Source Test Report

The Chemours Company, FC, LLC
22828 Highway 87W
Fayetteville, NC 28306

Sources Tested: VES Carbon Bed Inlet/Outlet
Test Date: May 19, 2021

AST Project No. 2021-1361O

Prepared By
Alliance Source Testing, LLC
7600 Morgan Road
Liverpool, NY 13090

Regulatory Information

Permit No. Title V Air Permit No. 03735T48

Source Information

Source Name	*Target Parameter*
VES Carbon Bed Inlet/Outlet	HFPO-DA

Contact Information

Test Location
The Chemours Company, FC, LLC
22828 Highway 87W
Fayetteville, NC 28306

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Alliance Source Testing, LLC (AST) has completed the source testing as described in this report. Results apply only to the source(s) tested and operating condition(s) for the specific test date(s) and time(s) identified within this report. All results are intended to be considered in their entirety, and AST is not responsible for use of less than the complete test report without written consent. This report shall not be reproduced in full or in part without written approval from the customer.

To the best of my knowledge and abilities, all information, facts and test data are correct. Data presented in this report has been checked for completeness and is accurate, error-free and legible. Onsite testing was conducted in accordance with approved internal Standard Operating Procedures. Any deviations or problems are detailed in the relevant sections on the test report.

This report is only considered valid once an authorized representative of AST has signed in the space provided below; any other version is considered draft. This document was prepared in portable document format (.pdf) and contains pages as identified in the bottom footer of this document.

7/16/2021

Patrick Grady, QSTI
Project Manager
Alliance Source Testing, LLC

Date

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Introduction

1.0 Introduction

Alliance Source Testing, LLC (AST) was retained by The Chemours Company (Chemours) to conduct compliance testing at the Fayetteville Works facility in Fayetteville, North Carolina. The facility operates under Title V Air Permit No. 03735T48. Testing was conducted to determine the emission rate of hexafluoro-propylene oxide-dimer acid (HFPO-DA) at the inlet and outlet of a carbon bed serving Vinyl Ethers South (VES).

1.1 Source and Control System Descriptions

VES is part of the fluoromonomer area at the Fayetteville facility. This area produces fluorocarbon compounds used to produce Chemours products, such as IXM, Krytox® and Viton®. Indoor air fugitive emissions from VES are vented to a carbon bed which is then vented to atmosphere through a process stack (NEP-Hdr2).

1.2 Project Team

Personnel involved in this project are identified in the following table.

Table 1-1
Project Team

Chemours Personnel	Kevin Smith
AST Personnel	Patrick Grady Eric Alongi Antonio Anderson Brian Goodhile Jeffrey Sheldon

Summary of Results

2.0 Summary of Results

AST conducted compliance testing at the Fayetteville Works facility in Fayetteville, North Carolina on May 19, 2021. Testing consisted of determining the emission rates of HFPO-DA at the inlet and outlet of a carbon bed serving VES.

Table 2-1 provides a summary of the emission testing results. Any difference between the summary results listed in the following tables and the detailed results contained in appendices is due to rounding for presentation.

Table 2-1
Summary of Results

Run Number	Run 1	Run 2	Run 3	Average
Date	**5/19/21**	**5/19/21**	**5/19/21**	**--**
HFPO-DA Data				
Outlet Emission Rate, lb/hr	4.6E-05	7.0E-05	1.0E-04	7.2E-05
Inlet Emission Rate, lb/hr	4.0E-04	2.3E-04	1.6E-04	2.6E-04
Reduction Efficiency, %	89	70	36	65

Testing Methodology

3.0 Testing Methodology

The emission testing program was conducted in accordance with the test methods listed in Table 3-1. Method descriptions are provided below while quality assurance/quality control data is provided in Appendix C.

Table 3-1
Source Testing Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Volumetric Flow Rate	1 & 2	Full Velocity Traverses
Moisture Content	4	Gravimetric Analysis
Hexafluoro-Propylene Oxide-Dimer Acid	OTM-45	Isokinetic Sampling

3.1 U.S. EPA Reference Test Methods 1 and 2 – Sampling/Traverse Points and Volumetric Flow Rate

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-1 in U.S. EPA Reference Test Method 1.

Full velocity traverses were conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system consisted of a pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer.

3.2 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content was determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train consisted of a series of chilled impingers. Prior to testing, each impinger was filled with a known quantity of water or silica gel. Each impinger was analyzed gravimetrically before and after each test run on the same balance to determine the amount of moisture condensed.

3.3 U.S. EPA Other Test Method 45 – Hexafluoro-Propylene Oxide-Dimer Acid

HFPO-DA emissions were evaluated in accordance with Other Test Method (OTM) 45. The sample train consisted of a borosilicate glass nozzle attached directly to a heated borosilicate glass-lined probe. The probe was connected directly to a heated borosilicate glass filter holder containing a solvent-extracted glass fiber filter. In order to minimize possible thermal degradation of the HFPO-DA, the probe and particulate filter were heated to just above stack temperature to minimize water vapor condensation before the filter. The filter holder exit was connected to a water-cooled coil condenser followed by a water-cooled sorbent module containing approximately 40 grams of XAD-2 resin. The XAD-2 inlet temperature was monitored to ensure that the module is maintained at a temperature below 20ºC.

The XAD-2 resin trap was followed by a condensate knockout impinger and a series of two impingers each containing 100-ml of high purity deionized water. The water impingers were followed by another condensate knockout impinger equipped with a second XAD-2 resin trap to account for any sample breakthrough. The final impinger contained approximately 250 grams of dry pre-weighed silica gel. The water impingers and condensate impingers were submerged in an ice bath through the duration of the testing. The water in the ice bath was also used to circulate around the coil condenser and the XAD-2 resin traps.

Exhaust gases were extracted from the sample locations isokinetically using a metering console equipped with a vacuum pump, a calibrated orifice, oil manometer and probe/filter heat controllers.

3.4 HFPO-DA Sample Train and Equipment Preparation

Prior to conducting the field work the following procedures were conducted to prepare the field sampling glassware and sample recovery tools.

1. Wash all glassware, brushes, and ancillary tools with low residue soap and hot water.
2. Rinse all glassware, brushes, and ancillary tools three (3) times with D.I. H_20.
3. Bake glassware (with the exception of probe liners) at 450˚C for approximately 2 hours, (XAD-2 resin tube glassware is cleaned by Eurofins/TestAmerica by this same procedure).
4. Solvent rinse three (3) times all glassware, brushes, and ancillary tools with the following sequence of solvents: acetone, methylene chloride, hexane, and methanol.
5. Clean glassware and tools will be sealed in plastic bags or aluminum foil for transport to the sampling site.
6. Squirt bottles will be new dedicated bottles of known history and dedicated to the D.I. Water and methanol/ammonium hydroxide (MeOH/ 5% NH_4OH) solvent contents. Squirt bottles will be labelled with the solvent content it contains.

3.5 HFPO-DA Sample Train Recovery

Following completion of each test run, the sample probe, nozzle and front-half of the filter holder were brushed and rinsed three times each with the MeOH/ 5% NH_4OH solution (Container #1). The glass fiber filter was removed from its housing and transferred to a polyethylene bottle (Container #2). Any particulate matter and filter fibers which adhered to the filter holder and gasket were also placed in Container #2. The XAD-2 resin trap was sealed, labelled and placed in an iced sample cooler. The back-half of the filter holder, coil condenser condensate trap and connecting glassware were rinsed with the same MeOH/ 5% NH_4OH solution and placed in Container #3.

The volume of water collected in the second and third impingers was measured for moisture determinations and then placed in Container #4. Impingers #2 and #3 were then rinsed with the MeOH/ 5% NH_4OH solution and placed in Container #5. The second (breakthrough) XAD-2 resin trap was sealed, labelled and placed in an iced sample cooler. The second condensate trap was rinsed with the MeOH/ 5% NH_4OH solution and placed in Container #5. The contents of the fifth impinger were placed in its original container and weighed for moisture determinations.

Containers were sealed and labeled with the appropriate sample information. Samples remained chilled until analysis. HFPO-DA analysis was conducted using liquid chromatography/dual mass spectrometry (LC/MS/MS).

Appendix A

Location: Chemours Company - Fayetteville Works Facility, NC
Source: VES Carbon Bed Outlet
Project No.: 2021-1361O
Run No.: 1
Parameter: HFPO-DA

Meter Pressure (Pm), in. Hg

$$Pm = Pb + \frac{\Delta H}{13.6}$$

where,

Pb	30.35	= barometric pressure, in. Hg
ΔH	1.556	= pressure differential of orifice, in H_2O
Pm	30.46	= in. Hg

Absolute Stack Gas Pressure (Ps), in. Hg

$$Ps = Pb + \frac{Pg}{13.6}$$

where,

Pb	30.35	= barometric pressure, in. Hg
Pg	1.50	= static pressure, in. H_2O
Ps	30.46	= in. Hg

Standard Meter Volume (Vmstd), dscf

$$Vmstd = \frac{17.636 \times Y \times Vm \times Pm}{Tm}$$

where,

Y	0.994	= meter correction factor
Vm	65.986	= meter volume, cf
Pm	30.46	= absolute meter pressure, in. Hg
Tm	546.0	= absolute meter temperature, ^oR
Vmstd	64.539	= dscf

Standard Wet Volume (Vwstd), scf

$$Vwstd = 0.04716 \times Vlc$$

where,

Vlc	30.6	= volume of H_2O collected, ml
Vwstd	1.443	= scf

Moisture Fraction (BWSsat), dimensionless (theoretical at saturated conditions)

$$BWSsat = \frac{10^{6.37-\left(\frac{2,827}{Ts+365}\right)}}{Ps}$$

where,

Ts	74.3	= stack temperature, °F
Ps	30.46	= absolute stack gas pressure, in. Hg
BWSsat	0.028	= dimensionless

Moisture Fraction (BWS), dimensionless (measured)

$$BWS = \frac{Vwstd}{(Vwstd + Vmstd)}$$

where,

Vwstd	1.443	= standard wet volume, scf
Vmstd	64.539	= standard meter volume, dscf
BWS	0.022	= dimensionless

Alliance SOURCE TESTING

Location: Chemours Company - Fayetteville Works Facility, NC
Source: VES Carbon Bed Outlet
Project No.: 2021-1361O
Run No.: 1
Parameter: HFPO-DA

Moisture Fraction (BWS), dimensionless

$$BWS = BWSmsd \text{ unless } BWSsat < BWSmsd$$

where,

BWSsat	0.028	= moisture fraction (theoretical at saturated conditions)
BWSmsd	0.022	= moisture fraction (measured)
BWS	0.022	

Molecular Weight (DRY) (Md), lb/lb-mole

$$Md = (0.44 \times \%\,CO_2) + (0.32 \times \%\,O2) + (0.28\,(100 - \%\,CO_2 - \%\,O2))$$

where,

CO_2	0.1	= carbon dioxide concentration, %
O_2	20.9	= oxygen concentration, %
Md	28.85	= lb/lb mol

Molecular Weight (WET) (Ms), lb/lb-mole

$$Ms = Md\ (1 - BWS) + 18.015\ (BWS)$$

where,

Md	28.85	= molecular weight (DRY), lb/lb mol
BWS	0.022	= moisture fraction, dimensionless
Ms	28.61	= lb/lb mol

Average Velocity (Vs), ft/sec

$$Vs = 85.49 \times Cp \times (\Delta P^{1/2})\,avg \times \sqrt{\frac{Ts}{Ps \times Ms}}$$

where,

Cp	0.840	= pitot tube coefficient
$\Delta P^{1/2}$	0.550	= velocity head of stack gas, $(in.\ H_2O)^{1/2}$
Ts	533.9	= absolute stack temperature, °R
Ps	30.46	= absolute stack gas pressure, in. Hg
Ms	28.61	= molecular weight of stack gas, lb/lb mol
Vs	30.9	= ft/sec

Average Stack Gas Flow at Stack Conditions (Qa), acfm

$$Qa = 60 \times Vs \times As$$

where,

Vs	30.9	= stack gas velocity, ft/sec
As	7.07	= cross-sectional area of stack, ft^2
Qa	13,114	= acfm

Average Stack Gas Flow at Standard Conditions (Qs), dscfm

$$Qs = 17.636 \times Qa \times (1 - BWS) \times \frac{Ps}{Ts}$$

where,

Qa	13,114	= average stack gas flow at stack conditions, acfm
BWS	0.022	= moisture fraction, dimensionless
Ps	30.46	= absolute stack gas pressure, in. Hg
Ts	533.9	= absolute stack temperature, °R
Qs	12,906	= dscfm

