IXM MANUFACTURING PROCESSES
POLYMERS STACK EMISSIONS TEST REPORT
TEST DATES: 17-18 JANUARY 2019

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1. INTRODUCTION

1.1 FACILITY AND BACKGROUND INFORMATION

The Chemours Fayetteville Works (Chemours) is located in Bladen County, North Carolina, approximately 10 miles south of the city of Fayetteville. The Chemours operating areas on the site include the Fluoromonomers, IXM and Polymers Processing Aid (PPA) manufacturing areas, Wastewater Treatment, and Powerhouse.

Chemours contracted Weston Solutions, Inc. (Weston) to perform HFPO Dimer Acid Fluoride, captured as HFPO Dimer Acid emission testing on the Polymers Stack. Testing was performed on 17-18 January 2019 and generally followed the "Emission Test Protocol" reviewed and approved by the North Carolina Department of Environmental Quality (NCDEQ). This report provides the results from the emission test program.

1.2 TEST OBJECTIVES

The specific objectives for this test program were as follows:

- Measure the emissions concentrations and mass emissions rates of HFPO Dimer Acid Fluoride from the Polymers stack which is located in the IXM processes.
- Monitor and record process data in conjunction with the test program.
- Provide representative emissions data.

1.3 TEST PROGRAM OVERVIEW

During the emissions test program, the concentrations and mass emissions rates of HFPO Dimer Acid Fluoride were measured on the Polymers stack.

Table 1-1 provides a summary of the test location and the parameters that were measured along with the sampling/analytical procedures that were followed.

Section 2 provides a summary of test results. A description of the processes is provided in Section 3. Section 4 provides a description of the test locations. The sampling and analytical procedures are provided in Section 5. Detailed test results and discussion are provided in Section 6.

Appendix C includes the summary reports for the laboratory analytical results. The full laboratory data packages are provided in electronic format and on CD with each hard copy.

Table 1-1
Sampling Plan for Polymers Stack

Sampling Point & Location	**Polymers Stack**				
Number of Tests:	3				
Parameters To Be Tested:	HFPO Dimer Acid Fluoride (HFPO-DAF)	Volumetric Flow Rate and Gas Velocity	Carbon Dioxide	Oxygen	Water Content
Sampling or Monitoring Method	EPA M-0010	EPA M1, M2, M3A, and M4 in conjunction with M-0010 tests	EPA M3A		EPA M4 in conjunction with M-0010 tests
Sample Extraction/ Analysis Method(s):	LC/MS/MS	NA[6]	NA		NA
Sample Size	$> 1m^3$	NA	NA	NA	NA
Total Number of Samples Collected[1]	3	3	3	3	3
Reagent Blanks (Solvents, Resins)[1]	1 set	0	0	0	0
Field Blank Trains[1]	1 per source	0	0	0	0
Proof Blanks[1]	1 per train	0	0	0	0
Trip Blanks[1,2]	1 set	0	0	0	
Lab Blanks	1 per fraction[3]	0	0	0	0
Laboratory or Batch Control Spike Samples (LCS)	1 per fraction[3]	0	0	0	0
Laboratory or Batch Control Spike Sample Duplicate (LCSD)	1 per fraction[3]	0	0	0	0
Media Blanks	1 set[4]	0	0	0	0
Isotope Dilution Internal Standard Spikes	Each sample	0	0	0	0
Total No. of Samples	7[5]	3	3	3	3

Key:

[1] Sample collected in field.

[2] Trip blanks include one XAD-2 resin module and one methanol sample per sample shipment.

[3] Lab blank and LCS/LCSD includes one set per analytical fraction (front half, back half and condensate).

[4] One set of media blank archived at laboratory at media preparation.

[5] Actual number of samples collected in field.

[6] Not applicable.

2. SUMMARY OF TEST RESULTS

A total of three test runs were performed on the Polymers Stack. Table 2-1 provides a summary of the HFPO Dimer Acid emission test results. Detailed test results summaries are provided in Section 6.

It is important to note that emphasis is being placed on the characterization of the emissions based on the stack test results. Research conducted in developing the protocol for stack testing HFPO Dimer Acid Fluoride, HFPO Dimer Acid Ammonium Salt and HFPO Dimer Acid realized that the resulting testing, including collection of the air samples and extraction of the various fraction of the sampling train, would result in all three compounds being expressed as simply the HFPO Dimer Acid. However, it should be understood that the total HFPO Dimer Acid results provided on Table 2-1 and in this report include a percentage of each of the three compounds.

Table 2-1
Summary of HFPO Dimer Acid Test Results

Source	Run No.	Emission Rates	
		lb/hr	g/sec
Polymers Stack	1	1.81E-04	2.28E-05
	2	1.51E-04	1.90E-05
	3	1.55E-04	1.95E-05
	Average[2]	1.62E-04	2.04E-05

3. PROCESS DESCRIPTIONS

The IXM area is included in the scope of this test program.

3.1 POLYMERS

The Polymers area consists of a polymerization process, finishing and recycle. There are two types of polymer produced, using products made in the Fluoromonomers and IXM Precursors areas: SR polymer and CR polymer. Both SR and CR polymerization processes take place in a solvent. The reaction is initiated and sustained by continuous addition of Dimer Peroxide initiator. There is a Recycle Still that takes solution and removes any impurities, allowing the solution to be used again. The finishing area takes the polymer produced during polymerization and transforms it into pellets.

3.2 PROCESS OPERATIONS AND PARAMETERS

Source	Operation/Product	Batch or Continuous
Polymers Stack	SR Polymer	Continuous – Polymerization Batch – Recycle Still Batch – Line Four extrusion

During the test program, operations parameters were monitored by Chemours and are included in Appendix A.

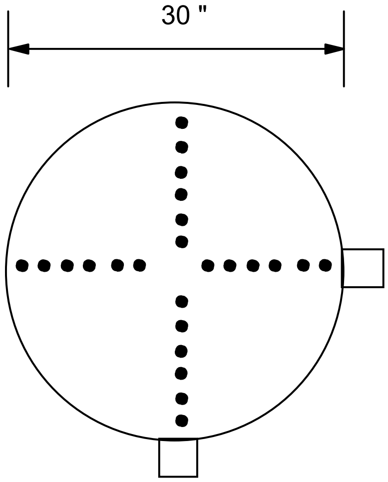
4. DESCRIPTION OF TEST LOCATIONS

4.1 POLYMERS STACK

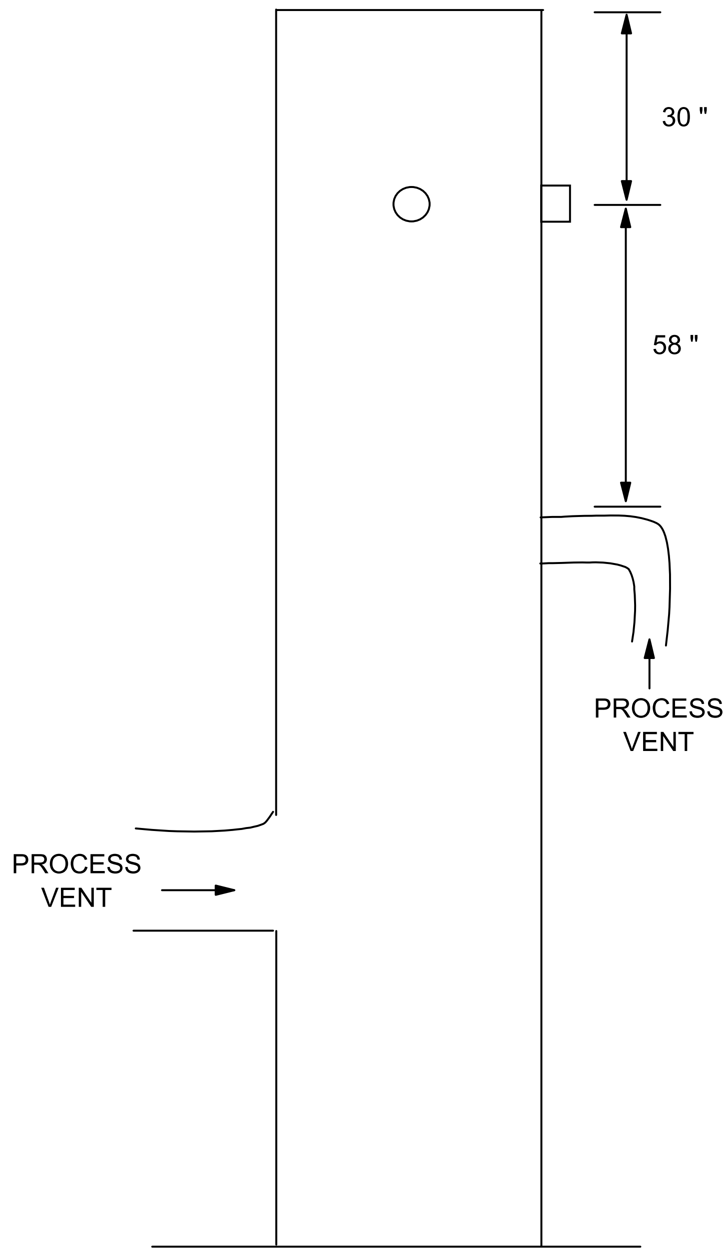
The Polymers stack is a 30-inch ID fiberglass stack located near the roof edge. Vent lines enter the stack at various points and a significant straight run of vertical stack without flow disturbances is not available. Two sample ports are installed in the stack 30 inches down from the stack exit and 58 inches up from the last vent line entry point. Per EPA Method 1, 24 traverse points, 12 per port, were used for sampling.

See Figure 4-1 for a schematic of the test port and traverse point locations.

Note: All measurements at the test location were confirmed prior to sampling.



TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE NEAR WALL (INCHES)
1	1
2	2
3	3 1/2
4	5 1/4
5	7 1/2
6	10 5/8
7	19 3/8
8	22 1/2
9	24 3/4
10	26 1/2
11	28
12	29



DRAWING NOT TO SCALE

FIGURE 4-1
POLYMERS STACK TEST PORT
AND TRAVERSE POINT LOCATIONS

5. SAMPLING AND ANALYTICAL METHODS

5.1 STACK GAS SAMPLING PROCEDURES

The purpose of this section is to describe the stack gas emissions sampling trains and to provide details of the stack sampling and analytical procedures utilized during the emissions test program.

5.1.1 Pre-Test Determinations

Preliminary test data were obtained at the test location. Stack geometry measurements were measured and recorded, and traverse point distances verified. A preliminary velocity traverse was performed utilizing a calibrated S-type pitot tube and an inclined manometer to determine velocity profiles. Flue gas temperatures were observed with a calibrated direct readout panel meter equipped with a chromel-alumel thermocouple. Preliminary water vapor content was estimated by wet bulb/dry bulb temperature measurements.

A check for the presence or absence of cyclonic flow was previously conducted at the test location. The cyclonic flow checks were negative (< 20°) verifying that the source was acceptable for testing.

Preliminary test data was used for nozzle sizing and sampling rate determinations for isokinetic sampling procedures.

Calibration of probe nozzles, pitot tubes, metering systems, and temperature measurement devices was performed as specified in Section 5 of EPA Method 5 test procedures.

5.2 STACK PARAMETERS

5.2.1 EPA Method 0010

The sampling train utilized to perform the HFPO Dimer Acid sampling was an EPA Method 0010 train (see Figure 5-1). The Method 0010 consisted of a borosilicate nozzle that attached directly to a heated borosilicate probe. In order to minimize possible thermal degradation of the HFPO Dimer Acid, the probe and particulate filter were heated above stack temperature to minimize water vapor condensation before the filter. The probe was connected directly to a heated borosilicate filter holder containing a solvent extracted glass fiber filter.

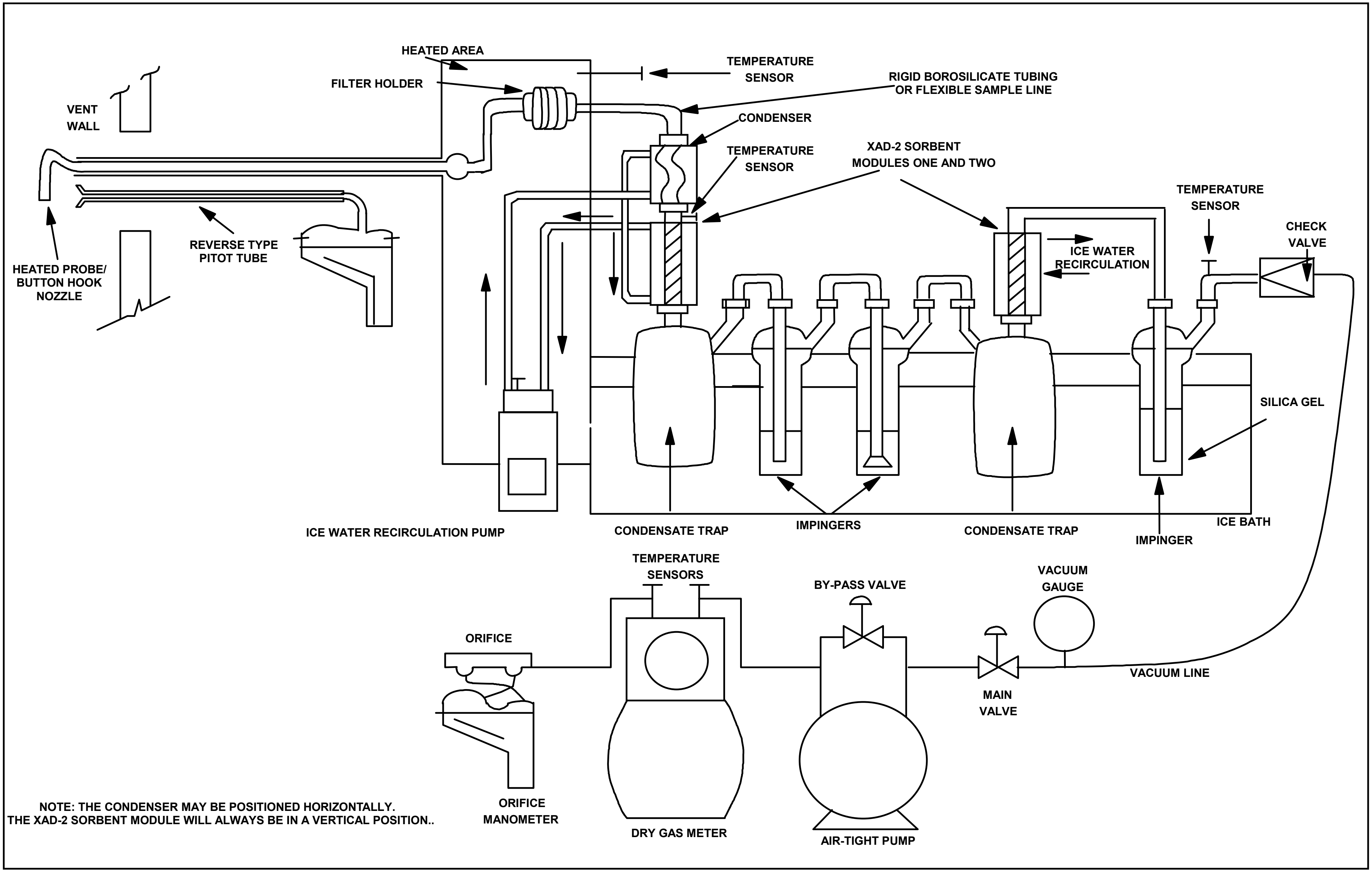


FIGURE 5-1
EPA METHOD 0010 SAMPLING TRAIN

A section of borosilicate glass or flexible polyethylene tubing connected the filter holder exit to a Grahm (spiral) type ice water-cooled condenser, an ice water-jacketed sorbent module containing approximately 40 grams of XAD-2 resin. The XAD-2 resin tube was equipped with an inlet temperature sensor. The XAD-2 resin trap was followed by a condensate knockout impinger and a series of two impingers that contained 100 milliliters of high purity distilled water. The train also included a second XAD-2 resin trap behind the impinger section to evaluate possible sampling train breakthrough. Each XAD-2 resin trap was connected to a 1-liter condensate knockout trap. The final impinger contained 300 grams of dry pre-weighed silica gel. All impingers and the condensate traps were maintained in an ice bath. Ice water was continuously circulated in the condenser and both XAD-2 modules to maintain method-required temperature. A control console with a leakless vacuum pump, a calibrated orifice, and dual inclined manometers was connected to the final impinger via an umbilical cord to complete the sample train.

