PPA MANUFACTURING PROCESS
CARBON BED INLET AND OUTLET STACK
EMISSIONS TEST REPORT
TEST DATES: 11-12 SEPTEMBER 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 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 process stack (outlet) and PPA carbon bed inlet. Testing was performed on 11-12 September 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 and PPA carbon bed inlet which are located in the PPA process area.
- Calculate the carbon bed removal efficiency for HFPO Dimer Acid.
- 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 and the PPA carbon bed inlet.

Tables 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.

Table 1-1
Sampling Plan for PPA Carbon Bed

Sampling Point & Location	**PPA Carbon Bed**				
Number of Tests:	6 (3 inlet, 3 outlet)				
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]	6	6	3	3	6
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	10[5]	6	3	3	6

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 (outlet) and on the PPA carbon bed inlet. 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

	Inlet		Outlet (Process Stack)		Removal Efficiency
	g/sec	lb/hr	g/sec	lb/hr	%
PPA Carbon Bed					
R1	7.47E-04	5.93E-03	3.02E-05	2.40E-04	96.0
R2	6.58E-04	5.23E-03	1.86E-05	1.48E-04	97.2
R3	4.35E-04	3.45E-03	1.21E-05	9.61E-05	97.2
Average	6.13E-04	4.87E-03	2.03E-05	1.61E-04	97.1

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, such as Teflon®, at other Chemours facilities, 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 carbon bed and the process stack (AEP-A1).

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

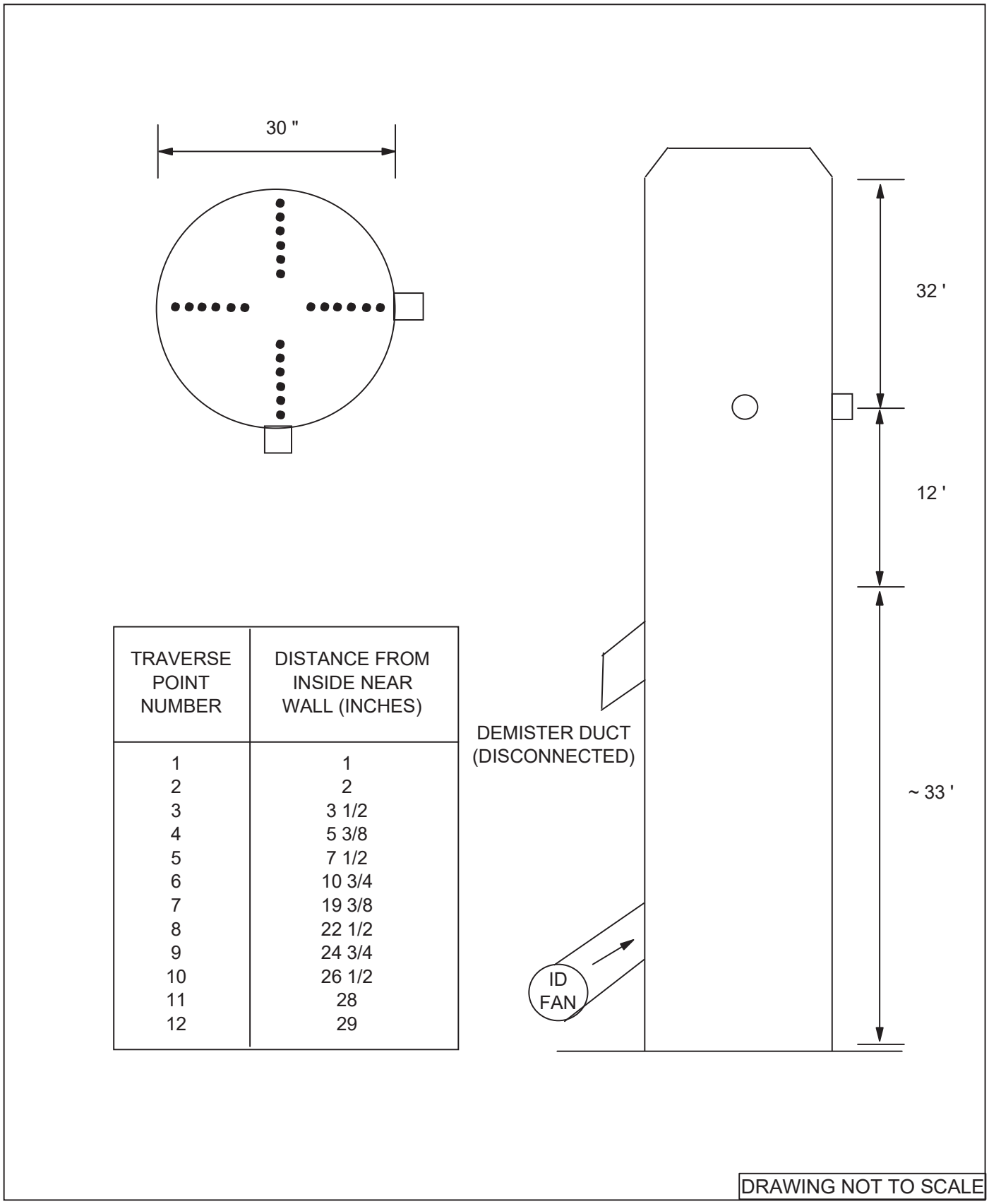
Two 4-inch ID test ports are in place on the 30-inch ID fiberglass stack. The ports are 12 feet (4.8 diameters) from the nearest downstream disturbance (carbon bed outlet) and 32 feet (12.8 diameters) from the nearest upstream disturbance (stack exit).

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.

4.2 PPA CARBON BED INLET

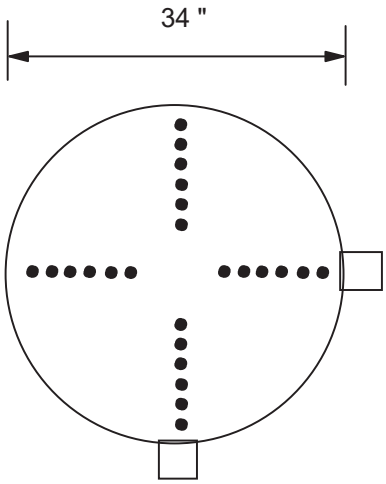
The fiberglass reinforced plastic (FRP) duct at the inlet of the PPA carbon bed is 34-inch ID. The test ports are located a minimum of 42 inches (> 1.2 duct diameters) from the nearest downstream disturbance and at least 57 inches (> 1.7 diameters) from the nearest upstream disturbance. Based on EPA Method 1, a total of 24 traverse points (12 per port) were used for HFPO Dimer Acid sampling. Figure 4-2 provides a schematic of the test port and traverse port locations.

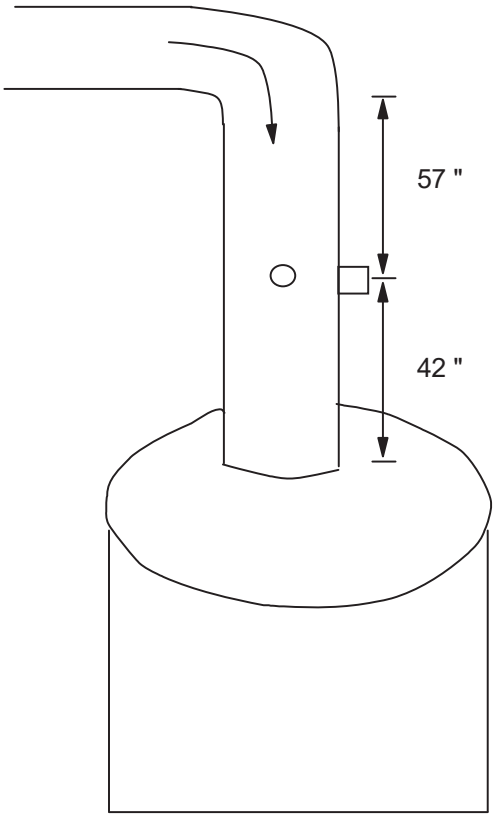


TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE NEAR WALL (INCHES)
1	1
2	2
3	3 1/2
4	5 3/8
5	7 1/2
6	10 3/4
7	19 3/8
8	22 1/2
9	24 3/4
10	26 1/2
11	28
12	29

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

IASDATA\CHEMOURS\15418.002.017\FIGURE 4-1 PPA EXHAUST STACK





CARBON BED

TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE NEAR WALL (INCHES)
1	3/4
2	2 1/4
3	4
4	6
5	8 1/2
6	12 1/8
7	21 5/8
8	25 1/2
9	28
10	30
11	31 3/4
12	33 1/4

DRAWING NOT TO SCALE

FIGURE 4-2
PPA PROCESS CARBON BED INLET
TEST PORT AND TRAVERSE POINT LOCATION

IASDATA\CHEMOURS\15418.002.017\FIGURE 4-2 PPA PROCESS SCHEMATIC

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 locations. The cyclonic flow check was negative (< 20°) verifying that the sources 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.