Alliance SOURCE TESTING

Location: Chemours Company - Fayetteville Works Facility, NC
Source: VES Carbon Bed Outlet
Project No.: 2021-1361O
Run No.: 1
Parameter: HFPO-DA

Dry Gas Meter Calibration Check (Yqa), dimensionless

$$Yqa = \frac{Y - \left(\frac{\Theta}{Vm} \sqrt{\frac{0.0319 \times Tm \times 29}{\Delta H@ \times \left(Pb + \frac{\Delta Havg.}{13.6} \right) \times Md}} \sqrt{\Delta H}\ avg. \right)}{Y} \times 100$$

where,

Y	0.994	= meter correction factor, dimensionless
Θ	96	= run time, min.
Vm	65.986	= total meter volume, dcf
Tm	546.0	= absolute meter temperature, °R
ΔH@	1.8	= orifice meter calibration coefficient, in. H_2O
Pb	30.35	= barometric pressure, in. Hg
ΔH avg	1.556	= average pressure differential of orifice, in H_2O
Md	28.85	= molecular weight (DRY), lb/lb mol
$(\Delta H)^{1/2}$	1.243	= average squareroot pressure differential of orifice, $(in. H2O)^{1/2}$
Yqa	-2.8	= dimensionless

Volume of Nozzle (Vn), ft^3

$$Vn = \frac{Ts}{Ps} \left(0.002669 \times Vlc + \frac{Vm \times Pm \times Y}{Tm} \right)$$

where,

Ts	533.9	= absolute stack temperature, °R
Ps	30.46	= absolute stack gas pressure, in. Hg
Vlc	30.6	= volume of H_2O collected, ml
Vm	65.986	= meter volume, cf
Pm	30.46	= absolute meter pressure, in. Hg
Y	0.994	= meter correction factor, unitless
Tm	546.0	= absolute meter temperature, °R
Vn	65.576	= volume of nozzle, ft^3

Isokinetic Sampling Rate (I), %

$$I = \left(\frac{Vn}{\theta \times 60 \times An \times Vs} \right) \times 100$$

where,

Vn	65.576	= nozzle volume, ft3
θ	96.0	= run time, minutes
An	0.00037	= area of nozzle, ft^2
Vs	30.9	= average velocity, ft/sec
I	98.3	= %

Location: Chemours Company - Fayetteville Works Facility, NC
Source: VES Carbon Bed Outlet
Project No.: 2021-1361O
Run No.: 1
Parameter: HFPO-DA

HFPO-DA Concentration (C_{HFPODA}), ng/dscm

$$C_{HFPODA} = \frac{M_{HFPODA} \times 35.313}{Vmstd}$$

where,

$M_{(HFPODA)}$	1,727.4	= HFPO-DA mass, ng
Vmstd	64.539	= standard meter volume, dscf
C_{HFPODA}	9.5E+02	= ng/dscm

HFPO-DA Emission Rate (ER_{HFPODA}), lb/hr

$$ER_{HFPODA} = \frac{C_{HFPODA} \times Qs \times 60}{Vmstd \times 4.5E+11}$$

where,

C_{HFPODA}	9.5E+02	= HFPO-DA concentration, ng/dscm
Qs	12,906	= average stack gas flow at standard conditions, dscfm
ER_{HFPODA}	4.6E-05	= lb/hr

Appendix B

Location Chemours Company - Fayetteville Works Facility, NC
Source VES Carbon Bed Outlet
Project No. 2021-1361O
Parameter HFPO-DA

Run Number		Run 1	Run 2	Run 3	Average
Date		5/19/21	5/19/21	5/19/21	--
Start Time		9:23	11:55	14:15	--
Stop Time		11:27	13:48	16:08	--
Run Time, min	(θ)	96.0	96.0	96.0	96.0
INPUT DATA					
Barometric Pressure, in. Hg	(Pb)	30.35	30.35	30.35	30.35
Meter Correction Factor	(Y)	0.994	0.994	0.994	0.994
Orifice Calibration Value	(ΔH @)	1.800	1.800	1.800	1.800
Meter Volume, ft^3	(Vm)	65.986	64.181	65.966	65.378
Meter Temperature, °F	(Tm)	86.4	79.4	83.0	82.9
Meter Temperature, °R	(Tm)	546.0	539.0	542.7	542.6
Meter Orifice Pressure, in. WC	(ΔH)	1.556	1.466	1.552	1.525
Volume H_2O Collected, mL	(Vlc)	30.6	28.0	27.8	28.8
Nozzle Diameter, in	(Dn)	0.262	0.262	0.262	0.262
Area of Nozzle, ft^2	(An)	0.0004	0.0004	0.0004	0.0004
FH HFPO-DA Mass, ng	$M_{(HFPODA)}$	1,300.0	2,020.0	1,780.0	1,700.0
BH HFPO-DA Mass, ng	$M_{(HFPODA)}$	393.0	613.0	2,070.0	1,025.3
Imp HFPO-DA Mass, ng	$M_{(HFPODA)}$	32.5	19.1	0.0	17.2
Breakthrough HFPO-DA Mass, ng	$M_{(HFPODA)}$	1.9	1.5	2.1	1.8
Total HFPO-DA Mass, ng	$M_{(HFPODA)}$	1,727.4	2,653.6	3,852.1	2,744.3
ISOKINETIC DATA					
Standard Meter Volume, ft^3	(Vmstd)	64.539	63.572	64.912	64.341
Standard Water Volume, ft^3	(Vwstd)	1.443	1.320	1.311	1.358
Moisture Fraction Measured	(BWSmsd)	0.022	0.020	0.020	0.021
Moisture Fraction @ Saturation	(BWSsat)	0.028	0.029	0.032	0.029
Moisture Fraction	(BWS)	0.022	0.020	0.020	0.021
Meter Pressure, in Hg	(Pm)	30.46	30.46	30.46	30.46
Volume at Nozzle, ft^3	(Vn)	65.576	64.692	66.381	65.55
Isokinetic Sampling Rate, (%)	(I)	98.3	98.6	98.7	98.5
DGM Calibration Check Value, (+/- 5%)	(Y_{qa})	-2.8	-1.9	-2.2	-2.3
EMISSION CALCULATIONS					
HFPO-DA Concentration, ng/dscm	$C_{(HFPODA)}$	9.5E+02	1.5E+03	2.1E+03	1.5E+03
HFPO-DA Emission Rate, lb/hr	$ER_{(HFPODA)}$	4.6E-05	7.0E-05	1.0E-04	7.2E-05
REDUCTION CALCULATIONS					
Inlet HFPO-DA Emission Rate, lb/hr	$ER_{(HFPODA)}$	4.0E-04	2.3E-04	1.6E-04	2.6E-04
HFPO-DA Reduction Efficiency, %	$ER_{(HFPODA)}$	88.6	69.7	35.7	64.7

Location Chemours Company - Fayetteville Works Facility, NC
Source VES Carbon Bed Outlet
Project No. 2021-1361O
Parameter HFPO-DA

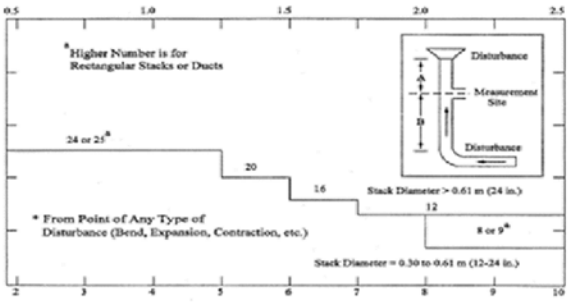
Run Number		Run 1	Run 2	Run 3	Average
Date		5/19/21	5/19/21	5/19/21	--
Start Time		9:23	11:55	14:15	--
Stop Time		11:27	13:48	16:08	--
Run Time, min		96.0	96.0	96.0	96.0
VELOCITY HEAD, in. WC					
Point 1		0.25	0.24	0.24	0.24
Point 2		0.25	0.24	0.24	0.24
Point 3		0.26	0.25	0.26	0.26
Point 4		0.27	0.27	0.28	0.27
Point 5		0.29	0.29	0.32	0.30
Point 6		0.32	0.31	0.32	0.32
Point 7		0.34	0.32	0.34	0.33
Point 8		0.35	0.32	0.35	0.34
Point 9		0.36	0.34	0.37	0.36
Point 10		0.36	0.34	0.37	0.36
Point 11		0.38	0.37	0.38	0.38
Point 12		0.39	0.38	0.36	0.38
Point 13		0.22	0.19	0.19	0.20
Point 14		0.21	0.21	0.21	0.21
Point 15		0.25	0.23	0.22	0.23
Point 16		0.25	0.26	0.26	0.26
Point 17		0.28	0.26	0.30	0.28
Point 18		0.32	0.27	0.33	0.31
Point 19		0.30	0.30	0.34	0.31
Point 20		0.32	0.32	0.35	0.33
Point 21		0.34	0.35	0.35	0.35
Point 22		0.34	0.35	0.35	0.35
Point 23		0.35	0.34	0.35	0.35
Point 24		0.32	0.32	0.32	0.32
CALCULATED DATA					
Square Root of ΔP, $(\text{in. WC})^{1/2}$	(ΔP)	0.550	0.541	0.553	0.548
Pitot Tube Coefficient	(Cp)	0.840	0.840	0.840	0.840
Barometric Pressure, in. Hg	(Pb)	30.35	30.35	30.35	30.35
Static Pressure, in. WC	(Pg)	1.50	1.20	1.15	1.28
Stack Pressure, in. Hg	(Ps)	30.46	30.44	30.43	30.44
Stack Cross-sectional Area, ft^2	(As)	7.07	7.07	7.07	7.07
Temperature, °F	(Ts)	74.3	75.5	78.4	76.0
Temperature, °R	(Ts)	533.9	535.2	538.0	535.712
Moisture Fraction Measured	(BWSmsd)	0.022	0.020	0.020	0.021
Moisture Fraction @ Saturation	(BWSsat)	0.028	0.029	0.032	0.029
Moisture Fraction	(BWS)	0.022	0.020	0.020	0.021
O_2 Concentration, %	(O_2)	20.9	20.9	20.9	20.9
CO_2 Concentration, %	(CO_2)	0.1	0.1	0.1	0.1
Molecular Weight, lb/lb-mole (dry)	(Md)	28.85	28.85	28.85	28.85
Molecular Weight, lb/lb-mole (wet)	(Ms)	28.61	28.63	28.64	28.63
Velocity, ft/sec	(Vs)	30.9	30.4	31.2	30.8
VOLUMETRIC FLOW RATE					
At Stack Conditions, acfm	(Qa)	13,114	12,903	13,230	13,082
At Standard Conditions, dscfm	(Qs)	12,906	12,680	12,936	12,841

Method 1 Data

Location Chemours Company - Fayetteville Works Facility, NC
Source VES Carbon Bed Outlet
Project No. 2021-1361O
Date: 05/19/21

Stack Parameters

Duct Orientation:	Horizontal	
Duct Design:	Circular	
Distance from Far Wall to Outside of Port:	51.00	in
Nipple Length:	15.00	in
Depth of Duct:	36.00	in
Cross Sectional Area of Duct:	7.07	ft^2
No. of Test Ports:	2	
Distance A:	12.5	ft
Distance A Duct Diameters:	4.2	(must be > 0.5)
Distance B:	31.0	ft
Distance B Duct Diameters:	10.3	(must be > 2)
Minimum Number of Traverse Points:	24	
Actual Number of Traverse Points:	24	
Number of Readings per Point:	1	