HFPO Dimer Acid Fluoride (CAS No. 2062-98-8) that is present in the stack gas is expected to be captured in the sampling train along with HFPO Dimer Acid (CAS No. 13252-13-6). HFPO Dimer Acid Fluoride undergoes hydrolysis instantaneously in water in the sampling train and during the sample recovery step and will be converted to HFPO Dimer Acid such that the amount of HFPO Dimer Acid emissions represents a combination of both HFPO Dimer Acid Fluoride and HFPO Dimer Acid.

During sampling, gas stream velocities were measured by attaching a calibrated S-type pitot tube into the gas stream adjacent to the sampling nozzle. The velocity pressure differential was observed immediately after positioning the nozzle at each traverse point, and the sampling rate adjusted to maintain isokineticity ± 10. Flue gas temperature was monitored at each point with a calibrated panel meter and thermocouple. Isokinetic test data was recorded at each traverse point during all test periods, as appropriate. Leak checks were performed on the sampling apparatus according to reference method instructions, prior to and following each run, component change (if required), or during midpoint port changes.

5.2.2 EPA Method 0010 Sample Recovery

At the conclusion of each test, the sampling train was dismantled, the openings sealed, and the components transported to the field laboratory trailer for recovery.

A consistent procedure was employed for sample recovery:

1. The two XAD-2 covered (to minimize light degradation) sorbent modules (1 and 2) were sealed and labeled.

2. The glass fiber filter(s) were removed from the holder with tweezers and placed in a polyethylene container along with any loose particulate and filter fragments.

3. The particulate adhering to the internal surfaces of the nozzle, probe and front half of the filter holder were rinsed with a solution of methanol and ammonium hydroxide into a polyethylene container while brushing a minimum of three times until no visible particulate remained. Particulate adhering to the brush was rinsed with methanol/ ammonium hydroxide into the same container. The container was sealed.

4. The volume of liquid collected in the first condensate trap was measured, the value recorded, and the contents poured into a polyethylene container.

5. All train components between the filter exit and the first condensate trap were rinsed with methanol/ammonium hydroxide. The solvent rinse was placed in a separate polyethylene container and sealed.

6. The volume of liquid in the impingers one, two, and second condensate trap were measured, the values recorded, and sample was placed in the same container as step 4 above and sealed.

7. The two impingers, condensate trap, and connectors were rinsed with methanol/ ammonium hydroxide. The solvent sample was placed in a separate polyethylene container and sealed.

8. The silica gel in the final impinger was weighed and the weight gain value recorded.

9. Site (reagent) blank samples of the methanol/ammonium hydroxide, XAD resin, filter and distilled water were retained for analysis.

Each container was labeled to clearly identify its contents. The height of the fluid level was marked on the container of each liquid sample to provide a reference point for a leakage check during transport. All samples were maintained cool.

During each test campaign, an M-0010 blank train was setup near the test location, leak checked and recovered along with the respective sample train. Following sample recovery, all samples were transported to the TestAmerica Inc. for sample extraction and analysis.

See Figure 5-2 for a schematic of the M-0010 sample recovery process.

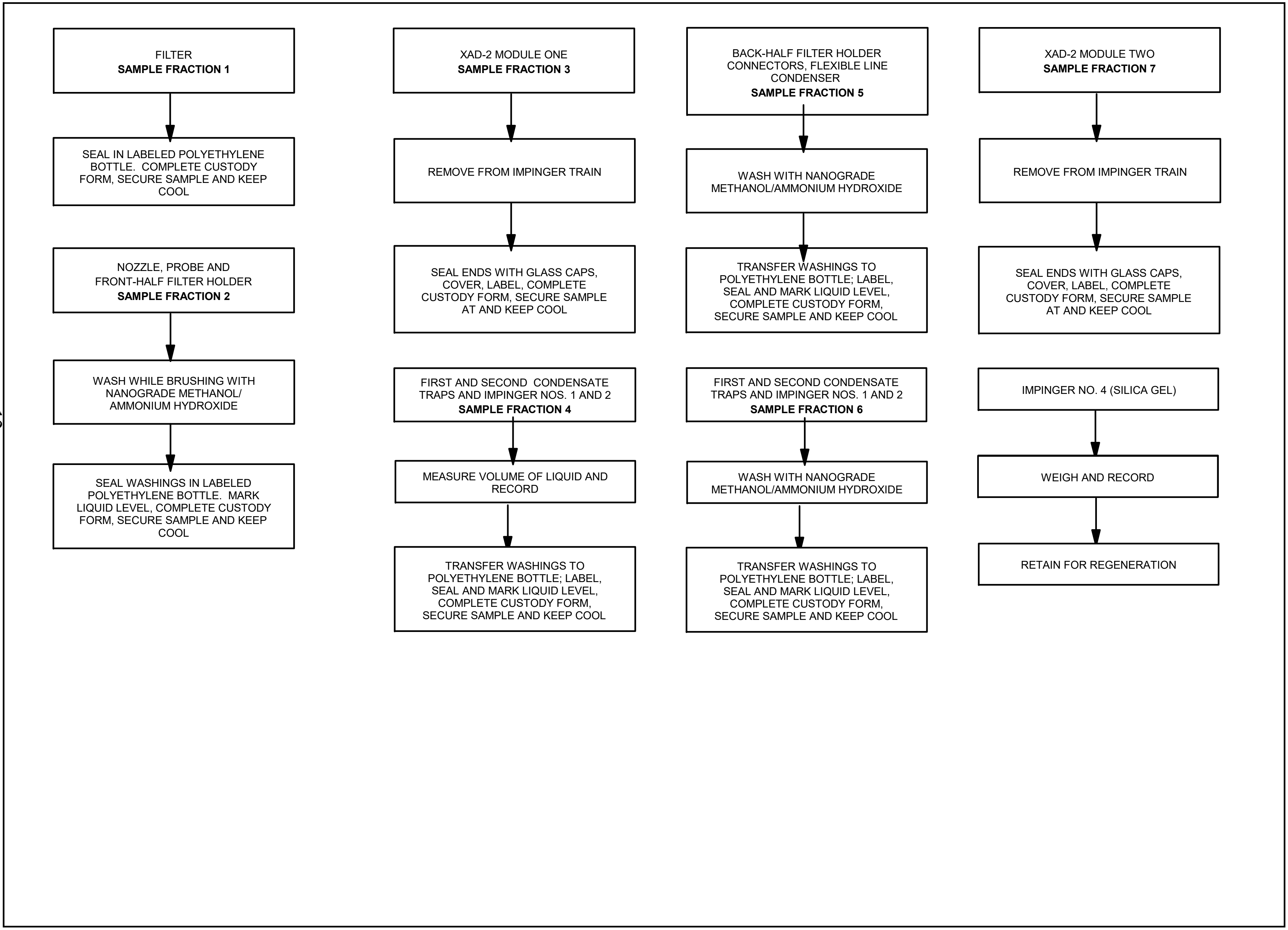


FIGURE 5-2
HFPO DIMER ACID SAMPLE RECOVERY PROCEDURES FOR METHOD 0010

IASDATA\CHEMOURS\15418.002.009\FIGURE 5-2 EPA 0010

5.2.3 EPA Method 0010 – Sample Analysis

Method 0010 sampling trains resulted in four separate analytical fractions for HFPO Dimer Acid analysis according to SW-846 Method 3542:

- Front-Half Composite—comprised of the Particulate Filter, and the probe, nozzle, and front-half of the filter holder solvent rinses,
- Back-Half Composite—comprised of the first XAD-2 resin material and the back-half of the filter holder with connecting glassware solvent rinses,
- Condensate Composite—comprised of the aqueous condensates and the contents of impingers one and two with solvent rinses,
- Breakthrough XAD-2 Resin Tube—comprised of the resin tube behind the series of impingers.

The second XAD-2 resin material was analyzed separately to evaluate any possible sampling train HFPO-DA breakthrough.

The front-half and back-half composites and the second XAD-2 resin material were placed in polypropylene wide-mouth bottles and tumbled with methanol containing 5% NH_4OH for 18 hours. Portions of the extracts were processed analytically for the HFPO dimer acid by liquid chromatography and duel mass spectroscopy (HPLC/MS/MS). The Condensate composite was concentrated onto a solid phase extraction (SPE) cartridge followed by desorption from the cartridge using methanol. Portions of those extracts were also processed analytically by HPLC/MS/MS.

Samples were spiked with isotope dilution internal standard (IDA) at the commencement of their preparation to provide accurate assessments of the analytical recoveries. Final data was corrected for IDA standard recoveries.

TestAmerica Laboratories, Inc. (TestAmerica) developed detailed procedures for the sample extraction and analysis for HFPO Dimer Acid. These procedures were incorporated into the test protocol.

5.3 GAS COMPOSITION

The Weston mobile laboratory equipped with instrumental analyzers was used to measure carbon dioxide (CO_2) and oxygen (O_2) concentrations. A diagram of the Weston sampling system is presented in Figure 5-3.

The sample was collected at the exhaust of the Method 0010 sampling system. At the end of the line, a tee permitted the introduction of calibration gas. The sample was drawn through a heated Teflon® sample line to the sample conditioner. The output from the sampling system was recorded electronically, and one-minute averages were recorded and displayed on a data logger.

Each analyzer was set up and calibrated internally by introduction of calibration gas standards directly to the analyzer from a calibration manifold. The calibration manifold is designed with an atmospheric vent to release excess calibration gas and maintains the calibration at ambient pressure. The direct calibration sequence consisted of alternate injections of zero and mid-range gases with appropriate adjustments until the desired responses were obtained. The high-range standards were then introduced in sequence without further adjustment.

The sample line integrity was verified by performing a bias test before and after each test period. The sampling system bias test consisted of introducing the zero gas and one up-range calibration standard in excess to the valve at the probe end when the system was sampling normally. The excess calibration gas flowed out through the probe to maintain ambient sampling system pressure. Calibration gas supply was regulated to maintain constant sampling rate and pressure. Instrument bias check response was compared to internal calibration responses to ensure sample line integrity and to calculate a bias correction factor after each run using the ratio of the measured concentration of the bias gas certified by the calibration gas supplier.

The oxygen and carbon dioxide content of each stack gas was measured according to EPA Method 3A procedures which incorporate the latest updates of EPA Method 7E. A Servomex Model 4900 analyzer (or equivalent) was used to measure oxygen content. A Servomex Model 4900 analyzer (or equivalent) was used to measure carbon dioxide content of the stack gas. Both analyzers were calibrated with EPA Protocol gases prior to the start of the test program and performance was verified by sample bias checks before and after each test run.

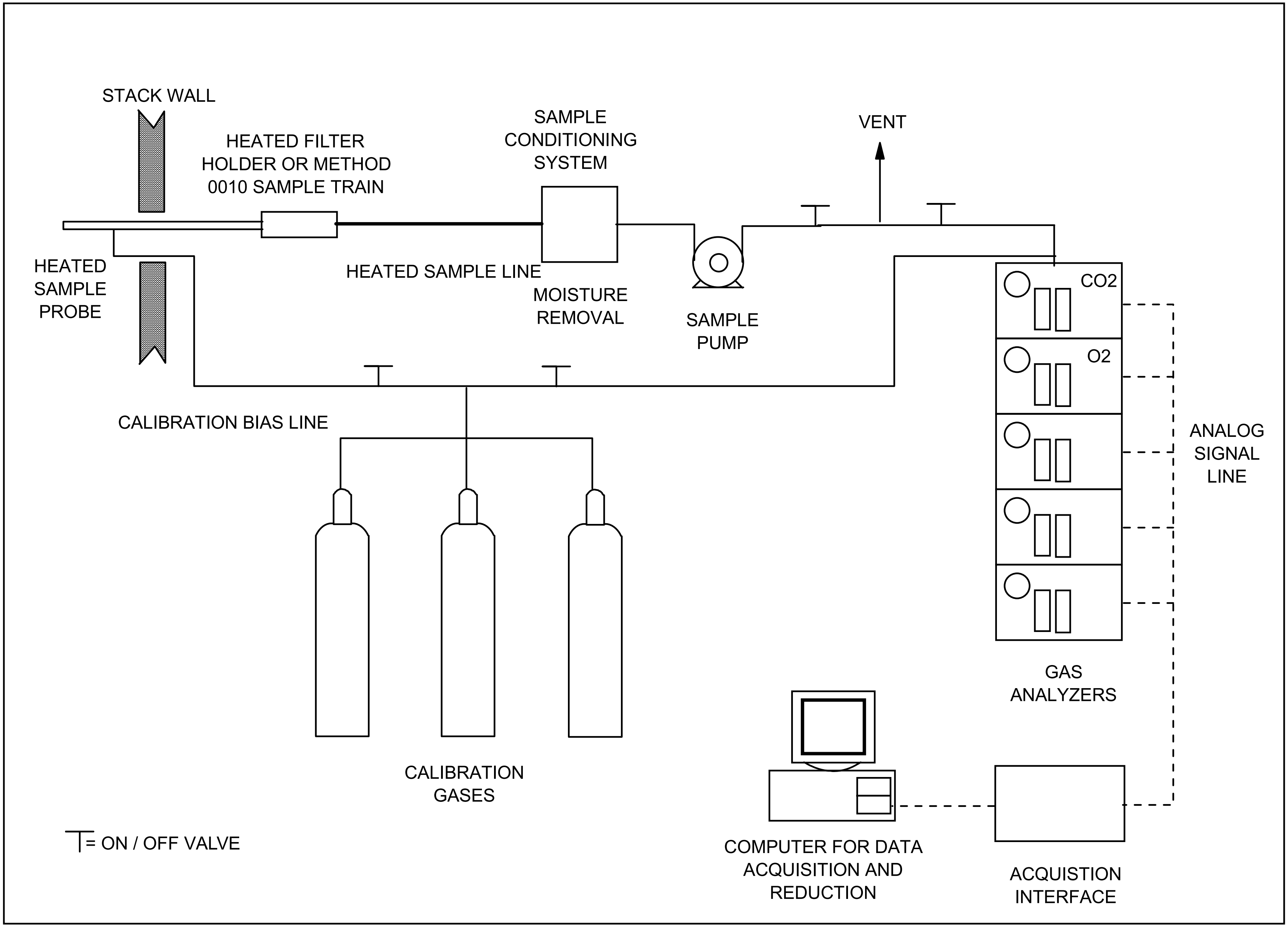


FIGURE 5-3
WESTON SAMPLING SYSTEM

IASDATA\CHEMOURS\15418.002.009\FIGURE 5-3 WESTON SAMPLING SYSTEM2

6. DETAILED TEST RESULTS AND DISCUSSION

Preliminary testing and the associated analytical results required significant sample dilution to bring the HFPO Dimer Acid concentration within instrument calibration; therefore, sample times and sample volumes were reduced for the formal test program. This was approved by the North Carolina Department of Environmental Quality (NCDEQ).

