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Project No. 5702

SOURCE EVALUATION REPORT

Bullseye Glass Company
Portland, Oregon

Glass Furnace T7
Baghouse BH-1 (Inlet & Outlet)
Total Chromium & Hexavalent Chromium
Supplement to Report Issued June 9, 2016

Test Dates: April 26 – 29, 2016
Report Issued: July 8, 2016

Test Site:
Bullseye Glass Company
3722 SE 21st Ave
Portland, OR 97202

Report ID: HORIZON ENGINEERING 16-5702

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Bullseye Glass Company, Portland, Oregon, Baghouse BH-1 (Inlet & Outlet), Chrome, April 26 – 29, 2016

1. QUALITY STATEMENT

I certify that this testing was performed in accordance with Montrose Air Quality Services (MAQS) Quality Assurance Manual (QAM).

Thomas Rhodes, EIT, QSTI
District Manager

Signature ______________________ Date 7/1/16

Name, Telephone Number and E-mail address of AETB

Horizon Engineering, an affiliate of Montrose Environmental
503-255-5050
trhodes@montrose-env.com

Name and E-mail Address of the Qualification Exam Provider

Source Evaluation Society (SES)
qstiprogram@gmail.com

Bullseye Glass Company, Portland, Oregon, Baghouse BH-1 (Inlet & Outlet), Chrome, April 26 – 29, 2016

2. CERTIFICATION

2.1 Project Manager

I hereby certify that the test detailed in this report, to the best of my knowledge, was accomplished in conformance with applicable rules and good practices. The results submitted herein are accurate and true to the best of my knowledge.

Name: Jason French, QSTI

Signature ______________ Date 6/29/16

2.2 Senior Report Review

I hereby certify that I have reviewed this report and find it to be true and accurate, and in conformance with applicable rules and good practices, to the best of my knowledge.

Name: Andy Vella, PE, QSTI

Signature ______________ Date 7/6/2016

2.3 Report Review

I hereby certify that I have reviewed this report and find it to be true and accurate, and in conformance with applicable rules and good practices, to the best of my knowledge.

Name: Michael E. Wallace, PE

Signature ______________ Date 6/30/16

3. INTRODUCTION

3.1 Test Site: Bullseye Glass Company
3722 SE 21st Ave
Portland, OR 97202

3.2 Mailing Address: Same as above

3.3 Test Log:

Baghouse, BH-1, Inlet and Outlet: Cr & Cr^{+6}

Test Date	Run No.	Test Time
Inlet		
April 26 – 27, 2016	1	17:30 (4/26) – 09:30 (4/27)
April 27 – 28, 2016	2	17:30 (4/27) – 09:30 (4/28)
April 28 – 29, 2016	3	17:00 (4/28) – 09:00 (4/29)
Outlet		
April 28 – 29, 2016	3	17:00 (4/28) – 09:00 (4/29)

Summary: Three runs of Inlet testing for Total Chrome and Cr^{+6}. One run on the Outlet was performed simultaneously during Inlet testing of Run 3 for Total Cr and Cr^{+6}.

This report supplements our June 9, 2016 report for source testing Bullseye Glass Company's Glass Furnace T7 controlled by Baghouse BH-1 and includes full data reduction of the total chromium and hexavalent chromium testing conducted April 26 – 29, 2016.

3.4 Test Purpose: Evaluate chromium emissions and potentially determine a maximum allowable chromium III usage rate."

3.5 Background Information: None

3.6 Participants:

Montrose Air Quality Services Personnel:

Jason French, QSTI, Team Leader, Calculations, and Report Review
Chris Hinson, QSTI, Field Technician
Joe Heffernan, QSTI, Field Technician
John Lewis, QSTI, Field Technician
Mihai Voivod, QSTI, Field Technician
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Josh Muswieck, Field Technician
Paul Berce, Field Technician
Sleight Halley, Field Technician
Thomas Rhodes, EIT, QSTI, Project Coordinator & Report Review
Michael E. Wallace, PE, Data Reduction, Calculations and QA/QC
Andy Vella, PE, QSTI, Senior Report Review
Mauri Fabio, Technical Writer

Test Arranged by: Dan Schwoerer, Bullseye Glass Company

Observers:

Plant Personnel: Dan Schwoerer, Bullseye Glass Company
Consultants: John Browning, Bridgewater Group
Agency Personnel: Michael Eisele, PE, ODEQ, Mark Ludwiczak, ODEQ; Zach Hedgepeth, US EPA

Test Plan Sent to: Michael Eisele, PE & George Davis, ODEQ

4. SUMMARY OF RESULTS

4.1 Tables of Results:

Table 1
Baghouse BH-1 Inlet
Total Chromium & Hexavalent Chromium Emission Results

Test Date: April 26 – 29, 2016	**Units**	**Run 1**	**Run 2**	**Run 3**	**Average**
Start Time		17:30 (4/26)	17:30 (4/27)	17:00 (4/28)	
End Time		09:30 (4/27)	09:30 (4/28)	09:00 (4/29)	
Sampling Time	minutes	760	890	880	843
Sampling Results					
Total Chromium	mg/dscm	0.32	0.23	0.11	0.22
	ng/dscm	316,500	233,800	108,000	219,400
Rate	lb/hr	0.0005	0.0003	0.0002	0.0003
	lb/ton-glass	0.015	0.010	0.004	0.010
	lb/ton-Chromium	2.00	1.34	0.60	1.31
Sample Weight	mg	1.81	0.979	0.440	1.08
Hexavalent Chromium	mg/dscm	0.31	0.25	0.11	0.22
	ng/dscm	309,700	247,300	105,500	220,800
Rate	lb/hr	0.0005	0.0004	0.0002	0.0003
	lb/ton-glass	0.014	0.010	0.004	0.010
	lb/ton-Chromium	1.96	1.42	0.58	1.32
Sample Weight	mg	1.77	1.04	0.430	1.08
Sample Volume	dscf	201.8	147.9	143.8	164.5
Flow Rate (Actual)	acf/min	520	470	470	490
Flow Rate (Standard)	dscf/min	430	390	370	400
Temperature	°F	167	163	181	171
Moisture	%	0.80	2.3	3.2	2.1
Percent Isokinetic	%	93	93	95	94

Table 2

Baghouse BH-1 Outlet

Total Chromium & Hexavalent Chromium Emission Results

(Measured Values)

Test Date: April 28 – 29, 2016	**Units**	**Run 3**[1]
Start Time		17:00 (4/28)
End Time		09:00 (4/29)
Sampling Time	minutes	910
Sampling Results		
Total Chromium	mg/dscm	0.029
	ng/dscm	29,100
Rate	lb/hr	0.00005
	lb/ton-glass	0.0016
	lb/ton-Chromium	0.213
Sample Weight	mg	0.102
Hexavalent Chromium	mg/dscm	0.028
	ng/dscm	28,200
Rate	lb/hr	0.00005
	lb/ton-glass	0.0015
	lb/ton-Chromium	0.206
Sample Weight	mg	0.099
Sample Volume	dscf	123.9
Flow Rate (Actual)	acf/min	580
Flow Rate (Standard)	dscf/min	500
Temperature	°F	140
Moisture	%	1.3
Percent Isokinetic	%	95

[1] One run on the outlet was performed simultaneously during Inlet testing of Run 3 for Total Cr and Cr+6.

Table 3

Baghouse BH-1 Outlet

Total Chromium & Hexavalent Chromium Emission Results

(Calculated Values, Estimated Based on PM Removal)

Test Date: April 26 – 29, 2016	**Units**	**Run 1**	**Run 2**	**Run 3**	**Average**
PM Removal Efficiency	%	99.29	99.56	99.57	99.47
Total Chromium	ng/dscm	2,200	1,100	500	1,300
Rate	lb/hr	0.0000036	0.0000015	0.0000007	0.0000019
	lb/ton-glass	0.00010	0.00004	0.00002	0.00006
	lb/ton-Chromium	0.0142	0.0059	0.0026	0.0076
Hexavalent Chromium	ng/dscm	2,200	1,100	500	1,300
Rate	lb/hr	0.0000035	0.0000016	0.0000006	0.0000019
	lb/ton-glass	0.00010	0.00005	0.00002	0.00006
	lb/ton-Chromium	0.014	0.006	0.003	0.008

Table 4

Baghouse BH-1 Inlet & Outlet

Process/Production Data

Test Date: April 26 – 29, 2016	**Units**	**Run 1**	**Run 2**	**Run 3**	**Average**
Chrome Addition Rate	lb/batch	8.1	8.1	8.1	8.1
	ton/hr	0.000253	0.000253	0.000253	0.000253
Glass Production Rate	lb/batch	1,111.81	1,111.81	1,111.81	1,111.81
	ton/hr	0.0347	0.0347	0.0347	0.0347

4.2 Discussion of Method Errors and Quality Assurance Procedures: This table is taken from a paper entitled "Significance of Errors in Stack Sampling Measurements," by R.T. Shigehara, W.F. Todd and W.S. Smith. It summarizes the maximum error expressed in percent, which may be introduced into the test procedures by equipment or instrument limitations.

Measurement	% Max Error
Stack Temperature Ts	1.4
Meter Temperature Tm	1.0
Stack Gauge Pressure Ps	0.42
Meter Gauge Pressure Pm	0.42
Atmospheric Pressure Patm	0.21
Dry Molecular Weight Md	0.42
Moisture Content Bws (Absolute)	1.1
Differential Pressure Head ΔP	10.0
Orifice Pressure Differential ΔH	5.0
Pitot Tube Coefficient Cp	2.4
Orifice Meter Coefficient Km	1.5
Diameter of Probe Nozzle Dn	0.80

4.2.1 Manual Methods: QA procedures outlined in the test methods were followed, including equipment specifications and operation, calibrations, sample recovery and handling, calculations and performance tolerances.

On-site quality control procedures include pre- and post-test leak checks on the sampling system and pitot lines. If pre-test checks indicate problems, the system is fixed and rechecked before starting testing. If post-test leak checks are not acceptable, the test run is voided and the run is repeated. The results of the leak checks for the test runs are on the Field Data sheets.

Thermocouples used to measure the exhaust temperature are calibrated in the field using EPA Alternate Method 11. A single-point calibration on each thermocouple system using a reference thermometer is performed.

Thermocouples must agree within ±2°F with the reference thermometer. Also, prior to use, thermocouple systems are checked for ambient temperature before heaters are started or readings are taken. Nozzles are inspected for nicks or dents and pitots are examined before and after each use to confirm that they are still aligned. The results were within allowable tolerances. Pre- and post-test calibrations on the meter boxes are included with the report along with semi-annual calibrations of critical orifices, pitots, nozzles, and thermocouples (sample box impinger outlet and oven, meter box inlet and outlet, and thermocouple indicators), as specified by ODEQ.

4.2.2 Audit Requirement: The EPA Stationary Source Audit Sample Program was restructured and promulgated on September 30, 2010 and was made effective 30 days after that date. The Standard requires that the Facility or their representative must order audit samples if they are available, with the exception of the methods listed in 40 CFR 60, 60.8(g)(1). The TNI website is referred to for a list of available accredited audit Providers and audits (www.nelac-institute.org/ssas/). If samples are not available from at least two accredited Providers they are not required. Currently, accredited Providers offer audit samples for EPA Methods 6, 7, 8, 12, 13A, 13B, 26, 26A, 29 and 101A. Based on the above, Bullseye Glass is not required to obtain audit samples for this test program.

5. SOURCE DESCRIPTION AND OPERATION

5.1 Process and Control Device Description and Operation:

Single natural gas fired colored art glass manufacturing tank furnace with an approximate operating capacity of 1,550 pound per batch; installed pre-2007.

Unspecified manufacturer baghouse filtration unit consisting of 14 filter bags and a design inlet gas flow rate of 1,000 acfm.

5.2 Test Ports:

5.2.1 Test Duct Characteristics:

Source: Baghouse, BH-1, Inlet

Construction: Steel
Shape: Circular
Size: 12 inches inside diameter
Orientation: Horizontal
Flow straighteners: None
Extension: None
Cyclonic Flow: None expected
Meets EPA Method 1 Criteria: Yes

Source: Baghouse, BH-1, Outlet

Construction: Steel
Shape: Circular
Size: 12.375 (E), 12.25 (W) inches inside diameter
Orientation: Vertical
Flow straighteners: None
Extension: None
Cyclonic Flow: None expected
Meets EPA Method 1 Criteria: Yes

5.3 Operating Parameters: See Production/Process Data section of Appendix.

5.4 Process Startups/Shutdowns or Other Operational Changes During Tests: Process was continuous during testing.

6. SAMPLING AND ANALYTICAL PROCEDURES

6.1 Sampling Procedures:

6.1.1 Sampling and Analytical Methods: Testing was in accordance with procedures and methods listed in the Source Test Plan dated March 24 & April 8 & 25, 2016 (see Correspondence Section in the Appendix), including the following: EPA methods in Title 40 Code of Federal Regulations Part 60 (40 CFR 60), Appendix A, from the Electronic Code of Federal Regulations (www.ecfr.gov), January, 2014; Oregon Department of Environmental Quality (ODEQ) methods in Source Sampling Manual Volume 1, April, 2015.

Baghouse, BH-1 – Inlet & Outlet

Flow Rate:	EPA Methods 1 and 2 (S-type pitot w/ isokinetic traverses)
CO_2 and O_2:	Assume ambient molecular weight 28.96
Moisture:	EPA Method 4 (incorporated w/ isokinetic or sampling methods)
Total Cr & Cr^{+6}:	SW-846 Method 0061 (isokinetic recirculatory impinger train technique with Cr^{+6} analysis by IC with Post-Column Derivatization-Visible Absorption and Total Cr analysis by ICP-MS)

6.1.2 Sampling Notes: One run for Outlet testing was performed simultaneously during Inlet testing of Run 3 for Total Cr and Cr^{+6}.

6.1.3 Laboratory Analysis:

Analyte	**Laboratory**
Total Chromium & Hexavalent Chromium	Chester LabNet, Tigard, OR

6.2 MAQS Test Equipment:

6.2.1 Manual Methods:

Equipment Name	**Identification**
Isokinetic Meter Boxes	CAE Express, Horizon No. 2 & No. 29
Probe Liner	Teflon
Pitots and Thermocouples	2-1, 2-2, I- 20, I-35, JF, MV, PT, JH, BS, JM, JL, BC, CH, PLB, SH
Barometer	Calibrated Barometer

7. DISCUSSION

The operation of Baghouse BH1 on Glass Furnace T7 was a pilot configuration. The purpose of this testing was to evaluate emissions and potentially determine a maximum allowable chromium III usage rate based on potential chromium VI emissions pursuant to temporary rules provided in OAR 340-244-9040. However, the hexavalent chromium emissions data received and a subsequent evaluation of the operating parameters during the test indicate the emissions data is likely biased high and is not representative of past or future operating conditions.

The data shows significant variation of potential chromium emissions across the three test runs indicating inconclusive results. In addition, chromium VI was detected in some of the samples at concentrations above the total chromium results indicating potential interference.

Further, the pilot configuration of the baghouse included the introduction of ambient air (containing approximately 21% oxygen) into the furnace exhaust stream to lower exhaust gas temperatures. This was done to protect the Teflon probes required by Method 0061 and to protect the filter media provided in the baghouse. Because the processing of chromium containing raw materials was not allowed prior to the source test, "normal" operating conditions had not been established and testing proceeded to collect pilot level emission data.

Introducing ambient air into the furnace exhaust likely increased the detected levels of chromium VI during the test due to the presence of oxygen in an exhaust stream reaching temperatures at or above 750 °F. The furnace exhaust configuration combined with the ambient air cooling methods used during the source test is not representative of past or future source operation planned at the facility. The normal operating process is to maintain a reducing rather than oxidizing environment. Nonetheless, the chromium emission rates measured during testing likely represent the upper bound of potential hexavalent chromium emissions and a conservative chromium III usage rate could be established based on the data provided in this report.

APPENDIX

Abbreviations, Acronyms & Nomenclature

Abbreviations and Acronyms Used in the Report

AAC	Atmospheric Analysis & Consulting, Inc.
ACDP	Air Contaminant Discharge Permit
ADEC	Alaska Department of Environmental Conservation
ADL	Above Detection Limit
BAAQMD	Bay Area Air Quality Management District
BACT	Best Achievable Control Technology
BCAA	Benton Clean Air Agency
BDL	Below Detection Limit
BHP	Boiler Horsepower
BIF	Boiler and Industrial Furnace
BLS	Black Liquor Solids
C	Carbon
C_3H_8	Propane
CAS	Columbia Analytical Laboratory
CEM	Continuous Emissions Monitor
CEMS	Continuous Emissions Monitoring System
CERMS	Continuous Emissions Rate Monitoring System
CET	Calibration Error Test
CFR	Code of Federal Regulations
CGA	Cylinder Gas Audit
CH_2O	Formaldehyde
CH_4	Methane
Cl_2	Chlorine
ClO_2	Chlorine Dioxide
CNCG	Concentrated Non-Condensable Gas
CO	Catalytic Oxidizer
CO_2	Carbon Dioxide
COC	Chain of Custody
CTM	Conditional Test Method
CTO	Catalytic Thermal Oxidizer
DE	Destruction Efficiency
Dioxins	Polychlorinated Dibenzo-p-dioxins (PCDD's)
DLL	Detection Level Limited
DNCG	Dilute Non-Condensable Gas
dscf	Dry Standard Cubic Feet
EIT	Engineer in Training
EPA	Environmental Protection Agency
ESP	Electrostatic Precipitator
EU	Emission Unit
FID	Flame Ionization Detector
Furans	Polychlorinated Dibenzofurans (PCDF's)
GC	Gas Chromatography
gr/dscf	Grains Per Dry Standard Cubic Feet
H_2S	Hydrogen Sulfide
HAP	Hazardous Air Pollutant
HCl	Hydrogen Chloride
HHV	Higher Heating Value
HRSG	Heat Recovery Steam Generator
IDEQ	Idaho Department of Environmental Quality
lb/hr	Pounds Per Hour
LHV	Lower Heating Value
LRAPA	Lane Regional Air Protection Agency
MACT	Maximum Achievable Control Technology
MDI	Methylene Diphyenyl Diisocyanate
MDL	Method Detection Limit
MEK	Methyl Ethyl Ketone
MeOH	Methanol
MMBtu	Million British Thermal Units
MRL	Method Reporting Limit
MS	Mass Spectrometry
MSF	Thousand Square Feet
NCASI	National Council for Air and Steam Improvement

Abbreviations and Acronyms Used in the Report

NCG	Non-condensable Gases
NCUAQMD	North Coast Unified Air Quality Management District
NDIR	Non-dispersive Infrared
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NMC	Non-Methane Cutter
NMOC	Non-Methane Organic Compounds
NMVOC	Non-Methane Volatile Organic Compounds
NWCAA	Northwest Clean Air Agency
NO_x	Nitrogen Oxides
NPD	Nitrogen Phosphorus Detector
O_2	Oxygen
ODEQ	Oregon Department of Environmental Quality
ORCAA	Olympic Region Clean Air Agency
PAHs	Polycyclic Aromatic Hydrocarbons
PCWP	Plywood and Composite Wood Products
PE	Professional Engineer
PM	Particulate Matter
ppbv	Parts Per Billion by Volume
ppmv	Parts Per Million by Volume
PS	Performance Specification
PSCAA	Puget Sound Clean Air Agency
PSEL	Plant Site Emission Limits
psi	pounds per square inch
PTE	Permanent Total Enclosure
PST	Performance Specification Test
PTM	Performance Test Method
QA/QC	Quality Assurance and Quality Control
QSTI	Qualified Source Testing Individual
RA	Relative Accuracy
RAA	Relative Accuracy Audit
RACT	Reasonably Available Control Technology
RATA	Relative Accuracy Test Audit
RCTO	Rotary Concentrator Thermal Oxidizer
RM	Reference Method
RTO	Regenerative Thermal Oxidizer
SCD	Sulfur Chemiluminescent Detector
SCR	Selective Catalytic Reduction System
SO_2	Sulfur Dioxide
SOG	Stripper Off-Gas
SRCAA	Spokane Regional Clean Air Agency
SWCAA	Southwest Clean Air Agency
TAP	Toxic Air Pollutant
TCA	Thermal Conductivity Analyzer
TCD	Thermal Conductivity Detector
TGNENMOC	Total Gaseous Non-Ethane Non-Methane Organic Compounds
TGNMOC	Total Gaseous Non-Methane Organic Compounds
TGOC	Total Gaseous Organic Compounds
THC	Total Hydrocarbon
TIC	Tentatively Identified Compound
TO	Thermal Oxidizer
TO	Toxic Organic (as in EPA Method TO-15)
TON	ton=2000 pounds
TPH	Tons Per Hour
TRS	Total Reduced Sulfur
TTE	Temporary Total Enclosure
VE	Visible Emissions
VOC	Volatile Organic Compounds
WC	Inches Water Column
WDOE	Washington Department of Ecology

NOMENCLATURE

Constants	Value	Units	Definition	Ref
Pstd(1)	29.92126	inHg	Standard Pressure	CRC
Pstd(2)	2116.22	lbf / ft²		CRC
Tstd	527.67	°R	Standard Temperature	CRC
R	1545.33	ft lbf / lbmol °R	Ideal Gas Constant	CRC
MW-atm	28.96456422	lbm / lbmole	Atmospheric (20.946 %O_2, 0.033% CO_2, Balance N_2+Ar)	
MW-C	12.011	lbm / lbmole	Carbon	CRC
MW-CO	28.0104	lbm / lbmole	Carbon Monoxide	CRC
MW-CO_2	44.0098	lbm / lbmole	Carbon Dioxide	CRC
MW-H_2O	18.01534	lbm / lbmole	Water	CRC
MW-NO_2	46.0055	lbm / lbmole	Nitrogen Dioxide	CRC
MW-O_2	31.9988	lbm / lbmole	Oxygen	CRC
MW-SO_2	64.0628	lbm / lbmole	Sulfur Dioxide	CRC
MW-N_2+Ar	28.15446807	lbm / lbmole (Balance with 98.82% N_2 & 1.18% Ar)	Emission balance	
C1	385.3211297	ft³ / lbmol	Ideal Gas Constant @ Standard Conditions	
C2	816.5455228	inHg in²/ °R ft²	Isokentics units correction constant	
Kp	5129.4	ft / min [(inHg lbm/mole) / (°R inH$_2$O)] ^½	Pitot tube constant	Ref 2.5.1
Symbol	**Units**	**Definition**	**Calculating Equation or Source of Data**	**EPA**
As	in²	Area, Stack		
An	in²	Area, Nozzle		
Bws	%	Moisture, % Stack gas	[100 Vw(std) / [Vw(std)+Vm(std)]]	Eq. 5-3
C	ppmv-C	Carbon (General Reporting Basis for Organics)		
C1	ft³/lbmol	Gas Constant @ Standard Conditions	[R Tstd / Pstd(2)]	
C2	inHg in²/ °R ft²		[14,400 Pstd / Tstd]	
Cd	lbm-GAS / MMdscf	Mass of gas per unit volume	[Cgas MWgas / C1]	
cg	gr/dscf	Grain Loading, Actual	[15.432 mn / Vm(std) 1,000]	Eq. 5-6
cg @ X%CO_2	gr/dscf	Grain Loading Corrected to X% Carbon Dioxide	[X% / CO_2%]	
cg @ X%O_2	gr/dscf	Grain Loading Corrected to X% Oxygen	[(20.946-X) / (20.946-O_2)]	
Cgas	ppmv, %	Gas Concentration, (Corrected)		
Cgas @ X%CO_2	ppmv	Gas Concentration Correction to X% Carbon Dioxide	[X% / CO_2%]	
Cgas @ X%O_2	ppmv	Gas Concentration Correction to X% Oxygen	[(20.946-X%) / (20.946-O_2%)]	
Cgas	ppmv		Mgas (lbm/hr) * 1,000,000*385.3211/60*Qsd*mw	
CO	ppmv	Carbon Monoxide		
Co	ft	Outer Circumference of Circular Stack		
Ci	ft	Inner Circumference of Circular Stack		
CO_2	%	Carbon Dioxide		
Cp		Pitot tube coefficient		
Ct	lb/hr	Particulate Mass Emissions	[60 cg Qsd/ 7,000]	
dH	in H_2O	Pressure differential across orifice		
Dn	in	Diameter, Nozzle		
dp^½		Average square root of velocity pressure		
Ds	in	Diameter, Stack		
E	lb / MMBtu	Pollutant Emission Rate	Cgas Fd MWgas (20.946 / (20.946-O_2)) / (1,000,000 C1)	
Fd	dscf / MMBtu	F Factor for Various Fuels		Table 19-1
I	%	Percent Isokinetic	[C2 Ts(abs) Vm(std) / (vs Ps mfg An Ø)]	Eq. 5-8*
Md	lbm / lbmole	Molecular weight, Dry Stack Gas	[(1-%O_2-%CO_2)(MWn2+ar)+(%O_2 MW-O_2)+(%CO_2 MW-CO_2)]	Eq. 3-1*
mfg		Mole fraction of dry stack gas	[1-Bws/100]	
Mgas	lbm/hr	Gaseous Mass Emisisons	[60 Cgas(ppmv) MW Pstd(2) Qsd / 1,000,000 R Tstd]	
mn	mg	Particulate lab sample weight		
Ms	lbm / lbmole	Molecular weight, Wet Stack	[Md mfg +MW-H_2O (1-mfg)]	Eq. 2-5
MW	lbm / lbmole	Molecular Weight		
NO_2	ppmv-NO_2	Nitrogen Dioxide (General Reporting Basis for NOx)		
NOx	ppmv-NO_2	Nitrogen Oxides (Reported as NO_2)		
O_2	%	Oxygen		
OPC	%	Opacity		
Pbar	in Hg	Pressure, Barometric		
Pg	in H_2O	Pressure, Static Stack		
Po	in Hg	Pressure, Absolute across Orifice	[Pbar + dH / 13.5951]	
Ps	in Hg	Pressure, Absolute Stack	[Pbar + Pg / 13.5951]	Eq. 2-6*
Qa	acf/min	Volumetric Flowrate, Actual	[As vs / 144]	
Qsd	dscf/min	Volumetric Flowrate, Dry Standard	[Qa Tstd mfg Ps] / [Pstd(1) Ts(abs)]	Eq 2-10*
Ri	MMBtu/hr		1,000,000 Mgas (20.946-O_2)] / [Cd Fd 20.946]	
SO_2	ppmv-SO_2	Sulfur Dioxide		
t	in	Wall thickness of a stack or duct		
TGOC	ppmv-C	Total Gaseous Organic Concentration (Reported as C)		
Tm	°F	Temperature, Dry gas meter		
Tm(abs)	°R	Temperature, Absolute Dry Meter	[Tm + 459.67]	
Ts	°F	Temperature, Stack gas		
Ts(abs)	°R	Temperature, Absolute Stack gas	[Ts + 459.67]	
Vlc	ml	Volume of condensed water		
Vm	dcf	Volume, Gas sample		
Vm(std)	dscf	Volume, Dry standard gas sample	[Y Vm Tstd Po]/ [Pstd(1) Tm(abs)]	Eq. 5-1
vs	fpm	Velocity, Stack gas	Kp Cp dp^½ [Ts(abs) / (Ps Ms)]^ ½	Eq. 2-9*
Vw(std)	scf	Volume, Water Vapor	0.04707 Vlc	Eq. 5-2
Y		Dry gas meter calibration factor		Fig. 5.6
Ø	min	Time, Total sample		

* Based on equation.

