PPA MANUFACTURING PROCESS
EMISSIONS TEST REPORT
TEST DATES: 07-08 JANUARY 2019

THE CHEMOURS COMPANY
FAYETTEVILLE, NORTH CAROLINA

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TABLE OF CONTENTS

Section **Page**

LIST OF FIGURES

Title **Page**

LIST OF TABLES

Title **Page**

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 Polymer Processing Aid (PPA) manufacturing areas, Wastewater Treatment, and Powerhouse.

Chemours contracted Weston Solutions, Inc. (Weston) to perform HFPO Dimer Acid emission testing on the PPA Stack. Testing was performed on 7-8 January 2019 and generally followed the "Emissions 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 from the PPA process stack which is located in the PPA process area.
- 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 were measured on the PPA process stack source.

Table 1-1 provides a summary of the test locations 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 PPA Process Stack

Sampling Point & Location	**PPA Process Stack**				
Number of Tests:	3				
Parameters To Be Tested:	HFPO Dimer Acid (HFPO-DA)	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 PPA process 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
PPA Process Stack	1	1.32E-04	1.66E-05
	2	1.40E-04	1.76E-05
	3	1.14E-04	1.44E-05
	Average	1.29E-04	1.62E-05

3. PROCESS DESCRIPTIONS

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

3.1 POLYMER PROCESSING AID (PPA) AREA

The PPA facility produces surfactants used to produce fluoropolymer products at other Chemours facilities, such as Teflon®, as well as sales to outside producers of fluoropolymers.

Process streams are vented to a caustic wet scrubber (ACD-A1), carbon bed and vented to a process stack (AEP-A1). The process inside the building is under negative pressure and the building air is vented to the process stack (AEP-A1) and the carbon bed.

3.2 PROCESS OPERATIONS AND PARAMETERS

Source	Operation/Product	Batch or Continuous
PPA	AF Column Reboiler/Virgin	Continuous once it starts taking off to feed tank
	Pressure Transfers/Virgin or Purified	Batch (pressure transfers from one vessel to another – every 2 hours)

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

- PPA Process
  - Caustic Wet Scrubber (ACD-A1)
    - Caustic recirculation flow rate
    - Differential pressure across the packing

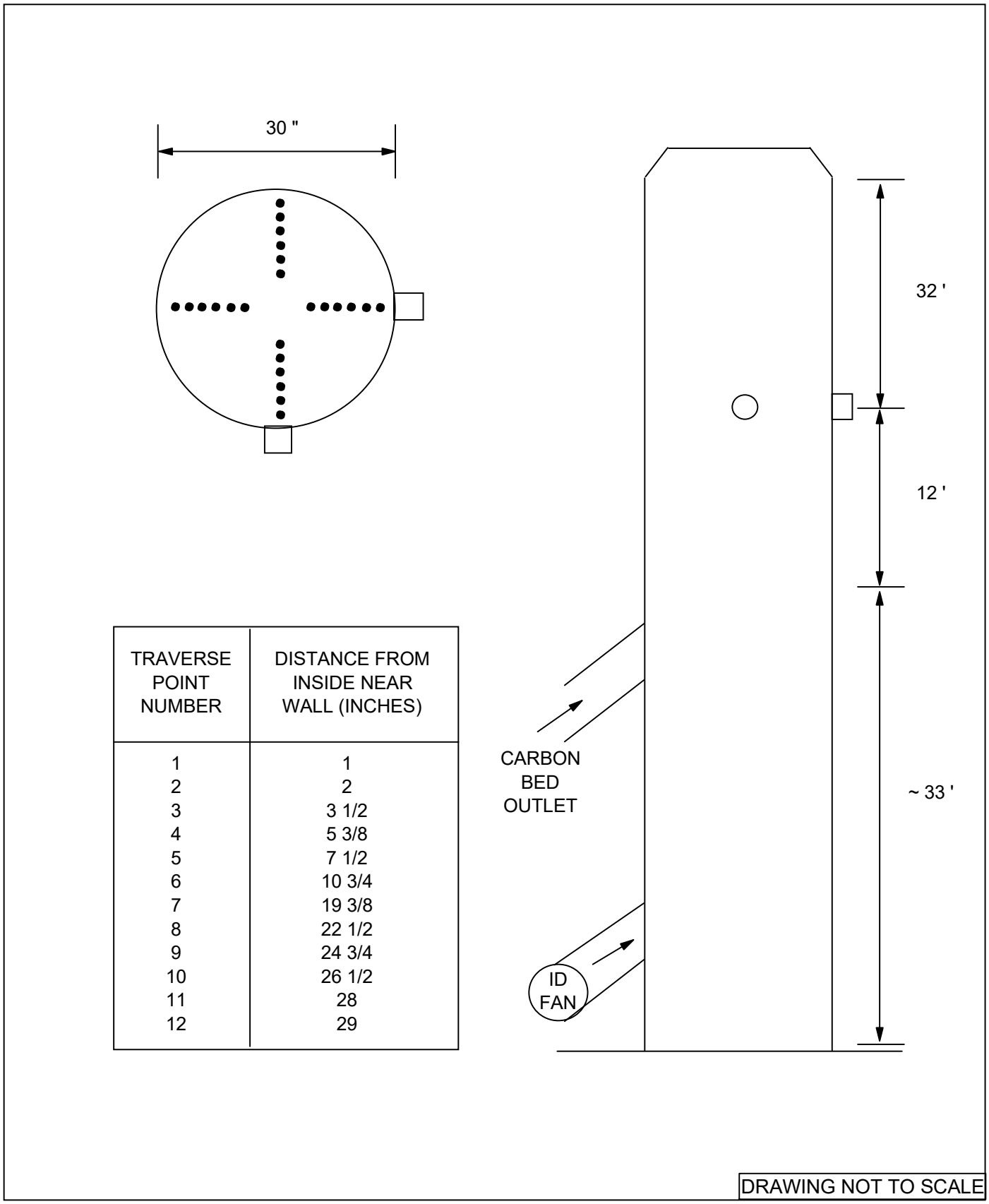
4. DESCRIPTION OF TEST LOCATIONS

4.1 PPA PROCESS STACK

Two 4-inch ID test ports are in place on the 30-inch ID fiberglass stack. The ports are 12 feet (4.8 diameters) from the nearest downstream disturbance (carbon bed outlet) and 32 feet (12.8 diameters) from the nearest upstream disturbance (stack exit).

Per EPA Method 1, a total of 24 traverse points (12 per axis) were used for M-0010 isokinetic 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 3/8
5	7 1/2
6	10 3/4
7	19 3/8
8	22 1/2
9	24 3/4
10	26 1/2
11	28
12	29

FIGURE 4-1
PPA PROCESS STACK TEST PORT
AND TRAVERSE POINT LOCATION

IASDATA\CHEMOURS\15418.002.009\FIGURE 4-1 PPA EXHAUST STACK

5. SAMPLING AND ANALYTICAL METHODS

5.1 STACK GAS SAMPLING PROCEDURES

The purpose of this section is to describe the stack gas emissions sampling train 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 was 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 check was negative (< 20°) verifying that the source were 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.

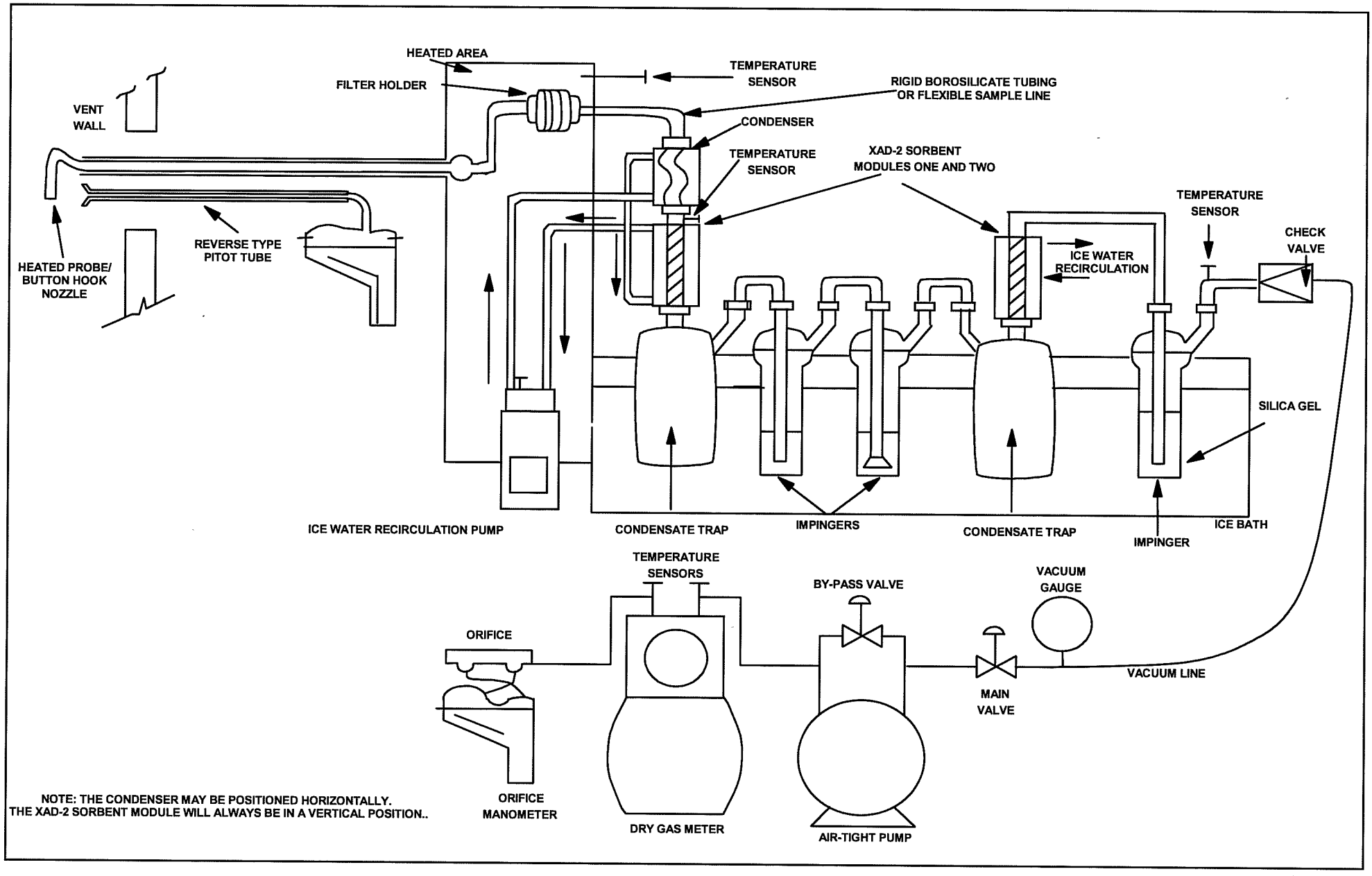


FIGURE 5-1
EPA METHOD 0010 SAMPLING TRAIN

IASDATA\CHEMOURS\15418.002.009\FIGURE 5-1 METHOD 0010

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 at 100% ± 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 impingers one and two, and the second condensate trap, were measured, the values recorded, and the sample was placed in the same container as Step 4 above, then 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 set up near the test location, leak checked and recovered along with the respective sample train. Following sample recovery, all samples were transported to TestAmerica Laboratories, Inc. (TestAmerica) for sample extraction and analysis.