Each test was a minimum of 96 minutes in duration. A total of three test runs were performed on the Polymers Stack.

Table 6-1 provides detailed test data and test results for the Polymers Stack.

The Method 3A sampling indicated that the O_2 and CO_2 concentrations were at ambient air levels (20.9% O_2, 0% CO_2), therefore, 20.9% O_2 and 0% CO_2 values were used in all calculations.

TABLE 6-1
CHEMOURS - FAYETTEVILLE, NC
SUMMARY OF HFPO DIMER ACID TEST DATA AND TEST RESULTS

Test Data			
Run number	1	2	3
Location	Polymers Stack	Polymers Stack	Polymers Stack
Date	1/17/2019	1/18/2019	1/18/2019
Time period	1443-1641	0835-1028	1111-1315
SAMPLING DATA:			
Sampling duration, min.	96.0	96.0	96.0
Nozzle diameter, in.	0.218	0.218	0.218
Cross sectional nozzle area, sq.ft.	0.000259	0.000259	0.000259
Barometric pressure, in. Hg	30.10	30.01	30.01
Avg. orifice press. diff., in H_2O	1.31	1.43	1.50
Avg. dry gas meter temp., deg F	64.7	49.4	61.7
Avg. abs. dry gas meter temp., deg. R	525	509	522
Total liquid collected by train, ml	25.6	9.0	11.2
Std. vol. of H_2O vapor coll., cu.ft.	1.2	0.4	0.5
Dry gas meter calibration factor	1.0069	1.0069	1.0069
Sample vol. at meter cond., dcf	57.360	58.671	60.644
Sample vol. at std. cond., dscf (1)	58.636	61.606	62.193
Percent of isokinetic sampling	97.2	95.4	94.9
GAS STREAM COMPOSITION DATA:			
CO_2, % by volume, dry basis	0.0	0.0	0.0
O_2, % by volume, dry basis	20.9	20.9	20.9
N_2, % by volume, dry basis	79.1	79.1	79.1
Molecular wt. of dry gas, lb/lb mole	28.84	28.84	28.84
H_20 vapor in gas stream, prop. by vol.	0.020	0.007	0.008
Mole fraction of dry gas	0.980	0.993	0.992
Molecular wt. of wet gas, lb/lb mole	28.62	28.76	28.74
GAS STREAM VELOCITY AND VOLUMETRIC FLOW DATA:			
Static pressure, in. H_2O	-0.24	-0.24	-0.24
Absolute pressure, in. Hg	30.08	29.99	29.99
Avg. temperature, deg. F	62	56	62
Avg. absolute temperature, deg.R	522	516	522
Pitot tube coefficient	0.84	0.84	0.84
Total number of traverse points	24	24	24
Avg. gas stream velocity, ft./sec.	40.6	42.5	43.7
Stack/duct cross sectional area, sq.ft.	4.91	4.91	4.91
Avg. gas stream volumetric flow, wacf/min.	11957	12517	12872
Avg. gas stream volumetric flow, dscf/min. (1)	11910	12743	12928

(1) Standard conditions = 68 deg. F. (20 deg. C.) and 29.92 in Hg (760 mm Hg)

TABLE 6-1(cont.)
CHEMOURS - FAYETTEVILLE, NC
SUMMARY OF HFPO DIMER ACID TEST DATA AND TEST RESULTS

TEST DATA			
Run number	1	2	3
Location	Polymers Stack	Polymers Stack	Polymers Stack
Date	1/17/2019	1/18/2019	1/18/2019
Time period	1443-1641	0835-1028	1111-1315
LABORATORY REPORT DATA, ug.			
HFPO Dimer Acid	6.75	5.51	5.63
EMISSION RESULTS, ug/dscm.			
HFPO Dimer Acid	4.06	3.15	3.20
EMISSION RESULTS, lb/dscf.			
HFPO Dimer Acid	2.54E-10	1.97E-10	2.00E-10
EMISSION RESULTS, lb/hr.			
HFPO Dimer Acid	1.81E-04	1.51E-04	1.55E-04
EMISSION RESULTS, g/sec.			
HFPO Dimer Acid	2.28E-05	1.90E-05	1.95E-05

APPENDIX A
PROCESS OPERATIONS DATA

Date 1/17/2019

Time	1400				1500				1600			
Stack Testing				RUN 1 - 1443-1641								
Recycle Still	Starting up to distill SR Solution											
Polymerization	Standard SR Polymer Production											
Line 4 Extrusion												
Line 3 Extrusion											Extruding CR 1050	

Date 1/18/2019

Time	800				900				1000				1100				1200				1300			
Stack Testing			RUN 2 - 0835-1028											RUN 3 - 1111-1315										
Recycle Still	Distilling SR Solution, taking off to waste																							
Polymerization	Standard SR Polymer Production																							
Line 4 Extrusion																								
Line 3 Extrusion																								

APPENDIX B
RAW AND REDUCED TEST DATA

CHEMOURS - FAYETTEVILLE, NC
INPUTS FOR HFPO DIMER ACID CALCULATIONS

Test Data			
Run number	1	2	3
Location	Polymers Stack	Polymers Stack	Polymers Stack
Date	1/17/2019	1/18/2019	1/18/2019
Time period	1443-1641	0835-1028	1111-1315
Operator	MW	MW	MW
Inputs For Calcs.			
Sq. rt. delta P	0.72582	0.76494	0.78166
Delta H	1.3125	1.4321	1.5013
Stack temp. (deg.F)	62.0	56.1	62.3
Meter temp. (deg.F)	64.7	49.4	61.7
Sample volume (act.)	57.360	58.671	60.644
Barometric press. (in.Hg)	30.10	30.01	30.01
Volume H_2O imp. (ml)	6.0	-4.0	-3.0
Weight change sil. gel (g)	19.6	13.0	14.2
% CO_2	0.0	0.0	0.0
% O_2	20.9	20.9	20.9
% N_2	79.1	79.1	79.1
Area of stack (sq.ft.)	4.910	4.910	4.910
Sample time (min.)	96.0	96.0	96.0
Static pressure (in.H_2O)	-0.24	-0.24	-0.24
Nozzle dia. (in.)	0.218	0.218	0.218
Meter box cal.	1.0069	1.0069	1.0069
Cp of pitot tube	0.84	0.84	0.84
Traverse points	24	24	24

Sample and Velocity Traverse Point Data Sheet - Method 1

Client: Chemours
Loaction/Plant: Fayetteville
Source: Polymers

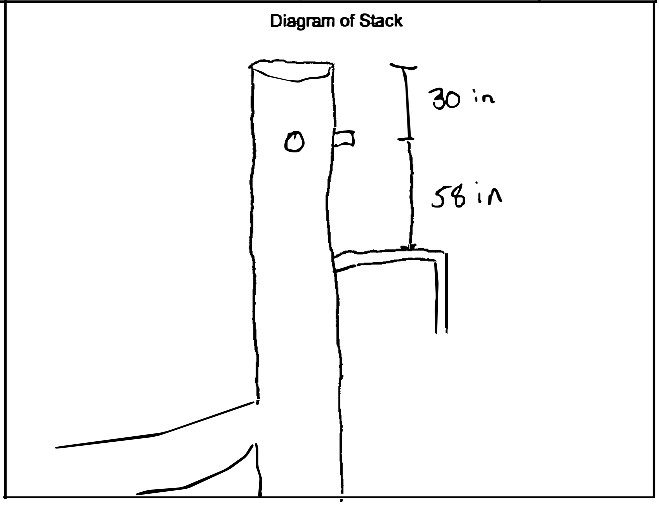
Operator: SR
Date: 3/21/18
W.O. Number:

Duct Type	☐ Circular	☐ Rectangular Duct		Indicate appropriate type
Traverse Type	☐ Particulate Traverse	☐ Velocity Traverse		☐ CEM Traverse

Distance from far wall to outside of port (in.) = C	48
Port Depth (in.) = D	18
Depth of Duct, diameter (in.) = C-D	30
Area of Duct (ft^2)	4.91
Total Traverse Points	24
Total Traverse Points per Port	12
Port Diameter (in.) —(Flange-Threaded-Hole)	
Monorail Length	
Rectangular Ducts Only	
Width of Duct, rectangular duct only (in.)	
Total Ports (rectangular duct only)	
Equivalent Diameter = (2*L*W)/(L+W)	

Flow Disturbances	
Upstream - A (ft)	2.5
Downstream - B (ft)	4.83
Upstream - A (duct diameters)	1.0
Downstream - B (duct diameters)	1.9

Diagram of Stack



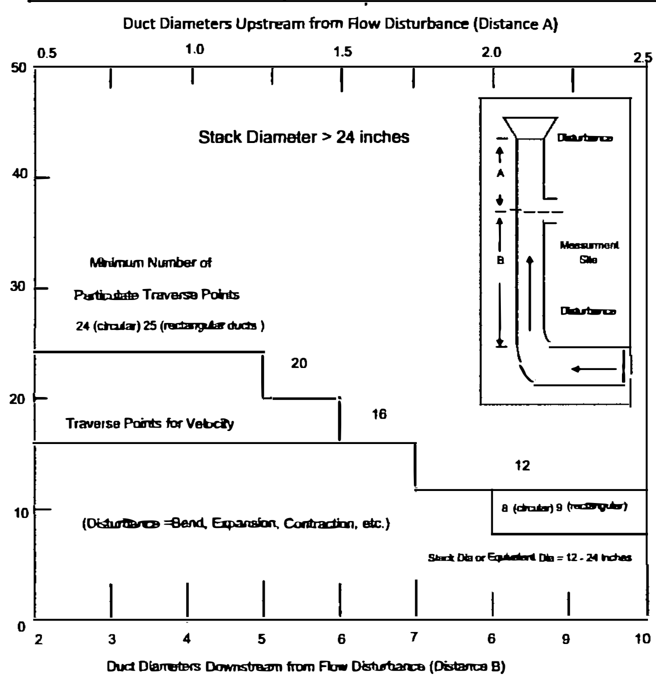
Traverse Point Locations

Traverse Point	% of Duct	Distance from Inside Duct Wall (in)	Distance from Outside of Port (in)
1	2.1	1	19
2	6.7	2	20
3	11.8	3 1/2	21 1/2
4	17.7	5 1/4	23 1/4
5	25	7 1/2	25 1/2
6	35.6	10 5/8	28 5/8
7	64.4	19 3/8	37 3/8
8	75	22 1/2	40 1/2
9	82.3	24 3/4	42 3/4
10	88.2	26 1/2	44
11	93.3	28	46
12	97.9	29	47

CEM 3 Point(Long Measurment Line) Stratification Point Locations

1	0.167		
2	0.50		
3	0.833		

Note: If stack dia < 12 inch use EPA Method 1A
(Sample port upstream of pitot port)
Note: If stack dia >24" then adjust traverse point to 1 inch from wall
If stack dia <24" then adjust traverse point to 0.5 inch from wall



Traverse Point Location Percent of Stack -Circular

Number of Traverse Points

Traverse Point Location	1	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		14.6		10.5		8.2		6.7
3				75		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
6						95.6		80.6		65.8		35.6
7								89.5		77.4		64.4
8								96.8		85.4		75
9										91.8		82.3
10										97.4		88.2
11												93.3
12												97.9

Traverse Point Location Percent of Stack -Rectangular

Number of Traverse Points

Traverse Point Location	1	2	3	4	5	6	7	8	9	10	11	12
1		25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2		75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3			83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4				87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5					90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6						91.7	78.6	68.8	61.1	55.0	50.0	45.8
7							92.9	81.3	72.2	65.0	59.1	54.2
8								93.8	83.3	75.0	68.2	62.5
9									94.4	85.0	77.3	70.8
10										95.0	86.4	79.2
11											95.5	87.5
12												95.8

WESTON

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

Client	Chemours
W.O.#	15418.002.009
Project ID	Chemours
Mode/Source ID	Polymer
Samp. Loc. ID	STK
Run No.ID	1
Test Method ID	M0010
Date ID	17JAN2019
Source/Location	Polymer Stack
Sample Date	1/17/19
Baro. Press (in Hg)	30.10
Operator	MR WINKLER

Stack Conditions	Assumed	Actual
% Moisture	≈2.5	
Impinger Vol (ml)		6.0
Silica gel (g)		19.6
CO2, % by Vol	0.1	
O2, % by Vol	20.8	
Temperature (°F)	≈50	
Meter Temp (°F)	≈61	
Static Press (in H_2O)	-0.24	-0.24
Ambient Temp (°F)	≈60	

Meter Box ID	12		
Meter Box Y	1.0069		
Meter Box Del H	1.8812		
Probe ID / Length	P704	5'	
Probe Material	Boro		
Pitot / Thermocouple ID	P704		
Pitot Coefficient	0.84		
Nozzle ID	G128		
Nozzle Measurements	0.218	0.218	0.218
Avg Nozzle Dia (in)	0.218		
Area of Stack (ft²)	4.91		
Sample Time	96		
Total Traverse Pts	24		

K Factor 2.47

	Initial	Mid-Point	Final
Sample Train (ft³)	0.001	0.001	0.001
Leak Check @ (in Hg)	≈15	≈7	≈5
Pitot leak check good	(yes) / no	(yes) / no	(yes) / no
Pitot Inspection good	(yes) / no	(yes) / no	(yes) / no
Method 3 System good	yes / no	(yes) / no	(yes) / no

Temp Check	Pre-Test Set	Post-Test Set
Meter Box Temp	60	53
Reference Temp	60	53
Pass/Fail (+/- 2°)	(Pass) / Fail	(Pass) / Fail
Temp Change Response ?	(yes) / no	(yes) / no

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft³)	STACK TEMP (°F)	DGM OUTLET TEMP (°F)	PROBE TEMP (°F)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (oF)	SAMPLE TRAIN VAC (in Hg)	XAD EXIT TEMP (F)		COMMENTS
	0	1443			441.130									
A 1	4		0.45	1.11	443.41	63	65	258	242	56	3	56		
2	8		0.53	1.31	445.84	64	67	257	245	56	3	56		
3	12		0.55	1.35	448.40	64	66	257	248	56	3	56		28.324
4	16		0.48	1.18	450.40	64	66	257	258	50	3	50		
5	20		0.48	1.18	452.70	64	67	255	257	44	3	44		
6	24		0.50	1.23	455.19	63	66	255	257	46	3	46		
7	28		0.50	1.23	457.38	63	67	254	256	50	3	50		
8	32		0.51	1.25	459.28	63	68	259	253	48	3	48		
9	36		0.48	1.18	462.01	62	67	259	252	48	3	48		
10	40		0.50	1.23	464.39	62	67	259	254	48	3	48		
11	44		0.59	1.46	466.81	63	67	259	254	48	4	48		
12	48	1531	0.64	1.58	469.454	63	67	259	254	48	4	48		
		1548			469.629									
B 1	4		0.35	0.86	471.82	61	64	259	255	54	3	54		
2	8		0.35	0.86	475.22	61	64	255	255	54	3	54		
3	12		0.35	0.86	476.80	60	64	213	213	54	3	54		
4	16	*1604	0.35	0.86	477.70	60	64	207	207	~~207~~ 54	3	54		29.036
5	20	1609	0.65	1.61	480.20	61	64	145	145	54	3	54		
6	24		0.65	1.61	483.00	61	62	135	145	53	3	54		
7	28		0.69	1.70	485.56	61	62	135	145	53	3	53		
8	32		0.69	1.70	488.70	61	62	135	145	52	3	52		
9	36		0.72	1.77	491.15	61	62	135	145	52	3	52		
10	40		0.65	1.60	494.01	61	62	135	145	52	3	52		
11	44		0.61	1.50	496.40	61	61	135	145	52	3	52		
12	48	1641	0.52	1.28	498.665	61	61	135	145	52	3	52		