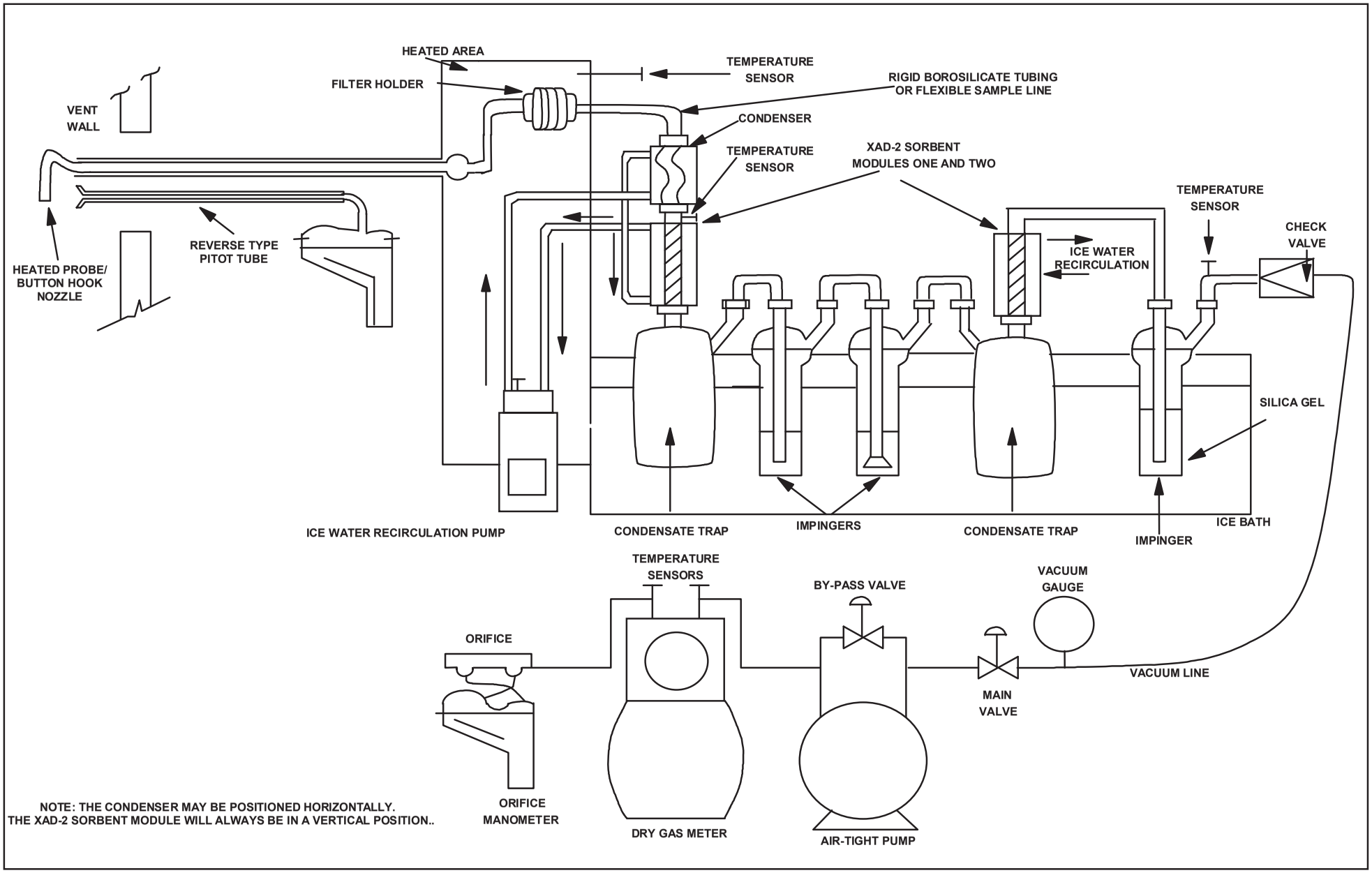


FIGURE 5-1
EPA METHOD 0010 SAMPLING TRAIN

IASDATA\CHEMOURS\15418.002.017\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 and 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 mL 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-L 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 the XAD-2 module 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.

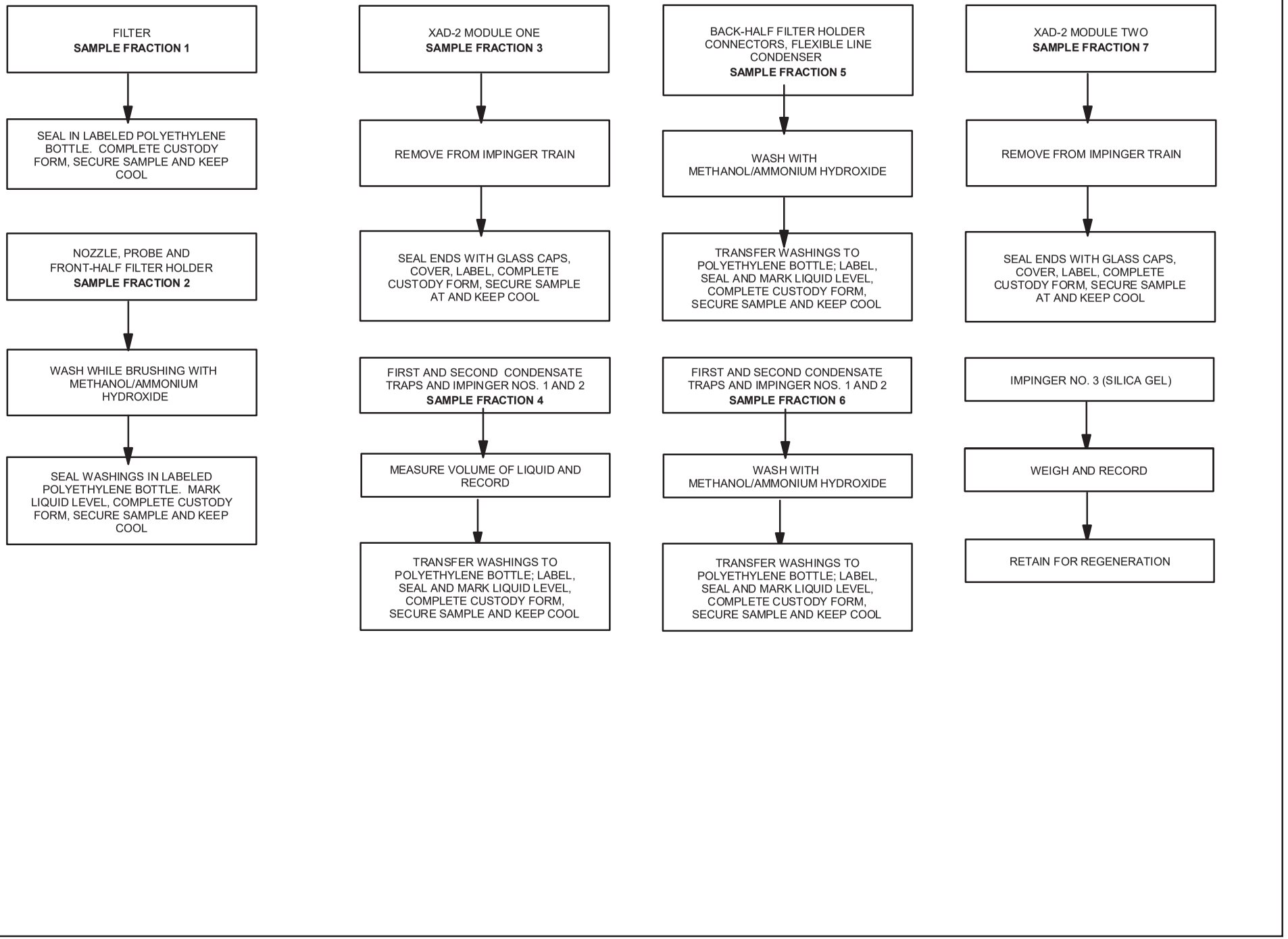


FIGURE 5-2
HFPO DIMER ACID SAMPLE RECOVERY PROCEDURES FOR METHOD 0010

IASDATA\CHEMOURS\15418.002.017\FIGURE 5-2 EPA 0010

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.

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.

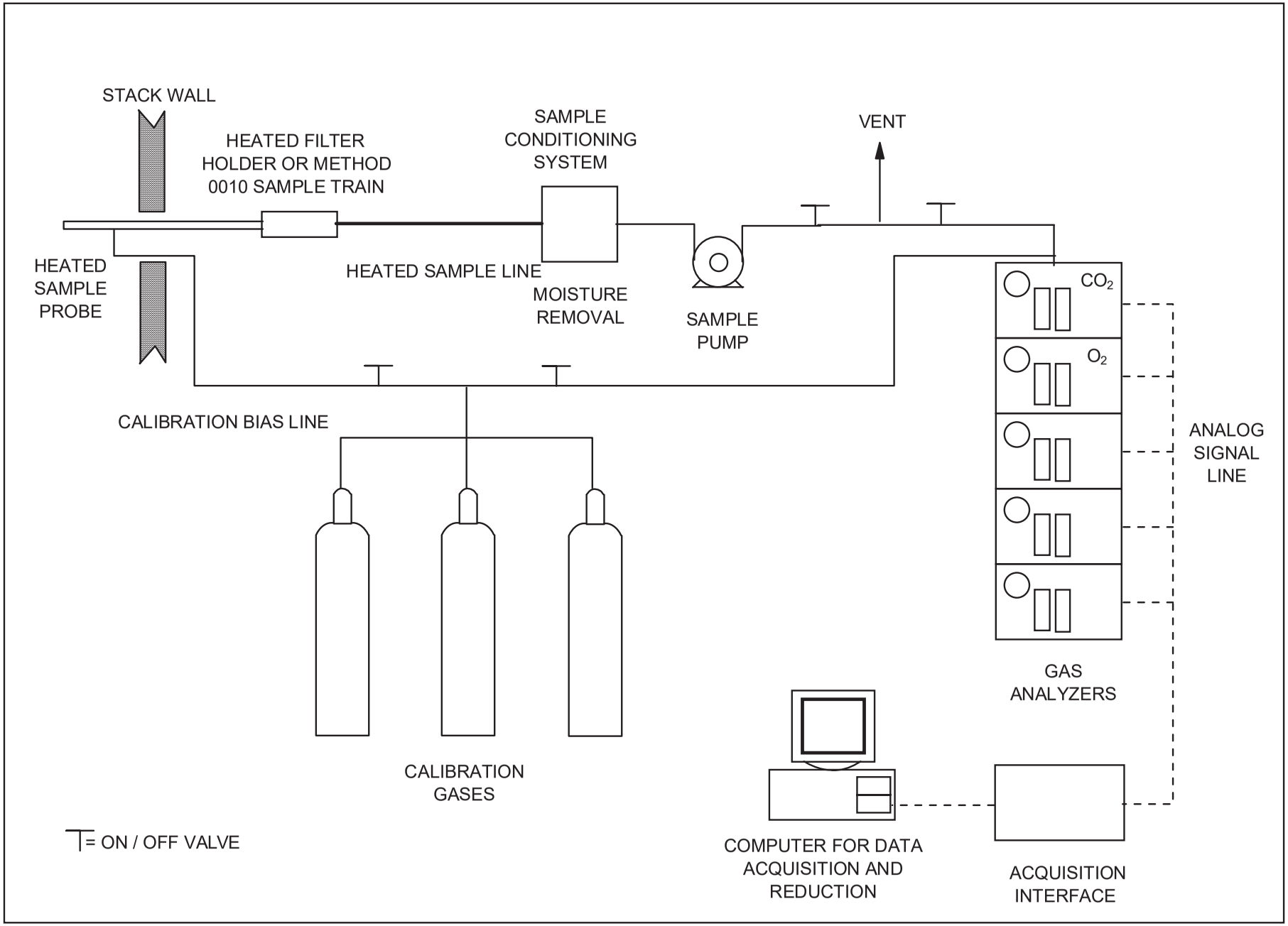


FIGURE 5-3
WESTON SAMPLING SYSTEM

I:\ASDATA\CHEMOURS\15418.002.017\FIGURE 5-3 WESTON SAMPLING SYSTEM

6. DETAILED TEST RESULTS AND DISCUSSION

Each test was a minimum of 96 minutes in duration. A total of three test runs were performed on the PPA process stack and on the PPA carbon bed inlet.

Tables 6-1 and 6-2 provide detailed test data and test results for the PPA carbon bed inlet and PPA process stack, respectively.

The Method 3A sampling at the PPA stack 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.

The carbon bed removal efficiency was calculated based upon the HFPO Dimer Acid inlet and outlet mass emission rates in lb/hr.