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

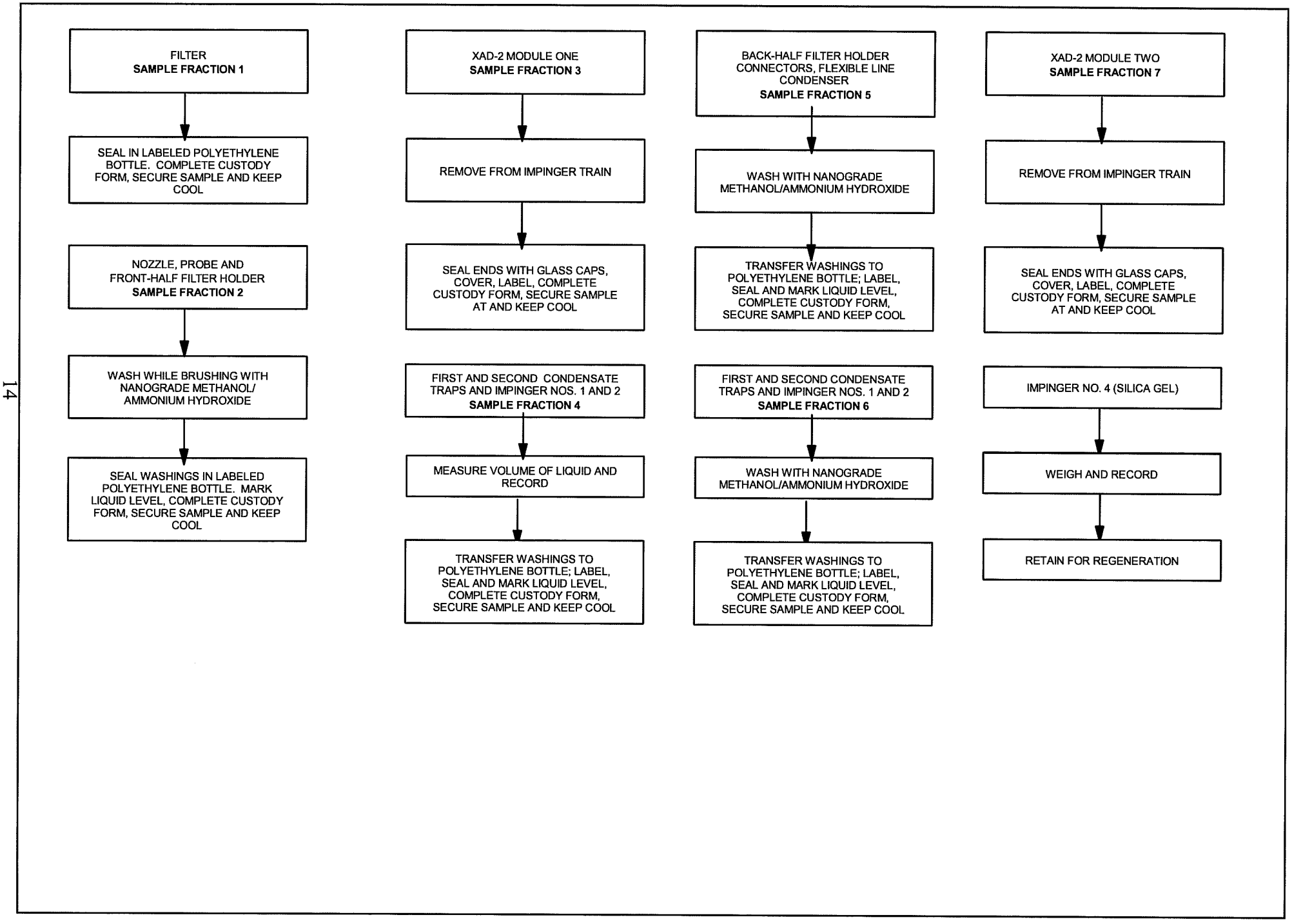


FIGURE 5-2
HFPO DIMER ACID SAMPLE RECOVERY PROCEDURES FOR METHOD 0010

IASDATA\CHEMOURS\15418.002.009\FIGURE 5-2 EPA 0010 PG 14

5.2.3 EPA Method 0010 – Sample Analysis

The 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 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.

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.

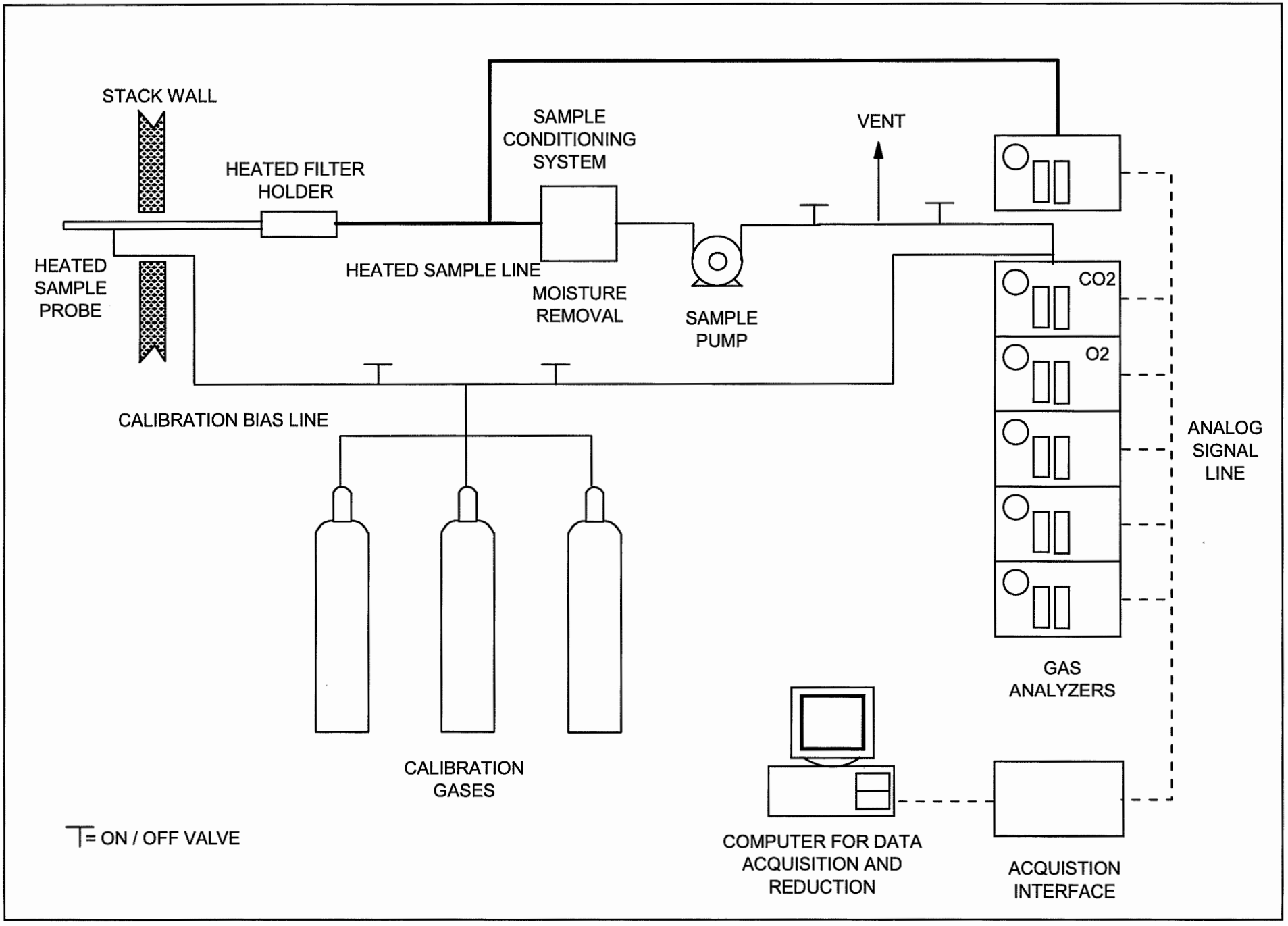


FIGURE 5-3
WESTON SAMPLING SYSTEM

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

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 PPA process stack.

Table 6-1 provides detailed test data and test results for the PPA process stack.