	Avg Delta P	Avg Delta H	Total Volume	Avg Ts	Avg Tm	Min/Max	Min/Max	Max	Max Vac	Min/Max
0.53292	~~0.53083~~	1.31250	~~58.07~~ 57.360	62.0	64.7	135/259	145/280	56	4	56
	Avg Sqrt Delta P	**Avg Sqrt Del H**								
0.72582	~~0.72455~~	1.13898								

Comments: * stopped pitot tube issues block tube

WESTON

EPA Method 0010 from EPA SW-846

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

Client	Chemours
W.O.#	15418.002.009
Project ID	Chemours
Mode/Source ID	Polymer
Samp. Loc. ID	STK
Run No.ID	2
Test Method ID	M0010
Date ID	17JAN2019
Source/Location	Polymer Stack
Sample Date	1/18/19
Baro. Press (in Hg)	30.01
Operator	MW WINKELER

Stack Conditions	Assumed	Actual
% Moisture	~2.2	
Impinger Vol (ml)		-4
Silica gel (g)		13.0
CO2, % by Vol	0.1	
O2, % by Vol	20.8	
Temperature (°F)	≈60	
Meter Temp (°F)	≈61	
Static Press (in H_2O)	-0.24	-0.24
Ambient Temp (°F)	≈45	

Meter Box ID	12		
Meter Box Y	1.0069		
Meter Box Del H	1.8812		
Probe ID / Length	P704	5	
Probe Material	Boro		
Pitot / Thermocouple ID	P704		
Pitot Coefficient	0.84		
Nozzle ID	G 218		
Nozzle Measurements	0.218	0.218	0.218
Avg Nozzle Dia (in)	0.218		
Area of Stack (ft²)	4.91		
Sample Time	96		
Total Traverse Pts	24		

K Factor 2.51

	Initial	Mid-Point	Final
Sample Train (ft³)	0.001	0.013	0.001
Leak Check @ (in Hg)	@15	@7	@7
Pitot leak check good	(yes) / no	(yes) / no	(yes) / no
Pitot Inspection good	(yes) / no	(yes) / no	(yes) / no
Method 3 System good	yes / no	yes / no	yes / no

Temp Check	Pre-Test Set	Post-Test Set
Meter Box Temp	46	55
Reference Temp	45	55
Pass/Fail (+/- 2°)	(Pass) / Fail	(Pass) / Fail
Temp Change Response ?	(yes) / no	(yes) / no

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft³)	STACK TEMP (°F)	DGM OUTLET TEMP (oF)	PROBE TEMP (oF)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (oF)	SAMPLE TRAIN VAC (in Hg)	XAD EXIT TEMP (F)		COMMENTS
	0	0835			497.824									
B 1	4		0.48	1.20	501.10	57	45	136	140	41	4	41		
2	8		0.56	1.40	503.15	57	45	136	141	41	4	41		
3	12		~~0.~~0.60	1.50	506.45	57	45	135	145	41	4	41		
4	16		0.60	1.50	508.56	56	45	130	130	41	4	41		29.58
5	20		0.63	1.58	511.14	56	46	100	100	41	4	40		
6	24		0.63	1.58	513.74	56	46	100	100	41	4	41		
7	28		0.60	1.50	516.21	56	47	100	100	41	4	41		
8	32		0.58	1.45	518.70	55	47	100	100	41	4	41		
9	36		0.62	1.55	521.10	55	47	100	100	40	5	40		
10	40		0.65	1.63	523.74	55	48	100	100	40	5	40		
11	44		0.58	1.45	526.12	55	48	100	100	40	5	40		
12	48	0923	0.48	1.20	528.400	55	48	100	100	40	4	40		2.39
		0940			528.780								←	K-Factor
A 1	4		0.48	1.14	531.00	56	51	100	100	40	4	40		
2	8		0.55	1.31	533.15	57	51	100	100	39	4	39		
3	12		0.58	1.38	536.01	56	51	100	100	39	4	39		MW
4	16		0.60	1.43	538.20	56	52	100	100	39	4	39		~~29.095~~
5	20		0.60	1.43	540.66	56	52	100	100	40	4	40		
6	24		0.63	1.50	543.30	56	53	100	100	40	4	40		29.095
7	28		0.63	1.50	546.52	56	53	100	100	42	4	42		
8	32		0.69	1.62	548.21	57	53	100	100	42	5	42		
9	36		0.68	1.62	550.87	57	53	100	100	42	5	42		
10	40		0.63	1.50	553.35	56	53	100	100	42	5	42		
11	44		0.53	1.26	555.50	57	54	100	100	43	4	43		
12	48	1028	0.48	1.14	557.875	57	54	100	100	44	4	44		
			Avg Delta P 0.58667	Avg Delta H 1.43208	Total Volume 58.671	Avg Ts 56.1	Avg Tm 49.4	Min/Max 100/136	Min/Max 100/145	Max 44	Max Vac 5	Min/Max 39/44		
			Avg Sqrt Delta P 0.76493	Avg Sqrt Del H 1.19504	Comments:									

WESTON

EPA Method 0010 from EPA SW-846

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

Client	Chemours
W.O.#	15418.002.009
Project ID	Chemours
Mode/Source ID	Polymer
Samp. Loc. ID	STK
Run No.ID	3
Test Method ID	M0010
Date ID	17JAN2019
Source/Location	Polymer Stack
Sample Date	1/18/19
Baro. Press (in Hg)	30.01
Operator	M WINKELER

Stack Conditions

	Assumed	Actual
% Moisture	≈2.2	
Impinger Vol (ml)		3
Silica gel (g)		14.2
CO2, % by Vol	0.1	
O2, % by Vol	20.7	
Temperature (°F)	348	
Meter Temp (°F)	148	
Static Press (in H_2O)	-0.24	-0.24
Ambient Temp (°F)	≈ 58.0	

Meter Box ID	12
Meter Box Y	1.0069
Meter Box Del H	1.8812
Probe ID / Length	P702 / 5
Probe Material	Boro
Pitot / Thermocouple ID	P702
Pitot Coefficient	0.84
Nozzle ID	G218
Nozzle Measurements	0.217 / 0.218 / 0.218
Avg Nozzle Dia (in)	0.218
Area of Stack (ft²)	4.91
Sample Time	96
Total Traverse Pts	24

K Factor 2.46

	Initial	Mid-Point	Final
Sample Train (ft³)	0.004	0.015	0.013
Leak Check @ (in Hg)	e15	e6	e6
Pitot leak check good	(yes) / no	(yes) / no	(yes) / no
Pitot Inspection good	(yes) / no	(yes) / no	(yes) / no
Method 3 System good	yes / no	yes / no	yes / no

Temp Check	Pre-Test Set	Post-Test Set
Meter Box Temp	55	63
Reference Temp	55	62
Pass/Fail (+/- 2°)	(Pass) / Fail	(Pass) / Fail
Temp Change Response ?	(yes) / no	(yes) / no

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft³)	STACK TEMP (°F)	DGM OUTLET TEMP (oF)	PROBE TEMP (oF)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (oF)	SAMPLE TRAIN VAC (in Hg)	XAD EXIT TEMP (F)		COMMENTS
	0	1111			558.112									
A 1	4		0.55	1.35	560.62	59	58	100	100	50	4	50		
2	8		0.55	1.35	563.21	59	58	100	100	50	4	50		
3	12		0.58	1.42	565.49	59	58	100	100	48	4	48		29.887
4	16		0.63	1.54	568.00	59	58	100	100	48	45	48		
5	20		0.63	1.54	570.60	59	58	100	100	47	5	47		
6	24		0.61	1.50	573.11	59	58	100	101	47	5	47		0.015
7	28		0.65	1.59	575.75	59	58	100	101	46	5	46		e6
8	32		0.68	1.67	578.49	59	58	100	101	46	5	46		
9	36		0.68	1.67	581.23	60	58	100	101	46	5	46		586.480
10	40		0.63	1.54	583.76	60	58	100	101	46	5	46		
11	44		0.55	1.35	586.14	60	58	100	102	46	4	46		
12	48	1159	0.48	1.18	587.999	59	58	100	103	46	4	46		587.999 WF
		1227			588.573									
B 1	4		0.58	1.42	591.08	61	58	100	101	56	4	56		
2	8		0.60	1.47	593.80	64	61	100	101	56	4	56		
3	12		0.65	1.59	596.21	64	63	100	100	50	4	50		
4	16		0.68	1.67	598.86	65	65	100	100	50	5	50		
5	20		0.70	1.72	601.55	67	65	100	105	50	5	50		
6	24		0.65	1.59	604.45	67	65	101	105	55	5	55		
7	28		0.66	1.62	606.94	67	67	101	101	66	5	66		
8	32		0.65	1.59	609.55	66	68	101	101	60	5	60		30.757
9	36		0.65	1.59	612.12	66	68	101	101	60	5	60		
10	40		0.63	1.54	614.72	66	68	101	101	59	4	59		
11	44		0.55	1.35	617.13	66	68	101	101	55	4	55		
12	48	1315	0.48	1.18	619.330	66	68	101	101	55		55		
			Avg Delta P 0.61250	Avg Delta H 1.50125	Total Volume 60.644	Avg Ts 62.3	Avg Tm 61.7	Min/Max 100/101	Min/Max 100/105	Max 66	Max Vac 5	Min/Max 46/66		
			Avg Sqrt Delta P 0.78166	Avg Sqrt Del H 1.22377	Comments:									

WESTON

EPA Method 0010 from EPA SW-846

SAMPLE RECOVERY FIELD DATA

EPA Method 0010 - HFPO Dimer Acid

Client: Chemours
Location/Plant: Fayetteville, NC
W.O. #: 15418.002.009.0001
Source & Location: Polymer Stack

Run No. 1
Sample Date: 1/17/19
Recovery Date: 1/17/19
Sample I.D.: CHEMOURS - Polymer - STK - 1 - M0010 -
Analyst: [illegible]
Filter Number: NA

	Impinger 1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final	1	100	103	2				206	319.6	
Initial	0	100	100	0				200	300	
Gain	1	0	3	2				6 ✓	19.6	✓

Impinger Color: clear
Silica Gel Condition: Good
Labeled? ✓
Sealed? ✓

Run No. 2
Sample Date: 1/18/19
Recovery Date: 1/18/19
Sample I.D.: CHEMOURS - Polymer - STK - 2 - M0010 -
Analyst: WF
Filter Number: NA

	Impinger 1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final	0	96	100	0				196	313.0	
Initial	0	100	100	0				200	300	
Gain	0	-4	0	0				-4 ✓	13.0	✓

Impinger Color: clear
Silica Gel Condition: Blue
Labeled? ✓
Sealed? ✓

Run No. 3
Sample Date: 1/18/19
Recovery Date: 1/18/19
Sample I.D.: CHEMOURS - Polymer - STK - 3 - M0010 -
Analyst: WF
Filter Number: NA

	Impinger 1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final	1	90	102	4				197	314.2	
Initial	0	100	100	0				200	300	
Gain	~~0~~ WF 1	-10	2	4				-3 ✓	14.2	✓

Impinger Color: clear
Silica Gel Condition: Blue
Labeled? ✓
Sealed? ✓

Check COC for Sample IDs of Media Blanks

WESTON SOLUTIONS

SAMPLE RECOVERY FIELD DATA

EPA Method 0010 - HFPO Dimer Acid

Client: Chemours
W.O. #:
Location/Plant: Fayetteville, NC
Source & Location: Polymer Stack

Run No. 1
Sample Date: 1/18/19
Recovery Date: 1/18/19
Sample I.D.: CHEMOURS - Polymer - STK - ~~1~~ BT - M0010 -
Analyst: WF
Filter Number: —

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final	0	100	100	0					300	
Initial	0	100	100	0					300	
Gain	0	0	0	0					0	

Impinger Color: Clear
Labeled? ✓
Silica Gel Condition: Blue
Sealed? ✓

Run No. 2
Sample Date:
Recovery Date:
Sample I.D.: CHEMOURS - Polymer - STK - 2 - M0010 -
Analyst:
Filter Number:

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final										
Initial		100	100						300	
Gain										

Impinger Color:
Labeled?
Silica Gel Condition:
Sealed?

Run No. 3
Sample Date:
Recovery Date:
Sample I.D.: CHEMOURS - Polymer - STK - 3 - M0010 -
Analyst:
Filter Number:

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final										
Initial		100	100						300	
Gain										

Impinger Color:
Labeled?
Silica Gel Condition:
Sealed?

Check COC for Sample IDs of Media Blanks

WESTON SOLUTIONS

METHODS AND ANALYZERS

Client:	**Chemours**	Project Number:	**15418.002.009**
Location:	**CHEMOURS**	Operator:	**SR**
Source:	**Polymers**	Date:	**17 Jan 2019**

ent Folders.A-F\Chemours Fayetteville\15418.002.009 Fayetteville Jan 2019 Carbon Bed Test\Data\Polymers\0117

Program Version: 2.1, built 19 May 2017 **File Version:** 2.03
Computer: WSWCAIRSERVICES **Trailer:** 27
Analog Input Device: Keithley KUSB-3108

Channel 1

Analyte	**O_2**
Method	**EPA 3A**, Using Bias
Analyzer Make, Model & Serial No.	**Servomex 4900**
Full-Scale Output, mv	**10000**
Analyzer Range, %	**25.0**
Span Concentration, %	**21.0**

Channel 2

Analyte	**CO_2**
Method	**EPA 3A**, Using Bias
Analyzer Make, Model & Serial No.	**Servomex 4900**
Full-Scale Output, mv	**10000**
Analyzer Range, %	**20.0**
Span Concentration, %	**16.6**

CALIBRATION DATA

Number 1

Client: **Chemours**
Location: **CHEMOURS**
Source: **Polymers**

Project Number: **15418.002.009**
Operator: **SR**
Date: **17 Jan 2019**

Start Time: 14:23

O_2
Method: EPA 3A
Calibration Type: Linear Zero and High Span

Calibration Standards

%	**Cylinder ID**
12.0	CC18055
21.0	SG9169108

Calibration Results

Zero	2 mv
Span, 21.0 %	8011 mv

Curve Coefficients

Slope	**Intercept**
381.4	2

CO_2
Method: EPA 3A
Calibration Type: Linear Zero and High Span

Calibration Standards

%	**Cylinder ID**
8.9	CC18055
16.6	SG9169108

Calibration Results

Zero	-9 mv
Span, 16.6 %	8288 mv

Curve Coefficients

Slope	**Intercept**
500.4	-9

WESTON SOLUTIONS

CALIBRATION ERROR DATA

Number 1

Client:	**Chemours**	Project Number:	**15418.002.009**
Location:	**CHEMOURS**	Operator:	**SR**
Source:	**Polymers**	Date:	**17 Jan 2019**

Calibration **1**

Start Time: 14:23

O_2

Method: EPA 3A

Span Conc. 21.0 %

Slope 381.4 **Intercept** 2.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
12.0	12.1	0.1	0.5	Pass
21.0	21.0	0.0	0.0	Pass

CO_2

Method: EPA 3A

Span Conc. 16.6 %

Slope 500.4 **Intercept** -9.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
8.9	8.6	-0.3	-1.8	Pass
16.6	16.6	0.0	0.0	Pass