CIRCULAR DUCT

LOCATION OF TRAVERSE POINTS

Number of traverse points on a diameter

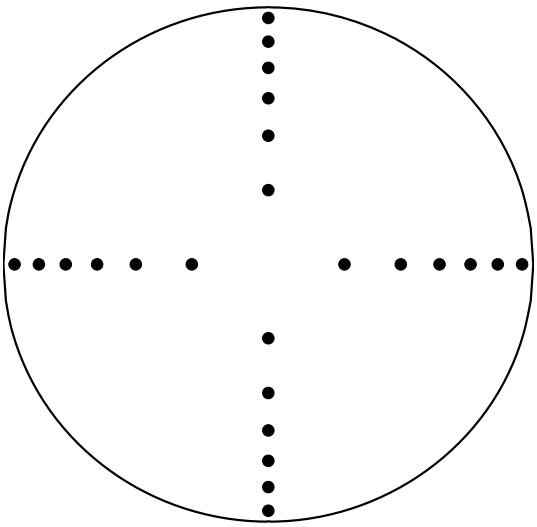
	2	3	4	5	6	7	8	9	10	11	12
1	14.6	--	6.7	--	4.4	--	3.2	--	2.6	--	2.1
2	85.4	--	25.0	--	14.6	--	10.5	--	8.2	--	6.7
3	--	--	75.0	--	29.6	--	19.4	--	14.6	--	11.8
4	--	--	93.3	--	70.4	--	32.3	--	22.6	--	17.7
5	--	--	--	--	85.4	--	67.7	--	34.2	--	25.0
6	--	--	--	--	95.6	--	80.6	--	65.8	--	35.6
7	--	--	--	--	--	--	89.5	--	77.4	--	64.4
8	--	--	--	--	--	--	96.8	--	85.4	--	75.0
9	--	--	--	--	--	--	--	--	91.8	--	82.3
10	--	--	--	--	--	--	--	--	97.4	--	88.2
11	--	--	--	--	--	--	--	--	--	--	93.3
12	--	--	--	--	--	--	--	--	--	--	97.9

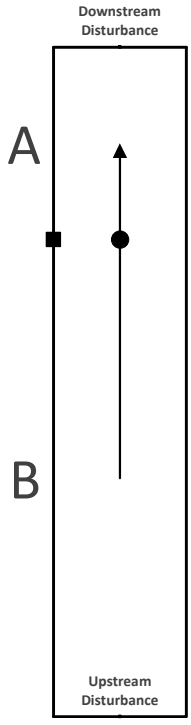
**Percent of stack diameter from inside wall to traverse point.*

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	2.1	1.00	16.00
2	6.7	2.41	17.41
3	11.8	4.25	19.25
4	17.7	6.37	21.37
5	25.0	9.00	24.00
6	35.6	12.82	27.82
7	64.4	23.18	38.18
8	75.0	27.00	42.00
9	82.3	29.63	44.63
10	88.2	31.75	46.75
11	93.3	33.59	48.59
12	97.9	35.00	50.00

Stack Diagram
A = 12.5 ft.
B = 31 ft.
Depth of Duct = 36 in.

Cross Sectional Area





Cyclonic Flow Check

Location Chemours Company - Fayetteville Works Facility, NC
Source VES Carbon Bed Outlet
Project No. 2021-1361O
Date 05/19/21

Sample Point	Angle (ΔP=0)
1	12
2	10
3	10
4	15
5	15
6	15
7	12
8	12
9	10
10	8
11	8
12	8
13	15
14	15
15	18
16	18
17	15
18	15
19	15
20	12
21	12
22	10
23	12
24	10
Average	13

Method 4 Data

Location Chemours Company - Fayetteville Works Facility, NC
Source VES Carbon Bed Outlet
Project No. 2021-1361O
Parameter HFPO-DA
Analysis Gravimetric

Run 1	Date:	5/19/21						
Impinger No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
Contents	XAD Trap	Empty	H2O	H2O	H2O	XAD Trap	Silica	--
Initial Mass, g	0.0	0.0	100.0	100.0	100.0	0.0	745.8	1045.8
Final Mass, g	0.0	2.0	102.0	102.0	100.0	0.0	770.4	1076.4
Gain	0.0	2.0	2.0	2.0	0.0	0.0	24.6	30.6
Run 2	**Date:**	5/19/21						
Impinger No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
Contents	XAD Trap	Empty	H2O	H2O	H2O	XAD Trap	Silica	--
Initial Mass, g	0.0	0.0	100.0	100.0	100.0	0.0	804.6	1104.6
Final Mass, g	0.0	2.0	102.0	104.0	100.0	0.0	824.6	1132.6
Gain	0.0	2.0	2.0	4.0	0.0	0.0	20.0	28.0
Run 3	**Date:**	5/19/21						
Impinger No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
Contents	XAD Trap	Empty	H2O	H2O	H2O	XAD Trap	Silica	--
Initial Mass, g	0.0	0.0	100.0	100.0	100.0	0.0	826.4	1126.4
Final Mass, g	0.0	2.0	104.0	100.0	100.0	0.0	848.2	1154.2
Gain	0.0	2.0	4.0	0.0	0.0	0.0	21.8	27.8

Alliance SOURCE TESTING

Isokinetic Field Data

Location:	Chemours Company - Fayetteville Works Facility, NC		**Start Time:**	9:23	**Source:**	VES Carbon Bed Outlet	
Date:	5/19/21	Run 1 VALID	**End Time:**	11:27	**Project No.:**	2021-1361O	**Parameter:** HFPO-DA

STACK DATA (EST)			EQUIPMENT			STACK DATA (EST)			FILTER NO.	STACK DATA (FINAL)			MOIST. DATA
Moisture:	1.5	% est.	Meter Box ID:	7		Est. Tm:	85	°F	OTM-45	Pb:	30.35	in. Hg	Vlc (ml)
Barometric:	30.35	in. Hg	Y:	0.994		Est. Ts:	70	°F		Pg:	1.50	in. WC	30.6
Static Press:	1.20	in. WC	ΔH @ (in.WC):	1.800		Est. ΔP:	0.31	in. WC		O_2:	20.9	%	K-FACTOR
Stack Press:	30.44	in. Hg	Probe ID:	P4-3		Est. Dn:	0.269	in.		CO_2:	0.1	%	5.077
CO_2:	0.0	%	Liner Material:	glass		Target Rate:	0.75	scfm					
O_2:	20.9	%	Pitot ID:	P4-3		LEAK CHECKS	Pre	Mid 1	Mid 2	Mid 3	Post	Check Pt.	Initial	Final	Corr.
N_2/CO:	79.1	%	Pitot Cp/Type:	0.840	S-type	Leak Rate (cfm):	0.009	0.006	0.007	--	0.005	Mid 1 (cf)	4.615	4.893	0.278
Md:	28.84	lb/lb-mole	Nozzle ID:	G-1	glass	Vacuum (in Hg):	12	10	10	--	10	Mid 2 (cf)			--
Ms:	28.67	lb/lb-mole	Nozzle Dn (in.):	0.262		Pitot Tube:	Pass	--	--	--	Pass	Mid 3 (cf)			--
												Mid-Point Leak Check Vol (cf):			0.278

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft^3)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)
					DGM Average	Stack				Probe	Filter	Imp Exit	Aux		
					Amb.	Amb.				Amb.	Amb.	Amb.	Amb.		
	Begin	End					Ideal	Actual					-		
1	0.00	4.00	600.444	0.25	76	72	1.25	1.25	2	79	78	52	39	101.8	28.02
2	4.00	8.00	603.002	0.25	84	72	1.26	1.30	2	80	81	48	38	97.8	28.02
3	8.00	12.00	605.495	0.26	87	74	1.32	1.30	2	82	83	48	37	100.3	28.63
4	12.00	16.00	608.110	0.27	90	75	1.37	1.40	2	83	84	48	40	95.0	29.21
5	16.00	20.00	610.648	0.29	93	75	1.48	1.50	2	80	82	48	41	96.9	30.27
6	20.00	24.00	613.344	0.32	94	74	1.64	1.60	3	79	81	47	38	99.4	31.77
7	24.00	28.00	616.255	0.34	94	74	1.74	1.70	3	80	81	47	37	100.8	32.74
8	28.00	32.00	619.300	0.35	94	74	1.79	1.80	3	79	82	47	38	96.1	33.22
9	32.00	36.00	622.244	0.36	95	74	1.85	1.90	3	80	82	47	38	98.0	33.69
10	36.00	40.00	625.292	0.36	95	74	1.85	1.90	3	80	82	47	40	98.8	33.69
11	40.00	44.00	628.364	0.38	95	74	1.95	2.00	3	80	81	47	38	101.7	34.62
12	44.00	48.00	631.611	0.39	95	75	1.99	2.00	3	81	82	47	37	92.9	35.10
1	48.00	52.00	634.615	0.22	84	75	1.11	1.10	2	83	84	64	43	104.1	26.36
2	52.00	56.00	637.099	0.21	84	75	1.06	1.10	2	84	80	50	35	94.8	25.76
3	56.00	60.00	639.310	0.25	84	74	1.26	1.30	2	81	80	44	38	103.0	28.08
4	60.00	64.00	641.933	0.25	82	74	1.25	1.30	2	81	79	43	37	102.0	28.08
5	64.00	68.00	644.521	0.28	82	74	1.40	1.40	2	80	80	42	35	94.6	29.71
6	68.00	72.00	647.061	0.32	82	74	1.60	1.60	2	78	77	41	36	96.3	31.77
7	72.00	76.00	649.822	0.30	81	74	1.50	1.50	2	77	76	41	38	94.4	30.76
8	76.00	80.00	652.440	0.32	81	75	1.60	1.60	2	79	79	41	38	100.4	31.80
9	80.00	84.00	655.311	0.34	81	75	1.70	1.70	3	79	80	41	39	96.1	32.77
10	84.00	88.00	658.143	0.34	81	75	1.67	1.70	3	80	82	40	38	97.6	32.53
11	88.00	92.00	660.999	0.35	81	75	1.75	1.80	3	81	82	40	38	100.4	33.25
12	92.00	96.00	664.001	0.32	81	75	1.60	1.60	3	82	83	40	39	94.7	31.80
	Final DGM:		666.708												

RESULTS	Run Time	Vm	ΔP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y_{qa}
	96.0 min	65.986 ft^3	0.30 in. WC	86.4 °F	74.3 °F	3	1.556 in. WC	98.3	0.022	-2.8

Alliance SOURCE TESTING

Isokinetic Field Data

Location:	Chemours Company - Fayetteville Works Facility, NC	**Start Time:**	11:55	**Source:**	VES Carbon Bed Outlet
Date:	5/19/21	**Run 2**	VALID	**End Time:**	13:48	**Project No.:**	2021-1361O	**Parameter:**	HFPO-DA

STACK DATA (EST)			EQUIPMENT			STACK DATA (EST)			FILTER NO.	STACK DATA (FINAL)			MOIST. DATA
Moisture:	1.5	% est.	Meter Box ID:	7		Est. Tm:	86	°F	OTM-45	Pb:	30.35	in. Hg	Vlc (ml)
Barometric:	30.35	in. Hg	Y:	0.994		Est. Ts:	74	°F		Pg:	1.20	in. WC	28.0
Static Press:	1.20	in. WC	ΔH @ (in.WC):	1.800		Est. ΔP:	0.30	in. WC		O_2:	20.9	%	K-FACTOR
Stack Press:	30.44	in. Hg	Probe ID:	P4-3		Est. Dn:	0.271	in.		CO_2:	0.1	%	5.05
CO_2:	0.0	%	Liner Material:	glass		Target Rate:	0.75	scfm					
O_2:	20.9	%	Pitot ID:	P4-3		LEAK CHECKS	Pre	Mid 1	Mid 2	Mid 3	Post	Check Pt.	Initial	Final	Corr.
N_2/CO:	79.1	%	Pitot Cp/Type:	0.840	S-type	Leak Rate (cfm):	0.005	0.007	0.009	--	0.008	Mid 1 (cf)	9.611	9.858	0.247
Md:	28.84	lb/lb-mole	Nozzle ID:	G-1	glass	Vacuum (in Hg):	12	10	12	--	10	Mid 2 (cf)			--
Ms:	28.67	lb/lb-mole	Nozzle Dn (in.):	0.262		Pitot Tube:	Pass	--	--	--	Pass	Mid 3 (cf)			--
												Mid-Point Leak Check Vol (cf):			0.247