The Method 3A sampling on all sources 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
PPA PROCESS STACK

Test Data			
Run number	1	2	3
Location	PPA Stack	PPA Stack	PPA Stack
Date	01/07/19	01/08/19	01/08/19
Time period	1240-1430	0800-0950	1053-1255
SAMPLING DATA:			
Sampling duration, min.	96.0	96.0	96.0
Nozzle diameter, in.	0.190	0.190	0.190
Cross sectional nozzle area, sq.ft.	0.000197	0.000197	0.000197
Barometric pressure, in. Hg	30.40	30.08	30.08
Avg. orifice press. diff., in H_2O	0.71	0.59	0.62
Avg. dry gas meter temp., deg F	65.8	51.5	65.2
Avg. abs. dry gas meter temp., deg. R	526	511	525
Total liquid collected by train, ml	19.2	19.5	25.2
Std. vol. of H_2O vapor coll., cu.ft.	0.9	0.9	1.2
Dry gas meter calibration factor	0.9915	0.9915	0.9915
Sample vol. at meter cond., dcf	44.005	40.425	42.900
Sample vol. at std. cond., dscf [1]	44.579	41.643	43.038
Percent of isokinetic sampling	103.6	103.7	106.6
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	0.022	0.027
Mole fraction of dry gas	0.980	0.978	0.973
Molecular wt. of wet gas, lb/lb mole	28.62	28.60	28.55
GAS STREAM VELOCITY AND VOLUMETRIC FLOW DATA:			
Static pressure, in. H_2O	0.23	0.23	0.23
Absolute pressure, in. Hg	30.42	30.10	30.10
Avg. temperature, deg. F	62	73	68
Avg. absolute temperature, deg.R	522	533	528
Pitot tube coefficient	0.84	0.84	0.84
Total number of traverse points	24	24	24
Avg. gas stream velocity, ft./sec.	37.7	36.3	36.4
Stack/duct cross sectional area, sq.ft.	4.90	4.90	4.90
Avg. gas stream volumetric flow, wacf/min.	11073	10677	10703
Avg. gas stream volumetric flow, dscf/min.	11155	10414	10470

[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
PPA PROCESS STACK

TEST DATA			
Run number	1	2	3
Location	PPA Stack	PPA Stack	PPA Stack
Date	01/07/19	01/08/19	01/08/19
Time period	1240-1430	0800-0950	1053-1255
LABORATORY REPORT DATA, ug.			
HFPO Dimer Acid	3.9945	4.2320	3.5520
EMISSION RESULTS, ug/dscm.			
HFPO Dimer Acid	3.16	3.59	2.91
EMISSION RESULTS, lb/dscf.			
HFPO Dimer Acid	1.98E-10	2.24E-10	1.82E-10
EMISSION RESULTS, lb/hr.			
HFPO Dimer Acid	1.32E-04	1.40E-04	1.14E-04
EMISSION RESULTS, g/sec.			
HFPO Dimer Acid	1.66E-05	1.76E-05	1.44E-05

APPENDIX A
PROCESS OPERATIONS DATA

Date 1/7/2019

Time	1100	1100				1200			1300				1400				1500			
Stack Testing									Run 1 - 1240-1430											
A/F column Feed Ratev (pounds per hour)																				
Charging water to Hyd - venting																				
Charging Sulfuric acid - venting																				
Hydrolysis - Wash Tank pressure Transfer to Hydrolysis																				
Hydrolysis - Phase Settle													1:45 to 2:30							
Vap heels pressure transfer																				
Vap cycle									12:45 to 1:30											
Venting after press tran from North/South Acid tank to Hyd																				
DAF tran to Hyd - venting during transfer									12:45 to 1:45											
Hydrolysis - transfer to Waste Acid Trailer																				
Scrubber Recirculation Flow	38 gpm																			
Scrubber dP	less than 0.5 inwc																			

Date 1/8/2019

Time	1100	800				900			1000					1100				1200			
Stack Testing		Run 2 - 0800-0950												Run 3 - 1053-1255							
A/F column Feed Ratev (pounds per hour)																					
Charging water to Hyd - venting																					
Charging Sulfuric acid - venting																					
Hydrolysis - Wash Tank pressure Transfer to Hydrolysis																					
Hydrolysis - Phase Settle					8:45 to 9:30									No transfers							
Vap heels pressure transfer																					
Vap cycle																					
Venting after press tran from North/South Acid tank to Hyd																					
DAF tran to Hyd - venting during transfer		8 am to 8:45												No transfers							
Hydrolysis - transfer to Waste Acid Trailer																					
Scrubber Recirculation Flow	38 gpm for duration																				
Scrubber dP	less than 0.5 inwc for duration																				

APPENDIX B
RAW AND REDUCED TEST DATA

CHEMOURS - FAYETTEVILLE, NC
INPUTS FOR HFPO DIMER ACID CALCULATIONS
PPA PROCESS STACK

Test Data			
Run number	1	2	3
Location	PPA Stack	PPA Stack	PPA Stack
Date	01/07/19	01/08/19	01/08/19
Time period	1240-1430	0800-0950	1053-1255
Operator	AS/KS	JL/KS	JL/KS
Inputs For Calcs.			
Sq. rt. delta P	0.67728	0.64296	0.64656
Delta H	0.7121	0.5946	0.6217
Stack temp. (deg.F)	62.0	72.6	68.1
Meter temp. (deg.F)	65.8	51.5	65.2
Sample volume (act.)	44.005	40.425	42.900
Barometric press. (in.Hg)	30.40	30.08	30.08
Volume H_2O imp. (ml)	9.0	10.0	14.0
Weight change sil. gel (g)	10.2	9.5	11.2
% 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.)	4.900	4.900	4.900
Sample time (min.)	96.0	96.0	96.0
Static pressure (in.H_2O)	0.23	0.23	0.23
Nozzle dia. (in.)	0.190	0.190	0.190
Meter box cal.	0.9915	0.9915	0.9915
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
Location/Plant: Fayetteville NC
Source: P&A Stack

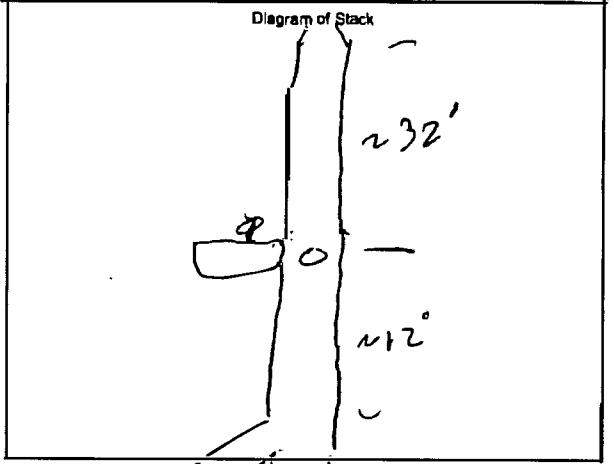
Operator: Paul
Date: 11/8/18
W.O. Number: 15918.002.007

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

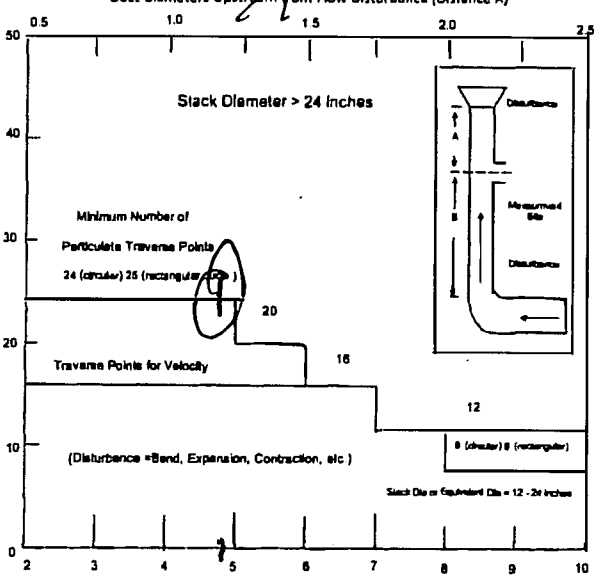
Distance from far wall to outside of port (in.) = C	45
Port Depth (in.) = D	15
Depth of Duct, diameter (in.) = C-D	30
Area of Duct (ft²)	4.90
Total Traverse Points	24
Total Traverse Points per Port	12
Port Diameter (in.) —(Flange-Threaded-Hole)	4"
Monorail Length	—
Rectangular Ducts Only	
Width of Duct, rectangular duct only (in.)	n/a
Total Ports (rectangular duct only)	n/a
Equivalent Diameter = (2*L*W)/(L+W)	n/a

Flow Disturbances	
Upstream - A (ft)	~32
Downstream - B (ft)	~12
Upstream - A (duct diameters)	~12.8
Downstream - B (duct diameters)	~4.8

Diagram of Stack



Duct Diameters Upstream from Flow Disturbance (Distance A)



Duct Diameters Downstream from Flow Disturbance (Distance B)

Traverse Point Locations

Traverse Point	% of Duct	Distance from Inside Duct Wall (in)	Distance from Outside of Port (in)
1	2.1	0.9	16
2	6.7	2.0	17
3	10.9	3.5	18 1/2
4	17.7	5.3	20 3/8
5	25	7.5	22 1/2
6	35.6	10.7	25 3/4
7	64.4	19.3	34 3/8
8	75	22.5	37 1/2
9	82.3	24.7	39 3/4
10	88.2	26.5	41 1/2
11	93.3	28.0	43
12	97.9	29.4	44
CEM 3 Point(Long Measurment Line) Stratificaton 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	Number of Traverse Points												
	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	Number of Traverse Points											
	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

Method 0010 HFPO Dimer Acid

Client	Chemours
W.O.#	15418.002.009.0001
Project ID	Chemours
Mode/Source ID	PPA
Samp. Loc. ID	STK
Run No.ID	1
Test Method ID	M 0010 HFPO Dimer Acid
Date ID	7JAN2019
Source/Location	PPA Stack
Sample Date	1-7-2019
Baro. Press (in Hg)	30.40 ✓
Operator	AS/KS ✓

Stack Conditions

	Assumed	Actual
% Moisture	2	
Impinger Vol (ml)		9
Silica gel (g)		10.2
CO2, % by Vol	0	0.0
O2, % by Vol	20.9	20.9
Temperature (°F)	55	
Meter Temp (°F)	65	
Static Press (in H_2O)	.23 ✓	0.23
Ambient Temp (°F)	~~50~~ JL 57°	

Meter Box ID	21
Meter Box Y	.9915 ✓
Meter Box Del H	2.0089
Probe ID / Length	696 5'
Probe Material	Boro
Pitot / Thermocouple ID	696
Pitot Coefficient	0.84
Nozzle ID	.190
Avg Nozzle Dia (in)	.190 ✓
Area of Stack (ft^2)	4.90 ✓
Sample Time	96 min ✓
Total Traverse Pts	24 ✓