BIAS
Number 1

Client:	**Chemours**	Project Number:	**15418.002.009**
Location:	**CHEMOURS**	Operator:	**SR**
Source:	**Polymers**	Date:	**17 Jan 2019**

Calibration **1**

Start Time: 14:26

O_2
Method: EPA 3A
Span Conc. 21.0 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.1	12.0	-0.1	-0.5	Pass

CO_2
Method: EPA 3A
Span Conc. 16.6 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.1	0.1	0.6	Pass
Span	8.6	8.4	-0.2	-1.2	Pass

RUN DATA

Number 1

Client: **Chemours**
Location: **CHEMOURS**
Source: **Polymers**

Calibration **1**

Project Number: **15418.002.009**
Operator: **SR**
Date: **17 Jan 2019**

Time	O_2 %	CO_2 %
	Port A	
14:43	20.9	0.0
14:44	20.9	0.0
14:45	20.8	0.0
14:46	20.8	0.0
14:47	20.9	0.0
14:48	20.9	0.0
14:49	20.9	0.0
14:50	20.9	0.0
14:51	20.9	0.0
14:52	21.0	0.0
14:53	21.0	0.0
14:54	21.0	0.0
14:55	21.0	0.0
14:56	21.0	0.0
14:57	21.0	0.0
14:58	21.0	0.0
14:59	21.0	0.0
15:00	21.0	0.0
15:01	21.0	0.0
15:02	21.0	0.0
15:03	21.0	0.0
15:04	21.0	0.0
15:05	21.0	0.0
15:06	21.0	0.0
15:07	21.0	0.0
15:08	21.0	0.0
15:09	21.0	0.0
15:10	21.0	0.0
15:11	21.0	0.0
15:12	21.0	0.0
15:13	21.0	0.0
15:14	21.0	0.0
15:15	21.0	0.0
15:16	21.0	0.0
15:17	21.0	0.0
15:18	21.0	0.0
15:19	21.0	0.0
15:20	21.0	0.0
15:21	21.0	0.0

RUN DATA
Number 1

Client: **Chemours**
Location: **CHEMOURS**
Source: **Polymers**

Calibration **1**

Project Number: **15418.002.009**
Operator: **SR**
Date: **17 Jan 2019**

Time	O_2 %	CO_2 %
15:22	21.0	0.0
15:23	21.0	0.0
15:24	21.0	0.0
15:25	21.0	0.0
15:26	21.0	0.0
15:27	21.0	0.0
15:28	21.0	0.0
15:29	21.0	0.0
15:30	21.0	0.0
15:31	21.0	0.0
Port B		
15:48	20.9	0.0
15:49	20.9	0.0
15:50	20.9	0.0
15:51	20.9	0.0
15:52	20.9	0.0
15:53	20.9	0.0
15:54	20.9	0.0
15:55	20.9	0.0
15:56	20.9	0.0
15:57	20.9	0.0
15:58	21.0	0.0
15:59	21.0	0.0
16:00	20.9	0.0
16:01	21.0	0.0
16:02	21.0	0.0
16:03	21.0	0.0
16:04	21.0	0.0
Break in run - pitot tube blocked		
16:09	20.9	0.0
16:10	20.9	0.0
16:11	20.9	0.0
16:12	20.9	0.0
16:13	20.9	0.0
16:14	20.9	0.0
16:15	20.9	0.0
16:16	20.9	0.0
16:17	20.9	0.0
16:18	20.9	0.0
16:19	21.0	0.0

WESTON SOLUTIONS

RUN DATA
Number 1

Client:	**Chemours**	Project Number:	**15418.002.009**
Location:	**CHEMOURS**	Operator:	**SR**
Source:	**Polymers**	Date:	**17 Jan 2019**

Calibration **1**

Time	O_2 %	CO_2 %
16:20	21.0	0.0
16:21	21.0	0.0
16:22	21.0	0.0
16:23	21.0	0.0
16:24	21.0	0.0
16:25	21.0	0.0
16:26	20.9	0.0
16:27	21.0	0.0
16:28	20.9	0.0
16:29	20.9	0.0
16:30	20.9	0.0
16:31	20.9	0.0
16:32	20.9	0.0
16:33	20.9	0.0
16:34	20.9	0.0
16:35	20.9	0.0
16:36	20.9	0.0
16:37	20.9	0.0
16:38	20.9	0.0
16:39	20.9	0.0
16:40	20.9	0.0
16:41	20.9	0.0
	End Run 1	
Avgs	**21.0**	**0.0**

WESTON SOLUTIONS

RUN SUMMARY

Number 1

Client: **Chemours**		Project Number:	**15418.002.009**
Location: **CHEMOURS**		Operator:	**SR**
Source: **Polymers**	Calibration **1**	Date:	**17 Jan 2019**

	O_2	CO_2
Method	EPA 3A	EPA 3A
Conc. Units	%	%

Time: 14:42 to 16:41

Run Averages

	O_2	CO_2
	21.0	0.0

Pre-run Bias at 14:26

	O_2	CO_2
Zero Bias	0.0	0.1
Span Bias	12.0	8.4
Span Gas	12.0	8.9

Post-run Bias at 17:03

	O_2	CO_2
Zero Bias	0.0	0.1
Span Bias	12.0	8.3
Span Gas	12.0	8.9

Run averages corrected for the average of the pre-run and post-run bias

	O_2	CO_2
	21.0	0.0

BIAS AND CALIBRATION DRIFT
Number 2

Client: **Chemours**
Location: **CHEMOURS**
Source: **Polymers**

Calibration **1**

Project Number: **15418.002.009**
Operator: **SR**
Date: **17 Jan 2019**

Start Time: 17:03

O_2
Method: EPA 3A
Span Conc. 21.0 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.1	12.0	-0.1	-0.5	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.0	12.0	0.0	0.0	Pass

*Bias No. 1

CO_2
Method: EPA 3A
Span Conc. 16.6 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.1	0.1	0.6	Pass
Span	8.6	8.3	-0.3	-1.8	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.1	0.1	0.0	0.0	Pass
Span	8.4	8.3	-0.1	-0.6	Pass

*Bias No. 1

METHODS AND ANALYZERS

Client: **Chemours**
Location: **CHEMOURS**
Source: **Polymers**

Project Number: **15418.002.009**
Operator: **SR**
Date: **18 Jan 2019**

ent Folders.A-F\Chemours Fayetteville\15418.002.009 Fayetteville Jan 2019 Carbon Bed Test\Data\Polymers\01181

Program Version: 2.1, built 19 May 2017 **File Version:** 2.03
Computer: WSWCAIRSERVICES **Trailer:** 27
Analog Input Device: Keithley KUSB-3108

Channel 1

Analyte	**O_2**
Method	**EPA 3A**, Using Bias
Analyzer Make, Model & Serial No.	**Servomex 4900**
Full-Scale Output, mv	**10000**
Analyzer Range, %	**25.0**
Span Concentration, %	**21.0**

Channel 2

Analyte	**CO_2**
Method	**EPA 3A**, Using Bias
Analyzer Make, Model & Serial No.	**Servomex 4900**
Full-Scale Output, mv	**10000**
Analyzer Range, %	**20.0**
Span Concentration, %	**16.6**

CALIBRATION DATA
Number 1

Client:	**Chemours**	Project Number:	**15418.002.009**
Location:	**CHEMOURS**	Operator:	**SR**
Source:	**Polymers**	Date:	**18 Jan 2019**

Start Time: 07:19

O_2
Method: EPA 3A
Calibration Type: Linear Zero and High Span

Calibration Standards

%	Cylinder ID
12.0	CC18055
21.0	SG9169108

Calibration Results

Zero	13 mv
Span, 21.0 %	8012 mv

Curve Coefficients

Slope	Intercept
380.9	13

CO_2
Method: EPA 3A
Calibration Type: Linear Zero and High Span

Calibration Standards

%	Cylinder ID
8.9	CC18055
16.6	SG9169108

Calibration Results

Zero	-10 mv
Span, 16.6 %	8293 mv

Curve Coefficients

Slope	Intercept
500.8	-10

WESTON SOLUTIONS

CALIBRATION ERROR DATA

Number 1

Client:	**Chemours**	Project Number:	**15418.002.009**
Location:	**CHEMOURS**	Operator:	**SR**
Source:	**Polymers**	Date:	**18 Jan 2019**

Calibration **1**

Start Time: 07:19

O_2

Method: EPA 3A

Span Conc. 21.0 %

Slope 380.9 **Intercept** 13.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
12.0	12.1	0.1	0.5	Pass
21.0	21.0	0.0	0.0	Pass

CO_2

Method: EPA 3A

Span Conc. 16.6 %

Slope 500.8 **Intercept** -10.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
8.9	8.6	-0.3	-1.8	Pass
16.6	16.6	0.0	0.0	Pass

WESTON SOLUTIONS

BIAS
Number 1

Client: **Chemours**
Location: **CHEMOURS**
Source: **Polymers**

Calibration **1**

Project Number: **15418.002.009**
Operator: **SR**
Date: **18 Jan 2019**

Start Time: 07:23

O_2
Method: EPA 3A
Span Conc. 21.0 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.1	12.0	-0.1	-0.5	Pass

CO_2
Method: EPA 3A
Span Conc. 16.6 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.1	0.1	0.6	Pass
Span	8.6	8.4	-0.2	-1.2	Pass

WESTON SOLUTIONS

RUN DATA
Number 2

Client: **Chemours**
Location: **CHEMOURS**
Source: **Polymers**

Calibration **1**

Project Number: **15418.002.009**
Operator: **SR**
Date: **18 Jan 2019**

Time	O_2 %	CO_2 %
	Port B	
08:35	20.9	0.1
08:36	20.9	0.1
08:37	20.9	0.1
08:38	20.9	0.1
08:39	20.9	0.1
08:40	20.9	0.1
08:41	20.9	0.1
08:42	20.9	0.1
08:43	20.9	0.1
08:44	20.9	0.1
08:45	20.9	0.1
08:46	20.9	0.1
08:47	20.9	0.1
08:48	20.9	0.1
08:49	20.9	0.1
08:50	20.9	0.1
08:51	20.9	0.1
08:52	20.9	0.1
08:53	20.9	0.1
08:54	20.9	0.1
08:55	20.9	0.1
08:56	20.9	0.1
08:57	20.9	0.1
08:58	20.9	0.1
08:59	20.9	0.1
09:00	20.9	0.1
09:01	20.9	0.1
09:02	20.2	0.1
09:03	20.9	0.1
09:04	20.9	0.1
09:05	20.9	0.1
09:06	20.9	0.1
09:07	20.9	0.1
09:08	20.9	0.1
09:09	20.9	0.1
09:10	20.9	0.1
09:11	20.9	0.1
09:12	20.9	0.1
09:13	20.9	0.1

WESTON SOLUTIONS

RUN DATA
Number 2

Client: **Chemours**
Location: **CHEMOURS**
Source: **Polymers**

Calibration **1**

Project Number: **15418.002.009**
Operator: **SR**
Date: **18 Jan 2019**

Time	O_2 %	CO_2 %
09:14	20.9	0.1
09:15	20.9	0.1
09:16	20.9	0.1
09:17	20.9	0.1
09:18	20.9	0.1
09:19	20.9	0.1
09:20	20.9	0.1
09:21	20.9	0.1
09:22	20.9	0.1
09:23	20.9	0.1
	Port B	
09:40	20.9	0.1
09:41	20.9	0.1
09:42	20.9	0.1
09:43	20.9	0.1
09:44	20.9	0.1
09:45	20.9	0.1
09:46	20.9	0.1
09:47	20.9	0.1
09:48	20.9	0.1
09:49	20.9	0.1
09:50	20.9	0.1
09:51	20.9	0.1
09:52	20.9	0.1
09:53	20.9	0.1
09:54	20.9	0.1
09:55	20.9	0.1
09:56	20.9	0.1
09:57	20.9	0.1
09:58	20.9	0.1
09:59	20.9	0.1
10:00	20.9	0.1
10:01	20.9	0.1
10:02	20.9	0.1
10:03	20.9	0.1
10:04	20.9	0.1
10:05	20.9	0.1
10:06	20.9	0.1
10:07	21.0	0.1
10:08	21.0	0.1

RUN DATA
Number 2

Client:	**Chemours**	Project Number:	**15418.002.009**
Location:	**CHEMOURS**	Operator:	**SR**
Source:	**Polymers**	Date:	**18 Jan 2019**

Calibration **1**

Time	O_2 %	CO_2 %
10:09	21.0	0.1
10:10	21.0	0.1
10:11	21.0	0.1
10:12	21.0	0.1
10:13	21.0	0.1
10:14	21.0	0.1
10:15	21.0	0.1
10:16	21.0	0.1
10:17	21.0	0.1
10:18	21.0	0.1
10:19	21.0	0.1
10:20	21.0	0.1
10:21	21.0	0.1
10:22	21.0	0.1
10:23	21.0	0.1
10:24	21.0	0.1
10:25	21.0	0.1
10:26	21.0	0.1
10:27	21.0	0.1
10:28	21.0	0.1
	End Run 2	
Avgs	**20.9**	**0.1**

WESTON SOLUTIONS℠

RUN SUMMARY

Number 2

Client:	**Chemours**	Project Number:	**15418.002.009**
Location:	**CHEMOURS**	Operator:	**SR**
Source:	**Polymers**	Date:	**18 Jan 2019**

Calibration **1**

	O_2	CO_2
Method	EPA 3A	EPA 3A
Conc. Units	%	%

Time: 08:34 to 10:28

Run Averages

	20.9	0.1

Pre-run Bias at 07:23

Zero Bias	0.0	0.1
Span Bias	12.0	8.4
Span Gas	12.0	8.9

Post-run Bias at 11:08

Zero Bias	0.1	0.0
Span Bias	12.0	8.4
Span Gas	12.0	8.9

Run averages corrected for the average of the pre-run and post-run bias

	21.0	0.1

WESTON SOLUTIONS

BIAS AND CALIBRATION DRIFT

Number 2

Client:	**Chemours**	Project Number:	**15418.002.009**
Location:	**CHEMOURS**	Operator:	**SR**
Source:	**Polymers**	Date:	**18 Jan 2019**

Calibration **1**

Start Time: 11:08

O_2

Method: EPA 3A

Span Conc. 21.0 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.1	0.1	0.5	Pass
Span	12.1	12.0	-0.1	-0.5	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.1	0.1	0.5	Pass
Span	12.0	12.0	0.0	0.0	Pass

*Bias No. 1

CO_2

Method: EPA 3A

Span Conc. 16.6 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	8.6	8.4	-0.2	-1.2	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.1	0.0	-0.1	-0.6	Pass
Span	8.4	8.4	0.0	0.0	Pass

*Bias No. 1

WESTON SOLUTIONS

RUN DATA
Number 3

Client: **Chemours**
Location: **CHEMOURS**
Source: **Polymers**

Calibration **1**

Project Number: **15418.002.009**
Operator: **SR**
Date: **18 Jan 2019**

Time	O_2 %	CO_2 %
	Port A	
11:11	20.8	0.2
11:12	20.9	0.1
11:13	20.9	0.1
11:14	20.9	0.1
11:15	20.9	0.1
11:16	20.9	0.1
11:17	20.9	0.1
11:18	20.9	0.1
11:19	20.9	0.1
11:20	20.9	0.1
11:21	21.0	0.1
11:22	21.0	0.1
11:23	21.0	0.1
11:24	21.0	0.1
11:25	21.0	0.1
11:26	21.0	0.1
11:27	21.0	0.1
11:28	21.0	0.1
11:29	21.0	0.1
11:30	21.0	0.1
11:31	21.0	0.1
11:32	21.0	0.1
11:33	21.0	0.1
11:34	21.0	0.1
11:35	21.0	0.1
11:36	21.0	0.1
11:37	21.0	0.1
11:38	21.0	0.1
11:39	21.0	0.1
11:40	21.0	0.1
11:41	21.0	0.1
11:42	21.0	0.1
11:43	21.0	0.1
11:44	21.0	0.1
11:45	21.0	0.1
11:46	21.0	0.1
11:47	21.0	0.1
11:48	21.0	0.1
11:49	21.0	0.1