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

Test Data			
Run number	1	2	3
Location	PPA CB Inlet	PPA CB Inlet	PPA CB Inlet
Date	09/11/19	09/11/19	09/12/19
Time period	0832-1019	1157-1354	0846-1029
SAMPLING DATA:			
Sampling duration, min.	96.0	96.0	96.0
Nozzle diameter, in.	0.250	0.250	0.250
Cross sectional nozzle area, sq.ft.	0.000341	0.000341	0.000341
Barometric pressure, in. Hg	30.30	30.30	30.15
Avg. orifice press. diff., in H_2O	1.16	1.22	1.22
Avg. dry gas meter temp., deg F	90.0	98.3	94.3
Avg. abs. dry gas meter temp., deg. R	550	558	554
Total liquid collected by train, ml	30.8	30.3	21.7
Std. vol. of H_2O vapor coll., cu.ft.	1.5	1.4	1.0
Dry gas meter calibration factor	0.9944	0.9944	0.9944
Sample vol. at meter cond., dcf	56.988	59.224	58.439
Sample vol. at std. cond., dscf [(1)]	55.222	56.549	55.920
Percent of isokinetic sampling	95.7	96.1	95.4
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.	0.026	0.025	0.018
Mole fraction of dry gas	0.974	0.975	0.982
Molecular wt. of wet gas, lb/lb mole	28.56	28.57	28.64
GAS STREAM VELOCITY AND VOLUMETRIC FLOW DATA:			
Static pressure, in. H_2O	-2.00	-2.00	-2.00
Absolute pressure, in. Hg	30.15	30.15	30.00
Avg. temperature, deg. F	83	89	84
Avg. absolute temperature, deg.R	543	549	544
Pitot tube coefficient	0.84	0.84	0.84
Total number of traverse points	24	24	24
Avg. gas stream velocity, ft./sec.	30.8	31.7	31.3
Stack/duct cross sectional area, sq.ft.	6.31	6.31	6.31
Avg. gas stream volumetric flow, wacf/min.	11647	12004	11839
Avg. gas stream volumetric flow, dscf/min.	11125	11349	11305

[(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 CARBON BED INLET

TEST DATA			
Run number	1	2	3
Location	PPA CB Inlet	PPA CB Inlet	PPA CB Inlet
Date	09/11/19	09/11/19	09/12/19
Time period	0832-1019	1157-1354	0846-1029
LABORATORY REPORT DATA, ug.			
HFPO Dimer Acid	222.6100	196.9280	129.1100
EMISSION RESULTS, ug/dscm.			
HFPO Dimer Acid	142.33	122.95	81.52
EMISSION RESULTS, lb/dscf.			
HFPO Dimer Acid	8.89E-09	7.68E-09	5.09E-09
EMISSION RESULTS, lb/hr.			
HFPO Dimer Acid	5.93E-03	5.23E-03	3.45E-03
EMISSION RESULTS, g/sec.			
HFPO Dimer Acid	7.47E-04	6.58E-04	4.35E-04

TABLE 6-2
CHEMOURS - FAYETTEVILLE, NC
SUMMARY OF HFPO DIMER ACID TEST DATA AND TEST RESULTS
PPA CARBON BED OUTLET

Test Data			
Run number	1	2	3
Location	PPA CBed Outlet	PPA CBed Outlet	PPA CBed Outlet
Date	09/11/19	09/11/19	09/12/19
Time period	0832-1019	1157-1354	0846-1029
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	30.26	30.28	30.16
Avg. orifice press. diff., in H_2O	0.69	0.68	0.66
Avg. dry gas meter temp., deg F	80.1	96.6	80.8
Avg. abs. dry gas meter temp., deg. R	540	557	541
Total liquid collected by train, ml	27.3	22.5	31.1
Std. vol. of H_2O vapor coll., cu.ft.	1.29	1.06	1.46
Dry gas meter calibration factor	0.9979	0.9979	0.9979
Sample vol. at meter cond., dcf	45.454	45.992	44.900
Sample vol. at std. cond., dscf [(1)]	44.901	44.117	44.147
Percent of isokinetic sampling	103.2	102.3	103.2
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.	0.028	0.023	0.032
Mole fraction of dry gas	0.972	0.977	0.968
Molecular wt. of wet gas, lb/lb mole	28.53	28.58	28.49
GAS STREAM VELOCITY AND VOLUMETRIC FLOW DATA:			
Static pressure, in. H_2O	1.20	1.20	1.20
Absolute pressure, in. Hg	30.35	30.37	30.25
Avg. temperature, deg. F	83	86	85
Avg. absolute temperature, deg.R	543	546	545
Pitot tube coefficient	0.84	0.84	0.84
Total number of traverse points	24	24	24
Avg. gas stream velocity, ft./sec.	40.0	39.7	39.8
Stack/duct cross sectional area, sq.ft.	4.90	4.90	4.90
Avg. gas stream volumetric flow, wacf/min.	11765	11671	11704
Avg. gas stream volumetric flow, dscf/min.	11278	11187	11095

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

*Run 3 conducted prior to Run 2

TABLE 6-2 (cont.)
CHEMOURS - FAYETTEVILLE, NC
SUMMARY OF HFPO DIMER ACID TEST DATA AND TEST RESULTS
PPA CARBON BED OUTLET

TEST DATA			
Run number	1	2	3
Location	PPA CBed Outlet	PPA CBed Outlet	PPA CBed Outlet
Date	09/11/19	09/11/19	09/12/19
Time period	0832-1019	1157-1354	0846-1029
LABORATORY REPORT DATA, ug.			
HFPO Dimer Acid	7.22	4.41	2.89
EMISSION RESULTS, ug/dscm.			
HFPO Dimer Acid	5.67	3.53	2.31
EMISSION RESULTS, lb/dscf.			
HFPO Dimer Acid	3.54E-10	2.20E-10	1.44E-10
EMISSION RESULTS, lb/hr.			
HFPO Dimer Acid	2.40E-04	1.48E-04	9.61E-05
HFPO Dimer Acid (From Inlet Data)	5.93E-03	5.23E-03	3.45E-03
EMISSION RESULTS, g/sec.			
HFPO Dimer Acid	3.02E-05	1.86E-05	1.21E-05
Carbon Bed Removal Efficiency, %	96.0	97.2	97.2

APPENDIX A
PROCESS OPERATIONS DATA

PPA Process Data

Date 9/11/2019

Time	800				900				1000				1100				1200				1300			
Stack Testing			Run 1 : 0832-1019														Run 2 : 1157 - 1354							
A/F column Feed Ratev (pounds per hour)																								
Charging water to Hyd - venting																							X	
Charging Sulfuric acid - venting			X			X											X	X						X
Hydrolysis - Wash Tank pressure Transfer to Hydrolysis							X	X																
Hydrolysis - Phase Settle																					X			
Vap heels pressure transfer																								
Vap cycle						X	X	X	X								X	X	X	X	X	X	X	X
Venting after press tran from North/South Acid tank to Hyd																								
DAF tran to Hyd - venting during transfer																								
Hydrolysis - transfer to Waste Acid Trailer				X																		X		
Wash Tk to Vaporizer pressure transfer (new 8-2019)					X																			
Scrubber Recirculation Flow			35 gpm														35 gpm							
Scrubber dP			-0.55 inwc														-0.6 inwc							

Date 9/12/2019

Time	800				900				1000				1100				1200				1300			
Stack Testing			Run 3: 0846-1029																					
A/F column Feed Ratev (pounds per hour)																								
Charging water to Hyd - venting							X																	
Charging Sulfuric acid - venting								X	X															
Hydrolysis - Wash Tank pressure Transfer to Hydrolysis																								
Hydrolysis - Phase Settle																								
Vap heels pressure transfer																								
Vap cycle			X	X	X	X	X	X	X															
Venting after press tran from North/South Acid tank to Hyd																								
DAF tran to Hyd - venting during transfer																								
Hydrolysis - transfer to Waste Acid Trailer																								
Wash Tk to Vaporizer pressure transfer (new 8-2019)																								
Scrubber Recirculation Flow			35 gpm																					
Scrubber dP			-0.6 inwc																					

APPENDIX B
RAW AND REDUCED TEST DATA

Sample and Velocity Traverse Point Data Sheet - Method 1

Client: Chemours
Location/Plant: Fayetteville, NC
Source: PPS Catpoon Bed inlet

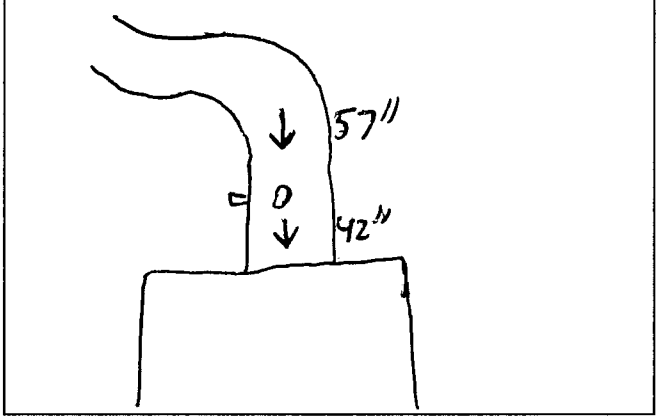
Operator: KS
Date: 6/11/18
W.O. Number:

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	51
Port Depth (in.) = D	~~14~~ 17
Depth of Duct, diameter (in.) = C-D	34
Area of Duct (ft²)	6.305
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)	3.50
Downstream - B (ft)	4.75
Upstream - A (duct diameters)	1.24
Downstream - B (duct diameters)	1.70

Diagram of Stack



Traverse Point Locations

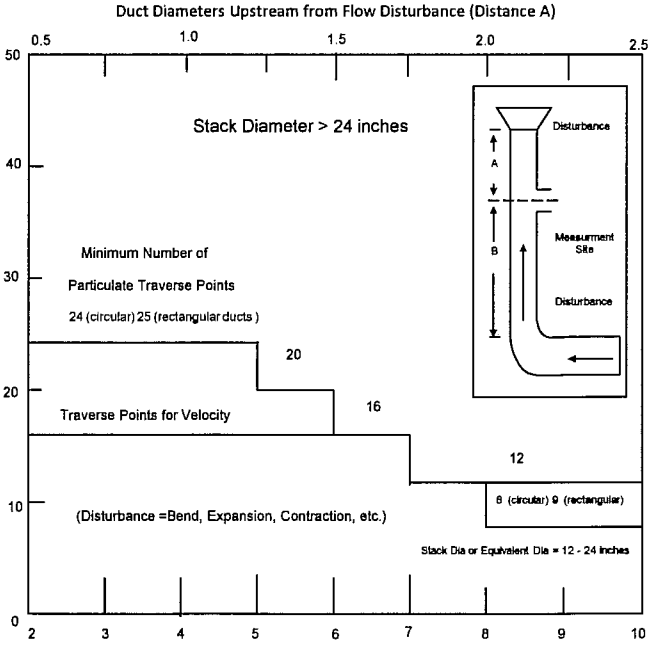
Traverse Point	% of Duct	Distance from Inside Duct Wall (in)	Distance from Outside of Port (in)	
1	2.1	0.714	17.41	18
2	6.7	2.28	19.28	19 1/3
3	11.8	4.01	21.01	21
4	17.7	6.02	23.02	23
5	25	8.50	25.5	25 1/2
6	35.6	12.10	29.10	29
7	64.4	21.90	38.9	39
8	75	25.5	42.5	42 1/2
9	82.3	27.98	44.98	45
10	88.2	29.98	46.98	47
11	93.3	31.72	48.72	48 3/4
12	97.9	33.30	50.3	50

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

Duct Diameters Upstream from Flow Disturbance (Distance A)



Duct Diameters Downstream from Flow Disturbance (Distanca B)

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		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3			83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5					90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7							92.9	81.3	72.2	65.0	59.1	54.2
8							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9									94.4	85.0	77.3	70.8
10									[illegible]	[illegible]	[illegible]	[illegible]
11											95.5	87.5
12											[illegible]	[illegible]