Leak Checks

	Initial	Mid-Point	Final
Sample Train (ft^3)	.001	.000	.000
Leak Check @ (in Hg)	15"	5"	5"
Pitot good	yes / no	yes / no	yes / no
Orsat good	yes / no	yes / no	yes / no

K Factor 1.55

Temp Check

	Pre-Test Set	Post-Test Set
Meter Box Temp	58	[illegible]
Reference Temp	57.2	57.2
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 (ft^3)	STACK TEMP (°F)	DGM INLET TEMP (°F)	DGM OUTLET TEMP (°F)	PROBE TEMP (°F)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (°F)	SAMPLE TRAIN VAC (in Hg)	XAD2 Exit	COMMENTS
	0	1240			110.686									
A 1	4		.55	.85	113.8	57	~~54~~ JL	60	253	252	58	3	59	
2	8		.53	.82	115.8	62		63	125	123	60	3	61	
3	12		.54	.83	117.8	61		62	129	130	59	3	58	
4	16		.53	.82	119.8	60		61	120	123	59	3	58	
5	20		.53	.82	121.8	61		64	120	130	54	3	58	
6	24		.51	.79	123.8	61		63	119	125	59	3	60	
7	28		.45	.69	125.8	61		65	119	123	61	3	60	
8	32		.45	.69	127.5	61		65	119	124	58	3	58	
9	36		.40	.62	129.2	63		65	119	124	60	3	62	
10	40		.36	.55	131.0	62		64	121	125	57	2	58	
11	44		.36	.55	132.5	61		65	121	124	61	2	60	
12	48	1328	.30 ✓	.46 ✓	134.071 ✓	61 ✓		67 ✓	120	123	60	2	59	
									~~120~~ JL	~~125~~ JL	~~61~~ JL		~~60~~ JL	135.218
B 1	52	1342	.53	.82	136.2	61		66	120	125	61	3	60	-1.147 LC
2	56		.53	.82	138.2	64		68	119	124	63	3	63	
3	60		.54	.83	140.2	61		67	119	124	60	3	60	
4	64		.53	.82	142.2	62		66	121	124	61	3	62	
5	68		.53	.82	144.3	66		68	121	124	66	3	60	
6	72		.49	.75	146.2	61		67	121	124	59	3	59	
7	76		.49	.75	148.2	61		67	121	124	59	3	60	
8	80		.48	.74	150.1	61		65	119	123	60	2.5	60	
9	84		.45	.69	151.9	66		70	121	123	64	2.5	64	
10	88		.36	.55	153.9	67		69	120	124	60	2	60	
11	92		.36	.55	155.3	63		69	120	124	60	2	60	
12	96	1430	.30 ✓	.46 ✓	156.538 ✓	64 ✓		69 ✓	120	124	61	2	62	
			Avg Sqrt Delta P	Avg Delta H	Total Volume	Avg Ts		Avg Tm	Min/Max	Min/Max	Max Temp	Max Vac	Max Temp	
			0.6773 ✓	0.721 ✓	44.005 ✓	61.9 ✓		65.8 ✓	119/	123/	66	3	63	
				Avg Sqrt Del H	Comments:									
			Avg: 0.4625 ✓	0.8403 ✓										

ISOKINETIC FIELD DATA SHEET

Method 0010 HFPO Dimer Acid

		Stack Conditions	Assumed	Actual
Client	Chemours			
W.O.#	15418.002.009.0001			
Project ID	Chemours	% Moisture	2	
Mode/Source ID	PPA	Impinger Vol (ml)		10
Samp. Loc. ID	STK	Silica gel (g)		9.5
Run No.ID	# 2	CO2, % by Vol	0	0.0
Test Method ID	M 0010 HFPO Dimer Acid	O2, % by Vol	20.9	20.9
Date ID	7JAN2019	Temperature (°F)	65	
Source/Location	PPA Stack	Meter Temp (°F)		
Sample Date	01/08/19	Static Press (in H_2O)	0.23 ✓	0.23
Baro. Press (in Hg)	30.08 ✓			
Operator	JL/KS ✓	Ambient Temp (°F)	50°	

Meter Box ID	21		
Meter Box Y	0.9915 ✓		
Meter Box Del H	2.0089	**Leak Checks**	
Probe ID / Length	696 / 5'	Sample Train (ft^3)	0.001 / 0.001 / .000
Probe Material	Boro	Leak Check @ (in Hg)	15" / 5" / 5"
Pitot / Thermocouple ID	696 / 696	Pitot good	yes / no / no / no / yes / no
Pitot Coefficient	0.84	Orsat good	yes / no / ~~no~~ / no / yes / no
Nozzle ID	0.190	**Temp Check**	Pre-Test Set / Post-Test Set
Avg Nozzle Dia (in)	0.190	Meter Box Temp	53 / 54
Area of Stack (ft^2)	4.90 ✓	Reference Temp	52.5 / 53.5
Sample Time	96 ✓	Pass/Fail (+/- 2°)	Pass / Fail / ~~Pass~~ / Fail
Total Traverse Pts	24 ✓	Temp Change Response	yes / no / ~~yes~~ / no

K Factor 1.5T 1.44

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 (ft^3)	STACK TEMP (°F)	DGM INLET TEMP (°F)	DGM OUTLET TEMP (°F)	PROBE TEMP (°F)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (°F)	SAMPLE TRAIN VAC (in Hg)	XAD Exit	COMMENTS
	0	0800			157.495									
A1	4		.48	~~2.69~~ .69	159.2	74	~~54~~ SL	54	119	124	57	2	53	
2	8		.48	.69	161.0	76		51	119	124	52	2	40	
3	12		.48	.69	163.0	76		50	119	124	49	2	38	
4	16		.48	.69	164.6	73		49	119	124	46	2	38	
5	20		.47	.67	166.4	73		49	121	123	45	2	39	
6	24		.46	.66	168.2	73		49	121	124	43	2	37	
7	28		.46	.66	169.9	73		49	121	124	43	2	36	
8	32		.42	.60	171.6	72		49	121	124	42	2	36	
9	36		.42	.60	173.3	72		49	119	124	41	2	36	
10	40		.40	.57	175.0	72		49	119	125	42	2	37	
11	44		.40	.57	176.6	71		50	120	124	42	2	36	178.554
12	48	0848	.40 ✓	.57 ✓	178.352	71 ✓		50 ✓	120	124	42	2	37	-.202 LC
											~~47~~ SL		41 SL	
B1	52	0902	.30	.43	180.0	70		50	119	124	47	2	41	
2	56		.32	.46	181.5	72		51	119	124	43	2	36	
3	60		.46	.66	183.2	72		51	120	124	43	2	35	
4	64		.46	.66	185.0	72		51	121	124	43	2	36	
5	69		.46	.66	186.8	72		52	121	124	42	2	35	
6	72		.44	.63	188.6	72		52	119	124	41	2	35	
7	76		.40	.57	190.3	72		53	121	~~124~~ 124	42	2	36	
8	80		.40	.57	191.9	72		54	121	124	43	2	36	
9	84		.38	.54	193.5	73		55	121	124	43	2	37	
10	88		.36	.51	195.1	73		56	121	124	44	2	37	
11	92		.32	.46	196.6	73		56	120	124	45	2	38	
12	96	0950	.32 ✓	.46 ✓	198.122	73 ✓		56 ✓	120	124	46	2	38	
			Avg Sqrt Delta P ~~.415~~ .643	Avg Delta H .5458	Total Volume 40.425 ✓	Avg Ts ✓ 72.583		Avg Tm ✓ 51.458	Min/Max 119/121	Min/Max 124/125	Max Temp 57	Max Vac 2	Max Temp 53	
			.415	Avg Sqrt Del H .7699	Comments:									

WESTON SOLUTIONS

$\sqrt{\Delta P} = 0.6429$

ISOKINETIC FIELD DATA SHEET

Method 0010 HFPO Dimer Acid

		Stack Conditions	Assumed	Actual					
Client	Chemours				Meter Box ID	21		K Factor	1.49
W.O.#	15418.002.009.0001				Meter Box Y	.9915 ✓			
Project ID	Chemours	% Moisture	2		Meter Box Del H	2.0089	Leak Checks	Initial	Mid-Point / Final
Mode/Source ID	PPA	Impinger Vol (ml)		14	Probe ID / Length	696 / 5'	Sample Train (ft³)	.001	.001 / 0.001
Samp. Loc. ID	STK	Silica gel (g)		11.2	Probe Material	Boro	Leak Check @ (in Hg)	15"	5" / 5"
Run No.ID	3	CO2, % by Vol	0	0	Pitot / Thermocouple ID	696 / 696	Pitot good	yes / no	yes / no / yes / no
Test Method ID	M 0010 HFPO Dimer Acid	O2, % by Vol	20.9	20.9	Pitot Coefficient	0.84	Orsat good	yes / no	yes / no / yes / no
Date ID	7JAN2019	Temperature (°F)	75		Nozzle ID	.190	Temp Check	Pre-Test Set	Post-Test Set
Source/Location	PPA Stack	Meter Temp (°F)	65		Avg Nozzle Dia (in)	.190 ✓	Meter Box Temp	60	60
Sample Date	01/08/19	Static Press (in H_2O)	.23 ✓	.023	Area of Stack (ft²)	4.90 ✓	Reference Temp	60.8	59.9
Baro. Press (in Hg)	30.08 ✓				Sample Time	96 ✓	Pass/Fail (+/- 2°)	Pass / Fail	Pass / Fail
Operator	SL/KS ✓	Ambient Temp (°F)	61°		Total Traverse Pts	24 ✓	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 INLET TEMP (°F)	DGM OUTLET TEMP (°F)	PROBE TEMP (°F)	FILTER BOX TEMP (F)	IMPING EXIT TEMP (°F)	SAMPLE TRAIN VAC (in Hg)	XAD Exit	COMMENTS
	0	1059			200.710									
A1	4		.47	.70	202.9	61	60SL	60	119	124	61	2	61	
2	8		.47	.70	204.7	63		60	121	124	61	2	60	
3	12		.47	.70	206.6	63		60	121	124	61	2	60	
4	16		.47	.70	209.6	64		61	121	124	60	2	61	
5	20		.45	.67	210.2	64		61	121	123	61	2	62	
6	24		.46	.68	212.0	64		61	119	124	61	2	62	
7	28		.46	.68	213.9	64		61	119	124	61	2	62	
8	32		.34	.50	215.6	66		63	119	124	63	2	64	
9	36		.34	.50	217.1	69		64	122	125	64	2	66	
10	40		.34	.50	218.9	72		63	122	124	62	2	66	
11	44		.33	.49	219.9	72		64	120	124	57	2	55	
12	48	1141	.33 ✓	.49 ✓	221.858	72 ✓		65 ✓	120	124	57	2	54	222.297
											65 SL		65 SL	-.439 LC
B1	52	1204	.45	.67	224.6	67		67	119	126	65	2	65	
2	56		.45	.67	226.4	67		66	120	123	64	2	64	
3	60		.45	.67	228.1	68		67	120	124	64	2	65	
4	64		.46	.68	229.9	70		68	121	124	66	2	66	
5	68		.46	.69	231.8	71		68	119	124	60	2	55	
6	72		.46	.68	233.6	71		69	119	123	66	2	66	
7	76		.40	.59	235.4	68		68	120	124	66	2	66	
8	80		.40	.59	237.1	71		69	121	125	66	2	67	
9	84		.41	.61	238.8	70		69	119	123	66	2	67	
10	88		.40	.59	240.6	69		69	119	125	66	2	66	
11	92		.40	.59	242.3	72 ✓		71	119	125	67	2	66	
12	96	1255	.40 ✓	.59 ✓	244.049	72 ✓		71	119	124	66	2	67	
			Avg Sqrt Delta P	Avg Delta H	Total Volume	Avg Ts		Avg Tm	Min/Max	Min/Max	Max Temp	Max Vac	Max Temp	
			0.64165 ✓	0.62107 ✓	42.900 ✓	68.1 ✓		65.2 ✓						

