	< 5.0E-04	< 1.19E-04	< 6.24E-04	< 0.50	< 5.0E-04	< 1.18E-04	< 6.14E-04
Trichloroethene	131.3874	< 0.5	< 5.0E-04	< 1.80E-04	< 9.34E-04	< 0.5	< 5.0E-04	< 1.89E-04	< 9.67E-04	< 0.5	< 5.0E-04	< 1.85E-04	< 9.75E-04	< 0.50	< 5.0E-04	< 1.85E-04	< 9.59E-04
1,2-Dichloropropane	112.9851	< 0.5	< 5.0E-04	< 1.55E-04	< 8.04E-04	< 0.5	< 5.0E-04	< 1.62E-04	< 8.32E-04	< 0.5	< 5.0E-04	< 1.59E-04	< 8.38E-04	< 0.50	< 5.0E-04	< 1.59E-04	< 8.24E-04
Bromodichloromethane	163.828	< 0.5	< 5.0E-04	< 2.25E-04	< 1.17E-03	< 0.5	< 5.0E-04	< 2.35E-04	< 1.21E-03	< 0.5	< 5.0E-04	< 2.31E-04	< 1.22E-03	< 0.50	< 5.0E-04	< 2.30E-04	< 1.20E-03
Heptane	100.2019	< 0.5	< 5.0E-04	< 1.37E-04	< 7.13E-04	< 0.5	< 5.0E-04	< 1.44E-04	< 7.37E-04	< 0.5	< 5.0E-04	< 1.41E-04	< 7.43E-04	< 0.50	< 5.0E-04	< 1.41E-04	< 7.31E-04
cis-1,3-Dichloropropene	110.9693	< 0.5	< 5.0E-04	< 1.52E-04	< 7.89E-04	< 0.5	< 5.0E-04	< 1.59E-04	< 8.17E-04	< 0.5	< 5.0E-04	< 1.56E-04	< 8.23E-04	< 0.50	< 5.0E-04	< 1.56E-04	< 8.10E-04
4-Methyl-2-pentanone	100.1589	< 0.5	< 5.0E-04	< 1.37E-04	< 7.12E-04	< 0.5	< 5.0E-04	< 1.44E-04	< 7.37E-04	< 0.5	< 5.0E-04	< 1.41E-04	< 7.43E-04	< 0.50	< 5.0E-04	< 1.41E-04	< 7.31E-04
trans-1,3-Dichloropropene	110.9693	< 0.5	< 5.0E-04	< 1.52E-04	< 7.89E-04	< 0.5	< 5.0E-04	< 1.59E-04	< 8.17E-04	< 0.5	< 5.0E-04	< 1.56E-04	< 8.23E-04	< 0.50	< 5.0E-04	< 1.56E-04	< 8.10E-04
1,1,2-Trichloroethane	133.4033	< 0.5	< 5.0E-04	< 1.83E-04	< 9.49E-04	< 0.5	< 5.0E-04	< 1.92E-04	< 9.82E-04	< 0.5	< 5.0E-04	< 1.88E-04	< 9.90E-04	< 0.50	< 5.0E-04	< 1.88E-04	< 9.73E-04
Toluene	92.1384	**7.5**	**7.5E-03**	**1.90E-03**	**9.83E-03**	**2.3**	**2.3E-03**	**6.09E-04**	**3.12E-03**	**1.8**	**1.8E-03**	**4.68E-04**	**2.46E-03**	**3.87**	**3.9E-03**	**9.91E-04**	**5.14E-03**
2-Hexanone	100.1589	< 1.0	< 1.0E-03	< 2.75E-04	< 1.42E-03	< 1.0	< 1.0E-03	< 2.88E-04	< 1.47E-03	< 1.0	< 1.0E-03	< 2.82E-04	< 1.49E-03	< 1.00	< 1.0E-03	< 2.82E-04	< 1.46E-03
Tetrachloroethene	165.833	< 0.5	< 5.0E-04	< 2.27E-04	< 1.18E-03	< 0.5	< 5.0E-04	< 2.38E-04	< 1.22E-03	< 0.5	< 5.0E-04	< 2.34E-04	< 1.23E-03	< 0.50	< 5.0E-04	< 2.33E-04	< 1.21E-03
Dibromochloromethane	208.279	< 0.5	< 5.0E-04	< 2.86E-04	< 1.48E-03	< 0.5	< 5.0E-04	< 2.99E-04	< 1.53E-03	< 0.5	< 5.0E-04	< 2.94E-04	< 1.54E-03	< 0.50	< 5.0E-04	< 2.93E-04	< 1.52E-03
1,2-Dibromoethane	187.861	< 0.5	< 5.0E-04	< 2.58E-04	< 1.34E-03	< 0.5	< 5.0E-04	< 2.70E-04	< 1.38E-03	< 0.5	< 5.0E-04	< 2.65E-04	< 1.39E-03	< 0.50	< 5.0E-04	< 2.64E-04	< 1.37E-03
Chlorobenzene	112.5566	< 0.5	< 5.0E-04	< 1.54E-04	< 8.01E-04	< 0.5	< 5.0E-04	< 1.62E-04	< 8.28E-04	< 0.5	< 5.0E-04	< 1.59E-04	< 8.35E-04	< 0.50	< 5.0E-04	< 1.58E-04	< 8.21E-04
Ethyl benzene	106.1650	**0.72**	**7.2E-04**	**2.10E-04**	**1.09E-03**	< 0.5	< 5.0E-04	< 1.53E-04	< 7.81E-04	< 0.5	< 5.0E-04	< 1.50E-04	< 7.88E-04	< 0.57	< 5.7E-04	< 1.71E-04	< 8.85E-04
m,p-Xylene	106.1650	**2.1**	**2.1E-03**	**6.12E-04**	**3.17E-03**	< 1.0	< 1.0E-03	< 3.05E-04	< 1.56E-03	< 1.0	< 1.0E-03	< 2.99E-04	< 1.58E-03	< 1.37	< 1.4E-03	< 4.05E-04	< 2.10E-03
o-Xylene	106.1650	**0.94**	**9.4E-04**	**2.74E-04**	**1.42E-03**	< 0.5	< 5.0E-04	< 1.53E-04	< 7.81E-04	< 0.5	< 5.0E-04	< 1.50E-04	< 7.88E-04	< 0.65	< 6.5E-04	< 1.92E-04	< 9.96E-04
Styrene	104.1491	< 1.0	< 1.0E-03	< 2.86E-04	< 1.48E-03	< 1.0	< 1.0E-03	< 2.99E-04	< 1.53E-03	< 1.0	< 1.0E-03	< 2.94E-04	< 1.55E-03	< 1.00	< 1.0E-03	< 2.93E-04	< 1.52E-03
Bromoform	252.731	< 1.0	< 1.0E-03	< 6.93E-04	< 3.59E-03	< 1.0	< 1.0E-03	< 7.26E-04	< 3.72E-03	< 1.0	< 1.0E-03	< 7.13E-04	< 3.75E-03	< 1.00	< 1.0E-03	< 7.11E-04	< 3.69E-03
1,1,2,2-Tetrachloroethane	167.8481	< 0.5	< 5.0E-04	< 2.30E-04	< 1.19E-03	< 0.5	< 5.0E-04	< 2.41E-04	< 1.24E-03	< 0.5	< 5.0E-04	< 2.37E-04	< 1.25E-03	< 0.50	< 5.0E-04	< 2.36E-04	< 1.22E-03
4-Ethyl toluene	120.1916	< 1.0	< 1.0E-03	< 3.30E-04	< 1.71E-03	< 1.0	< 1.0E-03	< 3.45E-04	< 1.77E-03	< 1.0	< 1.0E-03	< 3.39E-04	< 1.78E-03	< 1.00	< 1.0E-03	< 3.38E-04	< 1.75E-03
1,3,5-Trimethylbenzene	120.1916	< 1.0	< 1.0E-03	< 3.30E-04	< 1.71E-03	< 1.0	< 1.0E-03	< 3.45E-04	< 1.77E-03	< 1.0	< 1.0E-03	< 3.39E-04	< 1.78E-03	< 1.00	< 1.0E-03	< 3.38E-04	< 1.75E-03
1,2,4-Trimethylbenzene	120.195	< 1.0	< 1.0E-03	< 3.30E-04	< 1.71E-03	< 1.0	< 1.0E-03	< 3.45E-04	< 1.77E-03	< 1.0	< 1.0E-03	< 3.39E-04	< 1.78E-03	< 1.00	< 1.0E-03	< 3.38E-04	< 1.75E-03
1,3-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 4.03E-04	< 2.09E-03	< 1.0	< 1.0E-03	< 4.22E-04	< 2.16E-03	< 1.0	< 1.0E-03	< 4.14E-04	< 2.18E-03	< 1.00	< 1.0E-03	< 4.13E-04	< 2.15E-03
1,4-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 4.03E-04	< 2.09E-03	< 1.0	< 1.0E-03	< 4.22E-04	< 2.16E-03	< 1.0	< 1.0E-03	< 4.14E-04	< 2.18E-03	< 1.00	< 1.0E-03	< 4.13E-04	< 2.15E-03
Benzyl chloride	126.5832	< 1.0	< 1.0E-03	< 3.47E-04	< 1.80E-03	< 1.0	< 1.0E-03	< 3.64E-04	< 1.86E-03	< 1.0	< 1.0E-03	< 3.57E-04	< 1.88E-03	< 1.00	< 1.0E-03	< 3.56E-04	< 1.85E-03
1,2-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 4.03E-04	< 2.09E-03	< 1.0	< 1.0E-03	< 4.22E-04	< 2.16E-03	< 1.0	< 1.0E-03	< 4.14E-04	< 2.18E-03	< 1.00	< 1.0E-03	< 4.13E-04	< 2.15E-03
1,2,4-Trichlorobenzene	181.4461	< 1.0	< 1.0E-03	< 4.98E-04	< 2.58E-03	< 1.0	< 1.0E-03	< 5.21E-04	< 2.67E-03	< 1.0	< 1.0E-03	< 5.12E-04	< 2.69E-03	< 1.00	< 1.0E-03	< 5.10E-04	< 2.65E-03
Hexachloro-1,3-butadiene	260.7590	< 1.0	< 1.0E-03	< 7.15E-04	< 3.71E-03	< 1.0	< 1.0E-03	< 7.49E-04	< 3.84E-03	< 1.0	< 1.0E-03	< 7.35E-04	< 3.87E-03	< 1.00	< 1.0E-03	< 7.33E-04	< 3.81E-03

Italized compounds are on the Oregon Ambient Benchmark Concentration list
Bold compounds are on the Oregon Air Toxics list
Blue text indicates results measured above the reporting limit (RL).
The symbol '<' indicates that the actual result is less than the numerical value listed. For laboratory results (ppb) the value listed is the RL and is used in all subsequent calculations. Concentrations and emission rates calculated from '<' lab results are also identified with a '<' symbol.

Hollingsworth & Vose
Corvallis, OR
CFU 108 Tentatively Identified Compounds (TIC)

Run Number	1	2	3
Sample Collection Date	12/13/2022	12/13/2022	12/13/2022
Glass Production Rate Supplied by H&V (lb/hr)	385.7	390.4	380.1
Volumetric Flow Rate measured by Bison (dscfm)	17,607	18,441	18,097

Analyte	Molecular Weight	CFU 108-1				CFU 108-2				CFU 108-3				CFU 108 Averages			
	g/mol	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass
Propane	44.097	9.1	9.1E-03	1.10E-03	5.71E-03	7.6	7.6E-03	9.63E-04	4.93E-03	7.7	7.7E-03	9.57E-04	5.04E-03	8.13	8.1E-03	1.01E-03	5.23E-03
Isobutane	58.124	5.5	5.5E-03	8.77E-04	4.55E-03	4	4.0E-03	6.68E-04	3.42E-03	4.1	4.1E-03	6.72E-04	3.54E-03	4.53	4.5E-03	7.39E-04	3.83E-03
Butane	58.12	2.7	2.7E-03	4.30E-04	2.23E-03	2.4	2.4E-03	4.01E-04	2.05E-03	2.2	2.2E-03	3.61E-04	1.90E-03	2.43	2.4E-03	3.97E-04	2.06E-03
Pentane	72.150	3.2	3.2E-03	6.33E-04	3.28E-03	2	2.0E-03	4.15E-04	2.12E-03					2.60	2.6E-03	5.24E-04	2.70E-03
Hexane, 2,2-dimethyl	114.230	2.9	2.9E-03	9.09E-04	4.71E-03									2.90	2.9E-03	9.09E-04	4.71E-03
Cyclohexanone	98.150					2	2.0E-03	5.64E-04	2.89E-03					2.00	2.0E-03	5.64E-04	2.89E-03

Note: Concentrations listed for all TICs are estimated values. Therefore, all calculated concentrations and mass rates are also considered estimates.
ALS Lab data identified an unknown compound in the amount of 2.5ppb in the sample for CFU 108, run 1.

Bison Engineering, Inc.
Gaseous Testing Summary

Client: **Hollingsworth & Vose**
Facility: **Glass Plant 1**
Location: **Corvallis, OR**

Source: **CFU 108**
Test Date: **December 13, 2022**

Environmental Conditions / Test Notes: 40 °F and Partly sunny

Run		1	2	3	Average
Date		12/13/2022	12/13/2022	12/13/2022	
Run Start Time		14:30	15:40	16:50	
Run End Time		15:29	16:39	17:49	
Duration, min.		60	60	60	
Stack Diameter, in.		30.00	30.00	30.00	
Stack Area, sq.ft.		4.909	4.909	4.909	
Barometric Pressure, "Hg		30.00	30.00	30.00	30.00
Static Pressure, "H_2O		0.55	0.55	0.55	0.55
Stack Temperature, °F		194	208	209	204
CO_2, %vd		0.58	0.57	0.58	0.58
O_2, %vd		20.12	20.13	20.12	20.12
H_2O, %v		3.14	1.30	1.50	1.98
Wet Molecular Weight, lb/lb-mole		28.56	28.76	28.74	28.69
Velocity, FPS		76.17	79.89	78.76	78.27
WSCFM		18,178	18,684	18,372	18,411
DSCFM		17,607	18,441	18,097	18,048
Production Data, Total Rotary Course	lb/hr	385.7	390.4	380.1	385.4
Production Data, L1R5	lb/hr	189.7	196.0	192.1	192.6
Production Data, L1R6	lb/hr	196.0	194.4	188.1	192.8

Note: Negative concentrations are reported as zero.

Bison Engineering, Inc.
Pre-Test Traverse

Client: **Hollingsworth & Vose**
Location: **Corvallis, OR**
Source: **CFU 108**

Stack Temp: NA °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	NA	6
2	NA	7
3	NA	5
4	NA	1
5	NA	1
6	NA	2
7	NA	3
8	NA	0
9	NA	1
10	NA	5
11	NA	6
12	NA	10
13	NA	8
14	NA	2
15	NA	1
16	NA	0
Average:	NA	4

Flow is found to be: Non-cyclonic

No nozzle was needed for flow measurements, therefore no pre-velocity measurements or stack temperature was recorded prior to testing.

Bison Engineering, Inc.
EPA Method 1
Stack Parameters and Traverse Points

Client: **Hollingsworth & Vose**
Location: **Corvallis, OR**
Source: **CFU 108**
Facility: **Glass Plant 1**

Type of Testing: V 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.): 40.00 feet
Stack height (approx.): 7.00 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

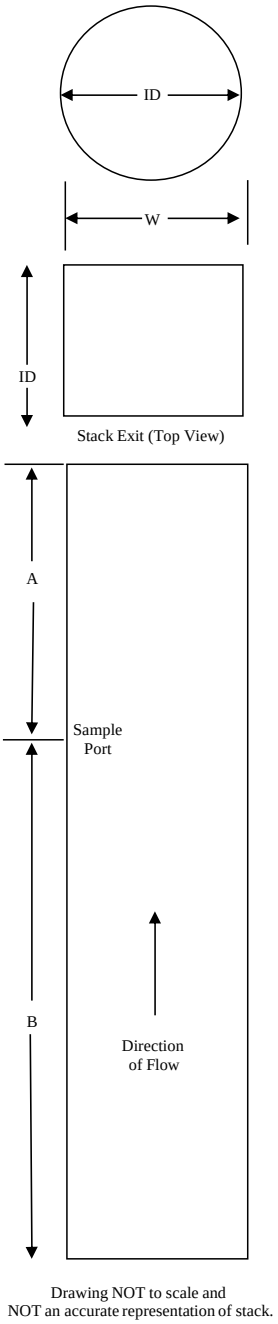
Sample Port Location:	Downstream flow disturbance from process B	Upstream flow disturbance toward exit A
Number of Inches:	128.00	102.00
Number of Diameters:	4.27	3.40

Minimum Number of Traverse Points: 16

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	3.2	0.96	7
2	10.5	3.15	9 1/8
3	19.4	5.82	11 7/8
4	32.3	9.69	15 3/4
5	67.7	20.31	26 1/4
6	80.6	24.18	30 1/8
7	89.5	26.85	32 7/8
8	96.8	29.04	35

Reference Diagram



Drawing NOT to scale and
NOT an accurate representation of stack.

Bison Engineering, Inc.
Method 2
Stack Gas Velocity and Volumetric Flow Rate

Client:	**Hollingsworth & Vose**	**Source:**	**CFU 108**
Facility:	**Glass Plant 1**	**Test Date:**	**12/13/22**
Location:	**Corvallis, OR**		

Molecular Weight		
Choose One by "x" below		
Measured	Ambient	Combustion
x		

Pitot ID	4E

Leak Checks:	Run 1		Run 2		Run 3	
	Pre	Post	Pre	Post	Pre	Post
Pitot	x	x	x	x	x	x
Barometric Pressure ("Hg)	30.00		30.00		30.00	

		Run 1		Run 2		Run 3	
Traverse	Sample Point	Velocity ΔP ("H_2O)	Stack Temperature (°F)	Velocity ΔP ("H_2O)	Stack Temperature (°F)	Velocity ΔP ("H_2O)	Stack Temperature (°F)
A	1	1.20	191	1.50	205	1.60	205
	2	1.50	191	1.50	206	1.70	207
	3	1.60	192	1.80	207	1.60	208
	4	1.60	193	1.70	208	1.70	209
	5	1.60	195	1.70	208	1.70	210
	6	1.50	195	1.40	208	1.60	210
	7	1.50	194	1.60	209	1.40	210
	8	1.40	195	1.20	208	1.50	210
B	1	1.30	196	1.50	206	1.60	209
	2	1.60	195	1.60	207	1.60	210
	3	1.60	195	1.60	208	1.60	210
	4	1.60	194	1.70	208	1.60	210
	5	1.60	195	1.80	208	1.60	210
	6	1.50	195	1.80	209	1.50	209
	7	1.50	195	1.70	208	1.40	210
	8	1.10	195	1.60	207	1.20	210
Method 2 -Flow Calculations							
Static Pressure, "H_2O			0.55		0.55		0.55
Pitot tube cp			0.84		0.84		0.84
Stack Area, ft^3			4.909		4.909		4.909
H_2O, %v			3.14		1.30		1.50
Average √ΔP			1.215		1.266		1.246
Average Absolute Temp. (°R)			653.8		667.2		668.9
Stack Pressure (in. Hg)			30.04		30.04		30.04
Stack Velocity (ft/sec)			76.17		79.89		78.76
Actual Flow Rate (acfm)			22,433		23,531		23,197
Standard Flow Rate (wscf/hr)			1,090,668		1,121,060		1,102,345
Dry Standard Flow Rate (dscf/hr)			1,056,421		1,106,486		1,085,810
Dry Standard Flow Rate (dscfm)			17,607		18,441		18,097

	O_2	CO_2	Calculated N_2
Run 1	20.12	0.58	79.31
Run 2	20.13	0.57	79.30
Run 3	20.12	0.58	79.30

	Molecular Weight (lb/lb-mole)					
	Calculated		Ambient		Combustion	
Run1	M_d	28.9	M_d		M_d	
	M_s	28.56	M_s		M_s	
Run 2	M_d	28.90	M_d		M_d	
	M_s	28.76	M_s		M_s	
Run 3	M_d	28.90	M_d		M_d	
	M_s	28.74	M_s		M_s	

Bison Engineering, Inc.
Moisture Field Data

Client:	**Hollingsworth & Vose**	**Meterbox ID:**	Box 11
Facility:	**Glass Plant 1**	**Meter "Y"-Factor**	0.9690
Location:	**Corvallis, OR**		
Source:	**CFU 108**		
Test date:	**12/13/2022**		

Moisture Field Data Entry

Run 1

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	8
Start Time	14:30	
End Time	15:30	
Bp, "Hg	30.00	

Minutes	Meter Volume	Meter °F	Condenser °F	Delta H
	447.135			
5	450.990	56	61	1.800
10	454.940	57	50	1.800
15	458.800	58	51	1.800
20	462.570	58	51	1.800
25	466.480	59	51	1.800
30	470.250	59	51	1.800
35	474.180	60	50	1.800
40	478.170	59	50	1.800
45	421.930	59	49	1.800
50	485.830	59	49	1.800
55	489.710	59	48	1.800
60	493.605	58	49	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	792.6	800.7	8.1
2	769.9	774.9	5.0
3	696.8	699.2	2.4
Silica Gel	991.3	1007.5	16.2
Impinger Totals:	2,259.3	3,282.3	15.5

Moisture Field Data Entry

Run 2

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	9
Start Time	15:40	
End Time	16:40	
Bp, "Hg	30.00	

Minutes	Meter Volume	Meter °F	Condenser °F	Delta H
	494.300			
5	498.190	56	45	1.800
10	501.870	55	46	1.800
15	505.720	55	48	1.800
20	509.540	55	49	1.800
25	513.350	54	51	1.800
30	517.150	54	50	1.800
35	520.980	54	51	1.800
40	525.210	54	51	1.800
45	528.660	54	52	1.800
50	532.350	53	51	1.800
55	536.140	53	53	1.800
60	539.940	53	52	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	760.0	763.7	3.7
2	779.7	780.8	1.1
3	616.1	616.6	0.5
Silica Gel	897.2	904.65	7.4
Impinger Totals:	3,053.0	3,065.8	5.3

Moisture Field Data Entry

Run 3

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	19	8
Start Time	16:50	
End Time	17:50	
Bp, "Hg	30.00	

Minutes	Meter Volume	Meter °F	Condenser °F	Delta H
	540.685			
5	544.460	52	41	1.800
10	548.220	51	42	1.800
15	552.000	51	42	1.800
20	555.730	51	44	1.800
25	559.520	50	44	1.800
30	563.260	50	44	1.800
35	567.040	50	46	1.800
40	570.760	50	45	1.800
45	574.510	50	46	1.800
50	578.260	50	45	1.800
55	582.000	50	46	1.800
60	585.750	50	46	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	800.7	807.2	6.5
2	774.9	776.4	1.5
3	699.2	700.0	0.8
Silica Gel	1007.5	1013.4	5.9
Impinger Totals:	3,282.3	3,297.0	8.8

Bison Engineering, Inc.
Method 4 Moisture Calculations

Client: **Hollingsworth & Vose**
Facility: **Glass Plant 1**
Location: **Corvallis, OR**
Source: **CFU 108**
Test date: **12/13/2022**

Method 4 -Moisture Determination					
Run Number	#	1	2	3	
Start Time	hh:mm	14:30	15:40	16:50	
Meter Box Identification	#	Box 11	Box 11	Box 11	
Meter "Y" Factor	Factor	0.9690	0.9690	0.9690	
Barometric Pressure	in Hg	30.00	30.00	30.00	
Sample Duration	hh:mm	1:00	1:00	1:00	
Average Meter Temperature	Deg F	58.4	54.2	50.4	
Average Condenser Temperature	Deg F	50.8	49.9	44.3	
Average Delta H	in H2O	1.800	1.800	1.800	
Average Meter Pressure	in Hg	30.132	30.132	30.132	
Meter Volume Start	dcf	447.135	494.300	540.685	
Meter Volume End	dcf	493.605	539.940	585.750	
Meter Volume	dcf	46.470	45.640	45.065	
Corrected Meter Volume	dscf	46.187	45.738	45.493	
Impinger Gain	g	15.5	5.3	8.8	
Silica Gel Gain	g	16.2	7.4	5.9	Average
Volume of Condensed Water Vapor	scf	1.495	0.601	0.693	0.930
Moisture Calculation	Bws	0.0314	0.0130	0.0150	0.020
Percent Moisture	Bws%	3.14	1.30	1.50	1.98

Bison Engineering, Inc.
Method 3A Oxygen
Calibration Error, System Bias and System Drift

Client:	**Hollingsworth & Vose**	Source:	**CFU 108**	Instrument Make:	**Servomex**
Facility:	**Glass Plant 1**	Date:	**December 13, 2022**	Instrument Model:	**1440**
Location:	**Corvallis, OR**			Instrument Serial #:	**01440D1-5041**

			Initial Values			Final Values								
		Analyzer Cal. Response	System Cal Response	Pre test System Cal. Bias % of span	pass/fail	System Cal Response	Post test System Cal. Bias % of span	pass/fail	System Drift % of span	pass/fail	Analyzer Span	Raw Avg Gas Conc	Corrected Gas Conc	Instrument Cal. Reference Gas
Run 1	zero	-0.02	0.11	0.59	pass	0.10	0.55	pass	0.05	pass				
	upscale	10.01	10.08	0.32	pass	10.08	0.32	pass	0.00	pass	21.94	20.07	20.12	10.05
Run 2	zero	-0.02	0.10	0.55	pass	0.12	0.64	pass	0.09	pass				
	upscale	10.01	10.08	0.32	pass	10.08	0.32	pass	0.00	pass	21.94	20.08	20.13	10.05
Run 3	zero	-0.02	0.12	0.64	pass	0.10	0.55	pass	0.09	pass				
	upscale	10.01	10.08	0.32	pass	10.08	0.32	pass	0.00	pass	21.94	20.07	20.12	10.05
				< 5%*			**< 5%***		**< 3%***					

Analyzer Calibration Error	Zero	Mid	High
Calibration Gas Standards	0	10.05	21.94
Cylinder Number		CC503830	SA20406
Calibration Gas Analyzer Response	-0.02	10.01	22.00
Analyzer Calibration Error	-0.09	-0.18	0.27
Analyzer Calibration Error < 2%*	pass	pass	pass

System Response Time	
30	seconds

System Leak Check		
	Completed	**Pass/Fail**
Pre-test	Yes	Pass
Post-test	Yes	Pass

Note: All units are in %
*Or < 0.5 % absolute difference

Bison Engineering, Inc.
Method 3A CO_2
Calibration Error, System Bias and System Drift

Client:	**Hollingsworth & Vose**	Source:	**CFU 108**	Instrument Make:	**Servomex**
Facility:	**Glass Plant 1**	Date:	**December 13, 2022**	Instrument Model:	**1440**
Location:	**Corvallis, OR**			Instrument Serial #:	**01440D1-5041**

			Initial Values			Final Values								
		Analyzer Cal. Response	System Cal Response	Pre test System Cal. Bias % of span	pass/fail	System Cal Response	Post test System Cal. Bias % of span	pass/fail	System Drift % of span	pass/fail	Analyzer Span	Raw Avg Gas Conc	Corrected Gas Conc	Instrument Cal. Reference Gas
Run 1	zero	-0.01	0.04	0.23	pass	0.05	0.28	pass	0.05	pass				
	upscale	9.82	9.96	0.65	pass	9.94	0.55	pass	0.09	pass	21.70	0.62	0.58	9.951
Run 2	zero	-0.01	0.05	0.28	pass	0.05	0.28	pass	0.00	pass				
	upscale	9.82	9.94	0.55	pass	10.02	0.92	pass	0.37	pass	21.70	0.62	0.57	9.951
Run 3	zero	-0.01	0.05	0.28	pass	0.04	0.23	pass	0.05	pass				
	upscale	9.82	10.02	0.92	pass	10.09	1.24	pass	0.32	pass	21.70	0.63	0.58	9.951
				< 5%*			**< 5%***		**< 3%***					

Analyzer Calibration Error	Zero	Mid	High
Calibration Gas Standards	0	9.951	21.70
Cylinder Number		CC503830	SA20406
Calibration Gas Analyzer Response	-0.01	9.82	21.89
Analyzer Calibration Error	-0.05	-0.60	0.88
Analyzer Calibration Error < 2%*	pass	pass	pass

System Response Time	
31	seconds

System Leak Check		
	Completed	**Pass/Fail**
Pre-test	Yes	Pass
Post-test	Yes	Pass

Note: All units are in %
*Or < 0.5 % absolute difference

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	6:07:36	8.05	0.01	
12/13/2022	6:08:36	-0.02	-0.01	**O2/CO2 Analyzer Zero**
12/13/2022	6:09:36	12.81	13.78	
12/13/2022	6:10:36	22.00	21.89	**O2/CO2 Analyzer Span**
12/13/2022	6:11:36	19.29	18.71	
12/13/2022	6:12:36	10.03	9.76	
12/13/2022	6:13:36	10.01	9.82	**O2/CO2 Analyzer Mid**
12/13/2022	6:14:36	10.39	9.02	
12/13/2022	6:15:36	6.97	0.29	
12/13/2022	6:16:36	0.13	0.04	
12/13/2022	6:17:36	0.08	0.03	**O2/CO2 System Zero**
12/13/2022	6:18:36	2.68	2.71	
12/13/2022	6:19:36	9.80	9.71	
12/13/2022	6:20:36	9.98	9.92	**O2/CO2 System Upscale**
12/13/2022	6:21:36	11.45	8.51	
12/13/2022	6:22:36	19.87	1.11	
				CFU 113
12/13/2022	6:55:36	20.32	0.78	**Start Run 1**
12/13/2022	6:56:36	20.29	0.78	
12/13/2022	6:57:36	20.26	0.74	
12/13/2022	6:58:36	20.33	0.77	
12/13/2022	6:59:36	20.33	0.79	
12/13/2022	7:00:36	20.33	0.80	
12/13/2022	7:01:36	20.33	0.79	
12/13/2022	7:02:36	20.34	0.79	
12/13/2022	7:03:36	20.33	0.79	
12/13/2022	7:04:36	20.33	0.80	
12/13/2022	7:05:36	20.33	0.80	
12/13/2022	7:06:36	20.34	0.79	
12/13/2022	7:07:36	20.34	0.78	
12/13/2022	7:08:36	20.33	0.79	
12/13/2022	7:09:36	20.33	0.79	
12/13/2022	7:10:36	20.34	0.79	
12/13/2022	7:11:36	20.34	0.79	
12/13/2022	7:12:36	20.34	0.79	
12/13/2022	7:13:36	20.34	0.78	
12/13/2022	7:14:36	20.35	0.78	
12/13/2022	7:15:36	20.34	0.78	

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	7:16:36	20.34	0.79	
12/13/2022	7:17:36	20.34	0.79	
12/13/2022	7:18:36	20.34	0.79	
12/13/2022	7:19:36	20.34	0.78	
12/13/2022	7:20:36	20.34	0.79	
12/13/2022	7:21:36	20.35	0.79	
12/13/2022	7:22:36	20.35	0.79	
12/13/2022	7:23:36	20.36	0.79	
12/13/2022	7:24:36	20.37	0.80	
12/13/2022	7:25:36	20.41	0.81	
12/13/2022	7:26:36	20.43	0.81	
12/13/2022	7:27:36	20.44	0.81	
12/13/2022	7:28:36	20.44	0.82	
12/13/2022	7:29:36	20.45	0.82	
12/13/2022	7:30:36	20.47	0.79	
12/13/2022	7:31:36	20.46	0.80	
12/13/2022	7:32:36	20.46	0.81	
12/13/2022	7:33:36	20.46	0.80	
12/13/2022	7:34:36	20.47	0.79	
12/13/2022	7:35:36	20.46	0.79	
12/13/2022	7:36:36	20.46	0.79	
12/13/2022	7:37:36	20.46	0.78	
12/13/2022	7:38:36	20.47	0.77	
12/13/2022	7:39:36	20.46	0.78	
12/13/2022	7:40:36	20.47	0.78	
12/13/2022	7:41:36	20.47	0.78	
12/13/2022	7:42:36	20.47	0.78	
12/13/2022	7:43:36	20.47	0.78	
12/13/2022	7:44:36	20.47	0.78	
12/13/2022	7:45:36	20.47	0.78	
12/13/2022	7:46:36	20.47	0.78	
12/13/2022	7:47:36	20.47	0.77	
12/13/2022	7:48:36	20.48	0.78	
12/13/2022	7:49:36	20.47	0.78	
12/13/2022	7:50:36	20.47	0.79	

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	7:51:36	20.47	0.80	
12/13/2022	7:52:36	20.48	0.79	
12/13/2022	7:53:36	20.48	0.78	
12/13/2022	7:54:36	20.48	0.80	**End Run 1**
		20.40	**0.79**	**Average**
12/13/2022	7:55:36	20.48	0.79	
12/13/2022	7:56:36	8.37	0.51	
12/13/2022	7:57:36	0.17	0.03	
12/13/2022	7:58:36	0.09	0.02	**O2/CO2 System Zero**
12/13/2022	7:59:36	4.09	4.00	
12/13/2022	8:00:36	9.98	9.70	
12/13/2022	8:01:36	10.08	9.83	**O2/CO2 System Upscale**
12/13/2022	8:02:36	14.76	5.58	
12/13/2022	8:03:36	20.36	0.88	
12/13/2022	8:04:36	20.45	0.81	
12/13/2022	8:05:36	20.46	0.80	**Start Run 2**
12/13/2022	8:06:36	20.47	0.79	
12/13/2022	8:07:36	20.48	0.78	
12/13/2022	8:08:36	20.48	0.78	
12/13/2022	8:09:36	20.48	0.78	
12/13/2022	8:10:36	20.48	0.78	
12/13/2022	8:11:36	20.48	0.78	
12/13/2022	8:12:36	20.48	0.78	
12/13/2022	8:13:36	20.48	0.80	
12/13/2022	8:14:36	20.48	0.80	
12/13/2022	8:15:36	20.49	0.79	
12/13/2022	8:16:36	20.49	0.79	
12/13/2022	8:17:36	20.49	0.78	
12/13/2022	8:18:36	20.49	0.80	
12/13/2022	8:19:36	20.48	0.81	
12/13/2022	8:20:36	20.48	0.81	
12/13/2022	8:21:36	20.48	0.80	
12/13/2022	8:22:36	20.48	0.81	
12/13/2022	8:23:36	20.48	0.80	
12/13/2022	8:24:36	20.49	0.79	
12/13/2022	8:25:36	20.49	0.80	
12/13/2022	8:26:36	20.48	0.80	

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	8:27:36	20.49	0.79	
12/13/2022	8:28:36	20.48	0.79	
12/13/2022	8:29:36	20.48	0.79	
12/13/2022	8:30:36	20.48	0.80	
12/13/2022	8:31:36	20.48	0.79	
12/13/2022	8:32:36	20.48	0.80	
12/13/2022	8:33:36	20.48	0.80	
12/13/2022	8:34:36	20.48	0.80	
12/13/2022	8:35:36	20.49	0.80	
12/13/2022	8:36:36	20.49	0.80	
12/13/2022	8:37:36	20.49	0.79	
12/13/2022	8:38:36	20.49	0.80	
12/13/2022	8:39:36	20.50	0.79	
12/13/2022	8:40:36	20.50	0.80	
12/13/2022	8:41:36	20.50	0.79	
12/13/2022	8:42:36	20.50	0.81	
12/13/2022	8:43:36	20.50	0.82	
12/13/2022	8:44:36	20.50	0.81	
12/13/2022	8:45:36	20.50	0.81	
12/13/2022	8:46:36	20.50	0.82	
12/13/2022	8:47:36	20.50	0.81	
12/13/2022	8:48:36	20.50	0.81	
12/13/2022	8:49:36	20.50	0.81	
12/13/2022	8:50:36	20.50	0.82	
12/13/2022	8:51:36	20.50	0.81	
12/13/2022	8:52:36	20.50	0.81	
12/13/2022	8:53:36	20.50	0.81	
12/13/2022	8:54:36	20.50	0.81	
12/13/2022	8:55:36	20.50	0.80	
12/13/2022	8:56:36	20.51	0.79	
12/13/2022	8:57:36	20.51	0.78	
12/13/2022	8:58:36	20.51	0.80	
12/13/2022	8:59:36	20.51	0.80	
12/13/2022	9:00:36	20.51	0.80	
12/13/2022	9:01:36	20.51	0.80	
12/13/2022	9:02:36	20.51	0.80	
12/13/2022	9:03:36	20.52	0.80	
12/13/2022	9:04:36	20.51	0.79	**End Run 2**
		20.49	**0.80**	**Average**

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	9:05:36	20.51	0.81	
12/13/2022	9:06:36	20.51	0.81	
12/13/2022	9:07:36	20.51	0.82	
12/13/2022	9:08:36	20.51	0.82	
12/13/2022	9:09:36	14.93	0.77	
12/13/2022	9:10:36	0.48	0.07	
12/13/2022	9:11:36	0.11	0.04	
12/13/2022	9:12:36	0.09	0.04	**O2/CO2 System Zero**
12/13/2022	9:13:36	0.08	0.03	
12/13/2022	9:14:36	9.88	9.73	
12/13/2022	9:15:36	10.08	10.03	**O2/CO2 System Upscale**
12/13/2022	9:16:36	12.33	4.13	
12/13/2022	9:17:36	19.42	0.77	
12/13/2022	9:18:36	20.47	0.81	
12/13/2022	9:19:36	20.49	0.82	
12/13/2022	9:20:36	20.50	0.83	**Start Run 3**
12/13/2022	9:21:36	20.51	0.82	
12/13/2022	9:22:36	20.52	0.81	
12/13/2022	9:23:36	20.52	0.81	
12/13/2022	9:24:36	20.52	0.82	
12/13/2022	9:25:36	20.52	0.82	
12/13/2022	9:26:36	20.52	0.82	
12/13/2022	9:27:36	20.52	0.83	
12/13/2022	9:28:36	20.52	0.83	
12/13/2022	9:29:36	20.53	0.83	
12/13/2022	9:30:36	20.53	0.83	
12/13/2022	9:31:36	20.52	0.84	
12/13/2022	9:32:36	20.52	0.84	
12/13/2022	9:33:36	20.52	0.84	
12/13/2022	9:34:36	20.51	0.85	
12/13/2022	9:35:36	20.51	0.84	
12/13/2022	9:36:36	20.51	0.85	
12/13/2022	9:37:36	20.51	0.85	
12/13/2022	9:38:36	20.51	0.85	
12/13/2022	9:39:36	20.51	0.84	
12/13/2022	9:40:36	20.51	0.85	
12/13/2022	9:41:36	20.51	0.84	

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	9:42:36	20.51	0.84	
12/13/2022	9:43:36	20.51	0.84	
12/13/2022	9:44:36	20.50	0.85	
12/13/2022	9:45:36	20.50	0.85	
12/13/2022	9:46:36	20.51	0.85	
12/13/2022	9:47:36	20.51	0.84	
12/13/2022	9:48:36	20.51	0.84	
12/13/2022	9:49:36	20.51	0.84	
12/13/2022	9:50:36	20.51	0.84	
12/13/2022	9:51:36	20.51	0.85	
12/13/2022	9:52:36	20.51	0.84	
12/13/2022	9:53:36	20.51	0.84	
12/13/2022	9:54:36	20.51	0.84	
12/13/2022	9:55:36	20.50	0.85	
12/13/2022	9:56:36	20.50	0.86	
12/13/2022	9:57:36	20.50	0.86	
12/13/2022	9:58:36	20.50	0.86	
12/13/2022	9:59:36	20.50	0.87	
12/13/2022	10:00:36	20.50	0.87	
12/13/2022	10:01:36	20.50	0.86	
12/13/2022	10:02:36	20.50	0.87	
12/13/2022	10:03:36	20.50	0.86	
12/13/2022	10:04:36	20.50	0.87	
12/13/2022	10:05:36	20.50	0.87	
12/13/2022	10:06:36	20.50	0.87	
12/13/2022	10:07:36	20.50	0.87	
12/13/2022	10:08:36	20.50	0.87	
12/13/2022	10:09:36	20.50	0.86	
12/13/2022	10:10:36	20.50	0.85	
12/13/2022	10:11:36	20.50	0.85	
12/13/2022	10:12:36	20.50	0.85	
12/13/2022	10:13:36	20.50	0.85	
12/13/2022	10:14:36	20.49	0.85	
12/13/2022	10:15:36	20.50	0.84	
12/13/2022	10:16:36	20.49	0.85	
12/13/2022	10:17:36	20.49	0.85	
12/13/2022	10:18:36	20.50	0.84	
12/13/2022	10:19:36	20.49	0.84	**End Run 3**
		20.51	**0.85**	**Average**