CHEMOURS - FAYETTEVILLE, NC
INPUTS FOR HFPO DIMER ACID CALCULATIONS
PPA CARBON BED INLET

Test Data			
Run number	1	2	3
Location	PPA CB Inlet	PPA CB Inlet	PPA CB Inlet
Date	09/11/19	09/11/19	09/12/19
Time period	0832-1019	1157-1354	0846-1029
Operator	KA/AS	KA/AS	KA/AS
Inputs For Calcs.			
Sq. rt. delta P	0.53968	0.55321	0.54712
Delta H	1.1625	1.2238	1.2213
Stack temp. (deg.F)	82.6	88.8	84.3
Meter temp. (deg.F)	90.0	98.3	94.3
Sample volume (act.)	56.988	59.224	58.439
Barometric press. (in.Hg)	30.30	30.30	30.15
Volume H_2O imp. (ml)	14.0	12.0	10.0
Weight change sil. gel (g)	16.8	18.3	11.7
% 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.)	6.310	6.310	6.310
Sample time (min.)	96.0	96.0	96.0
Static pressure (in.H_2O)	-2.00	-2.00	-2.00
Nozzle dia. (in.)	0.250	0.250	0.250
Meter box cal.	0.9944	0.9944	0.9944
Cp of pitot tube	0.84	0.84	0.84
Traverse points	24	24	24

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

			Stack Conditions	
Client	Chemours		Assumed	Actual
W.O.#	15418.002.017			
Project ID	Chemours	% Moisture	2	
Mode/Source ID	Carbon Bed Inlet	Impinger Vol (ml)		14
Samp. Loc. ID	IN	Silica gel (g)		16.8
Run No.ID	1	CO2, % by Vol	0.0	0.0
Test Method ID	M0010	O2, % by Vol	20.9	21.0
Date ID	9SEP2019	Temperature (°F)	89	82.625
Source/Location	PPA Inlet	Meter Temp (°F)	89	90.042
Sample Date	9/11/19 ✓	Static Press (in H_2O)	-2	-2 ✓
Baro. Press (in Hg)	30.30 ✓			
Operator	KF/AS ✓	Ambient Temp (°F)	85	

Meter Box ID	24	
Meter Box Y	0.9944 ✓	
Meter Box Del H	1.9231	
Probe ID / Length	P711	5'
Probe Material	Boro	
Pitot / Thermocouple ID	P711	
Pitot Coefficient	0.84 ✓	
Nozzle ID	.250	
Nozzle Measurements	.250 / .250 / .250	
Avg Nozzle Dia (in)	.250 ✓	
Area of Stack (ft^2)	6.31 ✓	
Sample Time	96 min ✓	
Total Traverse Pts	24	

	Initial	Mid-Point	Final
K Factor	3.9		
Sample Train (ft^3)	0.002	0.003	0.001
Leak Check @ (in Hg)	15"	9"	8"
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			
Reference Temp			
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 OUTLET TEMP (°F)	PROBE TEMP (°F)	FILTER BOX TEMP (°F)	IMPINGER EXIT TEMP (°F)	SAMPLE TRAIN VAC (in Hg)	XAD EXIT TEMP (F)		COMMENTS
		0	0832 ✓	.38	1.5	810.624									
A	1	4		~~.5047~~	~~1.8~~	813.5	79	75	116	116	58	5	48		
	2	8		.45	1.8	816.3	81	76	115	116	57	6	49		
	3	12		.42	1.6	819.1	81	78	116	117	58	6	51		
	4	16		.30	1.5	821.8	81	80	116	116	57	6	51		
	5	20		.38	1.5	824.6	81	83	115	115	65	6	51		
	6	24		.35	1.4	827.4	81	84	115	116	64	5	50		
	7	28		.28	1.1	829.8	82	86	116	115	62	4	51		
	8	32		.24	.94	831.6	82	88	115	115	63	4	53		
	9	36		.20	.78	833.7	81	89	116	115	63	4	55		
	10	40		.17	.66	835.9	82	90	115	116	63	3	52		
	11	44		.15	.59	837.5	82	90	116	116	64	3	54		
	12	48	0920	.15	.59	838.947	82	90	115	116	64	3	54		839.217 .270 MPLC
B	1	4	0931	.39	1.5	841.7	84	94	116	115	66	5	59		
	2	8		.38	1.5	844.3	84	94	116	117	62	5	52		
	3	12		.36	1.4	847.0	84	95	115	116	60	5	52		
	4	16		.33	1.3	849.7	84	96	117	117	61	5	53		
	5	20		.34	1.3	852.3	84	96	116	118	60	5	54		
	6	24		.32	1.2	854.6	84	97	115	117	60	5	53		
	7	28		.28	1.1	857.1	84	97	116	116	60	5	53		
	8	32		.26	1.0	859.3	84	97	115	114	60	5	55		
	9	36		.24	.94	861.5	84	97	116	115	61	4	54		
	10	40		.24	.94	863.9	84	97	116	116	62	4	53		
	11	44		.24	.94	865.9	84	96	115	116	63	4	54		
	12	48	1019 ✓	.21	.82	867.88	84	96	116	115	63	4	54		
				Avg Delta P .298 ✓	Avg Delta H 1.163 ✓	Total Volume 56.988 ✓	Avg Ts 82.625 ✓	~~Avg Tm 90.042~~	Min/Max 115/117	Min/Max 114/118	Max 66	Max Vac 6	Min/Max 48/59		95.68 2.56 %
				Avg Sqrt Delta P .540 ✓	Avg Sqrt Del H 1.066 ✓	Comments:		90.042 ✓							

WESTON SOLUTIONS

EPA Method 0010 from EPA SW-846

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ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

Client	Chemours	**Stack Conditions**	Assumed	Actual	Meter Box ID	24			K Factor	3.9
W.O.#	15418.002.017				Meter Box Y	0.9944 ✓				
Project ID	Chemours	% Moisture	2		Meter Box Del H	1.9231				
Mode/Source ID	Carbon Bed	Impinger Vol (ml)		12	Probe ID / Length	P711	5'			
Samp. Loc. ID	IN	Silica gel (g)		18.3	Probe Material	Boro				
Run No.ID	2	CO2, % by Vol	0.0		Pitot / Thermocouple ID	P711	–			
Test Method ID	M0010	O2, % by Vol	20.9		Pitot Coefficient	0.84 ✓				
Date ID	9SEP2019	Temperature (°F)	92	88.75	Nozzle ID	.250				
Source/Location	PPA CB Inlet	Meter Temp (°F)	97	98.292	Nozzle Measurements	.250	.250	.250		
Sample Date	9/11/19 ✓	Static Press (in H_2O)	-2	-2 ✓	Avg Nozzle Dia (in)	.250 ✓				
Baro. Press (in Hg)	30.30 ✓				Area of Stack (ft^2)	6.31 ✓				
Operator	KA/AS ✓	Ambient Temp (°F)	85		Sample Time	96 min ✓				
					Total Traverse Pts	24 ✓				

	Initial	Mid-Point	Final
Sample Train (ft^3)	0.000	0.009	0.014
Leak Check @ (in Hg)	13	8	9
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		
Reference Temp		
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 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	1157 ✓			~~668.032~~ 868.032									
KA ~~A~~ B	1	4		KA ~~.44~~ .41	1.6	871.0	88	90	116	118	65	6	55		
	2	8		.40	1.6	873.7	88	90	116	117	62	6	51		
	3	12		.39	1.5	876.4	88	91	115	116	60	5	52		
	4	16		.38	1.5	879.3	88	92	115	115	61	5	51		
	5	20		.38	1.5	882.2	88	94	115	115	62	5	52		
	6	24		.36	1.4	884.8	88	96	115	115	60	5	52		
	7	28		.34	1.3	887.3	88	96	116	115	62	5	53		
	8	32		.29	1.1	889.7	88	97	115	115	62	4	52		
	9	36		.26	1.0	892.0	88	98	115	115	63	4	51		
	10	40		.22	.86	894.0	88	99	115	115	63	4	53		
	11	44		.19	.74	896.0	88	100	116	115	64	4	54		
	12	48	1245	KA ~~.10~~ .16	.62	897.782	88	101	115	115	64	3	55		899.003
															MPLC
KA ~~B~~ A	1	4	1306	.47	1.6	901.8	89	101	115	115	66	6	56		1.24
	2	8		.44	1.7	904.7	89	100	115	117	64	6	54		
	3	12		.42	1.6	907.6	89	100	115	116	63	6	56		
	4	16		.40	1.6	910.4	89	100	115	115	61	6	53		
	5	20		.39	1.5	913.1	89	100	115	116	60	6	51		
	6	24		.38	1.5	916.0	89	101	115	115	61	6	50		
	7	28		.35	1.4	918.4	90	101	115	116	62	5	51		
	8	32		.29	1.1	921.0	90	102	116	115	63	4	52		
	9	36		.19	.74	923.1	90	102	115	115	62	4	53		
	10	40		.18	.70	925.0	90	102	115	115	62	4	52		
	11	44		.16	.62	926.7	90	103	115	115	63	3	53		
	12	48	1354 ✓	.15	.59	928.477	90	103	116	115	64	3	54		
				Avg Delta P .315 ✓	Avg Delta H 1.223 ✓	Total Volume 59.205	Avg Ts 88.75 ✓	Avg Tm 98.292 ✓	Min/Max 115/116	Min/Max 115/118	Max 66	Max Vac 6	Min/Max 50/56		95.60
				Avg Sqrt Delta P .553 ✓	Avg Sqrt Del H 1.091 ✓	Comments: 59.224									

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EPA Method 0010 from EPA SW-846

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ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

			Stack Conditions	
Client	Chemours		Assumed	Actual
W.O.#	15418.002.017			
Project ID	Chemours	% Moisture	2	
Mode/Source ID	Carbon Bed	Impinger Vol (ml)		
Samp. Loc. ID	IN	Silica gel (g)		
Run No.ID	3	CO2, % by Vol	0.0	
Test Method ID	M0010	O2, % by Vol	20.9	
Date ID	9SEP2019	Temperature (°F)	80	84.292
Source/Location	PPA CB1 Inlet	Meter Temp (°F)	83	94.333
Sample Date	9/12/19 ✓	Static Press (in H_2O)	-2	-2 ✓
Baro. Press (in Hg)	30.15 ✓			
Operator	KA/AS ✓	Ambient Temp (°F)	72	

Meter Box ID	24		
Meter Box Y	0.9944 ✓		
Meter Box Del H	1.9291		
Probe ID / Length	P711	5'	Sample Train (ft^3)
Probe Material	Boro		Leak Check @ (in Hg)
Pitot / Thermocouple ID	P711		Pitot leak check good
Pitot Coefficient	0.84 ✓		Pitot Inspection good
Nozzle ID	.250		Method 3 System good
Nozzle Measurements	.250	.250 .250	**Temp Check**
Avg Nozzle Dia (in)	.250 ✓		Meter Box Temp
Area of Stack (ft^2)	6.31 ✓		Reference Temp
Sample Time	96 ✓		Pass/Fail (+/- 2°)
Total Traverse Pts	24 ✓		Temp Change Response ?