Total Chromium & Hexavalent Chromium

Results & Example Calculations

Field Data

Sample Recovery Field Data & Worksheets

Blank Corrections

Laboratory Results, Worksheets & COC

Traverse Point Locations

Total Chromium and Hexavalent Chromium Emissions

Client	BULLSEYE GLASS	26-Apr-16 Date
Source	GLASS FURNACE T7 -INLET	JTF,JH,JL,BC,BS,PB,CH Operator
Location	PORTLAND OR	
	0061	MEW Analyist/QA

Definitions	Symbol	Units	Run 1	Run 2	Run 3	Average
Date, Starting			4/26/16	4/27/16	4/28/16	
Time, Starting			17:30	17:30	17:00	
Time, Ending			9:30	9:30	9:00	
Date, Ending			4/27/16	4/28/16	4/29/16	
Volume, Gas sample	Vm	dcf	209.580	151.465	148.999	170.01
Temperature, Dry gas meter	Tm	°F	88.11	83.68	90.09	87.29
Temperature, Stack gas	Ts	°F	167.44	163.16	181.00	170.53
Temperature, Stack Dry Bulb	Tdb	°F	229	na	na	
Temperature, Stack Wet Bulb	Twb	°F	114	na	na	
Pressure differential across orifice	dH	in H2O	0.303	0.123	0.122	0.18
Average square root velocity pressure	dp^½	in H2O^½	0.181	0.166	0.162	
Diameter, Nozzle	Dn	in	0.3103	0.2583	0.2583	
Pitot tube coefficient	Cp		0.8364	0.8248	0.8364	
Dry gas meter calibration factor	Y		0.99949	0.99949	0.99949	
Pressure, Barometric	Pbar	in Hg	29.90	30.10	30.10	
Pressure, Static Stack	Pg	in H2O	-0.3	-0.3	-0.3	
Time, Total sample	Ø	min	760	890	880	843
Stack Area	As	in²	113.1	113.1	113.1	
Nozzle Area	An	in²	0.0756	0.0524	0.0524	
Volume of condensed water	Vlc	ml	34.7	75.0	99.8	69.8
Oxygen		% O2	20.95	20.95	20.95	20.95
Carbon Dioxide		% CO2	0.03	0.03	0.03	0.03
Molecular weight, Dry Stack	Md	lbm / lbmole	28.96	28.96	28.96	28.96
Pressure, Absolute Stack	Ps	in Hg	29.88	30.08	30.08	30.01
Pressure, avg across orifice	Po	in Hg	29.92	30.11	30.11	30.05
Volume, Dry standard gas sample	Vm(std)	dscf	201.79	147.94	143.84	164.52
Volume, Water Vapor	Vw(std)	scf	1.63	3.53	4.70	3.29
Moisture, % Stack (EPA 4)	Bws(1)	%	0.80	2.33	3.16	2.10
Moisture, % Stack (Psychrometry-Sat)	Bws(2)	%	38.48	34.58	51.97	41.68
Moisture, % Stack (Theoretical)	Bws(3)	%	na	na	na	
Moisture, % Stack (Psychrometry)	Bws(4)	%	5.83	na	na	
Moisture, % Stack ODEQ5	Bws(5)	%	2.58	3.39	4.29	3.42
Mole Fraction dry Gas	mfg		97.42%	96.61%	95.71%	96.58%
Molecular weight, Wet Stack	Ms	lbm / lbmole	28.68	28.59	28.50	28.59
Velocity, Stack gas	vs	fpm	665	599	600	621
Volumetric Flowrate, Actual	Qa	acf/min	522	470	471	488
Volumetric Flowrate, Dry Standard	Qsd	dscf/min	428	387	373	396
Percent Isokinetic	I	%	92.9	92.7	94.5	93.3
Chrome Addition Rate		lb/batch	8.1	8.1	8.1	8.1
		ton/hr	0.000253	0.000253	0.000253	0.000253
Glass Production Rate		lb/batch	1,111.81	1,111.81	1,111.81	1111.81
		ton/hr	0.0347	0.0347	0.0347	0.0347
		Chrome 6+				
Sample weight-Total	mn	mg	1.769	1.036	0.430	1.078
Grain Loading, Actual	cg	gr / dscf	0.000135	0.000108	0.000046	0.000097
		ppbv	143.3	114.4	48.8	102.2
		mg / dscm	0.31	0.25	0.11	0.22
		ng / dscm	309,654	247,332	105,545	220,844
Mass Emissions	Ct	lbm / hr	0.00050	0.00036	0.00015	0.00033
		gm / hr	0.225	0.163	0.067	0.151
Production Basis		lbm / ton-glass	0.014	0.010	0.004	0.010
		lbm / ton-Cr	1.96	1.42	0.58	1.32
		TOTAL CHROME				
Sample weight-Total	mn	mg	1.808	0.979	0.440	1.076
Grain Loading, Actual	cg	gr / dscf	0.000138	0.000102	0.000047	0.000096
		ppbv	146.4	108.2	50.0	101.5
		mg / dscm	0.32	0.23	0.11	0.22
		ng / dscm	316,457	233,776	107,978	219,404
Mass Emissions	Ct	lbm / hr	0.00051	0.00034	0.00015	0.00033
		gm / hr	0.230	0.154	0.068	0.151
Production Basis		lbm / ton-glass	0.015	0.010	0.004	0.010
		lbm / ton-Cr	2.00	1.34	0.60	1.31

Total Chromium and Hexavalent Chromium Emissions (Measured)

Client	BULLSEYE		April 28, 2016	Date
Source	GLASS FURNACE T7 -OUTLET		JTF,JH,JL,BC,BS,PB,CH	Operator
Location	PORTLAND OR			
	0061		MEW	Analyist/QA

Definitions	Symbol	Units	Run 3
Date, Starting			4/28/16
Time, Starting			17:00
Time, Ending			9:00
Date, Ending			4/29/16
Volume, Gas sample	Vm	dcf	123.834
Temperature, Dry gas meter	Tm	°F	64.49
Temperature, Stack gas	Ts	°F	140.03
Temperature, Stack Dry Bulb	Tdb	°F	na
Temperature, Stack Wet Bulb	Twb	°F	na
Pressure differential across orifice	dH	in H2O	0.065
Average square root velocity pressure	dp^½	in H2O^½	0.198
Diameter, Nozzle	Dn	in	0.2097
Pitot tube coefficient	Cp		0.8248
Dry gas meter calibration factor	Y		0.98764
Pressure, Barometric	Pbar	in Hg	30.10
Pressure, Static Stack	Pg	in H2O	0.1
Time, Total sample	Ø	min	910
Stack Area	As	in²	119.1
Nozzle Area	An	in²	0.0345
Volume of condensed water	Vlc	ml	33.6
Oxygen		% O2	20.74
Carbon Dioxide		% CO2	1.01
Molecular weight, Dry Stack	Md	lbm / lbmole	29.11
Pressure, Absolute Stack	Ps	in Hg	30.11
Pressure, avg arcoss orifice	Po	in Hg	30.10
Volume, Dry standard gas sample	Vm(std)	dscf	123.88
Volume, Water Vapor	Vw(std)	scf	1.58
Moisture, % Stack (EPA 4)	Bws(1)	%	1.26
Moisture, % Stack (Psychrometry-Sat)	Bws(2)	%	19.55
Moisture, % Stack (Theoretical)	Bws(3)	%	na
Moisture, % Stack (Psychrometry)	Bws(4)	%	na
Moisture, % Stack (Predicted)	Bws(5)	%	3.06
Mole Fraction dry Gas	mfg		96.94%
Molecular weight, Wet Stack	Ms	lbm / lbmole	28.77
Velocity, Stack gas	vs	fpm	697.7
Volumetric Flowrate, Actual	Qa	acf/min	576.9
Volumetric Flowrate, Dry Standard	Qsd	dscf/min	495.1
Percent Isokinetic	I	%	94.8
Chrome 6+			
Sample weight-Total	mn	mg	0.0988
Grain Loading, Actual	cg	gr / dscf	0.000012
		ppbv	13.0
		ppmv	0.013
		mg / dscm	0.028
		ng / dscm	28,166
Mass Emissions	Ct	lbm / hr	0.000052
		gm / hr	0.024
Production Basis		lbm / ton-glass	0.0015
		lbm / ton-Cr	0.206
TOTAL CHROME			
Sample weight-Total	mn	mg	0.10220
Grain Loading, Actual	cg	gr / dscf	0.000013
		ppbv	13.5
		ppmv	0.013
		mg / dscm	0.029
		ng / dscm	29,135
Mass Emissions	Ct	lbm / hr	0.000054
		gm / hr	0.025
Production Basis		lbm / ton-glass	0.0016
		lbm / ton-Cr	0.213

Total Chromium and Hexavalent Chromium Emissions (Estimated Based on PM Removal)

Client	BULLSEYE	April 28, 2016	Date
Source	GLASS FURNACE T7 -OUTLET	JTF,JH,JL,BC,BS,PB,CH	Operator
Location	PORTLAND OR		
	0061	MEW	Analyist/QA

Definitions	Symbol	Units	Run 1	Run 2	Run 3	Average
Chrome Addition Rate		lb/batch	8.1	8.1	8.1	8.1
		ton/hr	0.000253	0.000253	0.000253	0.000253
Glass Production Rate		lb/batch	1,111.81	1,111.81	1,111.81	1111.81
		ton/hr	0.0347	0.0347	0.0347	0.0347
PM removal efficiency			99.29%	99.56%	99.57%	99.47%
Chrome 6+						
		ng / dscm	2,195	1,098	456	1,250
		mg/dscm	0.002195	0.001095	0.000456	0.001250
Mass Emissions	Ct	lbm / hr	0.0000035	0.0000016	0.0000006	0.0000019
		gm / hr	0.002	0.0007	0.0003	0.0009
Production Basis		lbm / ton-glass	0.00010	0.00005	0.00002	0.00006
		lbm / ton-Cr	0.014	0.006	0.003	0.008
TOTAL CHROME						
		ng / dscm	2,243	1,038	466	1,249
		mg/dscm	0.002243	0.001038	0.000466	0.001249
Mass Emissions	Ct	lbm / hr	0.0000036	0.0000015	0.0000007	0.0000019
		gm / hr	0.002	0.0007	0.0003	0.0009
Production Basis		lbm / ton-glass	0.00010	0.00004	0.00002	0.00006
		lbm / ton-Cr	0.0142	0.0059	0.0026	0.0076

Client: Bullseye Glass Company Date 4/26-4/29/2016

Source Glass Furnace T7-Inlet Project # 5702 Run # 2

Molecular Weights (lb/lbmol):

CO_2=44.0	O_2=32.0	N_2+Ar=28.0	H_2O=18.0	atm=28.96

Constants:

Pstd(1)=29.92129 in Hg	Tstd=527.67 °R	Kp=5129.4	C2=816.5455inHg in²/°R ft²

Pressure, Absolute Stack (Ps):

$$\text{Ps, inHg} = P_{\text{Barometric}} + \frac{P_{\text{static}}}{13.6} = \underline{30.10}\ \text{inHg} + \frac{\underline{-0.3}\ \text{in H2O}}{13.6} = \underline{30.08}\ \text{inHg}$$

Volume, Dry Standard Gas Sample (Vm[std]): $Tm = \underline{83.68}\ {}^\circ F + 459.7 = \underline{543.38}\ {}^\circ R$

$$Orifice\ Press = Pb\ \underline{30.10}\ inHg + \frac{\underline{0.123}\ \Delta H}{13.6} = \underline{30.11}\ inHg$$

$$Vm(std)\,ft^3 = \frac{Y \times MeterVol \times Tstd \times Orifice\ Pres(Po)}{Pstd(1) \times Tm\,{}^\circ R}$$

$$= \frac{\underline{0.99949} \times \underline{151.465}\ ft^3 \times 528\,{}^\circ R \times (Po\ \underline{30.11}\ inHg)}{29.92 inHg \times \underline{543.68}\,{}^\circ R} = \underline{148.04}\ dscf$$

Moisture, % Stack Gas (bws): $V_{wstd} = 0.04706 \times Cond.H2O, ml = 0.04706 \times \underline{75.0}\ ml = \underline{3.53}\ scf$

$$\text{bws} = 100 \times \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = \frac{\underline{3.53}\ scf}{\underline{3.53}\ scf + \underline{148.04}\ dscf} = \underline{2.33}\ \%$$

Mole Fraction Gas (mfg):

$$1 - \frac{\text{bws}}{100} = 1 - \frac{\underline{2.33}\ \%}{100} = \underline{0.9767}$$

Molecular Weight, Dry, Stack (Md): Ambient Conditions, Md = 28.96 lb/lb mol

Molecular Weight, Wet, Stack (Ms):

$$Ms\,\frac{lb}{lbmol} = (Md \times mfg) + (MolWtH_2O \times (1 - mfg)) = \left(\underline{28.96}\ \frac{lb}{lbmol} \times \underline{0.9767}\right) + (18.0 \times (1 - \underline{0.9767}))$$

$$= \underline{28.70}\ \frac{lb}{lbmol}$$

Client: Bullseye Glass Company Date 4/26-4/29/2016

Stack gas (vs): $Ts = \underline{163.16}\ °F + 459.7 = \underline{622.86}\ °R$

$$= vs\frac{feet}{\min} = Kp \times Cp \times dp\sqrt{inH_2O} \times \sqrt{\frac{Ts°R}{Ps \times Ms}}$$

$$= 5129.4 ft/\min ... \times \underline{0.8248} \times \underline{0.166}\ dp\sqrt{inH_2O} \times \sqrt{\frac{622.86°R}{\underline{30.08}\ inHg \times \underline{28.70}\ \frac{lb}{lbmol}}} = \underline{597}\ \frac{ft}{\min}$$

Flow Rate, Actual (Qa):

$$Qa\frac{actualCubicFeet}{\min} = \frac{AreaStack \times vs}{144} = \frac{\underline{113.1}\ in^2 \times \underline{597}\ \frac{ft}{\min}}{144} = \underline{469}\ acfm$$

Flow Rate, Dry Standard (Qsd):

$$Qsd\frac{dryStdFt^3}{\min} = \frac{Qa \times Tstd \times mfg \times Ps}{Pstd(1) \times Ts°R} = \frac{\underline{469}\ acfm \times 528°R \times \underline{0.9767} \times \underline{30.08}\ inHg}{29.92 inHg \times \underline{622.86}\ °R}$$

$$= \underline{390}\ \frac{dscf}{\min}$$

Percent Isokinetic (I):

$$I\% = \frac{C_2 \times Ts°R \times Vm(std)}{vs \times Ps \times mfg \times An \times \theta}$$

$$= \frac{816.5455 inHg \cdot in^2 / °R \cdot ft^2 \times \underline{622.86}\ °R \times \underline{148.04}\ dscf}{\underline{597}\ fpm \times \underline{30.08}\ inHg \times \underline{0.9767} \times \underline{0.0524}\ in^2 \times \underline{890}\ \min}$$

$$= \underline{92.05}\ \%$$

Grain Loading, actual (cg):

Total Chrome

$$cg\frac{gr}{dscf} = \frac{15.432 gr}{g} \times \frac{1g}{1000mg} \times \frac{mgSample}{Vm(std)} = \frac{15.432 gr}{g} \times \frac{1g}{1000mg} \times \frac{\underline{0.979}\ mg}{\underline{148.04}\ dscf}$$

$$= \underline{0.000102}\ \frac{gr}{dscf}$$

Mass Emissions (Ct):

$$Ct\frac{lb}{hr} = \frac{60 \times cg \times Qsd}{7000 grains/lb} = \frac{60 \times \underline{0.000102}\ \frac{gr}{dscf} \times \underline{390}\ dscf/\min}{7000 gr/lb} = \underline{0.00034}\ \frac{lb}{hr}$$

Sample Calculations, Chromium Concentration

Client: Bullseye Glass Company Source Glass Furnace T7 - Outlet
Date 4/28-4/29/2016 Project # 5702 Run # 3 Page —

CHROMIUM CONCENTRATION. mg/dscm

Total Chrome

Measured Results, gr/dscf 0.000013

Equation: $$CR, mg/dscm = Cr, gr/dscf \times \frac{lb}{7000gr} \times \frac{453{,}592mg}{lb} \times \frac{35.315cubicft}{cubicMeter}$$

Calculation: $$\underline{0.000013}\ Cr, gr/dscf \times \frac{lb}{7000gr} \times \frac{453{,}592mg}{lb} \times \frac{35.315cubicft}{cubicMeter}$$

$$= \underline{0.030}\ Cr, mg/dscm$$

Chromium Concentration. ng/dscm

Measured Results, mg/dscm: 0.030

1mg = 1,000,000 ng

$$= 1{,}000{,}000ng \times \frac{0.030\ mg/dscm}{1\ mg}$$

$$= 30{,}000\ ng/dscm$$

Client: Bullseye Glass Company Source Glass Furnace T7 - Inlet
Date 4/26-4/29/2016 Project # 5702 Run # 3

Chromium Emissions Production Based: lb/ton Chromium production:

Measured Cr Results, lb/hr 0.00015 Total Cr

Chromium Production, lb/batch 8.1

Equation: $$\frac{lbCr}{tonChromium} = \left(\frac{lbCr}{hr}\right) \times \left(\frac{batch}{lbChromium}\right) \times \left(\frac{16hrs}{batch}\right)$$

Calculation:

$$\left(\frac{0.00015\ lbCr}{hr}\right) \times \left(\frac{batch}{8.1\ \ lbChromium}\right) \times \left(\frac{16hrs}{day}\right) x(2000lbCr/1tonChromium) = \frac{0.593\ \ lbCr}{tonChromium}$$

Client: Bullseye Glass Company Source Glass Furnace T7-Outlet
Date 4/28-4/29/2016 Project # 5702 Run # 3

Chromium Emissions Production Based: lb/ton Chromium production:

Measured Cr Results, lb/hr 0.000052 Hex. Chrome

Chromium Production, lb/batch 8.1

Equation: $$\frac{lbCr}{tonChromium} = \left(\frac{lbCr}{hr}\right) \times \left(\frac{batch}{lbChromium}\right) \times \left(\frac{16hrs}{batch}\right)$$

Calculation:

$$\left(\frac{0.000052\,lbCr}{hr}\right) \times \left(\frac{batch}{8.1\ \ lbChromium}\right) \times \left(\frac{16hrs}{day}\right) x(2000lbCr/1tonChromium) = \frac{0.205\ lbCr}{tonChromium}$$

Client: Bullseye Glass Company Source Glass Furnace T7-Outlet
Date 4/28-4/29/2016 Project # 5702 Run # 3

Chromium Emissions Production Based: lb/ton glass production:

Measured Cr Results, lb/hr 0.000054 Total chrome

Glass Production, lb/batch 1,111.81

Equation: $$\frac{lbCr}{tonGlass} = \left(\frac{lbCr}{hr}\right) \times \left(\frac{batch}{lbGlass}\right) \times \left(\frac{16hrs}{batch}\right)$$

Calculation:

$$\left(\frac{0.000054\,lbCr}{hr}\right) \times \left(\frac{batch}{1,111.81\,lbGlass}\right) \times \left(\frac{16hrs}{day}\right) x(2000lbGlass/1tonGlass) = \frac{0.0016\,lbCr}{tonGlass}$$

Client: Bulkeye Glass Company Source Glass Furnace T7 - Inlet
Date 4/26-4/28/2016 Project # 5702 Run # 2

Chromium Emissions Production Based: lb/ton glass production:

Measured Cr Results, lb/hr 0.00036 Hex chrome

Glass Production, lb/batch 1,111.81

Equation: $$\frac{lbCr}{tonGlass}=\left(\frac{lbCr}{hr}\right)\times\left(\frac{batch}{lbGlass}\right)\times\left(\frac{16hrs}{batch}\right)$$

Calculation:

$$\left(\frac{0.00036\ lbCr}{hr}\right)\times\left(\frac{batch}{1,111.81\ lbGlass}\right)\times\left(\frac{16hrs}{day}\right)x(2000lbGlass/1tonGlass)=\frac{0.0104\ lbCr}{tonGlass}$$

Client: Bullseye Glass Company Source Glass Furnace T7-Outlet
Date — Project # 5702 Run # 1

Chromium Emissions Production Based: lb/ton Chromium production:

Calculated Cr Results, lb/hr 0.0000036 Total Chrome

Chromium Production, lb/batch 8.1

Equation: $$\frac{lbCr}{tonChromium} = \left(\frac{lbCr}{hr}\right) \times \left(\frac{batch}{lbChromium}\right) \times \left(\frac{16hrs}{batch}\right)$$

Calculation:
$$\left(\frac{0.0000036\,lbCr}{hr}\right) \times \left(\frac{batch}{8.1\ lbChromium}\right) \times \left(\frac{16hrs}{day}\right) x(2000lbCr / 1tonChromium) = \frac{0.0142\,lbCr}{tonChromium}$$

Run 1 (Total Chrome) Chromium concentration. ng/dscm

Calculated Results, mg/dscm : 0.002243 mg/dscm

1 mg = 1,000,000 ng → 1,000,000 ng × $\frac{0.002243\ mg/dscm}{1mg}$

= 2,243 ng/dscm

Calculating a Cr outlet emission rate based on PM removal efficiency

PM Destruction Efficiency = Chrome(lb/hr)(outlet) = Chrome(lb/hr)(Inlet) × (1 − PM DE)

(Total Chrome) Run 1 : PM removal efficiency = $\frac{(PM\ inlet(lb/hr)) - (PM\ outlet(lb/hr))}{(PM\ inlet(lb/hr))}$

$= \frac{0.300\ lb/hr - 0.00213\ lb/hr}{0.300\ lb/hr} = 0.9929$ or 99.29%

Cr outlet emission rate based on PM removal efficiency

(Chrome Outlet (lb/hr)) = (Chrome Inlet (lb/hr)) × (1 − DE)

0.0000036 lb/hr = 0.00051 lb/hr × (1 − 0.9929)

Client: Bullseye Glass Company Source Glass Furnace T7-Outlet
Date ——— Project # 5762 Run # 2

Chromium Emissions Production Based: lb/ton Chromium production:

Calculated Cr Results, lb/hr 0.0000016 Hex. Chrome

Chromium Production, lb/batch 8.1

Equation: $$\frac{lbCr}{tonChromium} = \left(\frac{lbCr}{hr}\right) \times \left(\frac{batch}{lbChromium}\right) \times \left(\frac{16hrs}{batch}\right)$$

Calculation:

$$\left(\frac{0.0000016\ lbCr}{hr}\right) \times \left(\frac{batch}{8.1\ lbChromium}\right) \times \left(\frac{16hrs}{day}\right) x(2000lbCr/1tonChromium) = \frac{0.006\ lbCr}{tonChromium}$$

Client: Bullseye Glass Company Source Glass Furnace T7-outlet
Date ——— Project # 5702 Run # 3

Chromium Emissions Production Based: lb/ton glass production:

Calculated Cr Results, lb/hr 0.0000007 Total Chrome

Glass Production, lb/batch 1,111.81

Equation: $$\frac{lbCr}{tonGlass} = \left(\frac{lbCr}{hr}\right) \times \left(\frac{batch}{lbGlass}\right) \times \left(\frac{16hrs}{batch}\right)$$

Calculation:

$$\left(\frac{0.0000007\ lbCr}{hr}\right) \times \left(\frac{batch}{1,111.81\ lbGlass}\right) \times \left(\frac{16hrs}{day}\right) x(2000lbGlass/1tonGlass) = \frac{0.00002\ lbCr}{tonGlass}$$

Client: Bullseye Glass Company Source Glass Furnace T7-outlet
Date________ Project # 5702 Run # 1

Chromium Emissions Production Based: lb/ton glass production:

Calculated Cr Results, lb/hr 0.0000035 Hex. Chrome

Glass Production, lb/batch 1,111.81

Equation: $$\frac{lbCr}{tonGlass} = \left(\frac{lbCr}{hr}\right) \times \left(\frac{batch}{lbGlass}\right) \times \left(\frac{16hrs}{batch}\right)$$

Calculation:

$$\left(\frac{0.0000035 lbCr}{hr}\right) \times \left(\frac{batch}{1,111.81\ lbGlass}\right) \times \left(\frac{16hrs}{day}\right) x(2000lbGlass/1tonGlass) = \frac{0.00010\ lbCr}{tonGlass}$$

Field Data Sheet

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

PAGE 1 OF 4

Client: Bullseye Glass
Facility Location: Portland, OR.
Source: Furnace T-7
Sample Location: Inlet of Baghouse

Date 4/26/16
Test Method 0061
Concurrent Testing ODEQ 5
Run # 1
Operator SDML Support Joe H.
Temperature, Ambient (Ta) 83°F
Moisture ~10% Tdb — Twb —
Press., Static (Pstat) -.30 Press., Bar (Pb) 29.90
Cyclonic Flow Expected ? NO If yes, avg. null angle — degrees

Glass Nozzle Measurements
1. .3100
2. .3100
3. .3110

→ .3103

ALT-011
Std TC (ID/°F) 3L/83
Stack TC (ID/°F) 2-2/83
Continuity Check (↑) or ↓

Probe 2-2 (G/s) Cp .8364 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O: Pre: Hi 0@6 Lo 0@6; Post — @ —, — @ —
Nozzle ~~.3107~~ .3103 Oven — Imp. Outlet 1-35
Filter — Heat Set — °F
Meter Box 2 dH@ 1.97675 Y 0.99949
Meter Leak Check: Pretest: .005 cfm 15 inHg; Post: — cfm — inHg

#	Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2O (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
			1730	363.109										
1	12	10		365.29	.020	.169	.17	172			67	82	82	4
2	11	20		—	.115	.989	.99	119			67	82	81	4
3	10	30		374.61	.080	.694	.69	112			61	86	81	4
4	9	40		377.38	.032	.268	.27	138			60	90	82	3
5	8	50		380.67	.050	.419	.42	187			63	89	83	3
6	7	60		383.96	.046	.373	.37	161			62	92	84	3
7	6	70	~~1840~~ / 1850	385.935	.016	.132	.13	151			62	93	85	2
8	5	80		389. —	.051	.383	.38	212			64	91	87	3
9	4	90		392.45	.050	.375	.38	215			63	94	89	3
10	3	100		394.80	.013	.097	.10	215			60	96	89	2
11	2	110		397.00	.023	.180	.18	186			63	96	89	2
12	1	120		399.88	.033	.278	.28	141			63	95	91	3
13	1	130		406.01	.181	1.37	1.4	209			61	97	91	5
14	2	140		409.38	.033	.245	.25	227			56	~~99~~ 102	92	~~5~~ 3
15	3	150		413.84	.106	.781	.78	232			58	98	92	5
16	4	160		417.96	.075	.558	.56	227			59	102	92	4
17	5	170		—	.045	.350	.35	193			61	101	93	3
18	6	180		424.05	.044	.342	.34	193			63	99	92	3
19	7	190		426.89	.030	.248	.25	153			63	98	93	3
20	8	200		429.03	.019	.145	.15	204			63	96	93	3
21	9	210		431.11	.019	.139	.14	236			64	95	92	3
22	10	220		433.22	.021	.162	.16	195			65	95	92	3
23	11	230	2130 / 2133	435.651	.028	.216	.22	196			61	95	91	3
24	12	240	2143	438.30	.029	.234	.23	165			51	94	91	3
25														

Notes:
* 1840 → Paused to check ph, Resumed at 1850
* 2130 → Paused to check ph, Resumed at 2133

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Reviewed by [signature], DEQ 4/27/2016

MONTROSE AIR QUALITY SERVICES	13585 NE Whitaker Way, Portland, OR 97230, Phone (503) 255-5050, Fax (503) 255-0505

PAGE 2 OF 4

Client: Bullseye Glass 38
Facility Location: Portland, OR
Source: Furnace T-7
Sample Location: Inlet

Date 4/26/16
Test Method OO61
Concurrent Testing ODEQ 5
Run # 1

Glass Nozzle Measurements
1 .3100
2 .3100
3 .3110
→ .3103

Probe 2-2 (B/s) Cp .8364 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O — Pre: Hi 0 @6 Lo 0 @6; Post 0 @5, 0 @5

Operator John Support Joe H.
Temperature, Ambient (Ta) 74°F
-6% Moisture ~~10%~~ Tdb 229 Twb 114
Press., Static (Pstat) -.30 Press., Bar (Pb) 29.9
Cyclonic Flow Expected ? No If yes, avg. null angle — degrees

ALT-011
Std TC (ID/°F) SL / 83
Stack TC (ID/°F) 2-2 / 83
Continuity Check ↑ or ↓

Nozzle .3103 Oven — Imp. Outlet 1-35
Filter — Heat Set — °F
Meter Box 2 dH@ 1.97675 Y 0.99949
Meter Leak Check: Pretest: .005 cfm 15 inHg; Post: .010 cfm 12 inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2O (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
		2143	438.30				Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
1 12	250		441.02	.032	.266	.27	147			51	94	91	3
2 11	260		—	.039	~~.327~~ .337	~~.33~~ .36	143			51	95	90	3
3 10	270		447.59	.040	.370	.37	136			51	95	90	3
4 9	280	2225	450.15	.022	.207	.21	127			51	96	91	3
5 8	290	2321	453.12	.022	.183	.18	203			54	95	91	3
6 7	300		456.62	.041	.380	.38	120			66	89	87	3
7 6	310		460.15	~~.037~~ .048	.425	.43	147			67	89	86	3
8 5	320		463.58	.049	.412	.41	180			66	90	86	3
9 4	330		466.73	.046	.361	.36	226			67	91	86	3
10 3	340		469.66	.040	.313	.31	227			65	91	85	3
11 2	350		—	.042	.331	.33	223			64	92	86	3
12 1	360		475.80	~~.08~~ .043	.369	.37	169			62	93	87	3
13 1	370		480.26	.088	.757	.76	167			62	93	87	5
14 2	380		485.12	.094	.804	.80	172			60	95	87	4
15 3	390		489.875	.088	.760	.76	167			61	96	87	4
16 4	400		492.455	.023	.201	.20	161			60	96	87	3
17 5	410		494.97	.031	.257	.26	189			62	94	87	3
18 6	420		496.996	.019	.155	.16	201			63	92	88	3
19 7	430		499.381	.026	.226	.23	160			63	92	87	3
20 8	440		502.514	.040	.359	.36	141			62	91	88	3
21 9	450		505.561	.038	.335	.34	152			61	92	87	4
22 10	460		508.275	.029	.267	.27	125			61	93	87	4
23 11	470		510.80	.027	.251	.25	120			62	92	88	4
24 12	480	239 4/27/16	512.962	.018	.168	.17				63	92	87	3
25	~~490~~												

Volume before resuming 450.697

Notes: 2225 → At 282 min, 10 sec, paused to switch out trains. Volume 450.645 Leak check .006 @ 7inHg
- Leak check of next train was .001 @ 7inHg → Resumed at 2321

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Field Data Sheet

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

PAGE 3 OF ~~3~~ 4 BC

Client: BULLSEYE GLASS
Facility Location: PORTLAND, OR
Source: FURNACE T7
Sample Location: INLET

Date 4/26/16 - 4/27/16
Test Method 0061
Concurrent Testing M5
Run #
Operator BC Support JM, JF, BS
Temperature, Ambient (Ta)
Moisture 6% Tdb Twb
Press., Static (Pstat) -.30 Press., Bar (Pb) 29.9
Cyclonic Flow Expected ? N If yes, avg. null angle — degrees

Glass Nozzle Measurements

1	.3100	.3103
2	.3100	
3	.3110	

ALT-011
Std TC (ID/°F) 83° JL
Stack TC (ID/°F) 83° 2-2
Continuity Check ↑ or ↓

Probe 2-2 (g)/s) Cp .8364 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @5 Lo 0 @5 Post — @ — / — @ —
Nozzle .3103 Oven — Imp. Outlet 1-35
Filter — Heat Set — °F
Meter Box 2 dH@ 1.97675 Y 0.99149
Meter Leak Check Pretest: 0.006 cfm 15 inHg Post: — cfm — inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2O (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
							Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
★		04:44	514.368										
1	490		517.197	.034	.293	.29	156			62	81	79	3
2	500		519.443	.022	.189	.19	156			63	82	79	3
3	510		522.537	.039	.328	.33	173			60	84	79	3
4	520		524.533	.020	.172	.17	159			57	86	80	3
5	530		526.753	.023	.198	.20	160			56	87	80	3
6	540		529.358	.030	.258	.26	161			57	87	80	3
7	550		531.579	.026	.228	.23	149			58	87	81	3
8	560		533.648	.017	.146	~~.~~ BC .15	162			57	86	81	2
9	570		536.757	.044	.367	.37	179			57	85	82	3
10	580		538.989	.022	.182	.18	184			56	86	81	3
11	590		541.114	.019	.168	.17	140			57	86	80	3
12	600		543.239	.018	.159	.16	142			56	85	82	3
13 12	610		545.363	.018	.158	.16	141			57	85	81	3
★ 14 11	620	~~07:04~~ 07:12	547.382	.017	.150	.15	143			56	86	81	3
15 10	630		549.605	.023	.200	.20	153			59	84	82	3
16 9	640		552.109	.0276	.238	.24	158			58	84	81	3
17 8	650		554.175	.020	.181	.18	129			57	85	82	3
18 7	660		556.566	.025	.224	.22	130			58	85	81	3
19 6	670		558.300	.015	.133	.13	140			58	86	82	3
20 5	680		559.973	.014	.122	.12	151			59	86	81	3
21 4	690		561.650	.015	.132	.13	149			60	87	82	3
22 3	700		563.749	.021	.185	.19	148			60	87	83	3
23 2	710		565.493	.015	.132	.13	150			61	86	82	3
24 1	720		567.165	.014	.123	.12	149			62	86	83	3
25 1	730		568.634	.012	.102	.10	170			62	87	83	3