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	10:20:36	20.49	0.85	
12/13/2022	10:21:36	13.55	0.59	
12/13/2022	10:22:36	0.36	0.03	
12/13/2022	10:23:36	0.11	0.02	
12/13/2022	10:24:36	0.09	0.02	**O2/CO2 System Zero**
12/13/2022	10:25:36	1.75	1.74	
12/13/2022	10:26:36	9.74	9.61	
12/13/2022	10:27:36	10.08	10.01	**O2/CO2 System Upscale**
12/13/2022	10:28:36	14.86	5.41	
12/13/2022	10:29:36	20.28	0.57	
12/13/2022	10:30:36	20.36	0.50	
12/13/2022	10:31:36	20.36	0.50	
12/13/2022	10:32:36	20.36	0.49	
12/13/2022	10:33:36	20.36	0.49	
12/13/2022	10:34:36	20.37	0.49	
				CFU 112
12/13/2022	10:35:36	20.38	0.48	**Start Run 1**
12/13/2022	10:36:36	20.36	0.49	
12/13/2022	10:37:36	20.37	0.48	
12/13/2022	10:38:36	20.36	0.49	
12/13/2022	10:39:36	20.36	0.48	
12/13/2022	10:40:36	20.35	0.48	
12/13/2022	10:41:36	20.37	0.47	
12/13/2022	10:42:36	20.37	0.47	
12/13/2022	10:43:36	20.38	0.47	
12/13/2022	10:44:36	20.37	0.47	
12/13/2022	10:45:36	20.37	0.47	
12/13/2022	10:46:36	20.37	0.47	
12/13/2022	10:47:36	20.35	0.48	
12/13/2022	10:48:36	20.36	0.48	
12/13/2022	10:49:36	20.36	0.48	
12/13/2022	10:50:36	20.37	0.48	
12/13/2022	10:51:36	20.35	0.49	
12/13/2022	10:52:36	20.35	0.49	
12/13/2022	10:53:36	20.34	0.49	
12/13/2022	10:54:36	20.36	0.49	
12/13/2022	10:55:36	20.36	0.48	
12/13/2022	10:56:36	20.36	0.49	

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	10:57:36	20.36	0.48	
12/13/2022	10:58:36	20.36	0.48	
12/13/2022	10:59:36	20.36	0.48	
12/13/2022	11:00:36	20.35	0.49	
12/13/2022	11:01:36	20.36	0.48	
12/13/2022	11:02:36	20.35	0.48	
12/13/2022	11:03:36	20.36	0.48	
12/13/2022	11:04:36	20.35	0.48	
12/13/2022	11:05:36	20.36	0.47	
12/13/2022	11:06:36	20.35	0.47	
12/13/2022	11:07:36	20.37	0.46	
12/13/2022	11:08:36	20.36	0.47	
12/13/2022	11:09:36	20.36	0.47	
12/13/2022	11:10:36	20.35	0.48	
12/13/2022	11:11:36	20.35	0.48	
12/13/2022	11:12:36	20.35	0.48	
12/13/2022	11:13:36	20.34	0.48	
12/13/2022	11:14:36	20.36	0.47	
12/13/2022	11:15:36	20.36	0.48	
12/13/2022	11:16:36	20.37	0.48	
12/13/2022	11:17:36	20.36	0.48	
12/13/2022	11:18:36	20.36	0.48	
12/13/2022	11:19:36	20.36	0.49	
12/13/2022	11:20:36	20.36	0.49	
12/13/2022	11:21:36	20.35	0.49	
12/13/2022	11:22:36	20.35	0.49	
12/13/2022	11:23:36	20.35	0.49	
12/13/2022	11:24:36	20.35	0.49	
12/13/2022	11:25:36	20.35	0.49	
12/13/2022	11:26:36	20.35	0.49	
12/13/2022	11:27:36	20.36	0.48	
12/13/2022	11:28:36	20.34	0.49	
12/13/2022	11:29:36	20.35	0.48	
12/13/2022	11:30:36	20.35	0.48	
12/13/2022	11:31:36	20.36	0.47	
12/13/2022	11:32:36	20.35	0.48	
12/13/2022	11:33:36	20.35	0.47	
12/13/2022	11:34:36	20.35	0.48	**End Run 1**
		20.36	**0.48**	**Average**

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	11:35:36	20.35	0.47	
12/13/2022	11:36:36	16.00	0.55	
12/13/2022	11:37:36	0.61	0.06	
12/13/2022	11:38:36	0.10	0.02	**O2/CO2 System Zero**
12/13/2022	11:39:36	2.27	2.28	
12/13/2022	11:40:36	9.83	9.76	
12/13/2022	11:41:36	10.07	10.06	**O2/CO2 System Upscale**
12/13/2022	11:42:36	12.07	8.05	
12/13/2022	11:43:36	20.01	0.76	
12/13/2022	11:44:36	20.33	0.52	
12/13/2022	11:45:36	20.33	0.50	**Start Run 2**
12/13/2022	11:46:36	20.34	0.50	
12/13/2022	11:47:36	20.34	0.50	
12/13/2022	11:48:36	20.34	0.50	
12/13/2022	11:49:36	20.34	0.49	
12/13/2022	11:50:36	20.34	0.49	
12/13/2022	11:51:36	20.35	0.48	
12/13/2022	11:52:36	20.34	0.49	
12/13/2022	11:53:36	20.35	0.48	
12/13/2022	11:54:36	20.35	0.48	
12/13/2022	11:55:36	20.36	0.47	
12/13/2022	11:56:36	20.35	0.47	
12/13/2022	11:57:36	20.37	0.46	
12/13/2022	11:58:36	20.35	0.47	
12/13/2022	11:59:36	20.35	0.47	
12/13/2022	12:00:36	20.34	0.47	
12/13/2022	12:01:36	20.34	0.48	
12/13/2022	12:02:36	20.34	0.48	
12/13/2022	12:03:36	20.34	0.48	
12/13/2022	12:04:36	20.35	0.47	
12/13/2022	12:05:36	20.34	0.48	
12/13/2022	12:06:36	20.34	0.48	
12/13/2022	12:07:36	20.34	0.48	
12/13/2022	12:08:36	20.35	0.48	
12/13/2022	12:09:36	20.33	0.50	
12/13/2022	12:10:36	20.34	0.49	
12/13/2022	12:11:36	20.34	0.49	

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	12:12:36	20.34	0.49	
12/13/2022	12:13:36	20.34	0.48	
12/13/2022	12:14:36	20.34	0.49	
12/13/2022	12:15:36	20.35	0.48	
12/13/2022	12:16:36	20.35	0.48	
12/13/2022	12:17:36	20.35	0.48	
12/13/2022	12:18:36	20.33	0.49	
12/13/2022	12:19:36	20.35	0.48	
12/13/2022	12:20:36	20.33	0.48	
12/13/2022	12:21:36	20.34	0.47	
12/13/2022	12:22:36	20.34	0.47	
12/13/2022	12:23:36	20.34	0.47	
12/13/2022	12:24:36	20.34	0.48	
12/13/2022	12:25:36	20.35	0.48	
12/13/2022	12:26:36	20.35	0.47	
12/13/2022	12:27:36	20.33	0.48	
12/13/2022	12:28:36	20.35	0.47	
12/13/2022	12:29:36	20.34	0.48	
12/13/2022	12:30:36	20.35	0.48	
12/13/2022	12:31:36	20.34	0.48	
12/13/2022	12:32:36	20.35	0.48	
12/13/2022	12:33:36	20.34	0.49	
12/13/2022	12:34:36	20.36	0.49	
12/13/2022	12:35:36	20.34	0.49	
12/13/2022	12:36:36	20.35	0.49	
12/13/2022	12:37:36	20.35	0.49	
12/13/2022	12:38:36	20.35	0.49	
12/13/2022	12:39:36	20.35	0.49	
12/13/2022	12:40:36	20.34	0.49	
12/13/2022	12:41:36	20.36	0.48	
12/13/2022	12:42:36	20.35	0.49	
12/13/2022	12:43:36	20.36	0.48	
12/13/2022	12:44:36	20.35	0.48	**End Run 2**
		20.34	**0.48**	**Average**
12/13/2022	12:45:36	16.14	0.56	
12/13/2022	12:46:36	0.61	0.06	
12/13/2022	12:47:36	0.10	0.02	
12/13/2022	12:48:36	0.08	0.02	**O2/CO2 System Zero**

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	12:49:36	3.32	3.33	
12/13/2022	12:50:36	9.94	9.86	
12/13/2022	12:51:36	10.07	10.03	**O2/CO2 System Upscale**
12/13/2022	12:52:36	11.09	8.99	
12/13/2022	12:53:36	19.74	0.96	
12/13/2022	12:54:36	20.31	0.51	
12/13/2022	12:55:36	20.33	0.50	
12/13/2022	12:56:36	20.35	0.49	
12/13/2022	12:57:36	20.35	0.49	
12/13/2022	12:58:36	20.35	0.49	
12/13/2022	12:59:36	20.34	0.50	
12/13/2022	13:00:36	20.34	0.49	**Start Run 3**
12/13/2022	13:01:36	20.34	0.50	
12/13/2022	13:02:36	20.35	0.49	
12/13/2022	13:03:36	20.34	0.49	
12/13/2022	13:04:36	20.34	0.50	
12/13/2022	13:05:36	20.35	0.49	
12/13/2022	13:06:36	20.35	0.49	
12/13/2022	13:07:36	20.35	0.48	
12/13/2022	13:08:36	20.34	0.49	
12/13/2022	13:09:36	20.35	0.48	
12/13/2022	13:10:36	20.33	0.49	
12/13/2022	13:11:36	20.35	0.48	
12/13/2022	13:12:36	20.35	0.48	
12/13/2022	13:13:36	20.35	0.48	
12/13/2022	13:14:36	20.34	0.48	
12/13/2022	13:15:36	20.34	0.49	
12/13/2022	13:16:36	20.35	0.48	
12/13/2022	13:17:36	20.34	0.48	
12/13/2022	13:18:36	20.34	0.48	
12/13/2022	13:19:36	20.33	0.49	
12/13/2022	13:20:36	20.35	0.48	
12/13/2022	13:21:36	20.34	0.48	
12/13/2022	13:22:36	20.35	0.48	
12/13/2022	13:23:36	20.34	0.49	
12/13/2022	13:24:36	20.34	0.49	
12/13/2022	13:25:36	20.33	0.50	
12/13/2022	13:26:36	20.34	0.49	

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	13:27:36	20.35	0.49	
12/13/2022	13:28:36	20.34	0.49	
12/13/2022	13:29:36	20.34	0.49	
12/13/2022	13:30:36	20.34	0.49	
12/13/2022	13:31:36	20.34	0.49	
12/13/2022	13:32:36	20.33	0.49	
12/13/2022	13:33:36	20.34	0.48	
12/13/2022	13:34:36	20.34	0.49	
12/13/2022	13:35:36	20.34	0.48	
12/13/2022	13:36:36	20.34	0.48	
12/13/2022	13:37:36	20.34	0.48	
12/13/2022	13:38:36	20.34	0.48	
12/13/2022	13:39:36	20.34	0.48	
12/13/2022	13:40:36	20.34	0.48	
12/13/2022	13:41:36	20.34	0.48	
12/13/2022	13:42:36	20.34	0.48	
12/13/2022	13:43:36	20.33	0.49	
12/13/2022	13:44:36	20.35	0.48	
12/13/2022	13:45:36	20.34	0.48	
12/13/2022	13:46:36	20.35	0.48	
12/13/2022	13:47:36	20.34	0.49	
12/13/2022	13:48:36	20.35	0.49	
12/13/2022	13:49:36	20.34	0.49	
12/13/2022	13:50:36	20.35	0.49	
12/13/2022	13:51:36	20.33	0.50	
12/13/2022	13:52:36	20.34	0.49	
12/13/2022	13:53:36	20.35	0.49	
12/13/2022	13:54:36	20.35	0.49	
12/13/2022	13:55:36	20.36	0.49	
12/13/2022	13:56:36	20.34	0.49	
12/13/2022	13:57:36	20.35	0.49	
12/13/2022	13:58:36	20.35	0.48	
12/13/2022	13:59:36	20.36	0.48	**End Run 3**
		20.34	**0.49**	**Average**
12/13/2022	14:00:36	20.34	0.49	
12/13/2022	14:01:36	8.67	0.42	
12/13/2022	14:02:36	0.17	0.03	
12/13/2022	14:03:36	0.09	0.03	**O2/CO2 System Zero**

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	14:04:36	0.08	0.03	
12/13/2022	14:05:36	7.00	7.00	
12/13/2022	14:06:36	10.05	10.00	**O2/CO2 System Upscale**
12/13/2022	14:07:36	12.06	8.09	
12/13/2022	14:08:36	20.69	0.39	
12/13/2022	14:09:36	21.04	0.10	
12/13/2022	14:10:36	21.05	0.09	
12/13/2022	14:11:36	21.05	0.10	
12/13/2022	14:12:36	21.05	0.09	
12/13/2022	14:13:36	21.05	0.09	
12/13/2022	14:14:36	21.05	0.09	
12/13/2022	14:15:36	20.75	0.26	
12/13/2022	14:16:36	20.08	0.61	
12/13/2022	14:17:36	10.86	0.55	
12/13/2022	14:18:36	0.25	0.05	
12/13/2022	14:19:36	0.11	0.04	**O2/CO2 System Zero**
12/13/2022	14:20:36	3.77	3.75	
12/13/2022	14:21:36	9.96	9.80	
12/13/2022	14:22:36	10.08	9.96	**O2/CO2 System Upscale**
12/13/2022	14:23:36	16.96	3.37	
12/13/2022	14:24:36	20.01	0.68	
12/13/2022	14:25:36	20.04	0.64	
12/13/2022	14:26:36	20.05	0.63	
12/13/2022	14:27:36	20.05	0.63	
12/13/2022	14:28:36	20.06	0.63	
12/13/2022	14:29:36	20.06	0.63	
				CFU108
12/13/2022	14:30:36	20.06	0.62	**Start Run 1**
12/13/2022	14:31:36	20.06	0.62	
12/13/2022	14:32:36	20.07	0.62	
12/13/2022	14:33:36	20.07	0.63	
12/13/2022	14:34:36	20.07	0.62	
12/13/2022	14:35:36	20.07	0.62	
12/13/2022	14:36:36	20.07	0.63	
12/13/2022	14:37:36	20.07	0.63	
12/13/2022	14:38:36	20.06	0.63	
12/13/2022	14:39:36	20.06	0.64	
12/13/2022	14:40:36	20.06	0.64	
12/13/2022	14:41:36	20.07	0.63	

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	14:42:36	20.07	0.63	
12/13/2022	14:43:36	20.08	0.63	
12/13/2022	14:44:36	20.07	0.63	
12/13/2022	14:45:36	20.07	0.63	
12/13/2022	14:46:36	20.06	0.63	
12/13/2022	14:47:36	20.06	0.63	
12/13/2022	14:48:36	20.07	0.62	
12/13/2022	14:49:36	20.07	0.62	
12/13/2022	14:50:36	20.07	0.62	
12/13/2022	14:51:36	20.07	0.62	
12/13/2022	14:52:36	20.07	0.62	
12/13/2022	14:53:36	20.07	0.62	
12/13/2022	14:54:36	20.07	0.62	
12/13/2022	14:55:36	20.07	0.62	
12/13/2022	14:56:36	20.07	0.62	
12/13/2022	14:57:36	20.07	0.62	
12/13/2022	14:58:36	20.07	0.62	
12/13/2022	14:59:36	20.07	0.62	
12/13/2022	15:00:36	20.07	0.63	
12/13/2022	15:01:36	20.07	0.62	
12/13/2022	15:02:36	20.07	0.63	
12/13/2022	15:03:36	20.07	0.63	
12/13/2022	15:04:36	20.07	0.63	
12/13/2022	15:05:36	20.08	0.63	
12/13/2022	15:06:36	20.07	0.63	
12/13/2022	15:07:36	20.07	0.63	
12/13/2022	15:08:36	20.07	0.63	
12/13/2022	15:09:36	20.07	0.63	
12/13/2022	15:10:36	20.07	0.63	
12/13/2022	15:11:36	20.06	0.63	
12/13/2022	15:12:36	20.06	0.62	
12/13/2022	15:13:36	20.06	0.62	
12/13/2022	15:14:36	20.06	0.62	
12/13/2022	15:15:36	20.06	0.62	
12/13/2022	15:16:36	20.06	0.61	
12/13/2022	15:17:36	20.06	0.61	
12/13/2022	15:18:36	20.06	0.61	
12/13/2022	15:19:36	20.06	0.61	
12/13/2022	15:20:36	20.06	0.61	

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	15:21:36	20.06	0.62	
12/13/2022	15:22:36	20.06	0.62	
12/13/2022	15:23:36	20.06	0.62	
12/13/2022	15:24:36	20.06	0.61	
12/13/2022	15:25:36	20.07	0.62	
12/13/2022	15:26:36	20.08	0.62	
12/13/2022	15:27:36	20.07	0.62	
12/13/2022	15:28:36	20.07	0.62	
12/13/2022	15:29:36	20.07	0.63	**End Run 1**
		20.07	**0.62**	**Average**
12/13/2022	15:30:36	20.07	0.63	
12/13/2022	15:31:36	18.23	0.81	
12/13/2022	15:32:36	1.30	0.20	
12/13/2022	15:33:36	0.12	0.05	
12/13/2022	15:34:36	0.10	0.05	**O2/CO2 System Zero**
12/13/2022	15:35:36	5.21	5.16	
12/13/2022	15:36:36	10.02	9.85	
12/13/2022	15:37:36	10.08	9.94	**O2/CO2 System Upscale**
12/13/2022	15:38:36	14.45	5.68	
12/13/2022	15:39:36	19.95	0.72	
12/13/2022	15:40:36	20.04	0.64	**Start Run 2**
12/13/2022	15:41:36	20.05	0.63	
12/13/2022	15:42:36	20.06	0.62	
12/13/2022	15:43:36	20.07	0.62	
12/13/2022	15:44:36	20.07	0.62	
12/13/2022	15:45:36	20.07	0.62	
12/13/2022	15:46:36	20.07	0.62	
12/13/2022	15:47:36	20.07	0.61	
12/13/2022	15:48:36	20.08	0.61	
12/13/2022	15:49:36	20.08	0.62	
12/13/2022	15:50:36	20.07	0.63	
12/13/2022	15:51:36	20.07	0.62	
12/13/2022	15:52:36	20.07	0.62	
12/13/2022	15:53:36	20.07	0.63	
12/13/2022	15:54:36	20.07	0.63	
12/13/2022	15:55:36	20.07	0.63	
12/13/2022	15:56:36	20.08	0.63	

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	15:57:36	20.07	0.63	
12/13/2022	15:58:36	20.07	0.63	
12/13/2022	15:59:36	20.08	0.63	
12/13/2022	16:00:36	20.08	0.63	
12/13/2022	16:01:36	20.08	0.63	
12/13/2022	16:02:36	20.08	0.63	
12/13/2022	16:03:36	20.08	0.62	
12/13/2022	16:04:36	20.08	0.62	
12/13/2022	16:05:36	20.08	0.62	
12/13/2022	16:06:36	20.08	0.62	
12/13/2022	16:07:36	20.07	0.62	
12/13/2022	16:08:36	20.08	0.62	
12/13/2022	16:09:36	20.09	0.61	
12/13/2022	16:10:36	20.09	0.61	
12/13/2022	16:11:36	20.08	0.61	
12/13/2022	16:12:36	20.07	0.62	
12/13/2022	16:13:36	20.08	0.62	
12/13/2022	16:14:36	20.08	0.62	
12/13/2022	16:15:36	20.08	0.62	
12/13/2022	16:16:36	20.08	0.62	
12/13/2022	16:17:36	20.08	0.63	
12/13/2022	16:18:36	20.08	0.63	
12/13/2022	16:19:36	20.08	0.63	
12/13/2022	16:20:36	20.08	0.63	
12/13/2022	16:21:36	20.08	0.63	
12/13/2022	16:22:36	20.08	0.63	
12/13/2022	16:23:36	20.08	0.63	
12/13/2022	16:24:36	20.08	0.63	
12/13/2022	16:25:36	20.08	0.63	
12/13/2022	16:26:36	20.08	0.63	
12/13/2022	16:27:36	20.08	0.63	
12/13/2022	16:28:36	20.07	0.63	
12/13/2022	16:29:36	20.07	0.62	
12/13/2022	16:30:36	20.08	0.62	
12/13/2022	16:31:36	20.08	0.61	
12/13/2022	16:32:36	20.08	0.61	
12/13/2022	16:33:36	20.08	0.62	
12/13/2022	16:34:36	20.07	0.62	
12/13/2022	16:35:36	20.08	0.62	

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	16:36:36	20.08	0.62	
12/13/2022	16:37:36	20.07	0.62	
12/13/2022	16:38:36	20.08	0.62	
12/13/2022	16:39:36	20.08	0.62	**End Run 2**
		20.08	**0.62**	**Average**
12/13/2022	16:40:36	20.07	0.62	
12/13/2022	16:41:36	20.09	0.61	
12/13/2022	16:42:36	11.47	0.83	
12/13/2022	16:43:36	0.28	0.08	
12/13/2022	16:44:36	0.12	0.05	**O2/CO2 System Zero**
12/13/2022	16:45:36	2.14	2.15	
12/13/2022	16:46:36	9.80	9.66	
12/13/2022	16:47:36	10.08	10.02	**O2/CO2 System Upscale**
12/13/2022	16:48:36	12.84	7.30	
12/13/2022	16:49:36	19.85	0.82	
12/13/2022	16:50:36	20.04	0.67	**Start Run 3**
12/13/2022	16:51:36	20.05	0.65	
12/13/2022	16:52:36	20.06	0.64	
12/13/2022	16:53:36	20.07	0.63	
12/13/2022	16:54:36	20.07	0.63	
12/13/2022	16:55:36	20.07	0.62	
12/13/2022	16:56:36	20.08	0.62	
12/13/2022	16:57:36	20.08	0.62	
12/13/2022	16:58:36	20.08	0.62	
12/13/2022	16:59:36	20.07	0.62	
12/13/2022	17:00:36	20.06	0.62	
12/13/2022	17:01:36	20.06	0.62	
12/13/2022	17:02:36	20.06	0.62	
12/13/2022	17:03:36	20.07	0.62	
12/13/2022	17:04:36	20.07	0.62	
12/13/2022	17:05:36	20.07	0.62	
12/13/2022	17:06:36	20.07	0.62	
12/13/2022	17:07:36	20.07	0.63	
12/13/2022	17:08:36	20.07	0.63	
12/13/2022	17:09:36	20.07	0.63	
12/13/2022	17:10:36	20.07	0.63	
12/13/2022	17:11:36	20.07	0.63	

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	17:12:36	20.07	0.63	
12/13/2022	17:13:36	20.08	0.63	
12/13/2022	17:14:36	20.09	0.63	
12/13/2022	17:15:36	20.08	0.63	
12/13/2022	17:16:36	20.07	0.63	
12/13/2022	17:17:36	20.07	0.63	
12/13/2022	17:18:36	20.07	0.63	
12/13/2022	17:19:36	20.07	0.62	
12/13/2022	17:20:36	20.07	0.63	
12/13/2022	17:21:36	20.07	0.62	
12/13/2022	17:22:36	20.07	0.63	
12/13/2022	17:23:36	20.06	0.63	
12/13/2022	17:24:36	20.06	0.63	
12/13/2022	17:25:36	20.06	0.63	
12/13/2022	17:26:36	20.07	0.63	
12/13/2022	17:27:36	20.07	0.63	
12/13/2022	17:28:36	20.07	0.63	
12/13/2022	17:29:36	20.07	0.63	
12/13/2022	17:30:36	20.07	0.63	
12/13/2022	17:31:36	20.07	0.63	
12/13/2022	17:32:36	20.07	0.64	
12/13/2022	17:33:36	20.06	0.64	
12/13/2022	17:34:36	20.07	0.64	
12/13/2022	17:35:36	20.08	0.63	
12/13/2022	17:36:36	20.09	0.63	
12/13/2022	17:37:36	20.08	0.64	
12/13/2022	17:38:36	20.08	0.64	
12/13/2022	17:39:36	20.07	0.64	
12/13/2022	17:40:36	20.07	0.63	
12/13/2022	17:41:36	20.08	0.64	
12/13/2022	17:42:36	20.08	0.64	
12/13/2022	17:43:36	20.07	0.63	
12/13/2022	17:44:36	20.07	0.63	
12/13/2022	17:45:36	20.08	0.63	
12/13/2022	17:46:36	20.08	0.63	
12/13/2022	17:47:36	20.08	0.62	
12/13/2022	17:48:36	20.08	0.62	
12/13/2022	17:49:36	20.07	0.63	**End Run 3**
		20.07	**0.63**	**Average**

Hollingsworth & Vose - Glass Plant 1
CFUs 113, 112, and 108
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	NOTES
12/13/2022	17:50:36	20.08	0.63	
12/13/2022	17:51:36	19.40	0.56	
12/13/2022	17:52:36	1.69	0.22	
12/13/2022	17:53:36	0.13	0.04	
12/13/2022	17:54:36	0.10	0.04	**O2/CO2 System Zero**
12/13/2022	17:55:36	2.60	2.62	
12/13/2022	17:56:36	9.88	9.84	
12/13/2022	17:57:36	10.08	10.09	**O2/CO2 System Upscale**
12/13/2022	17:58:36	15.94	4.60	
12/13/2022	17:59:36	20.88	0.25	

APPENDIX D: CFU 115 TEST DATA

Hollingsworth & Vose
Corvallis, OR
CFU 115 Speciated Organic Toxic Air Contaminants (TAC)

Run Number	1	2	3
Sample Collection Date	12/14/2022	12/14/2022	12/14/2022
Volumetric Flow Rate Measured by Bison (dscfm)	18,896	18,897	19,230

Analyte	Molecular Weight	CFU 115-1			CFU 115-2			CFU 115-3			CI		
	g/mol	ppb	ppm	lb/hr	ppb	ppm	lb/hr	ppb	ppm	lb/hr	ppb	ppm	lb/hr
Dichlorodifluoromethane	120.9129	< 0.5	< 5.0E-04	< 1.78E-04	< 0.5	< 5.0E-04	< 1.78E-04	< 0.5	< 5.0E-04	< 1.81E-04	< 0.50	< 5.0E-04	< 1.79E-04
Chloromethane	50.4872	**0.67**	**6.7E-04**	**9.96E-05**	**0.51**	**5.1E-04**	**7.58E-05**	**0.56**	**5.6E-04**	**8.47E-05**	**0.58**	**5.8E-04**	**8.67E-05**
Freon 114	170.92	< 0.5	< 5.0E-04	< 2.52E-04	< 0.5	< 5.0E-04	< 2.52E-04	< 0.5	< 5.0E-04	< 2.56E-04	< 0.50	< 5.0E-04	< 2.53E-04
Vinyl chloride	62.50	< 0.5	< 5.0E-04	< 9.20E-05	< 0.5	< 5.0E-04	< 9.20E-05	< 0.5	< 5.0E-04	< 9.36E-05	< 0.50	< 5.0E-04	< 9.25E-05
1,3-Butadiene	54.0904	< 0.5	< 5.0E-04	< 7.96E-05	< 0.5	< 5.0E-04	< 7.96E-05	< 0.5	< 5.0E-04	< 8.10E-05	< 0.50	< 5.0E-04	< 8.01E-05
Bromomethane	94.94	< 0.5	< 5.0E-04	< 1.40E-04	< 0.5	< 5.0E-04	< 1.40E-04	< 0.5	< 5.0E-04	< 1.42E-04	< 0.50	< 5.0E-04	< 1.41E-04
Chloroethane	64.51	< 0.5	< 5.0E-04	< 9.50E-05	< 0.5	< 5.0E-04	< 9.50E-05	< 0.5	< 5.0E-04	< 9.66E-05	< 0.50	< 5.0E-04	< 9.55E-05
Freon 11	137.3672	< 0.5	< 5.0E-04	< 2.02E-04	< 0.5	< 5.0E-04	< 2.02E-04	< 0.5	< 5.0E-04	< 2.06E-04	< 0.50	< 5.0E-04	< 2.03E-04
Freon 113	187.38	< 0.5	< 5.0E-04	< 2.76E-04	< 0.5	< 5.0E-04	< 2.76E-04	< 0.5	< 5.0E-04	< 2.81E-04	< 0.50	< 5.0E-04	< 2.77E-04
1,1-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.43E-04	< 0.5	< 5.0E-04	< 1.43E-04	< 0.5	< 5.0E-04	< 1.45E-04	< 0.50	< 5.0E-04	< 1.44E-04
Acetone	58.08	**54**	**5.4E-02**	**9.23E-03**	**25**	**2.5E-02**	**4.27E-03**	**22**	**2.2E-02**	**3.83E-03**	**33.67**	**3.4E-02**	**5.78E-03**
Carbon disulfide	76.143	< 0.5	< 5.0E-04	< 1.12E-04	< 0.5	< 5.0E-04	< 1.12E-04	< 0.5	< 5.0E-04	< 1.14E-04	< 0.50	< 5.0E-04	< 1.13E-04
Methylene chloride	84.9320	< 0.5	< 5.0E-04	< 1.25E-04	< 0.5	< 5.0E-04	< 1.25E-04	< 0.5	< 5.0E-04	< 1.27E-04	< 0.50	< 5.0E-04	< 1.26E-04
trans-1,2-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.43E-04	< 0.5	< 5.0E-04	< 1.43E-04	< 0.5	< 5.0E-04	< 1.45E-04	< 0.50	< 5.0E-04	< 1.44E-04
Methyl t-butyl ether	88.1482	< 0.5	< 5.0E-04	< 1.30E-04	< 0.5	< 5.0E-04	< 1.30E-04	< 0.5	< 5.0E-04	< 1.32E-04	< 0.50	< 5.0E-04	< 1.31E-04
Vinyl acetate	86.0892	< 0.5	< 5.0E-04	< 1.27E-04	< 0.5	< 5.0E-04	< 1.27E-04	< 0.5	< 5.0E-04	< 1.29E-04	< 0.50	< 5.0E-04	< 1.27E-04
2-Butanone	72.1057	**1.1**	**1.1E-03**	**2.34E-04**	**0.69**	**6.9E-04**	**1.46E-04**	**0.87**	**8.7E-04**	**1.88E-04**	**0.89**	**8.9E-04**	**1.89E-04**
cis-1,2-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.43E-04	< 0.5	< 5.0E-04	< 1.43E-04	< 0.5	< 5.0E-04	< 1.45E-04	< 0.50	< 5.0E-04	< 1.44E-04
1,1-Dichloroethane	98.9586	< 0.5	< 5.0E-04	< 1.46E-04	< 0.5	< 5.0E-04	< 1.46E-04	< 0.5	< 5.0E-04	< 1.48E-04	< 0.50	< 5.0E-04	< 1.47E-04
Ethyl acetate	88.1051	< 1.0	< 1.0E-03	< 2.59E-04	< 1.0	< 1.0E-03	< 2.59E-04	< 1.0	< 1.0E-03	< 2.64E-04	< 1.00	< 1.0E-03	< 2.61E-04
Hexane	86.1754	**32**	**3.2E-02**	**8.12E-03**	**13**	**1.3E-02**	**3.30E-03**	**8.3**	**8.3E-03**	**2.14E-03**	**17.77**	**1.8E-02**	**4.52E-03**
Chloroform	119.3767	< 0.5	< 5.0E-04	< 1.76E-04	< 0.5	< 5.0E-04	< 1.76E-04	< 0.5	< 5.0E-04	< 1.79E-04	< 0.50	< 5.0E-04	< 1.77E-04
Tetrahydrofuran	72.1057	< 0.5	< 5.0E-04	< 1.06E-04	< 0.5	< 5.0E-04	< 1.06E-04	< 0.5	< 5.0E-04	< 1.08E-04	< 0.50	< 5.0E-04	< 1.07E-04
1,2-Dichloroethane	98.9586	< 0.5	< 5.0E-04	< 1.46E-04	< 0.5	< 5.0E-04	< 1.46E-04	< 0.5	< 5.0E-04	< 1.48E-04	< 0.50	< 5.0E-04	< 1.47E-04
1,1,1-Trichloroethane	133.4033	< 0.5	< 5.0E-04	< 1.96E-04	< 0.5	< 5.0E-04	< 1.96E-04	< 0.5	< 5.0E-04	< 2.00E-04	< 0.50	< 5.0E-04	< 1.98E-04
Carbon tetrachloride	153.8215	< 0.5	< 5.0E-04	< 2.26E-04	< 0.5	< 5.0E-04	< 2.26E-04	< 0.5	< 5.0E-04	< 2.30E-04	< 0.50	< 5.0E-04	< 2.28E-04
Benzene	78.1118	**9.5**	**9.5E-03**	**2.18E-03**	**4.8**	**4.8E-03**	**1.10E-03**	**3.8**	**3.8E-03**	**8.89E-04**	**6.03**	**6.0E-03**	**1.39E-03**
Cyclohexane	84.1595	< 0.5	< 5.0E-04	< 1.24E-04	< 0.5	< 5.0E-04	< 1.24E-04	< 0.5	< 5.0E-04	< 1.26E-04	< 0.50	< 5.0E-04	< 1.25E-04
Trichloroethene	131.3874	< 0.5	< 5.0E-04	< 1.93E-04	< 0.5	< 5.0E-04	< 1.93E-04	< 0.5	< 5.0E-04	< 1.97E-04	< 0.50	< 5.0E-04	< 1.95E-04
1,2-Dichloropropane	112.9851	< 0.5	< 5.0E-04	< 1.66E-04	< 0.5	< 5.0E-04	< 1.66E-04	< 0.5	< 5.0E-04	< 1.69E-04	< 0.50	< 5.0E-04	< 1.67E-04
Bromodichloromethane	163.828	< 0.5	< 5.0E-04	< 2.41E-04	< 0.5	< 5.0E-04	< 2.41E-04	< 0.5	< 5.0E-04	< 2.45E-04	< 0.50	< 5.0E-04	< 2.43E-04
Heptane	100.2019	**3.6**	**3.6E-03**	**1.06E-03**	**2.3**	**2.3E-03**	**6.79E-04**	**1.5**	**1.5E-03**	**4.50E-04**	**2.47**	**2.5E-03**	**7.30E-04**
cis-1,3-Dichloropropene	110.9693	< 0.5	< 5.0E-04	< 1.63E-04	< 0.5	< 5.0E-04	< 1.63E-04	< 0.5	< 5.0E-04	< 1.66E-04	< 0.50	< 5.0E-04	< 1.64E-04
4-Methyl-2-pentanone	100.1589	< 0.5	< 5.0E-04	< 1.47E-04	< 0.5	< 5.0E-04	< 1.47E-04	< 0.5	< 5.0E-04	< 1.50E-04	< 0.50	< 5.0E-04	< 1.48E-04
trans-1,3-Dichloropropene	110.9693	< 0.5	< 5.0E-04	< 1.63E-04	< 0.5	< 5.0E-04	< 1.63E-04	< 0.5	< 5.0E-04	< 1.66E-04	< 0.50	< 5.0E-04	< 1.64E-04
1,1,2-Trichloroethane	133.4033	< 0.5	< 5.0E-04	< 1.96E-04	< 0.5	< 5.0E-04	< 1.96E-04	< 0.5	< 5.0E-04	< 2.00E-04	< 0.50	< 5.0E-04	< 1.98E-04
Toluene	92.1384	**23.0**	**2.3E-02**	**6.24E-03**	**18**	**1.8E-02**	**4.88E-03**	**15**	**1.5E-02**	**4.14E-03**	**18.67**	**1.9E-02**	**5.09E-03**
2-Hexanone	100.1589	< 1.0	< 1.0E-03	< 2.95E-04	< 1.0	< 1.0E-03	< 2.95E-04	< 1.0	< 1.0E-03	< 3.00E-04	< 1.00	< 1.0E-03	< 2.97E-04
Tetrachloroethene	165.833	< 0.5	< 5.0E-04	< 2.44E-04	< 0.5	< 5.0E-04	< 2.44E-04	< 0.5	< 5.0E-04	< 2.48E-04	< 0.50	< 5.0E-04	< 2.46E-04
Dibromochloromethane	208.279	< 0.5	< 5.0E-04	< 3.07E-04	< 0.5	< 5.0E-04	< 3.07E-04	< 0.5	< 5.0E-04	< 3.12E-04	< 0.50	< 5.0E-04	< 3.08E-04
1,2-Dibromoethane	187.861	< 0.5	< 5.0E-04	< 2.77E-04	< 0.5	< 5.0E-04	< 2.77E-04	< 0.5	< 5.0E-04	< 2.81E-04	< 0.50	< 5.0E-04	< 2.78E-04
Chlorobenzene	112.5566	< 0.5	< 5.0E-04	< 1.66E-04	< 0.5	< 5.0E-04	< 1.66E-04	< 0.5	< 5.0E-04	< 1.69E-04	< 0.50	< 5.0E-04	< 1.67E-04
Ethyl benzene	106.1650	**1.00**	**1.0E-03**	**3.13E-04**	**0.97**	**9.7E-04**	**3.03E-04**	**0.91**	**9.1E-04**	**2.89E-04**	**0.96**	**9.6E-04**	**3.02E-04**
m,p-Xylene	106.1650	**3.2**	**3.2E-03**	**1.00E-03**	**2.7**	**2.7E-03**	**8.44E-04**	**2.9**	**2.9E-03**	**9.22E-04**	**2.93**	**2.9E-03**	**9.22E-04**
o-Xylene	106.1650	**1.1**	**1.1E-03**	**3.44E-04**	**0.94**	**9.4E-04**	**2.94E-04**	**1.0**	**1.0E-03**	**3.18E-04**	**1.01**	**1.0E-03**	**3.19E-04**
Styrene	104.1491	< 1.0	< 1.0E-03	< 3.07E-04	< 1.0	< 1.0E-03	< 3.07E-04	< 1.0	< 1.0E-03	< 3.12E-04	< 1.00	< 1.0E-03	< 3.08E-04
Bromoform	252.731	< 1.0	< 1.0E-03	< 7.44E-04	< 1.0	< 1.0E-03	< 7.44E-04	< 1.0	< 1.0E-03	< 7.57E-04	< 1.00	< 1.0E-03	< 7.48E-04
1,1,2,2-Tetrachloroethane	167.8481	< 0.5	< 5.0E-04	< 2.47E-04	< 0.5	< 5.0E-04	< 2.47E-04	< 0.5	< 5.0E-04	< 2.51E-04	< 0.50	< 5.0E-04	< 2.49E-04
4-Ethyl toluene	120.1916	< 1.0	< 1.0E-03	< 3.54E-04	< 1.0	< 1.0E-03	< 3.54E-04	< 1.0	< 1.0E-03	< 3.60E-04	< 1.00	< 1.0E-03	< 3.56E-04
1,3,5-Trimethylbenzene	120.1916	< 1.0	< 1.0E-03	< 3.54E-04	< 1.0	< 1.0E-03	< 3.54E-04	< 1.0	< 1.0E-03	< 3.60E-04	< 1.00	< 1.0E-03	< 3.56E-04
1,2,4-Trimethylbenzene	120.195	< 1.0	< 1.0E-03	< 3.54E-04	< 1.0	< 1.0E-03	< 3.54E-04	< 1.0	< 1.0E-03	< 3.60E-04	< 1.00	< 1.0E-03	< 3.56E-04
1,3-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 4.33E-04	< 1.0	< 1.0E-03	< 4.33E-04	< 1.0	< 1.0E-03	< 4.40E-04	< 1.00	< 1.0E-03	< 4.35E-04
1,4-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 4.33E-04	< 1.0	< 1.0E-03	< 4.33E-04	< 1.0	< 1.0E-03	< 4.40E-04	< 1.00	< 1.0E-03	< 4.35E-04
Benzyl chloride	126.5832	< 1.0	< 1.0E-03	< 3.73E-04	< 1.0	< 1.0E-03	< 3.73E-04	< 1.0	< 1.0E-03	< 3.79E-04	< 1.00	< 1.0E-03	< 3.75E-04
1,2-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 4.33E-04	< 1.0	< 1.0E-03	< 4.33E-04	< 1.0	< 1.0E-03	< 4.40E-04	< 1.00	< 1.0E-03	< 4.35E-04
1,2,4-Trichlorobenzene	181.4461	< 1.0	< 1.0E-03	< 5.34E-04	< 1.0	< 1.0E-03	< 5.34E-04	< 1.0	< 1.0E-03	< 5.44E-04	< 1.00	< 1.0E-03	< 5.37E-04
Hexachloro-1,3-butadiene	260.7590	< 1.0	< 1.0E-03	< 7.68E-04	< 1.0	< 1.0E-03	< 7.68E-04	< 1.0	< 1.0E-03	< 7.81E-04	< 1.00	< 1.0E-03	< 7.72E-04

Italized compounds are on the Oregon Ambient Benchmark Concentration list
Bold compounds are on the Oregon Air Toxics list
Blue text indicates results measured above the reporting limit (RL).
The symbol '<' indicates that the actual result is less than the numerical value listed. For laboratory results (ppb) the value listed is the RL and is used in all subsequent calculations. Concentrations and emission rates calculated from '<' lab results are also identified with a '<' symbol.