K Factor 3.9

	Initial	Mid-Point	Final
Sample Train (ft^3)	0.001	0.002	.012
Leak Check @ (in Hg)	15"	8"	8"
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			
Reference Temp			
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 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	0846 ✓			928.616									
KA XB 1	4		.40	1.6	931.5	83	80	115	115	66	6	57		
2	8		.41	1.6	934.2	83	81	116	115	64	6	55		
3	12		.39	1.5	936.9	83	83	115	115	62	6	55		
4	16		.38	1.5	939.8	83	84	115	115	61	6	56		
5	20		.34	1.5	942.5	83	87	116	116	60	6	54		
6	24		.35	1.4	945.1	83	88	115	115	63	5	55		
7	28		.30	1.2	947.7	83	90	116	115	65	5	56		
8	32		.29	1.1	950.0	83	92	115	116	63	4	53		
9	36		.29	1.1	952.0	83	93	115	115	61	4	54		
10	40		.21	1.1	954.6	84	94	115	115	62	4	53		
11	44		.26	1.0	956.9	84	94	116	116	64	4	54		959.191
12	48	0934	.23	.90	959.044	84	96	115	115	61	4	53		.097
														NPLC
KA XA 1	4	0941	.44	1.7	961.9	86	99	115	115	66	6	54		
2	8		.45	1.8	964.9	85	99	115	115	61	7	53		
3	12		.43	1.7	967.8	85	99	115	115	57	6	54		
4	16		.41	1.6	970.7	85	99	115	115	56	6	53		
5	20		.38	1.5	973.4	85	100	115	115	58	6	55		
6	24		.35	1.4	976.1	85	101	115	115	60	5	56		
7	28		.25	.98	978.3	85	100	115	115	61	5	58		
8	32		.21	.82	980.4	85	101	115	115	62	4	57		
9	36		.19	.70	982.3	85	101	115	115	64	4	61		
10	40		.15	.59	984.1	86	101	115	116	64	4	60		
11	44		.14	.55	985.6	86	101	115	115	64	4	61		
12	48	1029 ✓	.12	.47	987.152	86	101			65	3	63		
			Avg Delta P	Avg Delta H	Total Volume ✓	Avg Ts	Avg Tm ✓	Min/Max	Min/Max	Max	Max Vac	Min/Max		
			.311	1.221 ✓	58.439 ✓	84.292 ✓	94.333 ✓	115/116	115/116	66	7	53/63		
			Avg Sqrt Delta P	Avg Sqrt Del H										
			.550	1.089 ✓										

WESTON solutions 0.3088 0.547

Comments:

EPA Method 0010 from EPA SW-846

amd

SAMPLE RECOVERY FIELD DATA

EPA Method 0010 - HFPO Dimer Acid

Client	Chemours	W.O. #	15418.002
Location/Plant	Fayetteville, NC	Source & Location	PPA Inlet

Run No. 1 — Sample Date 9-11-19 — Recovery Date 9-11-19

Sample I.D. Chemours - Carbon Bed Inlet - IN - 1 - M0010 - — Analyst 4 — Filter Number N/A

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20	Empty					Silica Gel	
Final	~~428~~ 428	102	102	2				214	316.8	
Initial	0	100	100	0				200	300	
Gain	8	2	2	2				14 ✓	16.8 ✓	

Impinger Color Clear — Labeled? ✓

Silica Gel Condition 20% spent — Sealed? ✓

Run No. 2 — Sample Date 9-11-19 — Recovery Date 9-11-19

Sample I.D. Chemours - Carbon Bed Inlet - IN - 2 - M0010 - — Analyst 4 — Filter Number N/A

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20	Empty					Silica Gel	
Final	5	102	100	5				212	318.3	
Initial	0	100	100	0				200	300	
Gain	5	2	0	5				12 ✓	18.3 ✓	

Impinger Color Clear — Labeled? ✓

Silica Gel Condition 20% spent — Sealed? ✓

Run No. 3 — Sample Date 9-12-19 — Recovery Date 9-12-19

Sample I.D. Chemours - Carbon Bed Inlet - IN - 3 - M0010 - — Analyst 4 — Filter Number N/A

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20	Empty					Silica Gel	
Final	6	102	100	2				210	311.7	
Initial	0	100	100	0				200	300	
Gain	6	2	0	2				10 ✓	11.7 ✓	

Impinger Color Clear — Labeled? ✓

Silica Gel Condition 20% spent — Sealed? ✓

Check COC for Sample IDs of Media Blanks

Sample and Velocity Traverse Point Data Sheet - Method 1

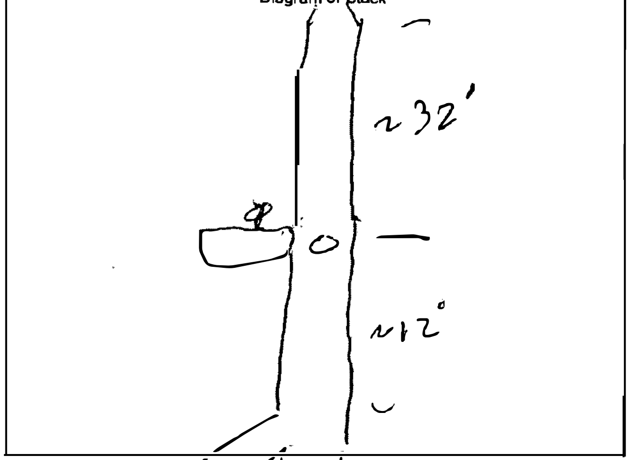
Client: chemours
Loaction/Plant: Fayetteville NC
Source: PPA Stack
Operator: Paul
Date: 1/8/08
W.O. Number: 15418.002.002

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)	/

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



Traverse Point Locations

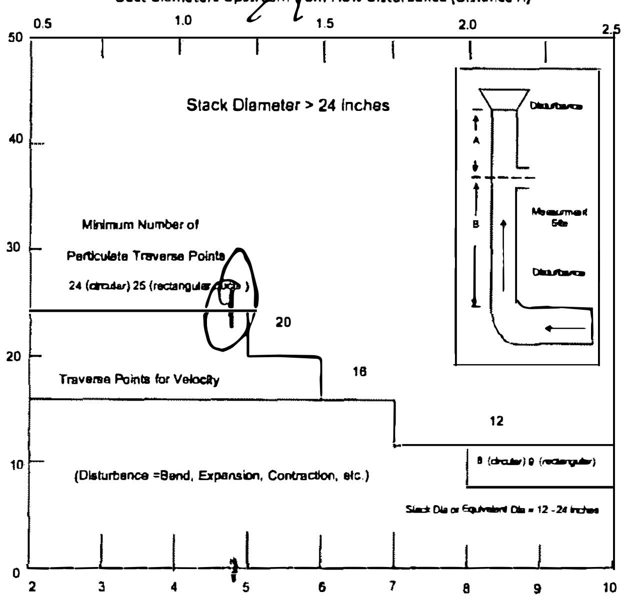
Traverse Point	% of Duct	Distance from Inside Duct Wall (In)	Distance from Outside of Port (In)
1	2.1	.6.3	16
2	6.7	2.0	17
3	11.8	3.5	18 1/2
4	17.7	5.3	20 3/8
5	25	7.5	22 1/2
6	35.6	10.7	25 3/4
7	64.4	19.3	34 3/8
8	75	22.5	37 1/2
9	82.3	24.7	39 3/4
10	88.2	26.5	41 1/2
11	93.3	28.0	43
12	97.9	29.4	44

CEM 3 Point(Long Measurment Line) 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

Duct Diameters Upstream from Flow Disturbance (Distance A)



Duct Diameters Downstream from Flow Disturbance (Distance B)

Traverse Point Location Percent of Stack -Circular

Traverse Location 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 Location 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

CHEMOURS - FAYETTEVILLE, NC
INPUTS FOR HFPO DIMER ACID CALCULATIONS
PPA CARBON BED OUTLET

Test Data			
Run number	1	2	3
Location	PPA CBed Outlet	PPA CBed Outlet	PPA CBed Outlet
Date	09/11/19	09/11/19	09/12/19
Time period	0832-1019	1157-1354	0846-1029
Operator	MW	MW	MW
Inputs For Calcs.			
Sq. rt. delta P	0.70377	0.69713	0.69721
Delta H	0.6858	0.6750	0.6613
Stack temp. (deg.F)	82.9	85.8	84.8
Meter temp. (deg.F)	80.1	96.6	80.8
Sample volume (act.)	45.454	45.992	44.900
Barometric press. (in.Hg)	30.26	30.28	30.16
Volume H_2O imp. (ml)	16.0	14.0	18.0
Weight change sil. gel (g)	11.3	8.5	13.1
% 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)	1.20	1.20	1.20
Nozzle dia. (in.)	0.190	0.190	0.190
Meter box cal.	0.9979	0.9979	0.9979
Cp of pitot tube	0.84	0.84	0.84
Traverse points	24	24	24

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

Page 1 of ___

		Stack Conditions	Assumed	Actual
Client	Chemours			
W.O.#	15418.002			
Project ID	Chemours	% Moisture	≈ 2	
Mode/Source ID	Carbon Bed Outlet	Impinger Vol (ml)		16
Samp. Loc. ID	OUT	Silica gel (g)		16.3
Run No.ID	1	CO2, % by Vol	0.0	
Test Method ID	M0010	O2, % by Vol	20.8	
Date ID	9SEP2019	Temperature (°F)	≈ 85	
Source/Location	PPA Outlet	Meter Temp (°F)	≈ 75	
Sample Date	9/11/19 ✓	Static Press (in H_2O)	1.2 ✓	
Baro. Press (in Hg)	30.26 ✓			
Operator	Mr. Winkler ✓	Ambient Temp (°F)	≈ 80	

Meter Box ID	22		
Meter Box Y	0.9979 ✓		
Meter Box Del H	1.8477		
Probe ID / Length	712	5'	Sample Train (ft^3)
Probe Material	Boro		Leak Check @ (in Hg)
Pitot / Thermocouple ID	P712		Pitot leak check good
Pitot Coefficient	0.84 ✓		Pitot Inspection good
Nozzle ID	G-190		Method 3 System good
Nozzle Measurements	0.190	0.190	**Temp Check**
Avg Nozzle Dia (in)	0.190 ✓		Meter Box Temp
Area of Stack (ft^2)	4.90 ✓		Reference Temp
Sample Time	96 ✓		Pass/Fail (+/- 2°)
Total Traverse Pts	24 ✓		Temp Change Response ?