WESTON SOLUTIONS

RUN DATA

Number 3

Client: **Chemours**
Location: **CHEMOURS**
Source: **Polymers**

Calibration **1**

Project Number: **15418.002.009**
Operator: **SR**
Date: **18 Jan 2019**

Time	O_2 %	CO_2 %
11:50	21.0	0.1
11:51	21.0	0.1
11:52	21.0	0.1
11:53	21.0	0.1
11:54	21.0	0.1
11:55	21.0	0.1
11:56	21.0	0.1
11:57	21.0	0.1
11:58	21.0	0.1
11:59	21.0	0.1
	Port B	
12:27	20.9	0.1
12:28	20.9	0.1
12:29	20.9	0.1
12:30	20.9	0.1
12:31	20.9	0.1
12:32	20.9	0.1
12:33	20.9	0.1
12:34	20.9	0.1
12:35	21.0	0.1
12:36	21.0	0.1
12:37	21.0	0.1
12:38	21.0	0.1
12:39	21.0	0.1
12:40	21.0	0.1
12:41	21.0	0.1
12:42	21.0	0.1
12:43	21.0	0.1
12:44	21.0	0.1
12:45	21.0	0.1
12:46	21.0	0.1
12:47	21.0	0.1
12:48	21.0	0.1
12:49	21.0	0.1
12:50	21.0	0.1
12:51	21.0	0.1
12:52	21.0	0.1
12:53	21.0	0.1
12:54	21.0	0.1
12:55	21.0	0.1

RUN DATA
Number 3

Client:	**Chemours**	Project Number:	**15418.002.009**
Location:	**CHEMOURS**	Operator:	**SR**
Source:	**Polymers**	Date:	**18 Jan 2019**

Calibration **1**

Time	O_2 %	CO_2 %
12:56	21.0	0.1
12:57	21.0	0.1
12:58	21.0	0.1
12:59	21.0	0.1
13:00	21.0	0.1
13:01	21.0	0.1
13:02	21.0	0.1
13:03	21.0	0.1
13:04	21.0	0.1
13:05	21.0	0.1
13:06	21.0	0.1
13:07	21.0	0.1
13:08	21.0	0.1
13:09	21.0	0.1
13:10	21.0	0.1
13:11	21.0	0.1
13:12	21.0	0.1
13:13	21.0	0.1
13:14	21.0	0.1
13:15	21.0	0.1
	End Run 3	
Avgs	**21.0**	**0.1**

WESTON SOLUTIONS℠

RUN SUMMARY

Number 3

Client:	**Chemours**	Project Number:	**15418.002.009**
Location:	**CHEMOURS**	Operator:	**SR**
Source:	**Polymers**	Date:	**18 Jan 2019**

Calibration **1**

	O_2	**CO_2**
Method	EPA 3A	EPA 3A
Conc. Units	%	%

Time: 11:10 to 13:15

Run Averages

	21.0	0.1

Pre-run Bias at 11:08

Zero Bias	0.1	0.0
Span Bias	12.0	8.4
Span Gas	12.0	8.9

Post-run Bias at 13:34

Zero Bias	0.0	0.0
Span Bias	11.9	8.3
Span Gas	12.0	8.9

Run averages corrected for the average of the pre-run and post-run bias

	21.1	0.1

WESTON SOLUTIONS

BIAS AND CALIBRATION DRIFT

Number 3

Client: **Chemours**
Location: **CHEMOURS**
Source: **Polymers**

Calibration **1**

Project Number: **15418.002.009**
Operator: **SR**
Date: **18 Jan 2019**

Start Time: 13:34

O_2
Method: EPA 3A
Span Conc. 21.0 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.1	11.9	-0.2	-1.0	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.1	0.0	-0.1	-0.5	Pass
Span	12.0	11.9	-0.1	-0.5	Pass

*Bias No. 2

CO_2
Method: EPA 3A
Span Conc. 16.6 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	8.6	8.3	-0.3	-1.8	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	8.4	8.3	-0.1	-0.6	Pass

*Bias No. 2

APPENDIX C
LABORATORY ANALYTICAL REPORT

Note: The analytical report is included on the attached CD.

Client Sample Results

Client Sample ID: H-2501,2502 POLYMER STK R1 M0010 FH

Lab Sample ID: 140-14024-1
Date Collected: 01/17/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	1.67		0.151	0.0163	ug/Sample		01/28/19 10:24	02/04/19 10:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*106*		*50 - 200*	*01/28/19 10:24*	*02/04/19 10:49*	*1*

Client Sample ID: H-2503,2504,2506 POLYMER STK R1 M0010 BH

Lab Sample ID: 140-14024-2
Date Collected: 01/17/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	5.08		0.200	0.0400	ug/Sample		01/30/19 04:34	02/06/19 11:07	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*42*	*X*	*50 - 200*	*01/30/19 04:34*	*02/06/19 11:07*	*1*

Client Sample ID: H-2505 POLYMER STK R1 M0010 IMP 1,2&3 CONDENSATE

Lab Sample ID: 140-14024-3
Date Collected: 01/17/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.204	0.0104	ug/Sample		01/30/19 04:45	02/04/19 12:17	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*96*		*50 - 200*	*01/30/19 04:45*	*02/04/19 12:17*	*1*

Client Sample ID: H-2507 POLYMER STK R1 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-14024-4
Date Collected: 01/17/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.200	0.0400	ug/Sample		01/30/19 04:34	02/06/19 11:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*88*		*50 - 200*	*01/30/19 04:34*	*02/06/19 11:10*	*1*

Client Sample ID: H-2508,2509 POLYMER STK R2 M0010 FH

Lab Sample ID: 140-14024-5

Date Collected: 01/18/19 00:00
Date Received: 01/20/19 10:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	**0.975**		0.126	0.0136	ug/Sample		01/28/19 10:24	02/04/19 10:52	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*101*		*50 - 200*	*01/28/19 10:24*	*02/04/19 10:52*	*1*

Client Sample ID: H-2510,2511,2513 POLYMER STK R2 M0010 BH

Lab Sample ID: 140-14024-6

Date Collected: 01/18/19 00:00
Date Received: 01/20/19 10:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	**4.53**		0.200	0.0400	ug/Sample		01/30/19 04:34	02/06/19 11:13	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*48*	*X*	*50 - 200*	*01/30/19 04:34*	*02/06/19 11:13*	*1*

Client Sample ID: H-2512 POLYMER STK R2 M0010 IMP 1,2&3 CONDENSATE

Lab Sample ID: 140-14024-7

Date Collected: 01/18/19 00:00
Date Received: 01/20/19 10:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.194	0.00989	ug/Sample		01/30/19 04:45	02/04/19 12:20	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*93*		*50 - 200*	*01/30/19 04:45*	*02/04/19 12:20*	*1*

Client Sample ID: H-2514 POLYMER STK R2 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-14024-8

Date Collected: 01/18/19 00:00
Date Received: 01/20/19 10:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.200	0.0400	ug/Sample		01/30/19 04:34	02/06/19 11:20	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*81*		*50 - 200*	*01/30/19 04:34*	*02/06/19 11:20*	*1*

Client Sample ID: H-2515,2516 POLYMER STK R3 M0010 FH

Lab Sample ID: 140-14024-9
Date Collected: 01/18/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	1.07		0.151	0.0163	ug/Sample		01/28/19 10:24	02/04/19 10:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*103*		*50 - 200*	*01/28/19 10:24*	*02/04/19 10:55*	*1*

Client Sample ID: H-2517,2518,2520 POLYMER STK R3 M0010 BH

Lab Sample ID: 140-14024-10
Date Collected: 01/18/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	4.42		0.250	0.0500	ug/Sample		01/30/19 04:34	02/06/19 11:23	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*51*		*50 - 200*	*01/30/19 04:34*	*02/06/19 11:23*	*1*

Client Sample ID: H-2519 POLYMER STK R3 M0010 IMP 1,2&3 CONDENSATE

Lab Sample ID: 140-14024-11
Date Collected: 01/18/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.0492	J	0.194	0.00989	ug/Sample		01/30/19 04:45	02/04/19 12:23	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*78*		*50 - 200*	*01/30/19 04:45*	*02/04/19 12:23*	*1*

Client Sample ID: H-2521 POLYMER STK R3 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-14024-12
Date Collected: 01/18/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.0939	J	0.200	0.0400	ug/Sample		01/30/19 04:34	02/06/19 11:27	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*83*		*50 - 200*	*01/30/19 04:34*	*02/06/19 11:27*	*1*

Client Sample Results

Client: Chemours Company FC, LLC The
Project/Site: Polymer Stack Field QC Samples

TestAmerica Job ID: 140-14026-1

Client Sample ID: H-2522,2523 POLYMER STK QC M0010 FH BT

Lab Sample ID: 140-14026-1

Date Collected: 01/18/19 00:00
Date Received: 01/20/19 10:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.159		0.0260	0.00281	ug/Sample		01/28/19 10:24	02/04/19 11:02	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*89*		*50 - 200*	*01/28/19 10:24*	*02/04/19 11:02*	*1*

Client Sample ID: H-2524,2525,2527 POLYMER STK QC M0010 BH BT

Lab Sample ID: 140-14026-2

Date Collected: 01/18/19 00:00
Date Received: 01/20/19 10:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.412		0.200	0.0400	ug/Sample		01/30/19 04:34	02/06/19 11:30	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*75*		*50 - 200*	*01/30/19 04:34*	*02/06/19 11:30*	*1*

Client Sample ID: H-2526 POLYMER STK QC M0010 IMP 1,2&3 CONDENSATE BT

Lab Sample ID: 140-14026-3

Date Collected: 01/18/19 00:00
Date Received: 01/20/19 10:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.000392	J	0.00250	0.000128	ug/Sample		01/30/19 04:45	02/04/19 12:26	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*102*		*50 - 200*	*01/30/19 04:45*	*02/04/19 12:26*	*1*

Client Sample ID: H-2528 POLYMER STK QC M0010 BREAKTHROUGH XAD-2 RESIN TUBE BT

Lab Sample ID: 140-14026-4

Date Collected: 01/18/19 00:00
Date Received: 01/20/19 10:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.200	0.0400	ug/Sample		01/30/19 04:34	02/06/19 11:33	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*79*		*50 - 200*	*01/30/19 04:34*	*02/06/19 11:33*	*1*

Client Sample ID: H-2529 POLYMER STK QC M0010 DI WATER RB
Lab Sample ID: 140-14026-5

Date Collected: 01/18/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.00250	0.000128	ug/Sample		01/30/19 04:45	02/04/19 12:30	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*115*		*50 - 200*	*01/30/19 04:45*	*02/04/19 12:30*	*1*

Client Sample ID: H-2530 POLYMER STK QC M0010 MEOH WITH 5% NH4OH RB
Lab Sample ID: 140-14026-6

Date Collected: 01/18/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.0250	0.00500	ug/Sample		01/30/19 04:34	02/06/19 11:36	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*95*		*50 - 200*	*01/30/19 04:34*	*02/06/19 11:36*	*1*

Client Sample ID: H-2531 POLYMER STK QC M0010 XAD-2 RESIN TUBE RB
Lab Sample ID: 140-14026-7

Date Collected: 01/18/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.200	0.0400	ug/Sample		01/30/19 04:34	02/06/19 11:40	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*82*		*50 - 200*	*01/30/19 04:34*	*02/06/19 11:40*	*1*

Client Sample ID: H-2532 POLYMER STK QC M0010 MEOH WITH 5% NH4OH TB
Lab Sample ID: 140-14026-8

Date Collected: 01/18/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.0250	0.00500	ug/Sample		01/30/19 04:34	02/06/19 11:43	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*96*		*50 - 200*	*01/30/19 04:34*	*02/06/19 11:43*	*1*

Client Sample Results

Client Sample ID: H-2533 POLYMER STK QC M0010 XAD-2 RESIN TUBE TB

Lab Sample ID: 140-14026-9

Date Collected: 01/18/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.200	0.0400	ug/Sample		01/30/19 04:34	02/06/19 11:46	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*83*		*50 - 200*	*01/30/19 04:34*	*02/06/19 11:46*	*1*

Client Sample ID: H-2534 POLYMER STK QC M0010 COMBINED GLASSWARE RINSES (MEOH/5% NH4OH) PB

Lab Sample ID: 140-14026-10

Date Collected: 01/17/19 00:00
Matrix: Air
Date Received: 01/20/19 10:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	**0.00556**	**J**	0.0250	0.00500	ug/Sample		01/30/19 04:34	02/06/19 11:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*95*		*50 - 200*	*01/30/19 04:34*	*02/06/19 11:49*	*1*

APPENDIX D
SAMPLE CALCULATIONS

SAMPLE CALCULATIONS FOR
HFPO DIMER ACID (METHOD 0010)

Client: Chemours
Test Number: Run 1
Test Location: Polymer Stack

Plant: Fayetteville, NC
Test Date: 1/17/2019
Test Period: 1443-1641

1. HFPO Dimer Acid concentration, lbs/dscf.

$$C_1 = \frac{W \times 2.2046 \times 10^{-9}}{Vm(std)}$$

$$C_1 = \frac{6.8 \times 2.2046 \times 10\text{-}9}{58.636}$$

$$= 2.54E\text{-}10$$

Where:

W = Weight of HFPO Dimer Acid collected in sample in ug.

C_1 = Polymer Stack HFPO Dimer Acid concentration, lbs/dscf.

$2.2046x10^{-9}$ = Conversion factor from ug to lbs.

2. HFPO Dimer Acid concentration, ug/dscm.

C_2 = W / (Vm(std) x 0.02832)

C_2 = 6.8 / (58.636 x 0.02832)

= 4.06E+00

Where:

C_2 = HFPO Dimer Acid concentration, ug/dscm.

0.02832 = Conversion factor from cubic feet to cubic meters.

3. HFPO Dimer Acid mass emission rate, lbs/hr.

MR1 = C_1 x Qs(std) x 60 min/hr

MR1 = 2.54E-10 x 11910 x 60

= 1.81E-04

Where:

MR1 = Polymer Stack HFPO Dimer Acid mass emission rate, lbs/hr.

4. HFPO Dimer Acid mass emission rate, g/sec.

MR2 = PMR1 x 453.59 / 3600

MR2 = 1.81E-04 x 453.59 /3600

= 2.28E-05

Where:

MR2 = Polymer Stack HFPO Dimer Acid mass emission rate, g/sec.

454 = Conversion factor from pounds to grams.

= Conversion factor from hours to seconds.