2/1A (BA) 96

Avg Delta P: 0.41958 ✓ | Avg Sqrt Del H: 0.78169 ✓ | Comments:

WESTON SOLUTIONS

SAMPLE RECOVERY FIELD DATA

Method 0010 HFPO Dimer Acid

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

Run No. 1 | Sample Date 1/7/19 | Recovery Date 1/7/19
Sample I.D. Chemours - PPA - STK - 1 - M 0010 HFPO Dimer Acid - Analyst PMM | Filter Number NA

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents									56	
Final	2	101	104	2					310.2	
Initial	0	100	100	0					300	
Gain	2	1	4	2				9	10.2	

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

Run No. 2 | Sample Date 1/8/19 | Recovery Date 1/8/19
Sample I.D. Chemours - PPA - STK - 2 - M 0010 HFPO Dimer Acid - Analyst PMM | Filter Number NA

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents									56	
Final	2	99	108	1					309.5	
Initial	0	100	100	0					300	
Gain	2	-1	8	1				10	9.5	

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

Run No. 3 | Sample Date 1/8/19 | Recovery Date 1/8/19
Sample I.D. Chemours - PPA - STK - 3 - M 0010 HFPO Dimer Acid - Analyst PMM | Filter Number NA

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents									56	
Final	14	101	96	4					311.2	
Initial	0	100	100	0					300	
Gain	14	1	-4	4				14	11.2	

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

Check COC for Sample IDs of Media Blanks

SAMPLE RECOVERY FIELD DATA

Method 0010 HFPO Dimer Acid

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

Run No. ___ Sample Date 1/8/19 Recovery Date 1/8/19

Sample I.D. Chemours - PPA - STK - BT - M 0010 HFPO Dimer Aci Analyst VMM Filter Number 1

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents										
Final	0	100	100	0					10	
Initial	0	100	100	0					10	
Gain	0	100	100	0					0	

Impinger Color clear Labeled? Y

Silica Gel Condition Good Sealed? Y

Run No. ___ Sample Date _____ Recovery Date _____

Sample I.D. _____ Analyst _____ Filter Number _____

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents										
Final										
Initial										
Gain										

Impinger Color _____ Labeled? _____

Silica Gel Condition _____ Sealed? _____

Run No. ___ Sample Date _____ Recovery Date _____

Sample I.D. _____ Analyst _____ Filter Number _____

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents										
Final										
Initial										
Gain										

Impinger Color _____ Labeled? _____

Silica Gel Condition _____ Sealed? _____

Check COC for Sample IDs of Media Blanks

METHODS AND ANALYZERS

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **7 Jan 2019**

File: C:\DATA\Chemours\010719 PPA stack.cem
Program Version: 2.1, built 19 May 2017 **File Version:** 2.02
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: **PPA**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **7 Jan 2019**

Start Time: 11:24

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	5 mv
Span, 21.0 %	7992 mv

Curve Coefficients

Slope	Intercept
380.3	5

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	5 mv
Span, 16.6 %	5516 mv

Curve Coefficients

Slope	Intercept
332.4	5

CALIBRATION ERROR DATA

Number 1

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **7 Jan 2019**

Start Time: 11:24

O_2
Method: EPA 3A
Span Conc. 21.0 %
Slope 380.3 **Intercept** 5.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
12.0	12.0	0.0	0.0	Pass
21.0	21.0	0.0	0.0	Pass

CO_2
Method: EPA 3A
Span Conc. 16.6 %
Slope 332.4 **Intercept** 5.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
8.9	8.7	-0.2	-1.2	Pass
16.6	16.6	0.0	0.0	Pass

BIAS

Number 1

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **7 Jan 2019**

Start Time: 11:39

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	12.0	11.9	-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	0.0	0.0	0.0	Pass
Span	8.7	8.4	-0.3	-1.8	Pass

RUN DATA

Number 1

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **7 Jan 2019**

Time	O_2 %	CO_2 %
	Start R1	
12:40	20.7	0.0
12:41	20.8	0.0
12:42	20.8	0.0
12:43	20.8	0.0
12:44	20.8	0.0
12:45	20.8	0.0
12:46	20.8	0.0
12:47	20.8	0.0
12:48	20.8	0.0
12:49	20.8	0.0
12:50	20.8	0.0
12:51	20.8	0.0
12:52	20.8	0.0
12:53	20.8	0.0
12:54	20.8	0.0
12:55	20.8	0.0
12:56	20.8	0.0
12:57	20.8	0.0
12:58	20.8	0.0
12:59	20.8	0.0
13:00	20.8	0.0
13:01	20.8	0.0
13:02	20.8	0.0
13:03	20.8	0.0
13:04	20.8	0.0
13:05	20.8	0.0
13:06	20.8	0.0
13:07	20.8	0.0
13:08	20.8	0.0
13:09	20.8	0.0
13:10	20.8	0.0
13:11	20.8	0.0
13:12	20.8	0.0
13:13	20.8	0.0
13:14	20.8	0.0
13:15	20.8	0.0
13:16	20.8	0.0
13:17	20.8	0.0
13:18	20.8	0.0
13:19	20.8	0.0

WESTON

RUN DATA

Number 1

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **7 Jan 2019**

Time	O_2 %	CO_2 %
13:20	20.8	0.0
13:21	20.8	0.0
13:22	20.8	0.0
13:23	20.8	0.0
13:24	20.8	0.0
13:25	20.8	0.0
13:26	20.8	0.0
13:27	20.8	0.0
13:28	20.8	0.0
	end port 1	
	port 2	
13:42	20.7	0.0
13:43	20.8	0.0
13:44	20.8	0.0
13:45	20.8	0.0
13:46	20.8	0.0
13:47	20.8	0.0
13:48	20.8	0.0
13:49	20.8	0.0
13:50	20.8	0.0
13:51	20.8	0.0
13:52	20.8	0.0
13:53	20.8	0.0
13:54	20.8	0.0
13:55	20.8	0.0
13:56	20.8	0.0
13:57	20.8	0.0
13:58	20.8	0.0
13:59	20.8	0.0
14:00	20.8	0.0
14:01	20.8	0.0
14:02	20.8	0.0
14:03	20.8	0.0
14:04	20.8	0.0
14:05	20.8	0.0
14:06	20.8	0.0
14:07	20.8	0.0
14:08	20.8	0.0
14:09	20.8	0.0
14:10	20.8	0.0
14:11	20.8	0.0

WESTON

RUN DATA

Number 1

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **7 Jan 2019**

Time	O_2 %	CO_2 %
14:12	20.8	0.0
14:13	20.8	0.0
14:14	20.8	0.0
14:15	20.8	0.0
14:16	20.8	0.0
14:17	20.8	0.0
14:18	20.8	0.0
14:19	20.8	0.0
14:20	20.8	0.0
14:21	20.8	0.0
14:22	20.8	0.0
14:23	20.8	0.0
14:24	20.8	0.0
14:25	20.8	0.0
14:26	20.8	0.0
14:27	20.8	0.0
14:28	20.8	0.0
14:30	20.8	0.0
Avgs	**20.8**	**0.0**

RUN SUMMARY

Number 1

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **7 Jan 2019**

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

Time: 12:39 to 14:30

Run Averages

	20.8	0.0

Pre-run Bias at 11:39

Zero Bias	0.0	0.0
Span Bias	11.9	8.4
Span Gas	12.0	8.9

Post-run Bias at 14:34

Zero Bias	0.0	0.0
Span Bias	11.9	8.4
Span Gas	12.0	8.9

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

	21.0	0.0

BIAS AND CALIBRATION DRIFT

Number 2

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **7 Jan 2019**

Start Time: 14:34

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	12.0	11.9	-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	11.9	11.9	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	8.7	8.4	-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	8.4	0.0	0.0	Pass

*Bias No. 1

METHODS AND ANALYZERS

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

File: C:\DATA\Chemours\010819 PPA.cem
Program Version: 2.1, built 19 May 2017 **File Version:** 2.02
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: **PPA**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 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	30 mv
Span, 21.0 %	8006 mv

Curve Coefficients

Slope	Intercept
379.8	30

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	1 mv
Span, 16.6 %	5513 mv

Curve Coefficients

Slope	Intercept
332.4	1

WESTON

CALIBRATION ERROR DATA

Number 1

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

Start Time: 07:19

O_2
Method: EPA 3A
Span Conc. 21.0 %
Slope 379.8 **Intercept** 30.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
12.0	12.0	0.0	0.0	Pass
21.0	21.0	0.0	0.0	Pass