K Factor 1.41

	Initial	Mid-Point	Final
	0.000	0.001	0.000
	@ 15	@ 5	@ 5
	yes / no	yes / no	yes / no
	yes / no	yes / no	yes / no
	yes / no	yes / no	yes / no
	yes / no	yes / no	yes / no
	Pre-Test Set		Post-Test Set
	71		79
	71		78
	Pass / Fail		Pass / Fail
	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 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	0832 ✓			385.856									
B 1	4		0.56	0.78	387.90	80	70	100	100	67	3	62		
2	8		0.56	0.78	389.81	80	70	100	100	66	3	50		22.684
3	12		0.56	0.76	392.72	80	70	100	100	56	3	48		
4	16		0.56	0.78	394.05	80	72	100	100	56	3	48		
5	20		0.56	0.78	396.10	80	74	100	98	56	3	50		
6	24		0.56	0.78	398.00	80	74	100	98	56	3	50		
7	28		0.54	0.74	400.02	80	76	100	102	55	3	48	←	1.38
8	32		0.52	0.72	401.90	83	77	100	100	55	3	48	New	K-Factor
9	36		0.50	0.69	403.56	83	77	100	100	56	3	52		
10	40		0.45	0.62	405.35	83	77	100	100	54	3	53		
11	44		0.39	0.53	407.00	83	77	100	100	54	3	52		
12	48	0920	0.35	0.47	408.540	83	77	100	100	54	3	52		
		0931			408.600									
1	4		0.55	0.75	410.600	84	80	100	100	66	3	48		
2	8		0.55	0.75	413.100	84	85	100	100	59	3	50		22.77
3	12		0.55	0.75	414.60	84	85	100	100	58	3	50		
4	16		0.55	0.75	416.70	84	85	100	100	57	3	50		
5	20		0.55	0.75	418.50	85	85	100	100	57	3	50		
6	24		0.55	0.75	420.57	86	86	100	100	58	3	50		
7	28		0.50	0.69	422.40	86	86	100	100	58	3	50		
8	32		0.50	0.69	424.50	86	88	100	101	58	3	50		
9	36		0.45	0.61	426.70	84	88	100	100	58	3	51		
10	40		0.40	0.55	428.10	84	88	100	100	58	3	49		
11	44		0.35	0.48	429.68	84	88	100	100	58	3	50		
12	48	1019 ✓	0.35	0.47	431.370	84	88	100	100	59	3	52		
			Avg Delta P ✓	Avg Delta H ✓	Total Volume ✓	Avg Ts ✓	Avg Tm ✓	Min/Max	Min/Max	Max	Max Vac	Min/Max		
			0.49833	0.69522	45.454	82.9	80	100/100	99/102	67	3	48/62		
			Avg Sqrt Delta P	Avg Sqrt Del H	Comments:									
			0.70377	0.82552										

WESTON SOLUTIONS

EPA Method 0010 from EPA SW-846

mmd

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

Page 1 of 1

Client	Chemours
W.O.#	15418.002.017
Project ID	Chemours
Mode/Source ID	PPA
Samp. Loc. ID	STK
Run No.ID	2
Test Method ID	M0010
Date ID	9SEP2019
Source/Location	PPA Stack
Sample Date	9/11/19
Baro. Press (in Hg)	30.28 ✓
Operator	MR WINKELEN ✓

Stack Conditions	Assumed	Actual
% Moisture	≈2	
Impinger Vol (ml)		14.0
Silica gel (g)		8.5
CO2, % by Vol	0.0	
O2, % by Vol	20.8	
Temperature (°F)	≈93	
Meter Temp (°F)	≈93	
Static Press (in H_2O)	1.2	
Ambient Temp (°F)	≈90	

Meter Box ID	2.2
Meter Box Y	0.9979 ✓
Meter Box Del H	1.8477
Probe ID / Length	PTFE 6'
Probe Material	Boro
Pitot / Thermocouple ID	712
Pitot Coefficient	0.84
Nozzle ID	0.190
Nozzle Measurements	0.190 / 0.190 / 0.190
Avg Nozzle Dia (in)	0.190 ✓
Area of Stack (ft^2)	4.90 ✓
Sample Time	96 ✓
Total Traverse Pts	24 ✓

Sample Train (ft^3)	
Leak Check @ (in Hg)	
Pitot leak check good	yes / no
Pitot Inspection good	yes / no
Method 3 System good	yes / no
Temp Check	
Meter Box Temp	
Reference Temp	
Pass/Fail (+/- 2°)	
Temp Change Response ?	

K Factor 1.38

	Initial	Mid-Point	Final
Sample Train (ft^3)	0.001	0.001	0.001
Leak Check @ (in Hg)	✓5	✓5	✓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	94		96
Reference Temp	93		94
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 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	1157 ✓			433.125									
A 1	4		0.54	0.74	435.45	85	94	99	102	67	3	52		
2	8		0.55	0.75	437.65	85	94	99	102	65	3	52		22.917
3	12		0.55	0.75	439.40	85	94	99	100	66	3	50		
4	16		0.54	0.74	441.00	85	94	100	100	66	3	52		
5	20		0.54	0.74	443.40	85	95	100	100	61	3	52		
6	24		0.54	0.74	445.20	85	95	100	100	61	3	52		
7	28		0.50	0.69	447.21	85	96	100	100	61	3	52		
8	32		0.50	0.70	449.00	85	96	100	100	61	3	52	← New K-Factor	
9	36		0.42	0.67	450.90	85	96	100	100	61	3	49		1.41
10	40		0.45	0.63	452.89	85	96	100	100	60	3	50		
11	44		0.35	0.49	454.40	85	96	100	101	61	3	51		
12	48	1245	0.35	0.49	456.042	85	96	100	101	61	3	52		
		1306			456.070									23.075
B 1	4		0.55	0.75	458.045	86	98	100	100	66	3	55		
2	8		0.55	0.75	460.05	86	98	100	100	64	3	52		
3	12		0.54	0.74	462.54	86	98	100	100	64	3	52		
4	16		0.54	0.74	464.17	86	98	100	100	64	3	52		
5	20		0.54	0.74	466.26	86	98	100	100	61	3	52		
6	24		0.54	0.74	468.21	86	98	100	100	61	3	49		
7	28		0.50	0.70	470.15	87	98	100	100	60	3	49		
8	32		0.48	0.67	472.16	87	98	100	100	60	3	49		
9	36		0.45	0.63	474.00	87	98	100	100	60	3	49		
10	40		0.45	0.63	475.80	87	98	100	100	60	3	50		
11	44		0.35	0.49	477.50	87	98	100	100	60	3	50		
12	48	1354 ✓	0.35	0.49	479.145	87	98	100	100	62	3	53		
			Avg Delta P ✓	Avg Delta H ✓	Total Volume	Avg Ts ✓	Avg Tm ✓	Min/Max	Min/Max	Max	Max Vac	Min/Max		
			0.48875	0.67500	45.994 ✓	85.8 ✓	96.6 ✓	99/100	100/102	67	3	49/55		
			Avg Sqrt Delta P ✓	Avg Sqrt Del H ✓	Comments:									
			0.69913	0.81951										

WESTON SOLUTIONS

EPA Method 0010 from EPA SW-846

MMA

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

		Stack Conditions	Assumed	Actual				
Client	Chemours				Meter Box ID	22		
W.O.#	15418.002.017				Meter Box Y	0.9979 ✓		
Project ID	Chemours	% Moisture	≈3.0		Meter Box Del H	1.8477		
Mode/Source ID	PPA	Impinger Vol (ml)		18.0	Probe ID / Length	P-12 6'	Sample Train (ft³)	
Samp. Loc. ID	STK	Silica gel (g)		13.4	Probe Material	Boro	Leak Check @ (in Hg)	
Run No.ID	3	CO2, % by Vol	0.0		Pitot / Thermocouple ID	P-12	Pitot leak check good	
Test Method ID	M0010	O2, % by Vol	20.8		Pitot Coefficient	0.84 ✓	Pitot Inspection good	
Date ID	9SEP2019	Temperature (°F)	≈80		Nozzle ID	G-180	Method 3 System good	
Source/Location	PPA Stack	Meter Temp (°F)	≈83 ✓		Nozzle Measurements	0.190 / 0.190 / 0.192	**Temp Check**	
Sample Date	9/12/19 ✓	Static Press (in H_2O)	1.2 ✓		Avg Nozzle Dia (in)	0.190 ✓	Meter Box Temp	
Baro. Press (in Hg)	~~30.28~~ 30.16 ✓				Area of Stack (ft²)	4.90 ✓	Reference Temp	
Operator	MR, WINKFIELD ✓	Ambient Temp (°F)	75		Sample Time	96 ✓	Pass/Fail (+/- 2°)	
					Total Traverse Pts	24 ✓	Temp Change Response ?	

K Factor 1,36

	Initial	Mid-Point	Final
Sample Train (ft³)	0.001	0.021	0.001
Leak Check @ (in Hg)	✓15	✓5	✓6
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	76		
Reference Temp	76		
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	0846 ✓			480.040									
BA 1	4		0.55	0.75	482.40	84	76	100	100	67	3	55		
2	8		0.55	0.75	484.34	84	77	100	100	66	3	55		22,700
3	12		0.55	0.74	486.10	84	77	100	100	66	3	55		
4	16		0.56	0.76	487.90	84	77	100	100	65	3	55		
5	20		0.56	0.76	490.00	85	79	100	100	64	3	55		
6	24		0.56	0.76	492.27	85	79	100	100	64	3	55		
7	28		0.56	0.76	494.10	85	79	100	100	63	3	51		
8	32		0.50	0.68	495.99	85	79	100	100	63	3	51		
9	36		0.48	0.65	497.70	85	79	100	100	63	3	50		
10	40		0.45	0.61	499.40	85	79	100	100	63	3	50		
11	44		0.35	0.47	501.17	84	79	100	100	63	3	50		
12	48	0934	0.35	0.47	502.740	84	79	100	100	63	3	50		
		0941			502.800									
B 1	4		0.54	0.73	504.70	85	82	100	100	66	3	50		22,200
2	8		0.54	0.73	507.00	85	82	100	100	66	3	51		
3	12		0.52	0.70	508.64	85	82	100	100	65	3	50		
4	16		0.54	0.73	510.60	85	82	100	100	65	3	50		
5	20		0.52	0.70	512.20	85	82	100	100	65	3	50		
6	24		0.52	0.70	514.50	85	82	100	100	64	3	51		
7	28		0.52	0.70	516.52	85	84	100	100	64	3	52		
8	32		0.48	0.65	518.27	85	85	100	100	64	3	53		
9	36		0.44	0.59	520.21	85	85	100	100	64	3	50		
10	40		0.40	0.54	521.99	85	85	100	100	64	3	53		
11	44		0.35	0.47	523.30	85	85	100	100	65	3	52		
12	48	1029 ✓	0.35	0.47	525.000	85	85	100	100	65	3	52		
			Avg Delta P ✓	Avg Delta H ✓	Total Volume ✓	Avg Ts ✓	Avg Tm ✓	Min/Max	Min/Max	Max	Max Vac	Min/Max		
			0.48917 ✓	0.6625 ✓	44,900	84.7	80.83	100	100	67	3	50/55		
			Avg Sqrt Delta P	Avg Sqrt Del H	Comments:									
			0.69721	0.8105 ✓										

WESTON SOLUTIONS

EPA Method 0010 from EPA SW-846

SAMPLE RECOVERY FIELD DATA

EPA Method 0010 - HFPO Dimer Acid

Client: Chemours | W.O. #: 15418.002
Location/Plant: Fayetteville, NC | Source & Location: PPA Outlet

Run No. 1 | Sample Date 9-11-19 | Recovery Date 9-11-19
Sample I.D. Chemours - Carbon Bed Outlet - OUT - 1 - M0010 - | Analyst GL | Filter Number N/A

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20	Empty					Silica Gel	
Final	12	100	100	4				216	311.3	
Initial	0	100	100	0				200	300	
Gain	12	0	0	4				16 ✓	11.3 ✓	

Impinger Color: Clear | Labeled? ✓
Silica Gel Condition: 20% spent | Sealed? ✓

Run No. 2 | Sample Date 9-11-19 | Recovery Date 9-11-19
Sample I.D. Chemours - Carbon Bed Outlet - OUT - 2 - M0010 - | Analyst GL | Filter Number N/A