EXAMPLE CALCULATIONS FOR
VOLUMETRIC FLOW AND MOISTURE AND ISOKINETICS

Client: Chemours | Facility: Fayetteville, NC
Test Number: Run 1 | Test Date: 1/17/19
Test Location: Polymer Stack | Test Period: 1443-1641

1. Volume of dry gas sampled at standard conditions (68 deg F, 29.92 in. Hg), dscf.

$$Vm(std) = \frac{17.64 \times Y \times Vm \times \left(Pb + \frac{\text{delta H}}{13.6} \right)}{(Tm + 460)}$$

$$Vm(std) = \frac{17.64 \times 1.0069 \times 57.360 \times \left(30.10 + \frac{1.313}{13.6} \right)}{64.67 + 460} = 58.636$$

Where:

Vm(std) =	Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscf.
Vm =	Volume of gas sample measured by the dry gas meter at meter conditions, dcf.
Pb =	Barometric Pressure, in Hg.
delt H =	Average pressure drop across the orifice meter, in H_2O
Tm =	Average dry gas meter temperature , deg F.
Y =	Dry gas meter calibration factor.
17.64 =	Factor that includes ratio of standard temperature (528 deg R) to standard pressure (29.92 in. Hg), deg R/in. Hg.
13.6 =	Specific gravity of mercury.

2. Volume of water vapor in the gas sample corrected to standard conditions, scf.

Vw(std) = (0.04707 x Vwc) + (0.04715 x Wwsg)

Vw(std) = (0.04707 x 6.0) + (0.04715 x 19.6) = 1.21

Where:

Vw(std) =	Volume of water vapor in the gas sample corrected to standard conditions, scf.
Vwc =	Volume of liquid condensed in impingers, ml.
Wwsg =	Weight of water vapor collected in silica gel, g.
0.04707 =	Factor which includes the density of water (0.002201 lb/ml), the molecular weight of water (18.0 lb/lb-mole), the ideal gas constant 21.85 (in. Hg) (ft^3)/lb-mole)(deg R); absolute temperature at standard conditions (528 deg R), absolute pressure at standard conditions (29.92 in. Hg), ft^3/ml.
0.04715 =	Factor which includes the molecular weight of water (18.0 lb/lb-mole), the ideal gas constant 21.85 (in. Hg) (ft^3)/lb-mole)(deg R); absolute temperature at standard conditions (528 deg R), absolute pressure at standard conditions (29.92 in. Hg), and 453.6 g/lb, ft^3/g.

3. Moisture content

$$bws = \frac{Vw(std)}{Vw(std) + Vm(std)}$$

$$bws = \frac{1.21}{1.21 + 58.636} = 0.020$$

Where:

bws = Proportion of water vapor, by volume, in the gas stream, dimensionless.

4. Mole fraction of dry gas.

Md = 1 - bws

Md = 1 - 0.020 = 0.980

Where:

Md = Mole fraction of dry gas, dimensionless.

5. Dry molecular weight of gas stream, lb/lb-mole.

MWd = (0.440 x % CO_2) + (0.320 x % O_2) + (0.280 x (% N_2 + % CO))

MWd = (0.440 x 0.0) + (0.320 x 20.9) + (0.280 x (79.1 + 0.00))

MWd = 28.84

Where:

MWd =	Dry molecular weight , lb/lb-mole.
% CO2 =	Percent carbon dioxide by volume, dry basis.
% O_2 =	Percent oxygen by volume, dry basis.
% N_2 =	Percent nitrogen by volume, dry basis.
% CO =	Percent carbon monoxide by volume, dry basis.
0.440 =	Molecular weight of carbon dioxide, divided by 100.
0.320 =	Molecular weight of oxygen, divided by 100.
0.280 =	Molecular weight of nitrogen or carbon monoxide, divided by 100.

6. Actual molecular weight of gas stream (wet basis), lb/lb-mole.

MWs = (MWd x Md) + (18 x (1 - Md))

MWs = (28.84 x 0.980) +(18 (1 - 0.980)) = 28.62

Where:

MWs =	Molecular weight of wet gas, lb/lb-mole.
18 =	Molecular weight of water, lb/lb-mole.

7. Average velocity of gas stream at actual conditions, ft/sec.

$$Vs = 85.49 \times Cp \times ((\text{delt } p)^{1/2})avg \times \left(\frac{Ts\ (avg)}{Ps \times MWs} \right)^{1/2}$$

$$Vs = 85.49 \times 0.84 \times 0.72582 \times \left(\frac{522}{30.08 \times 28.62} \right)^{1/2} = 40.6$$

Where:

Vs = Average gas stream velocity, ft/sec.

85.49 = Pitot tube constant, ft/sec x $\left(\frac{(lb/lb\text{-}mole)(in.\ Hg)}{(deg\ R)(in\ H_2O)} \right)^{1/2}$

Cp = Pitot tube coefficient, dimensionless.

Ts = Absolute gas stream temperature, deg R = Ts, deg F + 460.

Ps = Absolute gas stack pressure, in. Hg. = Pb + $\frac{P(static)}{13.6}$

delt p = Velocity head of stack, in. H_2O.

8. Average gas stream volumetric flow rate at actual conditions, wacf/min.

Qs(act) = 60 x Vs x As

Qs(act) = 60 x 40.6 x 4.91 = 11957

Where:

Qs(act) = Volumetric flow rate of wet stack gas at actual conditions, wacf/min.

As = Cross-sectional area of stack, ft^2.

60 = Conversion factor from seconds to minutes.

9. Average gas stream dry volumetric flow rate at standard conditions, dscf/min.

$$Qs(std) = 17.64 \times Md \times \frac{Ps}{Ts} \times Qs(act)$$

$$Qs(std) = 17.64 \times 0.980 \times \frac{30.08}{522.0} \times 11957$$

Qs(std) = 11910

Where:

Qs(std) = Volumetric flow rate of dry stack gas at standard conditions, dscf/min.

10. Isokinetic variation calculated from intermediate values, percent.

$$I = \frac{17.327 \times Ts \times Vm(std)}{Vs \times O \times Ps \times Md \times (Dn)^2}$$

$$I = \frac{17.327 \times 522 \times 58.636}{40.6 \times 96 \times 30.08 \times 0.980 \times (0.218)^2} = 97.2$$

Where:

I =	Percent of isokinetic sampling.
O =	Total sampling time, minutes.
Dn =	Diameter of nozzle, inches.
17.327 =	Factor which includes standard temperature (528 deg R), standard pressure (29.92 in. Hg), the formula for calculating area of circle $D^{2/4}$, conversion of square feet to square inches (144), conversion of seconds to minutes (60), and conversion to percent (100), $\frac{(in.\ Hg)(in^2)(min)}{(deg\ R)(ft^2)(sec)}$

APPENDIX E
EQUIPMENT CALIBRATION RECORDS

Sample and Velocity Traverse Point Data Sheet - Method 1

Client: Chemours Operator: SR

Loaction/Plant: Fayetteville Date: 3/21/18

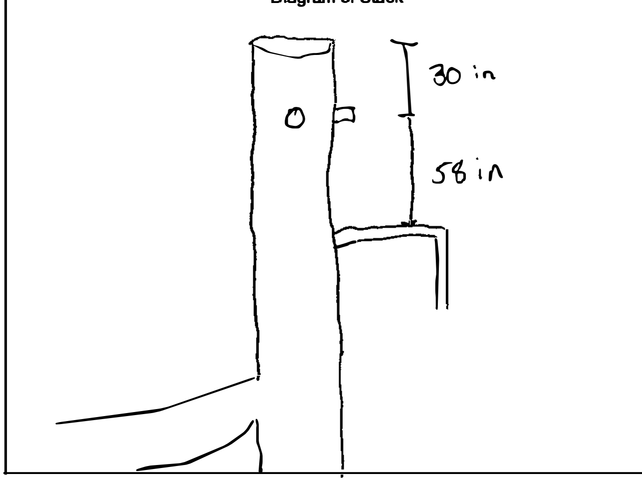
Source: Polymers W.O. Number:

Duct Type	☐ Circular	☐ Rectangular Duct	Indicate appropriate type	
Traverse Type	☐ Particulate Traverse	☐ Velocity Traverse	☐ CEM Traverse	

Distance from far wall to outside of port (in.) = C	48
Port Depth (in.) = D	18
Depth of Duct, diameter (in.) = C-D	30
Area of Duct (ft^2)	4.91
Total Traverse Points	24
Total Traverse Points per Port	12
Port Diameter (in.) —(Flange-Threaded-Hole)	
Monorail Length	
Rectangular Ducts Only	
Width of Duct, rectangular duct only (in.)	
Total Ports (rectangular duct only)	
Equivalent Diameter = (2*L*W)/(L+W)	

Flow Disturbances	
Upstream - A (ft)	2.5
Downstream - B (ft)	4.83
Upstream - A (duct diameters)	1.0
Downstream - B (duct diameters)	1.9

Diagram of Stack



Traverse Point Locations

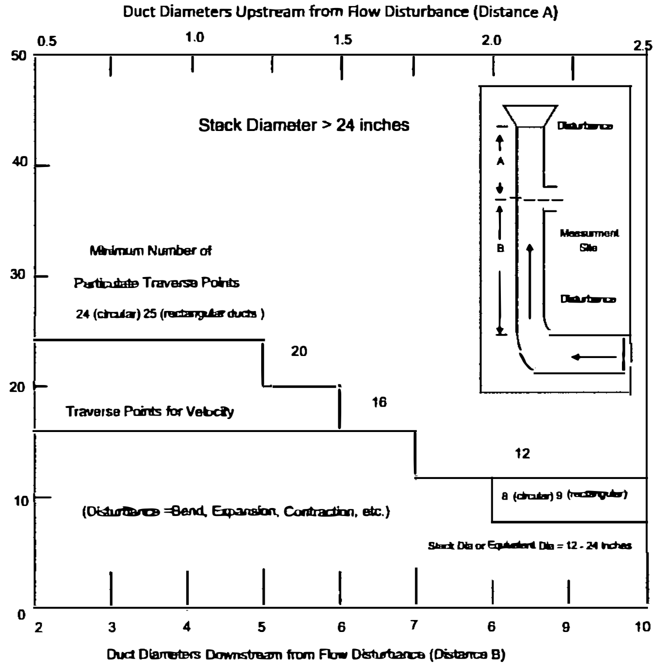
Traverse Point	% of Duct	Distance from Inside Duct Wall (in)	Distance from Outside of Port (in)
1	2.1	1	19
2	6.7	2	20
3	11.8	3 1/2	21 1/2
4	17.7	5 1/4	23 1/4
5	25	7 1/2	25 1/2
6	35.6	10 5/8	28 5/8
7	64.4	19 3/8	37 3/8
8	75	22 1/2	40 1/2
9	82.3	24 3/4	42 3/4
10	88.2	26 1/2	44
11	93.3	28	46
12	97.9	29	47

CEM 3 Point(Long Measurement Line) Stratification Point Locations

1	0.167		
2	0.50		
3	0.833		

Note: If stack dia < 12 inch use EPA Method 1A
(Sample port upstream of pitot port)

Note: If stack dia >24" then adjust traverse point to 1 inch from wall
If stack dia <24" then adjust traverse point to 0.5 inch from wall



Traverse Point Location Percent of Stack -Circular

Traverse Point Location	1	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		14.6		10.5		8.2		6.7
3				75		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
6						95.6		80.6		65.8		35.6
7								89.5		77.4		64.4
8								96.8		85.4		75
9										91.8		82.3
10										97.4		88.2
11												93.3
12												97.9

Traverse Point Location Percent of Stack -Rectangular

Traverse Point Location	1	2	3	4	5	6	7	8	9	10	11	12
1		25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2		75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3			83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4				87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5					90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6						91.7	78.6	68.8	61.1	55.0	50.0	45.8
7							92.9	81.3	72.2	65.0	59.1	54.2
8								93.8	83.3	75.0	68.2	62.5
9									94.4	85.0	77.3	70.8
10										95.0	86.4	79.2
11											95.5	87.5
12												95.8

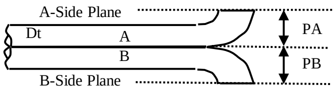
Type S Pitot Tube Inspection Data Form

Pitot Tube Identification Number: **P-702**

Inspection Date 5/30/18 Individual Conducting Inspection SR

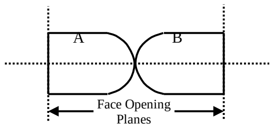
If all Criteria PASS
Cp is equal to 0.84

PASS/FAIL

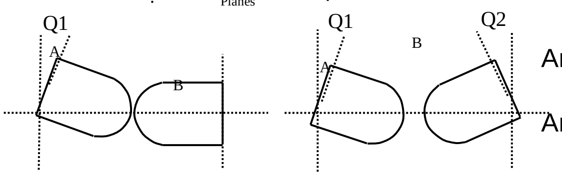


Distance to A Plane (PA) - inches 0.472 PASS
Distance to B Plane (PB) - inches 0.472 PASS
Pitot OD (D_t) - inches 0.375

$1.05\ D_t < P < 1.5\ D_t$ PA must Equal PB

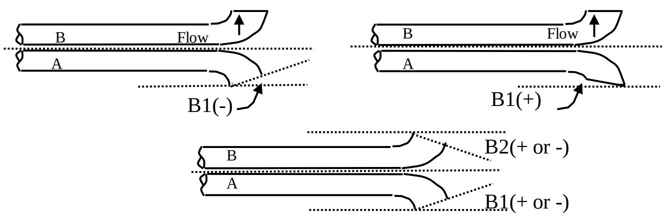


Are Open Faces Aligned Perpendicular to the Tube Axis ◉ YES ○ NO PASS



Angle of Q1 from vertical A Tube-degrees (absolute) 0 PASS
Angle of Q2 from vertical B Tube-degrees (absolute) 0 PASS

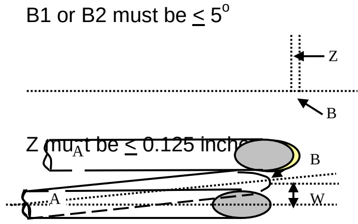
Q1 and Q2 must be $\leq 10^{o}$



Angle of B1 from vertical A Tube-degrees (absolute) 0 PASS

Angle of B1 from vertical B Tube-degrees (absolute) 0 PASS

B1 or B2 must be $\leq 5^{o}$

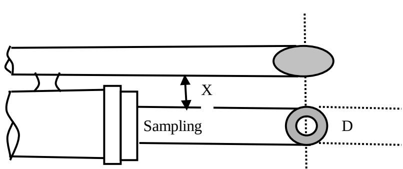


Z must be ≤ 0.125 inches

Horizontal offset between A and B Tubes (Z) - inches 0.01 PASS

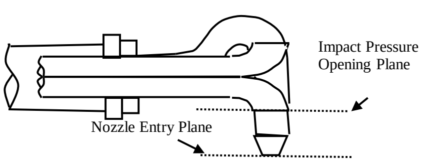
Vertical offset between A and B Tubes (W) - inches 0.023 PASS

W must be ≤ 0.03125 inches

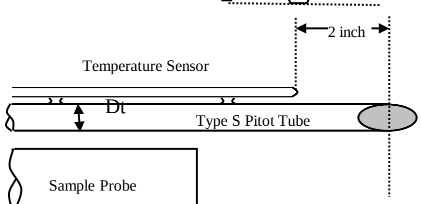


X must be ≥ 0.75 inches

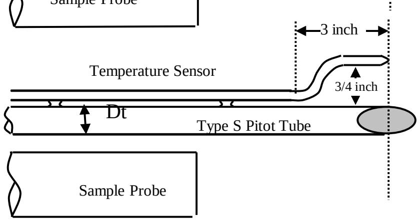
Distance between Sample Nozzle and Pitot (X) - inches 0.92 PASS



Impact Pressure Opening Plane is above the Nozzle Entry Plane ◉ YES ○ NO ○ NA



Thermocouple meets the Distance Criteria in the adjacent figure ◉ YES ○ NO ○ NA



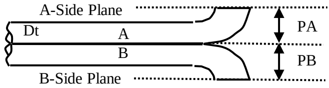
Thermocouple meets the Distance Criteria in the adjacent figure ○ YES ○ NO ◉ NA