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft^3)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)
					DGM Average	Stack				Probe	Filter	Imp Exit	Aux		
					Amb.	Amb.				Amb.	Amb.	Amb.	Amb.		
	Begin	End			--	--	Ideal	Actual		--	--	--	--		
1	0.00	4.00	666.942	0.24	76	75	1.19	1.20	2	80	81	64	52	106.8	27.54
2	4.00	8.00	669.566	0.24	77	75	1.19	1.20	2	81	82	58	47	101.4	27.54
3	8.00	12.00	672.061	0.25	78	75	1.24	1.30	2	83	82	58	46	100.3	28.10
4	12.00	16.00	674.583	0.27	79	75	1.34	1.30	2	79	83	54	47	94.6	29.21
5	16.00	20.00	677.061	0.29	79	75	1.44	1.40	2	78	82	52	48	100.6	30.27
6	20.00	24.00	679.790	0.31	79	75	1.54	1.50	3	79	83	50	48	97.4	31.29
7	24.00	28.00	682.521	0.32	80	75	1.60	1.60	3	81	83	50	48	101.7	31.80
8	28.00	32.00	685.425	0.32	80	75	1.60	1.60	3	82	84	51	47	97.6	31.80
9	32.00	36.00	688.211	0.34	79	75	1.69	1.70	3	78	81	50	46	94.7	32.77
10	36.00	40.00	690.991	0.34	79	75	1.69	1.70	3	79	81	49	44	92.2	32.77
11	40.00	44.00	693.698	0.37	79	75	1.84	1.80	4	80	82	52	46	95.5	34.19
12	44.00	48.00	696.621	0.38	79	75	1.89	1.90	4	80	82	50	46	96.4	34.65
1	48.00	52.00	699.611	0.19	78	76	0.94	0.94	2	80	83	64	52	103.9	24.52
2	52.00	56.00	701.889	0.21	79	76	1.04	1.00	2	82	84	58	46	101.8	25.78
3	56.00	60.00	704.240	0.23	80	76	1.15	1.20	2	83	84	58	42	101.7	26.98
4	60.00	64.00	706.700	0.26	80	76	1.29	1.30	2	81	83	54	42	101.0	28.69
5	64.00	68.00	709.298	0.26	80	76	1.29	1.30	2	82	84	49	42	97.3	28.69
6	68.00	72.00	711.800	0.27	80	76	1.34	1.35	2	83	84	48	42	99.2	29.23
7	72.00	76.00	714.400	0.30	80	76	1.49	1.50	2	83	84	48	42	97.8	30.81
8	76.00	80.00	717.100	0.32	80	76	1.59	1.60	2	82	84	45	42	98.2	31.83
9	80.00	84.00	719.900	0.35	81	76	1.74	1.75	3	82	83	45	42	93.7	33.28
10	84.00	88.00	722.700	0.35	81	76	1.74	1.75	3	82	83	45	43	97.1	33.28
11	88.00	92.00	725.600	0.34	81	76	1.69	1.70	3	83	84	45	43	98.3	32.80
12	92.00	96.00	728.494	0.32	81	76	1.60	1.60	3	82	83	45	44	100.7	31.83
	Final DGM:		731.370												

RESULTS	Run Time		Vm		ΔP		Tm		Ts		Max Vac	ΔH		%ISO	BWS	Y_{qa}
	96.0	min	64.181	ft^3	0.29	in. WC	79.4	°F	75.5	°F	4	1.466	in. WC	98.6	0.020	-1.9

Alliance SOURCE TESTING

Isokinetic Field Data

Location:	Chemours Company - Fayetteville Works Facility, NC		**Start Time:**	14:15	**Source:**	VES Carbon Bed Outlet	
Date:	5/19/21	Run 3 VALID	**End Time:**	16:08	**Project No.:**	2021-1361O	**Parameter:** HFPO-DA

STACK DATA (EST)			EQUIPMENT			STACK DATA (EST)			FILTER NO.	STACK DATA (FINAL)		MOIST. DATA
Moisture:	1.5	% est.	Meter Box ID:	7		Est. Tm:	79	°F	OTM-45	Pb:	30.35 in. Hg	Vlc (ml)
Barometric:	30.35	in. Hg	Y:	0.994		Est. Ts:	76	°F		Pg:	1.15 in. WC	27.8
Static Press:	1.20	in. WC	ΔH @ (in.WC):	1.800		Est. ΔP:	0.29	in. WC		O_2:	20.9 %	K-FACTOR
Stack Press:	30.44	in. Hg	Probe ID:	P4-3		Est. Dn:	0.276	in.		CO_2:	0.1 %	4.973
CO_2:	0.0	%	Liner Material:	glass		Target Rate:	0.75	scfm				
O_2:	20.9	%	Pitot ID:	P4-3		LEAK CHECKS	Pre	Mid 1	Mid 2	Mid 3	Post	
N_2/CO:	79.1	%	Pitot Cp/Type:	0.840	S-type	Leak Rate (cfm):	0.012	0.014	0.015	--	0.014	
Md:	28.84	lb/lb-mole	Nozzle ID:	G-1	glass	Vacuum (in Hg):	10	12	10	--	10	
Ms:	28.67	lb/lb-mole	Nozzle Dn (in.):	0.262		Pitot Tube:	Pass	--	--	--	Pass	

Check Pt.	Initial	Final	Corr.
Mid 1 (cf)	5.767	6.012	0.245
Mid 2 (cf)			--
Mid 3 (cf)			--
Mid-Point Leak Check Vol (cf):			0.245

Sample Pt.	Sample Time (minutes) Begin	End	Dry Gas Meter Reading (ft^3)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F) DGM Average Amb. --	Stack Amb. --	Orifice Press. ΔH (in. WC) Ideal	Actual	Pump Vac (in. Hg)	Gas Temperatures (°F) Probe Amb. --	Filter Amb. --	Imp Exit Amb. --	Aux Amb. --	% ISO	Vs (fps)
1	0.00	4.00	732.210	0.24	79	78	1.19	1.20	2	83	83	64	50	102.9	27.61
2	4.00	8.00	734.744	0.24	81	78	1.19	1.20	2	83	85	54	44	94.3	27.61
3	8.00	12.00	737.074	0.26	81	78	1.29	1.30	2	80	83	52	43	97.6	28.74
4	12.00	16.00	739.584	0.28	82	78	1.39	1.40	2	81	84	50	42	101.1	29.83
5	16.00	20.00	742.288	0.32	82	78	1.59	1.60	2	84	85	48	40	95.2	31.88
6	20.00	24.00	745.008	0.32	82	78	1.59	1.60	2	85	83	48	41	98.9	31.88
7	24.00	28.00	747.833	0.34	83	77	1.70	1.70	3	84	83	49	42	96.7	32.84
8	28.00	32.00	750.689	0.35	83	76	1.75	1.80	3	85	84	49	42	99.8	33.28
9	32.00	36.00	753.679	0.37	83	77	1.85	1.90	3	86	85	49	41	97.9	34.25
10	36.00	40.00	756.694	0.37	84	77	1.85	1.90	3	87	86	49	42	101.4	34.25
11	40.00	44.00	759.822	0.38	84	78	1.90	1.90	3	86	87	49	41	94.7	34.75
12	44.00	48.00	762.779	0.36	83	78	1.79	1.80	3	87	86	49	42	98.5	33.82
1	48.00	52.00	765.767	0.19	81	79	0.94	0.94	2	88	87	62	46	103.1	24.59
2	52.00	56.00	768.034	0.21	81	79	1.04	1.00	2	87	86	50	43	101.5	25.85
3	56.00	60.00	770.379	0.22	82	79	1.09	1.10	2	88	86	48	42	102.1	26.46
4	60.00	64.00	772.799	0.26	84	80	1.29	1.30	2	87	88	47	42	100.3	28.79
5	64.00	68.00	775.388	0.30	84	80	1.49	1.50	2	88	87	46	41	97.5	30.93
6	68.00	72.00	778.091	0.33	84	79	1.65	1.60	3	87	87	44	40	103.0	32.41
7	72.00	76.00	781.087	0.34	84	79	1.69	1.70	3	88	89	43	40	95.7	32.90
8	76.00	80.00	783.911	0.35	85	79	1.75	1.80	3	87	88	43	41	92.8	33.38
9	80.00	84.00	786.696	0.35	85	79	1.75	1.80	3	88	89	42	40	93.1	33.38
10	84.00	88.00	789.488	0.35	85	79	1.75	1.80	3	87	88	41	40	104.1	33.38
11	88.00	92.00	792.612	0.35	85	79	1.75	1.80	3	88	87	42	41	100.3	33.38
12	92.00	96.00	795.621	0.32	86	79	1.60	1.60	3	86	88	43	40	97.4	31.91
	Final DGM:		798.421												

RESULTS	Run Time	Vm	ΔP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y_{qa}
	96.0 min	65.966 ft^3	0.31 in. WC	83.0 °F	78.4 °F	3	1.552 in. WC	98.7	0.020	-2.2

Location Chemours Company - Fayetteville Works Facility, NC
Source VES Carbon Bed Inlet
Project No. 2021-1361O
Parameter HFPO-DA

Run Number		Run 1	Run 2	Run 3	Average
Date		5/19/21	5/19/21	5/19/21	--
Start Time		9:23	11:55	14:15	--
Stop Time		11:27	13:48	16:08	--
Run Time, min	(θ)	96.0	96.0	96.0	96.0
INPUT DATA					
Barometric Pressure, in. Hg	(Pb)	30.35	30.35	30.35	30.35
Meter Correction Factor	(Y)	1.002	1.002	1.002	1.002
Orifice Calibration Value	(ΔH @)	1.600	1.600	1.600	1.600
Meter Volume, ft^3	(Vm)	77.844	78.745	82.762	79.784
Meter Temperature, °F	(Tm)	85.5	89.0	90.1	88.2
Meter Temperature, °R	(Tm)	545.2	548.6	549.8	547.9
Meter Orifice Pressure, in. WC	(ΔH)	1.829	1.845	2.060	1.912
Volume H_2O Collected, mL	(Vlc)	-2.1	-2.1	-2.1	-2.1
Nozzle Diameter, in	(Dn)	0.235	0.235	0.235	0.235
Area of Nozzle, ft^2	(An)	0.0003	0.0003	0.0003	0.0003
FH HFPO-DA Mass, ng	$M_{(HFPODA)}$	7,380.0	2,940.0	3,270.0	4,530.0
BH HFPO-DA Mass, ng	$M_{(HFPODA)}$	5,130.0	4,280.0	1,660.0	3,690.0
Imp HFPO-DA Mass, ng	$M_{(HFPODA)}$	46.1	66.5	15.6	42.7
Breakthrough HFPO-DA Mass, ng	$M_{(HFPODA)}$	6.8	14.7	4.4	8.6
Total HFPO-DA Mass, ng	$M_{(HFPODA)}$	12,562.9	7,301.2	4,950.0	8,271.4
ISOKINETIC DATA					
Standard Meter Volume, ft^3	(Vmstd)	76.920	77.323	81.143	78.462
Standard Water Volume, ft^3	(Vwstd)	1.236	1.132	1.009	1.125
Moisture Fraction Measured	(BWSmsd)	0.016	0.014	0.012	0.014
Moisture Fraction @ Saturation	(BWSsat)	0.027	0.032	0.036	0.032
Moisture Fraction	(BWS)	0.016	0.014	0.012	0.014
Meter Pressure, in Hg	(Pm)	30.48	30.49	30.50	30.49
Volume at Nozzle, ft^3	(Vn)	76.931	78.035	82.453	79.14
Isokinetic Sampling Rate, (%)	(I)	100.0	100.5	100.0	100.2
DGM Calibration Check Value, (+/- 5%)	(Y_{qa})	1.3	1.8	1.3	1.5
EMISSION CALCULATIONS					
HFPO-DA Concentration, ng/dscm	$C_{(HFPODA)}$	5.8E+03	3.3E+03	2.2E+03	3.8E+03
HFPO-DA Emission Rate, lb/hr	$ER_{(HFPODA)}$	4.0E-04	2.3E-04	1.6E-04	2.6E-04

Location Chemours Company - Fayetteville Works Facility, NC
Source VES Carbon Bed Inlet
Project No. 2021-1361O
Parameter HFPO-DA