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20	Empty					Silica Gel	
Final	4	100	106	4				214	308.5	
Initial	0	100	100	0				200	300	
Gain	4	0	6	4				14 ✓	8.5 ✓	

Impinger Color: Clear | Labeled? ✓
Silica Gel Condition: 20% spent | Sealed? ✓

Run No. 3 | Sample Date 9-12-19 | Recovery Date 9-12-19
Sample I.D. Chemours - Carbon Bed Outlet - OUT - 3 - M0010 - | Analyst GL | Filter Number N/A

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20	Empty					Silica Gel	
Final	5	100	108	5				218	313.1	
Initial	0	100	100	0				200	300	
Gain	5	0	8	5				18 ✓	13.1 ✓	

Impinger Color: clear | Labeled? ✓
Silica Gel Condition: 20% spent | Sealed? ✓

Check COC for Sample IDs of Media Blanks

METHODS AND ANALYZERS

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **PPA Outlet**

Project Number:
Operator: **CMH**
Date: **11 Sep 2019**

File: C:\DATA\Chemours\fayetteville\091119 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, %	**17.1**

CALIBRATION DATA

Number 1

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **PPA Outlet**

Project Number:
Operator: **CMH**
Date: **11 Sep 2019**

Start Time: 07:15

O_2

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

Calibration Standards

%	**Cylinder ID**
12.1	ALM053372
21.0	CC112489

Calibration Results

Zero	14 mv
Span, 21.0 %	8007 mv

Curve Coefficients

Slope	**Intercept**
381.0	14

CO_2

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

Calibration Standards

%	**Cylinder ID**
9.0	ALM053372
17.1	CC112489

Calibration Results

Zero	-4 mv
Span, 17.1 %	8547 mv

Curve Coefficients

Slope	**Intercept**
501.5	-4

CALIBRATION ERROR DATA

Number 1

Client: **Chemours** Project Number:
Location: **Fayetteville, NC** Operator: **CMH**
Source: **PPA Outlet** Calibration **1** Date: **11 Sep 2019**

Start Time: 07:15

O_2
Method: EPA 3A
Span Conc. 21.0 %
Slope 381.0 **Intercept** 14.0

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

CO_2
Method: EPA 3A
Span Conc. 17.1 %
Slope 501.5 **Intercept** -4.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
9.0	9.0	0.0	0.0	Pass
17.0	17.0	0.0	0.0	Pass

BIAS

Number 1

Client: **Chemours** | Project Number:
Location: **Fayetteville, NC** | Operator: **CMH**
Source: **PPA Outlet** | Calibration **1** | Date: **11 Sep 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	12.0	12.0	0.0	0.0	Pass

CO_2

Method: EPA 3A

Span Conc. 17.1 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.1	0.1	0.6	Pass
Span	9.0	8.8	-0.2	-1.2	Pass

RUN DATA

Number 1

Client: **Chemours** | Project Number:
Location: **Fayetteville, NC** | Operator: **CMH**
Source: **PPA Outlet** | Calibration **1** | Date: **11 Sep 2019**

Time	O_2 %	CO_2 %
Start Run 1 0832		
08:32	20.8	0.1
08:33	20.8	0.1
08:34	20.8	0.1
08:35	20.8	0.1
08:36	20.8	0.0
08:37	20.8	0.0
08:38	20.8	0.0
08:39	20.8	0.0
08:40	20.8	0.0
08:41	20.8	0.0
08:42	20.8	0.0
08:43	20.8	0.0
08:44	20.8	0.0
08:45	20.8	0.0
08:46	20.8	0.0
08:47	20.8	0.0
08:48	20.8	0.0
08:49	20.8	0.0
08:50	20.8	0.0
08:51	20.8	0.0
08:52	20.8	0.0
08:53	20.8	0.0
08:54	20.8	0.0
08:55	20.8	0.0
08:56	20.8	0.0
08:57	20.8	0.0
08:58	20.8	0.0
08:59	20.8	0.0
09:00	20.8	0.0
09:01	20.8	0.0
09:02	20.8	0.0
09:03	20.8	0.0
09:04	20.8	0.0
09:05	20.8	0.0
09:06	20.8	0.0
09:07	20.8	0.0
09:08	20.8	0.0
09:09	20.8	0.0
09:10	20.8	0.0

RUN DATA

Number 1

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **PPA Outlet**

Calibration **1**

Project Number:
Operator: **CMH**
Date: **11 Sep 2019**

Time	O_2 %	CO_2 %
09:11	20.8	0.0
09:12	20.8	0.0
09:13	20.8	0.0
09:14	20.8	0.0
09:15	20.8	0.0
09:16	20.8	0.0
09:17	20.8	0.0
09:18	20.8	0.0
09:19	20.8	0.0
09:20	20.8	0.0
Port Change		
Start Port 2		
09:31	20.8	0.0
09:32	20.8	0.0
09:33	20.8	0.1
09:34	20.8	0.0
09:35	20.8	0.0
09:36	20.8	0.0
09:37	20.8	0.0
09:38	20.8	0.0
09:39	20.8	0.0
09:40	20.8	0.0
09:41	20.8	0.0
09:42	20.8	0.0
09:43	20.8	0.0
09:44	20.8	0.0
09:45	20.8	0.0
09:46	20.8	0.0
09:47	20.8	0.0
09:48	20.8	0.0
09:49	20.8	0.0
09:50	20.8	0.0
09:51	20.8	0.0
09:52	20.8	0.0
09:53	20.8	0.0
09:54	20.8	0.0
09:55	20.8	0.0
09:56	20.8	0.0
09:57	20.8	0.0
09:58	20.8	0.0

RUN DATA

Number 1

Client: **Chemours** | Project Number:
Location: **Fayetteville, NC** | Operator: **CMH**
Source: **PPA Outlet** | Calibration **1** | Date: **11 Sep 2019**

Time	O_2 %	CO_2 %
09:59	20.8	0.0
10:00	20.8	0.0
10:01	20.8	0.0
10:02	20.8	0.0
10:03	20.8	0.0
10:04	20.8	0.0
10:05	20.8	0.0
10:06	20.8	0.0
10:07	20.8	0.0
10:08	20.8	0.0
10:09	20.8	0.0
10:10	20.8	0.0
10:11	20.8	0.0
10:12	20.8	0.0
10:13	20.8	0.0
10:14	20.8	0.0
10:15	20.8	0.0
10:16	20.8	0.0
10:17	20.8	0.0
10:18	20.8	0.0
10:19	20.8	0.0
End Run 1		
Avgs	**20.8**	**0.0**

RUN SUMMARY

Number 1

Client: **Chemours** | Project Number:
Location: **Fayetteville, NC** | Operator: **CMH**
Source: **PPA Outlet** | Calibration **1** | Date: **11 Sep 2019**

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

Time: 08:31 to 10:19

Run Averages

20.8	0.0

Pre-run Bias at 07:23

Zero Bias	0.0	0.1
Span Bias	12.0	8.8
Span Gas	12.1	9.0

Post-run Bias at 10:21

Zero Bias	0.0	0.1
Span Bias	11.9	8.8
Span Gas	12.1	9.0

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** | Project Number:
Location: **Fayetteville, NC** | Operator: **CMH**
Source: **PPA Outlet** | Calibration **1** | Date: **11 Sep 2019**

Start Time: 10:21

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. 17.1 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.1	0.1	0.6	Pass
Span	9.0	8.8	-0.2	-1.2	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.1	0.1	0.0	0.0	Pass
Span	8.8	8.8	0.0	0.0	Pass

*Bias No. 1

RUN DATA

Number 2

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **PPA Outlet**

Calibration **1**

Project Number:
Operator: **CMH**
Date: **11 Sep 2019**

Time	O_2 %	CO_2 %
	Start R2	
11:57	20.8	0.1
11:58	20.8	0.1
11:59	20.8	0.1
12:00	20.8	0.1
12:01	20.8	0.1
12:02	20.8	0.0
12:03	20.8	0.0
12:04	20.8	0.1
12:05	20.8	0.1
12:06	20.8	0.1
12:07	20.8	0.0
12:08	20.8	0.1
12:09	20.8	0.1
12:10	20.8	0.1
12:11	20.8	0.1
12:12	20.8	0.1
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	0.1
12:21	20.8	0.1
12:22	20.8	0.1
12:23	20.8	0.0
12:24	20.8	0.0
12:25	20.8	0.1
12:26	20.8	0.1
12:27	20.8	0.0
12:28	20.8	0.0
12:29	20.8	0.1
12:30	20.8	0.0
12:31	20.8	0.1
12:32	20.8	0.0
12:33	20.8	0.1
12:34	20.8	0.1
12:35	20.8	0.0

RUN DATA

Number 2

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **PPA Outlet**

Calibration **1**

Project Number:
Operator: **CMH**
Date: **11 Sep 2019**

Time	O_2 %	CO_2 %
12:36	20.8	0.0
12:37	20.8	0.0
12:38	20.8	0.1
12:39	20.8	0.0
12:40	20.8	0.1
12:41	20.8	0.0
12:42	20.8	0.0
12:43	20.8	0.1
12:44	20.8	0.1
12:45	20.8	0.0
Port Change		
12:46	20.8	0.1
12:47	20.8	0.1
12:48	20.8	0.1
12:49	20.8	0.1
12:50	20.8	0.1
12:51	20.8	0.1
12:52	20.8	0.0
12:53	20.8	0.0
12:54	20.8	0.0
12:55	20.8	0.1
12:56	20.8	0.1
12:57	20.8	0.1
12:58	20.8	0.1
12:59	20.8	0.1
13:00	20.8	0.0
13:01	20.8	0.1
13:02	20.8	0.0
13:03	20.8	0.0
13:04	20.8	0.1
13:05	20.8	0.1
Resume		
13:06	20.8	0.1
13:07	20.8	0.1
13:08	20.8	0.1
13:09	20.8	0.1
13:10	20.8	0.0
13:11	20.8	0.1
13:12	20.8	0.1
13:13	20.8	0.0

RUN DATA

Number 2

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **PPA Outlet**

Calibration **1**

Project Number:
Operator: **CMH**
Date: **11 Sep 2019**

Time	O_2 %	CO_2 %
13:14	20.8	0.1
13:15	20.8	0.1
13:16	20.8	0.1
13:17	20.8	0.1
13:18	20.8	0.1
13:19	20.8	0.1
13:20	20.8	0.0
13:21	20.8	0.0
13:22	20.8	0.1
13:23	20.8	0.0
13:24	20.8	0.0
13:25	20.8	0.1
13:26	20.8	0.0
13:27	20.8	0.1
13:28	20.8	0.0
13:29	20.8	0.0
13:30	20.8	0.1
13:31	20.8	0.1
13:32	20.8	0.0
13:33	20.8	0.0
13:34	20.8	0.0
13:35	20.8	0.1
13:36	20.8	0.1
13:37	20.8	0.1
13:38	20.8	0.1
13:39	20.8	0.1
13:40	20.8	0.0
13:41	20.8	0.0
13:42	20.8	0.1
13:43	20.8	0.0
13:44	20.8	0.1
13:45	20.8	0.0
13:46	20.8	0.0
13:47	20.8	0.1
13:48	20.8	0.1
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