Type S Pitot Tube Inspection Data Form

Pitot Tube Identification Number: **P-704**

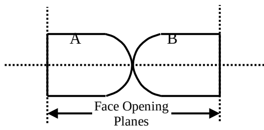
Inspection Date 5/30/18 Individual Conducting Inspection SR

If all Criteria PASS
Cp is equal to 0.84

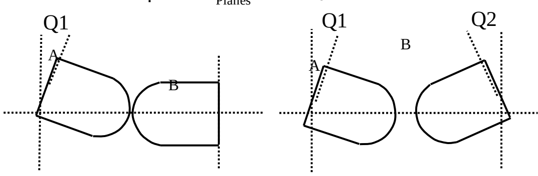


$1.05\ D_t < P < 1.5\ D_t$ PA must Equal PB

		PASS/FAIL
Distance to A Plane (PA) - inches	0.46	PASS
Distance to B Plane (PB) - inches	0.46	PASS
Pitot OD (D_t) - inches	0.375	

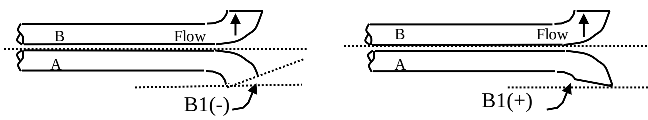


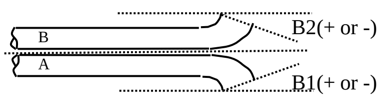
Are Open Faces Aligned Perpendicular to the Tube Axis ◉ YES ○ NO PASS



Q1 and Q2 must be ≤ 10°

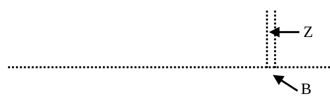
Angle of Q1 from vertical A Tube- degrees (absolute)	0	PASS
Angle of Q2 from vertical B Tube- degrees (absolute)	0	PASS



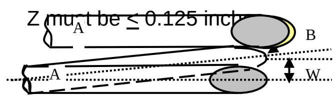


B1 or B2 must be ≤ 5°

Angle of B1 from vertical A Tube- degrees (absolute)	0	PASS
Angle of B1 from vertical B Tube- degrees (absolute)	0	PASS

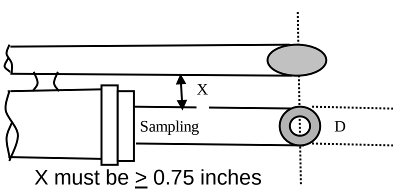


Z must be ≤ 0.125 inches



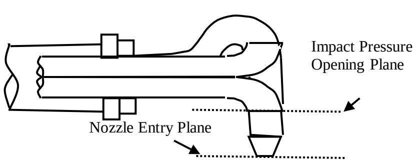
W must be ≤ 0.03125 inches

Horizontal offset between A and B Tubes (Z) - inches	0.015	PASS
Vertical offset between A and B Tubes (W) - inches	0.025	PASS

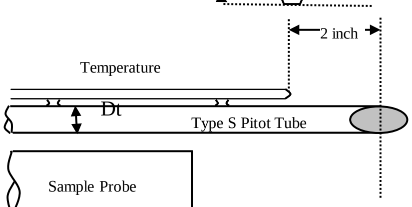


X must be ≥ 0.75 inches

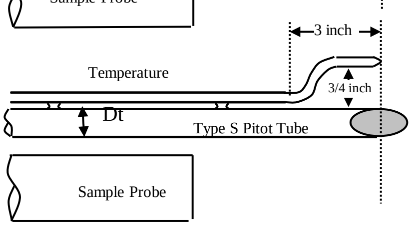
Distance between Sample Nozzle and Pitot (X) - inches	0.79	PASS



Impact Pressure Opening Plane is above the Nozzle Entry Plane ◉ YES ○ NO ○ NA



Thermocouple meets the Distance Criteria in the adjacent figure ◉ YES ○ NO ○ NA



Thermocouple meets the Distance Criteria in the adjacent figure ○ YES ○ NO ◉ NA

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E03NI79E15A00E4	Reference Number:	82-401288926-1
Cylinder Number:	CC18055	Cylinder Volume:	150.5 CF
Laboratory:	124 - Riverton (SAP) - NJ	Cylinder Pressure:	2015 PSIG
PGVP Number:	B52018	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Sep 04, 2018

Expiration Date: Sep 04, 2026

Certification performed in accordance with “EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)” document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	9.000 %	8.864 %	G1	+/- 0.7% NIST Traceable	09/04/2018
OXYGEN	12.00 %	12.00 %	G1	+/- 0.4% NIST Traceable	09/04/2018
NITROGEN	Balance			-	

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060629	CC413730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 09, 2019

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA 510-CO2-19GYCXEG	NDIR	Aug 09, 2018
Horiba MPA 510-O2-7TWMJ041	Paramagnetic	Aug 09, 2018

Triad Data Available Upon Request

Signature on file
Approved for Release

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

Airgas
an Air Liquide company

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E03NI62E15A0224	Reference Number:	82-401044874-1
Cylinder Number:	SG9169108	Cylinder Volume:	157.2 CF
Laboratory:	124 - Riverton (SAP) - NJ	Cylinder Pressure:	2015 PSIG
PGVP Number:	B52017	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Nov 18, 2017

Expiration Date: Nov 18, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	17.00 %	16.58 %	G1	+/- 0.7% NIST Traceable	11/18/2017
OXYGEN	21.00 %	21.00 %	G1	+/- 0.5% NIST Traceable	11/18/2017
NITROGEN	Balance			-	

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061336	CC360792	11.002 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2018
NTRM	09061415	CC273526	22.53 % OXYGEN/NITROGEN	+/- 0.4%	Mar 08, 2019

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA 510-CO2-19GYCXEG	NDIR	Oct 30, 2017
Horiba MPA 510-O2-7TWMJ041	Paramagnetic	Oct 27, 2017

Triad Data Available Upon Request

Signature on file
Approved for Release

INTERFERENCE CHECK

Date: 12/4/14-12/5/14
Analyzer Type: Servomex - O_2
Model No: 4900
Serial No: 49000-652921
Calibration Span: 21.09 %
Pollutant: 21.09% O_2 - CC418692

INTERFERENT GAS	ANALYZER RESPONSE		% OF CALIBRATION SPAN[(a)]
	INTERFERENT GAS RESPONSE (%)	INTERFERENT GAS RESPONSE, WITH BACKGROUND POLLUTANT (%)	
CO_2 (30.17% CC199689)	0.00	-0.01	0.00
NO (445 ppm CC346681)	0.00	0.02	0.11
NO_2 (23.78 ppm CC500749)	NA	NA	NA
N_2O (90.4 ppm CC352661)	0.00	0.05	0.24
CO (461.5 ppm XC006064B)	0.00	0.02	0.00
SO_2 (451.2 ppm CC409079)	0.00	0.05	0.23
CH_4 (453.1 ppm SG901795)	NA	NA	NA
H_2 (552 ppm ALM048043)	0.00	0.09	0.44
HCl (45.1 ppm CC17830)	0.00	0.03	0.14
NH_3 (9.69 ppm CC58181)	0.00	0.01	0.03
TOTAL INTERFERENCE RESPONSE			**1.20**
METHOD SPECIFICATION			**< 2.5%**

(a) The larger of the absolute values obtained for the interferent tested with and without the pollutant present was used in summing the interferences.

Chad Walker

INTERFERENCE CHECK

Date: 12/4/14-12/5/14
Analyzer Type: Servomex - CO_2
Model No: 4900
Serial No: 49000-652921
Calibration Span: 16.65%
Pollutant: 16.65% CO_2 - CC418692

INTERFERENT GAS	ANALYZER RESPONSE		% OF CALIBRATION SPAN[a]
	INTERFERENT GAS RESPONSE (%)	INTERFERENT GAS RESPONSE, WITH BACKGROUND POLLUTANT (%)	
CO_2 (30.17% CC199689)	NA	NA	NA
NO (445 ppm CC346681)	0.00	0.02	0.10
NO_2 (23.78 ppm CC500749)	0.00	0.00	0.02
N_2O (90.4 ppm CC352661)	0.00	0.01	0.04
CO (461.5 ppm XC006064B)	0.00	0.01	0.00
SO_2 (451.2 ppm CC409079)	0.00	0.11	0.64
CH_4 (453.1 ppm SG901795)	0.00	0.07	0.44
H_2 (552 ppm ALM048043)	0.00	0.04	0.22
HCl (45.1 ppm CC17830)	0.10	0.06	0.60
NH_3 (9.69 ppm CC58181)	0.00	0.02	0.14
TOTAL INTERFERENCE RESPONSE			**2.19**
METHOD SPECIFICATION			**< 2.5%**

[a] The larger of the absolute values obtained for the interferent tested with and without the pollutant present was used in summing the interferences.

Chad Walker

Long Cal and Temperature Cal Datasheet for Standard Dry Gas Meter Console

Calibrator MDW **Meter Box Number** 12 **Ambient Temp** 72

Date 10-Sep-18 **Wet Test Meter Number** P-2952 **Temp Reference Source** Thermocouple Simulator (Accuracy +/- 1°F)

Dry Gas Meter Number 14244707

Baro Press, in Hg (Pb)	29.96

Setting Orifice Manometer in H_20 (ΔH)	Gas Volume Wet Test Meter ft^3 (Vw)	Gas Volume Dry gas Meter ft^3 (Vd)	Temperatures Wet Test Meter °F (Tw)	Temperatures Dry Gas Meter Outlet, °F (Td_o)	Time, min (O)	Calibration Results Y	Calibration Results ΔH
0.5	5.0	885.853	73.0	75.00	12.60	1.0097	1.7823
		890.822		76.00			
		4.969		75.50			
1.0	5.0	892.810	73.0	76.00	9.1	1.0071	1.8559
		897.795		77.00			
		4.985		76.50			
1.5	10.0	898.799	73.0	77.00	15.20	1.0036	1.9381
		908.810		78.00			
		10.011		77.50			
2.0	10.0	915.870	73.0	78.00	13.1	1.0094	1.9158
		925.830		79.00			
		9.960		78.50			
3.0	10.0	926.870	73.0	79.00	10.70	1.0048	1.9137
		936.870		80.00			
		10.000		79.50			
						1.0069	**1.8812**

Vw - Gas Volume passing through the wet test meter
Vd - Gas Volume passing through the dry gas meter
Tw - Temp of gas in the wet test meter
Tdi - Temp of the inlet gas of the dry gas meter
Tdo - Temp of the outlet gas of the dry gas meter
Td - Average temp of the gas in the dry gas meter

0 - Time of calibration run
Pb - Barometric Pressure
ΔH - Pressure differential across orifice
Y - Ratio of accuracy of wet test meter to dry gas meter

$$Y = \frac{Vw * Pb * (td + 460)}{Vd * \left[Pb + \frac{(\Delta H)}{13.6}\right] * (tw + 460)}$$

$$\Delta H = \left[\frac{0.0317 * \Delta H}{Pb * (td + 460)}\right] * \left[\frac{(tw + 460) * O}{Vw}\right]^2$$

Reference Temperature Select Temperature ○ °C ◉ °F	Temperature Reading from Individual Thermocouple Input [1] Channel Number 1	2	3	4	5	6	Average Temperature Reading	Temp Difference [2] (%)
32	32	32	32	32	32	32	32.0	0.0%
212	212	212	212	212	212	212	212.0	0.0%
932	932	932	932	932	932	932	932.0	0.0%
1832	1834	1834	1834	1834	1834	1834	1834.0	-0.1%

1 - Channel Temps must agree with +/- 5°F or 3°C

2 - Acceptable Temperature Difference less than 1.5 %

$$\text{Temp Diff} = \left[\frac{(\text{Reference Temp}(°F) + 460) - (\text{Test Temp}(°F) + 460)}{\text{Reference Temp}(°F) + 460}\right]$$

WESTON SOLUTIONS

Y Factor Calibration Check Calculation

POLYMER STACK

METER BOX NO. 12

1/17/2019-1/18/2019

	Run 1	Run 2	Run 3
MWd = Dry molecular weight source gas, lb/lb-mole.			
0.32 = Molecular weight of oxygen, divided by 100.			
0.44 = Molecular weight of carbon dioxide, divided by 100.			
0.28 = Molecular weight of nitrogen or carbon monoxide, divided by 100.			
% CO_2 = Percent carbon dioxide by volume, dry basis.	0.0	0.0	0.0
% O_2 = Percent oxygen by volume, dry basis.	20.9	20.9	20.9

MWd = (0.32 * O_2) + (0.44 * CO_2) + (0.28 * (100 - (CO_2 + O_2)))

MWd = (0.32 * 20.9) + (0.44 * 0) + (0.28 * (100 - (0 + 20.9)))

MWd = (6.69) + (0.00) + (22.15)

	Run 1	Run 2	Run 3
MWd =	28.84	28.84	28.84

	Run 1	Run 2	Run 3
Tma = Source Temperature, absolute(°R)			
Tm = Average dry gas meter temperature , deg F.	64.7	49.4	61.7

Tma = Ts + 460

Tma = 64.67 + 460

	Run 1	Run 2	Run 3
Tma =	524.67	509.42	521.67

	Run 1	Run 2	Run 3
Ps = Absolute meter pressure, inches Hg.			
13.60 = Specific gravity of mercury.			
delta H = Avg pressure drop across the orifice meter during sampling, in H2O	1.31	1.43	1.50
Pb = Barometric Pressure, in Hg.	30.10	30.01	30.01

Pm = Pb + (delta H / 13.6)

Pm = 30.1 + (1.3125 / 13.6)

	Run 1	Run 2	Run 3
Pm =	30.20	30.12	30.12

	Run 1	Run 2	Run 3
Yqa = dry gas meter calibration check value, dimensionless.			
0.03 = (29.92/528)(0.75)2 (in. Hg/°/R) cfm2.			
29.00 = dry molecular weight of air, lb/lb-mole.			
Vm = Volume of gas sample measured by the dry gas meter at meter conditions, dcf.	57.360	58.671	60.644
Y = Dry gas meter calibration factor (based on full calibration)	1.0069	1.0069	1.0069
Delta H@ = Dry Gas meter orifice calibration coefficient, in. H2O.	1.8812	1.8812	1.8812
avg SQRT Delta H = Avg SQRT press. drop across the orifice meter during sampling , in. H_2O	1.1390	1.1950	1.2238
O = Total sampling time, minutes.	96	96	96

Yqa = (O / Vm) * SQRT (0.0319 * Tma * 29) / (Delta H@ * Pm * MWd) * avg SQRT Delta H

Yqa = (96.00 / 57.36) * SQRT (0.0319 * 524.67 * 29) / (1.88 * 30.20 * 28.84) * 1.14

Yqa = 1.674 * SQRT 485.369 / 1,638.238 * 1.14

	Run 1	Run 2	Run 3
Yqa =	1.0376	1.0501	1.0501

	Run 1	Run 2	Run 3
Diff = Absolute difference between Yqa and Y	3.05	4.29	4.29

Diff = ((Y - Yqa) / Y) * 100

Diff = ((1.0069 - 1.038) / 1.0069) * 100

Average Diff = 3.88

Allowable = 5.0

APPENDIX F
LIST OF PROJECT PARTICIPANTS

The following WESTON employees participated in this project.

Paul Meeter	Senior Project Manager
Wes Fritz	Team Member
Matt Winkeler	Team Member
Steve Rathfon	Team Member
Kyle Schweitzer	Team Member