Notes:

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★ LEAK CHECK/TRAIN CHANGE FROM 512.962 - 514.368
★ PAUSE FOR pH CHECK

Field Data Sheet

13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505
MONTROSE AIR QUALITY SERVICES

PAGE 4 OF 4

Client: BULLSEYE GLASS
Facility Location: PORTLAND, OR
Source: FURNACE 1-7
Sample Location: INLET

Date 4/26/16 - 4/27/16
Test Method 0010
Concurrent Testing M5
Run # 1

Glass Nozzle Measurements
1 .3100
2 .3100
3 .310
.303

Probe 2-2 (g / s) Cp .8364 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @5 Post 0 @7
Lo 0 @5 0 @10

Operator BC Support JM, JF, BS
ALT-011
Nozzle .303 Oven — Imp. Outlet 1-35

Temperature, Ambient (Ta)
Std TC (ID/°F) 83 21
Filter — Heat Set — °F

Moisture 6% Tdb Twb
Stack TC (ID/°F) 83 22
Meter Box 2 dH@ 1.97675 Y 0.99949

Press., Static (Pstat) -.30 Press., Bar (Pb) 29.9
Continuity Check ↑ or ↓
Meter Leak Check Pretest: 0.006 cfm 15 inHg
Post: 0.008 cfm 10 inHg

Cyclonic Flow Expected ? N If yes, avg. null angle — degrees

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2O (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
			—				Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
2	740		570.476	.017	.146	.15	161			61	87	84	3
3	750		572.584	.021	.182	.18	159			60	87	83	3
4	760	09:30	574.147	.020	.173	.17	158			58	87	84	3
5	770												
6	780												
7													
8													
9													
10													
11													
12													

Notes:

Field Data Sheet

switched nozzles just before starting run

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Glass Nozzle Measurements: .2583 ← .2580, .2580, .2590

Glass Nozzle	
1	~~.3100~~
2	~~.3100~~
3	~~.3110~~

~~.3103~~

Client: Bullseye Glass
Facility Location: Portland, OR
Source: Furnace T-7
Sample Location: Inlet

Date 4/27/16
Test Method 0061
Concurrent Testing ODEQ 5
Run # 2
Operator Stahl? Support Joe H.
Temperature, Ambient (Ta) 75°F
Moisture ~4% Tdb 202 Twb 105
Press., Static (Pstat) -0.3 Press., Bar (Pb) 30.10
Cyclonic Flow Expected ? NO If yes, avg. null angle — degrees

ALT-011
Std TC (ID/°F) 31 / 75
Stack TC (ID/°F) 27 / 74
Continuity Check ↑ or ↓

Probe 2-1 (G/s) Cp .8248 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @20 Post — @ —; Lo 0 @12 — @ —
Nozzle ~~.3103~~ .2583 Oven — Imp. Outlet 1-35
Filter — Heat Set — °F
Meter Box 2 dH@ 1.97675 Y .99949
Meter Leak Check .001 @ 7 Pretest: ~~.012~~ cfm ~~10~~ inHg
Post: — cfm — inHg

changed nozzles

#	Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2O (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
			1730	575.268				Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
1	1	10		—	.036	.122	.12	141			67	78	78	2
2	2	20		579.55	.053	.205	.21	147			62	80	78	2
3	3	30		581.95	.055	.206	.21	166			59	81	78	2
4	4	40		583.76	.031	.121	.12	197			57	84	79	2
5	5	50		585.74	.040	.155	.16	203			58	84	80	2
6	6	60		587.71	.035	.141	.14	182			56	86	82	2
7	7	70		—	.040	.175	.18	129			56	87	83	2
8	8	80		591.98	.038	.152	.15	186			56	88	84	2
9	9	90		593.87	.033	.132	.13	188			56	89	84	2
10	10	100		595.91	.036	.142	.14	195			58	89	85	2
11	11	110		597.77	.033	.129	.13	204			56	89	86	2
12	12	120		599.52	.030	.114	.11	226			57	89	85	2
13	12	130		601.70	.044	.181	.18	169			58	88	85	2
14	11	140		603.56	.035	.149	.15	149			55	89	86	2
15	★ 10	150	2000 / 2004	605.697 / 605.697	.035	.147	.15	159			57	89	85	2
16	9	160		608.13	.045	.183	.18	176			54	88	86	2
17	8	170		610.26	.034	.139	.14	173			55	89	85	2
18	7	180		612.25	.036	.151	.15	161			56	89	86	2
19	6	190		613.91	.022	.092	.09	160			56	90	86	2
20	5	200		615.54	.023	.100	.10	134			58	90	86	2
21	4	210		—	.023	.092	.09	188			58	90	86	2
22	3	220		618.68	.021	.080	.08	218			58	89	86	2
23	2	230		620.15	.020	.077	.08	217			58	89	86	2
24	1	240	2134	621.77	.028	.107	.11	219			58	89	87	2
25														

Notes: used the stack temp. of the ODEQ 5 for point #12 because the thermocouple was out of the stack.

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★ Paused at 150 min. to check the ph. (2000)
- Resumed at (2004)

Field Data Sheet

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: Bullseye Glass
Facility Location: Portland, OR
Source: Furnace T-7
Sample Location: Inlet

Date 4/27/16
Test Method 0061
Concurrent Testing ODEQ 5
Run # 2
Operator John Support Joe H.
Temperature, Ambient (Ta) 75°F
Moisture ~3% Tdb 156 Twb 95
Press., Static (Pstat) -0.3 Press., Bar (Pb) 30.1
Cyclonic Flow Expected ? No If yes, avg. null angle — degrees

Glass Nozzle Measurements

1	.2580	.2583
2	.2580	
3	.2590	

ALT-011
Std TC (ID/°F) 32/75
Stack TC (ID/°F) 2-1 / 74
Continuity Check ↑ or ↓

Probe ~~2-22-1~~ (G/S) Cp .8248 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @20 Post — @ —
Lo 0 @12 — @ —
Nozzle .2583 Oven — Imp. Outlet |-35
Filter — Heat Set — °F
Meter Box 2 dH@ 1.97675 Y 0.99949
Meter Leak Check .001 @ 7 Pretest: .012 cfm ~~10~~ inHg
Post: — cfm — inHg

#	Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2O (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
			2134	621.77				Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
1	1	250		623.74	.035	.139	.14	191			58	89	87	2
2	2	260	2156	625.73	.033	.143	.14	163			56	89	86	2
3	3	270	2159	627.97	.029	.126	.13	156			56	89	86	2
4	4	280		~~631.~~	.023	.099	.10	167			52	89	86	2
5	5	290		631.50	.022	.093	.09	180			55	89	86	2
6	6	300	2241	633.14	.022	.090	.09	213			57	89	86	2
7	7	310	2310	634.58	.018	.071	.07	224			58	89	86	2
8	8	320		636.74	.038	.166	.17	156			60	85	85	2
9	9	330	2339	639.40	.055	.245	.25	144			56	85	85	2
10	10	340	2343	642.20	.058	.251	.25	162			52	86	83	2
11	11	350		644.81	.059	.245	.25	187			53	86	83	2
12	12	360	0009	647.37	.066	.265	.27	211			52	87	83	~~2~~ 3
13	12	370		650.04	.064	.253	.25	221			51	87	83	3
14	11	380		652.71	.060	.235	.24	227			51	87	83	3
15	10	390		655.41	.065	.270	.27	188			53	87	83	3
16	9	400		657.—	.042	.185	.19	151			52	87	83	2
17	8	410		659.90	.044	.198	.20	137			54	87	83	2
18	7	420		661.77	.022	.098	.10	145			54	87	83	2
19	6	430		663.404	.021	.094	.09	139			56	87	83	2
20	5	440		664.885	.020	.0898	.09	139			56	87	83	2
21	4	450		666.186	.015	.062	.06	190			56	86	83	2
22	3	460		667.628	.022	.086	.09	209			57	86	83	2
23	2	470		668.985	.020	.079	.08	221			57	86	83	2
24	1	480	02:09	670.246	.019	~~.079~~ .08	.079	189			56	86	83	2
25														

(Notes on Back)

Notes: * 262 min. → paused to check ph ~~2159~~ (2156) → Resumed at (2159)
* 305 min. → Paused to allow plant personell to purge. (2241) → Resumed at (2310)
* PORT CHANGE @ 02:09

More Notes on Back

Ø Paused ~~att~~ at 334 min, (2339) <Checking the ph again>
- Resumed at (2343)

Field Data Sheet

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: Bullseye
Facility Location: Portland, OR
Source: Furnace T-7
Sample Location: Inlet

Date 4/27/16 - 4/28/16
Test Method 006
Concurrent Testing M5
Run # 2
Operator BC Support JM, JF, BS
Temperature, Ambient (Ta)
Moisture ~3% Tdb Twb
Press., Static (Pstat) -0.3 Press., Bar (Pb) 30.10
Cyclonic Flow Expected ? N If yes, avg. null angle – degrees

Glass Nozzle Measurements

1 .2580
2 .2580 } .2583 Teflon
3 .2590

ALT-011
Std TC (ID/°F) 75° SL
Stack TC (ID/°F) 74° 2-1
Continuity Check ↑ or ↓

Probe 2-1 ~~(g/s)~~ Cp .8048 Heat Set – °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @20 Post – @ –
Lo 0 @12 – @ –
Nozzle .2583 Oven – Imp. Outlet ~~<20~~ <35 JH
Filter – Heat Set – °F
Meter Box 2 dH@ 1.97675 Y 0.99949
Meter Leak Check Pretest: .001 cfm 7 inHg
Post: – cfm – inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2O (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
		02:38	670 ~~470~~ BC .246				Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
1	490		671.663	.017	.076	.08	138			56	82	83	2
2	500		673.173	.022	.098	.10 ~~.10~~ BC	140			58	84	82	2
3	510		674.598	.021	.093	.09	143			56	84	81	2
4	520		675.813	.016	.073	.07	130			57	85	81	2
5	530		677.088	.017	.077	.08	133			57	84	82	2
6	540		678.319	.015	.067	.07	134			57	85	82	2
7	550		679.739	.021	.096	.10	127			58	85	82	2
8	560		681.490	.030	.132	.13	149			58	84	81	2
9	570		683.563	.036	.156	.16	156			58	85	81	2
10	580		685.064	.025	.108	.11	159			56	84	81	2
11	590		686.526	.022	.095	.10	160			BC 57	84	81	2
12	600		688.095	.023	.100	.10	155			58	84	80	2
13 12	610		689.712	.022	.095	.10	161			57	84	81	2
14 11	620		691.371	.027	.117	.12	158			58	85	81	2
15 10	630		692.987	.026	.113	.11	159			58	85	82	2
16 9	640		694.599	.031	.133	.13	165			57	86	82	2
17 8	650	05:30	696.289	.030	.131	.13	153			57	84	81	2
☆ 18 7	660	06:45	697.900	.024	.105	.11	156			56	84	81	3
19 6	670		699.013	.016	.070	.07	149			58	82	79	3
20 5	680		700.240	.019	.084	.08	148			59	83	79	3
21 4	690		701.481	.015	.067	.07	140			60	84	80	3
22 3	700		702.445	.014	.063	.06	137			60	83	79	3
23 2	710		703.583	.015	.066	.07	145			60	83	80	3
24 1	720		704.724	.015	.067	.07	139			60	82	79	3
25 1	730		705.860	.013	.058	.06	142			61	82	79	3

Notes: ☆ PAUSED FOR pH CHECK @ 05:30

Field Data Sheet

PAGE 4 OF 4

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: BULLSEYE GLASS
Facility Location: PORTLAND, OR
Source: FURNACE T-7
Sample Location: ~~OUTLET~~ Inlet PS 5/9/16

Date 4/27/16 ~ 4/28/16
Test Method 0061
Concurrent Testing M5
Run # 2
Operator BC Support JM, JF, BS
Temperature, Ambient (Ta)
Moisture ~3% Tdb Twb
Press., Static (Pstat) -0.3 Press., Bar (Pb) 30.10
Cyclonic Flow Expected ? N If yes, avg. null angle — degrees

Glass Nozzle Measurements
1 .2580
2 .2680 } .2683
3 .2590

ALT-011
Std TC (ID/°F) 75° JL
Stack TC (ID/°F) 74° 2-1
Continuity Check ↑ or ↓

Probe 2-1 (g/s) Cp .8248 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @20 Post 0 @10
Lo 0 @12 0 @6
Nozzle .2583 Oven — Imp. Outlet <35
Filter — Heat Set — °F
Meter Box 2 dH@ 1.97675 Y 0.99949
Meter Leak Check Pretest: 0.001 cfm 7 inHg
Post: 0.010 cfm 5 inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2) (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts) Amb:	PROBE °F (Tp) Amb:	OVEN Filter °F (To) Amb:	IMPINGER Outlet °F (Ti) Amb:	METER Inlet/Avg. °F (Tm-in) Amb:	METER Outlet °F (Tm-out) Amb:	Pump Vacuum inHg (Pv)
2	740		707.037	.017	.075	.08	143			60	83	80	3
3	750		708.100	.016	.070	.07	149			60	82	79	3
4	760		709.301	.017	.076	.08	141			61	82	79	3
5	770		710.792	.021	.095	.10	133			61	82	80	3
6	780		712.292	.024	.107	.11	139			60	82	79	3
7	790		713.652	.021	.092	.09	150			60	81	78	3
8	800		714.757	.016	.071	.07	142			60	80	78	3
9	810		715.840	.016	.071	.07	139			60	81	78	3
10	820		717.542	.031	.137	.14	141			61	80	78	3
11	830		719.207	.029	.128	.13	143			60	81	78	3
12	840		720.354	.015	.066	.07	146			61	82	78	3
12	850		721.466	.016	.071	.07	145			61	82	79	3
11	860		722.816	.018	.081	.08	136			61	82	78	3
10	870		724.408	.026	.117	.12	134			62	82	79	3
9	880		726.134	.029	.130	.13	133			62	82	78	3
8	890	09:30	726.733	.030	.135	.14	134			63	82	79	3
7													
6													

Notes:

Field Data Sheet

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

- At 1735 did a wet bulb/dry bulb, Dry=205 wet=115 ~ 6.8%

Client: Bullseye Glass
Facility Location: Portland, OR.
Source: Furnace T-7
Sample Location: Inlet

Date 4/28/16
Test Method 0061
Concurrent Testing ODEQ 5
Run # 3

Glass Nozzle Measurements
1 .2580
2 .2580
3 .2590
Teflon .2583

Probe 2-2 (g/s) Cp .8364 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @ 15 Post —@—
Lo 0 @ 16 —@—

Operator John Support Joe H.
Temperature, Ambient (Ta) 86°F
Moisture ~3% Tdb — Twb —
Press., Static (Pstat) -.3 Press., Bar (Pb) 30.1
Cyclonic Flow Expected ? NO If yes, avg. null angle ____ degrees

ALT-011
Std TC (ID/°F) JL / 86°F
Stack TC (ID/°F) 2-2 / 86°F
Continuity Check ↑ or ↓

Nozzle .2583 Oven — Imp. Outlet 1-20
Filter — Heat Set — °F
Meter Box 2 dH@ 1.97675 Y 0.99949
Meter Leak Check Pretest: .010 cfm 8 inHg
Post: — cfm — inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2O (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
		1700	727.156				Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
1 12	10		729.24	.039	.173	.17	151			66	85	84	2
2 11	20		731.36	.037	.163	.16	153			65	85	84	2
3 10	30		733.50	.041	.169	.17	197			65	86	84	2
4 9	40		735.48	.032	.131	.13	202			65	88	85	2
5 8	50		737.15	.021	.087	.09	198			64	90	87	2
6 7	60		738.82	.026	.102	.10	196			63	92	87	2
7 6	70		740.60	.025	.108	.11	153			62	93	89	2
8 5	80		742.26	.027	.102	.10	236			62	95	90	2
9 4	90		744.37	.043	.161	.16	249			63	95	91	2
10 3	100		746.19	.031	.116	.12	252			60	96	92	2
11 2	110		748.70	.061	.227	.23	256			62	97	93	3
12 1	120		751.60	.067	.282	.28	187			58	98	93	3
13 1	130		754.63	~~.305~~ .071	.305	.31	174			56	100	94	3
14 2	140		757.35	.062	.245	.25	242			56	100	95	3
15 3	150	1930	760.28	.072	.279	.28	253			58	100	95	3
16 4	160		762.41	.038	.146	.15	262			55	100	95	3
17 5	170		764.71	.046	.180	.18	252			57	99	95	3
18 6	180		766.70	.030	.119	.12	243			56	98	95	2
19 7	190		768.72	.030	.137	.14	149			57	98	95	3
20 8	200		770.68	.030	.139	.14	138			58	97	95	3
21 9	210		772.19	.019	.081	.08	189			57	97	95	2
22 10	220		773.70	.020	.081	.08	223			60	97	94	2
23 11 *	230	2050 / 2118	775.680	.021	.082	.08	253			61	96	93	3
24 12	240	2128	778.23	.054	.226	.23	201			66	94	93	3
25													

JL 4/28/16

Did a wet bulb/dry bulb at 2050 wet → 115 dry → 225 ~ 6%

Notes: * Paused at 2050 to allow plant personell to purge. (230 min. of run time) (Also checked the ph at this time)
- Resumed testing at 2118

Field Data Sheet

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HORIZON ENGINEERING
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: Bullseye Glass
Facility Location: Portland, OR.
Source: Furnace T-7
Sample Location: Inlet

Date 4/28/16
Test Method OO61
Concurrent Testing ODEQ 5
Run # 3

Glass Nozzle Measurements
1 .2580
2 .2580
3 .2590
.2583

Teflon Probe 2-2 (g/s) Cp .8364 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @15 Post — @ —
Lo 0 @16 — @ —

Operator John L. Support Joe H.
Temperature, Ambient (Ta) 76°F
Moisture ~3% Tdb — Twb —
Press., Static (Pstat) +0.3 Press., Bar (Pb) 30.10
Cyclonic Flow Expected ? NO If yes, avg. null angle — degrees

ALT-011
Std TC (ID/°F) JL/86°F
Stack TC (ID/°F) 2-2/86°F
Continuity Check ↑ or ↓

Glass Nozzle .2583 Oven — Imp. Outlet 1-20
Filter — Heat Set — °F
Meter Box 2 dH@ 1.97675 Y 0.99949
Meter Leak Check Pretest: .010 cfm 8 inHg
Post: — cfm — inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2O (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
							Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
		2128	778.23										
1	250		780.55	.046	.195	.20	191			57	93	92	3
2	260		782.86	.040	.181	.18	152			57	94	91	3
3	270		784.71	.028	.119	.12	192			56	94	91	2
4	280		786.19	.023	.094	.09	215			59	93	91	2
5	290		787.61	.013	.053	.05	209			61	93	91	2
6	300		788.97	.020	.079	.08	233			64	93	91	3
7	310		790.70	.024	.098	.10	212			61	93	91	3
8	320		792.96	.042	.181	.18	182			58	94	91	4
9	330		795.74	.061	.270	.27	165			53	95	92	4
10	340		—	.069	.309	.31	158			50	96	91	4
11	350	2327	801.78	.074	.326	.33	169			50	96	91	5
12	360	2331 2332	804.82	.081	.351	.35	179			49	96	92	5
13	370		~~607~~ 807.65	.068	.276	.28	222			53	95	92	5
14	380		810.50	.075	.300	.30	232			50	95	92	~~7~~ 9 JL 4/28/16
15	390		812.82	.047	.186	.19	240			49	95	92	6
16	400		815.24	.051	.215	.22	194			52	94	91	10
17	410		817.10	.029	.122	.12	170			52	94	91	8
18	420		818.72	.024	.107	.11	158			55	94	91	8
19	430	0046	820.11	.020	.089	.09	160			57	93	91	8
20	440	1302	822.08	.024	.114	.11	121			57	93	90	15 →
21	450		823.487	.023	.093	.09	220			63	91	89	2
22	460		824.885	.022	.089	.09	217			63	91	89	2
23	470		826.432	.028	.112	.11	220			61	91	89	2
24	480	0147	827.991	.026	.104	.10	226			62	91	89	2
25													

Vacuum 2 in. after leak check

Notes: * Paused at 2327 to check ph. - Resumed testing at ~~2332~~ 2331 (359 min. of testing)

B:\Shared files\Field\Data Sheets\Method 5\Method 5_v2.pdf

Paused at (434 min) 0046 - leak check .014 @ 16 in Hg → shook up the silica gel to decrease the vacuum.
DGM volume = 821.032

(NOTES Continue on Back)

Leak check after shaking siliza gel .011 @ 7 in Hg

DGM = 821,245 before resuming. → Resumed testing at 1302

Field Data Sheet

PAGE 3 of 4

HORIZON ENGINEERING
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: BULLSEYE GLASS
Facility Location: PORTLAND, OR
Source: FURNACE 1-7
Sample Location: BH INLET

Date 4/28/16 - 4/29/16
Test Method 0061
Concurrent Testing M5
Run # 3
Operator BC Support JM, CH, BS, PB
Temperature, Ambient (Ta)
Moisture ~ 3% Tdb — Twb —
Press., Static (Pstat) -0.3 Press., Bar (Pb) 30.10
Cyclonic Flow Expected ? N If yes, avg. null angle — degrees

Glass Nozzle Measurements
1 .2580"
2 .2580
3 .2593
.2583

ALT-011
Std TC (ID/°F) 86° JL
Stack TC (ID/°F) 86° 2-2
Continuity Check ↑ or ↓

Probe 2-2 (B/S) Cp .8304 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @15 Post — @ —
Lo 0 @16 — @ —
Nozzle .2583 Oven — Imp. Outlet 120
Filter — Heat Set — °F
Meter Box 2 dH@ 1.97675 Y 0.99949
Meter Leak Check Pretest: 0.011 cfm 7 inHg
Post: — cfm — inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2) (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
							Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
		02:14	827.991										
1	490		829.240	.016	.071	.07	162			62	90	88	2
2	500		830.600	.019	.084	.08	160			62	89	87	2
3	510		832.168	.022	.098	.10	158			62	88	86	2
4	520		833.589	.018	.081	.08	147			60	88	86	2
5	530		834.982	.020	.087	.09	170			59	88	86	2
6	540		836.070	.013	.056	.06	178			60	88	86	2
7	550		837.237	.014	.060	.06	177			61	88	86	2
8	560		838.152	.010	.043	.04	182			60	88	86	2
9	570		839.260	.014	.061	.06	167			61	89	86	2
10	580		840.332	.012	.053	.05	164			59	89	87	2
11	590		841.442	.016	.068	.07	182			60	89	87	2
12	600		842.576	.014	.062	.06	155			60	89	87	2
13 12	610		843.628	.014	.063	.06	147			58	89	87	2
14 11	620		844.856	.015	.067	.07	150			59	89	86	2
15 10	630		846.241	.020	.091	.09	146			60	89	86	2
16 9	640		847.539	.017	.076	.08	150			56	88	86	2
17 8	650		848.646	.014	.059	.06	182			56	88	86	2
18 7	660		849.745	.014	.063	.06	146			57	89	86	2
19 6	670		850.990	.017	.078	.08	137			56	89	86	2
20 5	680		852.087	.012	.056	.06	140			56	88	86	2
21 4	690		852.977	.011	.049	.05	157			57	88	86	2
22 3	700		854.138	.017	.075	.08	161			59	87	86	2
✱ 23 2	710	[illegible]:05 [illegible]:13	855.269	.013	.057	.06	167			59	88	86	2
24 1	720		856.347	.012	.052	.05	171			60	87	86	2
25 1	730		—	.015	.066	.07	163			59	86	84	2

Notes:
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PAUSE FOR pH CHECK

Field Data Sheet

PAGE 4 of 4

HORIZON ENGINEERING
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: BULLSEYE GLASS
Facility Location: PORTLAND, OR
Source: FURNACE T-7
Sample Location: INLET

Date 4/28/16 – 4/29/16	Glass Nozzle Measurements		Probe 2-2 (g/s) Cp .836 Heat Set — °F
Test Method 0501	1	.2580	Post-Test Pitot Inspection (NC=no change, D=damaged)
Concurrent Testing M5	2	.2580 } .2583	Pitot Lk Rate Pre: Hi 0 @15 Post 0 @ 7
Run # 3	3	.2590	in H2O@in H2O Lo 0 @16 0 @ 6
Operator RC Support JM, CH, BS, PB	ALT-011		Nozzle .2583 Oven — Imp. Outlet 1-20
Temperature, Ambient (Ta)	Std TC (ID/°F) 86° JL		Filter — Heat Set — °F
Moisture ~3% Tdb — Twb —	Stack TC (ID/°F) 86° 2-2		Meter Box 2 dH@ 1.9775 Y 0.9949
Press., Static (Pstat) ~0.3 Press., Bar (Pb) 30.10	Continuity Check ↑ or ↓		Meter Leak Check Pretest: 0.011 cfm 7 inHg
Cyclonic Flow Expected ? N If yes, avg. null angle — degrees			Post: 0.014 cfm 16 inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2O (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
			—				Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
1 2	740		858.599	.013	.057	.06	162			60	88	86	2
2 3	750		859.634	.012	.053	.05	163			58	87	85	2
3 4	760		860.785	.012	.053	.05	159			58	86	84	2
4 5	770		862.156	.015	.066	.07	161			58	86	84	2
5 6	780		863.542	.018	.079	.08	161			57	87	84	2
* 6 7	790	07:23 / 07:26	864.725	.013	.056	.06	179			58	87	84	2
7 8	800		866.200	.020	.085	.09	183			57	87	85	2
8 9	810		867.738	.022	.101	.10	134			58	87	85	2
9 10	820		869.219	.019	.087	.09	140			57	88	85	2
10 11	830		870.403	.011	.058	.06	138			59	88	86	2
11 12	840		871.714	.015	.071	.07	120			58	88	86	2
12 12	850		873.100	.016	.075	.08	124			60	89	86	2
13 11	860		874.597	.019	.089	.09	121			61	89	87	2
14 10	870		875.977	.016	.073	.07	145			60	90	86	2
15 9	880	09:06	876.368	.014	.061	.06	163			60	89	86	2
16 8	890												
17 7	900												
18 6													
19 5													
20 4													
21 3													
22 2													
23 1													
24													
25													

Notes:

Field Data Sheet

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

.210
.210 .2096
.209

Glass Nozzle Measurements

1	~~.256~~	.2556
2	~~.256~~	
3	~~.255~~	MV 4/28/16

Client: Bullseye Glass
Facility Location: Portland, OR
Source: Furnace T7
Sample Location: outlet

Date 4/28/16
Test Method 0061
Concurrent Testing 5, 3A Gases
Run # 2
Operator MV Support PT, JH
Temperature, Ambient 73 (Ta)
Moisture 3% Tdb — Twb —
Press., Static (Pstat) 1 Press., Bar (Pb) 30.1
Cyclonic Flow Expected ? No If yes, avg. null angle — degrees

ALT-011
Std TC (ID/°F) MV / 74
Stack TC (ID/°F) 2-1 / 73
Continuity Check ↑ or ↓

Probe 2-1 (g / s) Cp .8248 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @6 Lo 0 @6 Post — @ — / — @ —
Nozzle ~~.2556~~ .2096 Oven — Imp. Outlet 1-35
Filter — Heat Set — °F
Meter Box 29 dH@ 1.739 Y 0.98764
Meter Leak Check Pretest: 0.005 cfm 5 inHg Post: — cfm — inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2) (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
			463.489				Amb: 135	Amb:	Amb:	Amb: 63	Amb: 68	Amb: 68	
1	10	1700	465.39	.07	.11	.11	141			40	65	66	1
2	20		467.30	.07	.11	.11	139			63	68	67	1
3	30		469.01	.06	.10	.10	132			62	68	66	1
4	40		470.400	.04	.06	.06	150			62	68	68	1
5	50		472.491	.06	.094	.09	163			65	70	68	1
6	60		473.107	.02	.03	.03	167			63	71	69	1
7	1:10		474.678	.04	.06	.06	156			64	71	69	1
8	1:20		475.815	.03	0.05	0.05	155			63	72	70	1
9	1:30		477.128	.03	.05	.05	170			63	72	70	1
10	1:40		478.634	.04	.06	.06	172			63	73	71	1
11	1:50		480.040	.04	.06	.06	162			62	73	71	1
12	2:00		481.504	.05	.08	.08	120			60	68	68	1
13	2:10		483.165	.05	.08	.08	122			58	68	67	1
14	2:20		484.423	.04	.06	.06	143			57	67	65	1
15	2:30		485.885	.04	.06	.06	167			57	67	65	1
16	2:40		487.244	.04	.06	.06	178			57	66	64	1
17	2:50		488.726	.05	.075	.08	182			57	66	64	1
18	3:00		490.119	.04	.06	.06	176			57	66	64	1
19	3:10		491.421	.03	.046	.05	160			57	65	63	1
20	3:20		492.601	.04	.064	.06	140			57	65	63	1
21	3:30		493.840	.03	.047	.05	155			58	65	63	1
22	3:40		494.905	.05	.077	.08	166			58	65	63	1
23	3:50		496.610	.05	.076	.08	172			58	65	63	1
24	4:00		497.256	.01	.015	.02	176			57	65	63	1
25	4:10		497.887	.01	.015	.02	150			58	65	63	1

Notes:

Field Data Sheet

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: Bullseye Glass
Facility Location: Portland, OR
Source: Furnace F7
Sample Location: Outlet

Date 4/28/16
Test Method 0061
Concurrent Testing 5, 3A (gasses)
Run # 3

Glass Nozzle Measurements
1 .210
2 .210
3 .209
.2096

Probe 2-1 (g/s) Cp .8248 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @6 Lo 0 @6 Post — @ —

Operator MV Support PT, JH
Temperature, Ambient 73 (Ta)
Moisture 3 %, Tdb — Twb —
Press., Static (Pstat) 1 Press., Bar (Pb) 30.1
Cyclonic Flow Expected ? NO If yes, avg. null angle — degrees