Hollingsworth & Vose
Corvallis, OR
CFU 115 Tentatively Identified Compounds (TIC)

Run Number	1	2	3
Sample Collection Date	12/14/2022	12/14/2022	12/14/2022
Volumetric Flow Rate measured by Bison (dscfm)	18,896	18,897	19,230

Analyte	Molecular Weight	CFU 115-1			CFU 115-2			CFU 115-3			CF		
	g/mol	ppb	ppm	lb/hr	ppb	ppm	lb/hr	ppb	ppm	lb/hr	ppb	ppm	lb/hr
Propane	44.097	24	2.4E-02	3.12E-03	20	2.0E-02	2.60E-03	25	2.5E-02	3.30E-03	23.00	2.3E-02	3.01E-03
Isobutane	58.124	18	1.8E-02	3.08E-03	12	1.2E-02	2.05E-03	12	1.2E-02	2.09E-03	14.00	1.4E-02	2.41E-03
Butane	58.12	18	1.8E-02	3.08E-03	10	1.0E-02	1.71E-03	8.6	8.6E-03	1.50E-03	12.20	1.2E-02	2.10E-03
Pentane	72.150	34	3.4E-02	7.22E-03	15	1.5E-02	3.19E-03	11	1.1E-02	2.38E-03	20.00	2.0E-02	4.26E-03
Pentane, 2-methyl-	86.175	18	1.8E-02	4.57E-03	7.7	7.7E-03	1.95E-03	5.5	5.5E-03	1.42E-03	10.40	1.0E-02	2.65E-03
Pentane, 3-methyl-	86.175	6.5	6.5E-03	1.65E-03							6.50	6.5E-03	1.65E-03
Pentane, 2,4-dimethyl-	100.20	16	1.6E-02	4.72E-03	6.6	6.6E-03	1.95E-03	4.8	4.8E-03	1.44E-03	9.13	9.1E-03	2.70E-03
Pentane, 2,3-dimethyl-	100.20	14	1.4E-02	4.13E-03	6.5	6.5E-03	1.92E-03	4.5	4.5E-03	1.35E-03	8.33	8.3E-03	2.47E-03
Butane, 2,2,3,3-tetramethyl-	114.2285	14	1.4E-02	4.71E-03	6.8			4.9	4.9E-03	1.68E-03	8.57	9.5E-03	3.19E-03
C6 Hydrocarbon*	86.1754		0.0E+00	0.00E+00	2.9			2.1	2.1E-03		2.50	1.1E-03	0.00E+00
Hexane, 2-methyl-	100.205	5.4	5.4E-03	1.59E-03	2.7	2.7E-03	7.97E-04				4.05	4.1E-03	1.19E-03

Note: Concentrations listed for all TICs are estimated values.
* Molecular weight used is the molecular weight of hexane
ALS Lab data identified an unknown compound in the amount of 2 ppb in the sample for CFU 115, run 3.

Hollingsworth & Vose
Corvallis, OR
CFU 115 Speciated Organic Toxic Air Contaminants (TAC)

Run Number	4	5	6
Sample Collection Date	12/14/2022	12/14/2022	12/14/2022
Glass Production Rate Supplied by H&V (lb/hr)	63.0	63.0	63.0
Volumetric Flow Rate Measured by Bison (dscfm)	19,219	19,187	18,996

Analyte	Molecular Weight	CFU 115-4				CFU 115-5				CFU 115-6				CFU 115 Averages			
	g/mol	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass
Dichlorodifluoromethane	120.9129	< 0.5	< 5.0E-04	< 1.81E-04	< 5.75E-03	< 0.5	< 5.0E-04	< 1.81E-04	< 5.74E-03	< 0.5	< 5.0E-04	< 1.79E-04	< 5.68E-03	< 0.50	< 5.0E-04	< 1.80E-04	< 5.72E-03
Chloromethane	50.4872	**17**	**1.7E-02**	**2.57E-03**	**8.16E-02**	**3.2**	**3.2E-03**	**4.83E-04**	**1.53E-02**	**5.4**	**5.4E-03**	**8.07E-04**	**2.56E-02**	**8.53**	**8.5E-03**	**1.29E-03**	**4.08E-02**
Freon 114	170.92	< 0.5	< 5.0E-04	< 2.56E-04	< 8.12E-03	< 0.5	< 5.0E-04	< 2.55E-04	< 8.11E-03	< 0.5	< 5.0E-04	< 2.53E-04	< 8.03E-03	< 0.50	< 5.0E-04	< 2.55E-04	< 8.09E-03
Vinyl chloride	62.50	< 0.5	< 5.0E-04	< 9.36E-05	< 2.97E-03	< 0.5	< 5.0E-04	< 9.34E-05	< 2.97E-03	< 0.5	< 5.0E-04	< 9.25E-05	< 2.94E-03	< 0.50	< 5.0E-04	< 9.32E-05	< 2.96E-03
1,3-Butadiene	54.0904	< 0.5	< 5.0E-04	< 8.10E-05	< 2.57E-03	< 0.5	< 5.0E-04	< 8.08E-05	< 2.57E-03	< 0.5	< 5.0E-04	< 8.00E-05	< 2.54E-03	< 0.50	< 5.0E-04	< 8.06E-05	< 2.56E-03
Bromomethane	94.94	< 0.5	< 5.0E-04	< 1.42E-04	< 4.51E-03	< 0.5	< 5.0E-04	< 1.42E-04	< 4.50E-03	< 0.5	< 5.0E-04	< 1.40E-04	< 4.46E-03	< 0.50	< 5.0E-04	< 1.42E-04	< 4.49E-03
Chloroethane	64.51	**0.5**	**5.0E-04**	**9.66E-05**	**3.07E-03**	< 0.5	< 5.0E-04	< 9.64E-05	< 3.06E-03	< 0.5	< 5.0E-04	< 9.55E-05	< 3.03E-03	< 0.50	< 5.0E-04	< 9.62E-05	< 3.05E-03
Freon 11	137.3672	< 0.5	< 5.0E-04	< 2.06E-04	< 6.53E-03	< 0.5	< 5.0E-04	< 2.05E-04	< 6.52E-03	< 0.5	< 5.0E-04	< 2.03E-04	< 6.45E-03	< 0.50	< 5.0E-04	< 2.05E-04	< 6.50E-03
Freon 113	187.38	< 0.5	< 5.0E-04	< 2.81E-04	< 8.91E-03	< 0.5	< 5.0E-04	< 2.80E-04	< 8.89E-03	< 0.5	< 5.0E-04	< 2.77E-04	< 8.80E-03	< 0.50	< 5.0E-04	< 2.79E-04	< 8.87E-03
1,1-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.45E-04	< 4.61E-03	< 0.5	< 5.0E-04	< 1.45E-04	< 4.60E-03	< 0.5	< 5.0E-04	< 1.43E-04	< 4.55E-03	< 0.50	< 5.0E-04	< 1.44E-04	< 4.59E-03
Acetone	58.08	**140**	**1.4E-01**	**2.43E-02**	**7.73E-01**	**44**	**4.4E-02**	**7.64E-03**	**2.43E-01**	**51**	**5.1E-02**	**8.77E-03**	**2.78E-01**	**78.33**	**7.8E-02**	**1.36E-02**	**4.31E-01**
Carbon disulfide	76.143	< 0.5	< 5.0E-04	< 1.14E-04	< 3.62E-03	< 0.5	< 5.0E-04	< 1.14E-04	< 3.61E-03	< 0.5	< 5.0E-04	< 1.13E-04	< 3.58E-03	< 0.50	< 5.0E-04	< 1.13E-04	< 3.60E-03
Methylene chloride	84.9320	< 0.5	< 5.0E-04	< 1.27E-04	< 4.04E-03	< 0.5	< 5.0E-04	< 1.27E-04	< 4.03E-03	< 0.5	< 5.0E-04	< 1.26E-04	< 3.99E-03	< 0.50	< 5.0E-04	< 1.27E-04	< 4.02E-03
trans-1,2-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.45E-04	< 4.61E-03	< 0.5	< 5.0E-04	< 1.45E-04	< 4.60E-03	< 0.5	< 5.0E-04	< 1.43E-04	< 4.55E-03	< 0.50	< 5.0E-04	< 1.44E-04	< 4.59E-03
Methyl t-butyl ether	88.1482	< 0.5	< 5.0E-04	< 1.32E-04	< 4.19E-03	< 0.5	< 5.0E-04	< 1.32E-04	< 4.18E-03	< 0.5	< 5.0E-04	< 1.30E-04	< 4.14E-03	< 0.50	< 5.0E-04	< 1.31E-04	< 4.17E-03
Vinyl acetate	86.0892	< 0.5	< 5.0E-04	< 1.29E-04	< 4.09E-03	< 0.5	< 5.0E-04	< 1.29E-04	< 4.08E-03	< 0.5	< 5.0E-04	< 1.27E-04	< 4.04E-03	< 0.50	< 5.0E-04	< 1.28E-04	< 4.07E-03
2-Butanone	72.1057	**3.1**	**3.1E-03**	**6.69E-04**	**2.12E-02**	**1.5**	**1.5E-03**	**3.23E-04**	1.03E-02	**1.4**	**1.4E-03**	**2.99E-04**	**9.48E-03**	**2.00**	**2.0E-03**	**4.30E-04**	**1.37E-02**
cis-1,2-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.45E-04	< 4.61E-03	< 0.5	< 5.0E-04	< 1.45E-04	< 4.60E-03	< 0.5	< 5.0E-04	< 1.43E-04	< 4.55E-03	< 0.50	< 5.0E-04	< 1.44E-04	< 4.59E-03
1,1-Dichloroethane	98.9586	< 0.5	< 5.0E-04	< 1.48E-04	< 4.70E-03	< 0.5	< 5.0E-04	< 1.48E-04	< 4.70E-03	< 0.5	< 5.0E-04	< 1.46E-04	< 4.65E-03	< 0.50	< 5.0E-04	< 1.48E-04	< 4.68E-03
Ethyl acetate	88.1051	< 1.0	< 1.0E-03	< 2.64E-04	< 8.38E-03	< 1.0	< 1.0E-03	< 2.63E-04	< 8.36E-03	< 1.0	< 1.0E-03	< 2.61E-04	< 8.28E-03	< 1.00	< 1.0E-03	< 2.63E-04	< 8.34E-03
Hexane	86.1754	**72**	**7.2E-02**	**1.86E-02**	**5.90E-01**	**79**	**7.9E-02**	**2.04E-02**	**6.46E-01**	**79**	**7.9E-02**	**2.01E-02**	**6.40E-01**	**76.67**	**7.7E-02**	**1.97E-02**	**6.25E-01**
Chloroform	119.3767	< 0.5	< 5.0E-04	< 1.79E-04	< 5.67E-03	< 0.5	< 5.0E-04	< 1.78E-04	< 5.66E-03	< 0.5	< 5.0E-04	< 1.77E-04	< 5.61E-03	< 0.50	< 5.0E-04	< 1.78E-04	< 5.65E-03
Tetrahydrofuran	72.1057	< 0.5	< 5.0E-04	< 1.08E-04	< 3.43E-03	< 0.5	< 5.0E-04	< 1.08E-04	< 3.42E-03	< 0.5	< 5.0E-04	< 1.07E-04	< 3.39E-03	< 0.50	< 5.0E-04	< 1.07E-04	< 3.41E-03
1,2-Dichloroethane	98.9586	< 0.5	< 5.0E-04	< 1.48E-04	< 4.70E-03	< 0.5	< 5.0E-04	< 1.48E-04	< 4.70E-03	< 0.5	< 5.0E-04	< 1.46E-04	< 4.65E-03	< 0.50	< 5.0E-04	< 1.48E-04	< 4.68E-03
1,1,1-Trichloroethane	133.4033	< 0.5	< 5.0E-04	< 2.00E-04	< 6.34E-03	< 0.5	< 5.0E-04	< 1.99E-04	< 6.33E-03	< 0.5	< 5.0E-04	< 1.97E-04	< 6.27E-03	< 0.50	< 5.0E-04	< 1.99E-04	< 6.31E-03
Carbon tetrachloride	153.8215	< 0.5	< 5.0E-04	< 2.30E-04	< 7.31E-03	< 0.5	< 5.0E-04	< 2.30E-04	< 7.30E-03	< 0.5	< 5.0E-04	< 2.28E-04	< 7.23E-03	< 0.50	< 5.0E-04	< 2.29E-04	< 7.28E-03
Benzene	78.1118	**16**	**1.6E-02**	**3.74E-03**	**1.19E-01**	**15**	**1.5E-02**	**3.50E-03**	**1.11E-01**	**13**	**1.3E-02**	**3.01E-03**	**9.54E-02**	**14.67**	**1.5E-02**	**3.42E-03**	**1.08E-01**
Cyclohexane	84.1595	**1.5**	**1.5E-03**	**3.78E-04**	**1.20E-02**	< 0.5	< 5.0E-04	< 1.26E-04	< 3.99E-03	< 0.5	< 5.0E-04	< 1.25E-04	< 3.95E-03	< 0.83	< 8.3E-04	< 2.09E-04	< 6.65E-03
Trichloroethene	131.3874	< 0.5	< 5.0E-04	< 1.97E-04	< 6.24E-03	< 0.5	< 5.0E-04	< 1.96E-04	< 6.23E-03	< 0.5	< 5.0E-04	< 1.94E-04	< 6.17E-03	< 0.50	< 5.0E-04	< 1.96E-04	< 6.22E-03
1,2-Dichloropropane	112.9851	< 0.5	< 5.0E-04	< 1.69E-04	< 5.37E-03	< 0.5	< 5.0E-04	< 1.69E-04	< 5.36E-03	< 0.5	< 5.0E-04	< 1.67E-04	< 5.31E-03	< 0.50	< 5.0E-04	< 1.68E-04	< 5.35E-03
Bromodichloromethane	163.828	< 0.5	< 5.0E-04	< 2.45E-04	< 7.79E-03	< 0.5	< 5.0E-04	< 2.45E-04	< 7.77E-03	< 0.5	< 5.0E-04	< 2.42E-04	< 7.70E-03	< 0.50	< 5.0E-04	< 2.44E-04	< 7.75E-03
Heptane	100.2019	**2.0**	**2.0E-03**	**6.00E-04**	**1.90E-02**	**2.9**	**2.9E-03**	**8.69E-04**	**2.76E-02**	**8.3**	**8.3E-03**	**2.46E-03**	**7.81E-02**	**4.40**	**4.4E-03**	**1.31E-03**	**4.16E-02**
cis-1,3-Dichloropropene	110.9693	< 0.5	< 5.0E-04	< 1.66E-04	< 5.27E-03	< 0.5	< 5.0E-04	< 1.66E-04	< 5.27E-03	< 0.5	< 5.0E-04	< 1.64E-04	< 5.21E-03	< 0.50	< 5.0E-04	< 1.65E-04	< 5.25E-03
4-Methyl-2-pentanone	100.1589	**0.58**	**5.8E-04**	**1.74E-04**	**5.52E-03**	< 0.5	< 5.0E-04	< 1.50E-04	< 4.75E-03	< 0.5	< 5.0E-04	< 1.48E-04	< 4.71E-03	< 0.53	< 5.3E-04	< 1.57E-04	< 4.99E-03
trans-1,3-Dichloropropene	110.9693	< 0.5	< 5.0E-04	< 1.66E-04	< 5.27E-03	< 0.5	< 5.0E-04	< 1.66E-04	< 5.27E-03	< 0.5	< 5.0E-04	< 1.64E-04	< 5.21E-03	< 0.50	< 5.0E-04	< 1.65E-04	< 5.25E-03
1,1,2-Trichloroethane	133.4033	< 0.5	< 5.0E-04	< 2.00E-04	< 6.34E-03	< 0.5	< 5.0E-04	< 1.99E-04	< 6.33E-03	< 0.5	< 5.0E-04	< 1.97E-04	< 6.27E-03	< 0.50	< 5.0E-04	< 1.99E-04	< 6.31E-03
Toluene	92.1384	**7.0**	**7.0E-03**	**1.93E-03**	**6.13E-02**	**9.7**	**9.7E-03**	**2.67E-03**	**8.48E-02**	**21**	**2.1E-02**	**5.73E-03**	**1.82E-01**	**12.57**	**1.3E-02**	**3.44E-03**	**1.09E-01**
2-Hexanone	100.1589	< 1.0	< 1.0E-03	< 3.00E-04	< 9.52E-03	< 1.0	< 1.0E-03	< 2.99E-04	< 9.51E-03	< 1.0	< 1.0E-03	< 2.96E-04	< 9.41E-03	< 1.00	< 1.0E-03	< 2.99E-04	< 9.48E-03
Tetrachloroethene	165.833	< 0.5	< 5.0E-04	< 2.48E-04	< 7.88E-03	< 0.5	< 5.0E-04	< 2.48E-04	< 7.87E-03	< 0.5	< 5.0E-04	< 2.45E-04	< 7.79E-03	< 0.50	< 5.0E-04	< 2.47E-04	< 7.85E-03
Dibromochloromethane	208.279	< 0.5	< 5.0E-04	< 3.12E-04	< 9.90E-03	< 0.5	< 5.0E-04	< 3.11E-04	< 9.88E-03	< 0.5	< 5.0E-04	< 3.08E-04	< 9.78E-03	< 0.50	< 5.0E-04	< 3.10E-04	< 9.86E-03
1,2-Dibromoethane	187.861	< 0.5	< 5.0E-04	< 2.81E-04	< 8.93E-03	< 0.5	< 5.0E-04	< 2.81E-04	< 8.91E-03	< 0.5	< 5.0E-04	< 2.78E-04	< 8.83E-03	< 0.50	< 5.0E-04	< 2.80E-04	< 8.89E-03
Chlorobenzene	112.5566	< 0.5	< 5.0E-04	< 1.69E-04	< 5.35E-03	< 0.5	< 5.0E-04	< 1.68E-04	< 5.34E-03	< 0.5	< 5.0E-04	< 1.67E-04	< 5.29E-03	< 0.50	< 5.0E-04	< 1.68E-04	< 5.33E-03
Ethyl benzene	106.1650	< 0.5	< 5.0E-04	< 1.59E-04	< 5.05E-03	< 0.5	< 5.0E-04	< 1.59E-04	< 5.04E-03	**0.69**	**6.9E-04**	**2.17E-04**	**6.88E-03**	**< 0.56**	**< 5.6E-04**	**< 1.78E-04**	**< 5.66E-03**
m,p-Xylene	106.1650	< 1.0	< 1.0E-03	< 3.18E-04	< 1.01E-02	< 1.0	< 1.0E-03	< 3.17E-04	< 1.01E-02	**1.5**	**1.5E-03**	**4.71E-04**	**1.50E-02**	**< 1.17**	**< 1.2E-03**	**< 3.69E-04**	**< 1.17E-02**
o-Xylene	106.1650	< 0.5	< 5.0E-04	< 1.59E-04	< 5.05E-03	< 0.5	< 5.0E-04	< 1.59E-04	< 5.04E-03	< 0.5	< 5.0E-04	< 1.57E-04	< 4.99E-03	< 0.50	< 5.0E-04	< 1.58E-04	< 5.02E-03
Styrene	104.1491	< 1.0	< 1.0E-03	< 3.12E-04	< 9.90E-03	< 1.0	< 1.0E-03	< 3.11E-04	< 9.88E-03	< 1.0	< 1.0E-03	< 3.08E-04	< 9.79E-03	< 1.00	< 1.0E-03	< 3.10E-04	< 9.86E-03
Bromoform	252.731	< 1.0	< 1.0E-03	< 7.57E-04	< 2.40E-02	< 1.0	< 1.0E-03	< 7.55E-04	< 2.40E-02	< 1.0	< 1.0E-03	< 7.48E-04	< 2.37E-02	< 1.00	< 1.0E-03	< 7.53E-04	< 2.39E-02
1,1,2,2-Tetrachloroethane	167.8481	< 0.5	< 5.0E-04	< 2.51E-04	< 7.98E-03	< 0.5	< 5.0E-04	< 2.51E-04	< 7.96E-03	< 0.5	< 5.0E-04	< 2.48E-04	< 7.89E-03	< 0.50	< 5.0E-04	< 2.50E-04	< 7.94E-03
4-Ethyl toluene	120.1916	< 1.0	< 1.0E-03	< 3.60E-04	< 1.14E-02	< 1.0	< 1.0E-03	< 3.59E-04	< 1.14E-02	< 1.0	< 1.0E-03	< 3.56E-04	< 1.13E-02	< 1.00	< 1.0E-03	< 3.58E-04	< 1.14E-02
1,3,5-Trimethylbenzene	120.1916	< 1.0	< 1.0E-03	< 3.60E-04	< 1.14E-02	< 1.0	< 1.0E-03	< 3.59E-04	< 1.14E-02	< 1.0	< 1.0E-03	< 3.56E-04	< 1.13E-02	< 1.00	< 1.0E-03	< 3.58E-04	< 1.14E-02
1,2,4-Trimethylbenzene	120.195	< 1.0	< 1.0E-03	< 3.60E-04	< 1.14E-02	< 1.0	< 1.0E-03	< 3.59E-04	< 1.14E-02	< 1.0	< 1.0E-03	< 3.56E-04	< 1.13E-02	< 1.00	< 1.0E-03	< 3.58E-04	< 1.14E-02
1,3-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 4.40E-04	< 1.40E-02	< 1.0	< 1.0E-03	< 4.39E-04	< 1.40E-02	< 1.0	< 1.0E-03	< 4.35E-04	< 1.38E-02	< 1.00	< 1.0E-03	< 4.38E-04	< 1.39E-02
1,4-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 4.40E-04	< 1.40E-02	< 1.0	< 1.0E-03	< 4.39E-04	< 1.40E-02	< 1.0	< 1.0E-03	< 4.35E-04	< 1.38E-02	< 1.00	< 1.0E-03	< 4.38E-04	< 1.39E-02
Benzyl chloride	126.5832	< 1.0	< 1.0E-03	< 3.79E-04	< 1.20E-02	< 1.0	< 1.0E-03	< 3.78E-04	< 1.20E-02	< 1.0	< 1.0E-03	< 3.75E-04	< 1.19E-02	< 1.00	< 1.0E-03	< 3.77E-04	< 1.20E-02
1,2-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 4.40E-04	< 1.40E-02	< 1.0	< 1.0E-03	< 4.39E-04	< 1.40E-02	< 1.0	< 1.0E-03	< 4.35E-04	< 1.38E-02	< 1.00	< 1.0E-03	< 4.38E-04	< 1.39E-02
1,2,4-Trichlorobenzene	181.4461	< 1.0	< 1.0E-03	< 5.43E-04	< 1.72E-02	< 1.0	< 1.0E-03	< 5.42E-04	< 1.72E-02	< 1.0	< 1.0E-03	< 5.37E-04	< 1.70E-02	< 1.00	< 1.0E-03	< 5.41E-04	< 1.72E-02
Hexachloro-1,3-butadiene	260.7590	< 1.0	< 1.0E-03	< 7.81E-04	< 2.48E-02	< 1.0	< 1.0E-03	< 7.79E-04	< 2.47E-02	< 1.0	< 1.0E-03	< 7.72E-04	< 2.45E-02	< 1.00	< 1.0E-03	< 7.77E-04	< 2.47E-02

Italized compounds are on the Oregon Ambient Benchmark Concentration list
Bold compounds are on the Oregon Air Toxics list
Blue text indicates results measured above the reporting limit (RL).
The symbol '<' indicates that the actual result is less than the numerical value listed. For laboratory results (ppb) the value listed is the RL and is used in all subsequent calculations.
Concentrations and emission rates calculated from '<' lab results are also identified with a '<' symbol.

Hollingsworth & Vose
Corvallis, OR
CFU 115 Tentatively Identified Compounds (TIC)

Run Number	4	5	6
Sample Collection Date	12/14/2022	12/14/2022	12/14/2022
Glass Production Rate Supplied by H&V (lb/hr)	63.0	63.0	63.0
Volumetric Flow Rate measured by Bison (dscfm)	19,219	19,187	18,996

Analyte	Molecular Weight	CFU 115-4				CFU 115-5				CFU 115-6				CFU 115 Averages			
	g/mol	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass
Propane	44.097		0.0E+00	0.00E+00	0.00E+00	34	3.4E-02	4.48E-03	1.42E-01	30	3.0E-02	3.92E-03	1.24E-01	32	2.1E-02	2.80E-03	8.89E-02
Isobutane	58.124		0.0E+00	0.00E+00	0.00E+00	28	2.8E-02	4.87E-03	1.54E-01	29	2.9E-02	4.99E-03	1.58E-01	29	1.9E-02	3.28E-03	1.04E-01
Butane	58.12		0.0E+00	0.00E+00	0.00E+00	26	2.6E-02	4.52E-03	1.43E-01	22	2.2E-02	3.78E-03	1.20E-01	24	1.6E-02	2.77E-03	8.78E-02
Butane, 2-Methyl	72.1488	11	1.1E-02	2.38E-03	7.54E-02	37	3.7E-02	7.98E-03	2.53E-01	23	2.3E-02	4.91E-03	1.56E-01	24	2.4E-02	5.09E-03	1.62E-01
Butane, 2,3-dimethyl	86.1754		0.0E+00	0.00E+00	0.00E+00	19	1.9E-02	4.89E-03	1.55E-01	12	1.2E-02	3.06E-03	9.72E-02	16	1.0E-02	2.65E-03	8.42E-02
Pentane	72.150	19	1.9E-02	4.10E-03	1.30E-01	73	7.3E-02	1.57E-02	5.00E-01	45	4.5E-02	9.61E-03	3.05E-01	46	4.6E-02	9.82E-03	3.12E-01
Pentane, 2-methyl-	86.175	8.8	8.8E-03	2.27E-03	7.21E-02	42	4.2E-02	1.08E-02	3.43E-01	25	2.5E-02	6.38E-03	2.02E-01	25	2.5E-02	6.49E-03	2.06E-01
Pentane, 2,4-dimethyl-	100.20	6.4	6.4E-03	1.92E-03	6.10E-02	44	4.4E-02	1.32E-02	4.18E-01	40	4.0E-02	1.19E-02	3.77E-01	30	3.0E-02	8.99E-03	2.85E-01
Pentane, 2,3-dimethyl-	100.20	31	3.1E-02	9.30E-03	2.95E-01	31	3.1E-02	9.29E-03	2.95E-01	32	3.2E-02	9.49E-03	3.01E-01	31	3.1E-02	9.36E-03	2.97E-01
Hexane, 2,2-dimethyl-	114.2285		0.0E+00	0.00E+00	0.00E+00	39	3.9E-02	1.33E-02	4.23E-01					39	2.0E-02	6.66E-03	2.11E-01
Butane, 2,2,3,3-tetramethyl-	114.2285	40	4.0E-02	1.37E-02	4.34E-01					53	5.3E-02	1.79E-02	5.69E-01	47	4.7E-02	1.58E-02	5.02E-01
Disulfide, dimethyl	94.1990	19	1.9E-02	5.36E-03	1.70E-01									19	1.9E-02	5.36E-03	1.70E-01
0-Cymene	134.218	41	4.1E-02	1.65E-02	5.23E-01									41	4.1E-02	1.65E-02	5.23E-01

Note: Concentrations listed for all TICs are estimated values.

Bison Engineering, Inc.
Gaseous Testing Summary

Client:	**Hollingsworth & Vose**	Source:	**CFU 115**
Facility:	**Glass Plant 2**	Test Date:	**December 14, 2022**
Location:	**Corvallis, OR**		

Environmental Conditions / Test Notes: 34 °F and Partly Sunny

Run	**1**	**2**	**3**	**Average**
Date	12/14/2022	12/14/2022	12/14/2022	
Run Start Time	8:00	9:10	10:20	
Run End Time	8:59	10:09	11:19	
Duration, min.	60	60	60	
Stack Diameter, in.	36.00	36.00	36.00	
Stack Area, sq.ft.	7.069	7.069	7.069	
Barometric Pressure, "Hg	30.15	30.15	30.15	30.15
Static Pressure, "H_2O	-0.74	-0.74	-0.74	-0.74
Stack Temperature, °F	269	271	270	270
CO_2, %vd	0.65	0.63	0.63	0.64
O_2, %vd	20.06	20.07	20.05	20.06
H_2O, %v	1.64	1.73	1.71	1.69
Wet Molecular Weight, lb/lb-mole	28.73	28.71	28.71	28.72
Velocity, FPS	62.15	62.39	63.42	62.65
WSCFM	19,211	19,230	19,565	19,335
DSCFM	18,896	18,897	19,230	19,008

Note: Negative concentrations are reported as zero.

Bison Engineering, Inc.
Gaseous Testing Summary

Client:	**Hollingsworth & Vose**	Source:	**CFU 115 - Round 2**
Facility:	**Glass Plant 2**	Test Date:	**December 14, 2022**
Location:	**Corvallis, OR**		

Environmental Conditions / Test Notes: 34 °F and Partly Sunny

Run		4	5	6	Average
Date		12/14/2022	12/14/2022	12/14/2022	
Run Start Time		13:05	14:15	15:25	
Run End Time		14:04	15:14	16:24	
Duration, min.		60	60	60	
Stack Diameter, in.		36.00	36.00	36.00	
Stack Area, sq.ft.		7.069	7.069	7.069	
Barometric Pressure, "Hg		30.15	30.15	30.15	30.15
Static Pressure, "H_2O		-0.72	-0.72	-0.72	-0.72
Stack Temperature, °F		272	269	272	271
CO_2, %vd		0.64	0.64	0.63	0.63
O_2, %vd		20.04	20.04	20.04	20.04
H_2O, %v		1.96	2.08	1.78	1.94
Wet Molecular Weight, lb/lb-mole		28.69	28.67	28.71	28.69
Velocity, FPS		63.73	63.41	62.82	63.32
WSCFM		19,603	19,595	19,341	19,513
DSCFM		19,219	19,187	18,996	19,134
Production Data, Total Flameblown	lb/hr	63.0	63.0	63.0	63.0
Production Data, L4R3	lb/hr	31.5	31.5	31.5	31.5
Production Data, L4R4	lb/hr	31.5	31.5	31.5	31.5

Note: Negative concentrations are reported as zero.

Bison Engineering, Inc.
Pre-Test Traverse

Client: **Hollingsworth & Vose**
Location: **Corvallis, OR**
Source: **CFU 115**

Stack Temp: NA °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	NA	2
2	NA	1
3	NA	6
4	NA	4
5	NA	5
6	NA	3
7	NA	0
8	NA	0
9	NA	0
10	NA	1
11	NA	2
12	NA	5
13	NA	3
14	NA	9
15	NA	8
16	NA	2

Average: NA 3
Flow is found to be: Non-cyclonic

No nozzle was needed for flow measurements, therefore no pre-velocity measurements or stack temperature was recorded prior to testing.

Bison Engineering, Inc.
EPA Method 1
Stack Parameters and Traverse Points

Client: **Hollingsworth & Vose**
Location: **Corvallis, OR**
Source: **CFU 115**
Facility: **Glass Plant 2**

Type of Testing: V 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.):	40.00	feet
Stack height (approx.):	8.00	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

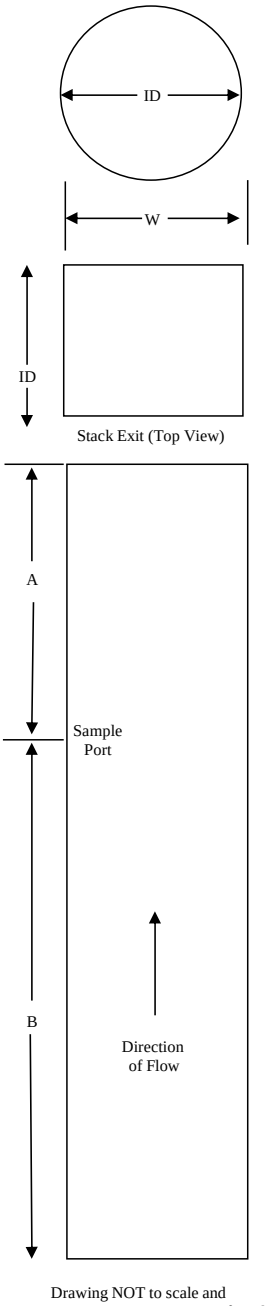
Sample Port Location:	Downstream flow disturbance from process B	Upstream flow disturbance toward exit A
Number of Inches:	134.00	45.00
Number of Diameters:	3.72	1.25

Minimum Number of Traverse Points: 16

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	3.2	1.15	6 1/8
2	10.5	3.78	8 3/4
3	19.4	6.98	12
4	32.3	11.63	16 5/8
5	67.7	24.37	29 3/8
6	80.6	29.02	34
7	89.5	32.22	37 1/4
8	96.8	34.85	39 7/8

Reference Diagram



Drawing NOT to scale and
NOT an accurate representation of stack.

Bison Engineering, Inc.
Method 2
Stack Gas Velocity and Volumetric Flow Rate

Client:	**Hollingsworth & Vose**	**Source:**	**CFU 115**
Facility:	**Glass Plant 2**	**Test Date:**	**12/14/22**
Location:	**Corvallis, OR**		

Molecular Weight		
Choose One by "x" below		
Measured	Ambient	Combustion
x		

Pitot ID	4E

Leak Checks:	Run 1		Run 2		Run 3	
	Pre	Post	Pre	Post	Pre	Post
Pitot	x	x	x	x	x	x
Barometric Pressure ("Hg)	30.15		30.15		30.15	

		Run 1		Run 2		Run 3	
Traverse	Sample Point	Velocity ΔP ("H_2O)	Stack Temperature (°F)	Velocity ΔP ("H_2O)	Stack Temperature (°F)	Velocity ΔP ("H_2O)	Stack Temperature (°F)
A	1	1.20	268	0.99	270	0.98	271
	2	1.10	269	0.94	270	0.84	272
	3	0.83	269	0.84	271	0.95	271
	4	0.97	270	0.87	271	1.00	271
	5	0.94	270	0.92	271	1.10	270
	6	0.96	270	0.87	272	0.90	270
	7	0.99	271	0.97	271	0.92	272
	8	0.88	270	0.97	269	0.85	270
B	1	1.00	265	0.95	268	1.10	270
	2	0.98	266	0.98	270	0.90	269
	3	0.82	268	0.96	271	0.92	269
	4	0.82	269	0.88	272	0.95	268
	5	0.82	269	0.84	272	0.96	269
	6	0.79	269	0.83	272	0.82	269
	7	0.77	269	0.76	271	0.81	269
	8	0.47	265	0.74	271	0.80	270
Method 2 -Flow Calculations							
Static Pressure, "H_2O			-0.74		-0.74		-0.74
Pitot tube cp			0.84		0.84		0.84
Stack Area, ft^3			7.069		7.069		7.069
H_2O, %v			1.64		1.73		1.71
Average √ΔP			0.943		0.945		0.961
Average Absolute Temp. (°R)			728.2		730.4		729.7
Stack Pressure (in. Hg)			30.10		30.10		30.10
Stack Velocity (ft/sec)			62.15		62.39		63.42
Actual Flow Rate (acfm)			26,357		26,462		26,897
Standard Flow Rate (wscf/hr)			1,152,665		1,153,771		1,173,887
Dry Standard Flow Rate (dscf/hr)			1,133,761		1,133,811		1,153,814
Dry Standard Flow Rate (dscfm)			18,896		18,897		19,230

	O_2	CO_2	Calculated N_2
Run 1	20.06	0.65	79.29
Run 2	20.07	0.63	79.30
Run 3	20.05	0.63	79.32

	Molecular Weight (lb/lb-mole)					
	Calculated		Ambient		Combustion	
Run1	M_d	28.91	M_d		M_d	
	M_s	28.73	M_s		M_s	
Run 2	M_d	28.90	M_d		M_d	
	M_s	28.71	M_s		M_s	
Run 3	M_d	28.90	M_d		M_d	
	M_s	28.71	M_s		M_s	

Bison Engineering, Inc.
Method 2
Stack Gas Velocity and Volumetric Flow Rate

Client:	**Hollingsworth & Vose**	**Source:**	**CFU 115 - Round 2**
Facility:	**Glass Plant 2**	**Test Date:**	**12/14/22**
Location:	**Corvallis, OR**		

Molecular Weight		
Choose One by "x" below		
Measured	Ambient	Combustion
x		

Pitot ID	4E

Leak Checks:	Run 4		Run 5		Run 6	
	Pre	Post	Pre	Post	Pre	Post
Pitot	x	x	x	x	x	x
Barometric Pressure ("Hg)	30.15		30.15		30.15	

		Run 4		Run 5		Run 6	
Traverse	Sample Point	Velocity ΔP ("H_2O)	Stack Temperature (°F)	Velocity ΔP ("H_2O)	Stack Temperature (°F)	Velocity ΔP ("H_2O)	Stack Temperature (°F)
A	1	1.10	272	1.00	265	1.10	270
	2	1.10	273	1.00	267	1.10	271
	3	0.95	273	0.99	268	0.94	272
	4	0.95	274	0.98	269	0.90	272
	5	0.98	274	0.90	270	0.97	272
	6	0.92	275	0.88	271	1.00	272
	7	0.91	274	0.93	271	1.00	271
	8	0.90	274	0.94	270	1.10	270
B	1	1.10	273	1.10	266	0.88	271
	2	0.94	272	0.99	267	0.92	272
	3	0.86	271	0.92	268	0.96	272
	4	0.84	270	0.83	269	0.96	273
	5	0.83	271	0.81	270	0.89	272
	6	0.85	271	0.82	270	0.82	272
	7	0.84	271	0.90	270	0.71	272
	8	0.83	268	0.82	271	0.39	271
Method 2 -Flow Calculations							
Static Pressure, "H_2O			-0.72		-0.72		-0.72
Pitot tube cp			0.84		0.84		0.84
Stack Area, ft^3			7.069		7.069		7.069
H_2O, %v			1.96		2.08		1.78
Average √ΔP			0.964		0.961		0.951
Average Absolute Temp. (°R)			731.9		728.5		731.2
Stack Pressure (in. Hg)			30.10		30.10		30.10
Stack Velocity (ft/sec)			63.73		63.41		62.82
Actual Flow Rate (acfm)			27,031		26,893		26,643
Standard Flow Rate (wscf/hr)			1,176,191		1,175,673		1,160,435
Dry Standard Flow Rate (dscf/hr)			1,153,138		1,151,219		1,139,779
Dry Standard Flow Rate (dscfm)			19,219		19,187		18,996

	O_2	CO_2	Calculated N_2
Run 1	20.04	0.64	79.32
Run 2	20.04	0.64	79.32
Run 3	20.04	0.63	79.33

	Molecular Weight (lb/lb-mole)					
	Calculated		Ambient		Combustion	
Run1	M_d	28.9	M_d		M_d	
	M_s	28.69	M_s		M_s	
Run 2	M_d	28.90	M_d		M_d	
	M_s	28.67	M_s		M_s	
Run 3	M_d	28.90	M_d		M_d	
	M_s	28.71	M_s		M_s	

Bison Engineering, Inc.
Moisture Field Data

Client:	**Hollingsworth & Vose**	**Meterbox ID:**	Box 11
Facility:	**Glass Plant 2**	**Meter "Y"-Factor**	0.9690
Location:	**Corvallis, OR**		
Source:	**CFU 115**		
Test date:	**12/14/2022**		

Moisture Field Data Entry

Run 1

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	16
Start Time	8:00	
End Time	9:00	
Bp, "Hg	30.15	

Minutes	Meter Volume	Meter °F	Condenser °F	Delta H
	591.315			
5	594.980	36	40	1.800
10	598.730	36	44	1.800
15	602.580	37	48	1.800
20	606.240	37	50	1.800
25	610.010	38	52	1.800
30	613.910	39	54	1.800
35	617.620	40	55	1.800
40	621.430	40	56	1.800
45	625.210	41	56	1.800
50	628.850	41	58	1.800
55	632.340	42	60	1.800
60	636.560	42	60	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	807.1	811.7	4.6
2	776.1	778.2	2.1
3	700.0	700.4	0.4
Silica Gel	919	928.5	9.5
Impinger Totals:	3,202.2	3,218.8	7.1

Moisture Field Data Entry

Run 2

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	8
Start Time	9:10	
End Time	10:10	
Bp, "Hg	30.15	

Meter Volume	Meter °F	Condenser °F	Delta H
639.175			
643.015	43	45	1.800
646.470	43	45	1.800
650.200	44	50	1.800
654.120	44	51	1.800
657.630	44	52	1.800
661.160	44	53	1.800
664.950	44	51	1.800
668.850	44	51	1.800
672.210	44	51	1.800
675.880	44	52	1.800
679.520	43	51	1.800
683.325	43	51	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	811.7	815.1	3.4
2	780.8	783.6	2.8
3	616.8	617.6	0.8
Silica Gel	913	922.9	9.9
Impinger Totals:	3,122.3	3,139.2	7.0

Moisture Field Data Entry

Run 3

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	7
Start Time	10:20	
End Time	11:20	
Bp, "Hg	30.15	

Meter Volume	Meter °F	Condenser °F	Delta H
683.825			
687.770	43	59	1.800
691.300	43	58	1.800
695.020	43	55	1.800
698.750	43	58	1.800
701.450	43	58	1.800
704.560	43	60	1.800
708.690	43	61	1.800
712.420	44	64	1.800
716.080	44	64	1.800
718.540	44	62	1.800
723.450	45	59	1.800
727.130	45	60	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	815.1	819.9	4.8
2	778.2	780.2	2.0
3	700.4	700.7	0.3
Silica Gel	928.5	937.8	9.3
Impinger Totals:	3,222.2	3,238.6	7.1