CO_2
Method: EPA 3A
Span Conc. 16.6 %
Slope 332.4 **Intercept** 1.0

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**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

Start Time: 07:25

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	12.0	12.0	0.0	0.0	Pass

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

RUN DATA

Number 2

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

Time	O_2 %	CO_2 %
	Start R2	
08:00	20.8	0.0
08:01	20.8	0.0
08:02	20.8	0.0
08:03	20.8	0.0
08:04	20.8	0.0
08:05	20.8	0.0
08:06	20.8	0.0
08:07	20.8	0.0
08:08	20.8	0.0
08:09	20.8	0.0
08:10	20.8	0.0
08:11	20.8	0.0
08:12	20.8	0.0
08:13	20.8	0.0
08:14	20.8	0.0
08:15	20.8	0.0
08:16	20.8	0.0
08:17	20.8	0.0
08:18	20.8	0.0
08:19	20.8	0.0
08:20	20.8	0.0
08:21	20.8	0.0
08:22	20.8	0.0
08:23	20.9	0.0
08:24	20.9	0.0
08:25	20.9	0.0
08:26	20.9	0.0
08:27	20.9	0.0
08:28	20.9	0.0
08:29	20.9	0.0
08:30	20.9	0.0
08:31	20.9	0.0
08:32	20.9	0.0
08:33	20.9	0.0
08:34	20.9	0.0
08:35	20.9	0.0
08:36	20.9	0.0
08:37	20.9	0.0
08:38	20.9	0.0
08:39	20.9	0.0

WESTON

RUN DATA

Number 2

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

Time	O_2 %	CO_2 %
08:40	20.9	0.0
08:41	20.9	0.0
08:42	20.9	0.0
08:43	20.9	0.0
08:44	20.9	0.0
08:45	20.9	0.0
08:46	20.9	0.0
08:47	20.9	0.0
08:48	20.9	0.0
	end port 1	
	start port 2	
09:02	20.8	0.0
09:03	20.8	0.0
09:04	20.9	0.0
09:05	20.9	0.0
09:06	20.9	0.0
09:07	20.9	0.0
09:08	20.9	0.0
09:09	20.9	0.0
09:10	20.9	0.0
09:11	20.9	0.0
09:12	20.9	0.0
09:13	20.9	0.0
09:14	20.9	0.0
09:15	20.9	0.0
09:16	20.9	0.0
09:17	20.9	0.0
09:18	20.9	0.0
09:19	20.9	0.0
09:20	20.9	0.0
09:21	20.9	0.0
09:22	20.9	0.0
09:23	20.9	0.0
09:24	20.9	0.0
09:25	20.9	0.0
09:26	20.9	0.0
09:27	20.9	0.0
09:28	20.9	0.0
09:29	20.9	0.0
09:30	20.9	0.0
09:31	20.9	0.0

WESTON SOLUTIONS

RUN DATA

Number 2

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

Time	O_2 %	CO_2 %
09:32	20.9	0.0
09:33	20.9	0.0
09:34	20.9	0.0
09:35	20.9	0.0
09:36	20.9	0.0
09:37	20.9	0.0
09:38	20.9	0.0
09:39	20.9	0.0
09:40	20.9	0.0
09:41	20.9	0.0
09:42	20.9	0.0
09:43	20.9	0.0
09:44	20.9	0.0
09:45	20.9	0.0
09:46	20.9	0.0
09:47	20.9	0.0
09:48	20.9	0.0
09:49	20.9	0.0
09:50	20.9	0.0
Avgs	**20.9**	**0.0**

RUN SUMMARY

Number 2

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

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

Time: 07:59 to 09:50

Run Averages

	20.9	0.0

Pre-run Bias at 07:25

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

Post-run Bias at 10:14

Zero Bias	0.0	0.0
Span Bias	11.9	8.4
Span Gas	12.0	8.9

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

	21.0	0.0

BIAS AND CALIBRATION DRIFT

Number 2

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

Start Time: 10:14

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	12.0	11.9	-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	11.9	-0.1	-0.5	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	0.0	0.0	0.0	0.0	Pass
Span	8.4	8.4	0.0	0.0	Pass

*Bias No. 1

RUN DATA

Number 3

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

Time	O_2 %	CO_2 %
	Start R3	
10:53	20.7	0.0
10:54	20.7	0.0
10:55	20.7	0.0
10:56	20.7	0.0
10:57	20.7	0.0
10:58	20.8	0.0
10:59	20.8	0.0
11:00	20.7	0.0
11:01	20.7	0.0
11:02	20.7	0.0
11:03	20.7	0.0
11:04	20.8	0.0
11:05	20.7	0.0
11:06	20.7	0.0
11:07	20.8	0.0
11:08	20.8	0.0
11:09	20.8	0.0
11:10	20.8	0.0
11:11	20.8	0.0
11:12	20.9	0.0
11:13	20.9	0.0
11:14	20.9	0.0
11:15	20.9	0.0
11:16	20.9	0.0
11:17	20.9	0.0
11:18	20.9	0.0
11:19	20.9	0.0
11:20	20.9	0.0
11:21	20.9	0.0
11:22	20.9	0.0
11:23	20.9	0.0
11:24	20.9	0.0
11:25	20.9	0.0
11:26	20.9	0.0
11:27	20.9	0.0
11:28	20.9	0.0
11:29	20.9	0.0
11:30	20.9	0.0
11:31	20.9	0.0
11:32	20.9	0.0

WESTON SOLUTIONS SM

RUN DATA

Number 3

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

Time	O_2 %	CO_2 %
11:33	20.9	0.0
11:34	20.9	0.0
11:35	20.9	0.0
11:36	20.9	0.0
11:37	20.9	0.0
11:38	20.9	0.0
11:39	20.9	0.0
11:40	20.9	0.0
11:41	20.9	0.0
	end port 1	
	start port 2	
12:04	20.7	0.0
12:05	20.7	0.0
12:06	20.7	0.0
12:07	20.7	0.0
12:08	20.7	0.0
12:09	20.7	0.0
12:10	20.7	0.0
12:11	20.7	0.0
12:12	20.8	0.0
12:13	20.8	0.0
12:14	20.8	0.0
12:15	20.8	0.0
12:16	20.8	0.0
12:17	20.8	0.0
12:18	20.8	0.0
12:19	20.8	0.0
12:20	20.8	0.0
12:21	20.9	0.0
12:22	20.9	0.0
12:23	20.9	0.0
12:24	20.8	0.0
12:25	20.8	0.0
12:26	20.9	0.0
12:27	20.8	0.0
12:28	20.8	0.0
12:29	20.8	0.0
12:30	20.8	0.0
12:31	20.8	0.0
12:32	20.9	0.0
12:33	20.8	0.0

WESTON SOLUTIONS

RUN DATA

Number 3

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

Time	O_2 %	CO_2 %
12:34	20.8	0.0
12:35	20.9	0.0
12:36	20.8	0.0
12:37	20.8	0.0
12:38	20.8	0.0
12:39	20.8	0.0
12:40	20.9	0.0
12:41	20.8	0.0
12:42	20.8	0.0
12:43	20.8	0.0
12:44	20.9	0.0
12:45	20.9	0.0
12:46	20.9	0.0
12:47	20.8	0.0
12:48	20.9	0.0
12:49	20.9	0.0
12:50	20.8	0.0
12:51	20.9	0.0
12:52	20.8	0.0
12:53	20.8	0.0
12:54	20.8	0.0
12:55	20.8	0.0
Avgs	**20.8**	**0.0**

RUN SUMMARY

Number 3

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

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

Time: 10:52 to 12:55

Run Averages

	20.8	0.0

Pre-run Bias at 10:14

Zero Bias	0.0	0.0
Span Bias	11.9	8.4
Span Gas	12.0	8.9

Post-run Bias at 13:10

Zero Bias	0.0	0.0
Span Bias	11.8	8.4
Span Gas	12.0	8.9

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

	21.1	0.0

BIAS AND CALIBRATION DRIFT

Number 3

Client: **Chemours**
Location: **CHEMOURS**
Source: **PPA**

Calibration **1**

Project Number: **15418.002.009**
Operator: **CMH**
Date: **8 Jan 2019**

Start Time: 13:10

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	12.0	11.8	-0.2	-1.0	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	11.9	11.8	-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	8.4	-0.2	-1.2	Pass

Calibration Drift

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

*Bias No. 2

APPENDIX C
LABORATORY ANALYTICAL REPORT

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

Client Sample Results

Client: Chemours Company FC, LLC The
Project/Site: PPA Carbon Bed Outlet - M0010

TestAmerica Job ID: 140-13892-1

Client Sample ID: G-2942,2943 PPA CARBON BED OUTLET R1 M0010 FH

Lab Sample ID: 140-13892-1

Date Collected: 01/07/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	3.85		0.101	0.0109	ug/Sample		01/10/19 08:39	01/17/19 11:26	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*120*		*50 - 200*	*01/10/19 08:39*	*01/17/19 11:26*	*1*

Client Sample ID: G-2944,2945,2947 PPA CARBON BED OUTLET R1 M0010 BH

Lab Sample ID: 140-13892-2

Date Collected: 01/07/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.0956	J	0.200	0.0400	ug/Sample		01/09/19 11:32	01/17/19 10:31	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*83*		*50 - 200*	*01/09/19 11:32*	*01/17/19 10:31*	*1*

Client Sample ID: G-2946 PPA CARBON BED OUTLET R1 M0010 IMP 1,2&3 CONDENSATE

Lab Sample ID: 140-13892-3

Date Collected: 01/07/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.190	0.00969	ug/Sample		01/10/19 08:41	01/17/19 11:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*96*		*50 - 200*	*01/10/19 08:41*	*01/17/19 11:49*	*1*

Client Sample ID: G-2948 PPA CARBON BED OUTLET R1 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-13892-4

Date Collected: 01/07/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.0489	J	0.200	0.0400	ug/Sample		01/09/19 11:32	01/17/19 10:34	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*90*		*50 - 200*	*01/09/19 11:32*	*01/17/19 10:34*	*1*