ALT-011
Std TC (ID/°F) MV 74
Stack TC (ID/°F) 2-1 73
Continuity Check ↑ or ↓

Nozzle .2096 Oven — Imp. Outlet 1-35
Filter — Heat Set — °F
Meter Box 29 dH@ 1.739 Y 0.98764
Meter Leak Check Pretest: 0.005 cfm 5 inHg Post: — cfm — inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2 (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
							Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
1	4:20		499.656	.06	.095	.01	151			59	65	63	1
2	4:30		500.951	.03	.047	.05	158			58	66	64	1
3	4:40		502.135	.03	.047	.05	154			58	66	65	1
4	4:50		503.825	.05	.081	.08	138			58	67	65	1
5	5:00		505.232	.05	.079	.08	150			57	67	65	1
6	5:10		506.616	.04	.062	.06	158			58	68	65	1
7	5:20		507.915	.04	.062	.06	163			59	68	65	1
8	5:30		509.440	.05	.078	.08	161			59	67	65	1
9	5:40		511.024	.05	.085	.09	110			57	66	65	1
10	5:50		512.666	.05	.085	.09	140			57	66	64	1
11	6:00		514.195	.05	.082	.08	127			57	66	64	1
12	6:10		515.800	.06	.097	0.10	135			57	66	64	1
13	6:20		517.621	.06	.10	0.10	120			57	66	64	1
14	6:30		519.307	.05	.08	.08	138			56	65	63	1
15	6:40		520.630	.04	.06	.06	152			56	65	62	1
16	6:50		521.888	.03	.046	.05	164			57	65	62	1
17	7:00		523.140	.03	.046	.05	167			57	65	62	1
18	7:10		524.380	.03	.047	.05	158			57	65	62	1
19	7:20		525.898	.05	.079	.08	147			57	65	63	1
20	7:30		527.341	.05	.080	.08	139			56	65	63	1
21	7:40		529.235	.06	.096	.10	136			55	64	62	1
22	7:50		531.022	.06	.099	.10	123			55	64	62	1
23	8:00	1:09	532.496	.05	.079	.08	144			54	64	62	1
24	8:10	1:33	~~533~~ 532.751	.07	.11	.11	150			55	62	63	1
25	8:20		535.315	.07	.11	.11	142			55	64	63	1

Notes:

532.496 } leak check
532.752 } 0.005 @ 5"

B:\Shared files\Field\Data Sheets\Method 5\Method 5_PDX-v1.pdf

Restart 24 (1:33) at 1:38

2 of 4

Field Data Sheet

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: Bulls eye Glass
Facility Location: Portland, OR
Source: Furnace T7
Sample Location: outlet

Date 4/28/16
Test Method 0061
Concurrent Testing 5, gasses
Run # 3

Glass Nozzle Measurements
1 .210
2 .210
3 .209

Probe 2-1 (g / s) Cp .8248 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @ 6 Lo 0 @ 6 Post — @ — — @ —

Operator MV Support PT, JH
Temperature, Ambient (Ta) —
Moisture 3% Tdb — Twb —
Press., Static (Pstat) / Press., Bar (Pb) 30.1
Cyclonic Flow Expected ? No If yes, avg. null angle — degrees

ALT-011
Std TC (ID/°F) MV / 74
Stack TC (ID/°F) 2-1 / 73
Continuity Check ↑ or ↓

Nozzle .2096 Oven — Imp. Outlet 1-35
Filter — Heat Set — °F
Meter Box 29 dH@ 1.739 Y 0.98764
Meter Leak Check Pretest: 0.005 cfm 15 inHg Post: — cfm — inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cft (Vm)	Velocity Head in H2O (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
			—				Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
1	8:30		537.164	.03	.048	.05	129			56	64	61	1
2	8:40		538.965	.08	.127	.13	135			57	64	60	1
3	8:50		—	.07	.111	.11	135			56	64	61	1
4	9:00		542.499	.07	.111	.11	132			54	65	62	1
5	9:10		544.364	.07	.111	.11	132			55	65	61	1
6	9:20		545.871	.07	.111	.11	130			54	62	60	1
7	9:30		547.105	.05	.079	.08	129			55	64	62	1
8	9:40		549.220	.08	.131	.13	131			56	64	60	1
9	9:50		550.462	.05	.082	.08	133			55	63	62	1
10	10:00		551.631	.04	.065	.07	133			56	64	61	1
11	10:10		552.789	.03	.049	.05	129			56	64	62	1
12	10:20		553.571	.03	.049	.05	125			56	64	63	1
13	10:30		555.037	.03	.049	.05	128			56	63	64	1
14	10:40		556.218	.03	.049	.05	121			56	63	63	1
15	10:50		—	.03	.049	.05	131			54	65	64	1
16	11:00		558.509	.05	.082	.08	131			55	64	64	1
17	11:10		560.005	.03	.049	.05	131			56	63	62	1
18	11:20		561.527	.03	.049	.05	132			51	64	62	1
19	11:30		563.017	.03	.049	.05	134			56	62	61	1
20	11:40		564.096	.03	.049	.05	132			54	63	61	1
21	11:50		565.107	.03	.049	.05	130			55	~~63~~ 62	61	1
22	12:00		566.062	.03	.049	.05	129			53	62	62	1
23	12:10		567.288	.03	.049	.05	128			54	64	62	1
24	12:20		568.133	.03	.049	.05	129			52	64	63	1
25	12:30		569.003	.03	.049	.05	129			53	62	62	

Notes:

Field Data Sheet

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: Bullseye Glass
Facility Location: Portland, OR
Source: Furnace T7
Sample Location: Outlet

Date 4/29/16
Test Method 5 0061
Concurrent Testing 5
Run # 3

Glass Nozzle Measurements
1 .210
2 .210
3 .209

Probe 2-1 (g / s) Cp .8248 Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0 @ 6 Post 0 @6; Lo 0 @ 6 0 @6

Operator MV Support PT, JH
ALT-011
Nozzle .2096 Oven — Imp. Outlet 1-35
Temperature, Ambient (Ta) —
Std TC (ID/°F) 2-1 / 74
Filter — Heat Set — °F
Moisture 3% Tdb — Twb —
Stack TC (ID/°F) MV / 73
Meter Box 29 dH@ 1.739 Y 0.98764
Press., Static (Pstat) 1 Press., Bar (Pb) 30.1
Continuity Check ↑ or ↓
Meter Leak Check Pretest: 0.005 cfm 5 inHg; Post: .012 cfm 6 inHg
Cyclonic Flow Expected ? NO If yes, avg. null angle — degrees

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2) (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
			—				Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
1	12:40		570.251	.03	.049	.05	127			52	62	62	1
2	12:50		572.113	.03	.049	.05	124			52	61	61	1
3	13:00		573.973	.03	.049	.05	123			52	60	61	1
4	13:10		574.149	.03	.049	.05	122			52	62	61	1
5	13:20		575.154	.03	.049	.05	123			51	61	61	1
6	13:30		576.164	.03	.049	.05	123			52	62	61	1
7	13:40		577.172	.03	.049	.05	123			52	61	61	1
→ 8	13:50		579.223	.02	.0328	.03	125			56	63	62	1
9	14:00		580.435	.02	.0328	.03	125			57	65	64	1
10	14:10		581.561	.02	.0328	.03	125			58	64	64	1
11	14:20		~~—~~	.02	.0328	.03				58	64	64	1
12	14:30		583.627	.03	.049	.05	123			58	66	65	1
13	14:40		584.721	.02	.328	.03	118			60	68	65	1
14	14:50		585.807	.02	.328	.03	115			60	67	66	1
15	15:00		586.009	.02	.328	.03	119			60	67	66	1
16	15:10	9:00	587.579	.02	.328	.03	119			59	66	67	1
17	15:20												
18	15:30												
19	15:40												
20	15:50												
21	16:00												
22	16:												
23													
24													
25													

Notes:

4 of 4

→ Pause @ 7:33
restart @ 7:39 (8

Sample Recovery / Moisture Catch

BULLSEYE GLASS
GLASS FURNACE T7 -INLET
PORTLAND OR
0061

26-Apr-16
JTF,JH,JL,BC,BS,PB,CH
MEW

Definitions	Symbol	Units	Run 1a	Run 1b	Run 1c	Run 2	Run 3
Impinger Contents							
	Impinger, Contents,Condensate & Rinse	g	606.20	578.00	593.00	588.00	656.00
	Impinger, Contents & Condensate	g	366.00	385.00	400.00	450.00	453.20
spg (g/ml)	Impinger	g	104.70	104.20	104.80	105.00	104.00
1.025	0.5M KOH (0.5N)	ml	300.00	300.00	300.00	300.00	300.00
1.0016	0.1 N HNO3	ml	0.00	0.00	0.00	0.00	0.00
	Condensate	g	-46.20	-26.70	-12.30	37.50	41.70
	0.5M KOH (0.5N)	ml	300.00	300.00	300.00	300.00	300.00
	0.1 HNO3	ml	239.81	192.69	192.69	137.78	202.47
	Sample Correction Volume	ml	534.34	488.29	488.29	434.63	497.85
	Sample sent to lab	ml	489.27	462.24	476.29	471.22	538.54
	Sample received by lab	ml	500.00	460.00	485.00	480.00	545.00
	Diff		2.2%	-0.5%	1.8%	1.9%	1.2%
Silica Gel Impinger	Final weight	g	1,431.00	765.00	941.00	830.00	904.00
	Initial weight	g	1,381.00	745.00	926.40	797.00	881.00
		g	23.00	1.70	5.50	4.40	34.90
	Gain	g	73.00	21.70	20.10	37.40	57.90
Total Moisture Gain	Condensate + Silica Gel gain	g	26.80	-5.00	7.80	74.90	99.60
Vlc	**Net Moisture Gain**	ml	26.85	0.00	7.81	75.04	99.78
	Net Moisture Gain	ml			34.66		
General Remarks	Sample Appearance		clear	clear	clear	lt grn	lt grn
	Container Marked		yes	yes	yes	yes	yes
	pH of Condensate		9.00	9.00	9.50	9.50	9.50

MONTROSE AIR QUALITY SERVICES

13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505
www.montrose-env.com

Sample Recovery Worksheet

Method 0061

Client: Bullseye

Date: 4/26 4/27/16

Facility Location: Portland, OR

Source: Glass Furnace T7

Operator: JF, JH

Sample Location: Inlet

Balance Calibration (1000, 500, 200 g) Tolerance must be within ± 1.0%

Need one per each 3-run test: 998 / 499 / 200

IMPINGER CONTENTS	4/26/16 JH **RUN 1** a	**RUN ~~2~~** 1b	**RUN ~~3~~** 1c
Container, condensate & rinse, grams	~~571~~ 606.2	578	593
Container & condensate, grams	366	385	400
Empty container, grams	104.7	104.2	104.8
Initial volume, ml	300	300	300
Initial contents	.5N KOH	KOH	KOH
Initial concentration	0.5 M	0.5 M	0.5 M
Net water gain, ml			
Condensate appearance	Clear	Clear	Clear
Level marked on container	✓	✓	✓
pH of condensate	~9	~9	~9.5
Rinsed with	DI H_2O / 0.1 N HNO_3		
Solvent Name and Lot No.	DI H_2O: 2122 →	→	
Solvent Name and Lot No.	HNO_3: 1856 →	→	

SILICA GEL (w/impinger, top off)			
Final weight, grams	791 640	SF 4/27/16 ~~745~~ 765	941
Initial weight, grams	741 520 620	SF 4-27 520 745	520 926.4
Net gain, grams			

TOTAL MOISTURE GAIN			
Impingers and silica gel, grams			

FILTERS			
Front filter number			
Front filter appearance			
Back filter number			
	4/26 N2 2237	Purge 4/27 03:27-03:57 @ 10 l/min	Purge 4/27 09:53 - @10 l/min

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MONTROSE AIR QUALITY SERVICES

13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505
www.montrose-env.com

Sample Recovery Worksheet

Client: Bullseye
Date: 4/26 - 4/28
Facility Location: Portland OR
Source: T7
Operator: JF JH
Sample Location: Inlet

Balance Calibration (1000, 500, 200 g) Tolerance must be within ± 1.0%
Need one per each 3-run test 998. 1499 1 200

IMPINGER CONTENTS	**RUN 1**	**RUN 2**	**RUN 3**
Container, condensate & rinse, grams		588	656
Container & condensate, grams		450	453.2
Empty container, grams		105	104
Initial volume, ml		300	300
Initial contents		KOH	KOH
Initial concentration		0.5 M	0.5 M
Net water gain, ml			
Condensate appearance		light grn tint	light green
Level marked on container			
pH of condensate		9.5	9.5
Rinsed with		DI H_2O / HNO_3	→
Solvent Name and Lot No.		DI H_2O: 2122	→
Solvent Name and Lot No.		HNO_3	
SILICA GEL (w/impinger, top off)			
Final weight, grams		830	904
Initial weight, grams	520	JF 4-28-11 ~~520~~ 797	~~520~~ 881
Net gain, grams			
TOTAL MOISTURE GAIN			
Impingers and silica gel, grams			
FILTERS			
Front filter number		NA	NA
Front filter appearance			
Back filter number			
		Purge w/ N_2 09:45-10:15 10 L/min	Purge w N_2 09:27-09:57 10 L/min

Sample Recovery / Moisture Catch

BULLSEYE
GLASS FURNACE T7 -OUTLET
PORTLAND OR

28-Apr-16
JTF,JH,JL,BC,BS,PB,CH

MEW

Definitions		Symbol	Units	Run 3
Impinger Contents				
		Impinger, Contents,Condensate & Rinse	g	596.00
		Impinger, Contents & Condensate	g	423.00
	spg (g/ml)	Impinger	g	105.00
	1.025	0.5M KOH (0.5N)	ml	300.00
	1.0016	0.1 N HNO3	ml	0.00
		Condensate	g	10.50
		0.5M KOH (0.5N)	ml	300.00
		0.1 HNO3	ml	172.72
		Sample Correction Volume	ml	468.78
		Sample sent to lab	ml	479.02
		Sample received by lab	ml	485.00
		Diff		1.2%
Silica Gel Impinger		Final weight	g	759.00
		Initial weight	g	736.00
			g	
		Gain	g	23.00
Total Moisture Gain		Condensate + Silica Gel gain	g	33.50
Vlc		**Net Moisture Gain**	ml	33.56
General Remarks		Sample Appearance		clear
		Container Marked		yes
		pH of Condensate		9.50

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505
www.montrose-env.com

Sample Recovery Worksheet

Client: Bullseye
Facility Location: Portland, OR
Operator: SF
Date: 4-29-16
Source: Glass Furnace T7
Sample Location: Outlet

Balance Calibration (1000, 500, 200 g) Tolerance must be within ± 1.0%
Need one per each 3-run test 999.1 499.1 ~~500~~ 200

IMPINGER CONTENTS	RUN 1	RUN 2	RUN 3
Container, condensate & rinse, grams			596
Container & condensate, grams			423
Empty container, grams			105
Initial volume, ml			300
Initial contents			KOH
Initial concentration			0.5 M
Net water gain, ml			
Condensate appearance			Clear
Level marked on container			✓
pH of condensate			9.5
Rinsed with			DI H_2O / HNO_3
Solvent Name and Lot No.			DI H_2O: 2122
Solvent Name and Lot No.			HNO_3: 1856

SILICA GEL (w/impinger, top off)	RUN 1	RUN 2	RUN 3
Final weight, grams			759
Initial weight, grams	520	520	~~520~~ 736
Net gain, grams			

TOTAL MOISTURE GAIN	RUN 1	RUN 2	RUN 3
Impingers and silica gel, grams			

FILTERS	RUN 1	RUN 2	RUN 3
Front filter number			NA
Front filter appearance			
Back filter number			

Purge w/ N_2
10:40-11:10
10 L/min

BULLSEYE GLASS
GLASS FURNACE T7

Apr 26-28, 2016
JTF,JH,JL,BC,BS,PB,CI
mew

		RESULTS		BLANK		CORRECTED RESULTS		TOTAL	TOTAL
TOTAL CHROME									
INLET		ml	ug/L	ml	ug/L	ug	mg	mg	mg
1A	FILTER	250	32.4	250	0	8.10	0.0081		
	0.1 N HNO3	250	45.8	250	0	11.45	0.0115		
	KOH	500	1070	790	0.843	534.33	0.5343	0.5539	
1B	FILTER	250	82	250	0	20.50	0.0205		
	0.1 N HNO3	250	16.7	250	0	4.18	0.0042		
	KOH	460	549	790	0.843	251.87	0.2519	0.2765	
1C	FILTER	250	35.1	250	0	8.78	0.0088		
	0.1 N HNO3	250	18.3	250	0	4.58	0.0046		
	KOH	485	1990	790	0.843	964.48	0.9645	0.9778	1.8083
2	FILTER	250	33.6	250	0	8.40	0.0084		
	0.1 N HNO3	250	8.04	250	0	2.01	0.0020		
	KOH	480	2020	790	0.843	968.93	0.9689		0.9793
3	FILTER	250	36.9	250	0	9.23	0.0092		
	0.1 N HNO3	250	2.74	250	0	0.69	0.0007		
	KOH	545	790	790	0.843	429.88	0.4299		0.4398
OUTLET		ml	ug/L	ml	ug/L	ug	mg		mg
3	FILTER	250	26.1	250	0	6.53	0.0065		
	0.1 N HNO3	250	1.1	250	0	0.28	0.0003		
	KOH	485	198	790	0.843	95.36	0.0954		0.1022

		RESULTS		BLANK		CORRECTED RESULTS		TOTAL	TOTAL
HEXAVALENT CHROME									
INLET		ml	ug/L	ml	ug/L	ug	mg	mg	mg
1A	KOH	500	1040	790	0.843	519.33	0.5193	0.5193	
1B	KOH	460	559	790	0.843	256.47	0.2565	0.2565	
1C	KOH	485	2050	790	0.843	993.58	0.9936	0.9936	1.7694
2	KOH	480	2160	790	0.843	1,036.13	1.0361		1.0361
3	KOH	545	790	790	0.843	429.88	0.4299		0.4299
OUTLET		ml	ug/L	ml	ug/L	ug	mg		mg
3	KOH	485	205	790	0.843	98.76	0.0988		0.0988

HORIZON ENGINEERING

PROJECT: 57202-BULLSEYE GLASS

CLIENT # H007
REPORT # 16-271

SUBMITTED BY:
CHESTER LabNet
12242 S.W. GARDEN PLACE
TIGARD, OR 97223
(503)624-2183/FAX (503)624-2653
www.ChesterLab.Net

CHESTER LabNet

12242 SW Garden Place ❖ Tigard, OR 97223-8246 ❖ USA
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Case Narrative

Date: May 5, 2016

General Information

Client:	Horizon Engineering
Client Number:	H007
Report Number:	16-271
Sample Description:	Impinger Trains
Sample Numbers:	16-S425 – 14-S447

Analysis

Analytes:	Cr VI, Total Cr
Analytical Protocols:	SW-846 Method 0061
Analytical Notes:	IC-PCR was used to measure hexavalent chromium and ICP was used to measure total chromium. The filter and probe rinse samples were digested per EPA method 29 and taken to 250 mL prior to analysis by ICP. Results have not been blank corrected.
QA/QC Review:	All of the data have been reviewed by the analysts performing the analyses and the project manager. All of the quality control and sample-specific information in this package is complete and meets or exceeds the minimum requirements for acceptability.
Comments:	If you have any questions or concerns regarding this analysis, please feel free to contact the project manager.
Disclaimer:	This report shall not be reproduced, except in full, without the written approval of the laboratory. The results only represent that of the samples as received into the laboratory.

Paul Duda 5/5/16

Project Manager Date
Paul Duda

Lab ID: 16-S425
Client ID: 1A Teflon Filter Inlet
Site: Bullseye Glass
Sample Date: 4/27/16
Sample Volume: 250. mL

	µg/L		µg/sample	
Analyte	Conc.	MDL	Conc.	MDL
Total Cr	32.4	0.500	8.11	0.125

Lab ID: 16-S426
Client ID: 1A HNO3 Rinse Inlet
Site: Bullseye Glass
Sample Date: 4/27/16
Sample Volume: 250. mL

	µg/L		µg/sample	
Analyte	Conc.	MDL	Conc.	MDL
Total Cr	45.8	0.500	11.5	0.125

Lab ID: 16-S427
Client ID: 1A KOH Imp Inlet
Site: Bullseye Glass
Sample Date: 4/27/16
Sample Volume: 500. mL

	µg/L		µg/sample	
Analyte	Conc.	MDL	Conc.	MDL
Cr VI	1040	0.020	518.	0.010
Total Cr	1070	0.500	536.	0.250

Lab ID: 16-S428
Client ID: 1B Teflon Filter Inlet
Site: Bullseye Glass
Sample Date: 4/27/16
Sample Volume: 250. mL

	µg/L		µg/sample	
Analyte	Conc.	MDL	Conc.	MDL
Total Cr	82.0	0.500	20.5	0.125

Lab ID: 16-S429
Client ID: 1B HNO3 Rinse Inlet
Site: Bullseye Glass
Sample Date: 4/27/16
Sample Volume: 250. mL

	µg/L		µg/sample	
Analyte	Conc.	MDL	Conc.	MDL
Total Cr	16.7	0.500	4.17	0.125

Lab ID: 16-S430
Client ID: 1B KOH Imp Inlet
Site: Bullseye Glass
Sample Date: 4/27/16
Sample Volume: 460. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Cr VI	559.	0.020	257.	0.009
Total Cr	549.	0.500	253.	0.230

Lab ID: 16-S431
Client ID: 1C Teflon Filter Inlet
Site: Bullseye Glass
Sample Date: 4/27/16
Sample Volume: 250. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Total Cr	35.1	0.500	8.78	0.125

Lab ID: 16-S432
Client ID: 1C HNO3 Rinse Inlet
Site: Bullseye Glass
Sample Date: 4/27/16
Sample Volume: 250. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Total Cr	18.3	0.500	4.57	0.125

Lab ID: 16-S433
Client ID: 1C KOH Imp Inlet
Site: Bullseye Glass
Sample Date: 4/27/16
Sample Volume: 485. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Cr VI	2050	0.020	994.	0.010
Total Cr	1990	0.500	964.	0.242

Lab ID: 16-S434
Client ID: 2 Teflon Filter Inlet
Site: Bullseye Glass
Sample Date: 4/28/16
Sample Volume: 250. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Total Cr	33.6	0.500	8.39	0.125

Lab ID: 16-S435
Client ID: 2 HNO3 Rinse Inlet
Site: Bullseye Glass
Sample Date: 4/28/16
Sample Volume: 250. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Total Cr	8.04	0.500	2.01	0.125

Lab ID: 16-S436
Client ID: 2 KOH Imp Inlet
Site: Bullseye Glass
Sample Date: 4/28/16
Sample Volume: 480. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Cr VI	2160	0.020	1,030	0.010
Total Cr	2020	0.500	972.	0.240

Lab ID: 16-S437
Client ID: 3 Teflon Filter Inlet
Site: Bullseye Glass
Sample Date: 4/29/16
Sample Volume: 250. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Total Cr	36.9	0.500	9.22	0.125

Lab ID: 16-S438
Client ID: 3 HNO3 Rinse Inlet
Site: Bullseye Glass
Sample Date: 4/29/16
Sample Volume: 250. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Total Cr	2.74	0.500	0.684	0.125

Lab ID: 16-S439
Client ID: 3 KOH Imp Inlet
Site: Bullseye Glass
Sample Date: 4/29/16
Sample Volume: 545. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Cr VI	790.	0.020	431.	0.011
Total Cr	790.	0.500	431.	0.272

Lab ID: 16-S440
Client ID: 3 Teflon Filter Outlet
Site: Bullseye Glass
Sample Date: 4/29/16
Sample Volume: 250. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Total Cr	26.1	0.500	6.52	0.125

Lab ID: 16-S441
Client ID: 3 HNO3 Rinse Outlet
Site: Bullseye Glass
Sample Date: 4/29/16
Sample Volume: 250. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Total Cr	1.10	0.500	0.276	0.125

Lab ID: 16-S442
Client ID: 3 KOH Imp Outlet
Site: Bullseye Glass
Sample Date: 4/29/16
Sample Volume: 485. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Cr VI	205.	0.020	99.4	0.010
Total Cr	198.	0.500	95.8	0.242

Lab ID: 16-S443
Client ID: Filter Blank #1
Site: Bullseye Glass
Sample Date: 4/28/16
Sample Volume: 250. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Total Cr	< MDL	0.500	< MDL	0.125

Lab ID: 16-S444
Client ID: Filter Blank #2
Site: Bullseye Glass
Sample Date: 4/28/16
Sample Volume: 250. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Total Cr	< MDL	0.500	< MDL	0.125

Lab ID: 16-S445
Client ID: H2O Blank
Site: Bullseye Glass
Sample Date: 4/28/16
Sample Volume: 250. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Total Cr	< MDL	0.500	< MDL	0.125

Lab ID: 16-S446
Client ID: 0.1N HNO3 Blank
Site: Bullseye Glass
Sample Date: 4/28/16
Sample Volume: 250. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Total Cr	< MDL	0.500	< MDL	0.125

Lab ID: 16-S447
Client ID: KOH Blank
Site: Bullseye Glass
Sample Date: 4/28/16
Sample Volume: 790. mL

Analyte	µg/L Conc.	µg/L MDL	µg/sample Conc.	µg/sample MDL
Cr VI	1.06	0.020	0.837	0.016
Total Cr	0.843	0.500	0.666	0.395

QA/QC Report

Client Name: Horizon Engineering
Project Number: H007
Analytical Technique: ICP - Optima 8300
Sample Description: SW-846 0061 filter and probe rinse
Report Number: 16-271

==

Blank Data

Analyte	Sample ID	Measured Conc. µg/L	MDL Conc. µg/L
Cr	ICB	< MDL	0.500
Cr	Prep_Blk	< MDL	0.500
Cr	CCB	< MDL	0.500
Cr	CCB	< MDL	0.500
Cr	CCB	< MDL	0.500

*: Method Blank concentration in µg/filter

Calibration QC

Analyte	Sample ID	Standard Conc. µg/L	Measured Conc. µg/L	Percent Recovery
Cr	ICV	2500	2510	100.3
Cr	*CRI*	*2.50*	*2.74*	*109.6*
Cr	CCV	2500	2420	96.7
Cr	CCV	2500	2450	98.0
Cr	CCV	2500	2380	95.4
Cr	CCV	2500	2320	92.8

CRI Limits: 70% - 130% Recovery

Replicate Data

Analyte	Sample ID	Sample Conc. µg/L	Replicate Conc. µg/L	RPD
Cr	16-S425	32.45	34.73	6.79
Cr	16-S426	45.84	45.12	1.58
Cr	16-S440	26.07	26.78	2.69
Cr	16-S441	1.105	0.820	29.6 #

RPD = {(sample-replicate)/[(sample+replicate)/2]}x100
N/C: RPD is not calculated when sample or replicate is below detection limit
#: per EPA CLP protocol, control limits do not apply if sample and/or replicate concentration is less than 5x the detection limit

Laboratory Control Sample/Matrix Post Spike Analysis

Analyte	Sample ID	Sample Conc. µg/L	Spike Conc. µg/L	Spike Amount µg/L	Percent Recovery
Cr	16-S428	82.05	2451.	2500.	94.8
Cr	16-S429	16.68	2374.	2500.	94.3
Cr	16-S440	26.07	2461.	2500.	97.4
Cr	16-S441	1.105	2376.	2500.	95.0

Percent Recovery = (spike - sample)/spike amount*100
*: per EPA CLP protocol, control limits do not apply if spike concentration is less than 25% of the sample concentration

QA/QC Limits
Continuing Calibration: ± 10% *LCS: ± 20%*
Duplicates: 20% RPD *Spikes: ± 25%*

QA/QC Report

Client Name: Horizon Engineering
Project Number: H007
Analytical Technique: IC-PCR
Sample Description: SW-846 Method 0061 Impinger Catch
Report Number: 16-271

Blank Data

Analyte	Sample ID	Measured Conc. µg/L	MDL Conc. µg/L
Cr VI	ICB	< MDL	0.020
Cr VI	CCB	< MDL	0.020

*: Method Blank concentration in µg/filter

Calibration QC

Analyte	Sample ID	Standard Conc. µg/L	Measured Conc. µg/L	Percent Recovery
Cr VI	ICV	1.00	0.98	97.9
Cr VI	CCV	1.00	0.95	95.2

Duplicate Data

Analyte	Sample ID	Sample Conc. µg/L	Replicate Conc. µg/L	RPD
Cr VI	16-S427	1040	1010	2.64

RPD = {(sample-duplicate)/[(sample+duplicate)/2]}x100
N/C: RPD is not calculated when sample or duplicate is below detection limit
#: per EPA CLP protocol, control limits do not apply if sample and/or duplicate concentration is less than 5x the detection limit

Laboratory Control Sample/Matrix Spike Analysis

Analyte	Sample ID	Sample Conc. µg/L	Spike Conc. µg/L	Spike Amount µg/L	Percent Recovery
Cr VI	16-S439	790.	1810	1000	102.

*: per EPA CLP protocol, control limits do not apply if spike concentration is less than 25% of the sample concentration

QA/QC Limits
Continuing Calibration: ± 10% *LCS: ± 20%*
Replicates: ± 20% RPD *Post Spikes: ± 25%*

QA/QC Report

Client Name: Horizon Engineering
Project Number: H007
Analytical Technique: ICP - Optima 8300
Sample Description: SW-846 Method 0061 Impinger Catch
Report Number: 16-271

Blank Data

Analyte	Sample ID	Measured Conc. µg/L	MDL Conc. µg/L
Cr	ICB	< MDL	0.500
Cr	CCB	< MDL	0.500

*: Method Blank concentration in µg/filter

Calibration QC

Analyte	Sample ID	Standard Conc. µg/L	Measured Conc. µg/L	Percent Recovery
Cr	ICV	2500	2480	99.4
Cr	*CRI*	*2.50*	*2.55*	*102.2*
Cr	CCV	2500	2510	100.5

CRI Limits: 70% - 130% Recovery

Duplicate Data

Analyte	Sample ID	Sample Conc. µg/L	Duplicate Conc. µg/L	RPD
Cr	16-S427	1071.	1075.	0.37

RPD = {(sample-duplicate)/[(sample+duplicate)/2]}x100
N/C: RPD is not calculated when sample or duplicate is below detection limit
#: per EPA CLP protocol, control limits do not apply if sample and/or duplicate concentration is less than 5x the detection limit

Laboratory Control Sample/Matrix Spike Analysis

Analyte	Sample ID	Sample Conc. µg/L	Spike Conc. µg/L	Spike Amount µg/L	Percent Recovery
Cr	16-S430	549.3	2821.	2500.	90.9

*: per EPA CLP protocol, control limits do not apply if spike concentration is less than 25% of the sample concentration

QA/QC Limits
Continuing Calibration: ± 10% *LCS: ± 20%*
Duplicates: 20% RPD *Spikes: ± 25%*

CHESTER LABNET
SOURCE SAMPLE RECEIPT CHECKLIST

Client	Horizon	Date	5/2/16
# Runs	6 + Blks	Report #	

Custody Seals Inspected, If Present	NA	
Chain-of-Custody Form Inspected	✓	
CoC present with samples?	✓	*
CoC indicate analytical methodology to be used? (eg M29 etc)	✓	!!
CoC indicate if compliance testing? (esp. M26)	Not Stated	!!
M26 samples have Thiosulfate added in field?	NA	!!
M29 indicate FH/BH separate or combined?	NA	!!
Has Form Been Signed?	✓	
Have Date and Time Custody Released Been Noted on Form?	✓	
All Sample Containers Inspected	✓	
Does Number of Samples Match Number on CoC Form?	✓	!!
Do All Sample ID Numbers Match Those on the CoC Form?	✓	!!
Did client mark sample volumes prior to shipment?	✓	*
If required by method, did client vent samples prior to shipment?	NA	
Are the Sample Containers Intact?	✓	!!
Are signs of leakage present?	NO	*
Chain-of-Custody Form Signed and Dated by CLN	✓	
Corrective Actions		
Client Contacted Due to Mismatching Sample ID Numbers		
Client Contacted Due to Broken Sample Container(s)	5/3/16	
Client Contacted Due to Leaking Sample Container(s)		
Client contacted for verification of methodology?		
Corrective Actions Documented?		
Corrective Actions Accomplished?		