Bison Engineering, Inc.
Moisture Field Data

Client:	**Hollingsworth & Vose**	**Meterbox ID:**	Box 11
Facility:	**Glass Plant 2**	**Meter "Y"-Factor**	0.9690
Location:	**Corvallis, OR**		
Source:	**CFU 115 - Round 2**		
Test date:	**12/14/2022**		

Moisture Field Data Entry

Run 4

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	5
Start Time	13:05	
End Time	14:05	
Bp, "Hg	30.15	

Minutes	Meter Volume	Meter °F	Condenser °F	Delta H
	730.580			
5	734.520	48	59	1.800
10	738.380	49	65	1.800
15	742.120	50	67	1.800
20	745.890	51	66	1.800
25	749.720	51	61	1.800
30	753.520	53	60	1.800
35	758.320	54	57	1.800
40	761.170	54	58	1.800
45	764.850	55	57	1.800
50	768.520	56	58	1.800
55	772.680	57	58	1.800
60	776.495	57	55	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	819.9	824.1	4.2
2	783.6	784.4	0.8
3	617.6	619.5	1.9
Silica Gel	922.9	935.7	12.8
Impinger Totals:	3,144.0	3,163.7	6.9

Moisture Field Data Entry

Run 5

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	16	6
Start Time	14:15	
End Time	15:15	
Bp, "Hg	30.15	

Meter Volume	Meter °F	Condenser °F	Delta H
777.180			
780.060	58	52	1.800
784.800	58	61	1.800
788.680	58	66	1.800
792.280	59	64	1.800
796.080	59	59	1.800
799.860	59	56	1.800
803.790	59	54	1.800
807.840	60	55	1.800
811.270	60	55	1.800
815.120	60	55	1.800
818.830	60	54	1.800
822.630	61	53	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	820.1	824.9	4.8
2	818.5	822.0	3.5
3	681.1	682.6	1.5
Silica Gel	854.8	865.4	10.6
Impinger Totals:	3,174.5	3,194.9	9.8

Moisture Field Data Entry

Run 6

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	7
Start Time	15:25	
End Time	16:25	
Bp, "Hg	30.15	

Meter Volume	Meter °F	Condenser °F	Delta H
823.000			
826.730	59	50	1.800
830.470	52	53	1.800
834.260	59	58	1.800
838.070	59	59	1.800
841.790	59	61	1.800
845.600	60	62	1.800
849.570	60	64	1.800
853.190	60	65	1.800
857.000	60	65	1.800
860.830	60	66	1.800
864.640	60	65	1.800
868.465	59	65	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	824.9	829.6	4.7
2	784.4	788.1	3.7
3	619.5	618.7	-0.8
Silica Gel	935.7	945.5	9.8
Impinger Totals:	3,164.5	3,181.9	7.6

Bison Engineering, Inc.
Method 4 Moisture Calculations

Client: **Hollingsworth & Vose**
Facility: **Glass Plant 2**
Location: **Corvallis, OR**
Source: **CFU 115**
Test date: **12/14/2022**

Method 4 -Moisture Determination					
Run Number	#	1	2	3	
Start Time	hh:mm	8:00	9:10	10:20	
Meter Box Identification	#	Box 11	Box 11	Box 11	
Meter "Y" Factor	Factor	0.9690	0.9690	0.9690	
Barometric Pressure	in Hg	30.15	30.15	30.15	
Sample Duration	hh:mm	1:00	1:00	1:00	
Average Meter Temperature	Deg F	39.1	43.7	43.6	
Average Condenser Temperature	Deg F	52.8	50.3	59.8	
Average Delta H	in H2O	1.800	1.800	1.800	
Average Meter Pressure	in Hg	30.282	30.282	30.282	
Meter Volume Start	dcf	591.315	639.175	683.825	
Meter Volume End	dcf	636.560	683.325	727.130	
Meter Volume	dcf	45.245	44.150	43.305	
Corrected Meter Volume	dscf	46.945	45.392	44.531	
Impinger Gain	g	7.1	7.0	7.1	
Silica Gel Gain	g	9.5	9.9	9.3	Average
Volume of Condensed Water Vapor	scf	0.783	0.797	0.773	0.784
Moisture Calculation	Bws	0.0164	0.0173	0.0171	0.017
Percent Moisture	Bws%	1.64	1.73	1.71	1.69

Bison Engineering, Inc.
Method 4 Moisture Calculations

Client: **Hollingsworth & Vose**
Facility: **Glass Plant 2**
Location: **Corvallis, OR**
Source: **CFU 115 - Round 2**
Test date: **12/14/2022**

Method 4 -Moisture Determination					
Run Number	#	4	5	6	
Start Time	hh:mm	13:05	14:15	15:25	
Meter Box Identification	#	Box 11	Box 11	Box 11	
Meter "Y" Factor	Factor	0.9690	0.9690	0.9690	
Barometric Pressure	in Hg	30.15	30.15	30.15	
Sample Duration	hh:mm	1:00	1:00	1:00	
Average Meter Temperature	Deg F	52.9	59.3	58.9	
Average Condenser Temperature	Deg F	60.1	57.0	61.1	
Average Delta H	in H2O	1.800	1.800	1.800	
Average Meter Pressure	in Hg	30.282	30.282	30.282	
Meter Volume Start	dcf	730.580	777.180	823.000	
Meter Volume End	dcf	776.495	822.630	868.465	
Meter Volume	dcf	45.915	45.450	45.465	
Corrected Meter Volume	dscf	46.355	45.326	45.370	
Impinger Gain	g	6.9	9.8	7.6	
Silica Gel Gain	g	12.8	10.6	9.8	Average
Volume of Condensed Water Vapor	scf	0.929	0.962	0.821	0.904
Moisture Calculation	Bws	0.0196	0.0208	0.0178	0.019
Percent Moisture	Bws%	1.96	2.08	1.78	1.94

Bison Engineering, Inc.
Method 3A Oxygen
Calibration Error, System Bias and System Drift

Client:	**Hollingsworth & Vose**	Source:	**CFU 115**	Instrument Make:	**Servomex**
Facility:	**Glass Plant 2**	Date:	**December 14, 2022**	Instrument Model:	**1440**
Location:	**Corvallis, OR**			Instrument Serial #:	**01440D1-5041**

			Initial Values			Final Values								
		Analyzer Cal. Response	System Cal Response	Pre test System Cal. Bias % of span	pass/fail	System Cal Response	Post test System Cal. Bias % of span	pass/fail	System Drift % of span	pass/fail	Analyzer Span	Raw Avg Gas Conc	Corrected Gas Conc	Instrument Cal. Reference Gas
Run 1	zero	-0.04	0.07	0.50	pass	0.07	0.50	pass	0.00	pass				
	upscale	10.03	10.00	-0.14	pass	9.94	-0.41	pass	0.27	pass	21.94	19.83	20.06	10.05
Run 2	zero	-0.04	0.07	0.50	pass	0.05	0.41	pass	0.09	pass				
	upscale	10.03	9.94	-0.41	pass	9.96	-0.32	pass	0.09	pass	21.94	19.81	20.07	10.05
Run 3	zero	-0.04	0.05	0.41	pass	0.04	0.36	pass	0.05	pass				
	upscale	10.03	9.96	-0.32	pass	9.93	-0.46	pass	0.14	pass	21.94	19.80	20.05	10.05
				< 5%*			**< 5%***		**< 3%***					

Analyzer Calibration Error	Zero	Mid	High
Calibration Gas Standards	0	10.05	21.94
Cylinder Number		CC503830	SA20406
Calibration Gas Analyzer Response	-0.04	10.03	22.00
Analyzer Calibration Error	-0.18	-0.09	0.27
Analyzer Calibration Error < 2%*	pass	pass	pass

System Response Time	
29	seconds

System Leak Check		
	Completed	**Pass/Fail**
Pre-test	Yes	Pass
Post-test	Yes	Pass

Note: All units are in %
*Or < 0.5 % absolute difference

Bison Engineering, Inc.
Method 3A Oxygen
Calibration Error, System Bias and System Drift

Client:	**Hollingsworth & Vose**	Source:	**CFU 115 - Round 2**	Instrument Make:	**Servomex**
Facility:	**Glass Plant 2**	Date:	**December 14, 2022**	Instrument Model:	**1440**
Location:	**Corvallis, OR**			Instrument Serial #:	**01440D1-5041**

		Initial Values				Final Values								
		Analyzer Cal. Response	System Cal Response	Pre test System Cal. Bias % of span	pass/fail	System Cal Response	Post test System Cal. Bias % of span	pass/fail	System Drift % of span	pass/fail	Analyzer Span	Raw Avg Gas Conc	Corrected Gas Conc	Instrument Cal. Reference Gas
Run 4	zero	-0.04	0.04	0.36	pass	0.05	0.41	pass	0.05	pass				
	upscale	10.03	9.93	-0.46	pass	9.95	-0.36	pass	0.09	pass	21.94	19.78	20.04	10.05
Run 5	zero	-0.04	0.05	0.41	pass	0.05	0.41	pass	0.00	pass				
	upscale	10.03	9.95	-0.36	pass	9.94	-0.41	pass	0.05	pass	21.94	19.78	20.04	10.05
Run 6	zero	-0.04	0.05	0.41	pass	0.05	0.41	pass	0.00	pass				
	upscale	10.03	9.94	-0.41	pass	9.96	-0.32	pass	0.09	pass	21.94	19.79	20.04	10.05
				< 5%*			**< 5%***		**< 3%***					

Analyzer Calibration Error	**Zero**	**Mid**	**High**
Calibration Gas Standards	0	10.05	21.94
Cylinder Number		CC503830	SA20406
Calibration Gas Analyzer Response	-0.04	10.03	22.00
Analyzer Calibration Error	-0.18	-0.09	0.27
Analyzer Calibration Error < 2%*	pass	pass	pass

System Response Time	
30	seconds

System Leak Check		
	Completed	**Pass/Fail**
Pre-test	Yes	Pass
Post-test	Yes	Pass

Note: All units are in %
*Or < 0.5 % absolute difference

Bison Engineering, Inc.
Method 3A CO_2
Calibration Error, System Bias and System Drift

Client:	**Hollingsworth & Vose**	Source:	**CFU 115**	Instrument Make:	**Servomex**
Facility:	**Glass Plant 2**	Date:	**December 14, 2022**	Instrument Model:	**1440**
Location:	**Corvallis, OR**			Instrument Serial #:	**01440D1-5041**

			Initial Values			Final Values								
		Analyzer Cal. Response	System Cal Response	Pre test System Cal. Bias % of span	pass/fail	System Cal Response	Post test System Cal. Bias % of span	pass/fail	System Drift % of span	pass/fail	Analyzer Span	Raw Avg Gas Conc	Corrected Gas Conc	Instrument Cal. Reference Gas
Run 1	zero	0.03	0.03	0.00	pass	0.04	0.05	pass	0.05	pass				
	upscale	9.87	10.05	0.83	pass	9.95	0.37	pass	0.46	pass	21.70	0.69	0.65	9.951
Run 2	zero	0.03	0.04	0.05	pass	0.05	0.09	pass	0.05	pass				
	upscale	9.87	9.95	0.37	pass	10.06	0.88	pass	0.51	pass	21.70	0.68	0.63	9.951
Run 3	zero	0.03	0.05	0.09	pass	0.04	0.05	pass	0.05	pass				
	upscale	9.87	10.06	0.88	pass	10.08	0.97	pass	0.09	pass	21.70	0.68	0.63	9.951
				< 5%*			**< 5%***		**< 3%***					

Analyzer Calibration Error	Zero	Mid	High
Calibration Gas Standards	0	9.951	21.70
Cylinder Number		CC503830	SA20406
Calibration Gas Analyzer Response	0.03	9.87	21.98
Analyzer Calibration Error	0.14	-0.37	1.29
Analyzer Calibration Error < 2%*	pass	pass	pass

System Response Time	
30	seconds

System Leak Check		
	Completed	**Pass/Fail**
Pre-test	Yes	Pass
Post-test	Yes	Pass

Note: All units are in %
*Or < 0.5 % absolute difference

Bison Engineering, Inc.
Method 3A CO_2
Calibration Error, System Bias and System Drift

Client:	**Hollingsworth & Vose**	Source:	**CFU 115 - Round 2**	Instrument Make:	**Servomex**
Facility:	**Glass Plant 2**	Date:	**December 14, 2022**	Instrument Model:	**1440**
Location:	**Corvallis, OR**			Instrument Serial #:	**01440D1-5041**

		Initial Values				Final Values								
		Analyzer Cal. Response	System Cal Response	Pre test System Cal. Bias % of span	pass/fail	System Cal Response	Post test System Cal. Bias % of span	pass/fail	System Drift % of span	pass/fail	Analyzer Span	Raw Avg Gas Conc	Corrected Gas Conc	Instrument Cal. Reference Gas
Run 4	zero	0.03	0.04	0.05	pass	0.04	0.05	pass	0.00	pass				
	upscale	9.87	10.08	0.97	pass	9.98	0.51	pass	0.46	pass	21.70	0.68	0.64	9.951
Run 5	zero	0.03	0.04	0.05	pass	0.05	0.09	pass	0.05	pass				
	upscale	9.87	9.98	0.51	pass	9.96	0.41	pass	0.09	pass	21.70	0.68	0.64	9.951
Run 6	zero	0.03	0.05	0.09	pass	0.05	0.09	pass	0.00	pass				
	upscale	9.87	9.96	0.41	pass	10.15	1.29	pass	0.88	pass	21.70	0.68	0.63	9.951
				< 5%*			**< 5%***		**< 3%***					

Analyzer Calibration Error	**Zero**	**Mid**	**High**
Calibration Gas Standards	0	9.951	21.70
Cylinder Number		CC503830	SA20406
Calibration Gas Analyzer Response	0.03	9.87	21.98
Analyzer Calibration Error	0.14	-0.37	1.29
Analyzer Calibration Error < 2%*	pass	pass	pass

System Response Time	
28	seconds

System Leak Check		
	Completed	**Pass/Fail**
Pre-test	Yes	Pass
Post-test	Yes	Pass

Note: All units are in %
*Or < 0.5 % absolute difference

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	7:13:52	0.04	0.04	
12/14/2022	7:14:52	-0.02	0.04	
12/14/2022	7:15:52	-0.04	0.03	**O2/CO2 Analyzer Zero**
12/14/2022	7:16:52	-0.05	0.03	
12/14/2022	7:17:52	-0.06	0.03	
12/14/2022	7:18:52	-0.07	0.02	
12/14/2022	7:19:52	-0.07	0.02	
12/14/2022	7:20:52	-0.08	0.02	
12/14/2022	7:21:52	-0.08	0.02	
12/14/2022	7:22:52	-0.09	0.02	
12/14/2022	7:23:52	-0.09	0.02	
12/14/2022	7:24:52	-0.10	0.01	
12/14/2022	7:25:52	-0.10	0.01	
12/14/2022	7:26:52	-0.10	0.01	\
12/14/2022	7:27:52	16.27	16.35	
12/14/2022	7:28:52	22.00	21.98	**O2/CO2 Analyzer Span**
12/14/2022	7:29:52	18.10	18.06	
12/14/2022	7:30:52	10.05	9.88	
12/14/2022	7:31:52	10.04	9.87	
12/14/2022	7:32:52	10.04	9.87	
12/14/2022	7:33:52	10.04	9.87	
12/14/2022	7:34:52	10.04	9.87	
12/14/2022	7:35:52	10.03	9.87	**O2/CO2 Analyzer Mid**
12/14/2022	7:36:52	10.03	9.87	
12/14/2022	7:37:52	10.03	9.87	
12/14/2022	7:38:52	10.01	9.59	
12/14/2022	7:39:52	20.50	0.21	
12/14/2022	7:40:52	20.94	0.14	
12/14/2022	7:41:52	20.92	0.15	
12/14/2022	7:42:52	20.07	0.62	
12/14/2022	7:43:52	8.23	0.30	
12/14/2022	7:44:52	0.15	0.04	
12/14/2022	7:45:52	0.07	0.03	**O2/CO2 System Zero**
12/14/2022	7:46:52	4.38	4.47	
12/14/2022	7:47:52	9.94	9.97	
12/14/2022	7:48:52	10.00	10.05	**O2/CO2 System Upscale**
12/14/2022	7:49:52	10.00	10.07	
12/14/2022	7:50:52	14.44	5.67	
12/14/2022	7:51:52	19.77	0.76	

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	7:52:52	19.82	0.71	
12/14/2022	7:53:52	19.83	0.70	
12/14/2022	7:54:52	19.83	0.70	
12/14/2022	7:55:52	19.84	0.70	
12/14/2022	7:56:52	19.84	0.70	
12/14/2022	7:57:52	19.83	0.70	
12/14/2022	7:58:52	19.83	0.70	
12/14/2022	7:59:52	19.83	0.70	
				CFU 115
12/14/2022	8:00:52	19.82	0.71	**Start Run 1**
12/14/2022	8:01:52	19.83	0.71	
12/14/2022	8:02:52	19.83	0.71	
12/14/2022	8:03:52	19.83	0.71	
12/14/2022	8:04:52	19.83	0.70	
12/14/2022	8:05:52	19.83	0.71	
12/14/2022	8:06:52	19.82	0.70	
12/14/2022	8:07:52	19.82	0.70	
12/14/2022	8:08:52	19.83	0.70	
12/14/2022	8:09:52	19.83	0.70	
12/14/2022	8:10:52	19.84	0.69	
12/14/2022	8:11:52	19.84	0.69	
12/14/2022	8:12:52	19.84	0.69	
12/14/2022	8:13:52	19.84	0.69	
12/14/2022	8:14:52	19.83	0.68	
12/14/2022	8:15:52	19.84	0.68	
12/14/2022	8:16:52	19.84	0.68	
12/14/2022	8:17:52	19.84	0.68	
12/14/2022	8:18:52	19.83	0.69	
12/14/2022	8:19:52	19.83	0.69	
12/14/2022	8:20:52	19.83	0.69	
12/14/2022	8:21:52	19.83	0.69	
12/14/2022	8:22:52	19.83	0.69	
12/14/2022	8:23:52	19.83	0.69	
12/14/2022	8:24:52	19.83	0.69	
12/14/2022	8:25:52	19.83	0.69	
12/14/2022	8:26:52	19.83	0.69	
12/14/2022	8:27:52	19.83	0.69	
12/14/2022	8:28:52	19.83	0.69	
12/14/2022	8:29:52	19.83	0.69	

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	8:30:52	19.82	0.69	
12/14/2022	8:31:52	19.83	0.69	
12/14/2022	8:32:52	19.82	0.69	
12/14/2022	8:33:52	19.82	0.69	
12/14/2022	8:34:52	19.82	0.70	
12/14/2022	8:35:52	19.82	0.69	
12/14/2022	8:36:52	19.82	0.69	
12/14/2022	8:37:52	19.82	0.69	
12/14/2022	8:38:52	19.82	0.69	
12/14/2022	8:39:52	19.82	0.69	
12/14/2022	8:40:52	19.82	0.69	
12/14/2022	8:41:52	19.83	0.68	
12/14/2022	8:42:52	19.83	0.68	
12/14/2022	8:43:52	19.83	0.68	
12/14/2022	8:44:52	19.83	0.68	
12/14/2022	8:45:52	19.83	0.68	
12/14/2022	8:46:52	19.82	0.69	
12/14/2022	8:47:52	19.82	0.69	
12/14/2022	8:48:52	19.82	0.69	
12/14/2022	8:49:52	19.82	0.69	
12/14/2022	8:50:52	19.83	0.69	
12/14/2022	8:51:52	19.83	0.69	
12/14/2022	8:52:52	19.82	0.69	
12/14/2022	8:53:52	19.82	0.70	
12/14/2022	8:54:52	19.82	0.69	
12/14/2022	8:55:52	19.82	0.70	
12/14/2022	8:56:52	19.82	0.69	
12/14/2022	8:57:52	19.82	0.69	
12/14/2022	8:58:52	19.83	0.69	
12/14/2022	8:59:52	19.82	0.69	**End Run 1**
		19.83	**0.69**	**Average**
12/14/2022	9:00:52	19.82	0.69	
12/14/2022	9:01:52	19.82	0.69	
12/14/2022	9:02:52	19.81	0.69	
12/14/2022	9:03:52	19.79	0.71	
12/14/2022	9:04:52	3.42	0.30	
12/14/2022	9:05:52	0.07	0.04	**O2/CO2 System Zero**
12/14/2022	9:06:52	4.72	4.77	

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	9:07:52	9.94	9.95	**O2/CO2 System Upscale**
12/14/2022	9:08:52	12.34	7.61	
12/14/2022	9:09:52	19.61	0.85	
12/14/2022	9:10:52	19.79	0.71	**Start Run 2**
12/14/2022	9:11:52	19.80	0.70	
12/14/2022	9:12:52	19.80	0.69	
12/14/2022	9:13:52	19.80	0.69	
12/14/2022	9:14:52	19.81	0.69	
12/14/2022	9:15:52	19.81	0.68	
12/14/2022	9:16:52	19.82	0.69	
12/14/2022	9:17:52	19.82	0.69	
12/14/2022	9:18:52	19.82	0.69	
12/14/2022	9:19:52	19.82	0.69	
12/14/2022	9:20:52	19.82	0.69	
12/14/2022	9:21:52	19.81	0.70	
12/14/2022	9:22:52	19.81	0.70	
12/14/2022	9:23:52	19.81	0.70	
12/14/2022	9:24:52	19.81	0.70	
12/14/2022	9:25:52	19.81	0.69	
12/14/2022	9:26:52	19.81	0.69	
12/14/2022	9:27:52	19.81	0.69	
12/14/2022	9:28:52	19.81	0.69	
12/14/2022	9:29:52	19.81	0.69	
12/14/2022	9:30:52	19.80	0.69	
12/14/2022	9:31:52	19.80	0.68	
12/14/2022	9:32:52	19.81	0.68	
12/14/2022	9:33:52	19.81	0.68	
12/14/2022	9:34:52	19.80	0.68	
12/14/2022	9:35:52	19.81	0.68	
12/14/2022	9:36:52	19.82	0.68	
12/14/2022	9:37:52	19.82	0.68	
12/14/2022	9:38:52	19.82	0.68	
12/14/2022	9:39:52	19.82	0.68	
12/14/2022	9:40:52	19.82	0.68	
12/14/2022	9:41:52	19.82	0.68	
12/14/2022	9:42:52	19.82	0.68	
12/14/2022	9:43:52	19.82	0.69	
12/14/2022	9:44:52	19.81	0.69	

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	9:45:52	19.81	0.69	
12/14/2022	9:46:52	19.81	0.69	
12/14/2022	9:47:52	19.81	0.69	
12/14/2022	9:48:52	19.81	0.69	
12/14/2022	9:49:52	19.81	0.69	
12/14/2022	9:50:52	19.81	0.69	
12/14/2022	9:51:52	19.81	0.69	
12/14/2022	9:52:52	19.82	0.68	
12/14/2022	9:53:52	19.82	0.68	
12/14/2022	9:54:52	19.82	0.68	
12/14/2022	9:55:52	19.81	0.68	
12/14/2022	9:56:52	19.81	0.68	
12/14/2022	9:57:52	19.81	0.67	
12/14/2022	9:58:52	19.81	0.67	
12/14/2022	9:59:52	19.81	0.67	
12/14/2022	10:00:52	19.82	0.67	
12/14/2022	10:01:52	19.82	0.67	
12/14/2022	10:02:52	19.81	0.67	
12/14/2022	10:03:52	19.81	0.67	
12/14/2022	10:04:52	19.81	0.68	
12/14/2022	10:05:52	19.82	0.67	
12/14/2022	10:06:52	19.81	0.68	
12/14/2022	10:07:52	19.81	0.68	
12/14/2022	10:08:52	19.81	0.68	
12/14/2022	10:09:52	19.81	0.69	**End Run 2**
		19.81	**0.68**	**Average**
12/14/2022	10:10:52	19.81	0.69	
12/14/2022	10:11:52	10.51	0.57	
12/14/2022	10:12:52	0.14	0.06	
12/14/2022	10:13:52	0.05	0.05	**O2/CO2 System Zero**
12/14/2022	10:14:52	6.91	7.03	
12/14/2022	10:15:52	9.96	10.06	**O2/CO2 System Upscale**
12/14/2022	10:16:52	10.23	9.78	
12/14/2022	10:17:52	18.82	1.51	
12/14/2022	10:18:52	19.78	0.71	
12/14/2022	10:19:52	19.79	0.70	
12/14/2022	10:20:52	19.79	0.69	**Start Run 3**

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	10:21:52	19.80	0.68	
12/14/2022	10:22:52	19.80	0.68	
12/14/2022	10:23:52	19.79	0.68	
12/14/2022	10:24:52	19.79	0.68	
12/14/2022	10:25:52	19.79	0.68	
12/14/2022	10:26:52	19.80	0.68	
12/14/2022	10:27:52	19.80	0.68	
12/14/2022	10:28:52	19.80	0.68	
12/14/2022	10:29:52	19.80	0.67	
12/14/2022	10:30:52	19.80	0.68	
12/14/2022	10:31:52	19.80	0.68	
12/14/2022	10:32:52	19.80	0.68	
12/14/2022	10:33:52	19.80	0.68	
12/14/2022	10:34:52	19.80	0.68	
12/14/2022	10:35:52	19.80	0.68	
12/14/2022	10:36:52	19.81	0.69	
12/14/2022	10:37:52	19.81	0.68	
12/14/2022	10:38:52	19.81	0.68	
12/14/2022	10:39:52	19.81	0.68	
12/14/2022	10:40:52	19.80	0.68	
12/14/2022	10:41:52	19.81	0.68	
12/14/2022	10:42:52	19.81	0.68	
12/14/2022	10:43:52	19.80	0.68	
12/14/2022	10:44:52	19.81	0.68	
12/14/2022	10:45:52	19.81	0.67	
12/14/2022	10:46:52	19.80	0.67	
12/14/2022	10:47:52	19.80	0.67	
12/14/2022	10:48:52	19.80	0.67	
12/14/2022	10:49:52	19.80	0.67	
12/14/2022	10:50:52	19.80	0.67	
12/14/2022	10:51:52	19.81	0.66	
12/14/2022	10:52:52	19.81	0.66	
12/14/2022	10:53:52	19.81	0.66	
12/14/2022	10:54:52	19.81	0.66	
12/14/2022	10:55:52	19.81	0.67	
12/14/2022	10:56:52	19.81	0.67	
12/14/2022	10:57:52	19.81	0.67	
12/14/2022	10:58:52	19.81	0.68	
12/14/2022	10:59:52	19.81	0.68	

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	11:00:52	19.81	0.68	
12/14/2022	11:01:52	19.81	0.68	
12/14/2022	11:02:52	19.81	0.69	
12/14/2022	11:03:52	19.81	0.68	
12/14/2022	11:04:52	19.81	0.68	
12/14/2022	11:05:52	19.81	0.68	
12/14/2022	11:06:52	19.81	0.68	
12/14/2022	11:07:52	19.81	0.68	
12/14/2022	11:08:52	19.81	0.68	
12/14/2022	11:09:52	19.80	0.68	
12/14/2022	11:10:52	19.80	0.68	
12/14/2022	11:11:52	19.80	0.68	
12/14/2022	11:12:52	19.80	0.68	
12/14/2022	11:13:52	19.80	0.67	
12/14/2022	11:14:52	19.80	0.67	
12/14/2022	11:15:52	19.80	0.67	
12/14/2022	11:16:52	19.80	0.67	
12/14/2022	11:17:52	19.80	0.67	
12/14/2022	11:18:52	19.79	0.68	
12/14/2022	11:19:52	19.80	0.67	**End Run 3**
		19.80	**0.68**	**Average**
12/14/2022	11:20:52	19.80	0.68	
12/14/2022	11:21:52	19.80	0.67	
12/14/2022	11:22:52	19.80	0.68	
12/14/2022	11:23:52	19.80	0.68	
12/14/2022	11:24:52	19.79	0.68	
12/14/2022	11:25:52	19.79	0.68	
12/14/2022	11:26:52	19.79	0.69	
12/14/2022	11:27:52	19.79	0.69	
12/14/2022	11:28:52	19.80	0.68	
12/14/2022	11:29:52	19.80	0.68	
12/14/2022	11:30:52	19.75	0.71	
12/14/2022	11:31:52	3.12	0.31	
12/14/2022	11:32:52	0.06	0.05	
12/14/2022	11:33:52	0.04	0.04	**O2/CO2 System Zero**
12/14/2022	11:34:52	0.02	0.04	
12/14/2022	11:35:52	0.02	0.04	
12/14/2022	11:36:52	7.49	7.64	

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	11:37:52	9.93	10.08	**O2/CO2 System Upscale**
12/14/2022	11:38:52	9.95	10.11	
12/14/2022	11:39:52	9.95	10.12	
12/14/2022	11:40:52	9.95	10.12	
12/14/2022	11:41:52	10.54	9.47	
12/14/2022	11:42:52	19.10	1.25	
				CFU 115 Retest
12/14/2022	13:05:52	19.79	0.68	**Start Run 4**
12/14/2022	13:06:52	19.79	0.69	
12/14/2022	13:07:52	19.79	0.69	
12/14/2022	13:08:52	19.78	0.69	
12/14/2022	13:09:52	19.78	0.69	
12/14/2022	13:10:52	19.78	0.69	
12/14/2022	13:11:52	19.78	0.69	
12/14/2022	13:12:52	19.79	0.68	
12/14/2022	13:13:52	19.80	0.68	
12/14/2022	13:14:52	19.79	0.68	
12/14/2022	13:15:52	19.79	0.68	
12/14/2022	13:16:52	19.79	0.68	
12/14/2022	13:17:52	19.78	0.68	
12/14/2022	13:18:52	19.79	0.67	
12/14/2022	13:19:52	19.79	0.67	
12/14/2022	13:20:52	19.78	0.67	
12/14/2022	13:21:52	19.78	0.68	
12/14/2022	13:22:52	19.78	0.67	
12/14/2022	13:23:52	19.77	0.68	
12/14/2022	13:24:52	19.77	0.68	
12/14/2022	13:25:52	19.77	0.68	
12/14/2022	13:26:52	19.77	0.68	
12/14/2022	13:27:52	19.77	0.68	
12/14/2022	13:28:52	19.78	0.68	
12/14/2022	13:29:52	19.77	0.68	
12/14/2022	13:30:52	19.77	0.69	
12/14/2022	13:31:52	19.78	0.69	
12/14/2022	13:32:52	19.77	0.70	
12/14/2022	13:33:52	19.77	0.70	
12/14/2022	13:34:52	19.77	0.70	
12/14/2022	13:35:52	19.77	0.69	

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	13:36:52	19.77	0.69	
12/14/2022	13:37:52	19.78	0.69	
12/14/2022	13:38:52	19.78	0.69	
12/14/2022	13:39:52	19.79	0.68	
12/14/2022	13:40:52	19.79	0.68	
12/14/2022	13:41:52	19.79	0.68	
12/14/2022	13:42:52	19.79	0.67	
12/14/2022	13:43:52	19.78	0.68	
12/14/2022	13:44:52	19.78	0.67	
12/14/2022	13:45:52	19.78	0.67	
12/14/2022	13:46:52	19.78	0.67	
12/14/2022	13:47:52	19.79	0.67	
12/14/2022	13:48:52	19.79	0.68	
12/14/2022	13:49:52	19.79	0.68	
12/14/2022	13:50:52	19.79	0.68	
12/14/2022	13:51:52	19.79	0.68	
12/14/2022	13:52:52	19.79	0.68	
12/14/2022	13:53:52	19.78	0.68	
12/14/2022	13:54:52	19.78	0.69	
12/14/2022	13:55:52	19.79	0.69	
12/14/2022	13:56:52	19.79	0.69	
12/14/2022	13:57:52	19.79	0.69	
12/14/2022	13:58:52	19.79	0.69	
12/14/2022	13:59:52	19.79	0.69	
12/14/2022	14:00:52	19.79	0.69	
12/14/2022	14:01:52	19.80	0.70	
12/14/2022	14:02:52	19.80	0.70	
12/14/2022	14:03:52	19.80	0.70	
12/14/2022	14:04:52	19.79	0.68	**End Run 4**
		19.78	**0.68**	**Average**
12/14/2022	14:05:52	19.79	0.69	
12/14/2022	14:06:52	13.79	0.65	
12/14/2022	14:07:52	0.28	0.07	
12/14/2022	14:08:52	0.05	0.04	**O2/CO2 System Zero**
12/14/2022	14:09:52	1.96	2.04	
12/14/2022	14:10:52	9.72	9.71	
12/14/2022	14:11:52	9.95	9.98	**O2/CO2 System Upscale**
12/14/2022	14:12:52	13.38	6.56	

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	14:13:52	19.66	0.78	
12/14/2022	14:14:52	19.75	0.70	
12/14/2022	14:15:52	19.76	0.69	**Start Run 5**
12/14/2022	14:16:52	19.78	0.69	
12/14/2022	14:17:52	19.78	0.68	
12/14/2022	14:18:52	19.78	0.68	
12/14/2022	14:19:52	19.78	0.69	
12/14/2022	14:20:52	19.78	0.69	
12/14/2022	14:21:52	19.78	0.69	
12/14/2022	14:22:52	19.78	0.69	
12/14/2022	14:23:52	19.78	0.69	
12/14/2022	14:24:52	19.77	0.69	
12/14/2022	14:25:52	19.77	0.69	
12/14/2022	14:26:52	19.77	0.70	
12/14/2022	14:27:52	19.78	0.69	
12/14/2022	14:28:52	19.78	0.69	
12/14/2022	14:29:52	19.78	0.69	
12/14/2022	14:30:52	19.78	0.69	
12/14/2022	14:31:52	19.77	0.69	
12/14/2022	14:32:52	19.77	0.68	
12/14/2022	14:33:52	19.78	0.68	
12/14/2022	14:34:52	19.78	0.68	
12/14/2022	14:35:52	19.77	0.68	
12/14/2022	14:36:52	19.77	0.68	
12/14/2022	14:37:52	19.77	0.68	
12/14/2022	14:38:52	19.77	0.68	
12/14/2022	14:39:52	19.77	0.68	
12/14/2022	14:40:52	19.78	0.68	
12/14/2022	14:41:52	19.78	0.68	
12/14/2022	14:42:52	19.77	0.68	
12/14/2022	14:43:52	19.77	0.68	
12/14/2022	14:44:52	19.77	0.69	
12/14/2022	14:45:52	19.77	0.68	
12/14/2022	14:46:52	19.78	0.68	
12/14/2022	14:47:52	19.78	0.69	
12/14/2022	14:48:52	19.78	0.69	
12/14/2022	14:49:52	19.78	0.69	
12/14/2022	14:50:52	19.78	0.69	

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	14:51:52	19.78	0.69	
12/14/2022	14:52:52	19.78	0.69	
12/14/2022	14:53:52	19.79	0.69	
12/14/2022	14:54:52	19.79	0.69	
12/14/2022	14:55:52	19.79	0.69	
12/14/2022	14:56:52	19.78	0.68	
12/14/2022	14:57:52	19.79	0.68	
12/14/2022	14:58:52	19.79	0.68	
12/14/2022	14:59:52	19.79	0.68	
12/14/2022	15:00:52	19.79	0.67	
12/14/2022	15:01:52	19.79	0.67	
12/14/2022	15:02:52	19.78	0.68	
12/14/2022	15:03:52	19.78	0.68	
12/14/2022	15:04:52	19.78	0.68	
12/14/2022	15:05:52	19.79	0.68	
12/14/2022	15:06:52	19.78	0.68	
12/14/2022	15:07:52	19.79	0.68	
12/14/2022	15:08:52	19.79	0.68	
12/14/2022	15:09:52	19.79	0.68	
12/14/2022	15:10:52	19.79	0.68	
12/14/2022	15:11:52	19.80	0.68	
12/14/2022	15:12:52	19.80	0.68	
12/14/2022	15:13:52	19.80	0.68	
12/14/2022	15:14:52	19.80	0.68	**End Run 5**
		19.78	**0.68**	**Average**
12/14/2022	15:15:52	19.80	0.69	
12/14/2022	15:16:52	19.80	0.68	
12/14/2022	15:17:52	19.80	0.69	
12/14/2022	15:18:52	10.73	0.58	
12/14/2022	15:19:52	0.15	0.06	
12/14/2022	15:20:52	0.05	0.05	**O2/CO2 System Zero**
12/14/2022	15:21:52	6.05	6.14	
12/14/2022	15:22:52	9.94	9.96	**O2/CO2 System Upscale**
12/14/2022	15:23:52	12.22	7.69	
12/14/2022	15:24:52	19.58	0.85	
12/14/2022	15:25:52	19.78	0.69	**Start Run 6**
12/14/2022	15:26:52	19.78	0.68	

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	15:27:52	19.79	0.68	
12/14/2022	15:28:52	19.79	0.68	
12/14/2022	15:29:52	19.79	0.68	
12/14/2022	15:30:52	19.80	0.67	
12/14/2022	15:31:52	19.80	0.68	
12/14/2022	15:32:52	19.80	0.68	
12/14/2022	15:33:52	19.80	0.67	
12/14/2022	15:34:52	19.80	0.67	
12/14/2022	15:35:52	19.80	0.67	
12/14/2022	15:36:52	19.79	0.68	
12/14/2022	15:37:52	19.79	0.69	
12/14/2022	15:38:52	19.79	0.69	
12/14/2022	15:39:52	19.80	0.69	
12/14/2022	15:40:52	19.80	0.69	
12/14/2022	15:41:52	19.79	0.69	
12/14/2022	15:42:52	19.80	0.69	
12/14/2022	15:43:52	19.80	0.69	
12/14/2022	15:44:52	19.79	0.69	
12/14/2022	15:45:52	19.79	0.69	
12/14/2022	15:46:52	19.79	0.69	
12/14/2022	15:47:52	19.79	0.68	
12/14/2022	15:48:52	19.80	0.68	
12/14/2022	15:49:52	19.79	0.68	
12/14/2022	15:50:52	19.79	0.68	
12/14/2022	15:51:52	19.79	0.68	
12/14/2022	15:52:52	19.79	0.68	
12/14/2022	15:53:52	19.79	0.68	
12/14/2022	15:54:52	19.79	0.67	
12/14/2022	15:55:52	19.79	0.67	
12/14/2022	15:56:52	19.79	0.68	
12/14/2022	15:57:52	19.78	0.68	
12/14/2022	15:58:52	19.78	0.68	
12/14/2022	15:59:52	19.79	0.68	
12/14/2022	16:00:52	19.79	0.68	
12/14/2022	16:01:52	19.79	0.69	
12/14/2022	16:02:52	19.80	0.69	
12/14/2022	16:03:52	19.79	0.70	
12/14/2022	16:04:52	19.79	0.69	
12/14/2022	16:05:52	19.80	0.69	

Hollingsworth & Vose - Glass Plant 2
CFU 115
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/14/2022	16:06:52	19.80	0.69	
12/14/2022	16:07:52	19.79	0.69	
12/14/2022	16:08:52	19.80	0.69	
12/14/2022	16:09:52	19.80	0.69	
12/14/2022	16:10:52	19.80	0.69	
12/14/2022	16:11:52	19.80	0.69	
12/14/2022	16:12:52	19.80	0.70	
12/14/2022	16:13:52	19.80	0.69	
12/14/2022	16:14:52	19.80	0.69	
12/14/2022	16:15:52	19.80	0.69	
12/14/2022	16:16:52	19.80	0.68	
12/14/2022	16:17:52	19.79	0.68	
12/14/2022	16:18:52	19.79	0.69	
12/14/2022	16:19:52	19.79	0.69	
12/14/2022	16:20:52	19.79	0.69	
12/14/2022	16:21:52	19.79	0.69	
12/14/2022	16:22:52	19.79	0.69	
12/14/2022	16:23:52	19.80	0.68	
12/14/2022	16:24:52	19.80	0.69	**End Run 6**
		19.79	**0.68**	**Average**
12/14/2022	16:25:52	19.80	0.69	
12/14/2022	16:26:52	13.03	0.50	
12/14/2022	16:27:52	0.23	0.07	
12/14/2022	16:28:52	0.05	0.05	**O2/CO2 System Zero**
12/14/2022	16:29:52	3.12	3.24	
12/14/2022	16:30:52	9.86	10.01	
12/14/2022	16:31:52	9.96	10.15	**O2/CO2 System Upscale**
12/14/2022	16:32:52	9.97	10.17	
12/14/2022	16:33:52	16.21	4.25	
12/14/2022	16:34:52	20.82	0.18	
12/14/2022	16:35:52	20.82	0.17	
12/14/2022	16:36:52	20.82	0.16	
12/14/2022	16:37:52	20.83	0.16	
12/14/2022	16:38:52	20.83	0.15	
12/14/2022	16:39:52	20.83	0.15	