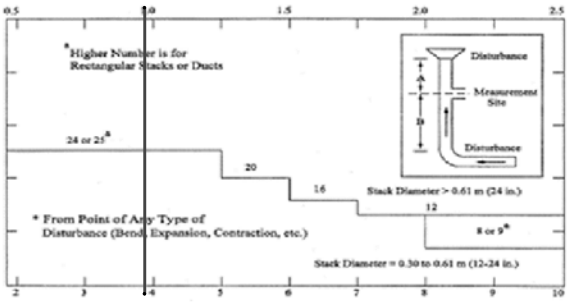
Run Number		Run 1	Run 2	Run 3	Average
Date		5/19/21	5/19/21	5/19/21	--
Start Time		9:23	11:55	14:15	--
Stop Time		11:27	13:48	16:08	--
Run Time, min		96.0	96.0	96.0	96.0
VELOCITY HEAD, in. WC					
Point 1		0.54	0.96	0.70	0.73
Point 2		0.56	0.96	0.68	0.73
Point 3		0.55	0.95	0.68	0.73
Point 4		0.58	0.95	0.74	0.76
Point 5		0.58	0.96	0.77	0.77
Point 6		0.63	0.88	0.75	0.75
Point 7		0.64	0.66	0.71	0.67
Point 8		0.63	0.64	0.66	0.64
Point 9		0.58	0.53	0.62	0.58
Point 10		0.55	0.37	0.61	0.51
Point 11		0.55	0.36	0.61	0.51
Point 12		0.55	0.36	0.60	0.50
Point 13		0.93	0.60	1.10	0.88
Point 14		0.93	0.59	1.10	0.87
Point 15		0.92	0.66	1.05	0.88
Point 16		0.93	0.64	1.05	0.87
Point 17		0.90	0.60	1.00	0.83
Point 18		0.90	0.58	0.96	0.81
Point 19		0.65	0.54	0.60	0.60
Point 20		0.55	0.53	0.57	0.55
Point 21		0.39	0.50	0.54	0.48
Point 22		0.39	0.51	0.37	0.42
Point 23		0.38	0.51	0.38	0.42
Point 24		0.36	0.51	0.38	0.42
CALCULATED DATA					
Square Root of ΔP, (in. WC)$^{1/2}$	(ΔP)	0.787	0.791	0.838	0.805
Pitot Tube Coefficient	(Cp)	0.840	0.840	0.840	0.840
Barometric Pressure, in. Hg	(Pb)	30.35	30.35	30.35	30.35
Static Pressure, in. WC	(Pg)	-2.00	-2.00	-2.00	-2.00
Stack Pressure, in. Hg	(Ps)	30.20	30.20	30.20	30.20
Stack Cross-sectional Area, ft^2	(As)	7.07	7.07	7.07	7.07
Temperature, °F	(Ts)	73.8	78.6	82.3	78.2
Temperature, °R	(Ts)	533.4	538.3	541.9	537.864
Moisture Fraction Measured	(BWSmsd)	0.016	0.014	0.012	0.014
Moisture Fraction @ Saturation	(BWSsat)	0.027	0.032	0.036	0.032
Moisture Fraction	(BWS)	0.016	0.014	0.012	0.014
O_2 Concentration, %	(O_2)	20.9	20.9	20.9	20.9
CO_2 Concentration, %	(CO_2)	0.1	0.1	0.1	0.1
Molecular Weight, lb/lb-mole (dry)	(Md)	28.85	28.85	28.85	28.85
Molecular Weight, lb/lb-mole (wet)	(Ms)	28.68	28.70	28.72	28.70
Velocity, ft/sec	(Vs)	44.3	44.8	47.5	45.5
VOLUMETRIC FLOW RATE					
At Stack Conditions, acfm	(Qa)	18,806	18,980	20,163	19,316
At Standard Conditions, dscfm	(Qs)	18,482	18,512	19,575	18,856

Method 1 Data

Location Chemours Company - Fayetteville Works Facility, NC
Source VES Carbon Bed Inlet
Project No. 2021-1361O
Date: 05/19/21

Stack Parameters

Duct Orientation:	Vertical	
Duct Design:	Circular	
Distance from Far Wall to Outside of Port:	51.00	in
Nipple Length:	15.00	in
Depth of Duct:	36.00	in
Cross Sectional Area of Duct:	7.07	ft^2
No. of Test Ports:	2	
Distance A:	2.9	ft
Distance A Duct Diameters:	1.0	(must be > 0.5)
Distance B:	3.4	ft
Distance B Duct Diameters:	1.1	(must be > 2)
Minimum Number of Traverse Points:	24	
Actual Number of Traverse Points:	24	
Number of Readings per Point:	1	



CIRCULAR DUCT

LOCATION OF TRAVERSE POINTS

Number of traverse points on a diameter

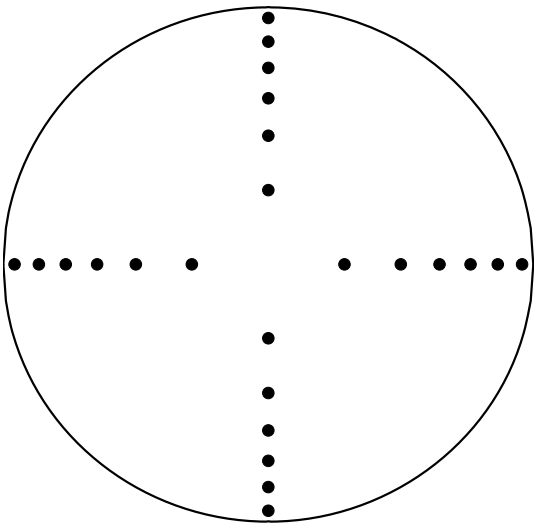
	2	3	4	5	6	7	8	9	10	11	12
1	14.6	--	6.7	--	4.4	--	3.2	--	2.6	--	2.1
2	85.4	--	25.0	--	14.6	--	10.5	--	8.2	--	6.7
3	--	--	75.0	--	29.6	--	19.4	--	14.6	--	11.8
4	--	--	93.3	--	70.4	--	32.3	--	22.6	--	17.7
5	--	--	--	--	85.4	--	67.7	--	34.2	--	25.0
6	--	--	--	--	95.6	--	80.6	--	65.8	--	35.6
7	--	--	--	--	--	--	89.5	--	77.4	--	64.4
8	--	--	--	--	--	--	96.8	--	85.4	--	75.0
9	--	--	--	--	--	--	--	--	91.8	--	82.3
10	--	--	--	--	--	--	--	--	97.4	--	88.2
11	--	--	--	--	--	--	--	--	--	--	93.3
12	--	--	--	--	--	--	--	--	--	--	97.9

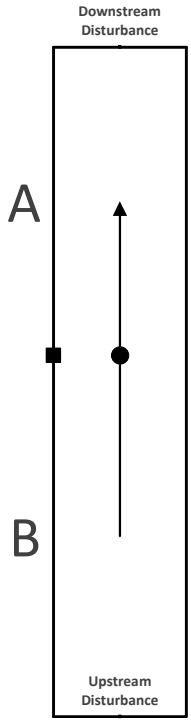
**Percent of stack diameter from inside wall to traverse point.*

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	2.1	1.00	16.00
2	6.7	2.41	17.41
3	11.8	4.25	19.25
4	17.7	6.37	21.37
5	25.0	9.00	24.00
6	35.6	12.82	27.82
7	64.4	23.18	38.18
8	75.0	27.00	42.00
9	82.3	29.63	44.63
10	88.2	31.75	46.75
11	93.3	33.59	48.59
12	97.9	35.00	50.00

Stack Diagram
A = 2.9166666
B = 3.4166666
Depth of Duct = 36 in.

Cross Sectional Area





Cyclonic Flow Check

Location Chemours Company - Fayetteville Works Facility, NC
Source VES Carbon Bed Inlet
Project No. 2021-1361O
Date 05/19/21

Sample Point	Angle (ΔP=0)
1	12
2	15
3	15
4	15
5	12
6	15
7	18
8	18
9	15
10	12
11	12
12	12
13	15
14	18
15	18
16	20
17	18
18	15
19	15
20	12
21	12
22	10
23	10
24	10
Average	14

Method 4 Data

Location Chemours Company - Fayetteville Works Facility, NC
Source VES Carbon Bed Inlet
Project No. 2021-1361O
Parameter HFPO-DA
Analysis Gravimetric

Run 1	Date:	5/19/21						
Impinger No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
Contents	XAD Trap	Empty	H2O	H2O	H2O	XAD Trap	Silica	--
Initial Mass, g	0.0	0.0	100.0	100.0	100.0	0.0	923.4	1223.4
Final Mass, g	0.0	2.0	104.0	100.0	100.0	0.0	943.6	1249.6
Gain	0.0	2.0	4.0	0.0	0.0	0.0	20.2	26.2
Run 2	**Date:**	5/19/21						
Impinger No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
Contents	XAD Trap	Empty	H2O	H2O	H2O	XAD Trap	Silica	--
Initial Mass, g	0.0	0.0	100.0	100.0	100.0	0.0	877.6	1177.6
Final Mass, g	0.0	2.0	104.0	100.0	102.0	0.0	893.6	1201.6
Gain	0.0	2.0	4.0	0.0	2.0	0.0	16.0	24.0
Run 3	**Date:**	5/19/21						
Impinger No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
Contents	XAD Trap	Empty	H2O	H2O	H2O	XAD Trap	Silica	--
Initial Mass, g	0.0	0.0	100.0	100.0	100.0	0.0	865.4	1165.4
Final Mass, g	0.0	2.0	100.0	100.0	102.0	0.0	882.8	1186.8
Gain	0.0	2.0	0.0	0.0	2.0	0.0	17.4	21.4

Alliance SOURCE TESTING

Isokinetic Field Data

Location:	Chemours Company - Fayetteville Works Facility, NC		**Start Time:**	9:23	**Source:**	VES Carbon Bed Inlet	
Date:	5/19/21	Run 1 VALID	**End Time:**	11:27	**Project No.:**	2021-1361O	**Parameter:** HFPO-DA

STACK DATA (EST)			EQUIPMENT			STACK DATA (EST)			FILTER NO.	STACK DATA (FINAL)			MOIST. DATA
Moisture:	1.5	% est.	Meter Box ID:	3		Est. Tm:	80	°F	OTM-45	Pb:	30.35	in. Hg	Vlc (ml)
Barometric:	30.35	in. Hg	Y:	1.002		Est. Ts:	69	°F		Pg:	-2.00	in. WC	-2.1
Static Press:	-2.10	in. WC	ΔH @ (in.WC):	1.600		Est. ΔP:	0.67	in. WC		O_2:	20.9	%	K-FACTOR
Stack Press:	30.20	in. Hg	Probe ID:	P4-2		Est. Dn:	0.224	in.		CO_2:	0.1	%	2.878
CO_2:	0.0	%	Liner Material:	glass		Target Rate:	0.75	scfm			Check Pt.	Initial	Final / Corr.
O_2:	20.9	%	Pitot ID:	P4-2		LEAK CHECK:	Pre	Mid 1	Mid 2 / Mid 3	Post	Mid 1 (cf)		--
N_2/CO:	79.1	%	Pitot Cp/Type:	0.840	S-type	Leak Rate (cfm):	0.001	--	-- / --	0.001	Mid 2 (cf)		--
Md:	28.84	lb/lb-mole	Nozzle ID:	G-3	glass	Vacuum (in Hg):	8	--	-- / --	10	Mid 3 (cf)		--
Ms:	28.67	lb/lb-mole	Nozzle Dn (in.):	0.235		Pitot Tube:	Pass	--	-- / --	Pass	Mid-Point Leak Check Vol (cf):		--