Client Sample ID: G-2949,2950 PPA CARBON BED OUTLET R2 M0010 FH

Lab Sample ID: 140-13892-5

Date Collected: 01/08/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	3.40		0.151	0.0163	ug/Sample		01/10/19 08:39	01/17/19 11:29	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*121*		*50 - 200*	*01/10/19 08:39*	*01/17/19 11:29*	*1*

Client Sample ID: G-2951,2952,2954 PPA CARBON BED OUTLET R2 M0010 BH

Lab Sample ID: 140-13892-6

Date Collected: 01/08/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.556		0.250	0.0500	ug/Sample		01/09/19 11:32	01/17/19 10:37	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*92*		*50 - 200*	*01/09/19 11:32*	*01/17/19 10:37*	*1*

Client Sample ID: G-2953 PPA CARBON BED OUTLET R2 M0010 IMP 1,2&3 CONDENSATE

Lab Sample ID: 140-13892-7

Date Collected: 01/08/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.205	0.0105	ug/Sample		01/10/19 08:41	01/17/19 11:52	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*96*		*50 - 200*	*01/10/19 08:41*	*01/17/19 11:52*	*1*

Client Sample ID: G-2955 PPA CARBON BED OUTLET R2 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-13892-8

Date Collected: 01/08/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.276		0.200	0.0400	ug/Sample		01/09/19 11:32	01/17/19 10:41	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*89*		*50 - 200*	*01/09/19 11:32*	*01/17/19 10:41*	*1*

Client Sample ID: G-2956,2957 PPA CARBON BED OUTLET R3 M0010 FH

Lab Sample ID: 140-13892-9

Date Collected: 01/08/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	3.24		0.126	0.0136	ug/Sample		01/10/19 08:39	01/17/19 11:32	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*122*		*50 - 200*	*01/10/19 08:39*	*01/17/19 11:32*	*1*

Client Sample ID: G-2958,2959,2961 PPA CARBON BED OUTLET R3 M0010 BH

Lab Sample ID: 140-13892-10

Date Collected: 01/08/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.105	J	0.225	0.0450	ug/Sample		01/09/19 11:32	01/17/19 10:44	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*89*		*50 - 200*	*01/09/19 11:32*	*01/17/19 10:44*	*1*

Client Sample ID: G-2960 PPA CARBON BED OUTLET R3 M0010 IMP 1,2&3 CONDENSATE

Lab Sample ID: 140-13892-11

Date Collected: 01/08/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.207	J	0.210	0.0107	ug/Sample		01/10/19 08:41	01/17/19 11:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*102*		*50 - 200*	*01/10/19 08:41*	*01/17/19 11:55*	*1*

Client Sample ID: G-2962 PPA CARBON BED OUTLET R3 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-13892-12

Date Collected: 01/08/19 00:00
Date Received: 01/09/19 11:25
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		01/09/19 11:32	01/17/19 10:47	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*89*		*50 - 200*	*01/09/19 11:32*	*01/17/19 10:47*	*1*

Client Sample Results

Client: Chemours Company FC, LLC The
Project/Site: PPA Carbon Bed Outlet QC Samples

TestAmerica Job ID: 140-13893-1

Client Sample ID: C-2401,2402 PPA CARBON BED QC M0010 FH BT

Lab Sample ID: 140-13893-1

Date Collected: 01/08/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.0356		0.0260	0.00281	ug/Sample		01/10/19 08:39	01/17/19 11:36	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*101*		*50 - 200*	*01/10/19 08:39*	*01/17/19 11:36*	*1*

Client Sample ID: C-2403,2404,2406 PPA CARBON BED QC M0010 BH BT

Lab Sample ID: 140-13893-2

Date Collected: 01/08/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.121	J	0.200	0.0400	ug/Sample		01/09/19 11:32	01/17/19 10:50	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*91*		*50 - 200*	*01/09/19 11:32*	*01/17/19 10:50*	*1*

Client Sample ID: C-2405 PPA CARBON BED QC M0010 IMP 1,2&3 CONDENSATE BT

Lab Sample ID: 140-13893-3

Date Collected: 01/08/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.00250	0.000128	ug/Sample		01/10/19 08:41	01/17/19 11:59	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*106*		*50 - 200*	*01/10/19 08:41*	*01/17/19 11:59*	*1*

Client Sample ID: C-2407 PPA CARBON BED QC M0010 BREAKTHROUGH XAD-2 RESIN TUBE BT

Lab Sample ID: 140-13893-4

Date Collected: 01/08/19 00:00
Date Received: 01/09/19 11:25
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		01/09/19 11:32	01/17/19 10:53	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*91*		*50 - 200*	*01/09/19 11:32*	*01/17/19 10:53*	*1*

Client Sample ID: C-2408 PPA CARBON BED QC M0010 DI WATER RB

Lab Sample ID: 140-13893-5

Date Collected: 01/07/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.00250	0.000128	ug/Sample		01/10/19 08:41	01/17/19 12:02	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*130*		*50 - 200*	*01/10/19 08:41*	*01/17/19 12:02*	*1*

Client Sample ID: C-2409 PPA CARBON BED QC M0010 MEOH WITH 5% NH4OH RB

Lab Sample ID: 140-13893-6

Date Collected: 01/07/19 00:00
Date Received: 01/09/19 11:25
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		0.0250	0.00500	ug/Sample		01/09/19 11:32	01/17/19 11:00	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*100*		*50 - 200*	*01/09/19 11:32*	*01/17/19 11:00*	*1*

Client Sample ID: C-2410 PPA CARBON BED QC M0010 XAD-2 RESIN TUBE RB

Lab Sample ID: 140-13893-7

Date Collected: 01/07/19 00:00
Date Received: 01/09/19 11:25
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		01/09/19 11:32	01/17/19 11:03	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*95*		*50 - 200*	*01/09/19 11:32*	*01/17/19 11:03*	*1*

Client Sample ID: C-2411 PPA CARBON BED QC M0010 MEOH WITH 5% NH4OH TB

Lab Sample ID: 140-13893-8

Date Collected: 01/07/19 00:00
Date Received: 01/09/19 11:25
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		0.0250	0.00500	ug/Sample		01/09/19 11:32	01/17/19 11:06	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*116*		*50 - 200*	*01/09/19 11:32*	*01/17/19 11:06*	*1*

Client Sample Results

Client: Chemours Company FC, LLC The
Project/Site: PPA Carbon Bed Outlet QC Samples

TestAmerica Job ID: 140-13893-1

Client Sample ID: C-2412 PPA CARBON BED QC M0010 XAD-2 RESIN TUBE TB

Lab Sample ID: 140-13893-9

Date Collected: 01/07/19 00:00
Date Received: 01/09/19 11:25
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		01/09/19 11:32	01/17/19 11:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*94*		*50 - 200*	*01/09/19 11:32*	*01/17/19 11:10*	*1*

Client Sample ID: C-2413 PPA CARBON BED QC M0010 COMBINED GLASSWARE RINSES (MEOH/5% NH4OH) PB

Lab Sample ID: 140-13893-10

Date Collected: 01/07/19 00:00
Date Received: 01/09/19 11:25
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.0248	J	0.0250	0.00500	ug/Sample		01/09/19 11:32	01/17/19 11:13	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*114*		*50 - 200*	*01/09/19 11:32*	*01/17/19 11:13*	*1*

APPENDIX D
SAMPLE CALCULATIONS

SAMPLE CALCULATIONS FOR HFPO DIMER ACID (METHOD 0010)

Client: Chemours
Test Number: Run 3
Test Location: PPA Stack

Plant: Fayetteville, NC
Test Date: 01/08/19
Test Period: 1053-1255

1. HFPO Dimer Acid concentration, lbs/dscf.

$$Conc1 = \frac{W \times 2.2046 \times 10^{-9}}{Vm(std)}$$

$$Conc1 = \frac{3.6 \times 2.2046 \times 10\text{-}9}{43.038}$$

Conc1 = 1.82E-10

Where:

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

Conc1 = Division Stack HFPO Dimer Acid concentration, lbs/dscf.

2.2046×10^{-9} = Conversion factor from ug to lbs.

2. HFPO Dimer Acid concentration, ug/dscm.

Conc2 = W / (Vm(std) x 0.02832)

Conc2 = 3.6 / (43.038 x 0.02832)

Conc2 = 2.91E+00

Where:

Conc2 = Division Stack 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.

$MR1_{(Outlet)}$ = Conc1 x Qs(std) x 60 min/hr

$MR1_{(Outlet)}$ = 1.82E-10 x 10470 x 60

$MR1_{(Outlet)}$ = 1.14E-04

Where:

$MR1_{(Outlet)}$ = Division Stack HFPO Dimer Acid mass emission rate, lbs/hr.

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

$MR2_{(Outlet)}$ = PMR1 x 453.59 / 3600

$MR2_{(Outlet)}$ = 1.14E-04 x 453.59 /3600

$MR2_{(Outlet)}$ = 1.44E-05

Where:

$MR2_{(Outlet)}$ = Division Stack HFPO Dimer Acid mass emission rate, g/sec.

453.6 = Conversion factor from pounds to grams.

3600 = Conversion factor from hours to seconds.

EXAMPLE CALCULATIONS FOR VOLUMETRIC FLOW AND MOISTURE AND ISOKINETICS

Client: Chemours	Facility: Fayetteville, NC
Test Number: Run 3	Test Date: 1/08/19
Test Location: PPA Stack	Test Period: 1053-1255

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

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

$$Vm(std) = \frac{17.64 \times 0.9915 \times 42.900 \times \left(30.08 + \frac{0.622}{13.6} \right)}{65.21 + 460} = 43.038$$

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.

$$Vw(std) = (0.04707 \times Vwc) + (0.04715 \times Wwsg)$$

$$Vw(std) = (0.04707 \times 14.0) + (0.04715 \times 11.2) = 1.19$$

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

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

$$bws = \frac{1.19}{1.19 + 43.038} = 0.027$$

Where:

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

4. Mole fraction of dry gas.

$Md = 1 - bws$

$Md = 1 - 0.027 = 0.973$

Where:

Md = Mole fraction of dry gas, dimensionless.

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

$MWd = (0.440 \times \%\ CO_2) + (0.320 \times \%\ O_2) + (0.280 \times (\%\ N_2 + \%\ CO))$

$MWd = (0.440 \times 0.0) + (0.320 \times 20.9) + (0.280 \times (79.1 + 0.00))$

$MWd = 28.84$

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.