Items marked !! shall be addressed ***prior to any analytical work being started.***
*Items marked * shall be noted in case narrative upon reporting of results to client.*

Signed Liz Ball

Notes

16-271

Company Name: Horizon Eng.	
Contact: Thomas Rhodes	Phone: 503-255-5050
E-Mail Address: trhodes@montrose-env.com	Fax
Report Address: 13585 NE Whitaker Way	
City: Portland	State: OR · Zip: 97230
Billing Address: Same	
City: —	State: — · Zip: —
PO #	Project: 57202 - Bullseye Glass

CHESTER LabNet

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cln@chesterlab.net

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Analysis Requested

Turn Around Time
☐ Standard
☒ Rush ASAP
Specify

LabNet ID	Field Sample ID	Site	Sample Date	Volume (m³)	Particle Size	Analysis Requested	Remarks
16-5425	1A teflon filter	Inlet	4/27/16	—	—		
426	1A HNO_3 Rinse	Inlet	"	—	—		
427	1A KOH Imp.	Inlet	"	—	—	SEE NOTES	
428, 429, 430	1B (Same as 1A)	Inlet	"	—	—		3 Samples
431, 432, 433	1C (Same as 1A)	Inlet	"	—	—		3 Samples
434, 435, 436	2 (Same as 1A)	Inlet	4/28/16	—	—		3 Samples
437, 438, 439	3 (Same as 1A)	Inlet	4/29/16	—	—		3 samples
440, 441, 442	3 (Same as 1A)	Outlet	4/29/16	—	—		3 Samples
16-5445	H_2O Blank	—	4/28/16	—	—		
5446	.1 N HNO_3 Blank	—	4/28/16	—	—		
5447	KOH Blank	—	4/28/16	—	—		
443, 444	Filter Blanks (x2)	—	4/28/16	—	—		~~Total Samples~~ CN: 2 samples

Relinquished By: (Signature) Date/Time	Received By: (Signature) Date/Time	Notes:
[signature] 5/2/16	Barbara Butler 5/2/16 13:02	Total Samples: 23
Barbara Butler 5-2-16 13:35	[signature] 5-2-16 13:40	EPA 0061 Analysis on ALL samples for Cr^{6+} & Total Cr

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Report # 16-
Page 12 of 13
HORIZON ENGINEERING 16-5702

<u>RAW DATA</u>

Available upon request

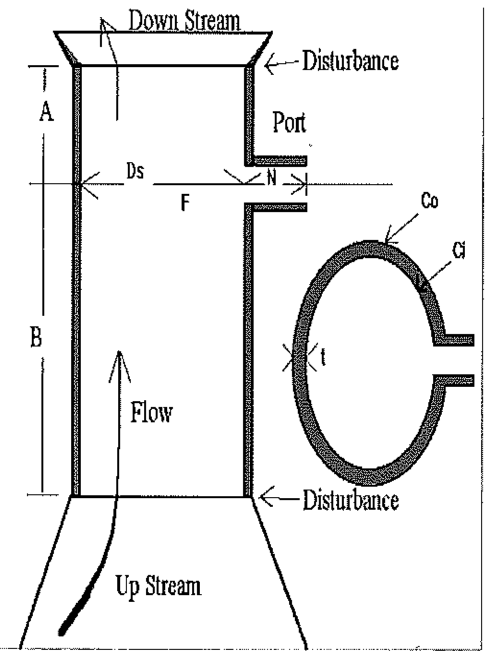
Traverse Point Locations

BULLSEYE GLASS
GLASS FURNACE T7 -INLET
PORTLAND OR
EPA 1

4/26 - 4/29/2016
JTF,JH,JL,BC,BS,PB,CH

MEW

Outer Circumference	Co	in	
Wall thickness	t	in	
INSIDE of FAR WALL to OUTSIDE of Nipple	F	in	13.75
INSIDE of NEAR WALL to OUTSIDE of Nipple	N	in	1.75
STACK WALL to to OUTSIDE of Nipple	N-t	in	
DOWNstream Disturb	A	in	40.0
UPstream Disturb	B	in	30.0
Inner Diameter	Ds	in	12
Area	As	sqin	113.1
DOWNstream Ratio	A/Ds		3.33
UPstream Ratio	B/Ds		2.50
Minimum #Pts (Particulate)			24
Minimum #Pts/Diameter			12
Minimum #Pts (NON-Particulate)			16
Minimum #Pts/Diameter			8
Actual Points per Diameter			12
Actual Points Used			



Trav Pt #No	Fract Stk ID (f)	Stack ID (Ds)	Actual Points (Dsxf)	Nearest 8ths (TP)	Adjusted Points (TP)	Traverse Points (TP + N)	Traverse Points (TP + N)
1	2.13%	12.0	0.3	0.25	0.5	2.25	2 1 / 4
2	6.70%	12.0	0.8	0.75	0.75	2.5	2 1 / 2
3	11.81%	12.0	1.4	1.375	1.375	3.125	3 1 / 8
4	17.73%	12.0	2.1	2.125	2.125	3.875	3 7 / 8
5	25.00%	12.0	3.0	3	3	4.75	4 3 / 4
6	35.57%	12.0	4.3	4.25	4.25	6	6
7	64.43%	12.0	7.7	7.75	7.75	9.5	9 1 / 2
8	75.00%	12.0	9.0	9	9	10.75	10 3 / 4
9	82.27%	12.0	9.9	9.875	9.875	11.625	11 5 / 8
10	88.19%	12.0	10.6	10.625	10.625	12.375	12 3 / 8
11	93.30%	12.0	11.2	11.25	11.25	13	13
12	97.87%	12.0	11.7	11.75	11.5	13.25	13 1 / 4

MONTROSE AIR QUALITY SERVICES
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505
www.montrose-env.com

EPA METHOD 1
TRAVERSE POINT LOCATIONS

Client: Bullseye Glass
Source: Glass Furnace T7
Date: 4/26/16

Facility Location: Portland
Sample Location: Inlet
Initials: JM

Traverse Point Number	Traverse Point Location (inches)
1	2 1/4
2	2 1/2
3	3 1/8
4	3 7/8
5	4 3/4
6	6
7	9 1/2
8	10 3/4
9	11 5/8
10	12 3/8
11	13
12	13 1/4

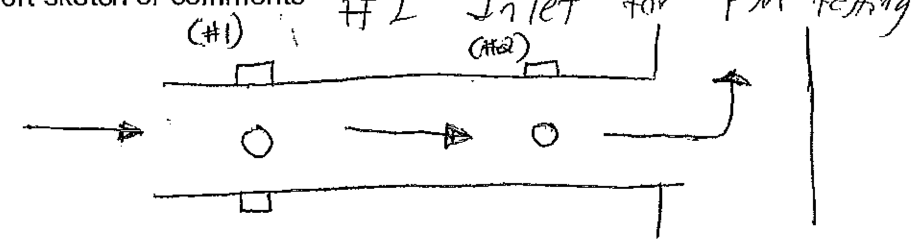
Duct Dimensions and Port Locations

Inside of far wall to outside of nipple, F 13 3/4 in
Inside of near wall to outside of nipple, N 1 3/4 in
Nearest downstream disturbance, A 11 in
Nearest upstream disturbance, B 57 in
Circular: Inside Diameter, F-N 12 in
Rectangular: Width Na " Depth Na "
Rectangular Equiv. Diameter: (2*W*D)/(W+D) Na "
Number of Ports: 2

Duct characteristics:

Construction: Steel PVC Fiberglas Other ____
Shape: Circular Rectangular Elliptical
Orientation: Vertical Horizontal Diagonal (~ angle: ___°)
Flow straighteners: Yes No
Stack Extension: Yes No
Cyclonic Flow Expected: Yes No
Cyclonic Flow Measured & Documented: Yes No
Average Null Angle <20°: Yes No N/A
Meets EPA M-1 Criteria: Yes No (If "No", explain why)

Test port sketch or comments #2 Inlet for PM testing



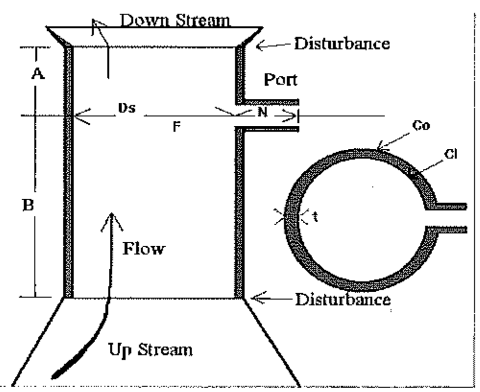
Traverse Point Locations

BULLSEYE
GLASS FURNACE T7 -OUTLET
PORTLAND OR
EPA 1

28-Apr-16
JTF,JH,JL,BC,BS,PB,CH
MEW

EAST

Outer Circumference	Co	in	
Wall thickness	t	in	
INSIDE of FAR WALL to OUTSIDE of Nipple	F	in	14.00
INSIDE of NEAR WALL to OUTSIDE of Nipple	N	in	1.625
STACK WALL to to OUTSIDE of Nipple	N-t	in	
DOWNstream Disturb	A	in	27.5
UPstream Disturb	B	in	69.5
Inner Diameter	Ds	in	12.375
Area	As	sqin	120.3
DOWNstream Ratio	A/Ds		2.22
UPstream Ratio	B/Ds		5.62
Minimum #Pts (Particulate)			20
Minimum #Pts/Diameter			10
Minimum #Pts (NON-Particulate)			16
Minimum #Pts/Diameter			8
Actual Points per Diameter			12
Actual Points Used			



Trav Pt #No	Fract Stk ID (f)	Stack ID (Ds)	Actual Points (Dsxf)	Nearest 8ths (TP)	Adjusted Points (TP)	Traverse Points (TP + N)	Traverse Points (TP + N)
1	2.13%	12.4	0.3	0.25	0.5	2.125	2 1 / 8
2	6.70%	12.4	0.8	0.875	0.875	2.5	2 1 / 2
3	11.81%	12.4	1.5	1.5	1.5	3.125	3 1 / 8
4	17.73%	12.4	2.2	2.25	2.25	3.875	3 7 / 8
5	25.00%	12.4	3.1	3.125	3.125	4.75	4 3 / 4
6	35.57%	12.4	4.4	4.375	4.375	6	6
7	64.43%	12.4	8.0	8	8	9.625	9 5 / 8
8	75.00%	12.4	9.3	9.25	9.25	10.875	10 7 / 8
9	82.27%	12.4	10.2	10.125	10.125	11.75	11 3 / 4
10	88.19%	12.4	10.9	10.875	10.875	12.5	12 1 / 2
11	93.30%	12.4	11.5	11.5	11.5	13.125	13 1 / 8
12	97.87%	12.4	12.1	12.125	11.875	13.5	13 1 / 2

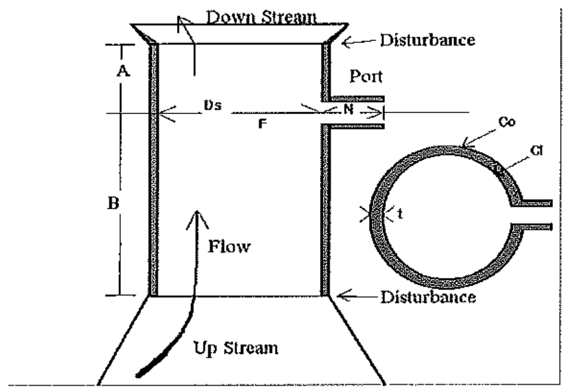
Traverse Point Locations

BULLSEYE
GLASS FURNACE T7 -OUTLET
PORTLAND OR
EPA 1

28-Apr-16
JTF,JH,JL,BC,BS,PB,CH
MEW

WEST

Outer Circumference	Co	in	
Wall thickness	t	in	
INSIDE of FAR WALL to OUTSIDE of Nipple	F	in	13.88
INSIDE of NEAR WALL to OUTSIDE of Nipple	N	in	1.625
STACK WALL to to OUTSIDE of Nipple	N-t	in	
DOWNstream Disturb	A	in	39.0
UPstream Disturb	B	in	57.0
Inner Diameter	Ds	in	12.25
Area	As	sqin	117.9
DOWNstream Ratio	A/Ds		3.18
UPstream Ratio	B/Ds		4.65
Minimum #Pts (Particulate)			24
Minimum #Pts/Diameter			12
Minimum #Pts (NON-Particulate)			16
Minimum #Pts/Diameter			8
Actual Points per Diameter			12
Actual Points Used			



Trav Pt #No	Fract Stk ID (f)	Stack ID (Ds)	Actual Points (Dsxf)	Nearest 8ths (TP)	Adjusted Points (TP)	Traverse Points (TP + N)	Traverse Points (TP + N)
1	2.13%	12.3	0.3	0.25	0.5	2.125	2 1 / 8
2	6.70%	12.3	0.8	0.875	0.875	2.5	2 1 / 2
3	11.81%	12.3	1.4	1.5	1.5	3.125	3 1 / 8
4	17.73%	12.3	2.2	2.125	2.125	3.75	3 3 / 4
5	25.00%	12.3	3.1	3.125	3.125	4.75	4 3 / 4
6	35.57%	12.3	4.4	4.375	4.375	6	6
7	64.43%	12.3	7.9	7.875	7.875	9.5	9 1 / 2
8	75.00%	12.3	9.2	9.25	9.25	10.875	10 7 / 8
9	82.27%	12.3	10.1	10.125	10.125	11.75	11 3 / 4
10	88.19%	12.3	10.8	10.75	10.75	12.375	12 3 / 8
11	93.30%	12.3	11.4	11.375	11.375	13	13
12	97.87%	12.3	12.0	12	11.75	13.375	13 3 / 8

MONTROSE AIR QUALITY SERVICES
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Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505
www.montrose-env.com

EPA METHOD 1
TRAVERSE POINT LOCATIONS

Client: Bullseye Glass Facility Location: Portland OR
Source: T7 - Baghouse outlet Sample Location: Roof
Date: 6/6/16 Initials: PR

Top Ports

Traverse Point Number	Traverse Point Location (inches)	
1	2 1/8	2 1/8
2	2 1/2	2 1/2
3	3 1/8	3 1/8
4	3 7/8	3 3/4
5	4 3/4	4 3/4
6	6	6
7	9 5/8	9 1/2
8	10 7/8	10 7/8
9	11 3/4	11 3/4
10	12 1/2	12 3/8
11	13 1/8	13
12	13 1/2	13 3/8
	E	W

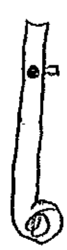
Duct Dimensions and Port Locations E W

Inside of far wall to outside of nipple, F 14 | 13 7/8
Inside of near wall to outside of nipple, N 1 5/8 | 1 5/8
Nearest downstream disturbance, A 27 1/2
Nearest upstream disturbance, B 69 1/2
Circular: Inside Diameter, F-N 12 3/8 | 12 1/4
Rectangular: Width_____" Depth_____"
Rectangular Equiv. Diameter: (2*W*D)/(W+D)_____"
Number of Ports: 2

Duct characteristics:

Construction: Steel PVC Fiberglas Other _____
Shape: Circular Rectangular Elliptical
Orientation: Vertical Horizontal Diagonal (~ angle: ___°)
Flow straighteners: Yes No
Stack Extension: Yes No
Cyclonic Flow Expected: Yes No
Cyclonic Flow Measured & Documented: Yes No
Average Null Angle <20°: Yes No N/A
Meets EPA M-1 Criteria: Yes No (If "No", explain why)

Test port sketch or comments



Calibration Information

Meter Box
Calibration Critical Orifices
Standard Meter
Pitots
Thermocouples and Indicators
Peristaltic Pump Calibration
Barometer

Biannual Meterbox Calibration

Method	EPA M-5 #7.2				
Location	Horizon Shop		Date	1/11/2016	
Meter Box ID	2		Pb=	30.2	(in Hg)
Meter ID	2713325		Ta=	51	(°F)
HE ID	000316		Tamb	510.67	(°R)
calibrated by	PT	Leak checks			
Orifice Set	ND	Negative	0 in/min @	27	inches Hg
		Positive	0 in/min @	6.2	inches H20

0.97<Y<1.03	Old 11/5/15	New 1/11/16	Change (+/-)	
Y=	1.02761	0.99949	-2.8%	PASS
dH@=	2.13525	1.97675	-8.0%	

	VAC (in Hg)	Critical Orifice ID	K	dH (inH_2O)	Meter (ft^3)	Net (ft^3)	Field T_{di} (°F)	Meter T_{do} (°F)	T_o (°R)	T_m (°R)	Time t (min)	Y	dH@	Y 0.020	dH@ 0.20	Allow. Toler
Initial	23	ND48	0.3353	0.68	282.216	6.0210	51.0	51.0	510.7	511.2	14.00	0.99809	1.98274	0.001	0.01	
Final					288.237		53.0	51.0						pass	pass	
Initial	21	ND55	0.44909	1.2	288.237	5.1750	53.0	51.0	511.2	512.4	9.00	1.00105	1.95551	0.002	0.02	
Final					293.412		55.0	52.0						pass	pass	
Initial	19	ND63	0.58688	2.1	293.412	5.2730	55.0	52.0	511.7	513.9	7.00	0.99931	1.99200	0.000	0.02	
Final					298.685		58.0	52.0						pass	pass	
												0.99949	1.97675			
											STDEV	0.0012				
											STDEV/AVG	0.12%				

Meterbox		Ambient Standard, °F	Ambient Measured, °F	Ambient Difference %	Amb.	Heated Standard, °F	Heated Measured, °F	Heated Difference %	Heated
YY	In	58.3	58.1	0.04%	pass	199.0	199.0	0.00%	pass
1/8/16	Out	57.7	56.5	0.23%	pass	200.0	200.0	0.00%	pass
FLUKE	605								
Calibrated by	PT								

Thermocouple Indicator	Channel	Ambient Standard, °F	Ambient Measured, °F	Ambient Difference %		200 +/- Standard, °F	200 +/- Measured, °F	200 +/- Difference %		400 +/- Standard, °F	400 +/- Measured, °F	400 +/- Difference %	
YY	Stack	50	48	0.39%	pass	200	198	0.30%	pass	400	399	0.12%	pass
1/8/16	Probe	50	48	0.39%	pass	200	198	0.30%	pass	400	398	0.23%	pass
	Oven	50	48	0.39%	pass	200	199	0.15%	pass	400	398	0.23%	pass
	Impinger	50	48	0.39%	pass	200	199	0.15%	pass	400	398	0.23%	pass
	Aux	50	48	0.39%	pass	200	199	0.15%	pass	400	399	0.12%	pass
	Meter In	50	50	0.00%	pass	200	198	0.30%	pass	400	398	0.23%	pass
	Meter Out	50	49	0.20%	pass	200	198	0.30%	pass	400	398	0.23%	pass
Signal Tester	542												
Calibrated by	PT												

Biannual Meterbox Calibration

Method	EPA M-5 #7.2				
Location	Horizon Shop		Date	2/26/2016	
Meter Box ID	29		Pb=	30.02	(in Hg)
Meter ID	7587707		Ta=	58	(°F)
HE ID			Tamb	517.67	(°R)
calibrated by	sh	Leak checks			
Orifice Set	ND	Negative	0 in/min @	27.5	inches Hg
		Positive	0 in/min @	6	inches H_2O

0.97<Y<1.03	Old	New	Change	
		2/26/16	(+/-)	
Y=		0.98764	100.0%	PASS
dH@=		1.73900	100.0%	

	VAC (in Hg)	Critical Orifice ID	K	dH (inH_2O)	Meter (ft^3)	Net (ft^3)	Field T_{di} (°F)	Meter T_{do} (°F)	T_o (°R)	T_m (°R)	Time t (min)	Y	dH@	Y 0.020	dH@ 0.20	Allow. Tolerance
Initial	23.5	ND48	0.33530	0.61	506.824	6.1400	59.0	59.0	519.7	519.9	14.00	0.98891	1.73749	0.001	0.00	
Final					512.964		62.0	61.0						pass	pass	
Initial	22.5	ND55	0.44909	1.1	512.964	5.8850	62.0	61.0	520.7	520.9	10.00	0.98779	1.73675	0.000	0.00	
Final					518.849		61.0	61.0						pass	pass	
Initial	20.5	ND63	0.58688	1.9	518.849	15.4200	61.0	61.0	522.2	522.4	20.00	0.98622	1.74274	0.001	0.00	
Final					534.269		65.0	64.0						pass	pass	
												0.98764	1.73900			
											STDEV	0.0011				
											STDEV/AVG	0.11%				

Meterbox		Ambient Standard, °F	Ambient Measured, °F	Ambient Difference %	Amb.	Heated Standard, °F	Heated Measured, °F	Heated Difference %	Heated
29	In	59.0	60.0	-0.19%	pass	197.0	197.0	0.00%	pass
2/26/16	Out	59.0	60.0	-0.19%	pass	197.0	197.0	0.00%	pass
Fluke	480								
Calibrated by	sh								

Thermocouple Indicator	Channel	Ambient Standard, °F	Ambient Measured, °F	Ambient Difference %		200 +/- Standard, °F	200 +/- Measured, °F	200 +/- Difference %		400 +/- Standard, °F	400 +/- Measured, °F	400 +/- Difference %	
29	Stack	50	46	0.78%	pass	250	246	0.56%	pass	450	446	0.44%	pass
26-Feb-16	Probe	50	46	0.78%	pass	250	246	0.56%	pass	450	445	0.55%	pass
	Oven	50	46	0.78%	pass	250	244	0.85%	pass	450	444	0.66%	pass
	Impinger	50	48	0.39%	pass	250	246	0.56%	pass	450	447	0.33%	pass
	Aux	50	48	0.39%	pass	250	247	0.42%	pass	450	447	0.33%	pass
	Meter	50	50	0.00%	pass	250	249	0.14%	pass	450	449	0.11%	pass
	Meter	50	50	0.00%	pass	250	250	0.00%	pass	450	450	0.00%	pass

Post Test Meterbox Calibration

Method	EPA M-5 #7.2
Location	Horizon Shop
Meter Box ID	2
Meter ID	2713325
calibrated by	SH

Date	4/30/2016	
Pb=	30.20	(in Hg)
Ta=	61.5	(oF)
Tamb	521.2	(oR)

	Biannual 1/11/2016	Post-Test 4/30/16	Change (+/-)	
Y=	0.99949	1.01415	1.4%	pass
dH@=	1.97675	1.98647	0.5%	

	VAC (in Hg)	Critical Orifice ID YD	K	dH (inH2O)	Meter (ft3)	Net (ft3)	Field Tdi (oF)	Meter Tdo (oF)	To (oR)	Tm (oR)	Time t (min)	Y	dH@	Y 0.020	dH@ 0.20	Allow. Tolerance
Initial	21.5	40	0.23930	0.3	876.626	5.205	59	59	519.5	520.0	17.0	1.0084	2.0029	0.006	0.02	
Final					881.831		62	60						pass	pass	
Initial	21.5	40	0.23930	0.3	881.831	5.172	62	60	520.5	521.8	17.0	1.0182	2.0246	0.004	0.04	
Final					887.003		64	61						pass	pass	
Initial	21.5	40	0.23930	0.3	887.003	6.125	64	61	522.5	524.0	20.0	1.0159	1.9319	0.002	0.05	
Final					893.128		67	64						pass	pass	
												1.01415	1.9865			

Post Test Meterbox Calibration

Method	EPA M-5 #7.2
Location	Horizon Shop
Meter Box ID	29
Meter ID	7587707
calibrated by	SH

Date	4/30/2016	
Pb=	30.2	(in Hg)
Ta=	61.5	(oF)
Tamb	521.2	(oR)

	Biannual 2/26/2016	Post-Test 4/30/16	Change (+/-)	
Y=	0.98764	0.99286	0.5%	pass
dH@=	1.73900	1.74335	0.2%	

	VAC (in Hg)	Critical Orifice ID YD	K	dH (inH2O)	Meter (ft3)	Net (ft3)	Field Tdi (oF)	Meter Tdo (oF)	To (oR)	Tm (oR)	Time t (min)	Y	dH@	Y	dH@	
														0.020	0.20	Allow. Tolerance
Initial	25	40	0.23609	0.3	591.039	5.1960	59	59	519.0	519.8	17.0	0.9962	1.7751	0.003	0.03	
Final					596.235		62	59						pass	pass	
Initial	25	40	0.23609	0.3	596.235	5.2240	62	59	521.0	522.0	17.0	0.9951	1.7494	0.002	0.01	
Final					601.459		64	63						pass	pass	
Initial	25	40	0.23609	0.3	601.459	6.5230	64	63	523.0	523.5	21.0	0.9873	1.7056	0.006	0.04	
Final					607.982		64	63						pass	pass	
												0.9929	1.7433			

Critical Orifice Calibrations

Client	HORIZON		12/3/15	Date
Set ID	SET "IZ" Avogadro		in house	Job
DGM (Y) =	1.00310		YY	Calibrated
DGM ID #	2299046		mew	QA/QC

Dry Gas Meter			Orifice ID #	40	Orifice ID #	48	Orifice ID #	55	Orifice ID #	63	Orifice ID #	73
K' Critical Orifice Coefficient				**0.23930**		**0.34956**		**0.45656**		**0.58764**		**0.80451**
	Symbol	Units	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2
Initial volume	V_i	ft²	644.002	650.177	657.643	663.064	668.513	674.495	680.673	688.025	694.226	704.545
Final Volume	V_f	ft²	650.177	657.429	663.064	668.513	674.495	680.673	688.025	694.226	704.545	722.965
Difference	V_m	ft²	6.175	7.252	5.421	5.449	5.982	6.178	7.352	6.201	10.319	18.420
Temperatures												
Ambient	T_a	°F	56.0	57.0	58.0	58.5	59.0	59.0	60.0	60.0	60.0	60.0
Absolute ambient	T_a	°R	515.67	516.67	517.67	518.17	518.67	518.67	519.67	519.67	519.67	519.67
Initial Inlet	T_i	°F	56.6	64.4	58.3	68.1	73.5	80.9	82.9	88.9	89.3	95.1
Outlet	T_f	°F	56.2	57.2	58.3	58.6	59.2	60.1	61	62.1	62.8	64.5
Final Inlet	T_i	°F	64.4	69.1	68.1	73.5	80.4	82.9	88.9	89.3	95.1	94
Outlet	T_f	°F	57.2	58.3	58.6	59.2	60.1	61	62.1	62.8	64.5	65.5
Avg. Temp	T_m	°R	518.27	521.92	520.495	524.52	527.97	530.895	533.395	535.445	537.595	539.445
Time		min	20	23	12	12	10	10	9	8	9	17
		sec	0	23	0	0	0	20	30	0	44	16
			20.00	23.38	12.00	12.00	10.00	10.33	9.50	8.00	9.73	17.27
SAMPLE RATE		ACFM	0.3088	0.3101	0.4517	0.4541	0.5982	0.5979	0.7739	0.7751	1.0602	1.0668
Orifice man. rdg	dH@	in H_2O	0.29	0.29	0.68	0.68	1.30	1.30	2.20	2.20	4.10	4.10
Barometric. Pressure	Pbar	inHg	29.58	29.55	29.55	29.55	29.52	29.52	29.52	29.52	29.52	29.52
Pump vacuum		inHg	20.6	20.6	19.0	19.0	17.6	17.6	15.8	15.8	12.8	12.8
K' factor			0.2395	0.2391	0.3499	0.3492	0.4579	0.4552	0.5883	0.5870	0.8034	0.8056
K' factor Average				0.2393		0.3496		0.4566		0.5876		0.8045
% Error (+/- 0.5)		%	PASS	0.079%	PASS	0.103%	PASS	0.304%	PASS	0.112%	PASS	0.140%

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Critical Orifice Calibrations

Client	HORIZON		12/2/15 Date
Set ID	"NR" Shop #2		in house Job
DGM (Y) =	1.00310	Fluke ID 455	YY Calibrated
DGM ID #	2299046	Std Manometer 537	mew QA/QC