Sample Pt.	Sample Time (minutes) Begin	End	Dry Gas Meter Reading (ft^3)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F) DGM Average Amb.	Stack Amb.	Orifice Press. ΔH (in. WC) Ideal	Actual	Pump Vac (in. Hg)	Gas Temperatures (°F) Probe Amb.	Filter Amb.	Imp Exit Amb.	Aux Amb.	% ISO	Vs (fps)
A-1	0.00	4.00	568.932	0.54	78	71	1.54	1.55	6	86	82	60	45	101.7	41.31
2	4.00	8.00	571.930	0.56	81	72	1.61	1.60	6	84	80	52	44	101.1	42.11
3	8.00	12.00	574.980	0.55	81	72	1.58	1.60	6	83	80	49	42	103.1	41.73
4	12.00	16.00	578.060	0.58	82	72	1.67	1.70	6	81	80	47	44	100.5	42.86
5	16.00	20.00	581.150	0.58	83	72	1.67	1.70	6	81	81	46	43	100.7	42.86
6	20.00	24.00	584.250	0.63	83	73	1.81	1.80	6	80	81	45	44	99.2	44.71
7	24.00	28.00	587.430	0.64	83	73	1.84	1.85	7	80	82	47	44	100.3	45.06
8	28.00	32.00	590.670	0.63	84	73	1.81	1.80	7	80	81	47	44	98.7	44.71
9	32.00	36.00	593.840	0.58	84	73	1.67	1.70	6	81	80	46	43	97.7	42.90
10	36.00	40.00	596.850	0.55	84	73	1.58	1.60	6	82	80	47	45	107.3	41.77
11	40.00	44.00	600.070	0.55	85	73	1.59	1.60	6	81	81	47	47	107.4	41.77
12	44.00	48.00	603.300	0.55	85	73	1.59	1.60	6	82	80	48	45	103.1	41.77
B-1	48.00	52.00	606.400	0.93	85	75	2.66	2.65	9	80	82	60	53	98.1	54.42
2	52.00	56.00	610.220	0.93	86	75	2.67	2.65	9	78	82	56	51	98.7	54.42
3	56.00	60.00	614.070	0.92	87	75	2.65	2.65	9	78	83	56	52	98.8	54.13
4	60.00	64.00	617.910	0.93	87	75	2.67	2.70	9	77	83	53	52	100.3	54.42
5	64.00	68.00	621.830	0.90	88	75	2.59	2.60	9	77	83	55	53	99.4	53.54
6	68.00	72.00	625.660	0.90	88	75	2.59	2.60	9	78	84	55	49	101.2	53.54
7	72.00	76.00	629.560	0.65	89	75	1.88	1.90	7	78	84	52	43	102.3	45.50
8	76.00	80.00	632.920	0.55	89	75	1.59	1.60	7	79	84	48	41	104.5	41.85
9	80.00	84.00	636.080	0.39	90	75	1.13	1.15	5	85	85	48	41	107.3	35.24
10	84.00	88.00	638.820	0.39	90	75	1.13	1.15	5	85	84	49	42	106.9	35.24
11	88.00	92.00	641.550	0.38	90	75	1.10	1.10	5	85	84	46	40	104.9	34.79
12	92.00	96.00	644.195	0.36	90	75	1.04	1.05	5	85	84	46	40	105.2	33.86
	Final DGM:		646.776												

RESULTS	Run Time	Vm	ΔP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y_{qa}
	96.0 min	77.844 ft^3	0.63 in. WC	85.5 °F	73.8 °F	9	1.829 in. WC	100.0	0.016	1.3

Alliance SOURCE TESTING

Isokinetic Field Data

Location:	Chemours Company - Fayetteville Works Facility, NC	**Start Time:**	11:55	**Source:**	VES Carbon Bed Inlet
Date:	5/19/21	**Run 2**	VALID	**End Time:**	13:48	**Project No.:**	2021-1361O	**Parameter:**	HFPO-DA

STACK DATA (EST)			EQUIPMENT			STACK DATA (EST)			FILTER NO.	STACK DATA (FINAL)			MOIST. DATA
Moisture:	1.5	% est.	Meter Box ID:	3		Est. Tm:	86	°F	OTM-45	Pb:	30.35	in. Hg	Vlc (ml)
Barometric:	30.35	in. Hg	Y:	1.002		Est. Ts:	74	°F		Pg:	-2.00	in. WC	-2.1
Static Press:	-2.10	in. WC	ΔH @ (in.WC):	1.600		Est. ΔP:	0.63	in. WC		O_2:	20.9	%	K-FACTOR
Stack Press:	30.20	in. Hg	Probe ID:	P4-2		Est. Dn:	0.227	in.		CO_2:	0.1	%	2.88
CO_2:	0.0	%	Liner Material:	glass		Target Rate:	0.75	scfm					
O_2:	20.9	%	Pitot ID:	P4-2		LEAK CHECK	Pre	Mid 1	Mid 2	Mid 3	Post	Check Pt.	Initial	Final	Corr.
N_2/CO:	79.1	%	Pitot Cp/Type:	0.840	S-type	Leak Rate (cfm):	0.003	--	--	--	0.003	Mid 1 (cf)			--
Md:	28.84	lb/lb-mole	Nozzle ID:	G-3	glass	Vacuum (in Hg):	8	--	--	--	11	Mid 2 (cf)			--
Ms:	28.67	lb/lb-mole	Nozzle Dn (in.):	0.235		Pitot Tube:	Pass	--	--	--	Pass	Mid 3 (cf)			--
												Mid-Point Leak Check Vol (cf):			--

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft^3)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)
					DGM Average	Stack				Probe	Filter	Imp Exit	Aux		
					Amb.	Amb.				Amb.	Amb.	Amb.	Amb.		
	Begin	End			--	--	Ideal	Actual		--	--	--	--		
A-1	0.00	4.00	646.865	0.96	84	77	2.73	2.75	9	85	83	60	56	98.3	55.40
2	4.00	8.00	650.740	0.96	87	77	2.75	2.75	9	87	84	57	56	99.7	55.40
3	8.00	12.00	654.690	0.95	88	77	2.73	2.75	9	90	91	56	54	99.5	55.11
4	12.00	16.00	658.620	0.95	88	77	2.73	2.74	9	90	91	53	54	98.3	55.11
5	16.00	20.00	662.500	0.96	88	77	2.75	2.74	9	90	91	52	54	101.3	55.40
6	20.00	24.00	666.520	0.88	88	78	2.52	2.55	8	90	92	53	53	100.8	53.09
7	24.00	28.00	670.350	0.66	88	78	1.89	1.90	7	88	92	54	54	103.2	45.97
8	28.00	32.00	673.750	0.64	88	78	1.84	1.85	7	89	92	55	54	103.8	45.27
9	32.00	36.00	677.120	0.53	89	78	1.53	1.50	6	89	92	54	54	101.3	41.20
10	36.00	40.00	680.120	0.37	89	78	1.07	1.05	5	90	92	54	52	107.0	34.42
11	40.00	44.00	682.770	0.36	89	78	1.04	1.05	5	90	91	54	53	101.9	33.95
12	44.00	48.00	685.260	0.36	89	78	1.04	1.05	5	91	91	54	54	105.0	33.95
B-1	48.00	52.00	687.825	0.60	87	79	1.72	1.70	6	93	90	56	53	101.9	43.88
2	52.00	56.00	691.020	0.59	88	79	1.69	1.70	6	92	91	56	54	105.0	43.51
3	56.00	60.00	694.290	0.66	89	79	1.89	1.90	6	91	91	54	54	97.3	46.02
4	60.00	64.00	697.500	0.64	89	79	1.84	1.85	6	91	91	52	54	102.8	45.31
5	64.00	68.00	700.840	0.60	89	79	1.72	1.75	6	93	91	51	50	102.4	43.88
6	68.00	72.00	704.060	0.58	89	80	1.66	1.65	6	89	89	50	48	104.5	43.18
7	72.00	76.00	707.290	0.54	91	80	1.55	1.55	6	87	88	49	45	104.5	41.66
8	76.00	80.00	710.420	0.53	91	80	1.52	1.55	6	90	87	50	43	102.5	41.27
9	80.00	84.00	713.460	0.50	91	80	1.44	1.45	6	90	86	50	41	107.9	40.09
10	84.00	88.00	716.570	0.51	92	80	1.47	1.50	6	90	86	50	43	102.9	40.49
11	88.00	92.00	719.570	0.51	92	80	1.47	1.50	6	90	87	50	45	103.9	40.49
12	92.00	96.00	722.600	0.51	92	80	1.47	1.50	6	90	87	50	45	103.3	40.49
	Final DGM:		725.610												

RESULTS	Run Time		Vm		ΔP		Tm		Ts		Max Vac	ΔH		%ISO	BWS	Y_{qa}
	96.0	min	78.745	ft^3	0.64	in. WC	89.0	°F	78.6	°F	9	1.845	in. WC	100.5	0.014	1.8

Alliance SOURCE TESTING

Isokinetic Field Data

Location:	Chemours Company - Fayetteville Works Facility, NC		**Start Time:**	14:15	**Source:**	VES Carbon Bed Inlet	
Date:	5/19/21	Run 3 VALID	**End Time:**	16:08	**Project No.:**	2021-1361O	**Parameter:** HFPO-DA

STACK DATA (EST)			EQUIPMENT			STACK DATA (EST)			FILTER NO.	STACK DATA (FINAL)			MOIST. DATA
Moisture:	1.5	% est.	**Meter Box ID:**	3		**Est. Tm:**	89	°F	OTM-45	**Pb:**	30.35	in. Hg	**Vlc (ml)**
Barometric:	30.35	in. Hg	**Y:**	1.002		**Est. Ts:**	79	°F		**Pg:**	-2.00	in. WC	-2.1
Static Press:	-2.10	in. WC	**ΔH @ (in.WC):**	1.600		**Est. ΔP:**	0.64	in. WC		**O_2:**	20.9	%	**K-FACTOR**
Stack Press:	30.20	in. Hg	**Probe ID:**	P4-2		**Est. Dn:**	0.226	in.		**CO_2:**	0.1	%	2.874
CO_2:	0.0	%	**Liner Material:**	glass		**Target Rate:**	0.75	scfm					
O_2:	20.9	%	**Pitot ID:**	P4-2		**LEAK CHECK**	**Pre**	**Mid 1**	**Mid 2**	**Mid 3**	**Post**	**Check Pt.**	**Initial**	**Final**	**Corr.**
N_2/CO:	79.1	%	**Pitot Cp/Type:**	0.840	S-type	Leak Rate (cfm):	0.003	--	--	--	0.003	Mid 1 (cf)			--
Md:	28.84	lb/lb-mole	**Nozzle ID:**	G-3	glass	Vacuum (in Hg):	11	--	--	--	11	Mid 2 (cf)			--
Ms:	28.67	lb/lb-mole	**Nozzle Dn (in.):**	0.235		Pitot Tube:	Pass	--	--	--	Pass	Mid 3 (cf)			--
												Mid-Point Leak Check Vol (cf):			--

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft^3)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)
					DGM Average	Stack				Probe	Filter	Imp Exit	Aux		
					Amb.	Amb.				Amb.	Amb.	Amb.	Amb.		
	Begin	End			--	--	Ideal	Actual		--	--	--	--		
A-1	0.00	4.00	725.735	0.70	89	81	2.00	2.03	4	92	92	66	55	97.8	47.48
2	4.00	8.00	729.050	0.68	90	81	1.95	1.96	5	93	93	48	50	98.6	46.80
3	8.00	12.00	732.350	0.68	91	81	1.95	1.96	6	94	93	44	48	99.0	46.80
4	12.00	16.00	735.670	0.74	91	81	2.12	2.10	7	93	93	46	40	98.4	48.82
5	16.00	20.00	739.110	0.77	91	81	2.21	2.20	8	91	93	47	39	100.4	49.80
6	20.00	24.00	742.690	0.75	91	81	2.15	2.15	8	90	94	46	41	100.6	49.15
7	24.00	28.00	746.230	0.71	91	81	2.04	2.05	8	88	93	46	41	102.2	47.82
8	28.00	32.00	749.730	0.66	91	82	1.89	1.90	7	86	93	46	41	102.4	46.14
9	32.00	36.00	753.110	0.62	91	82	1.78	1.80	7	86	93	46	41	103.1	44.72
10	36.00	40.00	756.410	0.61	91	82	1.75	1.75	7	85	91	46	43	102.7	44.36
11	40.00	44.00	759.670	0.61	91	82	1.75	1.75	7	85	90	46	42	102.4	44.36
12	44.00	48.00	762.920	0.60	91	82	1.72	1.70	7	84	89	48	43	102.2	44.00
B-1	48.00	52.00	766.139	1.10	91	82	3.14	3.15	10	83	84	55	46	97.0	59.57
2	52.00	56.00	770.260	1.10	91	82	3.14	3.15	10	84	84	46	44	98.9	59.57
3	56.00	60.00	774.460	1.05	90	82	2.99	3.00	10	84	83	50	43	100.1	58.20
4	60.00	64.00	778.610	1.05	89	82	2.99	3.00	10	85	83	51	43	100.3	58.20
5	64.00	68.00	782.760	1.00	89	83	2.84	2.90	10	85	83	52	43	101.4	56.85
6	68.00	72.00	786.850	0.96	89	83	2.73	2.75	10	85	83	54	47	102.2	55.70
7	72.00	76.00	790.890	0.60	89	83	1.71	1.70	7	85	83	54	47	104.0	44.04
8	76.00	80.00	794.150	0.57	89	84	1.62	1.65	7	85	84	55	47	103.5	42.96
9	80.00	84.00	797.310	0.54	89	84	1.54	1.55	7	85	84	55	46	105.0	41.82
10	84.00	88.00	800.430	0.37	89	84	1.05	1.05	5	85	85	56	46	108.8	34.61
11	88.00	92.00	803.110	0.38	89	84	1.08	1.10	5	85	85	56	44	107.8	35.08
12	92.00	96.00	805.800	0.38	89	84	1.08	1.10	5	86	85	56	45	108.1	35.08
	Final DGM:		808.497												