$MWs = (MWd \times Md) + (18 \times (1 - Md))$

$MWs = (28.84 \times 0.973) + (18 (1 - 0.973)) = 28.55$

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.

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

$$Vs = 85.49 \times 0.84 \times 0.64656 \times \left(\frac{528}{30.10 \times 28.55} \right)^{\wedge}1/2 = 36.4$$

Where:

Vs = Average gas stream velocity, ft/sec.

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

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.

$$Qs(act) = 60 \times Vs \times As$$

$$Qs(act) = 60 \times 36.4 \times 4.90 = 10703$$

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.

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

$$Qs(std) = 17.64 \times 0.973 \times \frac{30.10}{528.1} \times 10703$$

$$Qs(std) = 10470$$

Where:

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

10. Isokinetic variation calculated from intermediate values, percent.

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

$$I = \frac{17.327 \times 528 \times 43.038}{36.4 \times 96 \times 30.10 \times 0.973 \times (0.190)^{\wedge}2} = 106.6$$

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), $\frac{(\text{in. Hg})(\text{in}^2)(\text{min})}{(\text{deg R})(\text{ft}^2)(\text{sec})}$

APPENDIX E
EQUIPMENT CALIBRATION RECORDS

Balance ID:

Date	Initials	Calibration Weight	Measured Weight(1)	Maintenance and Adjustments
10/30/17	MPW	500.0	499.8	
10/31/17	MPW	500.0	499.9	
9/5/18	CH	500.0	500.1	
9/13/18	ZA	500.0	500.1	
10/8/18	JDO	500	499.6	NA-SOC
10/9/18	JDO	500	499.7	NA-SOC
10/10/18	JDO	500	499.6	NA-SOC
10/11/18	JDO	500	499.7	NA-SOC
10/23/18	TB	500	499.8	NA-Chem CW
10/24/18	JDO	500	499.8	NA Chem CW
10/25/18	JDO	500	499.8	NA Chem CW
01/07/19	CH	500	499.7	NA Chemours
01/08/19	CH	500	499.7	NA Chemours
01/09/19	CH	500	499.7	NA Chemours
1/10/19	JDO	500	499.6	NA Chem
1/11/19	CW	500.0	499.8	NA Chemours

(1) within ± 0.5 grams of calibration weight

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

Calibrator PM **Meter Box Number** 21 **Ambient Temp** 71

Date 12-Feb-18 **Wet Test Meter Number** P-2952 **Temp Reference Source** Thermocouple Simulator (Accuracy +/- 1°F)

Dry Gas Meter Number 17485140

Baro Press, in Hg (Pb)	29.64

Setting	Gas Volume		Temperatures					Calibration Results	
Orifice Manometer	Wet Test Meter	Dry gas Meter	Wet Test Meter	Dry Gas Meter					
in H_20 (ΔH)	ft^3 (Vw)	ft^3 (Vd)	°F (Tw)	Outlet, °F (Td_o)	Inlet, °F (Td_i)	Average, °F (Td)	Time, min (O)	Y	ΔH
0.5	5.0	570.015	70.0	69.00	69.00	70.0	13.00	0.9948	1.9159
		575.035		71.00	71.00				
		5.020		70.00	70.00				
1.0	5.0	575.035	70.0	71.00	71.00	71.5	9.3	0.9910	1.9555
		580.082		72.00	72.00				
		5.047		71.50	71.50				
1.5	10.0	580.082	70.0	72.00	72.00	73.0	15.6	0.9898	2.0575
		590.205		74.00	74.00				
		10.123		73.00	73.00				
2.0	10.0	590.205	70.0	74.00	74.00	74.5	13.6	0.9945	2.0792
		600.296		75.00	75.00				
		10.091		74.50	74.50				
3.0	10.0	600.296	70.0	75.00	75.00	75.5	11.0	0.9873	2.0365
		610.454		76.00	76.00				
		10.158		75.50	75.50				
							Average	**0.9915**	**2.0089**

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	Temperature Reading from Individual Thermocouple Input [1]						Average Temperature Reading	Temp Difference [2] (%)
Select Temperature ○ °C ◉ °F	Channel Number							
	1	2	3	4	5	6		
32	32	32	32	32	32		32.0	0.0%
212	212	212	212	212	212		212.0	0.0%
932	932	932	932	932	932		932.0	0.0%
1832	1830	1830	1830	1830	1830		1830.0	0.1%

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

2 - Acceptable Temperature Difference less than 1.5 %

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

Y Factor Calibration Check Calculation

MODIFIED METHOD 0010 TEST TRAIN

PPA STACK

METER BOX NO. 21

01/07/2019 + 01/08/2019

	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

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

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

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

MWd =	28.84	28.84	28.84

Tma = Source Temperature, absolute(°R)			
Tm = Average dry gas meter temperature , deg F.	65.8	51.5	65.2

$Tma = Ts + 460$

$Tma = 65.75 + 460$

Tma =	525.75	511.46	525.21

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	0.71	0.59	0.62
Pb = Barometric Pressure, in Hg.	30.40	30.08	30.08

$Pm = Pb + (delta H / 13.6)$

$Pm = 30.4 + (0.712083333333334 / 13.6)$

Pm =	30.45	30.12	30.13

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.	44.005	40.425	42.900
Y = Dry gas meter calibration factor (based on full calibration)	0.9915	0.9915	0.9915
Delta H@ = Dry Gas meter orifice calibration coefficient, in. H2O.	2.0089	2.0089	2.0089
avg SQRT Delta H = Avg SQRT press. drop across the orifice meter during sampling , in. H_2O	0.8403	0.7692	0.7870
O = Total sampling time, minutes.	96	96	96

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

$Yqa = (96.00 / 44.01) * SQRT (0.0319 * 525.75 * 29) / (2.01 * 30.45 * 28.84) * 0.84$

$Yqa = 2.182 * SQRT 486.371 / 1,763.927 * 0.84$

Yqa =	0.9626	0.9512	0.9291

Diff = Absolute difference between Yqa and Y	2.91	4.06	6.29

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

$Diff = ((0.9915 - 0.963) / 0.9915) * 100$

Average Diff = 4.42

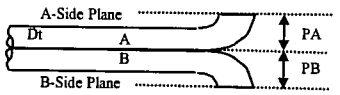
Allowable = 5.0

Type S Pitot Tube Inspection Data Form

Pitot Tube Identification Number: **P-696**

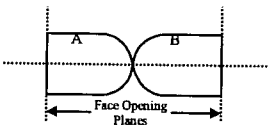
Inspection Date 1/5/18 Individual Conducting Inspection PM

If all Criteria PASS Cp is equal to 0.84

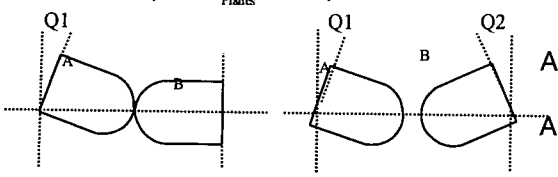


		PASS/FAIL
Distance to A Plane (PA) - inches	0.46	PASS
Distance to B Plane (PB) - inches	0.46	PASS
Pitot OD (D_t) - inches	0.375	

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

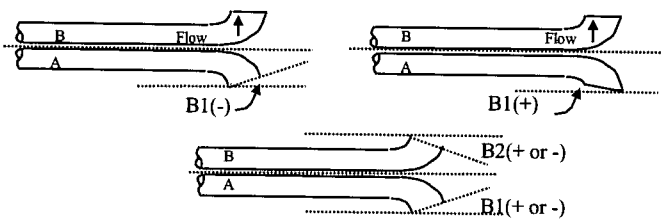


Are Open Faces Aligned Perpendicular to the Tube Axis ◉ YES ○ NO PASS



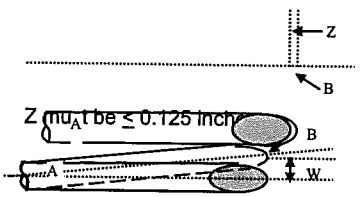
Angle of Q1 from vertical A Tube- degrees (absolute)	0	PASS
Angle of Q2 from vertical B Tube- degrees (absolute)	0	PASS

Q1 and Q2 must be ≤ 10°



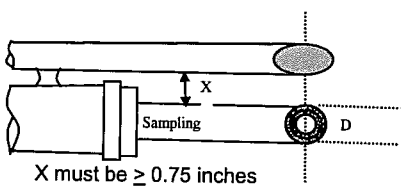
Angle of B1 from vertical A Tube- degrees (absolute)	0	PASS
Angle of B1 from vertical B Tube- degrees (absolute)	0	PASS

B1 or B2 must be ≤ 5°



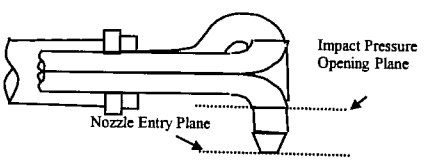
Horizontal offset between A and B Tubes (Z) - inches	0.005	PASS
Vertical offset between A and B Tubes (W) - inches	0.014	PASS

W must be ≤ 0.03125 inches

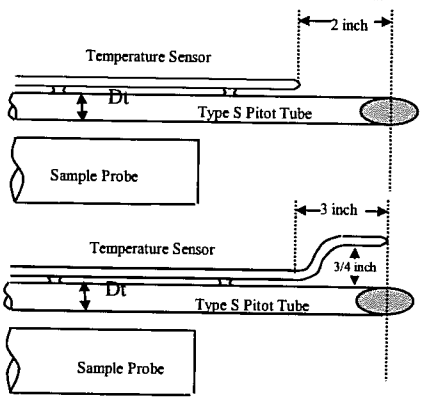


Distance between Sample Nozzle and Pitot (X) - inches	0.8	PASS

X must be ≥ 0.75 inches



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
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:	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

APPENDIX F
LIST OF PROJECT PARTICIPANTS

The following Weston employees participated in this project.

Paul Meeter	Senior Project Manager
Jacob Little	Team Member
Kyle Schweitzer	Team Member
Austin Squires	Team Member
Chris Hartsky	Team Member