Dry Gas Meter			Orifice ID #	40	Orifice ID #	48	Orifice ID #	55	Orifice ID #	63	Orifice ID #	73
K' Critical Orifice Coefficient				0.23609		0.34106		0.44771		0.57050		0.77954
	Symbol	Units	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2
Initial volume	V_i	ft^2	580.170	587.015	595.181	600.520	605.860	612.315	618.785	625.170	631.564	637.752
Final Volume	V_f	ft^2	587.015	595.181	600.520	605.860	612.315	618.785	625.170	631.564	637.752	643.920
Difference	V_m	ft^2	6.845	8.166	5.339	5.340	6.455	6.470	6.385	6.394	6.188	6.168
Temperatures												
Ambient	T_a	°F	59.5	58.0	58.0	58.5	58.5	59.0	59.0	59.5	59.5	59.5
Absolute ambient	T_a	°R	519.17	517.67	517.67	518.17	518.17	518.67	518.67	519.17	519.17	519.17
Initial Inlet	T_i	°F	73.1	67.6	68.6	75.2	76.2	81.9	82.5	87.2	88.0	93.7
Outlet	T_f	°F	64.3	60.1	58.5	59.0	59.5	60.3	60.8	61.6	62.3	63.1
Final Inlet	T_i	°F	67.6	68.6	75.2	76.2	81.9	82.5	87.2	88.0	93.7	94.7
Outlet	T_f	°F	60.1	58.5	59.0	59.5	60.3	60.8	61.6	62.3	63.1	64.0
Avg. Temp	T_m	°R	525.945	523.37	524.995	527.145	529.145	531.045	532.695	534.445	536.445	538.545
Time		min	22	26	12	12	11	11	8	8	6	6
		sec	10	42	0	0	0	0	30	30	0	0
			22.17	26.70	12.00	12.00	11.00	11.00	8.50	8.50	6.00	6.00
SAMPLE RATE		ACFM	0.3088	0.3058	0.4449	0.4450	0.5868	0.5882	0.7512	0.7522	1.0313	1.0280
Orifice man. rdg	dH@	in H_2O	0.28	0.28	0.66	0.66	1.20	1.20	2.00	2.00	3.90	3.90
Barometric. Pressure	Pbar	inHg	30.08	30.08	30.05	30.02	30.02	29.99	30.02	30.02	29.99	29.99
Pump vacuum		inHg	21.2	21.2	19.6	19.6	18.0	18.0	16.2	16.2	13.0	13.0
K' factor			0.2368	0.2354	0.3416	0.3405	0.4479	0.4475	0.5709	0.5701	0.7823	0.7768
K' factor Average				0.2361		0.3411		0.4477		0.5705		0.7795
% Error (+/- 0.5)		%	PASS	0.308%	PASS	0.171%	PASS	0.039%	PASS	0.069%	PASS	0.357%

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Secondary Standard

M5 1.0031

DATE: 7/22/2015

Operator: Joe Ward

Meter No: 2299046				Meter Box ΔH@		0.0000			Meter Box Yd		1.0031			Barometric Pressure:			29.71	
				Standard Meter Gas Volume (V_s)			Meter Box Gas Volume (V_{dg})			Std. Meter Temperature (t_s)			Meter Box Temperature (t_d)					
Q	P	H	Yds	Initial	Final	Vf	Initial	Final	Vf	Inlet	Outlet	Avg.	Inlet	Outlet	Avg.	Time	Yd	Run #
1.21	-1.60	0.00	1.0000	0.0	5.005	5.005	192.235	197.290	5.055	72.0	72.0	72.0	76.0	76.0	76.0	4.08	1.0015	1
1.21	-1.60	0.00	1.0000	0.0	6.025	6.025	197.290	203.386	6.096	72.0	72.0	72.0	76.0	76.0	76.0	4.91	0.9997	1
1.21	-1.60	0.00	1.0000	0.0	5.005	5.005	203.386	208.775	5.059	72.0	72.0	72.0	76.0	76.0	76.0	4.09	1.0007	1
0.40	-0.60	0.00	1.0000	0.0	9.145	9.145	255.492	264.670	9.178	72.0	72.0	72.0	76.0	76.0	76.0	22.49	1.0054	2
0.40	-0.60	0.00	1.0000	0.0	5.000	5.000	264.670	269.691	5.021	72.0	72.0	72.0	76.0	76.0	76.0	12.29	1.0048	2
0.40	-0.60	0.00	1.0000	0.0	6.000	6.000	269.691	275.726	6.035	72.0	72.0	72.0	76.0	76.0	76.0	14.73	1.0032	2
0.62	-0.80	0.00	1.0000	0.0	5.000	5.000	279.510	284.532	5.022	72.0	72.0	72.0	77.0	77.0	77.0	8.00	1.0070	3
0.62	-0.80	0.00	1.0000	0.0	5.005	5.005	284.532	289.565	5.033	72.0	72.0	72.0	77.0	77.0	77.0	8.01	1.0058	3
0.62	-0.80	0.00	1.0000	0.0	5.015	5.015	289.565	294.610	5.045	72.0	72.0	72.0	77.0	77.0	77.0	8.01	1.0054	3
0.83	-1.40	0.00	1.0000	0.0	6.005	6.005	307.368	313.408	6.040	72.0	72.0	72.0	76.0	76.0	76.0	7.17	1.0052	4
0.83	-1.40	0.00	1.0000	0.0	9.025	9.025	313.408	322.502	9.094	72.0	72.0	72.0	76.0	76.0	76.0	10.75	1.0034	4
0.83	-1.40	0.00	1.0000	0.0	5.000	5.000	322.502	327.531	5.029	72.0	72.0	72.0	76.0	76.0	76.0	5.97	1.0052	4
1.00	-1.50	0.00	1.0000	0.0	9.300	9.300	331.290	340.710	9.420	72.0	72.0	72.0	76.0	76.0	76.0	9.15	0.9984	5
1.00	-1.50	0.00	1.0000	0.0	5.005	5.005	340.710	345.770	5.060	72.0	72.0	72.0	76.0	76.0	76.0	4.92	1.0003	5
1.00	-1.50	0.00	1.0000	0.0	5.005	5.005	345.770	350.831	5.061	72.0	72.0	72.0	76.0	76.0	76.0	4.95	1.0001	5
																AVERAGE	1.0031	

Operator Signature

Millennium Instruments Inc.
2402 Springridge Drive unit A
Spring Grove IL. 60081
PHONE#(815)675-3225
FAX#(815)675-6965
E-mail: millennium@millinst.com
www.millinst.com

Biannual Probe Calibration **Horizon Engineering, LLC**

Probe ID:	2-1	Std. Manometer ID	610/611/584
Date:	08/26/15	Std. P-Types Pitot	160-18
Operator:	JL		
Procedure:	Method 2 Section 10.0		

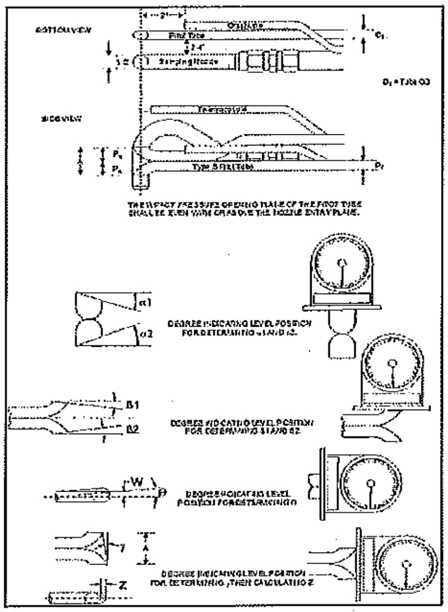
Run #	DpP (P-Type)	DpS (S-Type)	Cp	dS	Avg Cp	S <0.01		
1	0.195	0.262	0.8541	0.001	**0.8528**	0.002	Cp Limits	Fail
2	0.492	0.660	0.8548	0.002			MAX/MIN	Pass
3	0.855	1.150	0.8536	0.001			S Limits	Pass
4	1.413	1.922	0.8488	0.004				

Method 2 Passing Criteria 10.14.3/12.4

MONTROSE ENVIRONMENTAL

Client: Bullseye
Project No: 5702

Type S Pitot Tube Inspection Form

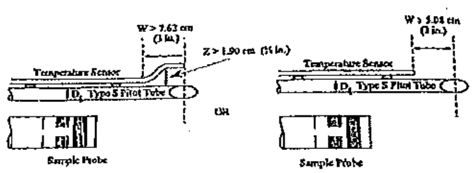


PITOT TUBE/PROBE # 2-1

Complete this section for all pitot tubes:

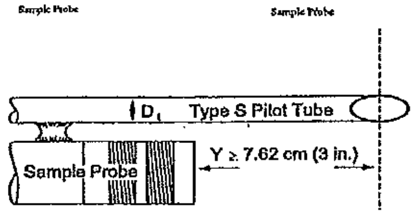
Parameter	Value	Allowable Range	Check
Assembly Level?	Y	Yes	✓
Ports Damaged?	N	No	✓
α1	1	-10° < α1 < +10°	✓
α2	0	-10° < α2 < +10°	✓
β1	0	-5° < β1 < +5°	✓
β2	1	-5° < β2 < +5°	✓
γ	0	NA	NA
Θ	0	NA	NA
Z_1 = A tan γ	0	Z_1 ≤ .125"	✓
W_1 = A tan Θ	0	W_1 ≤ .031"	✓
D_T	.375	.188" to .375"	✓
A/(2D_T)	.25	1.05 ≤ P_A/D_T ≤ 1.5	✓
A	.75	2.1D_T ≤ A ≤ 3D_T	✓

2.1 D_T = ________ 3D_T = ________



Complete this section for pitot tubes attached to Method 5 probes:

W_2	N/A	W_2 > 3"	✓
	2.25	W_2 > 2"	✓
Z_2	N/A	Z_2 > 0.75"	✓
Y	3	Y ≥ 3"	✓



Certification

I certify that pitot tube/probe number 2-1 meets or exceeds all specifications, criteria and/or applicable design features. See 40 CFR Pt. 60, App. A, EPA Method 2.

Certified by: [signature] 5/3/16
Personnel (Signature/Date)

Biannual Probe Calibration **Horizon Engineering, LLC**

Probe ID: 2-2
Date: 02/02/16
Operator: SH
Procedure: Method 2 Section 10.0

Std. Manometer ID 610/611/584
Std. P-Types Pitot 160-18

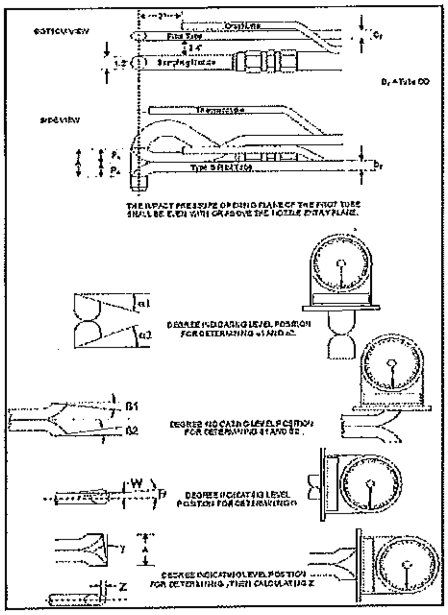
Run #	DpP (P-Type)	DpS (S-Type)	Cp	dS	Avg Cp	S <0.01		
1	0.200	0.280	0.8367	0.000	**0.8364**	0.005	Cp Limits	Pass
2	0.480	0.670	0.8380	0.002			MAX/MIN	Pass
3	0.900	1.290	0.8269	0.009			S Limits	Pass
4	1.490	2.050	0.8440	0.008				

Method 2 Passing Criteria 10.14.3/12.4

MONTROSE ENVIRONMENTAL

Client: Bullseye
Project No: 5702

Type S Pitot Tube Inspection Form

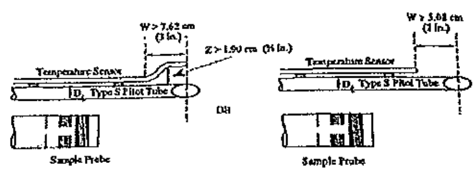


PITOT TUBE/PROBE # 2-2

Complete this section for all pitot tubes:

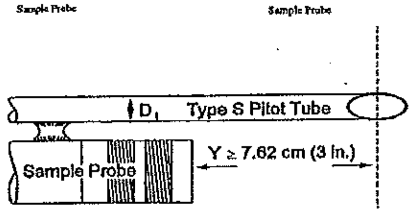
Parameter	Value	Allowable Range	Check
Assembly Level?	Yes	Yes	✓
Ports Damaged?	No	No	✓
$\alpha 1$	0	$-10° < \alpha 1 < +10°$	✓
$\alpha 2$	0	$-10° < \alpha 2 < +10°$	✓
$\beta 1$	0	$-5° < \beta 1 < +5°$	✓
$\beta 2$	0	$-5° < \beta 2 < +5°$	✓
γ	0	NA	NA
Θ	0	NA	NA
$Z_1 = A \tan \gamma$	0	$Z_1 \leq .125"$	✓
$W_1 = A \tan \Theta$	0	$W_1 \leq .031"$	✓
D_T	.375	.188" to .375"	✓
$A/(2D_T)$	1.638	$1.05 \leq P_A/D_T \leq 1.5$	✓
A	1.175	$2.1D_T \leq A \leq 3D_T$	✓

$2.1 D_T$ = ________ $3D_T$ = ________



Complete this section for pitot tubes attached to Method 5 probes:

Parameter	Value	Allowable Range	Check
W_2	—	$W_2 > 3"$	—
	2	$W_2 > 2"$	✓
Z_2	—	$Z_2 > 0.75"$	—
Y	3"	$Y \geq 3"$	✓



Certification

I certify that pitot tube/probe number 2-2 meets or exceeds all specifications, criteria and/or applicable design features. See 40 CFR Pt. 60, App. A, EPA Method 2.

Certified by: [signature] 5/3/16
Personnel (Signature/Date)

Sample Box Thermocouple Calibrations

Month:	4/4/2016	Tester/Standard: PB,BW				Location: Horizon Shop/Auburn shop/Bellingham			Fluke 526
		Ambient				Ice			Fluke 377
	Date	Standard, °F	Measured, °F	Difference %		Standard, °F	Measured, °F	Difference %	
Sample Box - impinger out									
I-01	4/7/2016	64.3	68.3	-0.76%	pass	34.7	34.3	0.08%	pass
I-02									
I-03	4/7/2016	66.3	66.0	0.06%	pass	33.1	32.7	0.08%	pass
I-04	1/27/2016	69.0	68.9	0.02%	pass	31.7	31.9	-0.04%	pass
I-05	10/7/2015	68.7	67.3	0.26%	pass	36.9	35.2	0.34%	pass
I-06	1/27/2016	57.7	55.7	0.39%	pass	31.7	32.6	-0.18%	pass
I-07	10/7/2015	68.7	67.3	0.26%	pass	37.1	37.6	-0.10%	pass
I-08	4/7/2016	63.8	65.1	-0.25%	pass	35.0	34.2	0.16%	pass
I-09	10/7/2015	68.6	66.6	0.38%	pass	37.2	36.8	0.08%	pass
I-10	1/27/2016	69.1	67.4	0.32%	pass	31.7	32.0	-0.06%	pass
I-11	1/27/2016	57.7	55.7	0.39%	pass	31.7	33.3	-0.33%	pass
I-12	4/7/2016	66.3	67.9	-0.30%	pass	33.2	33.7	-0.10%	pass
I-13	4/7/2016	64.4	63.5	0.17%	pass	33.0	32.9	0.02%	pass
I-14	4/7/2016	64.0	64.3	-0.06%	pass	33.5	32.7	0.16%	pass
I-15									
I-16	2/26/2016	64.0	65.0	-0.19%	pass	32.0	33.0	-0.20%	pass
I-17	10/7/2015	68.5	67.3	0.23%	pass	37.1	37.1	0.00%	pass
I-18									
I-19									
I-20	4/6/2016	66.8	66.5	0.06%	pass	33.1	33.1	0.00%	pass
I-21									
I-22	3/14/2016	88.8	89.0	-0.04%	pass	31.9	32.0	-0.02%	pass
I-23	4/7/2016	66.1	64.8	0.25%	pass	33.1	33.8	-0.14%	pass
I-24	10/7/2015	68.6	67.1	0.28%	pass	36.5	36.4	0.02%	pass
I-25	2/26/2016	64.0	64.0	0.00%	pass	32.0	34.0	-0.41%	pass
I-26	4/7/2016	65.6	66.5	-0.17%	pass	34.7	34.4	0.06%	pass
I-27	4/7/2016	66.1	66.4	-0.06%	pass	34.3	33.3	0.20%	pass
I-28	4/7/2016	64.3	63.1	0.23%	pass	33.5	33.9	-0.08%	pass
I-29	1/27/2016	67.5	65.5	0.38%	pass	31.7	32.1	-0.08%	pass
I-30	4/6/2016	66.8	65.6	0.23%	pass	33.2	33.7	-0.10%	pass
I-31	4/7/2016	68.0	69.1	-0.21%	pass	35.1	33.3	0.36%	pass
I-32									
I-33									
I-34									
I-35	4/7/2016	64.0	63.6	0.08%	pass	33.1	32.1	0.20%	pass
I-36	10/7/2015	69.8	68.1	0.32%	pass				
I-37	4/7/2016	66.1	66.9	-0.15%	pass	33.8	33.4	0.08%	pass
I-38	4/7/2016	64.2	63.9	0.06%	pass	33.1	33.1	0.00%	pass
I-39	4/7/2016	66.0	66.2	-0.04%	pass	34.7	34.0	0.14%	pass
I-40	4/7/2016	64.3	62.7	0.31%	pass	33.1	32.0	0.22%	pass
I-41	4/7/2016	64.0	62.2	0.34%	pass	33.0	33.3	-0.06%	pass
GS-02	4/6/2016	66.5	65.1	0.27%	pass	36.6	35.6	0.20%	pass
GS-03	4/6/2016	66.4	64.7	0.32%	pass	35.7	33.4	0.46%	pass
GS-202-01	4/7/2016	64.0	62.8	0.23%	pass	33.1	32.5	0.12%	pass
GS-202-02	4/7/2016	65.6	66.9	-0.25%	pass	32.7	33.5	-0.16%	pass
GA-05	11/3/2015	50.5	48.5	0.39%	pass	33.0	33.5	-0.10%	pass

GN-2	1/27/2016	57.7	57.2	0.10%	pass	31.8	31.9	-0.02%	pass
GN-7	4/6/2016	66.5	65.0	0.29%	pass	33.8	33.1	0.14%	pass
4721	11/3/2015	54.2	53.0	0.23%	pass	35.1	34.8	0.06%	pass
SEA-GN-1	4/7/2016	64.0	62.1	0.36%	pass	33.0	33.5	-0.10%	pass
		50.5	48.5	0.39%	pass	33.0	33.5	-0.10%	pass
		50.5	48.5	0.39%	pass	33.0	33.5	-0.10%	pass
		50.5	48.5	0.39%	pass	33.0	33.5	-0.10%	pass
		50.5	48.5	0.39%	pass	33.0	33.5	-0.10%	pass

Calibration
Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4039-6313610

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Manufactured for and distributed by: Thomas Scientific, Box 99, 99 High Hill Road, Swedeboro, NJ 08085-0099 U.S.A.

Instrument Identification:

JF

Model: 9327K16 S/N: 140754307 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/24/15	1000351744
Temperature Probe	128	3/12/15	15-CJ73J-4-1
Temperature Calibration Bath TC-309	B3A444		
Digital Thermometer	140073820	1/28/15	4000-5680560

Certificate Information:

Technician: 68 Procedure: CAL-03 Cal Date: 10/31/14 Due Date: 10/31/16
Test Conditions: 23.0°C 43.0 %RH 1021 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C		N.A.		0.000	-0.3	Y	-1.0	1.0	0.10	>4:1
°C		N.A.		100.000	99.7	Y	99.0	101.0	0.059	>4:1

This instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

Nicol Rodriguez
Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Water-Proof Thermometer °F/°C should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Water-Proof Thermometer °F/°Cs change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Control Company is an ISO 17025:2005 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.
Control Company is ISO 9001:2008 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-2006-AQ-HOU-RvA.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

ilac-MRA

ACCREDITED

Calibration
Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4039-5554528

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Cust ID:Horizon Engineering, 13585 NE Whitaker Way, Attn. Joe Heffernan III, Portland, OR 97230 U.S.A. (RMA:982686)

JH

Instrument Identification:

ID: CS Model: 90205-22 S/N: 111896552 Manufacturer:Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/13/14	1000332071
Temperature Probe	128	2/20/14	6-B48Z9-30-1
Temperature Calibration Bath TC-218	A73332		
Thermistor Module	A27129	10/25/14	1000346002
Temperature Probe	5202	11/30/14	15-B15PW-1-1

Certificate Information:

Technician: 68 Procedure: CAL-03 Cal Date: 12/03/13 **Cal Due: 12/03/15**

Test Conditions: 24.5°C 44.0 %RH 1007 mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C		N.A.		0.000	-0.5	Y	-1.0	1.0	0.100	>4:1
°C		N.A.		100.000	99.7	Y	99.0	101.0	0.059	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

Nicol Rodriguez
Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Water-Proof Thermometer °F/°C should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Water-Proof Thermometer °F/°Cs change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Control Company is an ISO 17025:2005 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.
Control Company is ISO 9001:2008 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-2006-AQ-HOU-RvA.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

ilac-MRA ACCREDITED Calibration Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4039-7216692

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Cust ID:Horizon Engineering, 13585 NE Whitaker Way, , Portland, OR 97230 U.S.A. (RMA:1000681)

JL

Instrument Identification:

Model: 90205-22 S/N: 240289961 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	3/03/16	1000371058
Temperature Probe	3039	4/02/16	15--A0P2S-20-1
Temperature Calibration Bath TC-231	A79341		
Digital Thermometer	130070752	2/20/16	4000-6561724

Certificate Information:

Technician: 68 Procedure: CAL-03 Cal Date: 11/16/15 Due Date: 11/16/16

Test Conditions: 24.9°C 50.0 %RH 1011 mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C	0.000	-0.2	Y	0.000	-0.2	Y	-1.0	1.0	0.10	>4:1
°C	100.000	100.0	Y	100.000	100.0	Y	99.0	101.0	0.059	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

Nicol Rodriguez

Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Water-Proof Thermometer °F/°C should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Water-Proof Thermometer °F/°Cs change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Control Company is an ISO 17025:2005 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.
Control Company is ISO 9001:2008 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-2006-AQ-HOU-RvA.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

Calibration Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4039-6313618

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Manufactured for and distributed by: Thomas Scientific, Box 99, 99 High Hill Road, Swedeboro, NJ 08085-0099 U.S.A.

Instrument Identification:

Model: 9327K16 S/N: 140754311 Manufacturer: Control Company CH

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/24/15	1000351744
Temperature Probe	128	3/12/15	15-CJ73J-4-1
Temperature Calibration Bath TC-309	B3A444		
Digital Thermometer	140073820	1/28/15	4000-5680560

Certificate Information:

Technician: 68 Procedure: CAL-03 Cal Date: 10/31/14 Due Date: 10/31/16
Test Conditions: 23.0°C 43.0 %RH 1021 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C		N.A.		0.000	-0.5	Y	-1.0	1.0	0.10	>4:1
°C		N.A.		100.000	99.7	Y	99.0	101.0	0.059	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

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Nicol Rodriguez
Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Water-Proof Thermometer °F/°C should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Water-Proof Thermometer °F/°Cs change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

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International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

Calibration Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4039-6313622

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Manufactured for and distributed by: Thomas Scientific, Box 99, 99 High Hill Road, Swedeboro, NJ 08085-0099 U.S.A.

Instrument Identification:

BC

Model: 9327K16 S/N: 140754314 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/24/15	1000351744
Temperature Probe	128	3/12/15	15-CJ73J-4-1
Temperature Calibration Bath TC-309	B3A444		
Digital Thermometer	140073820	1/28/15	4000-5680560

Certificate Information:

Technician: 68 Procedure: CAL-03 Cal Date: 10/31/14 Due Date: 10/31/16

Test Conditions: 23.0°C 43.0 %RH 1021 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C		N.A.		0.000	-0.5	Y	-1.0	1.0	0.10	>4:1
°C		N.A.		100.000	99.7	Y	99.0	101.0	0.059	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

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Nicol Rodriguez
Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Maintaining Accuracy:

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Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

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International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

HORIZON ENGINEERING 16-5702

Calibration Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4039-6313605

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Manufactured for and distributed by: Thomas Scientific, Box 99, 99 High Hill Road, Swedeboro, NJ 08085-0099 U.S.A.

Instrument Identification:

BS

Model: 9327K16 S/N: 140754303 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/24/15	1000351744
Temperature Probe	128	3/12/15	15-CJ73J-4-1
Temperature Calibration Bath TC-309	B3A444		
Digital Thermometer	140073820	1/28/15	4000-5680560

Certificate Information:

Technician: 68 Procedure: CAL-03 Cal Date: 10/31/14 Due Date: 10/31/16
Test Conditions: 23.0°C 43.0 %RH 1021 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C		N.A.		0.000	-0.2	Y	-1.0	1.0	0.10	>4:1
°C		N.A.		100.000	99.5	Y	99.0	101.0	0.059	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

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Nicol Rodriguez
Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Water-Proof Thermometer °F/°C should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Water-Proof Thermometer °F/°Cs change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

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Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

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International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

ilac-MRA A2LA ACCREDITED Calibration Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4039-6313611

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Manufactured for and distributed by: Thomas Scientific, Box 99, 99 High Hill Road, Swedeboro, NJ 08085-0099 U.S.A.

Instrument Identification:

MV

Model: 9327K16 S/N: 140754308 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/24/15	1000351744
Temperature Probe	128	3/12/15	15-CJ73J-4-1
Temperature Calibration Bath TC-309	B3A444		
Digital Thermometer	140073820	1/28/15	4000-5680560

Certificate Information:

Technician: 68 Procedure: CAL-03 Cal Date: 10/31/14 Due Date: 10/31/16

Test Conditions: 23.0°C 43.0 %RH 1021 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C		N.A.		0.000	-0.3	Y	-1.0	1.0	0.10	>4:1
°C		N.A.		100.000	99.8	Y	99.0	101.0	0.059	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

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Nicol Rodriguez
Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Water-Proof Thermometer °F/°C should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Water-Proof Thermometer °F/°Cs change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

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Control Company is ISO 9001:2008 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-2006-AQ-HOU-RvA.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

ilac-MRA A2LA ACCREDITED
Calibration
Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4039-7216695

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Cust ID:Horizon Engineering, 13585 NE Whitaker Way, , Portland, OR 97230 U.S.A. (RMA:1000681)

Instrument Identification:

PB

Model: 90205-22 S/N: 130301083 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	3/03/16	1000371058
Temperature Probe	3039	4/02/16	15--A0P2S-20-1
Temperature Calibration Bath TC-231	A79341		
Digital Thermometer	130070752	2/20/16	4000-6561724

Certificate Information:

Technician: 68 Procedure: CAL-03 Cal Date: 11/16/15 Due Date: 11/16/16
Test Conditions: 24.9°C 50.0 %RH 1011 mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C	0.000	-0.3	Y	0.000	-0.3	Y	-1.0	1.0	0.10	>4:1
°C	100.000	99.8	Y	100.000	99.8	Y	99.0	101.0	0.059	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

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Nicol Rodriguez
Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Water-Proof Thermometer °F/°C should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Water-Proof Thermometer °F/°Cs change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Control Company is an ISO 17025:2005 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.
Control Company is ISO 9001:2008 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-2006-AQ-HOU-RvA.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

ilac-MRA ACCREDITED
Calibration Certificate No. 1750.01

Cert. No.: 4039-7216696

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Cust ID:Horizon Engineering, 13585 NE Whitaker Way, , Portland, OR 97230 U.S.A. (RMA:1000681)

SH

Instrument Identification:

Model: 90205-22 S/N: 130306869 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	3/03/16	1000371058
Temperature Probe	3039	4/02/16	15--A0P2S-20-1
Temperature Calibration Bath TC-231	A79341		
Digital Thermometer	130070752	2/20/16	4000-6561724

Certificate Information:

Technician: 68 Procedure: CAL-03 Cal Date: 11/16/15 Due Date: 11/16/16
Test Conditions: 24.9°C 50.0 %RH 1011 mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C	0.000	-0.2	Y	0.000	-0.2	Y	-1.0	1.0	0.10	>4:1
°C	100.000	99.8	Y	100.000	99.8	Y	99.0	101.0	0.059	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

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Nicol Rodriguez, Quality Manager   Aaron Judice, Technical Manager

Maintaining Accuracy:

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Recalibration:

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Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

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International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

Calibration
Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4039-6506386

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Manufactured for and distributed by: Thomas Scientific, Box 99, 99 High Hill Road, Swedeboro, NJ 08085-0099 U.S.A.

Instrument Identification:

PAT

Model: 9327K16 S/N: 150067645 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-231	A79341		
Thermistor Module	A27129	11/04/15	1000365407
Temperature Probe	5202	11/19/16	6-CV9Y2-1-1
Thermistor Module	A17118	2/24/15	1000351744
Temperature Probe	3039	3/12/15	15-CJ73J-1-1
Temperature Calibration Bath TC-179	A45240		

Certificate Information:

Technician: 68 Procedure: CAL-03 Cal Date: 1/28/15 Due Date: 1/28/17
Test Conditions: 25.0°C 32.0 %RH 1022 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C		N.A.		0.000	-0.4	Y	-1.0	1.0	0.10	>4:1
°C		N.A.		100.000	99.4	Y	99.0	101.0	0.059	>4:1

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Nicol Rodriguez
Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Maintaining Accuracy:

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Recalibration:

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Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

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Control Company is ISO 9001:2008 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-2006-AQ-HOU-RvA.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

Calibration
Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4039-7175480

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Manufactured for and distributed by: Thomas Scientific, Box 99, 99 High Hill Road, Swedeboro, NJ 08085-0099 U.S.A.

Instrument Identification:

JM

Model: 9327K16 S/N: 151830463 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	3/03/16	1000371058
Temperature Probe	3039	4/02/16	15--A0P2S-20-1
Temperature Calibration Bath TC-231	A79341		
Thermistor Module	A27129	11/04/15	1000365407
Temperature Probe	5202	11/19/16	6-CV9Y2-1-1

Certificate Information:

Technician: 68 Procedure: CAL-03 Cal Date: 10/30/15 Due Date: 10/30/17
Test Conditions: 24.4°C 50.0 %RH 1012 mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C		N.A.		0.000	-0.3	Y	-1.0	1.0	0.10	>4:1
°C		N.A.		100.000	100.2	Y	99.0	101.0	0.059	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

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Nicol Rodriguez
Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Maintaining Accuracy:

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Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

MONTROSE
AIR QUALITY SERVICES

peristaltic Pump Cals

Client: Bullseye Glass
Plant: Portland, OR
Sampling Location: Shop
Test Conditions:
Initials: JM
Date: 4/15/16

Pump ID	Vol (mL)	Time (sec)	Flow (ml/min)
Pump 1	200 mL	261.82	45.8
Pump 2	200mL	131.23	91.4
Pump 3	200mL	117.34	102.3

BAROMETER CALIBRATIONS

Horizon Shop
2016 Calibrations
JH

					mew
BAROMETER CALIBRATIONS		inHg	inHg	Diff	inHg
ELEVATION OF STANDARD 30 FT			NWS	%	
TV 1			#N/A	#N/A	#N/A
TV 2			#N/A	#N/A	#N/A
TV 3	1/8/2016	30.10	30.02	0.3%	0.08
TV 4	1/15/2016	30.20	30.06	0.5%	0.14
TV 5	1/8/2016	30.20	30.02	0.6%	0.18
Portland Shop Barometer			#N/A	#N/A	#N/A
Shortridge #1 (HE 276)	1/8/2016	30.30	30.02	0.9%	0.28
Shortridge #2 (HE 028)	1/8/2016	30.00	30.02	-0.1%	-0.02
Shortridge #3 (HE 226)	1/8/2016	30.00	30.02	-0.1%	-0.02
Shortridge #4 (HE 325)	1/13/2016	29.93	29.90	0.1%	0.03
Shortridge #5 (HE 414)	1/15/2016	29.99	30.06	-0.2%	-0.07
Shortridge #6	1/13/2016	29.93	29.80	0.4%	0.13
Shortridge #7 (HE 324)	1/8/2016	30.10	30.02	0.3%	0.08
Shortridge #8			#N/A	#N/A	
CARL SLIMP			#N/A	#N/A	

QA/QC Documentation
Procedures

Introduction The QA procedures outlined in the U. S. Environmental Protection Agency (EPA) test methods are followed, including procedures, equipment specifications, calibrations, sample extraction and handling, calculations, and performance tolerances. Many of the checks performed have been cited in the Sampling section of the report text. The results of those checks are on the applicable field data sheets in the Appendix.