APPENDIX E: CFU 118 TEST DATA

Hollingsworth & Vose
Corvallis, OR
CFU 118 Speciated Organic Toxic Air Contaminants (TAC)

Run Number	1	2	3
Sample Collection Date	12/15/2022	12/15/2022	12/15/2022
Glass Production Rate Supplied by H&V (lb/hr)	108.7	110.3	110.3
Volumetric Flow Rate Measured by Bison (dscfm)	17,146	17,895	17,188

Analyte	Molecular Weight	CFU 118-1				CFU 118-2				CFU 118-3				CFU 118 Averages			
	g/mol	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass
Dichlorodifluoromethane	120.9129	< 0.5	< 5.0E-04	< 1.62E-04	< 2.97E-03	< 0.5	< 5.0E-04	< 1.69E-04	< 3.06E-03	< 0.5	< 5.0E-04	< 1.62E-04	< 2.94E-03	< 0.50	< 5.0E-04	< 1.64E-04	< 2.99E-03
Chloromethane	50.4872	**1.3**	**1.3E-03**	**1.75E-04**	**3.23E-03**	**2**	**2.0E-03**	**2.82E-04**	**5.10E-03**	**1.3**	**1.3E-03**	**1.76E-04**	**3.19E-03**	**1.53**	**1.5E-03**	**2.11E-04**	**3.84E-03**
Freon 114	170.92	< 0.5	< 5.0E-04	< 2.28E-04	< 4.20E-03	< 0.5	< 5.0E-04	< 2.38E-04	< 4.32E-03	< 0.5	< 5.0E-04	< 2.29E-04	< 4.15E-03	< 0.50	< 5.0E-04	< 2.32E-04	< 4.22E-03
Vinyl chloride	62.50	< 0.5	< 5.0E-04	< 8.35E-05	< 1.54E-03	< 0.5	< 5.0E-04	< 8.71E-05	< 1.58E-03	< 0.5	< 5.0E-04	< 8.37E-05	< 1.52E-03	< 0.50	< 5.0E-04	< 8.48E-05	< 1.54E-03
1,3-Butadiene	54.0904	< 0.5	< 5.0E-04	< 7.22E-05	< 1.33E-03	< 0.5	< 5.0E-04	< 7.54E-05	< 1.37E-03	< 0.5	< 5.0E-04	< 7.24E-05	< 1.31E-03	< 0.50	< 5.0E-04	< 7.34E-05	< 1.34E-03
Bromomethane	94.94	< 0.5	< 5.0E-04	< 1.27E-04	< 2.33E-03	< 0.5	< 5.0E-04	< 1.32E-04	< 2.40E-03	< 0.5	< 5.0E-04	< 1.27E-04	< 2.30E-03	< 0.50	< 5.0E-04	< 1.29E-04	< 2.35E-03
Chloroethane	64.51	< 0.5	< 5.0E-04	< 8.62E-05	< 1.59E-03	< 0.5	< 5.0E-04	< 8.99E-05	< 1.63E-03	< 0.5	< 5.0E-04	< 8.64E-05	< 1.57E-03	< 0.50	< 5.0E-04	< 8.75E-05	< 1.59E-03
Freon 11	137.3672	< 0.5	< 5.0E-04	< 1.83E-04	< 3.38E-03	< 0.5	< 5.0E-04	< 1.91E-04	< 3.47E-03	< 0.5	< 5.0E-04	< 1.84E-04	< 3.34E-03	< 0.50	< 5.0E-04	< 1.86E-04	< 3.39E-03
Freon 113	187.38	< 0.5	< 5.0E-04	< 2.50E-04	< 4.60E-03	< 0.5	< 5.0E-04	< 2.61E-04	< 4.74E-03	< 0.5	< 5.0E-04	< 2.51E-04	< 4.55E-03	< 0.50	< 5.0E-04	< 2.54E-04	< 4.63E-03
1,1-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.29E-04	< 2.38E-03	< 0.5	< 5.0E-04	< 1.35E-04	< 2.45E-03	< 0.5	< 5.0E-04	< 1.30E-04	< 2.35E-03	< 0.50	< 5.0E-04	< 1.31E-04	< 2.40E-03
Acetone	58.08	**23**	**2.3E-02**	**3.57E-03**	**6.57E-02**	**13**	**1.3E-02**	**2.11E-03**	**3.82E-02**	**16**	**1.6E-02**	**2.49E-03**	**4.51E-02**	**17.33**	**1.7E-02**	**2.72E-03**	**4.97E-02**
Carbon disulfide	76.143	< 0.5	< 5.0E-04	< 1.02E-04	< 1.87E-03	< 0.5	< 5.0E-04	< 1.06E-04	< 1.92E-03	< 0.5	< 5.0E-04	< 1.02E-04	< 1.85E-03	< 0.50	< 5.0E-04	< 1.03E-04	< 1.88E-03
Methylene chloride	84.9320	< 0.5	< 5.0E-04	< 1.13E-04	< 2.09E-03	< 0.5	< 5.0E-04	< 1.18E-04	< 2.15E-03	< 0.5	< 5.0E-04	< 1.14E-04	< 2.06E-03	< 0.50	< 5.0E-04	< 1.15E-04	< 2.10E-03
trans-1,2-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.29E-04	< 2.38E-03	< 0.5	< 5.0E-04	< 1.35E-04	< 2.45E-03	< 0.5	< 5.0E-04	< 1.30E-04	< 2.35E-03	< 0.50	< 5.0E-04	< 1.31E-04	< 2.40E-03
Methyl t-butyl ether	88.1482	< 0.5	< 5.0E-04	< 1.18E-04	< 2.17E-03	< 0.5	< 5.0E-04	< 1.23E-04	< 2.23E-03	< 0.5	< 5.0E-04	< 1.18E-04	< 2.14E-03	< 0.50	< 5.0E-04	< 1.20E-04	< 2.18E-03
Vinyl acetate	86.0892	< 0.5	< 5.0E-04	< 1.15E-04	< 2.12E-03	< 0.5	< 5.0E-04	< 1.20E-04	< 2.18E-03	< 0.5	< 5.0E-04	< 1.15E-04	< 2.09E-03	< 0.50	< 5.0E-04	< 1.17E-04	< 2.13E-03
2-Butanone	72.1057	**0.58**	**5.8E-04**	**1.12E-04**	**2.06E-03**	< 0.5	< 5.0E-04	< 1.01E-04	< 1.82E-03	< 0.5	< 5.0E-04	< 9.65E-05	< 1.75E-03	**< 0.53**	**< 5.3E-04**	**< 1.03E-04**	**< 1.88E-03**
cis-1,2-Dichloroethene	96.9427	< 0.5	< 5.0E-04	< 1.29E-04	< 2.38E-03	< 0.5	< 5.0E-04	< 1.35E-04	< 2.45E-03	< 0.5	< 5.0E-04	< 1.30E-04	< 2.35E-03	< 0.50	< 5.0E-04	< 1.31E-04	< 2.40E-03
1,1-Dichloroethane	98.9586	< 0.5	< 5.0E-04	< 1.32E-04	< 2.43E-03	< 0.5	< 5.0E-04	< 1.38E-04	< 2.50E-03	< 0.5	< 5.0E-04	< 1.33E-04	< 2.40E-03	< 0.50	< 5.0E-04	< 1.34E-04	< 2.45E-03
Ethyl acetate	88.1051	< 1.0	< 1.0E-03	< 2.35E-04	< 4.33E-03	< 1.0	< 1.0E-03	< 2.46E-04	< 4.45E-03	< 1.0	< 1.0E-03	< 2.36E-04	< 4.28E-03	< 1.00	< 1.0E-03	< 2.39E-04	< 4.35E-03
Hexane	86.1754	**17**	**1.7E-02**	**3.91E-03**	**7.20E-02**	**7.3**	**7.3E-03**	**1.75E-03**	**3.18E-02**	**10**	**1.0E-02**	**2.31E-03**	**4.18E-02**	**11.43**	**1.1E-02**	**2.66E-03**	**4.86E-02**
Chloroform	119.3767	< 0.5	< 5.0E-04	< 1.59E-04	< 2.93E-03	< 0.5	< 5.0E-04	< 1.66E-04	< 3.02E-03	< 0.5	< 5.0E-04	< 1.60E-04	< 2.90E-03	< 0.50	< 5.0E-04	< 1.62E-04	< 2.95E-03
Tetrahydrofuran	72.1057	< 0.5	< 5.0E-04	< 9.63E-05	< 1.77E-03	< 0.5	< 5.0E-04	< 1.01E-04	< 1.82E-03	< 0.5	< 5.0E-04	< 9.65E-05	< 1.75E-03	< 0.50	< 5.0E-04	< 9.78E-05	< 1.78E-03
1,2-Dichloroethane	98.9586	< 0.5	< 5.0E-04	< 1.32E-04	< 2.43E-03	< 0.5	< 5.0E-04	< 1.38E-04	< 2.50E-03	< 0.5	< 5.0E-04	< 1.33E-04	< 2.40E-03	< 0.50	< 5.0E-04	< 1.34E-04	< 2.45E-03
1,1,1-Trichloroethane	133.4033	< 0.5	< 5.0E-04	< 1.78E-04	< 3.28E-03	< 0.5	< 5.0E-04	< 1.86E-04	< 3.37E-03	< 0.5	< 5.0E-04	< 1.79E-04	< 3.24E-03	< 0.50	< 5.0E-04	< 1.81E-04	< 3.30E-03
Carbon tetrachloride	153.8215	< 0.5	< 5.0E-04	< 2.05E-04	< 3.78E-03	< 0.5	< 5.0E-04	< 2.14E-04	< 3.89E-03	< 0.5	< 5.0E-04	< 2.06E-04	< 3.73E-03	< 0.50	< 5.0E-04	< 2.09E-04	< 3.80E-03
Benzene	78.1118	**3.8**	**3.8E-03**	**7.93E-04**	**1.46E-02**	**1.7**	**1.7E-03**	**3.70E-04**	**6.71E-03**	**2.2**	**2.2E-03**	**4.60E-04**	**8.34E-03**	**2.57**	**2.6E-03**	**5.41E-04**	**9.88E-03**
Cyclohexane	84.1595	< 0.5	< 5.0E-04	< 1.12E-04	< 2.07E-03	< 0.5	< 5.0E-04	< 1.17E-04	< 2.13E-03	< 0.5	< 5.0E-04	< 1.13E-04	< 2.04E-03	< 0.50	< 5.0E-04	< 1.14E-04	< 2.08E-03
Trichloroethene	131.3874	< 0.5	< 5.0E-04	< 1.75E-04	< 3.23E-03	< 0.5	< 5.0E-04	< 1.83E-04	< 3.32E-03	< 0.5	< 5.0E-04	< 1.76E-04	< 3.19E-03	< 0.50	< 5.0E-04	< 1.78E-04	< 3.25E-03
1,2-Dichloropropane	112.9851	< 0.5	< 5.0E-04	< 1.51E-04	< 2.78E-03	< 0.5	< 5.0E-04	< 1.58E-04	< 2.86E-03	< 0.5	< 5.0E-04	< 1.51E-04	< 2.74E-03	< 0.50	< 5.0E-04	< 1.53E-04	< 2.79E-03
Bromodichloromethane	163.828	< 0.5	< 5.0E-04	< 2.19E-04	< 4.03E-03	< 0.5	< 5.0E-04	< 2.28E-04	< 4.14E-03	< 0.5	< 5.0E-04	< 2.19E-04	< 3.98E-03	< 0.50	< 5.0E-04	< 2.22E-04	< 4.05E-03
Heptane	100.2019	**1.8**	**1.8E-03**	**4.82E-04**	**8.87E-03**	**0.78**	**7.8E-04**	**2.18E-04**	**3.95E-03**	**2.2**	**2.2E-03**	**5.90E-04**	**1.07E-02**	**1.59**	**1.6E-03**	**4.30E-04**	**7.84E-03**
cis-1,3-Dichloropropene	110.9693	< 0.5	< 5.0E-04	< 1.48E-04	< 2.73E-03	< 0.5	< 5.0E-04	< 1.55E-04	< 2.80E-03	< 0.5	< 5.0E-04	< 1.49E-04	< 2.69E-03	< 0.50	< 5.0E-04	< 1.50E-04	< 2.74E-03
4-Methyl-2-pentanone	100.1589	< 0.5	< 5.0E-04	< 1.34E-04	< 2.46E-03	< 0.5	< 5.0E-04	< 1.40E-04	< 2.53E-03	< 0.5	< 5.0E-04	< 1.34E-04	< 2.43E-03	< 0.50	< 5.0E-04	< 1.36E-04	< 2.47E-03
trans-1,3-Dichloropropene	110.9693	< 0.5	< 5.0E-04	< 1.48E-04	< 2.73E-03	< 0.5	< 5.0E-04	< 1.55E-04	< 2.80E-03	< 0.5	< 5.0E-04	< 1.49E-04	< 2.69E-03	< 0.50	< 5.0E-04	< 1.50E-04	< 2.74E-03
1,1,2-Trichloroethane	133.4033	< 0.5	< 5.0E-04	< 1.78E-04	< 3.28E-03	< 0.5	< 5.0E-04	< 1.86E-04	< 3.37E-03	< 0.5	< 5.0E-04	< 1.79E-04	< 3.24E-03	< 0.50	< 5.0E-04	< 1.81E-04	< 3.30E-03
Toluene	92.1384	**6.4**	**6.4E-03**	**1.58E-03**	**2.90E-02**	**3.2**	**3.2E-03**	**8.22E-04**	**1.49E-02**	**5.9**	**5.9E-03**	**1.46E-03**	**2.64E-02**	**5.17**	**5.2E-03**	**1.28E-03**	**2.34E-02**
2-Hexanone	100.1589	< 1.0	< 1.0E-03	< 2.68E-04	< 4.92E-03	< 1.0	< 1.0E-03	< 2.79E-04	< 5.06E-03	< 1.0	< 1.0E-03	< 2.68E-04	< 4.86E-03	< 1.00	< 1.0E-03	< 2.72E-04	< 4.95E-03
Tetrachloroethene	165.833	< 0.5	< 5.0E-04	< 2.21E-04	< 4.08E-03	< 0.5	< 5.0E-04	< 2.31E-04	< 4.19E-03	< 0.5	< 5.0E-04	< 2.22E-04	< 4.03E-03	< 0.50	< 5.0E-04	< 2.25E-04	< 4.10E-03
Dibromochloromethane	208.279	< 0.5	< 5.0E-04	< 2.78E-04	< 5.12E-03	< 0.5	< 5.0E-04	< 2.90E-04	< 5.26E-03	< 0.5	< 5.0E-04	< 2.79E-04	< 5.06E-03	< 0.50	< 5.0E-04	< 2.82E-04	< 5.15E-03
1,2-Dibromoethane	187.861	< 0.5	< 5.0E-04	< 2.51E-04	< 4.62E-03	< 0.5	< 5.0E-04	< 2.62E-04	< 4.75E-03	< 0.5	< 5.0E-04	< 2.52E-04	< 4.56E-03	< 0.50	< 5.0E-04	< 2.55E-04	< 4.64E-03
Chlorobenzene	112.5566	< 0.5	< 5.0E-04	< 1.50E-04	< 2.77E-03	< 0.5	< 5.0E-04	< 1.57E-04	< 2.85E-03	< 0.5	< 5.0E-04	< 1.51E-04	< 2.73E-03	< 0.50	< 5.0E-04	< 1.53E-04	< 2.78E-03
Ethyl benzene	106.1650	< 0.5	< 5.0E-04	< 1.42E-04	< 2.61E-03	< 0.5	< 5.0E-04	< 1.48E-04	< 2.68E-03	< 0.5	< 5.0E-04	< 1.42E-04	< 2.58E-03	< 0.50	< 5.0E-04	< 1.44E-04	< 2.62E-03
m,p-Xylene	106.1650	< 1.0	< 1.0E-03	< 2.84E-04	< 5.22E-03	< 1.0	< 1.0E-03	< 2.96E-04	< 5.37E-03	< 1.0	< 1.0E-03	< 2.84E-04	< 5.15E-03	< 1.00	< 1.0E-03	< 2.88E-04	< 5.25E-03
o-Xylene	106.1650	< 0.5	< 5.0E-04	< 1.42E-04	< 2.61E-03	< 0.5	< 5.0E-04	< 1.48E-04	< 2.68E-03	< 0.5	< 5.0E-04	< 1.42E-04	< 2.58E-03	< 0.50	< 5.0E-04	< 1.44E-04	< 2.62E-03
Styrene	104.1491	< 1.0	< 1.0E-03	< 2.78E-04	< 5.12E-03	< 1.0	< 1.0E-03	< 2.90E-04	< 5.27E-03	< 1.0	< 1.0E-03	< 2.79E-04	< 5.06E-03	< 1.00	< 1.0E-03	< 2.82E-04	< 5.15E-03
Bromoform	252.731	< 1.0	< 1.0E-03	< 6.75E-04	< 1.24E-02	< 1.0	< 1.0E-03	< 7.05E-04	< 1.28E-02	< 1.0	< 1.0E-03	< 6.77E-04	< 1.23E-02	< 1.00	< 1.0E-03	< 6.86E-04	< 1.25E-02
1,1,2,2-Tetrachloroethane	167.8481	< 0.5	< 5.0E-04	< 2.24E-04	< 4.12E-03	< 0.5	< 5.0E-04	< 2.34E-04	< 4.24E-03	< 0.5	< 5.0E-04	< 2.25E-04	< 4.08E-03	< 0.50	< 5.0E-04	< 2.28E-04	< 4.15E-03
4-Ethyl toluene	120.1916	< 1.0	< 1.0E-03	< 3.21E-04	< 5.91E-03	< 1.0	< 1.0E-03	< 3.35E-04	< 6.08E-03	< 1.0	< 1.0E-03	< 3.22E-04	< 5.84E-03	< 1.00	< 1.0E-03	< 3.26E-04	< 5.94E-03
1,3,5-Trimethylbenzene	120.1916	< 1.0	< 1.0E-03	< 3.21E-04	< 5.91E-03	< 1.0	< 1.0E-03	< 3.35E-04	< 6.08E-03	< 1.0	< 1.0E-03	< 3.22E-04	< 5.84E-03	< 1.00	< 1.0E-03	< 3.26E-04	< 5.94E-03
1,2,4-Trimethylbenzene	120.195	< 1.0	< 1.0E-03	< 3.21E-04	< 5.91E-03	< 1.0	< 1.0E-03	< 3.35E-04	< 6.08E-03	< 1.0	< 1.0E-03	< 3.22E-04	< 5.84E-03	< 1.00	< 1.0E-03	< 3.26E-04	< 5.94E-03
1,3-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 3.93E-04	< 7.23E-03	< 1.0	< 1.0E-03	< 4.10E-04	< 7.43E-03	< 1.0	< 1.0E-03	< 3.94E-04	< 7.14E-03	< 1.00	< 1.0E-03	< 3.99E-04	< 7.26E-03
1,4-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 3.93E-04	< 7.23E-03	< 1.0	< 1.0E-03	< 4.10E-04	< 7.43E-03	< 1.0	< 1.0E-03	< 3.94E-04	< 7.14E-03	< 1.00	< 1.0E-03	< 3.99E-04	< 7.26E-03
Benzyl chloride	126.5832	< 1.0	< 1.0E-03	< 3.38E-04	< 6.22E-03	< 1.0	< 1.0E-03	< 3.53E-04	< 6.40E-03	< 1.0	< 1.0E-03	< 3.39E-04	< 6.15E-03	< 1.00	< 1.0E-03	< 3.43E-04	< 6.26E-03
1,2-Dichlorobenzene	147.0014	< 1.0	< 1.0E-03	< 3.93E-04	< 7.23E-03	< 1.0	< 1.0E-03	< 4.10E-04	< 7.43E-03	< 1.0	< 1.0E-03	< 3.94E-04	< 7.14E-03	< 1.00	< 1.0E-03	< 3.99E-04	< 7.26E-03
1,2,4-Trichlorobenzene	181.4461	< 1.0	< 1.0E-03	< 4.85E-04	< 8.92E-03	< 1.0	< 1.0E-03	< 5.06E-04	< 9.17E-03	< 1.0	< 1.0E-03	< 4.86E-04	< 8.81E-03	< 1.00	< 1.0E-03	< 4.92E-04	< 8.97E-03
Hexachloro-1,3-butadiene	260.7590	< 1.0	< 1.0E-03	< 6.97E-04	< 1.28E-02	< 1.0	< 1.0E-03	< 7.27E-04	< 1.32E-02	< 1.0	< 1.0E-03	< 6.98E-04	< 1.27E-02	< 1.00	< 1.0E-03	< 7.07E-04	< 1.29E-02

Italized compounds are on the Oregon Ambient Benchmark Concentration list
Bold compounds are on the Oregon Air Toxics list
Blue text indicates results measured above the reporting limit (RL).
The symbol '<' indicates that the actual result is less than the numerical value listed. For laboratory results (ppb) the value listed is the RL and is used in all subsequent calculations.
Concentrations and emission rates calculated from '<' lab results are also identified with a '<' symbol.

Hollingsworth & Vose
Corvallis, OR
CFU 118 Tentatively Identified Compounds (TIC)

Run Number	1	2	3
Sample Collection Date	12/15/2022	12/15/2022	12/15/2022
Glass Production Rate Supplied by H&V (lb/hr)	108.7	110.3	110.3
Volumetric Flow Rate measured by Bison (dscfm)	17,146	17,895	17,410

Analyte	Molecular Weight	CFU 118-1				CFU 118-2				CFU 118-3				CFU 118 Averages			
	g/mol	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass	ppb	ppm	lb/hr	lb/ton glass
Propane	44.097	32	3.2E-02	3.77E-03	6.94E-02	19	1.9E-02	2.34E-03	4.24E-02	23	2.3E-02	2.75E-03	4.99E-02	24.67	2.5E-02	2.95E-03	5.39E-02
Isobutane	58.124	12	1.2E-02	1.86E-03	3.43E-02	10	1.0E-02	1.62E-03	2.94E-02	9.1	9.1E-03	1.43E-03	2.60E-02	10.37	1.0E-02	1.64E-03	2.99E-02
Butane	58.12	10	1.0E-02	1.55E-03	2.86E-02	7	7.0E-03	1.13E-03	2.06E-02	6.2	6.2E-03	9.77E-04	1.77E-02	7.73	7.7E-03	1.22E-03	2.23E-02
Butane, 2-Methyl	72.1488	8.9	8.9E-03	1.72E-03	3.16E-02									8.90	8.9E-03	1.72E-03	3.16E-02
Butane, 2,3-dimethyl	86.1754	3.2	3.2E-03	7.37E-04	1.36E-02									3.20	3.2E-03	7.37E-04	1.36E-02
Pentane	72.150	15	1.5E-02	2.89E-03	5.32E-02	6.9	6.9E-03	1.39E-03	2.52E-02	6.7	6.7E-03	1.31E-03	2.38E-02	9.53	9.5E-03	1.86E-03	3.40E-02
Pentane, 2-methyl-	86.175	6.1	6.1E-03	1.40E-03	2.58E-02	2.6	2.6E-03	6.25E-04	1.13E-02	3.2	3.2E-03	7.48E-04	1.36E-02	3.97	4.0E-03	9.26E-04	1.69E-02
Pentane, 2,4-dimethyl-	100.20	8.2	8.2E-03	2.19E-03	4.04E-02	3.2	3.2E-03	8.94E-04	1.62E-02					5.70	5.7E-03	1.54E-03	2.83E-02
Pentane, 2,3-dimethyl-	100.20	7.2	7.2E-03	1.93E-03	3.55E-02	3.3	3.3E-03	9.22E-04	1.67E-02	6.1	6.1E-03	1.66E-03	3.01E-02	5.53	5.5E-03	1.50E-03	2.74E-02
Pentane, 2,3,4-trimethyl	114.229									2.8	2.8E-03	8.68E-04	1.57E-02	2.80	2.8E-03	8.68E-04	1.57E-02
Butane, 2,2,3,3-tetramethyl-	114.2285	8.9	8.9E-03	2.72E-03	5.00E-02	4.0	4.0E-03	1.27E-03	2.31E-02	14	1.4E-02	4.34E-03	7.87E-02	8.97	9.0E-03	2.78E-03	5.06E-02
1-Pentene, 4-methyl-	84.1595									5.2	5.2E-03	1.19E-03	2.15E-02	5.20	5.2E-03	1.19E-03	2.15E-02
Heptane, 2,4-dimethyl	128.2551									2.6	2.6E-03	9.05E-04	1.64E-02	2.60	2.6E-03	9.05E-04	1.64E-02

Note: Concentrations listed for all TICs are estimated values.

Bison Engineering, Inc.
Gaseous Testing Summary

Client:	**Hollingsworth & Vose**	Source:	**CFU 118**
Facility:	**Glass Plant 2**	Test Date:	**December 15, 2022**
Location:	**Corvallis, OR**		

Environmental Conditions / Test Notes: 25 °F

Run		1	2	3	Average
Date		12/15/2022	12/15/2022	12/15/2022	
Run Start Time		8:20	9:30	10:40	
Run End Time		9:19	10:29	11:39	
Duration, min.		60	60	60	
Stack Diameter, in.		30.00	30.00	30.00	
Stack Area, sq.ft.		4.909	4.909	4.909	
Barometric Pressure, "Hg		30.21	30.21	30.21	30.21
Static Pressure, "H_2O		-0.73	-0.73	-0.73	-0.73
Stack Temperature, °F		222	225	226	224
CO_2, %vd		0.54	0.55	0.54	0.54
O_2, %vd		20.19	20.21	20.23	20.21
H_2O, %v		1.13	1.39	1.17	1.23
Wet Molecular Weight, lb/lb-mole		28.77	28.75	28.76	28.76
Velocity, FPS		75.52	79.33	76.08	76.97
WSCFM		17,342	18,147	17,392	17,627
DSCFM		17,146	17,895	17,188	17,410
Production Data, Total Rotary Fine	lb/hr	108.7	110.3	110.3	109.8
Production Data, L4R8	lb/hr	55.5	56.3	56.3	56.1
Production Data L4R9	lb/hr	53.2	54.0	54.0	53.7

Note: Negative concentrations are reported as zero.

Bison Engineering, Inc.
Pre-Test Traverse

Client: **Hollingsworth & Vose**
Location: **Corvallis, OR**
Source: **CFU 118**

Stack Temp: NA °F

Traverse Point	Velocity ΔP ("H_2O)	Null Angle
1	NA	2
2	NA	4
3	NA	3
4	NA	5
5	NA	0
6	NA	1
7	NA	0
8	NA	0
9	NA	1
10	NA	4
11	NA	6
12	NA	8
13	NA	0
14	NA	1
15	NA	3
16	NA	0

Average: NA 2
Flow is found to be: Non-cyclonic

No nozzle was needed for flow measurements, therefore no pre-velocity measurements or stack temperature was recorded prior to testing.

Bison Engineering, Inc.
EPA Method 1
Stack Parameters and Traverse Points

Client: **Hollingsworth & Vose**
Location: **Corvallis, OR**
Source: **CFU 118**
Facility: **Glass Plant 2**

Type of Testing:	V	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.):	40.00	feet
Stack height (approx.):	8.00	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

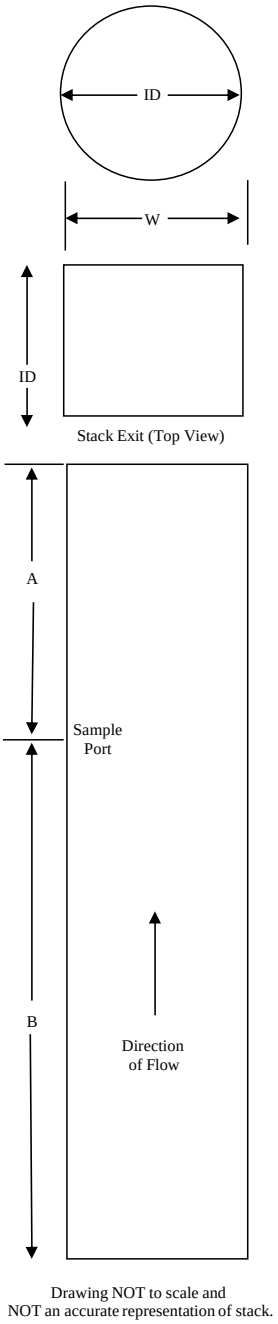
Sample Port Location:	Downstream flow disturbance from process B	Upstream flow disturbance toward exit A
Number of Inches:	142.00	52.00
Number of Diameters:	4.73	1.73

Minimum Number of Traverse Points: 16

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	3.2	0.96	7
2	10.5	3.15	9 1/8
3	19.4	5.82	11 7/8
4	32.3	9.69	15 3/4
5	67.7	20.31	26 1/4
6	80.6	24.18	30 1/8
7	89.5	26.85	32 7/8
8	96.8	29.04	35

Reference Diagram



Drawing NOT to scale and
NOT an accurate representation of stack.

Bison Engineering, Inc.
Method 2
Stack Gas Velocity and Volumetric Flow Rate

Client:	**Hollingsworth & Vose**	**Source:**	**CFU 118**
Facility:	**Glass Plant 2**	**Test Date:**	**12/15/22**
Location:	**Corvallis, OR**		

Molecular Weight		
Choose One by "x" below		
Measured	Ambient	Combustion
x		

Pitot ID	4E

Leak Checks:	Run 1		Run 2		Run 3	
	Pre	Post	Pre	Post	Pre	Post
Pitot	x	x	x	x	x	x
Barometric Pressure ("Hg)	30.21		30.21		30.21	

		Run 1		Run 2		Run 3	
Traverse	Sample Point	Velocity ΔP ("H_2O)	Stack Temperature (°F)	Velocity ΔP ("H_2O)	Stack Temperature (°F)	Velocity ΔP ("H_2O)	Stack Temperature (°F)
A	1	1.60	219	1.50	225	1.50	220
	2	1.50	222	1.40	225	1.40	221
	3	1.50	223	1.60	225	1.60	224
	4	1.30	223	1.60	226	1.60	225
	5	1.50	223	1.70	227	1.60	226
	6	1.60	223	1.80	228	1.40	227
	7	1.60	223	1.70	228	1.20	227
	8	1.50	222	1.80	227	1.60	227
B	1	1.20	221	1.40	220	1.60	226
	2	1.60	223	1.60	221	1.20	226
	3	1.70	222	1.70	222	1.10	226
	4	1.30	223	1.50	224	1.40	226
	5	1.20	223	1.50	225	1.50	227
	6	1.30	223	1.40	225	1.30	227
	7	1.20	223	1.40	225	1.30	227
	8	1.00	223	1.20	228	1.50	227
Method 2 -Flow Calculations							
Static Pressure, "H_2O			-0.73		-0.73		-0.73
Pitot tube cp			0.84		0.84		0.84
Stack Area, ft^3			4.909		4.909		4.909
H_2O, %v			1.13		1.39		1.17
Average √ΔP			1.186		1.243		1.192
Average Absolute Temp. (°R)			682.1		684.7		685.2
Stack Pressure (in. Hg)			30.16		30.16		30.16
Stack Velocity (ft/sec)			75.52		79.33		76.08
Actual Flow Rate (acfm)			22,242		23,363		22,407
Standard Flow Rate (wscf/hr)			1,040,508		1,088,822		1,043,518
Dry Standard Flow Rate (dscf/hr)			1,028,750		1,073,687		1,031,309
Dry Standard Flow Rate (dscfm)			17,146		17,895		17,188

	O_2	CO_2	Calculated N_2
Run 1	20.19	0.54	79.27
Run 2	20.21	0.55	79.24
Run 3	20.23	0.54	79.24

	Molecular Weight (lb/lb-mole)					
	Calculated		Ambient		Combustion	
Run1	M_d	28.89	M_d		M_d	
	M_s	28.77	M_s		M_s	
Run 2	M_d	28.90	M_d		M_d	
	M_s	28.75	M_s		M_s	
Run 3	M_d	28.89	M_d		M_d	
	M_s	28.76	M_s		M_s	

Bison Engineering, Inc.
Moisture Field Data

Client:	**Hollingsworth & Vose**	**Meterbox ID:**	Box 11
Facility:	**Glass Plant 2**	**Meter "Y"-Factor**	0.9690
Location:	**Corvallis, OR**		
Source:	**CFU 118**		
Test date:	**12/15/2022**		

Moisture Field Data Entry

Run 1

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	15	4
Start Time	8:20	
End Time	9:20	
Bp, "Hg	30.21	

Minutes	Meter Volume	Meter °F	Condenser °F	Delta H
	896.200			
5	899.850	34	30	1.800
10	903.450	34	34	1.800
15	907.040	35	35	1.800
20	910.640	35	36	1.800
25	914.260	36	37	1.800
30	917.860	36	38	1.800
35	921.480	36	37	1.800
40	924.990	37	39	1.800
45	928.710	37	38	1.800
50	932.330	38	40	1.800
55	935.950	38	39	1.800
60	939.595	38	40	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	823.4	829.7	6.3
2	822.0	822.5	0.5
3	682.6	681.5	-1.1
Silica Gel	865.4	870.7	5.3
Impinger Totals:	3,193.4	3,204.4	5.7

Moisture Field Data Entry

Run 2

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	17	5
Start Time	9:30	
End Time	10:30	
Bp, "Hg	30.21	

Minutes	Meter Volume	Meter °F	Condenser °F	Delta H
	939.975			
5	943.720	38	35	1.800
10	947.450	39	39	1.800
15	951.200	39	40	1.800
20	954.930	39	41	1.800
25	958.720	40	42	1.800
30	962.400	40	41	1.800
35	966.130	40	43	1.800
40	969.860	40	42	1.800
45	973.610	41	44	1.800
50	977.330	41	44	1.800
55	981.030	42	45	1.800
60	984.790	43	44	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	829.7	835.4	5.7
2	785.5	787.4	1.9
3	619.2	620.0	0.8
Silica Gel	946.8	952.3	5.5
Impinger Totals:	3,181.2	3,195.1	8.4

Moisture Field Data Entry

Run 3

Leak Checks:	Pre-test	Post-test
Train leak rate, dcf	0.000	0.000
Leak check vacuum, "Hg	16	4
Start Time	10:40	
End Time	11:40	
Bp, "Hg	30.21	

Minutes	Meter Volume	Meter °F	Condenser °F	Delta H
	985.250			
5	988.810	45	40	1.800
10	992.580	45	41	1.800
15	996.250	46	43	1.800
20	999.930	47	46	1.800
25	1003.610	47	45	1.800
30	1007.280	47	46	1.800
35	1011.020	47	46	1.800
40	1014.660	47	46	1.800
45	1018.350	47	48	1.800
50	1022.010	47	48	1.800
55	1025.720	47	47	1.800
60	1029.395	47	48	1.800

Impinger gain by weight (g):

#	Initial	Final	Gain
1	835.4	840.1	4.7
2	822.5	824.0	1.5
3	681.5	682.1	0.6
Silica Gel	870.7	875.2	4.5
Impinger Totals:	3,210.1	3,221.4	6.8

Bison Engineering, Inc.
Method 4 Moisture Calculations

Client: **Hollingsworth & Vose**
Facility: **Glass Plant 2**
Location: **Corvallis, OR**
Source: **CFU 118**
Test date: **12/15/2022**

Method 4 -Moisture Determination					
Run Number	#	1	2	3	
Start Time	hh:mm	8:20	9:30	10:40	
Meter Box Identification	#	Box 11	Box 11	Box 11	
Meter "Y" Factor	Factor	0.9690	0.9690	0.9690	
Barometric Pressure	in Hg	30.21	30.21	30.21	
Sample Duration	hh:mm	1:00	1:00	1:00	
Average Meter Temperature	Deg F	36.2	40.2	46.6	
Average Condenser Temperature	Deg F	36.9	41.7	45.3	
Average Delta H	in H2O	1.800	1.800	1.800	
Average Meter Pressure	in Hg	30.342	30.342	30.342	
Meter Volume Start	dcf	896.200	939.975	985.250	
Meter Volume End	dcf	939.595	984.790	1029.395	
Meter Volume	dcf	43.395	44.815	44.145	
Corrected Meter Volume	dscf	45.381	46.490	45.215	
Impinger Gain	g	5.7	8.4	6.8	
Silica Gel Gain	g	5.3	5.5	4.5	Average
Volume of Condensed Water Vapor	scf	0.519	0.655	0.533	0.569
Moisture Calculation	Bws	0.0113	0.0139	0.0117	0.012
Percent Moisture	Bws%	1.13	1.39	1.17	1.23

Bison Engineering, Inc.
Method 3A Oxygen
Calibration Error, System Bias and System Drift

Client:	**Hollingsworth & Vose**	Source:	**CFU 118**	Instrument Make:	**Servomex**
Facility:	**Glass Plant 2**	Date:	**December 15, 2022**	Instrument Model:	**1440**
Location:	**Corvallis, OR**			Instrument Serial #:	**01440D1-5041**

			Initial Values			Final Values								
		Analyzer Cal. Response	System Cal Response	Pre test System Cal. Bias % of span	pass/fail	System Cal Response	Post test System Cal. Bias % of span	pass/fail	System Drift % of span	pass/fail	Analyzer Span	Raw Avg Gas Conc	Corrected Gas Conc	Instrument Cal. Reference Gas
Run 1	zero	-0.01	0.01	0.09	pass	0.02	0.14	pass	0.05	pass				
	upscale	9.97	9.95	-0.09	pass	9.93	-0.18	pass	0.09	pass	21.94	19.95	20.19	10.05
Run 2	zero	-0.01	0.02	0.14	pass	0.02	0.14	pass	0.00	pass				
	upscale	9.97	9.93	-0.18	pass	9.92	-0.23	pass	0.05	pass	21.94	19.94	20.21	10.05
Run 3	zero	-0.01	0.02	0.14	pass	0.05	0.27	pass	0.14	pass				
	upscale	9.97	9.92	-0.23	pass	9.92	-0.23	pass	0.00	pass	21.94	19.93	20.23	10.05
				< 5%*			**< 5%***		**< 3%***					

Analyzer Calibration Error	Zero	Mid	High
Calibration Gas Standards	0	10.05	21.94
Cylinder Number		CC503830	SA20406
Calibration Gas Analyzer Response	-0.01	9.97	21.98
Analyzer Calibration Error	-0.05	-0.36	0.18
Analyzer Calibration Error < 2%*	pass	pass	pass

System Response Time	
30	seconds

System Leak Check		
	Completed	**Pass/Fail**
Pre-test	Yes	Pass
Post-test	Yes	Pass

Note: All units are in %
*Or < 0.5 % absolute difference

Bison Engineering, Inc.
Method 3A CO_2
Calibration Error, System Bias and System Drift

Client:	**Hollingsworth & Vose**	Source:	**CFU 118**	Instrument Make:	**Servomex**
Facility:	**Glass Plant 2**	Date:	**December 15, 2022**	Instrument Model:	**1440**
Location:	**Corvallis, OR**			Instrument Serial #:	**01440D1-5041**

		Initial Values				Final Values								
		Analyzer Cal. Response	System Cal Response	Pre test System Cal. Bias % of span	pass/fail	System Cal Response	Post test System Cal. Bias % of span	pass/fail	System Drift % of span	pass/fail	Analyzer Span	Raw Avg Gas Conc	Corrected Gas Conc	Instrument Cal. Reference Gas
Run 1	zero	0.04	0.06	0.09	pass	0.05	0.05	pass	0.05	pass				
	upscale	9.85	9.88	0.14	pass	9.85	0.00	pass	0.14	pass	21.70	0.59	0.54	9.951
Run 2	zero	0.04	0.05	0.05	pass	0.05	0.05	pass	0.00	pass				
	upscale	9.85	9.85	0.00	pass	9.87	0.09	pass	0.09	pass	21.70	0.59	0.55	9.951
Run 3	zero	0.04	0.05	0.05	pass	0.07	0.14	pass	0.09	pass				
	upscale	9.85	9.87	0.09	pass	9.96	0.51	pass	0.41	pass	21.70	0.59	0.54	9.951
				< 5%*			**< 5%***		**< 3%***					

Analyzer Calibration Error	Zero	Mid	High
Calibration Gas Standards	0	9.951	21.70
Cylinder Number		CC503830	SA20406
Calibration Gas Analyzer Response	0.04	9.85	21.93
Analyzer Calibration Error	0.18	-0.47	1.06
Analyzer Calibration Error < 2%*	pass	pass	pass

System Response Time	
28	seconds

System Leak Check		
	Completed	**Pass/Fail**
Pre-test	Yes	Pass
Post-test	Yes	Pass

Note: All units are in %
*Or < 0.5 % absolute difference

Bison Engineering, Inc.
Stratification Check

Client:	**Hollingsworth & Vose**	Source:	**CFU 118**
Facility:	**Glass Plant 2**	Test Date:	**December 15, 2022**
Location:	**Corvallis, OR**		

Stack Diameter: 30 inches
Port Depth: 6 inches

3 POINT METHOD					
% of diameter	Pt	Pt location	O2%	Diff (+/- 5%)	Pass/Fail
16.7%	S1	11.01	19.95	0.00%	PASS
50.0%	S2	21.00	19.95	0.00%	PASS
83.3%	S3	30.99	19.95	0.00%	PASS
		AVERAGE:	19.95		