RESULTS	Run Time		Vm		ΔP		Tm		Ts		Max Vac	ΔH		%ISO	BWS	Y_{qa}
	96.0	min	82.762	ft^3	0.72	in. WC	90.1	°F	82.3	°F	10	2.060	in. WC	100.0	0.012	1.3

Appendix C

QA/QC Data

Location Chemours Company - Fayetteville Works Facility, NC
Source VES Carbon Bed Outlet
Project No. 2021-1361O
Parameter HFPO-DA

Date	Nozzle ID	Nozzle Diameter (in.) #1	#2	#3	Dn (Average)	Difference	Criteria	Material
5/19/21	G-1	0.262	0.262	0.262	0.262	0.000	≤ 0.004 in.	glass

Date	Pitot ID	Evidence of damage?	Evidence of mis-alignment?	Calibration or Repair required?
5/19/21	P4-3	no	no	no

Date	Meter Box ID	Positive Pressure Leak Check
5/19/21	7	Pass

QA/QC Data

Location Chemours Company - Fayetteville Works Facility, NC
Source VES Carbon Bed Inlet
Project No. 2021-1361O
Parameter HFPO-DA

Date	Nozzle ID	Nozzle Diameter (in.) #1	#2	#3	Dn (Average)	Difference	Criteria	Material
5/19/21	G-3	0.235	0.235	0.235	0.235	0.000	≤ 0.004 in.	glass

Date	Pitot ID	Evidence of damage?	Evidence of mis-alignment?	Calibration or Repair required?
5/19/21	P4-2	no	no	no

Date	Meter Box ID	Positive Pressure Leak Check
5/19/21	3	Pass

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
2) Record barometric pressure before and after calibration procedure.
3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
4) Record data and information in the **GREEN** cells, YELLOW cells are calculated.

					INITIAL	FINAL	AVG (P_{bar})
DATE:	2/10/2021	METER SERIAL #:	MB3	BAROMETRIC PRESSURE (in Hg):	30.38	30.38	30.38
METER PART #:		CRITICAL ORIFICE SET SERIAL #:	1393				

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) q	DGM DH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y % Diff to Average Y	Y % Diff with other orifices	$DH_@$
11	1	0.306	24	889.290	895.162	5.872	57	60	61	60	60	60.25	15.00	0.44	6.0587	6.1346	1.013			1.53
	2	0.306																		
	3	0.306																		
																AVG =	1.013	1.06	1.35	
16	1	0.4268	22.5	895.162	900.693	5.531	58	61	62	60	61	61	10.00	0.86	5.7045	5.6987	0.999			1.54
	2	0.4268																		
	3	0.4268																		
																AVG =	0.999	-0.29	-0.20	
18	1	0.4961	21.5	900.693	907.113	6.420	58	62	63	61	61	61.75	10.00	1.2	6.6172	6.6240	1.001			1.59
	2	0.4961																		
	3	0.4961																		
																AVG =	1.001	-0.09	0.47	
26	1	0.7131	19	907.113	916.371	9.258	58	63	65	61	62	62.75	10.00	2.6	9.5563	9.5215	0.996			1.67
	2	0.7131																		
	3	0.7131																		
																AVG =	0.996	-0.56	-0.43	
31	1	0.8358	17.5	916.371	927.180	10.809	58	65	67	62	63	64.25	10.00	3.6	11.1521	11.1598	1.001			1.68
	2	0.8358																		
	3	0.8358																		
																AVG =	1.001	-0.12	0.44	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 1.002

AVERAGE $DH_@$ = 1.60

(1) $$Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm}$$

= Net volume of gas sample passed through DGM, corrected to standard conditions
K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)
T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $$Vcr_{(std)} = K' * \frac{Pbar * \Theta}{\sqrt{Tamb}}$$

= Volume of gas sample passed through the critical orifice, corrected to standard conditions
T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)
K' = Average K' factor from Critical Orifice Calibration

(3) $$Y = \frac{Vcr_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

$$DH_@ = \left(\frac{0.75\ q}{V_{cr(std)}}\right)^2 DH \left(\frac{V_{m(std)}}{V_m}\right)$$

RAMBOLL

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
2) Record barometric pressure before and after calibration procedure.
3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
4) Record data and information in the **GREEN** cells, YELLOW cells are calculated.

					INITIAL	FINAL	AVG (P_{bar})
DATE:	1/11/2021	METER SERIAL #:	MB 5	BAROMETRIC PRESSURE (in Hg):	29.92	29.92	29.92
METER PART #:		CRITICAL ORIFICE SET SERIAL #:	1393				

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	FINAL	NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) q	DGM DH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y % Diff to Average Y	Y % Diff with other orifices	$DH_@$
11	1	0.306	23.5	606.287	614.284	7.997	64	65	66	67	66	66	20.00	0.51	8.0390	8.0016	0.995			1.80
	2	0.306																		
	3	0.306																		
																AVG =	0.995	0.43	0.82	
16	1	0.4268	22	614.297	619.908	5.611	65	66	67	66	66	66.25	10.00	1.05	5.6453	5.5749	0.988			1.91
	2	0.4268																		
	3	0.4268																		
																AVG =	0.988	-0.36	0.02	
18	1	0.4961	21	619.923	626.441	6.518	66	67	68	66	66	66.75	10.00	1.4	6.5572	6.4739	0.987			1.89
	2	0.4961																		
	3	0.4961																		
																AVG =	0.987	-0.38	-0.02	
26	1	0.7131	19	626.447	635.794	9.347	66	68	72	67	67	68.5	10.00	2.9	9.4065	9.3057	0.989			1.90
	2	0.7131																		
	3	0.7131																		
																AVG =	0.989	-0.18	0.20	
31	1	0.8358	17.5	635.813	646.695	10.882	67	71	74	68	69	70.5	10.00	4	10.9392	10.8965	0.996			1.90
	2	0.8358																		
	3	0.8358																		
																AVG =	0.996	0.50	0.89	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.991

AVERAGE $DH_@$ = 1.88

(1) $$Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm}$$

= Net volume of gas sample passed through DGM, corrected to standard conditions
K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)
T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $$Vcr_{(std)} = K' * \frac{Pbar * \Theta}{\sqrt{Tamb}}$$

= Volume of gas sample passed through the critical orifice, corrected to standard conditions
T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)
K' = Average K' factor from Critical Orifice Calibration

(3) $$Y = \frac{Vcr_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

$$DH_@ = \left(\frac{0.75\ q}{V_{cr(std)}}\right)^2 DH \left(\frac{V_{m(std)}}{V_m}\right)$$

RAMBOLL

Initial Oven Box Thermocouple Calibration

ID Number	Ice Bath			Ambient			Hot Water Bath			Technician	Date Performed
	Reference Temperature (^{o}R)	Thermocouple Temperature (^{o}R)	Deviation*	Reference Temperature (^{o}R)	Thermocouple Temperature (^{o}R)	Deviation*	Reference Temperature (^{o}R)	Thermocouple Temperature (^{o}R)	Deviation*		
OB-1	491.67	492.67	0.2%	524.67	523.67	-0.2%	671.67	673.67	0.3%	SMilo	02/22/21
OB-2	491.67	492	0.1%	530.67	531	0.1%	671.67	672	0.0%	SRW	03/02/21
OB-3	491.67	493	0.3%	530.67	530	-0.1%	671.67	671	-0.1%	SRW	03/02/21
OB-4	491.67	493.67	0.4%	524.67	524.67	0.0%	671.67	670.67	-0.1%	SMilo	02/22/21
OB-A	491.67	493	0.3%	530.67	529	-0.3%	671.67	673	0.2%	SRW	03/02/21
OB-B	491.67	492	0.1%	530.67	530	-0.1%	671.67	672	0.0%	SRW	03/02/21
OB-5	491.67	492	0.1%	530.67	530	-0.1%	671.67	670	-0.2%	SRW	03/02/21
OB-C	491.67	492	0.1%	530.67	529	-0.3%	671.67	674	0.3%	SRW	03/03/21
OB-6	491.67	493.67	0.4%	524.67	525	0.1%	671.67	669.67	-0.3%	SMilo	02/22/21
OB-7	491.67	494.67	0.6%	524.67	525	0.1%	671.67	669.67	-0.3%	SMilo	02/22/21
OB-E	491.67	492	0.1%	530.67	529	-0.3%	671.67	671.67	0.0%	SRW	03/03/21
OB-10	491.67	492	0.1%	530.67	531	0.1%	671.67	670	-0.2%	SRW	03/03/21
OB-11	491.67	495	0.7%	530.67	532	0.3%	671.67	672	0.0%	SRW	03/03/21
OB-12	491.67	493	0.3%	530.67	531	0.1%	671.67	671	-0.1%	SRW	03/03/21

Reference Thermocouple: Fluke S/N: 83450033 or S/N 90460057 traceable to the Untied States National Institute of Standards and Technology
*Acceptable Deviation: 1.5%

Initial Impinger Outlet Thermocouple Calibration

ID Number	Ice Bath			Ambient			Hot Water Bath			Technician	Date Performed
	Reference Temperature (°Rk)	Thermocouple Temperature (°Rk)	Deviation*	Reference Temperature (°Rk)	Thermocouple Temperature (°Rk)	Deviation*	Reference Temperature (°Rk)	Thermocouple Temperature (°Rk)	Deviation*		
IO-1	494.17	493.87	-0.1%	524.37	523.17	-0.2%	672.17	672.67	0.1%	SM	03/16/21
IO-2	493.67	493.87	0.0%	524.57	523.17	-0.3%	671.77	672.67	0.1%	SM	03/16/21
IO-3	493.57	493.87	0.1%	521.37	523.17	0.3%	671.77	672.67	0.1%	SM	03/16/21
IO-4	493.97	493.87	0.0%	524.37	523.17	-0.2%	671.17	672.67	0.2%	SM	03/16/21
IO-5	493.77	493.87	0.0%	524.07	523.17	-0.2%	672.37	672.67	0.0%	SM	03/16/21
IO-6	493.97	493.87	0.0%	522.97	523.17	0.0%	670.77	672.67	0.3%	SM	03/16/21
IO-7	493.17	493.87	0.1%	524.37	523.17	-0.2%	671.37	672.67	0.2%	SM	03/16/21
IO-8	494.37	493.87	-0.1%	523.67	523.17	-0.1%	670.37	672.67	0.3%	SM	03/16/21
IO-9											
IO-10	493.77	493.87	0.0%	524.27	523.17	-0.2%	671.27	672.67	0.2%	SM	03/16/21
IO-11	494.37	493.87	-0.1%	524.37	523.17	-0.2%	672.27	672.67	0.1%	SM	03/16/21
IO-12	493.77	493.87	0.0%	522.17	523.17	0.2%	671.47	672.67	0.2%	SM	03/16/21
IO-13										SM	03/16/21
IO-14	493.87	493.87	0.0%	524.37	523.17	-0.2%	670.87	672.67	0.3%	SM	03/16/21
IO-15	494.17	493.87	-0.1%	524.37	523.17	-0.2%	671.47	672.67	0.2%	SM	03/16/21
IO-16	494.37	493.87	-0.1%	524.37	523.17	-0.2%	671.07	672.67	0.2%	SM	03/16/21
IO-17	493.37	493.87	0.1%	522.17			670.97				
IO-18	494.17	493.87	-0.1%	524.37	523.17	-0.2%	671.27	672.67	0.2%	SM	03/16/21
IO-19	493.97	493.87	0.0%	524.77	523.17	-0.3%	672.97	672.67	0.0%	SM	03/16/21

Reference Thermocouple: Fluke S/N: 83450033 or S/N 90460057 traceable to the Untied States National Institute of Standards and Technology
*Acceptable Deviation: 1.5%