Continuous Analyzer Methods Field crews operate the continuous analyzers according to the test method requirements, and Horizon's additional specifications. On site quality control procedures include:

- Analyzer calibration error before initial run and after a failed system bias or drift test (within ± 2.0% of the calibration span of the analyzer for the low, mid, and high-level gases or 0.5 ppmv absolute difference)
- System bias at low-scale (zero) and upscale calibration gases (within ± 5.0% of the calibration span or 0.5 ppmv absolute difference)
- Drift check (within ±3.0% of calibration span for low, and mid or high-level gases, or 0.5 ppmv absolute difference)
- System response time (during initial sampling system bias test)
- Checks performed with EPA Protocol 1 or NIST traceable gases
- Leak free sampling system
- Data acquisition systems record 10-second data points or one-minute averages of one second readings
- NO_2 to NO conversion efficiency (before each test)
- Purge time (≥ 2 times system response time and will be done before starting run 1, whenever the gas probe is removed and re-inserted into the stack, and after bias checks)
- Sample time (at least two times the system response time at each sample point)
- Sample flow rate (within approximately 10% of the flow rate established during system response time check)
- Interference checks for analyzers used will be included in the final test report
- Average concentration (run average ≤ calibration span for each run)
- Stratification test (to be done during run 1 at three(3) or twelve(12) points according to EPA Method 7E; Method 3A, if done for molecular weight only, will be sampled near the centroid of the exhaust; stratification is check not normally applicable for RATAs)

Manual Equipment QC Procedures On site quality control procedures include pre- and post-test leak checks on trains and pitot systems. If pre-test checks indicate problems, the system is fixed and rechecked before starting testing. If post-test leak checks are not acceptable, the test run is voided and the run is repeated. Thermocouples and readouts are verified in the field to read ambient prior to the start of any heating or cooling devices.

Sample Handling Samples taken during testing are handled to prevent contamination from other runs and ambient conditions. Sample containers are glass, Teflon™, or polystyrene (filter petri dishes) and are pre-cleaned by the laboratory and in the Horizon Engineering shop. Sample levels are marked on containers and are verified by the laboratory. All particulate sample containers are kept upright and are delivered to the laboratory by Horizon personnel.

Data Processing Personnel performing data processing double-check that data entry and calculations are correct. Results include corrections for field blanks and analyzer drift. Any abnormal values are verified with testing personnel and the laboratory, if necessary.

After results are obtained, the data processing supervisor validates the data with the following actions:

- verify data entry
- check for variability within replicate runs
- account for variability that is not within performance goals (check the method, testing, and operation of the plant)
- verify field quality checks

Equipment Calibrations Periodic calibrations are performed on each piece of measurement equipment according to manufacturers' specifications and applicable test method requirements. The Oregon Department of Environmental Quality (ODEQ) Source Testing Calibration Requirements sheet is used as a guideline. Calibrations are performed using primary standard references and calibration curves where applicable.

Dry Gas Meters Dry gas meters used in the manual sampling trains are calibrated at three rates using a standard dry gas meter that is never taken into the field. The standard meter is calibration verified by the Northwest Natural Gas meter shop once every year. Dry gas meters are post-test calibrated with documentation provided in test reports.

Thermocouples Sample box oven and impinger outlet thermocouples are calibration checked against an NIST traceable thermocouple and indicator system every six months at three points. Thermocouple indicators and temperature controllers are checked using a NIST traceable signal generator. Readouts are checked over their usable range and are adjusted if necessary (which is very unusual). Probe thermocouples are calibrated in the field using the ALT-011 alternate Method 2 calibration procedure, which is documented on the field data sheet for the first run the probe thermocouple was used.

Pitots Every six months, S-type pitots are calibrated in a wind tunnel at three points against a standard pitot using inclined manometers. They are examined for dents and distortion to the alignment, angles, lengths, and proximity to thermocouples before each test. Pitots are protected with covers during storage and handling until they are ready to be inserted in the sample ports.

Nozzles Stainless steel nozzles are calibrated twice each year by checking for nicks or dents and making diameter measurements in triplicate. Quartz and borosilicate glass nozzles (and often stainless steel nozzles) are commonly calibrated in the field by taking the average of three consecutive diameter measurements. These field calibrations are recorded on the field data sheet for the first run the nozzle was used.

Correspondence

Source Test Plan and Correspondence

HORIZON ENGINEERING LLC
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www.horizonengineering.com

March 24, 2016

Project No. 5702

Mr. George Davis
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Northwestern Region – Portland Office
700 NE Multnomah St., Suite 600
Portland, OR 97232

Mr. Michael Eisele, P.E.
Oregon Department of Environmental Quality
Western Region – Salem Office
4026 Fairview Industrial Drive
Salem, OR 97302

Re: Source Testing: Bullseye Glass Co.
3722 SE 21st Ave
Portland, OR 97202

This correspondence is notice that Horizon Engineering is to do source testing for the above-referenced facility, tentatively scheduled for April 2016. This will serve as the Source Test Plan unless changes are requested prior to the start of testing.

1. **Source to be Tested:** Glass Furnace T7
2. **Test Locations:** Baghouse BH-1 Inlet and Outlet
3. **Purpose of the Testing:** Performance testing for new baghouse
4. **Source Description:** Source description will be included in the final report.
5. **Pollutants to be Tested:** particulate matter (PM), Total Cr, and Cr^{+6}.
6. **Test Methods to be Used:** Testing will be conducted in accordance with EPA methods in Title 40 Code of Federal Regulations Part 60 (40 CFR 60), Appendix A, from the Electronic Code of Federal Regulations (www.ecfr.gov), January, 2014; Oregon Department of Environmental Quality (ODEQ) methods in Source Sampling Manual Volume 1, April, 2015.

Flow Rate:	EPA Methods 1 and 2 (S-type pitot w/ isokinetic traverses)
CO_2 and O_2:	EPA Method 3A (NDIR and paramagnetic analyzers)[1]
Moisture:	EPA Method 4 (incorporated w/ ODEQ Method 5)
PM:	ODEQ Method 5 (filterable and condensable PM; isokinetic impinger train technique)
Total Cr & Cr^{+6}:	SW-846 Method 0061 (isokinetic recirculatory impinger train technique with Cr^{+6} analysis by IC with Post-Column Derivatization-Visible Absorption and Total Cr analysis by ICP-MS)

7. **Continuous Analyzer Data Recording:** Data acquisition system (DAS) will be used. Strip chart records may be used as backup. One-minute averages of one-second readings are logged. Run averages, tabulated data and the graphic outputs from the DAS are included in the test reports.

8. **Continuous Analyzer Gas Sampling:** EPA Method 3A will be sampled at one point near the exhaust centroid because it is not done for a correction. Particulate and gas sampling will be simultaneous.

9. **Criteria Location:** It is assumed today, but it will be confirmed on or before the test day, that each test port location meets criteria in EPA Methods 1 and 2.

10. **Quality Assurance/Quality Control (QA/QC):** Method-specific quality assurance/quality control procedures must be performed to ensure that the data is valid for determining source compliance. Documentation of the procedures and results will be presented in the source test report for review. Omission of this critical information may result in rejection of the data, requiring a retest. This documentation will include at least the following:

    Continuous analyzer procedures: Field crews will operate the analyzers according to the test method requirements with additional data backup. On-site procedures include:

    EPA Method 3A:
    - Analyzer calibration error before initial run and after a failed system bias or drift test (within ± 2.0% of the calibration span of the analyzer for the low, mid, and high-level gases or 0.5 ppmv absolute difference)
    - System bias at low-scale (zero) and upscale calibration gases (within ± 5.0% of the calibration span or 0.5 ppmv absolute difference)
    - Drift check (within ±3.0% of calibration span for low, and mid or high-level gases, or 0.5 ppmv absolute difference)
    - System response time (during initial sampling system bias test)
    - Checks performed with EPA Protocol 1 or NIST traceable gases except zero gas
    - Zero gas meets the definition for zero air material as defined by 40 CFR 72.2
    - Leak free sampling system
    - Data acquisition systems record 10-second data points or one-minute averages of one second readings

[1] EPA Method 3A will only be measured at the baghouse outlet.

- Purge time (≥ 2 times system response time and will be done before starting run 1, whenever the gas probe is removed and re-inserted into the stack, and after bias checks)
- Sample time (at least two times the system response time at each sample point)
- Sample flow rate (within approximately 10% of the flow rate established during system response time check)
- Interference checks for analyzers used will be included in the final test report
- Average concentration (run average ≤ calibration span for each run)
- Stratification test (to be done during run 1 at three(3) or twelve(12) points according to EPA Method 7E; EPA Method 3A if done for molecular weight only will be sampled near the centroid of the exhaust; and stratification check not normally applicable for RATAs)

Manual equipment procedures: Field crews will operate the manual testing equipment according to the test method requirements. On-site procedures include:

- Operators will perform pre- and post-test leak checks on the sampling system and pitot lines.
- Thermocouples attached to the pitots and probes are calibrated in the field using EPA Alternate Method 11. A single-point calibration on each thermocouple system using a reference thermometer is performed. Thermocouples must agree within ±2°F with the reference thermometer. Also, prior to use, thermocouple systems are checked for ambient temperature before heaters are started.
- Nozzles are inspected for nicks or dents and pitots are examined before and after each use to confirm that they are still aligned.
- Pre- and post-test calibrations on the meter boxes will be included with the report, along with semi-annual calibrations of critical orifices, pitots, nozzles and thermocouples (sample box impinger outlet and oven, meter box inlet and outlet, and thermocouple indicators).
- Blank reagents are submitted to the laboratory with the samples. Liquid levels are marked on sample jars in the field and are verified by the laboratory.
- The Oregon Method 5, 7, and 17 minimum sample volume shall be the greater of 31.8 dscf or sufficient to ensure a minimum ISDL of one-half (1/2) the emission standard.

SW-846 Method 0061: Field crews will operate the manual testing equipment according to the test method requirements. On-site procedures include:

- 0.5 M KOH will be used to ensure that the pH of the solution is above 8.5 after sampling.
- pH of the impinger solution will be checked during sample recovery.
- The sample train will be purged with N_2 at a rate of 10 L/min for 30 minutes.
- If the stack temperature is above 200 ^{0}F, the Teflon sample and recirculating lines may be placed in an ice bath to keep the recirculated reagent cool enough so it does not turn to steam.

Audit Sample Requirement: The EPA Stationary Source Audit Sample Program was restructured and promulgated on September 30, 2010 and was made effective 30 days after that date. The Standard requires that the Facility or their representative must order audit samples if they are available, with the exception of the methods listed in 40 CFR 60, 60.8(g)(1). The TNI website is referred to for a list of available accredited audit Providers and audits (www.nelac-institute.org/ssas/). If samples are not available from at least two accredited Providers they are not required. Currently, accredited Providers offer audit samples for EPA Methods 6, 7, 8, 12, 13A, 13B, 26, 26A, 29 and 101A. Based on the above, Bullseye Glass is not required to obtain audit samples for this test program.

11. **Number of Sampling Replicates and their Duration:** One (1) test run of approximately sixteen hours at each location. Inlet and outlet testing will be simultaneous. In no case will sampling replicates be separated by twenty-four (24) or more hours, unless prior authorization is granted by the Department.

12. **Reporting Units for Results:** Results will be expressed as concentrations (ppmv, μg/dscm. or gr/dscf), as rates (lb/hr), and on a production basis if that information is provided.

13. **Horizon Engrg. Contact:**		Thomas Rhodes or
		(503) 255-5050
	Fax	(503) 255-0505
	E-mail	trhodes@montrose-env.com
14. **Consultant:**		John Browning
		(503) 212-2515
	Cell	(503) 412-9842
	E-mail	jbrowning@bridgeh2o.com
15. **Source Site Personnel:**		Dan Schwoerer
		(503) 232-8887
	Fax	(503) 238-9963
	E-mail	danschwoerer@bullseyeglass.com
16. **Regulatory Contacts:**		George Davis
		(503) 229-5534
	Fax	(503) 229-6945
	Email	davis.george@deq.state.or.us
		Michael Eisele
		(503) 378-5070
	Fax	(503) 378-4196
	E-mail	EISELE.Michael@deq.state.or.us

17. **Applicable Process/Production/Control Information:** Operating data that characterize the source are considered to be:

- Type and quantity of material being processed – 1,200 to 1,350 pounds of batch materials to make dark green cathedral glass with a chromium content greater than 1.00%

- Furnace temperature – Furnace to be regulated between the temperature of 2,100^{0}F and 2,575^{0}F as per usual production parameters.
- Redox settings – Combustion gasses to be mixed at a ratio of 1.02 to 1.20 parts natural gas for 2.0 parts oxygen as per usual production parameters
- Baghouse pressure drop – Pressure readings will be tracked during the testing cycle
- All normally recorded process information

Process/Production/Control information is to be gathered for each test run by the Source Site Personnel and provided to Horizon for inclusion in the report.

The source must operate at the rate specified in the Permit during testing. Rates not in agreement with those stipulated in the Permit can result in test rejection for application to determine compliance or emission factor verification. Imposed process limitations could also result from atypical rates.

If the Permit does not specify a process rate for testing, we recommend a normal maximum rate.

18. **Source Test Audit Report:** Source Test Audit Report forms will be submitted along with the source test report for this testing.

19. **Plant Entry & Safety Requirements:** The test team will follow internal safety policies and abide by any site specific safety and entry requirements.

20. **Responsibilities of Test Personnel:** The test team will consist of one Project Manager and eight Technicians.

21. **Tentative Test Schedule:**

    Day 1: Mobilize
    Day 2: Test
    Day 3: Demobilize

22. **Other Considerations:** The testing locations for the baghouse inlet are on a horizontal section of ducting. Depending on the port orientation, to prevent the recirculating impinger solution from draining out of the nozzle, the SW-846 Method 0061sample train may only be sampled from the horizontal port.

23. **Administrative Notes:** Unless notified prior to the start of testing, this test plan is considered to be approved for compliance testing of this source. A letter acknowledging receipt of this plan and agreement on the content (or changes as necessary) would be appreciated.

    The Department will be notified of any changes in source test plans prior to testing. It is recognized that significant changes not acknowledged, which could affect accuracy and reliability of the results, could result in test report rejection.

    Source test reports will be prepared by Horizon Engineering and will include all results and example calculations, field sampling and data reduction procedures, laboratory analysis reports, and QA/QC documentation. Source test reports will be submitted to you within 45days of the completion of the field work, unless another deadline is agreed upon. Bullseye Glass should send one (1) hardcopy of the completed source test report to you at the address above.

Any questions or comments relating to this test plan should be directed to me.

Sincerely,

Thomas Rhodes, QSTI
District Manager
Horizon Engineering, an affiliate of Montrose Environmental Group, Inc.

For information on Horizon Engineering and Montrose Environmental, go to www.montrose-env.com

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HORIZON ENGINEERING LLC

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April 25, 2016

Project No. 5702

Mr. George Davis
Oregon Department of Environmental Quality
Northwestern Region – Portland Office
700 NE Multnomah St., Suite 600
Portland, OR 97232

Mr. Michael Eisele, P.E.
Oregon Department of Environmental Quality
Western Region – Salem Office
4026 Fairview Industrial Drive
Salem, OR 97302

Re: Source Test Plan Addendum: Bullseye Glass Co.
3722 SE 21st Ave
Portland, OR 97202

The purpose of this correspondence is to submit an addendum to the Bullseye Glass Co. Source Test Plan submitted to you on April 8, 2016.

As recently discussed, the normal operation of the glass furnace T7 and its control device (baghouse BH-1) will include periodic pulse jet cleaning of the filter bags to maintain optimum filtration efficiency. It has been observed that during pulse jet cleaning, filtered particulate matter potentially flows towards the baghouse inlet ducting where the test sample probes will be located. In order to eliminate the potential for filtered particulate matter being entrained into the sampling probe thereby producing biased test results we are proposing to pause inlet sampling during periods of pulse jet cleaning. We anticipate approximately 4 to 6 cleaning cycles lasting about 5 minutes each distributed throughout the 16 hour test period. As such, we propose to addend item 17 of the source test plan as follows:

- Pulse jet cleaning – Pause inlet sampling during pulse jet cleaning cycles and record the time and duration of the pause

Bullseye Glass Co. has decided to include two additional test runs for total Cr & Cr^{+6} at the baghouse outlet. These additional runs will be conducted during Run 2 and Run 3.

Any questions or comments relating to this test plan should be directed to me.

Sincerely,

Thomas Rhodes, QSTI
District Manager
Horizon Engineering, an affiliate of Montrose Environmental Group, Inc.

For information on Horizon Engineering and Montrose Environmental, go to www.montrose-env.com

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April 8, 2016 Project No. 5702

Mr. George Davis
Oregon Department of Environmental Quality
Northwestern Region – Portland Office
700 NE Multnomah St., Suite 600
Portland, OR 97232

Mr. Michael Eisele, P.E.
Oregon Department of Environmental Quality
Western Region – Salem Office
4026 Fairview Industrial Drive
Salem, OR 97302

Re: Source Testing: Bullseye Glass Co.
3722 SE 21st Ave
Portland, OR 97202

This correspondence is notice that Horizon Engineering is to do source testing for the above-referenced facility, tentatively scheduled for April 2016. This will serve as the Source Test Plan unless changes are requested prior to the start of testing.

1. **Source to be Tested:** Glass Furnace T7
2. **Test Locations:** Baghouse BH-1 Inlet and Outlet
3. **Purpose of the Testing:** Performance testing for new baghouse. Cr^{+6} emissions will be estimated using the Cr^{+6} inlet results and the PM removal efficiency.
4. **Source Description:** Source description will be included in the final report.
5. **Pollutants to be Tested:** particulate matter (PM), Total Cr, and Cr^{+6}.
6. **Test Methods to be Used:** Testing will be conducted in accordance with EPA methods in Title 40 Code of Federal Regulations Part 60 (40 CFR 60), Appendix A, from the Electronic Code of Federal Regulations (www.ecfr.gov), January, 2014; Oregon Department of Environmental Quality (ODEQ) methods in Source Sampling Manual Volume 1, April, 2015.

Baghouse Inlet

Flow Rate:	EPA Methods 1 and 2 (S-type pitot w/ isokinetic traverses)
CO_2 and O_2:	Assume same molecular weight as the outlet
Moisture:	EPA Method 4 (incorporated w/ ODEQ Method 5)
PM:	ODEQ Method 5 (filterable and condensable PM; isokinetic impinger train technique)
Total Cr & Cr^{+6}:	SW-846 Method 0061 (isokinetic recirculatory impinger train technique with Cr^{+6} analysis by IC with Post-Column Derivatization-Visible Absorption and Total Cr analysis by ICP-MS)

Baghouse Outlet

Flow Rate:	EPA Methods 1 and 2 (S-type pitot w/ isokinetic traverses)
Fixed Gases:	EPA Method 3C (Tedlar bags with analysis by GC/TCD for CH_4, N_2, O_2, & CO_2)[1]
Moisture:	EPA Method 4 (incorporated w/ ODEQ Method 5)
PM:	ODEQ Method 5 (filterable and condensable PM; isokinetic impinger train technique)

7. **Continuous Analyzer Data Recording:** Data acquisition system (DAS) will be used. Strip chart records may be used as backup. One-minute averages of one-second readings are logged. Run averages, tabulated data and the graphic outputs from the DAS are included in the test reports.

8. **Continuous Analyzer Gas Sampling:** EPA Method 3A will be sampled at one point near the exhaust centroid because it is not done for a correction. Particulate and gas sampling will be simultaneous.

9. **Criteria Location:** It is assumed today, but it will be confirmed on or before the test day, that each test port location meets criteria in EPA Methods 1 and 2.

10. **Quality Assurance/Quality Control (QA/QC):** Method-specific quality assurance/quality control procedures must be performed to ensure that the data is valid for determining source compliance. Documentation of the procedures and results will be presented in the source test report for review. Omission of this critical information may result in rejection of the data, requiring a retest. This documentation will include at least the following:

    Manual equipment procedures: Field crews will operate the manual testing equipment according to the test method requirements. On-site procedures include:

    - Operators will perform pre- and post-test leak checks on the sampling system and pitot lines.
    - Thermocouples attached to the pitots and probes are calibrated in the field using EPA Alternate Method 11. A single-point calibration on each thermocouple system using a reference thermometer is performed. Thermocouples must agree within ±2°F with the reference thermometer.

[1] It is anticipated that several Tedlar bag samples will be taken during the run to encompass the entire length of the test run.

Also, prior to use, thermocouple systems are checked for ambient temperature before heaters are started.

- Nozzles are inspected for nicks or dents and pitots are examined before and after each use to confirm that they are still aligned.
- Pre- and post-test calibrations on the meter boxes will be included with the report, along with semi-annual calibrations of critical orifices, pitots, nozzles and thermocouples (sample box impinger outlet and oven, meter box inlet and outlet, and thermocouple indicators).
- Blank reagents are submitted to the laboratory with the samples. Liquid levels are marked on sample jars in the field and are verified by the laboratory.
- The Oregon Method 5, 7, and 17 minimum sample volume shall be the greater of 31.8 dscf or sufficient to ensure a minimum ISDL of one-half (1/2) the emission standard.

SW-846 Method 0061: Field crews will operate the manual testing equipment according to the test method requirements. On-site procedures include:

- 0.5 M KOH will be used to ensure that the pH of the solution is above 8.5 after sampling.
- pH of the impinger solution will be checked during sample recovery.
- pH of the impinger solution may be checked periodically during the test run. The sample train will be leak check before and after any disassembly that may be required. If additional KOH is added, the volume will be recorded.
- The sample train will be purged with N_2 at a rate of 10 L/min for 30 minutes.
- If the stack temperature is above 200 ^{0}F, the Teflon sample and recirculating lines may be placed in an ice bath to keep the recirculated reagent cool enough so it does not turn to steam.

Audit Sample Requirement: The EPA Stationary Source Audit Sample Program was restructured and promulgated on September 30, 2010 and was made effective 30 days after that date. The Standard requires that the Facility or their representative must order audit samples if they are available, with the exception of the methods listed in 40 CFR 60, 60.8(g)(1). The TNI website is referred to for a list of available accredited audit Providers and audits (www.nelac-institute.org/ssas/). If samples are not available from at least two accredited Providers they are not required. Currently, accredited Providers offer audit samples for EPA Methods 6, 7, 8, 12, 13A, 13B, 26, 26A, 29 and 101A. Based on the above, Bullseye Glass is not required to obtain audit samples for this test program.

11. **Number of Sampling Replicates and their Duration:** Three (3) test runs of approximately sixteen hours at each location. Inlet and outlet testing will be simultaneous. In no case will sampling replicates be separated by twenty-four (24) or more hours, unless prior authorization is granted by the Department.

12. **Reporting Units for Results:** Results will be expressed as concentrations (ppmv, μg/dscm. or gr/dscf), as rates (lb/hr), removal efficiency (%), and on a production basis if that information is provided.

13. **Horizon Engrg. Contact:** Thomas Rhodes or
(503) 255-5050
Fax (503) 255-0505
E-mail trhodes@montrose-env.com

14. **Consultant:** John Browning
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15. **Source Site Personnel:** Dan Schwoerer
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E-mail danschwoerer@bullseyeglass.com

16. **Regulatory Contacts:** George Davis
(503) 229-5534
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Email davis.george@deq.state.or.us

Michael Eisele
(503) 378-5070
Fax (503) 378-4196
E-mail EISELE.Michael@deq.state.or.us

17. **Applicable Process/Production/Control Information:** Operating data that characterize the source are considered to be:

- Type and quantity of material being processed – 1,200 to 1,350 pounds of batch materials to make dark green cathedral glass with a high chromium content. Cullet will not be used during the source test.
- Furnace temperature – Furnace to be regulated between the temperature of 2,100^{0}F and 2,575^{0}F as per usual production parameters.
- Redox settings – Combustion gasses to be mixed at a ratio of 1.00 parts natural gas for 1.90 to 1.80 parts oxygen as per usual production parameters, in a furnace plumbed with natural gas and liquid oxygen
- Baghouse pressure drop – Pressure readings will be tracked during the testing cycle
- All normally recorded process information

Process/Production/Control information is to be gathered for each test run by the Source Site Personnel and provided to Horizon for inclusion in the report.

The source must operate at the rate specified in the Permit during testing. Rates not in agreement with those stipulated in the Permit can result in test rejection for application to determine compliance or emission factor verification. Imposed process limitations could also result from atypical rates.

If the Permit does not specify a process rate for testing, we recommend a normal maximum rate.

18. **Source Test Audit Report:** Source Test Audit Report forms will be submitted along with the source test report for this testing.

19. **Plant Entry & Safety Requirements:** The test team will follow internal safety policies and abide by any site specific safety and entry requirements.

20. **Responsibilities of Test Personnel:** The test team will consist of one Project Manager and up to eight Technicians.

21. **Tentative Test Schedule:**

April 25 (Mon):	Mobilize and setup
April 26 (Tues):	Begin test Run 1
April 27 (Wed):	Begin test Run 2
April 28 (Thurs):	Begin test Run 3
April 29 (Fri):	Complete testing and demobilize

22. **Other Considerations:** None known

23. **Administrative Notes:** Unless notified prior to the start of testing, this test plan is considered to be approved for compliance testing of this source. A letter acknowledging receipt of this plan and agreement on the content (or changes as necessary) would be appreciated.

    The Department will be notified of any changes in source test plans prior to testing. It is recognized that significant changes not acknowledged, which could affect accuracy and reliability of the results, could result in test report rejection.

    Source test reports will be prepared by Horizon Engineering and will include all results and example calculations, field sampling and data reduction procedures, laboratory analysis reports, and QA/QC documentation. Source test reports will be submitted to you within 45 days of the completion of the field work, unless another deadline is agreed upon. Bullseye Glass should send one (1) hardcopy of the completed source test report to you at the address above.

Any questions or comments relating to this test plan should be directed to me.

Sincerely,

Thomas Rhodes, QSTI
District Manager
Horizon Engineering, an affiliate of Montrose Environmental Group, Inc.

For information on Horizon Engineering and Montrose Environmental, go to www.montrose-env.com

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Oregon
Kate Brown, Governor

Department of Environmental Quality
Western Region Salem Office
4026 Fairview Industrial Dr SE
Salem, OR 97302
(503) 378-8240
FAX (503) 373-7944
TTY 711

April 12, 2016

Eric Durrin
Bullseye Glass Company
3722 SE 21st Ave
Portland, OR 97202

Thomas Rhodes
Horizon Engineering
13585 NE Whitaker Way
Portland, OR 97230

Re: Bullseye Glass Company
ACDP Permit 26-3135-ST-01
Source Test Plan

Eric Durrin and Thomas Rhodes:

DEQ originally received the source test plan for testing the emissions from glass furnace T7 located at Bullseye Glass in Portland, OR on March 21, 2016. DEQ received the first revised plan on March 25, 2016, and final revised plan on April 8, 2016. The final plan details the methods and approach to determine the emission rate and removal efficiency of particulate matter (PM) from the baghouse inlet and exhaust, and the measurement of total chromium (Cr) and hexavalent chromium (Cr^{+6}) at the baghouse inlet. DEQ has reviewed the source test plan and is approving it with the following conditions:

GENERAL PROCESS CONDITIONS

1.) Only regular operating staff may adjust the production process and emission control parameters during the source performance tests and within two (2) hours prior to the tests. Any operating adjustments made during the source performance tests, which are a result of consultation during the tests with source testing personnel, equipment vendors or consultants, may render the source performance test invalid. Any adjustments made during the test must be recorded and included in the test report.

2.) Testing shall be performed while the furnace is making glass with the highest percentage of chromium normally used. The furnace must also be fired in the most oxidizing condition under which chromium containing glass is normally made. The ingredients in the batch must be the most oxidizing ingredients normally used to make chromium containing glass. Documentation stating and explaining this must be provided in the test report.

3.) During source testing the following process parameters must be monitored, recorded, and documented in the source test report. The process parameters below are to be reported for each individual test run and averaged for all test runs, if appropriate.

- Amount of total chromium in the batch (lbs)
- Type and quantity of material being processed
- Oxygen usage (quantity used, hourly minimum)
- Natural gas usage (quantity used, hourly minimum)
- Furnace temperature (^{o}F, hourly minimum)
- Baghouse pressure drop (inches of water column, twice per test run)
- Weight of charges during each batch (lbs)
- Time of charges
- Weight of finished product (lbs)
- Duration of the charging period (hrs)
- Duration of refining period (hrs)
- All other normally recorded information

TOTAL CHROMIUM & HEXAVALENT CHROMIUM (EPA SW-846 METHOD 0061) CONDITIONS

4.) During sampling, make sure other sampling equipment is not interfering with isokinetic sampling.

5.) Take steps to minimize the blockage effects of the sampling probe in the test duct/stack.

6.) Testing must be performed using two ports located 90 degrees from each other.

7.) The sample shall be collected in a different plane (i.e., different set of ports and a port at a different angle) than the inlet particulate sample.

8.) To ensure that representative chromium samples are collected during these extended test intervals (~16 hours), four sequential traverses should be performed on each of the two ports. For example, sampling points should be moved every ten minutes (120 minutes per traverse), rather than performing a single traverse (40 minutes per point). The test run only needs to include one port change.