Hollingsworth & Vose - Glass Plant 2
CFU 118
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes	
12/15/2022	6:10:50	0.07	0.05		
12/15/2022	6:11:50	-0.01	0.04	**O2/CO2 Analyzer Zero**	
12/15/2022	6:12:50	14.06	14.48		
12/15/2022	6:13:50	21.98	21.93	**O2/CO2 Analyzer Span**	
12/15/2022	6:14:50	15.44	15.20		
12/15/2022	6:15:50	9.97	9.85	**O2/CO2 Analyzer Mid**	
12/15/2022	6:16:50	11.65	2.37		
12/15/2022	6:17:50	0.22	0.09		
12/15/2022	6:18:50	0.01	0.06	**O2/CO2 System Zero**	
12/15/2022	6:19:50	3.35	3.42		
12/15/2022	6:20:50	9.86	9.72		
12/15/2022	6:21:50	9.95	9.88	**O2/CO2 System Upscale**	
12/15/2022	6:22:50	13.62	6.35		
12/15/2022	6:23:50	20.02	0.61		
12/15/2022	8:04:50	19.95	0.59	**Stratification Check**	
12/15/2022	8:05:50	19.95	0.59	**S1**	**19.95**
12/15/2022	8:06:50	19.95	0.59		
12/15/2022	8:07:50	19.95	0.59		
12/15/2022	8:08:50	19.95	0.59		
12/15/2022	8:09:50	19.95	0.59		
12/15/2022	8:10:50	19.95	0.60	**S2**	**19.95**
12/15/2022	8:11:50	19.95	0.60		
12/15/2022	8:12:50	19.95	0.60		
12/15/2022	8:13:50	19.95	0.59		
12/15/2022	8:14:50	19.95	0.60		
12/15/2022	8:15:50	19.95	0.60	**S3**	**19.95**
12/15/2022	8:16:50	19.95	0.60		
12/15/2022	8:17:50	19.95	0.60		
12/15/2022	8:18:50	19.95	0.60		
12/15/2022	8:19:50	19.95	0.60		
				CFU 118	
12/15/2022	8:20:50	19.95	0.60	**Start Run 1**	
12/15/2022	8:21:50	19.96	0.60		
12/15/2022	8:22:50	19.95	0.60		
12/15/2022	8:23:50	19.95	0.60		
12/15/2022	8:24:50	19.95	0.59		
12/15/2022	8:25:50	19.95	0.60		

Hollingsworth & Vose - Glass Plant 2
CFU 118
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/15/2022	8:26:50	19.95	0.59	
12/15/2022	8:27:50	19.95	0.59	
12/15/2022	8:28:50	19.95	0.59	
12/15/2022	8:29:50	19.95	0.59	
12/15/2022	8:30:50	19.95	0.59	
12/15/2022	8:31:50	19.95	0.59	
12/15/2022	8:32:50	19.95	0.59	
12/15/2022	8:33:50	19.95	0.59	
12/15/2022	8:34:50	19.95	0.59	
12/15/2022	8:35:50	19.95	0.59	
12/15/2022	8:36:50	19.95	0.59	
12/15/2022	8:37:50	19.95	0.60	
12/15/2022	8:38:50	19.95	0.59	
12/15/2022	8:39:50	19.94	0.60	
12/15/2022	8:40:50	19.94	0.60	
12/15/2022	8:41:50	19.95	0.60	
12/15/2022	8:42:50	19.95	0.59	
12/15/2022	8:43:50	19.95	0.59	
12/15/2022	8:44:50	19.95	0.59	
12/15/2022	8:45:50	19.95	0.59	
12/15/2022	8:46:50	19.95	0.59	
12/15/2022	8:47:50	19.95	0.59	
12/15/2022	8:48:50	19.95	0.59	
12/15/2022	8:49:50	19.94	0.59	
12/15/2022	8:50:50	19.95	0.59	
12/15/2022	8:51:50	19.95	0.59	
12/15/2022	8:52:50	19.95	0.58	
12/15/2022	8:53:50	19.94	0.58	
12/15/2022	8:54:50	19.94	0.58	
12/15/2022	8:55:50	19.94	0.58	
12/15/2022	8:56:50	19.95	0.58	
12/15/2022	8:57:50	19.94	0.58	
12/15/2022	8:58:50	19.95	0.58	
12/15/2022	8:59:50	19.95	0.58	
12/15/2022	9:00:50	19.95	0.58	
12/15/2022	9:01:50	19.95	0.58	
12/15/2022	9:02:50	19.95	0.59	
12/15/2022	9:03:50	19.95	0.59	
12/15/2022	9:04:50	19.95	0.59	

Hollingsworth & Vose - Glass Plant 2
CFU 118
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/15/2022	9:05:50	19.95	0.59	
12/15/2022	9:06:50	19.95	0.60	
12/15/2022	9:07:50	19.95	0.60	
12/15/2022	9:08:50	19.95	0.60	
12/15/2022	9:09:50	19.95	0.60	
12/15/2022	9:10:50	19.95	0.59	
12/15/2022	9:11:50	19.94	0.59	
12/15/2022	9:12:50	19.94	0.60	
12/15/2022	9:13:50	19.94	0.59	
12/15/2022	9:14:50	19.94	0.59	
12/15/2022	9:15:50	19.94	0.59	
12/15/2022	9:16:50	19.94	0.59	
12/15/2022	9:17:50	19.94	0.58	
12/15/2022	9:18:50	19.94	0.58	
12/15/2022	9:19:50	19.94	0.58	**End Run 1**
		19.95	**0.59**	**Average**
12/15/2022	9:20:50	19.94	0.59	
12/15/2022	9:21:50	12.25	0.65	
12/15/2022	9:22:50	0.16	0.06	
12/15/2022	9:23:50	0.02	0.05	**O2/CO2 System Zero**
12/15/2022	9:24:50	3.95	3.97	
12/15/2022	9:25:50	9.88	9.76	
12/15/2022	9:26:50	9.93	9.85	**O2/CO2 System Upscale**
12/15/2022	9:27:50	16.34	3.74	
12/15/2022	9:28:50	19.89	0.63	
12/15/2022	9:29:50	19.92	0.61	
12/15/2022	9:30:50	19.93	0.61	**Start Run 2**
12/15/2022	9:31:50	19.93	0.61	
12/15/2022	9:32:50	19.94	0.61	
12/15/2022	9:33:50	19.94	0.61	
12/15/2022	9:34:50	19.94	0.60	
12/15/2022	9:35:50	19.95	0.60	
12/15/2022	9:36:50	19.95	0.60	
12/15/2022	9:37:50	19.95	0.59	
12/15/2022	9:38:50	19.95	0.59	
12/15/2022	9:39:50	19.94	0.59	
12/15/2022	9:40:50	19.94	0.59	

Hollingsworth & Vose - Glass Plant 2
CFU 118
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/15/2022	9:41:50	19.95	0.59	
12/15/2022	9:42:50	19.94	0.59	
12/15/2022	9:43:50	19.94	0.59	
12/15/2022	9:44:50	19.94	0.58	
12/15/2022	9:45:50	19.93	0.58	
12/15/2022	9:46:50	19.93	0.58	
12/15/2022	9:47:50	19.93	0.58	
12/15/2022	9:48:50	19.93	0.58	
12/15/2022	9:49:50	19.93	0.58	
12/15/2022	9:50:50	19.93	0.58	
12/15/2022	9:51:50	19.93	0.58	
12/15/2022	9:52:50	19.93	0.58	
12/15/2022	9:53:50	19.93	0.59	
12/15/2022	9:54:50	19.93	0.58	
12/15/2022	9:55:50	19.92	0.59	
12/15/2022	9:56:50	19.94	0.60	
12/15/2022	9:57:50	19.94	0.60	
12/15/2022	9:58:50	19.93	0.59	
12/15/2022	9:59:50	19.93	0.59	
12/15/2022	10:00:50	19.93	0.59	
12/15/2022	10:01:50	19.93	0.59	
12/15/2022	10:02:50	19.94	0.59	
12/15/2022	10:03:50	19.94	0.59	
12/15/2022	10:04:50	19.94	0.59	
12/15/2022	10:05:50	19.94	0.59	
12/15/2022	10:06:50	19.94	0.58	
12/15/2022	10:07:50	19.94	0.58	
12/15/2022	10:08:50	19.93	0.58	
12/15/2022	10:09:50	19.94	0.58	
12/15/2022	10:10:50	19.94	0.58	
12/15/2022	10:11:50	19.94	0.58	
12/15/2022	10:12:50	19.94	0.58	
12/15/2022	10:13:50	19.94	0.58	
12/15/2022	10:14:50	19.95	0.58	
12/15/2022	10:15:50	19.95	0.58	
12/15/2022	10:16:50	19.95	0.58	
12/15/2022	10:17:50	19.95	0.59	
12/15/2022	10:18:50	19.95	0.58	
12/15/2022	10:19:50	19.95	0.59	

Hollingsworth & Vose - Glass Plant 2
CFU 118
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/15/2022	10:20:50	19.95	0.59	
12/15/2022	10:21:50	19.95	0.59	
12/15/2022	10:22:50	19.95	0.59	
12/15/2022	10:23:50	19.95	0.60	
12/15/2022	10:24:50	19.95	0.59	
12/15/2022	10:25:50	19.95	0.59	
12/15/2022	10:26:50	19.95	0.59	
12/15/2022	10:27:50	19.95	0.59	
12/15/2022	10:28:50	19.95	0.59	
12/15/2022	10:29:50	19.95	0.59	**End Run 2**
		19.94	**0.59**	**Average**
12/15/2022	10:30:50	19.95	0.59	
12/15/2022	10:31:50	19.95	0.58	
12/15/2022	10:32:50	13.96	0.87	
12/15/2022	10:33:50	0.24	0.09	
12/15/2022	10:34:50	0.02	0.05	**O2/CO2 System Zero**
12/15/2022	10:35:50	0.78	0.88	
12/15/2022	10:36:50	9.41	9.31	
12/15/2022	10:37:50	9.92	9.85	
12/15/2022	10:38:50	9.92	9.87	**O2/CO2 System Upscale**
12/15/2022	10:39:50	17.32	2.83	
12/15/2022	10:40:50	19.89	0.62	**Start Run 3**
12/15/2022	10:41:50	19.91	0.60	
12/15/2022	10:42:50	19.93	0.60	
12/15/2022	10:43:50	19.93	0.59	
12/15/2022	10:44:50	19.93	0.60	
12/15/2022	10:45:50	19.93	0.60	
12/15/2022	10:46:50	19.94	0.59	
12/15/2022	10:47:50	19.94	0.59	
12/15/2022	10:48:50	19.94	0.60	
12/15/2022	10:49:50	19.94	0.60	
12/15/2022	10:50:50	19.94	0.59	
12/15/2022	10:51:50	19.93	0.59	
12/15/2022	10:52:50	19.93	0.58	
12/15/2022	10:53:50	19.93	0.59	
12/15/2022	10:54:50	19.93	0.59	
12/15/2022	10:55:50	19.93	0.59	

Hollingsworth & Vose - Glass Plant 2
CFU 118
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/15/2022	10:56:50	19.93	0.58	
12/15/2022	10:57:50	19.93	0.58	
12/15/2022	10:58:50	19.92	0.58	
12/15/2022	10:59:50	19.92	0.58	
12/15/2022	11:00:50	19.92	0.57	
12/15/2022	11:01:50	19.92	0.58	
12/15/2022	11:02:50	19.92	0.57	
12/15/2022	11:03:50	19.92	0.57	
12/15/2022	11:04:50	19.93	0.57	
12/15/2022	11:05:50	19.93	0.58	
12/15/2022	11:06:50	19.93	0.58	
12/15/2022	11:07:50	19.93	0.58	
12/15/2022	11:08:50	19.93	0.58	
12/15/2022	11:09:50	19.93	0.59	
12/15/2022	11:10:50	19.93	0.59	
12/15/2022	11:11:50	19.94	0.59	
12/15/2022	11:12:50	19.93	0.60	
12/15/2022	11:13:50	19.93	0.59	
12/15/2022	11:14:50	19.93	0.60	
12/15/2022	11:15:50	19.93	0.60	
12/15/2022	11:16:50	19.93	0.60	
12/15/2022	11:17:50	19.94	0.60	
12/15/2022	11:18:50	19.94	0.59	
12/15/2022	11:19:50	19.94	0.59	
12/15/2022	11:20:50	19.94	0.59	
12/15/2022	11:21:50	19.94	0.59	
12/15/2022	11:22:50	19.94	0.59	
12/15/2022	11:23:50	19.94	0.58	
12/15/2022	11:24:50	19.94	0.58	
12/15/2022	11:25:50	19.94	0.58	
12/15/2022	11:26:50	19.94	0.58	
12/15/2022	11:27:50	19.94	0.58	
12/15/2022	11:28:50	19.94	0.58	
12/15/2022	11:29:50	19.94	0.59	
12/15/2022	11:30:50	19.94	0.59	
12/15/2022	11:31:50	19.94	0.59	
12/15/2022	11:32:50	19.93	0.59	
12/15/2022	11:33:50	19.93	0.59	
12/15/2022	11:34:50	19.93	0.59	

Hollingsworth & Vose - Glass Plant 2
CFU 118
Calibrations and Test Runs

Date	Time	O2 [%]	CO2 [%]	Notes
12/15/2022	11:35:50	19.93	0.60	
12/15/2022	11:36:50	19.93	0.60	
12/15/2022	11:37:50	19.94	0.60	
12/15/2022	11:38:50	19.93	0.60	
12/15/2022	11:39:50	19.93	0.60	**End Run 3**
		19.93	**0.59**	**Average**
12/15/2022	11:40:50	19.94	0.60	
12/15/2022	11:41:50	4.90	0.66	
12/15/2022	11:42:50	0.05	0.07	**O2/CO2 System Zero**
12/15/2022	11:43:50	0.02	0.07	
12/15/2022	11:44:50	4.64	4.72	
12/15/2022	11:45:50	9.88	9.89	
12/15/2022	11:46:50	9.92	9.96	**O2/CO2 System Upscale**
12/15/2022	11:47:50	14.98	5.24	
12/15/2022	11:48:50	20.72	0.22	

Hollingsworth & Vose
Corvallis, OR
Summary of Speciated Organic Toxic Air Contaminants (TAC)

Analyte	CFU 108	CFU 112	CFU 113	CFU 115	CFU 118
	lb/ton glass				
Dichlorodifluoromethane	< 8.82E-04	< 4.70E-04	< 4.05E-05	< 5.72E-03	< 2.99E-03
Chloromethane	< 3.68E-04	< 1.96E-04	< 1.69E-05	4.08E-02	3.84E-03
Freon 114	< 1.25E-03	< 6.64E-04	< 5.72E-05	< 8.09E-03	< 4.22E-03
Vinyl chloride	< 4.56E-04	< 2.43E-04	< 2.09E-05	< 2.96E-03	< 1.54E-03
1,3-Butadiene	< 3.95E-04	< 2.21E-04	5.79E-04	< 2.56E-03	< 1.34E-03
Bromomethane	< 6.93E-04	< 3.69E-04	< 3.18E-05	< 4.49E-03	< 2.35E-03
Chloroethane	< 4.71E-04	< 2.51E-04	< 2.16E-05	< 3.05E-03	< 1.59E-03
Freon 11	< 1.00E-03	< 5.34E-04	< 4.60E-05	< 6.50E-03	< 3.39E-03
Freon 113	< 1.37E-03	< 7.28E-04	< 6.27E-05	< 8.87E-03	< 4.63E-03
1,1-Dichloroethene	< 7.07E-04	< 3.77E-04	< 3.25E-05	< 4.59E-03	< 2.40E-03
Acetone	1.24E-02	1.92E-02	5.48E-03	4.31E-01	4.97E-02
Carbon disulfide	< 5.56E-04	< 2.96E-04	3.82E-05	< 3.60E-03	< 1.88E-03
Methylene chloride	< 6.20E-04	< 3.30E-04	< 2.84E-05	< 4.02E-03	< 2.10E-03
trans-1,2-Dichloroethene	< 7.07E-04	< 3.77E-04	< 3.25E-05	< 4.59E-03	< 2.40E-03
Methyl t-butyl ether	< 6.43E-04	< 3.42E-04	< 2.95E-05	< 4.17E-03	< 2.18E-03
Vinyl acetate	< 6.28E-04	< 3.34E-04	< 2.88E-05	< 4.07E-03	< 2.13E-03
2-Butanone	< 5.71E-04	< 7.83E-04	7.24E-05	1.37E-02	< 1.88E-03
cis-1,2-Dichloroethene	< 7.07E-04	< 3.77E-04	< 3.25E-05	< 4.59E-03	< 2.40E-03
1,1-Dichloroethane	< 7.22E-04	< 3.84E-04	< 3.31E-05	< 4.68E-03	< 2.45E-03
Ethyl acetate	< 1.29E-03	< 6.85E-04	< 5.90E-05	< 8.34E-03	< 4.35E-03
Hexane	2.00E-03	1.64E-02	7.89E-04	6.25E-01	4.86E-02
Chloroform	< 8.71E-04	< 4.64E-04	< 4.00E-05	< 5.65E-03	< 2.95E-03
Tetrahydrofuran	< 5.26E-04	< 2.80E-04	< 2.41E-05	< 3.41E-03	< 1.78E-03
1,2-Dichloroethane	< 7.22E-04	< 3.84E-04	< 3.31E-05	< 4.68E-03	< 2.45E-03
1,1,1-Trichloroethane	< 9.73E-04	< 5.18E-04	< 4.47E-05	< 6.31E-03	< 3.30E-03
Carbon tetrachloride	< 1.12E-03	< 5.98E-04	< 5.15E-05	< 7.28E-03	< 3.80E-03
Benzene	1.10E-03	4.24E-03	1.31E-03	1.08E-01	9.88E-03
Cyclohexane	< 6.14E-04	< 3.27E-04	< 2.82E-05	< 6.65E-03	< 2.08E-03
Trichloroethene	< 9.59E-04	< 5.10E-04	< 4.40E-05	< 6.22E-03	< 3.25E-03
1,2-Dichloropropane	< 8.24E-04	< 4.39E-04	< 3.78E-05	< 5.35E-03	< 2.79E-03
Bromodichloromethane	< 1.20E-03	< 6.36E-04	< 5.49E-05	< 7.75E-03	< 4.05E-03
Heptane	< 7.31E-04	1.59E-03	< 5.53E-05	4.16E-02	7.84E-03
cis-1,3-Dichloropropene	< 8.10E-04	< 4.31E-04	< 3.72E-05	< 5.25E-03	< 2.74E-03
4-Methyl-2-pentanone	< 7.31E-04	< 3.89E-04	< 3.35E-05	< 4.99E-03	< 2.47E-03
trans-1,3-Dichloropropene	< 8.10E-04	< 4.31E-04	< 3.72E-05	< 5.25E-03	< 2.74E-03
1,1,2-Trichloroethane	< 9.73E-04	< 5.18E-04	< 4.47E-05	< 6.31E-03	< 3.30E-03
Toluene	5.14E-03	1.26E-02	3.28E-04	1.09E-01	2.34E-02
2-Hexanone	< 1.46E-03	< 7.78E-04	< 6.71E-05	< 9.48E-03	< 4.95E-03
Tetrachloroethene	< 1.21E-03	< 6.44E-04	< 5.55E-05	< 7.85E-03	< 4.10E-03
Dibromochloromethane	< 1.52E-03	< 8.09E-04	< 6.97E-05	< 9.86E-03	< 5.15E-03
1,2-Dibromoethane	< 1.37E-03	< 7.30E-04	< 6.29E-05	< 8.89E-03	< 4.64E-03
Chlorobenzene	< 8.21E-04	< 4.37E-04	< 3.77E-05	< 5.33E-03	< 2.78E-03
Ethyl benzene	< 8.85E-04	< 4.62E-04	< 3.56E-05	< 5.66E-03	< 2.62E-03

APPENDIX F: M204 TEST DATA

BISON ENGINEERING, INC.

COMPANY	**Hollingsworth & Vose**
FACILITY	**Glass Plant 1**
LOCATION	**Corvallis, Oregon**
SOURCE	**Raw Materials Handling**
DATE	**12/14/22**
METHOD	**204**
POLLUTANT	**PTE Verification**

Bison Engineering, Inc.
Method 204 Field Data Summary

Client: Hollingsworth & Vose
Source: Glass Plant 1 - Raw Materials Handling
Location: Corvallis, Oregon
Date: 12/14/2022

Area Description	Pressure Differential	Pass/Fail
	inH_2O	Press. Diff. ≤ -0.007 inH_2O
North Man Door	-0.0275	Pass
NE Load In/Out Door	-0.0189	Pass
SE Load In/Out Door	-0.0164	Pass
Second Floor Load In/Out Door	-0.0271	Pass
Second Floor Man Door	-0.3319	Pass
Average of all NDOs	**-0.0843**	Pass

Acceptance criteria per EPA Method 204, Section 8.3:
The facial velocity (FV) shall be at least 3,600 m/hr (200 fpm).
Alternatively, pressure differential across the opening may be measured.
A pressure drop of 0.013 mmHg (0.007 inH_2O) corresponds to a FV of 3,600 m/hr.
The average FV of air through all natural draft openings (NDOs) shall be at least 3,600 m/hr (200 fpm).
The direction of airflow through all NDOs shall be into the enclosure.

Bison Engineering, Inc.
Method 204 Field Data

Client: Hollingsworth & Vose
Source: Glass Plant 1 - Raw Materials Handling
Location: Corvallis, Oregon
Date: 12/14/2022

Area Description		North Man Door			NE Load In/Out Door			SE Load In/Out Door		
Time (mm:ss)		13:00	13:25	13:45	13:05	13:28	13:48	13:09	13:33	13:50
Units		Inches of H_2O			Inches of H_2O			Inches of H_2O		
Readings	#1	-0.0429	-0.0221	-0.0187	-0.0128	-0.0270	-0.0175	-0.0258	-0.0241	-0.0095
	#2	-0.0546	-0.0131	-0.0196	-0.0092	-0.0208	-0.0199	-0.0110	-0.0212	-0.0117
	#3	-0.0321	-0.0182	-0.0517	-0.0136	-0.0256	-0.0188	-0.0162	-0.0180	-0.0157
	#4	-0.0319	-0.0194	-0.0136	-0.0156	-0.0230	-0.0158	-0.0129	-0.0203	-0.0119
	#5	-0.0325	-0.0179	-0.0247	-0.0161	-0.0225	-0.0247	-0.0195	-0.0164	-0.0119
Average		**-0.0388**	**-0.0181**	**-0.0257**	**-0.0135**	**-0.0238**	**-0.0193**	**-0.0171**	**-0.0200**	**-0.0121**
Overall			**-0.0275**			**-0.0189**			**-0.0164**	

Area Description		Second Floor Man Door			Second Floor Load In/Out Door		
Time (mm:ss)		13:19	13:40	13:59	13:14	13:37	13:54
Units		Inches of H_2O			Inches of H_2O		
Readings	#1	-0.1159	-0.1105	-0.3637	-0.0303	-0.0304	-0.0115
	#2	-0.2738	-0.1574	-0.5723	-0.0379	-0.0321	-0.0111
	#3	-0.3279	-0.0940	-0.6484	-0.0255	-0.0222	-0.0101
	#4	-0.3686	-0.0338	-0.7000	-0.0585	-0.0356	-0.0114
	#5	-0.4390	-0.0296	-0.7430	-0.0287	-0.0359	-0.0249
Average		**-0.3050**	**-0.0851**	**-0.6055**	**-0.0362**	**-0.0312**	**-0.0138**
Overall			**-0.3319**			**-0.0271**	

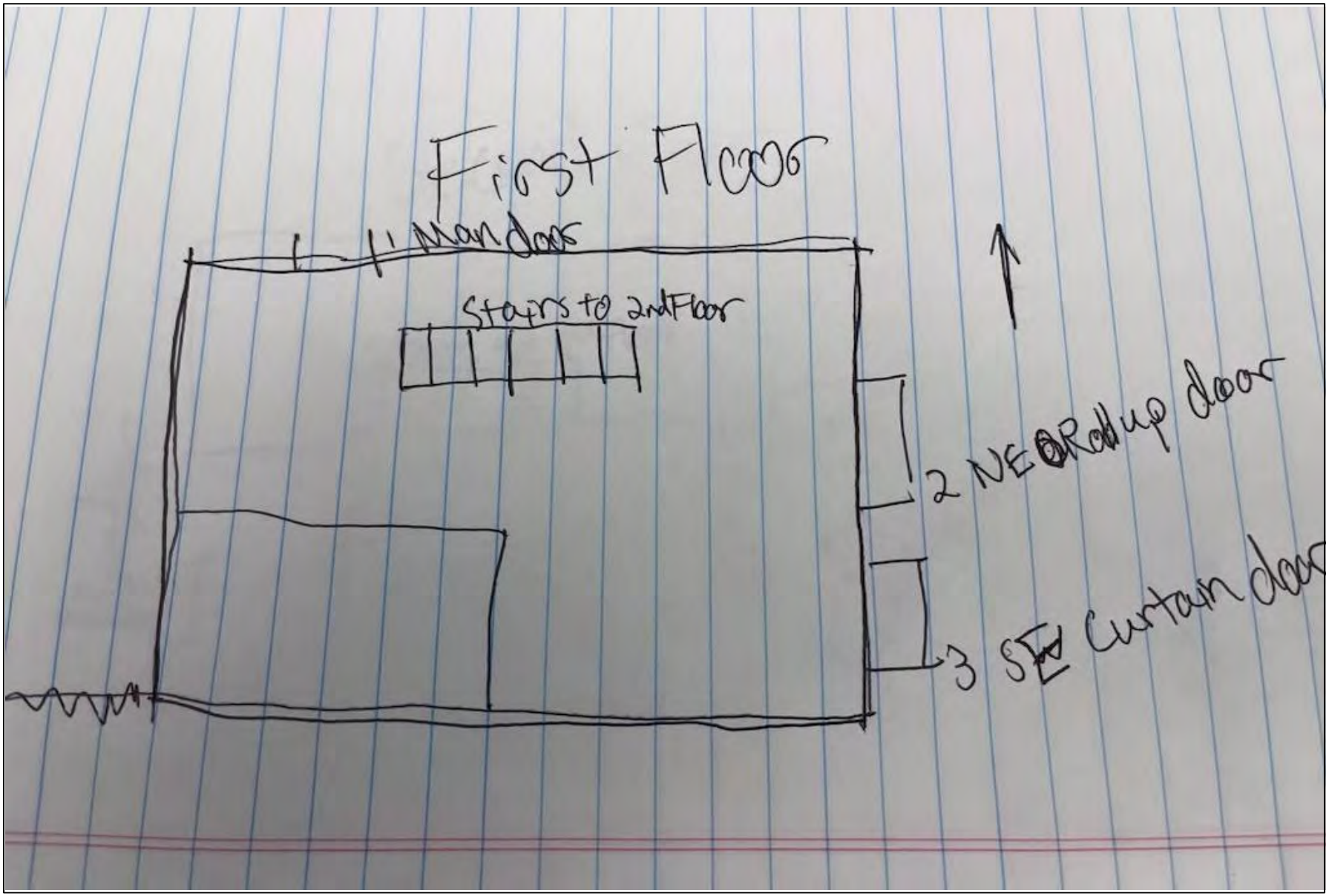
Average of all NDOs:
-0.0843 Inches of H_2O

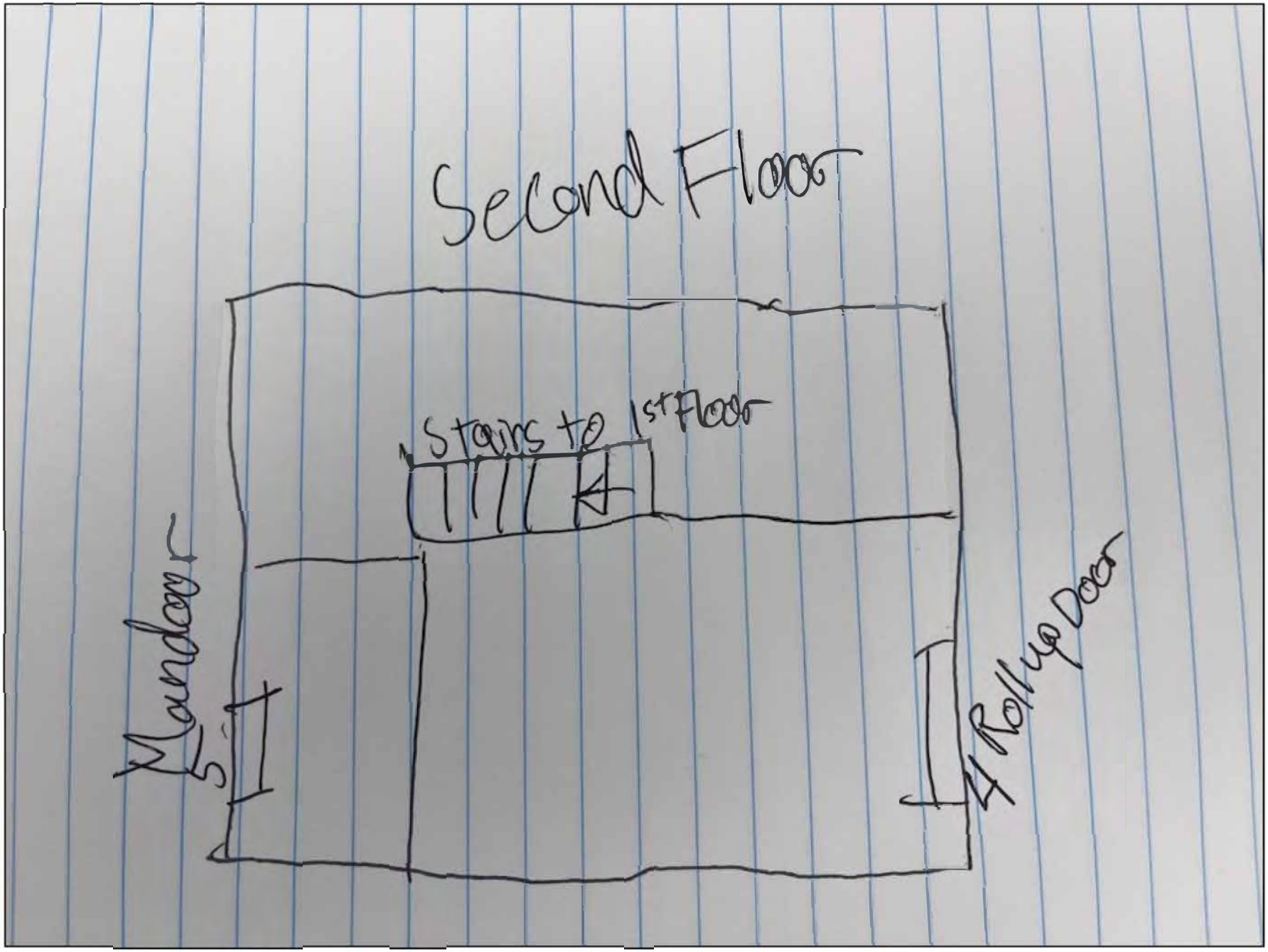
Bison Engineering, Inc.
Method 204 Verification of Permanent Total Enclosure

Client: H&V Glass plant 1
Location: Corvallis OR
Enclosure: Raw materials Handling
Date: 12-14-22

	Area	1 - North Man Door			2 - NE Load In/Out Door			3 - SE Load In/Out Door			4 - Second Floor Load In/Out Doors		
	Time	13:00	13:25	13:45	13:05	13:28	13:48	13:09	13:33	13:50	13:14	13:37	13:54
	Units	Inches of H_2O			Inches of H_2O			Inches of H_2O			Inches of H_2O		
Readings	#1	-0.0429	-0.1722	-0.0187	-0.0128	-0.0270	-0.0175	-0.0258	-0.0241	-0.0095	-0.0303	-0.0304	-0.0165
	#2	-0.0546	-0.0131	-0.0196	-0.0092	-0.0208	-0.0199	-0.0110	-0.0212	-0.0147	-0.0379	-0.0381	-0.0111
	#3	-0.0321	-0.0182	-0.0577	-0.0136	-0.0256	-0.0198	-0.0162	-0.0180	-0.0137	-0.0255	-0.0322	-0.0101
	#4	-0.0319	-0.0194	-0.0136	-0.0156	-0.0230	-0.0158	-0.0129	-0.0208	-0.0119	-0.0385	-0.0396	-0.0114
	#5	-0.0325	-0.0179	-0.0247	-0.0169	-0.0225	-0.0297	-0.0195	-0.0169	-0.0119	-0.0287	-0.0359	-0.0249

	Area	5 - Second Floor Main Door			6 -			7 -			8 -		
	Time	13:19	13:40	13:59									
	Units	Inches of H_2O			Inches of H_2O			Inches of H_2O			Inches of H_2O		
Readings	#1	-0.1159	-0.1105	-0.3637									
	#2	-0.2738	-0.1574	-0.5723									
	#3	-0.3259	-0.0940	-0.6484									
	#4	-0.3686	-0.0338	-0.7000									
	#5	-0.4590	-0.0596	-0.7430									


First Floor
1' Man door
Stairs to 2nd Floor
2 NE OR Roll up door
3 SE Curtain door


Second Floor
Stairs to 1st Floor
Mandoor
4' Roll up Door

APPENDIX G: LABORATORY REPORTS

Client:

EPA Method TO-15
Speciated Organics

Source: CFU104
Process Description:

Run 1
Date: 12/13/22
Cannister ID: 0475 (1460) / 000896
Start: 14:30
Stop: 15:30

Time	Pressure (Inches HG)
14:30	30
14:40	28
14:50	27
15:00	20
15:10	15
15:20	10
15:30	5

Notes:

Run 2
Date: 12/13/22
Cannister ID: 0493 (4752) / 1165
Start: 15:40
Stop: 16:40

Time	Pressure (Inches HG)
15:40	30
15:50	27
16:00	24
16:10	17
16:20	12
16:30	8
16:40	4

Notes:

Run 3
Date: 12/13/22
Cannister ID: 0302 (L4572) / 0256
Start: 1650
Stop: 1750

Time	Pressure (Inches HG)
1650	26
1700	23
1710	15
1720	9
1730	4
1740	3
1750	2

Notes:

Client:

EPA Method TO-15
Speciated Organics

Source: CF0112
Process Description:

Run 1
Date: 12/13/22
Cannister ID: 1213 (35641)/0427
Start: 1035
Stop: 11:35

Time	Pressure (Inches HG)
1035	30
1045	29
1055	27
1105	21
1110	16
1115	12
1125	7

Notes:

Run 2
Date: 12/13/22
Cannister ID: 8001677 (35624)/1162
Start: 11:45-12:45
Stop: 12:45

Time	Pressure (Inches HG)
11:45	29
11:55	25
12:05	21
12:15	17
12:25	13
12:35	8
12:45	4

Notes:

Run 3
Date: 12/13/22
Cannister ID: 0334 (4763)/1044
Start: 1300
Stop: 1400

Time	Pressure (Inches HG)
1300	29
1310	26
1320	17
1330	13
1340	11
1350	8
1400	3

Notes:

Client:

EPA Method TO-15
Speciated Organics

Source: CFU113
Process Description:

Run 1
Date: 12/13/22 (0957)
Cannister ID: SL: 3754 / 06388
Start: 06:55
Stop: 07:55

Time	Pressure (Inches Hg)
06:55	30.0
07:05	27
07:15	22
07:25	17
07:35	12
07:45	8
07:55	2

Notes:

Run 2
Date: 12/13/22
Cannister ID: 0448 / 00490 (0048) / 0090
Start: 08:05
Stop: 09:05

Time	Pressure (Inches Hg)
08:05	30
08:15	29
08:25	25
08:35	20
08:45	16
08:55	13
09:05	9

Notes:

Run 3
Date: 12/13/22
Cannister ID: 1459 (44002) / 0393
Start: 09:20
Stop: 10:20

AMATA 12/13

Time	Pressure (Inches Hg)
09:20	29
09:30	27
09:40	23
09:50	18
10:00	11
10:10	10
10:20	6

Notes:

Client:

EPA Method TO-15
Speciated Organics

Source: CFU115
Process Description:

Run 1
Date: 12/14/22
Canister ID: 0377(4762) / 001148
Start: 0900
Stop: 0900

Time	Pressure (Inches Hg)
0800	30
0810	28
0820	19
0830	15
0840	10
0850	7
0900	5

Notes:

Run 2
Date: 12/14/22
Canister ID: 1222(35519) / 001149
Start: 0910
Stop: 1010

Time	Pressure (Inches Hg)
0910	29
0920	26
0930	22
0940	17
0950	14
1000	9
1010	5

Notes:

Run 3
Date: 12/14/22
Cannister ID: 0294(4770) / 0886
Start: 10:20
Stop: 11:20

Time	Pressure (Inches Hg)
10:20	30
10:30	27
10:40	24
10:50	19
11:00	15
11:10	10
11:20	5

Notes:

Client:

EPA Method TO-15

Speciated Organics

Source: CFUHS - ROUND 2

Process Description:

Run 4

Date: 12/14/22

Cannister ID: 0298 (4801) / 0464

Start: 1305

Stop: 1405

Time	Pressure (Inches HG)
1305	24
1315	21
1325	18
1335	~~10~~ 15
1345	11
1355	8
1405	6

Notes:

PMTR 12/14

Run 5

Date: 12/14/22

Cannister ID: 0806 (21261) / 1019

Start: 1415

Stop: 1515

Time	Pressure (Inches HG)
1415	30
1425	27
1435	24
1445	18
1455	15
1505	11
1515	7

Notes:

Run 6

Date: 12/14/22

Cannister ID: 0856 (21178) / 1063

Start: 1525

Stop: 1625

Time	Pressure (Inches HG)
1525	30
1535	27
1545	25
1555	20
1605	15
1615	11
1625	6

Notes:

Client:

EPA Method TO-15
Speciated Organics

Source: CFU 19
Process Description:

Run 1
Date: 12/15/22
Cannister ID: 1263 (36574) / 0717
Start: 0820
Stop: 0920

Time	Pressure (Inches Hg)
0820	14
0830	14
0840	14
0850	14
0900	13
0910	9
0920	3

Notes:

Run 2
Date: 12/16/22
Cannister ID: 0537 (48129) / 1182
Start: 0930
Stop: 1030

Time	Pressure (Inches Hg)
0930	30
0940	27
0950	23
1000	19
1010	15
1020	10
1030	5

Notes:

Run 3
Date: 12/15/22
Cannister ID: 0662 (20848) / 1034
Start: 1040
Stop: 1140

Time	Pressure (Inches Hg)
1040	27
1050	25
1100	21
1110	17
1120	13
1130	7
1140	7

Notes:

ANALYTICAL REPORT

Report Date: January 05, 2023

Conor Fox
Bison Engineering
3143 E Lyndale Ave.
Helena, MT 59601

Phone: 406-442-5768

E-mail: cfox@bison-eng.com

Workorder: **34-2236123**
Project ID: HAV222965
Purchase Order: HAV216269/HAV222965
Project Manager Jessica Cofrancesco

Client Sample ID	Lab ID	Collect Date	Receive Date	Sampling Site
CFU113 Run 2	2236123001	NA	12/27/22	HAV222965
CFU113 Run 1	2236123002	NA	12/27/22	HAV222965
CFU112 Run 1	2236123003	NA	12/27/22	HAV222965
CFU113 Run 3	2236123004	NA	12/27/22	HAV222965
CFU112 Run 3	2236123005	NA	12/27/22	HAV222965
CFU108 Run 2	2236123006	NA	12/27/22	HAV222965
CFU112 Run 2	2236123007	NA	12/27/22	HAV222965
CFU108 Run 1	2236123008	NA	12/27/22	HAV222965
CFU118 Run 3	2236123009	NA	12/27/22	HAV222965
CFU118 Run 1	2236123010	NA	12/27/22	HAV222965
CFU115 Run 6	2236123011	NA	12/27/22	HAV222965
CFU118 Run 2	2236123012	NA	12/27/22	HAV222965
CFU115 Run 2	2236123013	NA	12/27/22	HAV222965
CFU115 Run 5	2236123014	NA	12/27/22	HAV222965
CFU115 Run 4	2236123015	NA	12/27/22	HAV222965
CFU115 Run 3	2236123016	NA	12/27/22	HAV222965
CFU108 Run 3	2236123017	NA	12/27/22	HAV222965
CFU115 Run 1	2236123018	NA	12/27/22	HAV222965

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU113 Run 2** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123001 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 18:36

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	<0.50	<1.0	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	**17**	**37**	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**94**	**220**	1.0	1	E
Carbon disulfide	**0.80**	**2.5**	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**1.7**	**5.0**	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**12**	**44**	0.50	1	
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**28**	**89**	0.50	1	E
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**0.70**	**2.9**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU113 Run 2** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123001 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 18:36

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**4.4**	**17**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	<0.50	<2.2	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 18:36