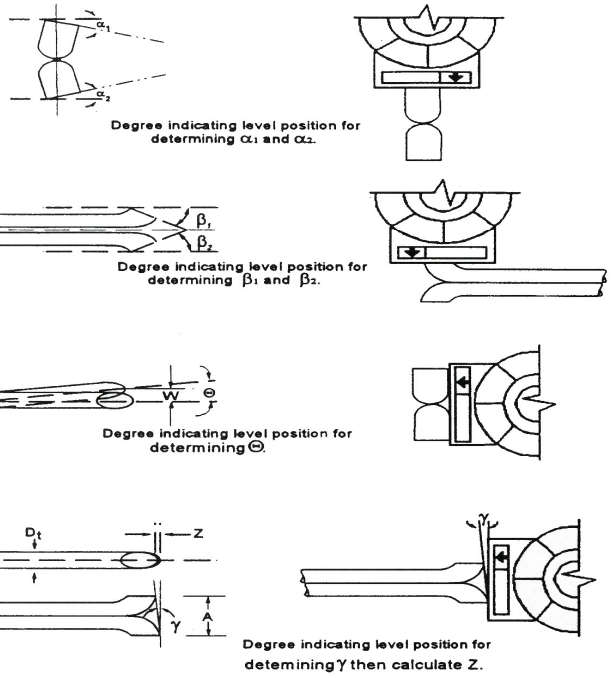
Initial Sample Probe Calibration Form

Probe ID: P4-1/TC-7C | Date: 01/28/21 | Technician: S. Waters

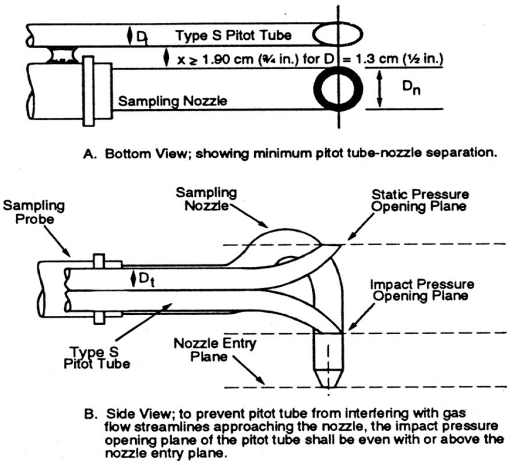
"S" Type Pitot Calibration

Is the Pitot Level and Perpindicular?	Yes
Is There any Obstruction?	No
Is the Pitot Damaged	No
α_1 ($-10^o = \alpha_1 = +10^o$)	1
α_2 ($-10^o = \alpha_2 = +10^o$)	0
β_1 ($-5^o = \beta_1 = +5^o$)	1
β_2 ($-5^o = \beta_2 = +5^o$)	1
γ	1
Θ	0
z = A Tan γ (< 0.125")	0.011
W = A Tan Θ (< 0.03125")	0.0000
D_t (3/16 = D_t = 3/8")	0.252
A	0.655
$A/2D_t$ (1.05 = P_A/D_t = 1.5)	1.300

Source: Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III, Stationary Source-Specific Methods. EPA/600/R-94/038c, September 30, 1994

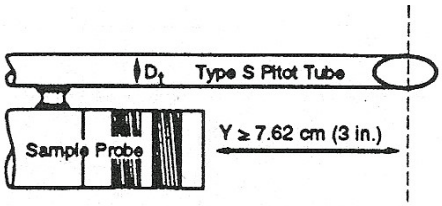


Verification of "S" Type Pitot, Thermocouple and Nozzle Placement



Does X Exceed 0.75 inches? Yes

Does Y Exceed 3 inches? NA



Thermocouple Calibration

	Ice Bath °R			Ambient °R			Boiling Water °R		
	1	2	3	1	2	3	1	2	3
Reference Temp	492	492	492	526	526	526	672	672	672
Thermocouple Temp	492	492	492	525	525	525	672	672	672
Difference (%)	0.0	0.0	0.0	-0.2	-0.2	-0.2	0.0	0.0	0.0

Temperature values must be within 1.5% of reference temperature

I certify that the probe ID P4-1/TC-7C meets or exceeds all specifications, criteria and/or applicable design features and is herby assigned a pitot tube calibration factor C_p of 0.84.

Certified By: S. Waters Date: 01/28/21

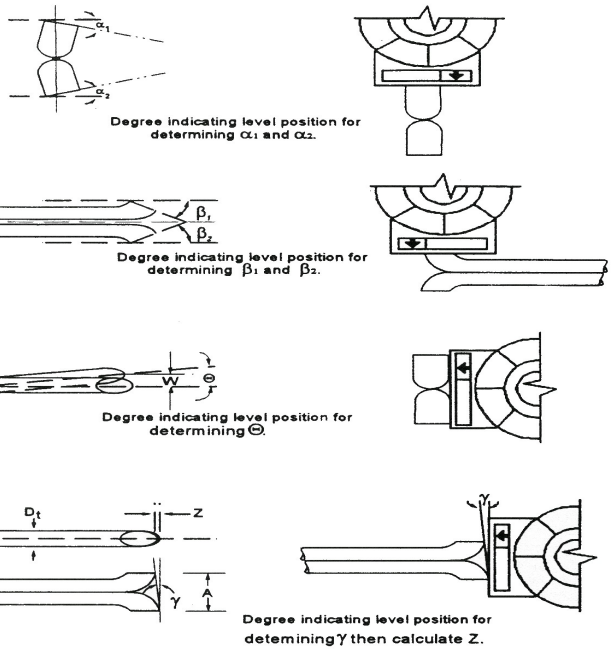
Initial Sample Probe Calibration Form

Probe ID: P4-2/TC-5D | Date: 01/28/21 | Technician: SRW

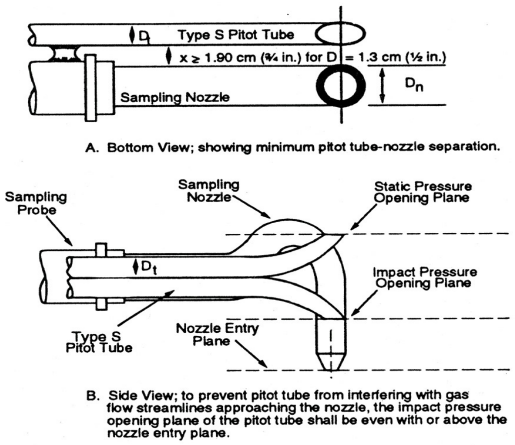
"S" Type Pitot Calibration

Is the Pitot Level and Perpindicular?	Yes
Is There any Obstruction?	No
Is the Pitot Damaged	No
α_1 ($-10^o = \alpha_1 = +10^o$)	2
α_2 ($-10^o = \alpha_2 = +10^o$)	1
β_1 ($-5^o = \beta_1 = +5^o$)	1
β_2 ($-5^o = \beta_2 = +5^o$)	1
γ	1
Θ	0
z = A Tan γ (< 0.125")	0.011
W = A Tan Θ (< 0.03125")	0.0000
D_t ($3/16 = D_t = 3/8$")	0.251
A	0.650
$A/2D_t$ ($1.05 = P_A/D_t = 1.5$)	1.295

Source: Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III, Stationary Source-Specific Methods. EPA/600/R-94/038c, September 30, 1994

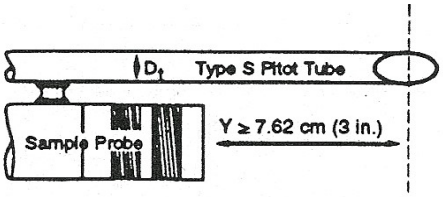


Verification of "S" Type Pitot, Thermocouple and Nozzle Placement



Does X Exceed 0.75 inches? Yes

Does Y Exceed 3 inches? NA



Thermocouple Calibration

	Ice Bath ^oR			Ambient ^oR			Boiling Water ^oR		
	1	2	3	1	2	3	1	2	3
Reference Temp	493	493	493	525	525	525	672	672	672
Thermocouple Temp	491	491	491	524	524	524	671	671	671
Difference (%)	-0.4	-0.4	-0.4	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1

Temperature values must be within 1.5% of reference temperature

I certify that the probe ID P4-2/TC-5D meets or exceeds all specifications, criteria and/or applicable design features and is herby assigned a pitot tube calibration factor C_P of 0.84.

Certified By: SRW Date: 01/28/21

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POST TEST DRY GAS METER CALIBRATION

					INITIAL	FINAL	AVG (P_{bar})
DATE:	05/26/21	METER BOX #:	3	BAROMETRIC PRESSURE (in Hg):	29.75	29.75	29.75
TECHNICIAN:	S. Milo	CRITICAL ORIFICE SET SERIAL #:	1393				

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) q	DGM DH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y % Diff to Average Y	$DH_@$
	1																		
	2																		
	3																		
																AVG =			
18	1	0.4961	22	810.245	816.694	6.449	71	73	73	73	73	73	10.00	1.2	6.3722	6.4067	1.005	-0.06	1.62
	2	0.4961	22	816.694	823.127	6.433	72	73	73	73	73	73	10.00	1.2	6.3564	6.4007	1.007	0.10	1.63
	3	0.4961	22	823.127	829.575	6.448	72	73	74	73	74	73.5	10.00	1.2	6.3652	6.4007	1.006	-0.04	1.63
																AVG =	1.006		
	1																		
	2																		
	3																		
																AVG =			

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 1.006

PRE-DETERMINED DRY GAS METER CALIBRATION FACTOR, Y = 1.002

PERCENT DIFFERENCE = 0.4

POST TEST DRY GAS METER CALIBRATION

DATE:	05/26/21	METER BOX #:	5	BAROMETRIC PRESSURE (in Hg):	INITIAL 29.88	FINAL 29.88	AVG (P_{bar}) 29.88
TECHNICIAN:	S. Milo	CRITICAL ORIFICE SET SERIAL #:	1393				

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) q	DGM DH ($in H_2O$)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y % Diff to Average Y	$DH_@$
	1																		
	2																		
	3																		
																AVG =			
18	1	0.4961	21.5	82.544	89.090	6.546	75	73	75	72	73	73.25	10.00	1.4	6.4964	6.4106	0.987	0.12	1.90
	2	0.4961	21.5	89.090	95.669	6.579	77	75	77	73	75	75	10.00	1.4	6.5077	6.3986	0.983	-0.24	1.90
	3	0.4961	21.5	95.669	104.206	8.537	78	76	79	75	76	76.5	13.00	1.4	8.4209	8.3105	0.987	0.13	1.90
																AVG =	0.986		
	1																		
	2																		
	3																		
																AVG =			

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.986

PRE-DETERMINED DRY GAS METER CALIBRATION FACTOR, Y = 0.991

PERCENT DIFFERENCE = -0.5

Post-Test Sample Probe Calibration Form

Probe ID P4-1

Visual Inspection

Do pitot tips appear to be damaged?	NO
Do thermocouple wires appear broken or shorted?	NO
Do all components appear to be in good condition?	YES

Post-Test Thermocouple Calibration

Reference Temperature ^{O}F	Thermocouple Temperature ^{O}I	Difference ^{O}F
65.7	67	1.3

Reference Thermocouple: Fluke S/N: 83450033 traceable to the Untied States National Institute of Standards and Technology

Accepatable Deviation +/- 2 ^{O}F

X Acceptable

_____ Unacceptable

Date 05/26/21 Technician S. Milo

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Post-Test Sample Probe Calibration Form

Probe ID P4-2

Visual Inspection

Do pitot tips appear to be damaged?	NO
Do thermocouple wires appear broken or shorted?	NO
Do all components appear to be in good condition?	YES

Post-Test Thermocouple Calibration

Reference Temperature ^{O}F	Thermocouple Temperature ^{O}F	Difference ^{O}F
65.7	66.5	0.8

Reference Thermocouple: Fluke S/N: 83450033 traceable to the Untied States National Institute of Standards and Technology

Accepatable Deviation +/- 2 ^{O}F

X Acceptable

_____ Unacceptable

Date 05/26/21 Technician S. Milo

Appendix D

Viny Ethers South Operations Data

Date	05/19/21								
Time	800	900	1000	1100	1200	1300	1400	1500	1600
Stack Testing			Run 1: 9:23-11:27		Run 2: 11:55-13:48			Run 3: 14:15-16:08	
VES Product					PM/PE				
VES Precursor	48 kg/hr		48 kg/hr			48 kg/hr		48 kg/hr	48 kg/hr
VES Condensation (HFPO)	88 kg/hr		88 kg/hr			88 kg/hr		88 kg/hr	88 kg/hr
VES ABR (East)	135 kg/hr	Burnout							
VES ABR (West)		100 kg/hr	130 kg/hr 135 kg/hr 125 kg/hr			135 kg/hr			
VES Refining					68 kg/hr				

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