9.) Ensure the recirculating KOH cannot be lost out the sampling nozzle.

10.) With the exception of the sampling nozzle (glass) and the silica gel impinger, all of the sampling train components (including connecting fittings) shall be Teflon.

11.) In Section 10, Horizon notes that the pH of the KOH sample solution will be measured after the completion of the testing, which is required by the method. Given the duration of the testing you may, to make sure the pH of the absorbing solution remains above 8.5, momentarily pause the test to check the pH periodically throughout the run (e.g., every few hours). Any pH data collected shall be documented on the field data sheet. Leak checks must be completed any time the sampling system is opened. Leak checks of the equipment and any gain in volume by the dry gas meter due to the leak checks must also be documented on the field data sheets. Correct the final sample volume by the amount collected during the leak checks and use the corrected sample volume amount for emissions calculations.

12.) Equation 7.6.4 of the method has an error. If Horizon opts to perform a blank correction, please use the following equation:

m = [(S, ug/ml * Vls, ml) – (B, ug/ml * 300 ml)] x d

(Note: The above equation assumes that the impingers are initially charged with 300 mls of the KOH reagent)

13.) Verify the KOH recirculation rate is at least 50 ml/min.

14.) Record the nitrogen purge rate and duration.

15.) Following purging and filtration, the sample solution is to be transferred to polyethylene sample bottles.

16.) Following the test, the impinger solution shall be purged with nitrogen and filtered through an acetate membrane filter (0.45 um pore size); refer to Section 5.4.3 of the method.

17.) The volume of DI water used to rinse the sampling train directly affects the detection limit. The volume should be sufficient to quantitatively rinse the train; it should not be excessive. We recommend that a pre-measured volume of rinse water (e.g., 100 mls) be provided to the sample recovery person so that the same amount of rinse is used for each test.

18.) Take steps to make sure the level of hexavalent chromium in the KOH reagent is as low as possible before testing begins.

19.) Meticulously follow the procedures in section 7.1.2 to make sure the sampling trains are free of contaminates.

20.) The hexavalent chromium analyses are to be completed within 14 days of sample collection (Section 6.3 of the method).

21.) Hexavalent and total chromium test results must be reported as indicated below for each individual test run and averaged for all three test runs. Hand calculations must be provided for at least one test run.

- ng/dscm
- lbs/hr
- lbs/ton of chromium processed
- lbs/ton of glass produced

22.) Use the particulate removal efficiency to calculate the emission rate of hexavalent and total chromium emissions. Report results as indicated below for each individual test run and averaged for all three test runs. Hand calculations must be provided for at least one test run.

- ng/dscm
- lbs/hr
- lbs/ton of chromium processed
- lbs/ton of glass produced

Note that Item 22 data (baghouse *exhaust* chromium emissions) shall be clearly denoted in the report's summary table(s) as 'calculated (vs. measured) values'.

FLOW RATE AND MOISTURE (EPA METHODS 1, 2, & 4) CONDITIONS

23.) The exhaust duct configurations and flow measurements must meet the EPA Methods 1/1A & 2 criteria. Documentation including clear diagrams must be provided in the source test report.

24.) The sample locations must be checked for cyclonic flow. Documentation of this must be provided in the test report.

25.) Ensure that the manometer used to record pressure readings meets the criteria of Method 2 Section 6.2.

26.) Moisture content of the exhaust stack gas must be determined by EPA Method 4 for each test run. In addition, Section 12.1.7 of EPA Method 4 states "In saturated or moisture droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one using a value based upon the saturated conditions (alternate method) and one based upon the results of the impinger analysis (EPA Method 4). If this is the case, then ODEQ Method 4 (wet bulb/dry bulb) shall be used as the alternative method. At a minimum, two measurements of moisture content using ODEQ Method 4 shall be made for each run and averaged for the run. The lower of the two values as determined by EPA Method 4 and ODEQ Method 4 shall be considered correct for each run.

EXHAUST GAS COMPOSITION (EPA METHOD 3C/ASTM METHODS 1946) CONDITIONS

27.) N_2, O_2, CO_2, CO, CH_4, C_2H_6, and C_3H_8 concentrations must be determined to calculate the molecular weight of the exhaust. Collect sample at a constant rate over the duration of the test run. Record the sampling rate on the field data sheet.

28.) Immediately after the completion of the test run, close the bag valve and keep the bag under positive pressure until the sample is analyzed to ensure any leakage of the bag will not dilute the sample. A band around the bag should be sufficient to accomplish this although other measures may be taken that accomplish the same result. In the event that multiple bags are collected, record the start and end times of the collection periods.

29.) Analyze each bag separately and time weight the concentrations to get an average molecular weight over the duration of each test run.

30.) EPA Method 3A is cited in the test plan, DEQ understands that this is an inaccuracy and that Method 3A will not be used during this testing program. The methods referenced in this section will be used to determine the molecular weight in place of Method 3A.

PARTICULATE MATTER (EPA/ ODEQ METHOD 5) CONDITIONS

31.) During sampling, make sure other equipment is not interfering with isokinetic sampling.

32.) Additional (i.e., empty) impingers may be added between the second and fourth impinger to collect condensate from the flue gas.

33.) At the inlet sampling location, the particulate sample shall be collected in a different plane (i.e., different set of ports and a port at a different angle) than the chromium sample is being collected.

34.) Take steps to minimize the blockage of the sampling location with sampling equipment.

35.) To ensure that representative particulate samples are collected during these extended test intervals (~16 hours), four sequential traverses should be performed on each of the two ports. For example, sampling points should be moved every ten minutes (120 minutes per traverse), rather than performing a single traverse (40 minutes per point). The test run only needs to include one port change.

36.) If the filter becomes plugged to the point in which isokinetics can no longer be maintained pause the inlet and outlet sampling. Leak check the sampling system with the clogged filter; replace the filter; repeat the check the sampling system; make note of the dry gas meter's volume displacement caused by the leak checks; and continue testing. Correct the final sample volume by the amount collected during the leak checks and use the corrected sample volume amount for emissions calculations.

37.) For ODEQ Method 5, the method quantifiable limit (MQL) is 7 mg of PM, which should be taken into consideration when targeting a minimum sample volume and when calculating results. If less than 7 mg is collected, calculations shall be based not on the actual mass of PM collected but on the MQL of 7 mg as a "less than quantifiable limit" value.

38.) For both the inlet and outlet of the baghouse provide filterable, condensable and total PM test results. The results must be reported as follows for each test run and averaged for all three test runs. Complete hand calculations must be provided for at least one test run.

- gr/dscf
- lb/hour
- lb/ton of glass produced
- % removal efficiency based on lb/hour of the inlet and outlet results

GENERAL TESTING CONDITIONS

39.) The ODEQ must be notified of any changes in the source test plan and/or the specified methods prior to testing. Significant changes not acknowledged by the DEQ could be basis for invalidating an entire test run and potentially the entire testing program. Documentation of any deviations must include an evaluation of the impact of the deviation on the test data. Deviations may result in rejection of the data, requiring a retest.

40.) Method-specific quality assurance/quality control (QA/QC) procedures must be performed to ensure that the data is valid. Documentation of the procedures and results shall be presented in the source test report for review. Omission of this critical information will result in rejection of the data, requiring a retest.

41.) A copy of a completed Source Test Audit Report (STAR) for all applicable Methods performed must accompany the submittal of the Source Test Report. A copy of the STAR forms is available electronically from the regional source test coordinator.

42.) In an attempt to conserve natural resources and to minimize storage space requirements, the test report should be printed on both sides of each page within the document. DEQ recognizes this may not be feasible for some supporting documentation (i.e. figures, maps, etc.).

43.) The source test report shall be submitted to the DEQ within 45 days following the completion of the source test.

DEQ understands that the source test is scheduled for April 26-28, 2016. If you have any questions, please contact me at (503) 378-5070.

Sincerely,

Mike Eisele

Mike Eisele, PE
AQ Source Test Coordinator
Western Region-Salem

cc: George Davis, DEQ: NWR-AQ File

Quality Assurance Documentation
MAQS QSTI/QI Certification Dates
Qualified Individual (QI) Certificates
QMS Statement of Conformance

QSTI Certification Expiration Dates

QSTI Employee 26 April 2016	Cert. No.	Group 1 Expirations		Group 2 Expirations		Group 3 Expirations	
		Certificate	Exam (QI)	Certificate	Exam (QI)	Certificate	Exam (QI)
Andy Vella	2008-247	24 December 2017	24 June 2017	24 June 2017	24 June 2017	25 June 2017	25 June 2017
Brett Sherwood	-	-	25 February 2021	-	26 February 2021	-	-
Carl Slimp	2009-362	22 May 2018	22 May 2018	26 March 2018	26 March 2018	31 July 2018	31 July 2018
C. David Bagwell	2005-022	29 March 2020	29 March 2020	-	17 December 2020	29 March 2020	29 March 2020
Chris Hinson	2014-830	5 September 2018	5 September 2018	27 October 2018	27 October 2018	21 November 2018	21 November 2018
Danny Phipps	2016-915	16 December 2020	16 December 2020	17 December 2020	17 December 2020	16 March 2021	17 March 2021
David Wagner	2012-658	3 April 2017	3 April 2017	3 April 2017	3 April 2017	3 April 2017	3 April 2017
Jason French	2013-771	19 March 2018	5 August 2017	19 March 2018	11 December 2017	19 March 2018	6 August 2017
Joe Heffernan III	2009-325	16 December 2020	16 December 2020	16 December 2020	16 December 2020	23 March 2019	25 March 2018
John Lewis	2011-550	28 January 2020	28 July 2020	29 January 2020	29 January 2020	-	25 February 2021
Mark Stanfield	2009-337	25 January 2020	25 January 2020	-	-	5 April 2020	5 April 2020
Mihai Voivod	2016-916	25 February 2021	26 February 2021	29 July 2020	29 July 2020	17 December 2020	17 December 2020
Robert Rusi	2012-656	19 March 2017	19 March 2017	19 March 2017	19 March 2017	19 March 2017	19 March 2017
Scott Chesnut	2012-655	19 March 2017	19 March 2017	19 March 2017	19 March 2017	19 March 2017	19 March 2017
Tom Lyons	2012-721	30 July 2017	24 June 2017	30 July 2017	24 June 2017	30 July 2017	25 June 2017
Thomas Rhodes	2010-408	16 December 2020	16 December 2020	17 December 2020	17 December 2020	14 April 2020	25 March 2018

QSTI Employee 26 April 2016	Cert. No.	Group 4 Expirations		Group 5 Expirations	
		Certificate	Exam (QI)	Certificate	Exam (QI)
Andy Vella	2008-247	9 March 2020	9 March 2020	-	-
Brett Sherwood	-	-	-	-	-
Carl Slimp	2009-362	22 December 2018	22 December 2018	-	-
C. David Bagwell	2005-022	-	11 December 2017	-	-
Chris Hinson	2014-830	9 February 2019	9 February 2019	-	-
Danny Phipps	2016-915	17 March 2021	18 March 2021	-	-
David Wagner	2012-658	3 April 2017	3 April 2017	-	-
Jason French	2013-771	19 March 2018	11 December 2017	-	-
Joe Heffernan III	2009-325	17 December 2020	17 December 2020	-	-
John Lewis	2011-550	24 August 2016	26 February 2021	-	-
Mark Stanfield	2009-337	5 April 2020	5 April 2020	-	-
Mihai Voivod	2016-916	-	-	-	-
Robert Rusi	2012-656	19 March 2017	19 March 2017	-	-
Scott Chesnut	2012-655	19 March 2017	19 March 2017	-	-
Tom Lyons	2012-721	30 July 2017	25 June 2017	-	-
Thomas Rhodes	2010-408	9 March 2020	9 March 2020	-	-

****Red type indicates expired certification or QI as of date above****

Orange type indicates certification/QI within 6 months of expiration from date above

****Green type indicates certification/QI valid for greater than 6 months from date above****

SOURCE EVALUATION SOCIETY

SES

Qualified Source Testing Individual

LET IT BE KNOWN THAT

JASON T. FRENCH

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 20TH DAY OF MARCH 2013 AND EFFECTIVE UNTIL MARCH 19TH, 2018

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2013-771

HORIZON ENGINEERING

SOURCE EVALUATION SOCIETY

SES

Qualified Source Testing Individual

LET IT BE KNOWN THAT

JOSEPH M. HEFFERNAN, III

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 17TH DAY OF DECEMBER 2015 AND EFFECTIVE UNTIL DECEMBER 16TH, 2020

Peter R. Westlin, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

Karen D. Kajiya-Mills, QSTI/QSTO Review Board

Theresa Lowe, QSTI/QSTO Review Board

Bruce Randall QSTI/QSTO Review Board

CERTIFICATE NO. 2009-325

SOURCE EVALUATION SOCIETY

SES

Qualified Source Testing Individual

LET IT BE KNOWN THAT

JOHN S. LEWIS

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 29TH DAY OF JULY 2015 AND EFFECTIVE UNTIL JULY 28TH, 2020

Peter R. Westlin, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Theresa Lowe, QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

CERTIFICATE
NO.
2011-550

SOURCE EVALUATION SOCIETY CORPORATE SEAL 1995 NORTH CAROLINA

SOURCE EVALUATION SOCIETY

SES

Qualified Source Testing Individual

LET IT BE KNOWN THAT

CHRISOPHER J. HINSON

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 6TH DAY OF SEPTEMBER 2013 AND EFFECTIVE UNTIL SEPTEMBER 5TH, 2018

Peter R. Westlin, QSTI/QSTO Review Board	*C. David Bagwell, QSTI/QSTO Review Board*	APPLICATION NO. 2014-830
Peter S. Pakalnis, QSTI/QSTO Review Board	*Karen D. Kajiya-Mills , QSTI/QSTO Review Board*	
Theresa Lowe, QSTI/QSTO Review Board	*Glenn C. England, QSTI/QSTO Review Board*	

SOURCE EVALUATION SOCIETY CORPORATE SEAL 1995 NORTH CAROLINA

SOURCE EVALUATION SOCIETY

SES

Qualified Source Testing Individual

LET IT BE KNOWN THAT

MIHAI V. VOIVOD

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 26TH DAY OF FEBRUARY 2016 AND EFFECTIVE UNTIL FEBRUARY 25TH, 2021

Peter R. Westlin, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Theresa Lowe, QSTI/QSTO Review Board

Bruce Randall QSTI/QSTO Review Board

CERTIFICATE NO. 2016-916

From: Theresa Lowe <tf_lowe@yahoo.com>
Sent: Wednesday, March 9, 2016 5:34:32 PM
To: Brett Sherwood
Cc: Gail Westlin
Subject: QSTI Score - Brett M. Sherwood

THIS EMAIL IS THE OFFICIAL NOTIFICATION OF YOUR SES QUALIFIED SOURCE TESTING INDIVIDUAL OR OBSERVER (QSTI/QSTO) EXAM(S) RESULTS (*Please Print Out for Your Records*)

To:	***Brett M. Sherwood***
Employed by:	***Montrose Environmental***
Phone:	***503-255-5050***
Email:	***bsherwood@montrose-env.com***

The Source Evaluation Society, through its contract with Eastern Technical Associates, has received the score of the exam(s) you completed on the date(s) as listed below. You are required to receive a score of 40 to pass an exam. As noted below, a "P" indicates you passed the exam, a "DNP" indicates that you did not pass the exam.

Group #	*Exam*	*Date of Exam*	*Exam #*	*Score*	*Status*
1	EPA Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods	2/25/16	12713		P
1A	Stack Gas Flow Rate Measurements Sampling Methods				
2	EPA Manual Gaseous Pollutants Source Sampling Methods	2/26/16	12715		P
3	EPA Gaseous Pollutants Instrumental Methods				
4	EPA Hazardous Metals Measurement Methods				
5	Part 75 CEMS RATA Testing				

NOTE: (1) The ECMPS AETB reporting requirements include a provision for an email address to be noted for the exam provider. Your exam provider is the Source Evaluation Society. Please use the following email address: qstiprogram@gmail.com. (2) Your exam score(s), per ASTM D7036-04, will be applicable for five years. You will need to re-take your exam(s) before expiration in order to maintain a current status. You are responsible for keeping track of scheduling for your re-test.

If you passed one or more exams, you are eligible to apply for your SES QSTI/QSTO qualification approval(s). To complete the qualification process, you will need to do the following: For New Applications / Additional Group Certificates / Renewals: Please check the SES Website (www.sesnews.org) under the link for the "SES QSTI/QSTO Program" for directions on how to apply for your certificate or contact Gail Westlin at gail_westlin@yahoo.com or Theresa Lowe at tf_lowe@yahoo.com.

If a QSTI/QSTO candidate receives notice that he or she did not pass a SES methods group exam(s), the QSTI/QSTO candidate ask the Committee for a review of their exam(s). Any review request should be sent to gail_westlin@yahoo.com or tf_lowe@yahoo.com. As part of the review, the Committee will provide references to methods for those questions missed.

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

I Jason French, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

Employee Signature

7-27-15
Date

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

I CHRIS HINSON, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

Employee Signature

8/14/15
Date

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

I John Sterling Lewis, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

Employee Signature

8/10/15
Date

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

I Joe Heffernan III, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

[illegible]
Employee Signature

8/12/15
Date

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

I Brett Sherwood, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

Employee Signature	9/17/15 Date

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

I BRANDON CRAWFORD, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

Employee Signature

7/31/15
Date

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

I Mihai Voivod, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

M. Voivod
Employee Signature

7/27/15
Date

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

I Patrick Todd, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

Employee Signature

7/27/15
Date

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

I Paul L. Berce, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

Paul L. Berce
Employee Signature

2/17/16
Date

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

I Josh Muswieck, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

Employee Signature

2-17-16

Date

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

I Sleight Halley, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

Employee Signature

2/25/16

Date

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

MICHAEL WALLACE

I ______, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

______
Employee Signature

5/23/16
Date

MONTROSE
AIR QUALITY SERVICES

Quality Management System Conformance Statement

I Mauri Fabio, as an employee of Montrose Air Quality Services, LLC (MAQS), sign this Quality Management System Conformance Statement to verify that I have read and understand the requirements set forth in the MAQS Quality Policy Statement and in the MAQS Quality Manual. Furthermore, I understand my role in the company as it pertains to the Quality Management System.

Employee Signature

5/17/2016
Date

Personnel Qualifications

JASON T. FRENCH, QSTI
PROJECT MANAGER

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Qualified Source Test Individual (QSTI) Application #2013-771
  - Group I, Manual *Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods*
  - Group II, *Manual Gas Source Sampling Methods*
  - Group III, *Gaseous Pollutants Instrumental Methods*
  - Group IV, Hazardous Metals Measurements
- B.S. in Mechanical Engineering from the University of South Florida in Tampa, Florida, 2004
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- Certified Visible Emissions Evaluator
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Jason French joined Horizon Engineering in February 2011. His previous experience includes working for 5 years as a staff engineer with an environmental and construction company based in Tallahassee, Florida as well as working for the Florida Department of Environmental Protection. He performs source emission testing and related activities, including writing quotes and source test protocols, field sampling, test equipment maintenance and calibration, equipment preparation, in-field data recording, calculations and training. He is thoroughly trained in all EPA source testing procedures and also experienced using methods from the National Council for Air & Stream Improvement (NCASI), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), American Society for Testing and Materials (ASTM) and many regional (Pacific Northwest and Northern California) agency methods.

JOHN S. LEWIS, QSTI (GI, II, IV)
FIELD TECHNICIAN II

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Qualified Source Test Individual (QSTI)
  - Group I, *Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods*
  - Group II, *Manual Gaseous Pollutants Source Sampling Methods*
  - Group IV, *Hazardous Metals Measurements*
- B.S. in Social Science and Geography from Frostburg State University, 1998
- Certified Visible Emissions Evaluator
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

John Lewis has been with Horizon Engineering since 2008. He brings six years of prior experience working in education, transportation, and roof restoration system installation. He has performed source tests at hundreds of industrial sources. He performs source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, equipment preparation, and in-field data recording. He is thoroughly trained in all EPA source test procedures 2008-present. He is also experienced using methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

JOSEPH M. HEFFERNAN III, QSTI (GI-IV)
PROJECT MANAGER/TEAM LEADER

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Qualified Source Test Individual (QSTI)
  - Group I, *Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods*
  - Group II, Manual Gas Source Sampling Methods
  - Group III, Gaseous Pollutants Instrumental Methods
  - Group IV, *Hazardous Metals Measurements*
- B.S. in Physical Education from Northern Illinois University, 1999
- Minor in Marketing, with emphasis in Sports Marketing
- Certified Visible Emissions Evaluator
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL DEVELOPMENT

- Stationary Source Sampling and Analysis for Air Pollutants (SSSAAP) Conference, 2008, 2011

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Joe Heffernan has been with Horizon Engineering since 2004. He brings four prior years experience from another air pollution testing organization in Illinois for a total of more than 12 years of professional experience in the field of air quality. He has performed source tests at hundreds of industrial sources domestically and internationally and has developed the skills necessary to earn the title of Project Manager. He performs source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, equipment preparation, and in-field data recording. He is thoroughly trained in all EPA source test procedures 2000-present. He is also experienced using methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

Chris Hinson, E.I.T., QSTI (GI-IV)
PROJECT MANAGER

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Qualified Source Test Individual (QSTI)
  - Group I, *Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods*
  - Group II, *Manual Gas Source Sampling Methods*
  - Group III, *Gaseous Pollutants Instrumental Sampling Methods*
  - Group IV, *Hazardous Metals Measurement Sampling Methods*
- Engineer in Training (E.I.T.) Certification
- Bachelors of Science, Nuclear Engineering, 2012 – Purdue University
- Certified Visible Emissions Evaluator
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL EXPERIENCE

Chris Hinson has been with Horizon Engineering, LLC since 2014. He has performed source tests at hundreds of industrial sources. He performs source emission testing and activities related to source emission testing, including field sampling, laboratory analysis, test equipment maintenance and calibration, equipment preparation, in-field data recording and calculations. Chris has performed greenhouse gas testing and monitoring at many different facilities. He is also experienced using methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

MIHAI VOIVOD
FIELD TECHNICIAN II

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Qualified Individual (QI)
  - Group II, *Manual Gas Source Sampling Methods,* (passed exam, application pending)
- B.S. in Biotechnical and Ecological Systems Engineering from Babes Bolyai University in Cluj, Romania, 2009
- Certified Visible Emissions Evaluator
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL EXPERIENCE

Mihai Voivod has been with Horizon Engineering since September 2012. He brings 3 years of prior professional experience in the electronics manufacturing industry working for Silicon Forest Electronics in Vancouver, Washington and during an internship at a Romanian laboratory. At Horizon, he performs source emission testing and activities related to source emission testing, including field sampling, test equipment fabrication, maintenance, and calibration, equipment preparation, and in-field data recording. He is being trained to perform all EPA source test procedures and is also learning methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

His experience in the electronics manufacturing industry included operating a selective solder machine and an automated optical inspection (AOI) machine. His education specialty was laboratory sampling analysis and instrumentation operation and troubleshooting.

BRANDON CRAWFORD
FIELD TECHNICIAN I

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- B.S. in Environmental Science from Oregon State University, Corvallis, Oregon, 2013, Specialized in Environmental Conservation and Sustainability
- Certified Visible Emissions Evaluator
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- DOT dangerous goods ground shipping training
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL EXPERIENCE

Brandon Crawford has been with Horizon Engineering since June 2014. He brings previous industrial experience as an intern for ATI Albany Operations/Wah Chang. He is being trained to perform source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, equipment preparation, and in-field data recording. He is being trained in all EPA source test procedures 2002-present. He is also learning to use methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

BRETT SHERWOOD
FIELD TECHNICIAN I

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- B.S. in Environmental Science from Washington State University, Pullman, Washington, 2012
- Certificate in Geographic Information Systems, University of Washington, 2013
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL EXPERIENCE

Brett Sherwood has been with Horizon Engineering, LLC since June 2014. His previous experience included survey work performing APS surveying and mapping, working as an environmental technician for the King County Department of Natural Resources and Parks performing surface and groundwater sampling, and working as a technician with the State of Washington Department of Fish and Wildlife ocean sampling program. He is being trained to perform source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, equipment preparation, and in-field data recording. He is receiving training in all EPA source test procedures from 2002 to present. He is also learning to use methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

PATRICK A. TODD
SHOP STEWARD/FIELD TECHNICIAN

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Working towards Associates of Facility Maintenance Technology at Portland Community College
- Certified Visible Emissions Evaluator
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL EXPERIENCE

Patrick Todd has been with Horizon Engineering since 2009. He is the shop steward and equipment maintenance expert. He performs source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, equipment preparation, and in-field data recording. He is thoroughly trained in all EPA source test procedures 2009-present. He is also experienced using methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

Josh Muswieck
FIELD TECHNICIAN I

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- B.S. in in Environmental Science, Oregon Institute of Technology, Klamath Falls, Or 2015
- Opacity & Visual Emissions Certified (EPA Method 9)
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protections, MSDS review, toxic and hazardous substances)
- DOT Medical Card
- Transportation Worker Identification Credential (TWIC) approved
- Respirator Fit-Tested
- Red Cross First Aid & CPR Certified
- Aerial Boom/Scissor Lift Certified Operator

PROFESSIONAL EXPERIENCE

Josh Muswieck joined Horizon Engineering in 2016. He has previous work experience as a Biological Science Technician for the USGS and Research Assistant for Oregon Tech Environmental Science Department. He is receiving training in all EPA source test procedures and is also learning to use methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

PAUL LAWAI'A BERCE
FIELD TECHNICIAN I

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- B.S. in Environmental Science from Oregon State University, Corvallis, Oregon, 2015
- C-Stop certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- DOT Medical Card
- Transportation Worker Identification Credential (TWIC) approved
- Respirator fit tested
- Lift equipment operator certified

PROFESSIONAL EXPERIENCE

Paul Berce has been with Montrose Air Quality Service since February 2016. His previous experience included work as an invasive species eradication Field Associate 1 for the Maui Invasive Species Committee, a non-profit, community and county funded organization on Maui, Hawaii. There, he led field crews on eradication and containment of target plant and animal species through survey methodologies and point source treatment. He was trained in the proper identification/handling of chemicals (pesticides and herbicides) and their responsible and proper application. He is receiving training in all EPA source test procedures and is learning to use methods from the National Council for Air &Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

SLEIGHT HALLEY
FIELD TECHNICIAN I

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- B.S. in Chemistry from Carroll College, Helena, Montana, 2012
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- DOT Medical Card
- Transportation Worker Identification Credential (TWIC) Approved

PROFESSIONAL EXPERIENCE

Sleight Halley has been with Horizon Engineering since January, 2016. His previous experience included work as an analytical chemist with Analytical 360 LLC in Yakima, Washington. He is receiving training in all EPA source test procedures and is also learning to use methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

THOMAS A. RHODES, E.I.T., QSTI (GI-IV)
DISTRICT MANAGER

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Qualified Source Test Individual (QSTI)
  - Group I, *Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods*
  - Group II, *Manual Gaseous Pollutants Source Sampling Methods*
  - Group III, *Gaseous Pollutants Instrumental Methods*
  - Group IV, *Hazardous Metals Measurements*
- Engineer in Training (E.I.T.) Certification, 2001
- B.S. in Chemical Engineering from University of California in Santa Barbara, 2001
- Attended Allan Hancock College in Santa Maria, California, 1996-1998
- Certified Visible Emissions Evaluator
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- North Slope Training Co-operative class for Unescorted North Slope Safety Orientation (Awareness Level)
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL DEVELOPMENT

- Stationary Source Sampling and Analysis for Air Pollutants (SSSAAP) Conference, 2008

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)
- American Chemical Society (ACS)

PROFESSIONAL EXPERIENCE

Thomas Rhodes has been with Horizon Engineering since 2002. He brings three prior years experience as an engineering associate and engineering intern for several companies. He has performed source tests at hundreds of industrial sources. He performs source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, equipment preparation, and in-field data recording. He is thoroughly trained in all EPA source test procedures 2002-present. He is also experienced using methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

MICHAEL E. WALLACE, P.E.
SENIOR ENGINEER

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Professional Engineer (P.E.) from the State of Oregon, 2002-present
- B.S. in Mechanical Engineering from Oregon State University in Corvallis, Oregon, 1989
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL DEVELOPMENT

- Stationary Source Sampling and Analysis for Air Pollutants (SSSAAP) Conference, approximately 5 years

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Mike Wallace has been with Horizon Engineering since 1991. He is responsible for performing calculations, formulating spreadsheets, quality assurance review, and operating Horizon's gas chromatograph. He is thoroughly trained in all EPA source test procedures 1991-present. He is also experienced using methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

ANDY VELLA, P.E., QSTI (GI-IV)
ENGINEER
TECHNICAL WRITER

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Professional Engineer (P.E.) Oregon license #87091PE
- Qualified Source Test Individual (QSTI)
  - Group I, *Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods*
  - Group II, *Manual Gas Source Sampling Methods*
  - Group III, *Gaseous Pollutants Instrumental Sampling Methods*
  - Group IV, *Hazardous Metals Measurement Sampling Methods*
- B.S. in Chemical Engineering from University of Illinois in Urbana, IL, 2005
- Minor in Mathematics
- Certified Visible Emissions Evaluator
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Andras Vella has been with Horizon Engineering since 2011. He brings six prior years experience from Clean Air Engineering in Illinois. His primary duty before joining Horizon was FTIR repair, operation, and data review. He has performed source tests at hundreds of industrial sources. He performs source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, equipment preparation, in-field data recording, data reduction and analysis, quality assurance review and report preparation. He is thoroughly trained in all EPA source test procedures 2005-present. He is also experienced using methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

MAURI FABIO
TECHNICAL REPORT WRITER

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- B.A. in Geology from University of Hawaii at Manoa in Honolulu, HI, 2011
- Certified Visible Emissions Evaluator
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL EXPERIENCE

Mauri Fabio joined Horizon Engineering in 2016. Her current responsibilities include data reduction and analysis, quality assurance review, and report preparation. She has a year experience with the United Stated Geological Survey (USGS) with laboratory analysis, data collection and processing, testing, field research, report preparation, and mapping preparation. She has experience with laboratory instrumentation such as a scanning electron microscopy (SEM) and energy dispersive x-ray microanalysis (EDS). Field work and data collection in Death Valley and worked with the deformation group at the USGS on Mt. Hood for reconnoitering potential sites for remote instrumentation.

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