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propene	88	4.70	1	J
Acetaldehyde	34	5.06	1	J
2-Butene	41	5.28	1	J
Butane	12	5.36	1	J
1-Propene, 2-methyl-	5.8	5.47	1	J
Cyclopropane, ethyl-	13	6.63	1	J
Pentane	8.1	6.86	1	J
1,2-Pentadiene	7.1	6.96	1	J

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU113 Run 2** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123001 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 18:36

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
3-Penten-1-yne	14	7.62	1	J
1-Propene, 2-methyl-	24	9.00	1	J

Sample ID: **CFU113 Run 1** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123002 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 19:16

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	<0.50	<1.0	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	**16**	**36**	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**250**	**590**	1.0	1	E
Carbon disulfide	**0.77**	**2.4**	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**0.87**	**2.6**	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**20**	**70**	0.50	1	
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU113 Run 1**
Lab ID: 2236123002
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 19:16
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**18**	**57**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	<0.50	<2.0	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**0.96**	**3.6**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	<0.50	<2.2	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU113 Run 1** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123002 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 19:16

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propene	81	4.70	1	J
Acetaldehyde	31	5.06	1	J
2-Butene	40	5.28	1	J
Butane	10	5.38	1	J
Cyclopropane, ethyl-	12	6.63	1	J
Pentane	8.4	6.86	1	J
3-Penten-1-yne, (E)-	12	7.62	1	J
1-Hexene	19	9.00	1	J
Pentane, 2,4-dimethyl-	8.4	10.17	1	J
Butane, 2,2,3,3-tetramethyl-	19	11.86	1	J

Sample ID: **CFU112 Run 1** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123003 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 19:55

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	<0.50	<1.0	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	**0.58**	**1.3**	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**67**	**160**	1.0	1	E
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU112 Run 1**
Lab ID: 2236123003
Matrix: Air

Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA

Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable

Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 19:55

Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**2.3**	**6.9**	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**47**	**160**	0.50	1	E
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**12**	**38**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**3.8**	**16**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**31**	**120**	0.50	1	E
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	**0.68**	**3.0**	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU112 Run 1** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123003 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 19:55

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 19:55

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	15	4.72	1	J
Isobutane	11	5.07	1	J
Butane	9.0	5.38	1	J
Pentane	20	6.86	1	J
2-Pentene, (E)-	4.2	7.00	1	J
Pentane, 2-methyl-	7.9	8.48	1	J
1-Pentene, 4-methyl-	7.8	10.17	1	J
Pentane, 2,3-dimethyl-	5.6	11.29	1	J
1-Heptene	3.9	11.78	1	J
Pentane, 2,2,4-trimethyl-	7.2	11.86	1	J

Sample ID: **CFU113 Run 3** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123004 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 20:34

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	<0.50	<1.0	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU113 Run 3**
Lab ID: 2236123004
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 20:34
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	**15**	**33**	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**66**	**160**	1.0	1	E
Carbon disulfide	**0.68**	**2.1**	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**2.0**	**6.0**	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**8.3**	**29**	0.50	1	
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**30**	**97**	0.50	1	E
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**1.3**	**5.5**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**11**	**43**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU113 Run 3**
Lab ID: 2236123004
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 20:34
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	<0.50	<2.2	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 20:34
Instrument ID: 5975-J

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propene	83	4.70	1	J
Acetaldehyde	36	5.06	1	J
1-Propene, 2-methyl-	35	5.28	1	J
Butane	10	5.38	1	J
1-Butene	5.8	5.47	1	J
1-Propene, 2-methyl-	5.2	5.64	1	J
Cyclopropane, ethyl-	11	6.63	1	J
Pentane	5.2	6.86	1	J
1-Hexene	22	9.00	1	J
1-Heptene	7.0	11.78	1	J

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU112 Run 3**
Lab ID: 2236123005
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 21:14
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	<0.50	<1.0	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**15**	**35**	1.0	1	
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	<0.50	<1.5	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**4.8**	**17**	0.50	1	
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**1.7**	**5.4**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**0.55**	**2.3**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU112 Run 3**
Lab ID: 2236123005
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 21:14
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**5.9**	**22**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	<0.50	<2.2	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 21:14
Instrument ID: 5975-J

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	7.5	4.72	1	J
Isobutane	4.2	5.07	1	J
Butane	3.5	5.38	1	J
Pentane	3.6	6.86	1	J

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU108 Run 2**
Lab ID: 2236123006
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 21:53
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	<0.50	<1.0	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**11**	**26**	1.0	1	
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	<0.50	<1.5	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**1.3**	**4.5**	0.50	1	
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**0.65**	**2.1**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	<0.50	<2.0	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU108 Run 2**
Lab ID: 2236123006
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 21:53
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**2.3**	**8.8**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	<0.50	<2.2	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 21:53
Instrument ID: 5975-J

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	7.6	4.72	1	J
Isobutane	4.0	5.07	1	J
Butane	2.4	5.38	1	J
Pentane	2.0	6.86	1	J
Cyclohexanone	2.0	16.33	1	J

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU112 Run 2** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123007 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 22:32

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	<0.50	<1.0	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**46**	**110**	1.0	1	E
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**1.4**	**4.1**	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**22**	**76**	0.50	1	E
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**7.3**	**23**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**1.8**	**7.4**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU112 Run 2** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123007 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 22:32

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**16**	**59**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	<0.50	<2.2	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 22:32

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	11	4.72	1	J
Isobutane	6.6	5.07	1	J
Butane	6.5	5.38	1	J
Pentane	13	6.86	1	J
Cyclopropane, 1,2-dimethyl-, trans-	2.9	7.00	1	J
1-Butene, 3-methyl-	2.2	7.27	1	J
Pentane, 2-methyl-	4.6	8.48	1	J
1-Pentene, 4-methyl-	4.2	10.17	1	J

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU112 Run 2** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123007 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 22:32

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Pentane, 2,3-dimethyl-	3.6	11.29	1	J
Butane, 2,2,3,3-tetramethyl-	4.2	11.86	1	J

Sample ID: **CFU108 Run 1** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123008 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 23:12

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	<0.50	<1.0	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**24**	**57**	1.0	1	E
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**0.63**	**1.8**	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**2.8**	**9.7**	0.50	1	
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU108 Run 1** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123008 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 23:12

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**1.7**	**5.6**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	<0.50	<2.0	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**7.5**	**28**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	**0.72**	**3.1**	0.50	1	
m,p-Xylene	**2.1**	**9.1**	1.0	1	
o-Xylene	**0.94**	**4.1**	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU108 Run 1** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123008 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 23:12

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	9.1	4.72	1	J
Unknown Compound	2.5	4.84	1	J
Isobutane	5.5	5.07	1	J
Butane	2.7	5.38	1	J
Pentane	3.2	6.86	1	J
Hexane, 2,2-dimethyl-	2.9	11.86	1	J

Sample ID: **CFU118 Run 3** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123009 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 23:50

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	**1.3**	**2.8**	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**16**	**39**	1.0	1	
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	<0.50	<1.5	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU118 Run 3**
Lab ID: 2236123009
Matrix: Air

Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA

Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable

Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 23:50

Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**10**	**36**	0.50	1	
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**2.2**	**6.9**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**2.2**	**9.2**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**5.9**	**22**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	<0.50	<2.2	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU118 Run 3** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123009 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 23:50

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/04/2023 23:50

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	23	4.72	1	J
Isobutane	9.1	5.07	1	J
Butane	6.2	5.38	1	J
Pentane	6.7	6.86	1	J
Pentane, 2-methyl-	3.2	8.48	1	J
1-Pentene, 4-methyl-	5.2	10.17	1	J
Pentane, 2,3-dimethyl-	6.1	11.29	1	J
Butane, 2,2,3,3-tetramethyl-	14	11.86	1	J
Pentane, 2,3,4-trimethyl-	2.8	13.51	1	J
Heptane, 2,4-dimethyl-	2.6	15.22	1	J

Sample ID: **CFU118 Run 1** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123010 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 00:30

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	**1.3**	**2.7**	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU118 Run 1** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123010 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 00:30

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**23**	**55**	1.0	1	E
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**0.58**	**1.7**	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**17**	**60**	0.50	1	
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**3.8**	**12**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**1.8**	**7.3**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**6.4**	**24**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU118 Run 1**
Lab ID: 2236123010
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 00:30
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Ethyl benzene	<0.50	<2.2	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 00:30
Instrument ID: 5975-J

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	32	4.72	1	J
Isobutane	12	5.07	1	J
Butane	10	5.38	1	J
Butane, 2-methyl-	8.9	6.38	1	J
Pentane	15	6.86	1	J
Butane, 2,3-dimethyl-	3.2	8.40	1	J
Pentane, 2-methyl-	6.1	8.48	1	J
Pentane, 2,4-dimethyl-	8.2	10.17	1	J
Pentane, 2,3-dimethyl-	7.2	11.29	1	J
Butane, 2,2,3,3-tetramethyl-	8.9	11.86	1	J

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 6** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123011 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 01:09

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	**5.4**	**11**	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**51**	**120**	1.0	1	E
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**1.4**	**4.3**	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**79**	**280**	0.50	1	E
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**13**	**41**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**8.3**	**34**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 6**
Lab ID: 2236123011
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 01:09
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**21**	**78**	0.50	1	E
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	**0.69**	**3.0**	0.50	1	
m,p-Xylene	**1.5**	**6.3**	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 01:09
Instrument ID: 5975-J

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	30	4.72	1	J
Isobutane	29	5.07	1	J
Butane	22	5.38	1	J
Butane, 2-methyl-	23	6.38	1	J
Pentane	45	6.86	1	J
Butane, 2,3-dimethyl-	12	8.40	1	J
Pentane, 2-methyl-	25	8.48	1	J
Pentane, 2,4-dimethyl-	40	10.17	1	J

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 6** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123011 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 01:09

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Pentane, 2,3-dimethyl-	32	11.29	1	J
Butane, 2,2,3,3-tetramethyl-	53	11.86	1	J

Sample ID: **CFU118 Run 2** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123012 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 01:48

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	**2.0**	**4.1**	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**13**	**30**	1.0	1	
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	<0.50	<1.5	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**7.3**	**26**	0.50	1	
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU118 Run 2**
Lab ID: 2236123012
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 01:48
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**1.7**	**5.4**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**0.78**	**3.2**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**3.2**	**12**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	<0.50	<2.2	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU118 Run 2** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123012 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 01:48

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	19	4.72	1	J
Isobutane	10	5.07	1	J
Butane	7.0	5.38	1	J
Pentane	6.9	6.86	1	J
Pentane, 2-methyl-	2.6	8.48	1	J
Pentane, 2,4-dimethyl-	3.2	10.17	1	J
Pentane, 2,3-dimethyl-	3.3	11.29	1	J
Butane, 2,2,3,3-tetramethyl-	4.0	11.86	1	J

Sample ID: **CFU115 Run 2** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123013 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 02:28

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	**0.51**	**1.0**	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**25**	**58**	1.0	1	E
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**0.69**	**2.0**	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 2** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123013 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 02:28

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**13**	**45**	0.50	1	
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**4.8**	**15**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**2.3**	**9.4**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**18**	**68**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	**0.97**	**4.2**	0.50	1	
m,p-Xylene	**2.7**	**12**	1.0	1	
o-Xylene	**0.94**	**4.1**	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 2** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123013 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 02:28

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 02:28

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	20	4.72	1	J
Isobutane	12	5.07	1	J
Butane	10	5.38	1	J
Pentane	15	6.86	1	J
Pentane, 2-methyl-	7.7	8.48	1	J
C6 Hydrocarbon	2.9	8.87	1	J
Pentane, 2,4-dimethyl-	6.6	10.17	1	J
Hexane, 2-methyl-	2.7	11.21	1	J
Pentane, 2,3-dimethyl-	6.5	11.29	1	J
Butane, 2,2,3,3-tetramethyl-	6.8	11.86	1	J

Sample ID: **CFU115 Run 5** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123014 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 10:05

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	**3.2**	**6.6**	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 5**
Lab ID: 2236123014
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 10:05
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**44**	**100**	1.0	1	E
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**1.5**	**4.4**	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**79**	**280**	0.50	1	E
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**15**	**47**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**2.9**	**12**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**9.7**	**36**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 5**
Lab ID: 2236123014
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 10:05
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	<0.50	<2.2	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 10:05
Instrument ID: 5975-J

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	34	4.72	1	J
Isobutane	28	5.07	1	J
Butane	26	5.36	1	J
Butane, 2-methyl-	37	6.37	1	J
Pentane	73	6.86	1	J
Butane, 2,3-dimethyl-	19	8.40	1	J
Pentane, 2-methyl-	42	8.48	1	J
Pentane, 2,4-dimethyl-	44	10.17	1	J
Pentane, 2,3-dimethyl-	31	11.29	1	J
Hexane, 2,2-dimethyl-	39	11.86	1	J

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 4** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123015 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 10:43

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	**17**	**35**	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	**0.50**	**1.3**	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**140**	**320**	1.0	1	E
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**3.1**	**9.1**	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**72**	**250**	0.50	1	E
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**16**	**51**	0.50	1	
Cyclohexane	**1.5**	**5.2**	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**2.0**	**8.2**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	**0.58**	**2.4**	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 4**
Lab ID: 2236123015
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 10:43
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**7.0**	**26**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	<0.50	<2.2	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 10:43
Instrument ID: 5975-J

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Butane, 2-methyl-	11	6.37	1	J
Pentane	19	6.86	1	J
Pentane, 2-methyl-	8.8	8.48	1	J
Pentane, 2,4-dimethyl-	6.4	10.17	1	J
Pentane, 2,3-dimethyl-	31	11.29	1	J
Butane, 2,2,3,3-tetramethyl-	40	11.86	1	J
Disulfide, dimethyl	19	12.93	1	J
o-Cymene	41	19.30	1	J

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 3**
Lab ID: 2236123016
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 11:22
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	**0.56**	**1.2**	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**22**	**52**	1.0	1	E
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**0.87**	**2.6**	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**8.3**	**29**	0.50	1	
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**3.8**	**12**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**1.5**	**6.2**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 3**
Lab ID: 2236123016
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 11:22
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**15**	**55**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	**0.91**	**4.0**	0.50	1	
m,p-Xylene	**2.9**	**12**	1.0	1	
o-Xylene	**1.0**	**4.5**	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 11:22
Instrument ID: 5975-J

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	25	4.72	1	J
Unknown Compound	2.0	4.84	1	J
Isobutane	12	5.07	1	J
Butane	8.6	5.38	1	J
Pentane	11	6.86	1	J
Pentane, 2-methyl-	5.5	8.48	1	J
C6 Hydrocarbon	2.1	8.87	1	J
Pentane, 2,4-dimethyl-	4.8	10.17	1	J

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 3** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123016 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 11:22

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Pentane, 2,3-dimethyl-	4.5	11.29	1	J
Butane, 2,2,3,3-tetramethyl-	4.9	11.86	1	J

Sample ID: **CFU108 Run 3** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123017 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 12:01

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	<0.50	<1.0	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**9.3**	**22**	1.0	1	
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	<0.50	<1.5	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**0.71**	**2.5**	0.50	1	
Chloroform	<0.50	<2.4	0.50	1	
Tetrahydrofuran	<0.50	<1.5	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU108 Run 3**
Lab ID: 2236123017
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 12:01
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**0.56**	**1.8**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	<0.50	<2.0	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**1.8**	**7.0**	0.50	1	
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	<0.50	<2.2	0.50	1	
m,p-Xylene	<1.0	<4.3	1.0	1	
o-Xylene	<0.50	<2.2	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU108 Run 3** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123017 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 12:01

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	7.7	4.72	1	J
Isobutane	4.1	5.07	1	J
Butane	2.2	5.36	1	J

Sample ID: **CFU115 Run 1** | Sampling Site: HAV222965 | Received: 12/27/2022
Lab ID: 2236123018 | Media: Summa 6 Liter Canister
Matrix: Air | Sampling Parameter: NA

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable | **Analysis:** EPA TO-15, Air | **Instrument ID:** 5975-J
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 12:41

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Dichlorodifluoromethane	<0.50	<2.5	0.50	1	
Chloromethane	**0.67**	**1.4**	0.50	1	
Freon 114	<0.50	<3.5	0.50	1	
Vinyl chloride	<0.50	<1.3	0.50	1	
1,3-Butadiene	<0.50	<1.1	0.50	1	
Bromomethane	<0.50	<1.9	0.50	1	
Chloroethane	<0.50	<1.3	0.50	1	
Freon 11	<0.50	<2.8	0.50	1	
Freon 113	<0.50	<3.8	0.50	1	
1,1-Dichloroethene	<0.50	<2.0	0.50	1	
Acetone	**54**	**130**	1.0	1	E
Carbon disulfide	<0.50	<1.6	0.50	1	
Methylene chloride	<0.50	<1.7	0.50	1	
trans-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
Methyl t-butyl ether	<0.50	<1.8	0.50	1	
Vinyl acetate	<0.50	<1.8	0.50	1	
2-Butanone	**1.1**	**3.2**	0.50	1	
cis-1,2-Dichloroethene	<0.50	<2.0	0.50	1	
1,1-Dichloroethane	<0.50	<2.0	0.50	1	
Ethyl acetate	<1.0	<3.6	1.0	1	
Hexane	**32**	**110**	0.50	1	E
Chloroform	<0.50	<2.4	0.50	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 1**
Lab ID: 2236123018
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 12:41
Instrument ID: 5975-J

Analyte	Result (ppb)	Result (ug/m³)	RL (ppb)	Dilution	Qual
Tetrahydrofuran	<0.50	<1.5	0.50	1	
1,2-Dichloroethane	<0.50	<2.0	0.50	1	
1,1,1-Trichloroethane	<0.50	<2.7	0.50	1	
Carbon tetrachloride	<0.50	<3.1	0.50	1	
Benzene	**9.5**	**30**	0.50	1	
Cyclohexane	<0.50	<1.7	0.50	1	
Trichloroethene	<0.50	<2.7	0.50	1	
1,2-Dichloropropane	<0.50	<2.4	0.50	1	
Bromodichloromethane	<0.50	<3.4	0.50	1	
Heptane	**3.6**	**15**	0.50	1	
cis-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
4-Methyl-2-pentanone	<0.50	<2.0	0.50	1	
trans-1,3-Dichloropropene	<0.50	<2.3	0.50	1	
1,1,2-Trichloroethane	<0.50	<2.7	0.50	1	
Toluene	**23**	**87**	0.50	1	E
2-Hexanone	<1.0	<4.1	1.0	1	
Tetrachloroethene	<0.50	<3.4	0.50	1	
Dibromochloromethane	<0.50	<4.3	0.50	1	
1,2-Dibromoethane	<0.50	<3.8	0.50	1	
Chlorobenzene	<0.50	<2.3	0.50	1	
Ethyl benzene	**1.0**	**4.4**	0.50	1	
m,p-Xylene	**3.2**	**14**	1.0	1	
o-Xylene	**1.1**	**5.0**	0.50	1	
Styrene	<1.0	<4.3	1.0	1	
Bromoform	<1.0	<10	1.0	1	
1,1,2,2-Tetrachloroethane	<0.50	<3.4	0.50	1	
4-Ethyl toluene	<1.0	<4.9	1.0	1	
1,3,5-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,2,4-Trimethylbenzene	<1.0	<4.9	1.0	1	
1,3-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,4-Dichlorobenzene	<1.0	<6.0	1.0	1	
Benzyl chloride	<1.0	<5.2	1.0	1	
1,2-Dichlorobenzene	<1.0	<6.0	1.0	1	
1,2,4-Trichlorobenzene	<1.0	<7.4	1.0	1	
Hexachlorobutadiene	<1.0	<11	1.0	1	

Results Continued on Next Page

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

Analytical Results

Sample ID: **CFU115 Run 1**
Lab ID: 2236123018
Matrix: Air
Sampling Site: HAV222965
Media: Summa 6 Liter Canister
Sampling Parameter: NA
Received: 12/27/2022

Analysis Method - EPA TO-15 by IH-AN-014

Preparation: Not Applicable
Analysis: EPA TO-15, Air
Batch: IVOA/6039 (HBN: 302293)
Analyzed: 01/05/2023 12:41
Instrument ID: 5975-J

Tentatively Identified Compound	Result (ppb)	Retention Time	Dilution	Qual
Propane	24	4.72	1	J
Isobutane	18	5.07	1	J
Butane	18	5.38	1	J
Pentane	34	6.86	1	J
Pentane, 2-methyl-	18	8.48	1	J
Pentane, 3-methyl-	6.5	8.87	1	J
Pentane, 2,4-dimethyl-	16	10.17	1	J
Hexane, 2-methyl-	5.4	11.20	1	J
Pentane, 2,3-dimethyl-	14	11.29	1	J
Butane, 2,2,3,3-tetramethyl-	14	11.86	1	J

Comments

Quality Control: EPA TO-15 by IH-AN-014 - (Batch: 302293)

The percent difference for target compounds in the CCV standard must be less than 30% relative to the target. The following compounds did not meet this criteria: 2-Butanone, Ethyl Acetate, 4-methyl-2-Pentanone, 2-Hexanone, 4-ethyl Toluene, 1,2,4-Trimethylbenzene, Benzyl Chloride, 1,2-Dichlorobenzene, 1,2,4-Trichlorobenzene and Hexachloro-1,3-butadiene.

Not all compounds in the LCS/LCSD were within performance limits. This is not a method requirement.

Report Authorization (/S/ is an electronic signature that complies with 21 CFR Part 11)

Method	Analyst	Peer Review
EPA TO-15 by IH-AN-014 (302293)	/S/ Paul Kelly 01/05/2023 13:14	/S/ Thomas J. Masoian 01/05/2023 14:44

Laboratory Contact Information

ALS Environmental
960 W Levoy Drive
Salt Lake City, Utah 84123

Phone: (801) 266-7700
Email: alslt.lab@ALSGlobal.com
Web: www.alsglobal.com/slt

ANALYTICAL REPORT

Workorder: 34-2236123
Client: Bison Engineering
Project Manager: Jessica Cofrancesco

General Lab Comments

The results provided in this report relate only to the items tested.
Samples were received in acceptable condition unless otherwise noted.
The following was provided by the client: Sample ID, Collection Date, Sampling Location, Media Type, Sampling Parameter.
Collection Date, Media Type, and Sampling Parameter can potentially affect the validity of the results.
Samples have not been blank corrected unless otherwise noted.
This test report shall not be reproduced, except in full, without written approval of ALS.

ALS provides professional analytical services for all samples submitted. ALS is not in a position to interpret the data and assumes no responsibility for the quality of the samples submitted.

All quality control samples processed with the samples in this report yielded acceptable results unless otherwise noted.

ALS is accredited for specific fields of testing (scopes) in the following testing sectors. The quality system implemented at ALS conforms to accreditation requirements and is applied to all analytical testing performed by ALS. The following table lists testing sector, accreditation body, accreditation number and website. Please contact these accrediting bodies or your ALS project manager for the current scope of accreditation that applies to your analytical testing.

Testing Sector	Accreditation Body (Standard)	Certificate Number	Website
Industrial Hygiene	AIHA (ISO 17025 & AIHA IHLAP)	101574	http://www.aihaaccreditedlabs.org
	DOECAP-AP	L22-62	http://www.pjlabs.com
	Washington	C596	https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Laboratory-Accreditation
Dietary Supplements	PJLA (ISO 17025)	L22-61	http://www.pjlabs.com

Result Symbol Definitions

MDL = Method Detection Limit, a statistical estimate of method/media/instrument sensitivity.
RL = Reporting Limit, a verified value of method/media/instrument sensitivity.
CRDL = Contract Required Detection Limit
Reg. Limit = Regulatory Limit.
ND = Not Detected, testing result not detected above the MDL or RL.
< Means this testing result is less than the numerical value.
** No result could be reported, see sample comments for details.

Qualifier Symbol Definitions

U = Qualifier indicates that the analyte was not detected above the MDL.
J = Qualifier Indicates that the analyte value is between the MDL and the RL. It is also used to indicate an estimated value for tentatively identified compounds in mass spectrometry where a 1:1 response is assumed.
B = Qualifier indicates that the analyte was detected in the blank.
E = Qualifier indicates that the analyte result exceeds calibration range.
P = Qualifier indicates that the RPD between the two columns is greater than 40%.
Q = Qualifier indicates that the analyte was outside the limits in a lab QC sample.

APPENDIX H: PLANT OPERATING RECORDS

Table 1

December 2022 Source Test—Production Data

Hollingsworth & Vose Fiber Company—Corvallis, OR

Source Test	Product Type	Test ID	Test Time [1]	Production Rates (lb/hr)														
				CFU-113 [2]			CFU-112 [3]			CFU-108 [3]			CFU-115 [4]			CFU-118 [5]		
				L1	L2	Total	L2R4	L2R9	Total	L1R5	L1R6	Total	L4R3	L4R4	Total	L4R8	L4R9	Total
12/13/2022 CFU-113 Outlet	Glass Melt (GM)	Run 1	06:55 - 07:55	2,095.9	1,863.4	3,959.3	--	--	--	--	--	--	--	--	--	--	--	--
		Run 2	08:05 - 09:05	2,107.0	2,036.4	4,143.4	--	--	--	--	--	--	--	--	--	--	--	--
		Run 3	09:20 - 10:20	2,057.0	2,020.5	4,077.5	--	--	--	--	--	--	--	--	--	--	--	--
		Average		2,086.6	1,973.4	4,060.0	--	--	--	--	--	--	--	--	--	--	--	--
12/13/2022 CFU-112 Outlet	Ultra-Rotary Coarse (URC)	Run 1	10:35 - 11:35	--	--	--	354.0	346.8	700.8	--	--	--	--	--	--	--	--	--
		Run 2	11:45 - 12:45	--	--	--	341.3	351.6	692.8	--	--	--	--	--	--	--	--	--
		Run 3	13:00 - 14:00	--	--	--	354.7	345.2	700.0	--	--	--	--	--	--	--	--	--
		Average		--	--	--	350.0	347.9	697.8	--	--	--	--	--	--	--	--	--
12/13/2022 CFU-108 Outlet	Rotary Coarse (RC)	Run 1	14:30 - 15:30	--	--	--	--	--	--	189.7	196.0	385.7	--	--	--	--	--	--
		Run 2	15:40 - 16:40	--	--	--	--	--	--	196.0	194.4	390.4	--	--	--	--	--	--
		Run 3	16:50 - 17:50	--	--	--	--	--	--	192.1	188.1	380.1	--	--	--	--	--	--
		Average		--	--	--	--	--	--	192.6	192.8	385.4	--	--	--	--	--	--
12/14/2022 CFU-115 Outlet [6]	Flameblown (FB)	Run 4	13:05 - 14:05	--	--	--	--	--	--	--	--	--	31.5	31.5	63.0	--	--	--
		Run 5	14:15 - 15:15	--	--	--	--	--	--	--	--	--	31.5	31.5	63.0	--	--	--
		Run 6	15:25 - 16:25	--	--	--	--	--	--	--	--	--	31.5	31.5	63.0	--	--	--
		Average		--	--	--	--	--	--	--	--	--	31.5	31.5	63.0	--	--	--
12/15/2022 CFU-118 Outlet	Rotary Fine (RF)	Run 1	08:20 - 09:20	--	--	--	--	--	--	--	--	--	--	--	--	55.5	53.2	108.7
		Run 2	09:30 - 10:30	--	--	--	--	--	--	--	--	--	--	--	--	56.3	54.0	110.3
		Run 3	10:40 - 11:40	--	--	--	--	--	--	--	--	--	--	--	--	56.3	54.0	110.3
		Average		--	--	--	--	--	--	--	--	--	--	--	--	56.1	53.7	109.8

Notes

CFU = ceramic filtration unit.

hr = hour.

lb = pound.

References

[1] Information provided by Bison Engineering.

[2] Information provided by Hollingsworth & Vose Fiber Company. The hourly production rate represents the total of the average production rate at each position measured during the test run.

[3] Information provided by Hollingsworth & Vose Fiber Company. The hourly fiber pull rate represents the average pull rate measured during the test run.

[4] Information provided by Hollingsworth & Vose Fiber Company. Average pull rates from 12/14/2022.

[5] Information provided by Hollingsworth & Vose Fiber Company. Value represents the average pull rate measured before and after the test run.

[6] Only results from Runs 4 through 6 were used.

Table 2

December 2022 Source Test—Natural Gas Usage

Hollingsworth & Vose Fiber Company—Corvallis, OR

Source Test	Product Type	Test ID	Test Time [1]	Natural Gas Usage (cf/hr)														
				CFU-113 [2]			CFU-112 [3]			CFU-108 [3]			CFU-115 [3]			CFU-118 [3]		
				L1	L2	Total	L2R4	L2R9	Total	L1R5	L1R6	Total	L4R3	L4R4	Total	L4R8	L4R9	Total
12/13/2022 CFU-113 Outlet	Glass Melt (GM)	Run 1	06:55 - 07:55	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Run 2	08:05 - 09:05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Run 3	09:20 - 10:20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Average		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12/13/2022 CFU-112 Outlet	Ultra-Rotary Coarse (URC)	Run 1	10:35 - 11:35	--	--	--	2,127.8	2,220.1	4,347.9	--	--	--	--	--	--	--	--	--
		Run 2	11:45 - 12:45	--	--	--	2,125.7	2,216.9	4,342.6	--	--	--	--	--	--	--	--	--
		Run 3	13:00 - 14:00	--	--	--	2,124.3	2,215.7	4,339.9	--	--	--	--	--	--	--	--	--
		Average		--	--	--	2,125.9	2,217.6	4,343.5	--	--	--	--	--	--	--	--	--
12/13/2022 CFU-108 Outlet	Rotary Coarse (RC)	Run 1	14:30 - 15:30	--	--	--	--	--	--	2,842.8	2,780.7	5,623.6	--	--	--	--	--	--
		Run 2	15:40 - 16:40	--	--	--	--	--	--	2,827.2	2,795.4	5,622.6	--	--	--	--	--	--
		Run 3	16:50 - 17:50	--	--	--	--	--	--	2,822.0	2,781.7	5,603.7	--	--	--	--	--	--
		Average		--	--	--	--	--	--	2,830.7	2,785.9	5,616.6	--	--	--	--	--	--
12/14/2022 CFU-115 Outlet [4]	Flameblown (FB)	Run 4	13:05 - 14:05	--	--	--	--	--	--	--	--	--	3,210.2	3,248.9	6,459.0	--	--	--
		Run 5	14:15 - 15:15	--	--	--	--	--	--	--	--	--	3,202.6	3,245.9	6,448.5	--	--	--
		Run 6	15:25 - 16:25	--	--	--	--	--	--	--	--	--	3,164.7	3,230.1	6,394.7	--	--	--
		Average		--	--	--	--	--	--	--	--	--	3,192.5	3,241.6	6,434.1	--	--	--
12/15/2022 CFU-118 Outlet	Rotary Fine (RF)	Run 1	08:20 - 09:20	--	--	--	--	--	--	--	--	--	--	--	--	2,594.7	2,557.4	5,152.1
		Run 2	09:30 - 10:30	--	--	--	--	--	--	--	--	--	--	--	--	2,574.0	2,549.3	5,123.4
		Run 3	10:40 - 11:40	--	--	--	--	--	--	--	--	--	--	--	--	2,577.7	2,557.6	5,135.3
		Average		--	--	--	--	--	--	--	--	--	--	--	--	2,582.1	2,554.8	5,136.9

Notes

cf = cubic feet.

CFU = ceramic filtration unit.

hr = hour.

References

[1] Information provided by Bison Engineering.

[2] Information provided by Hollingsworth & Vose Fiber Company. Hourly natural gas consumption rates for glass melt are not available.

[3] Information provided by Hollingsworth & Vose Fiber Company. The hourly natural gas usage rate represents the average usage rate measured during the test run.

[4] Only results from Runs 4 through 6 were used.

Table 3

December 2022 Source Test—Differential Pressure

Hollingsworth & Vose Fiber Company—Corvallis, OR

Source Test	Product Type	Test ID	Test Time [1]	Differential Pressure [2] ("w.c.)
12/13/2022 CFU-113 Outlet	Glass Melt (GM)	Run 1	06:55 - 07:55	3.85
		Run 2	08:05 - 09:05	3.87
		Run 3	09:20 - 10:20	3.85
		Average		3.86
12/13/2022 CFU-112 Outlet	Ultra-Rotary Coarse (URC)	Run 1	10:35 - 11:35	4.39
		Run 2	11:45 - 12:45	4.39
		Run 3	13:00 - 14:00	4.39
		Average		4.39
12/13/2022 CFU-108 Outlet	Rotary Coarse (RC)	Run 1	14:30 - 15:30	6.70
		Run 2	15:40 - 16:40	7.52
		Run 3	16:50 - 17:50	7.81
		Average		7.35
12/14/2022 CFU-115 Outlet [3]	Flameblown (FB)	Run 4	13:05 - 14:05	4.10
		Run 5	14:15 - 15:15	4.08
		Run 6	15:25 - 16:25	4.08
		Average		4.09
12/15/2022 CFU-118 Outlet	Rotary Fine (RF)	Run 1	08:20 - 09:20	5.02
		Run 2	09:30 - 10:30	5.24
		Run 3	10:40 - 11:40	5.32
		Average		5.19

Notes

" w.c. = inches water column.

CFU = ceramic filtration unit.

References

[1] Information provided by Hollingsworth & Vose Fiber Company.

[2] Information provided by Hollingsworth & Vose Fiber Company. The hourly natural gas usage rate represents the average usage rate measured during the test run.

[3] Only results from Runs 4 through 6 were used.

APPENDIX I: CALIBRATIONS AND CERTIFICATIONS

STAC STACK TESTING ACCREDITATION COUNCIL

A2LA American Association for Laboratory Accreditation

Accredited Air Emission Testing Body

A2LA has accredited

BISON ENGINEERING, INC.

In recognition of the successful completion of the joint A2LA and Stack Testing Accreditation Council (STAC) evaluation process, this laboratory is accredited to perform testing activities in compliance with ASTM D7036:2004 - Standard Practice for Competence of Air Emission Testing Bodies.

Presented this 27th day of January 2022 .

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 4675.01
Valid to November 30, 2023

This accreditation program is not included under the A2LA ILAC Mutual Recognition Arrangement.

APEX INSTRUMENTS

METERBOX CALIBRATION USING REFERENCE DGM

Meter Console Information	
Console Model Number	C-5000
Console Serial Number	2029
DGM Model Number	SK25EX
DGM Serial Number	13966757

Calibration Conditions			
Date	Time	30-Oct-22	10:07
Barometric Pressure		26.15	in Hg
Calibration Technician		JCR	
Calibration Meter Gamma		1.0000	

Standardized Factors/Conversions		
Temperature	528	R
Pressure	29.92	in Hg
K_1	17.647	R/in Hg

<<<<<<<Your reference meter here

Calibration Data

Run Time	Metering Console						Reference Meter				
Elapsed	Manometer ΔH	Volume Initial	Volume Final	Sample Volume	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Sample Volume	Outlet Temp Initial	Outlet Temp Final
Θ minutes	P_m in H_2O	V_{mi} cubic feet	V_{mf} cubic feet	V_m cubic feet	t_{Oi} °F	t_{Of} °F	V_{wi} cubic feet	V_{wf} cubic feet	V_w cubic feet	t_{wi} °F	t_{wf} °F
10.00	6.00	105.857	120.570	14.713	57	60	0.000	14.711	14.711	66	67
10.00	3.00	120.839	131.248	10.409	60	64	0.000	10.272	10.272	67	68
10.00	2.00	131.500	140.046	8.546	64	67	0.000	8.369	8.369	68	69
10.00	1.00	140.265	146.436	6.171	67	69	0.000	6.011	6.011	69	70
10.00	0.50	146.624	151.016	4.392	69	71	0.000	4.272	4.272	70	70

Results

Standardized Data				Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate	$\Delta H_@$	
				Value	Variation	Std & Corr	0.75 SCFM	Variation
$V_{m(std)}$ cubic feet	$Q_{m(std)}$ ft^3/min	$V_{w(std)}$ cubic feet	$Q_{w(std)}$ ft^3/min	Y	ΔY	$Q_{m(std)(corr)}$ ft^3/min	$\Delta H_@$ in H_2O	$\Delta\Delta H_@$
13.316	1.332	12.894	1.289	0.9683	-0.001	1.289	1.808	-0.006
9.280	0.928	8.986	0.899	0.9683	-0.001	0.899	1.849	0.034
7.547	0.755	7.308	0.731	0.9683	-0.001	0.731	1.851	0.037
5.409	0.541	5.239	0.524	0.9686	0.000	0.524	1.793	-0.022
3.829	0.383	3.720	0.372	0.9713	0.002	0.372	1.771	-0.043
Pre-test Y	0.968	% Deviation	PASS	**0.9690**	**Y Average**		**1.815**	**$\Delta H_@$ Average**

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

Note: For $DH_@$, orifice pressure differential that equates to 0.75cfm (0.0212m^3/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is +-0.2inches (5.1mm) H_20.

Initials JCR Date 10/30/2022

JCR 30-Oct-22

APEX INSTRUMENTS
METERBOX CALIBRATION USING REFERENCE DGM

Meter Console Information	
Console Model Number	C-5000
Console Serial Number	2029
DGM Model Number	SK25EX
DGM Serial Number	13966757

Calibration Conditions			
Date	Time	17-Dec-22	12:51
Barometric Pressure		25.92	in Hg
Calibration Technician		MTK	
Calibration Meter Gamma		1.0000	

Standardized Factors/Conversions		
Temperature	528	R
Pressure	29.92	in Hg
K_1	17.647	R/in Hg

<<<<<<<Your reference meter here

Calibration Data

Run Time	Metering Console						Reference Meter				
	Manometer	Volume	Volume	Sample	Outlet Temp	Outlet Temp	Volume	Volume	Sample Volume	Outlet Temp	Outlet Temp
Elapsed	ΔH	Initial	Final	Volume	Initial	Final	Initial	Final		Initial	Final
Θ minutes	P_m in H_2O	V_{mi} cubic feet	V_{mf} cubic feet	V_m cubic feet	t_{Oi} ˚F	t_{Of} ˚F	V_{wi} cubic feet	V_{wf} cubic feet	V_w cubic feet	t_{wi} ˚F	t_{wf} ˚F
10.00	6.00	83.005	97.750	14.745	62	65	0.000	14.602	14.602	65	65
14.00	3.00	97.940	112.630	14.690	65	68	0.000	14.335	14.335	65	67
15.00	2.00	113.100	125.770	12.670	68	70	0.000	12.289	12.289	67	67
10.00	1.00	126.100	132.190	6.090	70	71	0.000	5.880	5.880	67	68
10.00	0.50	132.500	136.830	4.330	71	72	0.000	4.163	4.163	68	67

Results

Standardized Data				Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate	$\Delta H_@$	
				Value	Variation			
$V_{m(std)}$ cubic feet	$Q_{m(std)}$ ft^3/min	$V_{w(std)}$ cubic feet	$Q_{w(std)}$ ft^3/min	Y	ΔY	$Q_{m(std)(corr)}$ ft^3/min	$\Delta H_@$ in H_2O	$\Delta\Delta H_@$
13.103	1.310	12.722	1.272	0.9710	0.002	1.272	1.823	-0.042
12.871	0.919	12.465	0.890	0.9685	0.000	0.890	1.851	-0.014
11.018	0.735	10.666	0.711	0.9681	-0.001	0.711	1.925	0.060
5.266	0.527	5.099	0.510	0.9682	0.000	0.510	1.867	0.002
3.732	0.373	3.610	0.361	0.9674	-0.001	0.361	1.859	-0.006
Pre-test Y	0.9690	% Deviation	PASS	**0.9686**	**Y Average**		**1.865**	**$\Delta H_@$ Average**

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

Note: For $DH_@$, orifice pressure differential that equates to 0.75cfm (0.0212m^3/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is +-0.2inches (5.1mm) H_20.

Initials MTK Date 17-Dec-22

MTK

AIRDATA MULTIMETER CERTIFICATE OF RECALIBRATION

Customer ID: 022037 S/N: M16654
Customer: BISON ENGINEERING, INC. City: HELENA State: MT
As-Received Model #: ADM-850L Converted to Model #: Order #: R213346
PO #: Customer Eqpt ID#: Calibration Due Date: 01/2024

This instrument has been calibrated using Calibration Standards which are traceable to NIST (National Institute of Standards and Technology). Test accuracy ratio is 4:1 for pressures and temperature. Quality Assurance Program and calibration procedures meet the requirements for ANSI/NCSL Z540-1, ISO 17025, MIL-STD 45662A and manufacturer's specifications. Calibration accuracy is certified when meters are used with properly functioning accessories only. All Uncertainties are expressed in expanded terms (twice the calculated uncertainty). This report shall not be reproduced, except in full, without the written approval of Shortridge Instruments, Inc. Results relate only to the item calibrated. For limitations on use, see Shortridge Instruments, Inc. Instruction Manual for the use of AirData Multimeters. Procedure used: Procedure for Differential Pressure, Absolute Pressure and Temperature Recalibration of AirData Multimeters SIP-CP02 Revision: 30 Dated: 04/04/16

Calibration Technician(s): D. Babb Calibration Date: 01/14/2022
Calibration Approved by: M. Romuez Title: Cal Supv Date: 01/17/2022

AS-Received By D. Babb	FINAL Test By D. Babb	Test By
Date 12/28/2021 Rh 37 %	Date 01/14/2022 Rh 33 %	Date Rh %
Ambient Temperature 72 °F	Ambient Temperature 71 °F	Ambient Temperature °F
Barometric Pressure 28.19 in Hg	Barometric Pressure 28.46 in Hg	Barometric Pressure N/A in Hg
All within spec (YES) NO NA	All within spec (YES) NO	All within spec YES NO

ABSOLUTE PRESSURE TEST (in Hg)

TEST METER TOLERANCE = ± 2.0 % ± .1 in Hg AS-RECEIVED TEST WITHIN SPEC (YES) NO N/A See Notes

Pressure Standard: Heise #02-R S/N: 41741/42451 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #04-R S/N: 41743/42453 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #06-R S/N: 41742/42452-1 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #08-R S/N: 42186/43328 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #10-R S/N: 42203/43352 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #12A-R S/N: 45605/48491 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #14-R S/N: 43412/45043-2 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #16-R S/N: 43413/45044 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #18-R S/N: 44581/46845 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #20-R S/N: 44582/46847 As-Rcvd Test 2 Test 3

Approx Set Pt	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff
14.0	14.09	14.1	.07	14.19	14.2	.07			
28.4	28.19	28.3	.39	28.46	28.5	.14		NA	
40.0	40.12	40.2	.20	40.57	40.6	.07			

DIFFERENTIAL PRESSURE TEST (in wc)

TEST METER TOLERANCE = ± 2.0 % ± 0.001 in wc AS-RECEIVED TEST WITHIN SPEC (YES) NO N/A See Notes

Pressure Standard: Heise #01-L S/N: 41739/42449 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #01-R S/N: 41739/42446 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #02-L S/N: 41741/42454 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #03A-L S/N: 45570/48461 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #03A-R S/N: 45570/48460 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #04-L S/N: 41743/42456 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #05-L S/N: 41740/42450 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #05-R S/N: 41740/42447 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #06-L S/N: 41742/42455 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #07-L S/N: 42185/42186 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #07-R S/N: 42185/43326 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #08-L S/N: 42186/43329 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #09-L S/N: 42202/43351 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #09-R S/N: 42202/43350 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #10-L S/N: 42203/43353 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #11-L S/N: 43165/44551-1 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #11-R S/N: 43165/44730 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #12A-L S/N: 45605/48490-1 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #13-L S/N: 43415/45041 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #13-R S/N: 43415/45039 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #14-L S/N: 43412/45045 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #15-L S/N: 43416/45042 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #15-R S/N: 43416/45040 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #16-L S/N: 43413/45046 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #17-L S/N: 44579/46842 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #17-R S/N: 44579/46841 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #18-L S/N: 44581/46846 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #19-L S/N: 44580/46844 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #19-R S/N: 44580/46843 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #20-L S/N: 44582/46848 As-Rcvd Test 2 Test 3

Approx Set Pt	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff
0.0100	.0105	.0104	-.95	.0106	.0106	.00			
0.0200	.0207	.0206	-.48	.0205	.0205	.00			
0.0300	.0302	.0302	.00	.0301	.0301	.00			
0.0400	.0402	.0401	-.25	.0404	.0405	.25			
0.0500	.0501	.0501	.00	.0502	.0502	.00			
0.1250	.1258	.1255	-.24	.1252	.1249	-.24			
0.2250	.2256	.2252	-.18	.2258	.2256	-.09		NA	
1.000	1.015	1.012	-.30	1.014	1.011	-.30			
2.000	2.006	2.000	-.30	2.019	2.015	-.20			
3.600	3.611	3.597	-.39	3.617	3.604	-.36			
4.400	4.403	4.406	.07	4.410	4.413	.07			
27.00	27.11	27.11	.00	27.08	27.07	-.04			
50.00	50.16	50.02	-.28	50.14	50.02	-.24			
Overange	NA	✓	NA	NA	✓	NA	NA		NA

AIRDATA MULTIMETER CERTIFICATE OF RECALIBRATION

S/N: M16654

Order #: R213346

LOW VELOCITY CONFIRMATION (FPM)

TEST METER TOLERANCE = ± 3.0% ± 7 FPM AS-RECEIVED TEST WITHIN SPEC (YES) NO N/A See Notes

Vel Eqv Trans Std: S/N: M02009	As-Rcvd	Test 2	Test 3	Vel Eqv Trans Std: S/N: M10897	As-Rcvd	Test 2	Test 3
Vel Eqv Trans Std: S/N: M02903	As-Rcvd	Test 2	Test 3	Vel Eqv Trans Std: S/N: M10901	As-Rcvd	(Test 2)	Test 3
Vel Eqv Trans Std: S/N: M10839	As-Rcvd	Test 2	Test 3	Vel Eqv Trans Std: S/N: M13492	(As-Rcvd)	Test 2	Test 3
Vel Eqv Trans Std: S/N: M10840	As-Rcvd	Test 2	Test 3	Vel Eqv Trans Std: S/N: M19325	As-Rcvd	Test 2	Test 3

Approx Set Point	Standard	Test Meter	Diff	Standard	Test Meter	Diff	Standard	Test Meter	Diff
100	106	104	-2	105	106	1		NA	
500	511	511	0	510	509	-1			

ADM-880C, ADM-870/870C and ADM-860/860C models are read in AirFoil Mode. ADM-850/850L models are read in Pitot Tube Mode.

TEMPERATURE TEST - AIRDATA MULTIMETER (° F)

TEST METER TOLERANCE = ± 0.2° F AS-RECEIVED TEST WITHIN SPEC (YES) NO N/A See Notes

RTD Simulator: S/N 249	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F 95° F 154.4° F
RTD Simulator: S/N 250	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F 95° F 154.4° F
RTD Simulator: S/N 253	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F 95° F 154.4° F
RTD Simulator: S/N 254	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F 95° F 154.4° F
RTD Simulator: S/N 256	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F 95° F 154.4° F
RTD Simulator: S/N 257	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F 95° F 154.4° F
RTD Simulator: S/N 292	(As-Rcvd)	(Test 2)	Test 3	Set Point: 35.6° F 95° F 154.4° F
RTD Simulator: S/N 293	(As-Rcvd)	(Test 2)	Test 3	Set Point: 35.6° F (95° F) 154.4° F
RTD Simulator: S/N 294	(As-Rcvd)	(Test 2)	Test 3	Set Point: 35.6° F 95° F (154.4° F)
RTD Simulator: S/N 313	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F 95° F 154.4° F
RTD Simulator: S/N 314	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F 95° F 154.4° F
RTD Simulator: S/N 315	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F 95° F 154.4° F
RTD Simulator: S/N 316	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F 95° F 154.4° F
RTD Simulator: S/N 317	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F 95° F 154.4° F
RTD Simulator: S/N 318	As-Rcvd	Test 2	Test 3	Set Point: 35.6° F 95° F 154.4° F

RTD Simulator Temperature Equivalent Set Point	Test Meter	Difference	Test Meter	Difference	Test Meter	Difference
35.60	35.7	.1	35.7	.1		
95.00	94.9	-.1	950	.0		NA
154.40	154.3	-.1	154.3	-.1		

There were no additions to or deviations from the specified calibration procedure during the calibration process.

Any calibration due date shown is specified by the customer.

The enclosed ADM Calibration Standards for Pressure and Temperature form(s) is/are an integral part of this calibration and must remain with this Certificate of Calibration. There may be more than one such form included that pertains to this calibration.

Any additional information required pertaining to this calibration or to any repairs performed may be included in other documentation. If applicable, these documents may include, but not be limited to an AirData Multimeter Recalibration Notes form, and/or a Repair Record Notes form.

NOTES: _____

Shortridge Instruments, Inc.
7855 East Redfield Road Scottsdale, Arizona 85260
(480) 991-6744 • Fax (480) 443-1267 • www.shortridge.com

CO ID: 022037 MULTITEMP AND/OR TEMPROBE RECALIBRATION TEST REPORT Order #: R213346

Customer: Bison Engineering, Inc. City: Helena State: MT

Procedure used: Procedure for Calibration/Recalibration of MultiTemps and/or TemProbes SIP-CP14 Rev: 03 Dated: 07/31/14. There were no additions to or deviations from the calibration procedure during this calibration process.

Equipment Being Tested: MultiTemp and TemProbes _____ TemProbe(s) ✓

AS-RECEIVED TEMPERATURE TEST (° F)
MULTITEMP TOLERANCE (MULTITEMP AND TEMPROBES TESTED AS A UNIT) = ± 0.5° F
TEMPROBE TOLERANCE = ± 0.3° F

Thermometer #1 S/N 8A089 / Thermistor S/N A410660	Set Point: 35° F 95° F 155° F
Thermometer #2 S/N 8B104 / Thermistor S/N 871507	Set Point: 35° F 95° F (155° F)
Thermometer #5 S/N B11780 / Thermistor S/N B10505	Set Point: (35° F) 95° F 155° F
Thermometer #6 S/N B11782 / Thermistor S/N B10509	Set Point: 35° F (95° F) 155° F
Thermometer #7 S/N B49938 / Thermistor S/N B482202	Set Point: 35° F 95° F 155° F
Temperature Standard AirData Multimeter S/N M00136	Set Point: 35° F 95° F 155° F
Temperature Standard AirData Multimeter S/N M96100	Set Point: (35° F) (95° F) (155° F)

Test By: D. Babb Date: 12/28/2021 Rh: 37 % Ambient Temperature: 72 °F Barometric Pressure: 28.21 in Hg

Approx Set Point	Temp Standard	Test Probe #1 ADT-442	Test Probe #2 ADT-446	Test Probe #3 ADT-_____	Test Probe #4 ADT-_____	Test Probe #5 ADT-_____	Test Probe #6 ADT-_____	Test Probe #7 ADT-_____	Test Probe #8 ADT-_____
35°	35.0	35.0	35.1						
95°	95.0	95.0	95.0		NA				
155°	155.0	155.1	155.0						

A check in the box to the right of a TemProbe reading indicates that the reading is Out Of Specification.

If all As-Received readings were within specification, and no repairs were performed, no Final test is required.

NOTES: _____

FINAL TEMPERATURE TEST (° F)
MULTITEMP TOLERANCE (MULTITEMP AND TEMPROBES TESTED AS A UNIT) = ± 0.5° F
TEMPROBE TOLERANCE = ± 0.3° F

Thermometer #1 S/N 8A089 / Thermistor S/N A410660	Set Point: 35° F 95° F 155° F
Thermometer #2 S/N 8B104 / Thermistor S/N 871507	Set Point: 35° F 95° F 155° F
Thermometer #5 S/N B11780 / Thermistor S/N B10505	Set Point: 35° F 95° F 155° F
Thermometer #6 S/N B11782 / Thermistor S/N B10509	Set Point: 35° F 95° F 155° F
Thermometer #7 S/N B49938 / Thermistor S/N B482202	Set Point: 35° F 95° F 155° F
Temperature Standard AirData Multimeter S/N M00136	Set Point: 35° F 95° F 155° F
Temperature Standard AirData Multimeter S/N M96100	Set Point: 35° F 95° F 155° F

Test By: _____ Date: _____ Rh: _____ % Ambient Temperature: _____ °F Barometric Pressure: _____ in Hg

Approx Set Point	Temp Standard	Test Probe #1 ADT-_____	Test Probe #2 ADT-_____	Test Probe #3 ADT-_____	Test Probe #4 ADT-_____	Test Probe #5 ADT-_____	Test Probe #6 ADT-_____	Test Probe #7 ADT-_____	Test Probe #8 ADT-_____
35°									
95°					NA				
155°									

NOTES: _____

Calibration standards used by Shortridge Instruments, Inc. are traceable to NIST (National Institute of Standards and Technology). Calibration is performed in accordance with ANSI/NCSL Z540-1, ISO 17025, MIL-STD 45662A and manufacturer's specifications. Calibration accuracy is certified when meters are used with properly functioning accessories only. This report shall not be reproduced, except in full, without the written approval of Shortridge Instruments, Inc. Results relate only to the item calibrated. Limitations on use: See Shortridge Instruments, Inc. Instruction Manual for the use of AirData Multimeters.

The enclosed ADM or HDM Calibration Standards form(s) is/are an integral part of this calibration and must remain with this Certificate of Calibration. Note: There may be more than one such form included that pertains to this calibration. Any calibration due date shown is specified by the customer.

Calibration Approved by: M. Ramirez Title: Cal Supv Date: 01/17/2022

Shortridge Instruments, Inc. • 7855 E Redfield Road, Scottsdale, AZ 85260 • (480) 991-6744 • Fax (480) 443-1267 • www.shortridge.com

Shortridge Instruments, Inc. AirData Multimeter Calibration Equipment

Order Number: R213346 Serial Number: M166654 Test Type: Initial As-Received (Final)

ABSOLUTE PRESSURE STANDARDS

ADM #02-R	S/N: 41741/42451	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/30/21	Due Date: 04/2022
ADM #04-R	S/N: 41743/42453	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/19/21	Due Date: 11/2022
ADM #06-R	S/N: 41742/42452-1	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/17/21	Due Date: 08/2022
ADM #08-R	S/N: 42186/43328	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/10/21	Due Date: 03/2022
ADM #10-R	S/N: 42203/43352	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/27/21	Due Date: 02/2022
ADM #12A-R	S/N: 45605/48491	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 07/27/21	Due Date: 07/2022
ADM #14-R	S/N: 43412/45043-2	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/24/21	Due Date: 09/2022
ADM #16-R	S/N: 43413/45044	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/17/21	Due Date: 08/2022
ADM #18-R	S/N: 44581/46845	Heise Model: PPM-2	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/26/21	Due Date: 10/2022
ADM #20-R	S/N: 44582/46847	Heise Model: PPM-2	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 06/16/21	Due Date: 06/2022
#02-R, 04-R, 06-R, 08-R, 10-R, 12A-R, 14-R, 16-R			Rated Accuracy: 0.05% fs (0.0305 in Hg)	Range: 0-30 psia	Resolution: 0.01	Uncertainty: < 0.0358
#18-R, 20-R			Rated Accuracy: 0.05% fs (0.0305 in Hg)	Range: 0-60 in Hg	Resolution: 0.001	Uncertainty: < 0.0358

DIFFERENTIAL PRESSURE STANDARDS

ADM #01-L	S/N: 41739/42449	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 05/06/21	Due Date: 04/2022
ADM #01-R	S/N: 41739/42446	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 05/07/21	Due Date: 04/2022
ADM #02-L	S/N: 41741/42454	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 05/05/21	Due Date: 04/2022
ADM #03A-L	S/N: 45570/48461	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/24/21	Due Date: 11/2022
ADM #03A-R	S/N: 45570/48460	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/24/21	Due Date: 11/2022
ADM #04-L	S/N: 41743/42456	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/23/21	Due Date: 11/2022
ADM #05-L	S/N: 41740/42450	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/08/21	Due Date: 08/2022
ADM #05-R	S/N: 41740/42447	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/07/21	Due Date: 08/2022
ADM #06-L	S/N: 41742/42455	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/07/21	Due Date: 08/2022
ADM #07-L	S/N: 42185/42186	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/08/21	Due Date: 03/2022
ADM #07-R	S/N: 42185/43326	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/08/21	Due Date: 03/2022
ADM #08-L	S/N: 42186/43329	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/08/21	Due Date: 03/2022
ADM #09-L	S/N: 42202/43351	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/26/21	Due Date: 02/2022
ADM #09-R	S/N: 42202/43350	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/26/21	Due Date: 02/2022
ADM #10-L	S/N: 42203/43353	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/26/21	Due Date: 02/2022
ADM #11-L	S/N: 43165/44551-1	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 07/30/21	Due Date: 07/2022
ADM #11-R	S/N: 43165/44730	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 07/30/21	Due Date: 07/2022
ADM #12A-L	S/N: 45605/48490-1	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/09/21	Due Date: 07/2022
ADM #13-L	S/N: 43415/45041	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/24/21	Due Date: 09/2022
ADM #13-R	S/N: 43415/45039	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/24/21	Due Date: 09/2022
ADM #14-L	S/N: 43412/45045	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/24/21	Due Date: 09/2022
ADM #15-L	S/N: 43416/45042	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/08/21	Due Date: 08/2022
ADM #15-R	S/N: 43416/45040	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/07/21	Due Date: 08/2022
ADM #16-L	S/N: 43413/45046	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/07/21	Due Date: 08/2022
ADM #17-L	S/N: 44579/46842	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 10/2022
ADM #17-R	S/N: 44579/46841	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 10/2022
ADM #18-L	S/N: 44581/46846	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 10/2022
ADM #19-L	S/N: 44580/46844	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 06/23/21	Due Date: 06/2022
ADM #19-R	S/N: 44580/46843	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 06/24/21	Due Date: 06/2022
ADM #20-L	S/N: 44582/46848	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 06/23/21	Due Date: 06/2022
#01-L, 03A-L, 05-L, 07-L, 09-L, 11-L, 13-L, 15-L, 17-L, 19-L			Rated Accuracy: > 0.07% fs (0.000175 in wc)	Range: 0.0-0.25 in wc	Res.: 0.00001	Uncertainty: < 0.00035
#01-R, 03A-R, 05-R, 07-R, 09-R, 11-R, 13-R, 15-R, 17-R, 19-R			Rated Accuracy: > 0.06% fs (0.003 in wc)	Range: 0.0-5.0 in wc	Res.: 0.0001	Uncertainty: < 0.00348
#02-L, 04-L, 06-L, 08-L, 10-L, 12A-L, 14-L, 16-L, 18-L, 20-L			Rated Accuracy: > 0.06% fs (0.03 in wc)	Range: 0.0-50.0 in wc	Res.: 0.001	Uncertainty: < 0.0346

Shortridge Instruments, Inc.
7855 East Redfield Road Scottsdale, Arizona 85260
(480) 991-6744 • Fax (480) 443-1267 • www.shortridge.com

Customer Order Number, Meter Serial Number, and Test Type are referenced on page 1

LOW VELOCITY EQUIVALENT CONFIRMATION STANDARDS

Vel Eqv Transfer Standard S/N: M02009	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 08/20/21	Due Date: 08/2022
Vel Eqv Transfer Standard S/N: M02903	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 12/16/21	Due Date: 12/2022
Vel Eqv Transfer Standard S/N: M10839	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/26/21	Due Date: 10/2022
Vel Eqv Transfer Standard S/N: M10840	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/26/21	Due Date: 10/2022
Vel Eqv Transfer Standard S/N: M10897	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 01/26/21	Due Date: 01/2022
Vel Eqv Transfer Standard S/N: M10901	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, inc.	Calibration Date: 12/16/21	Due Date: 12/2022
Vel Eqv Transfer Standard S/N: M13492	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, inc.	Calibration Date: 08/20/21	Due Date: 08/2022
Vel Eqv Transfer Standard S/N: M19325	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 06/29/21	Due Date: 06/2022

Rated Accuracy: Velocity ± 1.5 % ± 3.5 fpm Range: 100-5000 fpm Resolution: 0.1 Uncertainty: <5.00 fpm at 100 fpm; <7.50 fpm at 500 fpm

TEMPERATURE STANDARDS

RTD Simulator S/N: 249	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 250	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 253	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 254	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 256	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 257	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 292	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 293	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 294	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 313	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/16/18	Due Date: 03/2022
RTD Simulator S/N: 314	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/16/18	Due Date: 03/2022
RTD Simulator S/N: 315	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/16/18	Due Date: 03/2022
RTD Simulator S/N: 316	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/16/18	Due Date: 04/2022
RTD Simulator S/N: 317	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/16/18	Due Date: 04/2022
RTD Simulator S/N: 318	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/16/18	Due Date: 04/2022

Rated Accuracy: 0.025% of setting Range: 100.00 Ω to 11111.10 Ω Resolution: 0.01 Ω Uncertainty: ≤ 32 ppm

Thermometer #1 S/N 8A089/Thermistor S/N A410660	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 08/26/21	Due Date: 08/2023
Thermometer #2 S/N 8B104/Thermistor S/N 871507	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 11/04/20	Due Date: 11/2022
Thermometer #5 S/N B11780/Thermistor S/N B10505	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 11/04/20	Due Date: 11/2022
Thermometer #6 S/N B11782/Thermistor S/N B10509	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 02/24/20	Due Date: 02/2022
Thermometer #7 S/N B49938/Thermistor S/N B482202	Model 1504/5610	Mfgd and Calibrated by Fluke		Calibration Date: 10/13/21	Due Date: 10/2023

Rated Accuracy(combined): 0.0324° F Range: 32° F to 176° F Resolution: 0.001° F Combined Uncertainty with Baths: ≤ 0.040° F

Temp Transfer Standard S/N M00136	Model ADM-870	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/26/21	Due Date: 10/2022
Temp Transfer Standard S/N M96100	Model ADM-870	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 03/17/21	Due Date: 03/2022

Rated Accuracy: 0.03° F Range: 33° F to 158° F Resolution: 0.01° F Uncertainty: < 0.023° F

Total combined Uncertainty for MultiTemp and TemProbe testing : ≤ 0.046° F

This form must remain with the Certificate of Calibration corresponding to the Customer Order Number and Meter Serial Number referenced on page 1.

Shortridge Instruments, Inc.
7855 East Redfield Road Scottsdale, Arizona 85260
(480) 991-6744 • Fax (480) 443-1267 • www.shortridge.com

Shortridge Instruments, Inc. AirData Multimeter Calibration Equipment

Order Number: R213346 Serial Number: m16654 Test Type: Initial (As-Received) Final

ABSOLUTE PRESSURE STANDARDS

ADM #02-R	S/N: 41741/42451	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/30/21	Due Date: 04/2022
ADM #04-R	S/N: 41743/42453	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/19/21	Due Date: 11/2022
ADM #06-R	S/N: 41742/42452-1	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/17/21	Due Date: 08/2022
ADM #08-R	S/N: 42186/43328	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/10/21	Due Date: 03/2022
ADM #10-R	S/N: 42203/43352	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/27/21	Due Date: 01/2022
ADM #12A-R	S/N: 45605/48491	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 07/27/21	Due Date: 07/2022
ADM #14-R	S/N: 43412/45043-2	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/24/21	Due Date: 09/2022
ADM #16-R	S/N: 43413/45044	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/17/21	Due Date: 08/2022
ADM #18-R	S/N: 44581/46845	Heise Model: PPM-2	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/26/21	Due Date: 10/2022
ADM #20-R	S/N: 44582/46847	Heise Model: PPM-2	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 06/16/21	Due Date: 06/2022

#02-R, 04-R, 06-R, 08-R, 10-R, 12A-R, 14-R, 16-R	Rated Accuracy: 0.05% fs (0.0305 in Hg)	Range: 0-30 psia	Resolution: 0.01	Uncertainty: < 0.0358
#18-R, 20-R	Rated Accuracy: 0.05% fs (0.0305 in Hg)	Range: 0-60 in Hg	Resolution: 0.001	Uncertainty: < 0.0358

DIFFERENTIAL PRESSURE STANDARDS

ADM #01-L	S/N: 41739/42449	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 05/06/21	Due Date: 04/2022
ADM #01-R	S/N: 41739/42446	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 05/07/21	Due Date: 04/2022
ADM #02-L	S/N: 41741/42454	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 05/05/21	Due Date: 04/2022
ADM #03A-L	S/N: 45570/48461	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/24/21	Due Date: 11/2022
ADM #03A-R	S/N: 45570/48460	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/24/21	Due Date: 11/2022
ADM #04-L	S/N: 41743/42456	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/23/21	Due Date: 11/2022
ADM #05-L	S/N: 41740/42450	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/08/21	Due Date: 08/2022
ADM #05-R	S/N: 41740/42447	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/07/21	Due Date: 08/2022
ADM #06-L	S/N: 41742/42455	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/07/21	Due Date: 08/2022
ADM #07-L	S/N: 42185/42186	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/08/21	Due Date: 03/2022
ADM #07-R	S/N: 42185/43326	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/08/21	Due Date: 03/2022
ADM #08-L	S/N: 42186/43329	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/08/21	Due Date: 03/2022
ADM #09-L	S/N: 42202/43351	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/26/21	Due Date: 01/2022
ADM #09-R	S/N: 42202/43350	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/26/21	Due Date: 01/2022
ADM #10-L	S/N: 42203/43353	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/26/21	Due Date: 01/2022
ADM #11-L	S/N: 43165/44551-1	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 07/30/21	Due Date: 07/2022
ADM #11-R	S/N: 43165/44730	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 07/30/21	Due Date: 07/2022
ADM #12A-L	S/N: 45605/48490-1	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/09/21	Due Date: 07/2022
ADM #13-L	S/N: 43415/45041	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/24/21	Due Date: 09/2022
ADM #13-R	S/N: 43415/45039	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/24/21	Due Date: 09/2022
ADM #14-L	S/N: 43412/45045	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/24/21	Due Date: 09/2022
ADM #15-L	S/N: 43416/45042	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/08/21	Due Date: 08/2022
ADM #15-R	S/N: 43416/45040	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/07/21	Due Date: 08/2022
ADM #16-L	S/N: 43413/45046	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/07/21	Due Date: 08/2022
ADM #17-L	S/N: 44579/46842	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 10/2022
ADM #17-R	S/N: 44579/46841	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 10/2022
ADM #18-L	S/N: 44581/46846	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 10/29/21	Due Date: 10/2022
ADM #19-L	S/N: 44580/46844	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 06/23/21	Due Date: 06/2022
ADM #19-R	S/N: 44580/46843	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 06/24/21	Due Date: 06/2022
ADM #20-L	S/N: 44582/46848	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 06/23/21	Due Date: 06/2022

#01-L, 03A-L, 05-L, 07-L, 09-L, 11-L, 13-L, 15-L, 17-L, 19-L	Rated Accuracy: > 0.07% fs (0.000175 in wc)	Range: 0.0-0.25 in wc	Res.: 0.00001	Uncertainty: < 0.00035
#01-R, 03A-R, 05-R, 07-R, 09-R, 11-R, 13-R, 15-R, 17-R, 19-R	Rated Accuracy: > 0.06% fs (0.003 in wc)	Range: 0.0-5.0 in wc	Res.: 0.0001	Uncertainty: < 0.00348
#02-L, 04-L, 06-L, 08-L, 10-L, 12A-L, 14-L, 16-L, 18-L, 20-L	Rated Accuracy: > 0.06% fs (0.03 in wc)	Range: 0.0-50.0 in wc	Res.: 0.001	Uncertainty: < 0.0346

Shortridge Instruments, Inc.
7855 East Redfield Road Scottsdale, Arizona 85260
(480) 991-6744 • Fax (480) 443-1267 • www.shortridge.com

Customer Order Number, Meter Serial Number, and Test Type are referenced on page 1

LOW VELOCITY EQUIVALENT CONFIRMATION STANDARDS

Vel Eqv Transfer Standard S/N: M02009	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 08/20/21	Due Date: 08/2022
Vel Eqv Transfer Standard S/N: M02903	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 12/16/20	Due Date: 12/2021
Vel Eqv Transfer Standard S/N: M10839	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/26/21	Due Date: 10/2022
Vel Eqv Transfer Standard S/N: M10840	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/26/21	Due Date: 10/2022
Vel Eqv Transfer Standard S/N: M10897	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 01/26/21	Due Date: 01/2022
Vel Eqv Transfer Standard S/N: M10901	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 12/16/20	Due Date: 12/2021
Vel Eqv Transfer Standard S/N: M13492	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 08/20/21	Due Date: 08/2022
Vel Eqv Transfer Standard S/N: M19325	Model ADM-870C	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 06/29/21	Due Date: 06/2022

Rated Accuracy: Velocity ± 1.5 % ± 3.5 fpm Range: 100-5000 fpm Resolution: 0.1 Uncertainty: <5.00 fpm at 100 fpm; <7.50 fpm at 500 fpm

TEMPERATURE STANDARDS

RTD Simulator S/N: 249	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 250	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 253	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 254	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 256	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 257	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 292	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 293	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 294	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 313	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/16/18	Due Date: 03/2022
RTD Simulator S/N: 314	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/16/18	Due Date: 03/2022
RTD Simulator S/N: 315	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/16/18	Due Date: 03/2022
RTD Simulator S/N: 316	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/16/18	Due Date: 04/2022
RTD Simulator S/N: 317	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/16/18	Due Date: 04/2022
RTD Simulator S/N: 318	Model RTD-1000/500	Mfgd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/16/18	Due Date: 04/2022

Rated Accuracy: 0.025% of setting Range: 100.00 Ω to 11111.10 Ω Resolution: 0.01 Ω Uncertainty: ≤ 32 ppm

Thermometer #1 S/N 8A089/Thermistor S/N A410660	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 08/26/21	Due Date: 08/2023
Thermometer #2 S/N 8B104/Thermistor S/N 871507	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 11/04/20	Due Date: 11/2022
Thermometer #5 S/N B11780/Thermistor S/N B10505	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 11/04/20	Due Date: 11/2022
Thermometer #6 S/N B11782/Thermistor S/N B10509	Model 1504/5610	Mfgd by Hart Scientific	Calibrated by Fluke	Calibration Date: 02/24/20	Due Date: 02/2022
Thermometer #7 S/N B49938/Thermistor S/N B482202	Model 1504/5610	Mfgd and Calibrated by Fluke		Calibration Date: 10/13/21	Due Date: 10/2023

Rated Accuracy(combined): 0.0324° F Range: 32° F to 176° F Resolution: 0.001° F Combined Uncertainty with Baths: ≤ 0.040° F

Temp Transfer Standard S/N M00136	Model ADM-870	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/26/21	Due Date: 10/2022
Temp Transfer Standard S/N M96100	Model ADM-870	Mfgd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 03/17/21	Due Date: 03/2022

Rated Accuracy: 0.03° F Range: 33° F to 158° F Resolution: 0.01° F Uncertainty: < 0.023° F

Total combined Uncertainty for MultiTemp and TemProbe testing : ≤ 0.046° F

This form must remain with the Certificate of Calibration corresponding to the Customer Order Number and Meter Serial Number referenced on page 1.

Shortridge Instruments, Inc.
7855 East Redfield Road Scottsdale, Arizona 85260
(480) 991-6744 • Fax (480) 443-1267 • www.shortridge.com

Field Barometer Calibration Form

Project #: HAV222965

IN OFFICE PRE-TEST CALIBRATION

Reference Standard Used:

Standard ID	Serial number	Adjusted on:	Calibration due:
Helena mercury barometer	BIS01	12/9/2022	Must be properly adjusted prior to every use

Field Barometer Verification:

Barometer ID: TS4

Reference Value (in Hg)	Observed (in Hg)	Correction*	Tolerance (+/- 0.1 in Hg)**
25.90	25.90	0.00	PASS

*Correction is the difference between the observed and reference values

**EPA Method 5, Section 6.1.2 and EPA Method 2, Section 6.5.

Technician: ARB

Date: 12/9/2022

Field Balance and Weights Calibration Form

Project #: HAV222965

IN OFFICE PRE-TEST CHECKS

Date: 12/9/2022

Performed by: ARB

Environmental conditions in the lab:

Temperature °F	Pressure "Hg
69	25.90

Reference Standard(s) Used:

Standard ID	Serial number(s)	Calibrated on:	Calibration due:
500g and 200g weight set	10696	2/12/2022	2/12/2023

Verification of Field Balance Against Reference Standard Weights:

Balance ID: HLNFB1

Nominal Value (g)	Observed (g)	Correction*	Tolerance (+/- 0.5g)**
500	500.0	0.0	PASS
1000	1000.0	0.0	PASS
2000	2000.0	0.0	PASS

Verification of Field Standard Weights :

Weights ID: HLNFW1

Nominal Value (g)	Observed (g)	Correction*	Tolerance (+/- 0.5g)**
500	500.0	0.0	PASS
1000	1000.0	0.0	PASS
2000	2000.0	0.0	PASS

*Correction is the difference between the observed and nominal mass values

**EPA Method 5, Section 6.3.4

ONSITE BALANCE VERIFICATION

Date: 12/13/2022
Performed by: MTK

Environmental conditions onsite:

Temperature °F	Pressure "Hg
39	30.00

Field Balance Verification:

Balance ID: HLNFB1
Weights ID: HLN FW1

Nominal Value (g)	Observed (g)	Correction*	PASS/FAIL Tolerance (+/- 0.5g)
500	500.1	0.1	PASS
1000	1000.0	0.0	PASS
2000	2000.0	0.0	PASS

*Correction is the difference between the observed and nominal mass values

ONSITE BALANCE VERIFICATION

Date: 12/14/2022
Performed by: MTK

Environmental conditions onsite:

Temperature °F	Pressure "Hg
34	30.15

Field Balance Verification:
Balance ID: HLNFB1
Weights ID: HLN FW1

Nominal Value (g)	Observed (g)	Correction*	PASS/FAIL Tolerance (+/- 0.5g)
500	500.0	0.0	PASS
1000	1000.0	0.0	PASS
2000	2000.0	0.0	PASS

*Correction is the difference between the observed and nominal mass values

ONSITE BALANCE VERIFICATION

Date: 12/15/2022
Performed by: MTK

Environmental conditions onsite:

Temperature °F	Pressure "Hg
25	30.21

Field Balance Verification:
Balance ID: HLNFB1
Weights ID: HLN FW1

Nominal Value (g)	Observed (g)	Correction*	PASS/FAIL Tolerance (+/- 0.5g)
500	500.1	0.1	PASS
1000	1000.1	0.1	PASS
2000	2000.0	0.0	PASS

*Correction is the difference between the observed and nominal mass values

BISON ENGINEERING, INC.

Field Caliper Calibration Form

Project #: HAV222965

IN OFFICE PRE-TEST CHECKS

Date: 12/9/2022

Performed by: ARB

Reference Standard Used:

Standard ID	Serial number	Calibrated on:	Calibration due:
HLN1 Aurora	77160806226	3/21/2022	3/21/2023

Caliper Verification:

Field Caliper ID: WS1

Inside Diameter

Reference Value (inches)	Observed (inches)	Correction*	Tolerance (+/- 0.0050 inch)
0.273	0.273	0.000	PASS

*Correction is the difference between the observed and reference values

Outside Diameter

Reference Value (inches)	Observed (inches)	Correction*	Tolerance (+/- 0.0050 inch)
0.375	0.375	0.000	PASS

*Correction is the difference between the observed and reference values

BISON ENGINEERING, INC.

Digital Manometer Calibration Form

Project #: HAV222965

IN OFFICE POST-TEST CHECKS

Date: 12/17/2022

Performed by: MTK

Reference Standard Used: Fluid manometer

Digital Manometer Serial No.: HLN DM1

Reference Value (" of H_2O)	Digital readout (" of H_2O)	Correction*	Tolerance (+/- 5%)	Digital readout (" of H_2O)	Correction*	Tolerance (+/- 5%)
4.00	3.990	-0.25%	PASS	4.000	0.00%	PASS
3.00	2.990	-0.33%	PASS	3.030	0.99%	PASS
2.00	1.990	-0.50%	PASS	1.980	-1.01%	PASS
1.00	0.980	-2.00%	PASS	1.010	0.99%	PASS
0.50	0.500	0.00%	PASS	0.490	-2.04%	PASS
0.30	0.290	-3.33%	PASS	0.300	0.00%	PASS
0.20	0.200	0.00%	PASS	0.200	0.00%	PASS
0.10	0.100	0.00%	PASS	0.100	0.00%	PASS

*Correction is the difference between the observed and reference values

BISON ENGINEERING, INC.

Thermocouple Calibration Form

Project #: HAV222965

POST-TEST CHECKS

Reference Standard Used:

Standard ID	Serial number(s)	Calibrated on:	Calibration due:
Omega	T-318009	10/13/2022	10/13/2023

Temperature Meter Mode:

Thermocouple ID	Continuity (x = pass)	Observed Temp (°F)	Reference Temp (°F)	Correction*	Tolerance (+/- 2°F)**
Stack Temp - 4E	x	68.6	69.2	0.6	PASS
Condenser - GN3	x	67.8		1.4	PASS
DGM Outlet	x	68.5		0.7	PASS
DGM Inlet (If applicable)	x	68.6		0.6	PASS

Calibration Output Mode:

Switch the Omega from 'Meter Input' to 'Calibration Output' mode. Test the meter box temperature readout by sending a voltage output equivalent to a temperature similar to stack temperature.

Meter Box ID	Reference Temp Output (°F)	Meter Box Readout (°F)	Correction*	Tolerance (+/- 2°F)**
Box 11	300.0	301	1.0	PASS

*Correction is the difference between the observed and reference values
**Alt-011 6/21/94 Alternative Method 2 Thermocouple Calibration Procedure:
Continuity Check - confirm the thermocouple is reading at the tip by subjecting it to a change in temperature (e.g. removing it from the stack, or touching it with your hand).
Single-point temperature check at ambient temperature, or any temperature, within the range specified by the manufacturer.

Technician: MTK

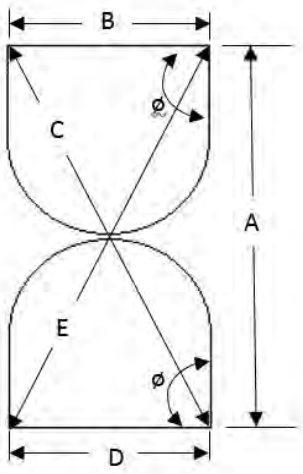
Date: 12/17/2022

BISON ENGINEERING, INC.

S-Type Pitot Tube Geometric Calibration

Pitot ID: 4E

Date of Geometric Calibration (< 6 months): 7/7/2022



A	0.88
B	0.40
C	0.95
D	0.39
E	0.95

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \emptyset$$

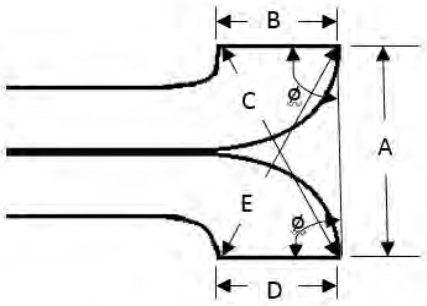
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \emptyset$$

ø	87.17

$(80° < \emptyset < 100°)$

ø	88.13

$(80° < \emptyset < 100°)$



A	0.88
B	0.63
C	1.09
D	0.63
E	1.09

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \emptyset$$

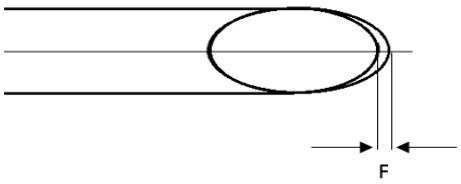
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \emptyset$$

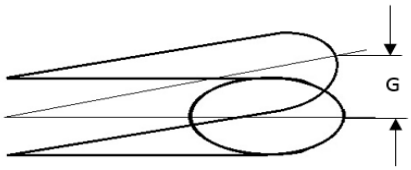
ø	90.49

$(85° < \emptyset < 95°)$

ø	90.49

$(85° < \emptyset < 95°)$





F=	0.070

(F < 0.125)

G=	0.000

(G < 0.032)

Results of the Post-Test Pitot Inspection (mark with x below)**:**

No change X

Damaged _____

New Calibration _____

Technician: MTK **Date:** 12/17/2022

Airgas Specialty Gases
Airgas USA LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number:	E03NI80E15A0138	Reference Number:	153-402491513-1
Cylinder Number:	CC503830	Cylinder Volume:	141.0 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72022	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Jul 18, 2022

Expiration Date: Jul 18, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	10.00 %	9.951 %	G1	+/- 0.8% NIST Traceable	07/18/2022
OXYGEN	10.00 %	10.05 %	G1	+/- 0.8% NIST Traceable	07/18/2022
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060405	CC411744	7.489 % CARBON DIOXIDE/NITROGEN	0.6%	May 14, 2025
NTRM	98051010	SG9161286BAL	12.05 % OXYGEN/NITROGEN	0.7%	Dec 14, 2023

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA-510 SV4MEUTJ CO2	CO2 NDIR (Dixon)	Jun 23, 2022
Horiba MPA-510 W603MM58 O2	O2 Paramagnetic (Mason)	Jun 23, 2022

Triad Data Available Upon Request

Signature on file
Approved for Release

Airgas
an Air Liquide company

Airgas USA, LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI56E15A1055	Reference Number:	153-402284491-1
Cylinder Number:	SA20406	Cylinder Volume:	161.7 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72021	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Nov 16, 2021

Expiration Date: Nov 16, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	22.00 %	21.70 %	G1	+/- 0.7% NIST Traceable	11/16/2021
OXYGEN	22.00 %	21.94 %	G1	+/- 0.5% NIST Traceable	11/16/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060802	CC415397	24.04 % CARBON DIOXIDE/NITROGEN	0.6%	Dec 11, 2025
NTRM	12062008	CC367433	22.883 % OXYGEN/NITROGEN	0.2%	May 14, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA-510 SV4MEUTJ CO2	CO2 NDIR (Dixon)	Oct 28, 2021
Horiba MPA-510 W603MM58 O2	O2 Paramagnetic (Mason)	Nov 03, 2021

Triad Data Available Upon Request

Approved for Release

This is the last page of the report.