RUN DATA

Number 2

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **PPA Outlet**

Calibration **1**

Project Number:
Operator: **CMH**
Date: **11 Sep 2019**

Time	O_2 %	CO_2 %
13:54	20.8	0.0
End of Run 2		
Avgs	**20.8**	**0.1**

RUN SUMMARY

Number 2

Client: **Chemours** Project Number:
Location: **Fayetteville, NC** Operator: **CMH**
Source: **PPA Outlet** Calibration **1** Date: **11 Sep 2019**

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

Time: 11:56 to 13:54

Run Averages

20.8	0.1

Pre-run Bias at 10:21

Zero Bias	0.0	0.1
Span Bias	11.9	8.8
Span Gas	12.1	9.0

Post-run Bias at 13:55

Zero Bias	0.0	0.1
Span Bias	11.9	8.8
Span Gas	12.1	9.0

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** | Project Number:
Location: **Fayetteville, NC** | Operator: **CMH**
Source: **PPA Outlet** | Calibration **1** | Date: **11 Sep 2019**

Start Time: 13:55

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. 2

CO_2
Method: EPA 3A
Span Conc. 17.1 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.1	0.1	0.6	Pass
Span	9.0	8.8	-0.2	-1.2	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.1	0.1	0.0	0.0	Pass
Span	8.8	8.8	0.0	0.0	Pass

*Bias No. 2

METHODS AND ANALYZERS

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **PPA Outlet**

Project Number:
Operator: **CMH**
Date: **12 Sep 2019**

File: C:\DATA\Chemours\fayetteville\091219 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, %	**17.1**

CALIBRATION DATA

Number 1

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **PPA Outlet**

Project Number:
Operator: **CMH**
Date: **12 Sep 2019**

Start Time: 07:16

O_2

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

Calibration Standards

%	**Cylinder ID**
12.1	ALM053372
21.0	CC112489

Calibration Results

Zero	11 mv
Span, 21.0 %	8009 mv

Curve Coefficients

Slope	**Intercept**
381.2	11

CO_2

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

Calibration Standards

%	**Cylinder ID**
9.0	ALM053372
17.1	CC112489

Calibration Results

Zero	1 mv
Span, 17.1 %	8546 mv

Curve Coefficients

Slope	**Intercept**
501.2	1

CALIBRATION ERROR DATA

Number 1

Client: **Chemours** Project Number:
Location: **Fayetteville, NC** Operator: **CMH**
Source: **PPA Outlet** Calibration **1** Date: **12 Sep 2019**

Start Time: 07:16

O_2
Method: EPA 3A
Span Conc. 21.0 %
Slope 381.2 **Intercept** 11.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
12.1	12.1	0.0	0.0	Pass
21.0	21.0	0.0	0.0	Pass

CO_2
Method: EPA 3A
Span Conc. 17.1 %
Slope 501.2 **Intercept** 1.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
9.0	9.0	0.0	0.0	Pass
17.0	17.0	0.0	0.0	Pass

BIAS

Number 1

Client: **Chemours** | Project Number:
Location: **Fayetteville, NC** | Operator: **CMH**
Source: **PPA Outlet** | Calibration **1** | Date: **12 Sep 2019**

Start Time: 07:22

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	12.1	0.0	0.0	Pass

CO_2

Method: EPA 3A

Span Conc. 17.1 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	9.0	8.8	-0.2	-1.2	Pass

RUN DATA

Number 3

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **PPA Outlet**

Calibration **1**

Project Number:
Operator: **CMH**
Date: **12 Sep 2019**

Time	O_2 %	CO_2 %
Start Run 3		
08:46	20.8	0.0
08:47	20.8	0.0
08:48	20.8	0.0
08:49	20.8	0.0
08:50	20.8	0.0
08:51	20.8	0.0
08:52	20.8	0.0
08:53	20.8	0.0
08:54	20.8	0.0
08:55	20.8	0.0
08:56	20.8	0.0
08:57	20.8	0.0
08:58	20.8	0.0
08:59	20.8	0.0
09:00	20.8	0.0
09:01	20.8	0.0
09:02	20.8	0.0
09:03	20.8	0.0
09:04	20.8	0.0
09:05	20.8	0.0
09:06	20.8	0.0
09:07	20.8	0.0
09:08	20.8	0.0
09:09	20.8	0.0
09:10	20.8	0.0
09:11	20.8	0.0
09:12	20.8	0.0
09:13	20.8	0.0
09:14	20.8	0.0
09:15	20.8	0.0
09:16	20.8	0.0
09:17	20.8	0.0
09:18	20.8	0.0
09:19	20.8	0.0
09:20	20.8	0.0
09:21	20.8	0.0
09:22	20.8	0.0
09:23	20.8	0.0
09:24	20.8	0.0

RUN DATA

Number 3

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **PPA Outlet**

Calibration **1**

Project Number:
Operator: **CMH**
Date: **12 Sep 2019**

Time	O_2 %	CO_2 %
09:25	20.8	0.0
09:26	20.8	0.0
09:27	20.8	0.0
09:28	20.8	0.0
09:29	20.8	0.0
09:30	20.8	0.0
09:31	20.8	0.0
09:32	20.8	0.0
09:33	20.8	0.0
Port Change		
Resume Run		
09:41	20.8	0.0
09:42	20.8	0.0
09:43	20.8	0.0
09:44	20.8	0.0
09:45	20.8	0.0
09:46	20.8	0.0
09:47	20.8	0.0
09:48	20.8	0.0
09:49	20.8	0.0
09:50	20.8	0.0
09:51	20.8	0.0
09:52	20.8	0.0
09:53	20.8	0.0
09:54	20.8	0.0
09:55	20.8	0.0
09:56	20.8	0.0
09:57	20.8	0.0
09:58	20.8	0.0
09:59	20.8	0.0
10:00	20.8	0.0
10:01	20.8	0.0
10:02	20.8	0.0
10:03	20.8	0.0
10:04	20.8	0.0
10:05	20.8	0.0
10:06	20.8	0.0
10:07	20.8	0.0
10:08	20.8	0.0
10:09	20.8	0.0

RUN DATA

Number 3

Client: **Chemours** | Project Number:
Location: **Fayetteville, NC** | Operator: **CMH**
Source: **PPA Outlet** | Calibration **1** | Date: **12 Sep 2019**

Time	O_2 %	CO_2 %
10:10	20.8	0.0
10:11	20.8	0.0
10:12	20.8	0.0
10:13	20.8	0.0
10:14	20.8	0.0
10:15	20.8	0.0
10:16	20.8	0.0
10:17	20.8	0.0
10:18	20.8	0.0
10:19	20.8	0.0
10:20	20.8	0.0
10:21	20.8	0.0
10:22	20.8	0.0
10:23	20.8	0.0
10:24	20.8	0.0
10:25	20.8	0.0
10:26	20.8	0.0
10:27	20.8	0.0
10:28	20.8	0.0
10:29	20.8	0.0
End of Run		
Avgs	**20.8**	**0.0**

RUN SUMMARY

Number 3

Client:	**Chemours**		Project Number:
Location:	**Fayetteville, NC**		Operator: **CMH**
Source:	**PPA Outlet**	Calibration **1**	Date: **12 Sep 2019**

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

Time: 08:45 to 10:29

Run Averages

20.8	0.0

Pre-run Bias at 07:22

Zero Bias	0.0	0.0
Span Bias	12.1	8.8
Span Gas	12.1	9.0

Post-run Bias at 11:02

Zero Bias	0.0	0.0
Span Bias	12.1	8.8
Span Gas	12.1	9.0

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

20.7	0.0

BIAS AND CALIBRATION DRIFT

Number 2

Client: **Chemours** | Project Number:
Location: **Fayetteville, NC** | Operator: **CMH**
Source: **PPA Outlet** | Calibration **1** | Date: **12 Sep 2019**

Start Time: 11:02

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	12.1	0.0	0.0	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.1	12.1	0.0	0.0	Pass

*Bias No. 1

CO_2
Method: EPA 3A
Span Conc. 17.1 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	9.0	8.8	-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	8.8	8.8	0.0	0.0	Pass

*Bias No. 1

APPENDIX C
LABORATORY ANALYTICAL REPORT

eurofins | Environment Testing TestAmerica

ANALYTICAL REPORT

Job Number: 140-16648-1

Job Description: PPA Carbon Bed Inlet - M0010

Contract Number: LBIO-67048

For:
Chemours Company FC, LLC The
c/o AECOM
Sabre Building, Suite 300
4051 Ogletown Road
Newark, DE 19713

Attention: Michael Aucoin

Approved for release.
Courtney M Adkins
Project Manager I
9/24/2019 10:39 AM

Courtney M Adkins, Project Manager I
5815 Middlebrook Pike, Knoxville, TN, 37921
(865)291-3000
courtney.adkins@testamericainc.com
09/24/2019

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Qualifiers

LCMS

Qualifier	Qualifier Description
D	Sample results are obtained from a dilution; the surrogate or matrix spike recoveries reported are calculated from diluted samples.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

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

Job ID: 140-16648-1

Method	Method Description	Protocol	Laboratory
8321A	HFPO-DA	SW846	TAL DEN
8321A	PFOA and PFOS	SW846	TAL DEN
None	Leaching Procedure	TAL SOP	TAL DEN
None	Leaching Procedure for Condensate	TAL SOP	TAL DEN
None	Leaching Procedure for XAD	TAL SOP	TAL DEN
Split	Source Air Split	None	TAL DEN

Protocol References:

None = None

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TAL SOP = TestAmerica Laboratories, Standard Operating Procedure

Laboratory References:

TAL DEN = Eurofins TestAmerica, Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Sample Summary

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

Job ID: 140-16648-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
140-16648-1	K-2901,2902 PPA CB INLET R1 M0010 FH	Air	09/11/19 00:00	09/16/19 08:00	
140-16648-2	K-2903,2904,2906 PPA CB INLET R1 M0010 BH	Air	09/11/19 00:00	09/16/19 08:00	
140-16648-3	K-2905 PPA CB INLET R1 M0010 IMPINGERS 1,2&3 COND	Air	09/11/19 00:00	09/16/19 08:00	
140-16648-4	K-2907 PPA CB INLET R1 M0010 BREAKTHROUGH XAD-2 RESIN TUBE	Air	09/11/19 00:00	09/16/19 08:00	
140-16648-5	K-2908,2909 PPA CB INLET R2 M0010 FH	Air	09/12/19 00:00	09/16/19 08:00	
140-16648-6	K-2910,2911,2913 PPA CB INLET R2 M0010 BH	Air	09/12/19 00:00	09/16/19 08:00	
140-16648-7	K-2912 PPA CB INLET R2 M0010 IMPINGERS 1,2&3 COND	Air	09/12/19 00:00	09/16/19 08:00	
140-16648-8	K-2914 PPA CB INLET R2 M0010 BREAKTHROUGH XAD-2 RESIN TUBE	Air	09/12/19 00:00	09/16/19 08:00	
140-16648-9	K-2915,2916 PPA CB INLET R3 M0010 FH	Air	09/12/19 00:00	09/16/19 08:00	
140-16648-10	K-2917,2918,2920 PPA CB INLET R3 M0010 BH	Air	09/12/19 00:00	09/16/19 08:00	
140-16648-11	K-2919 PPA CB INLET R3 M0010 IMPINGERS 1,2&3 COND	Air	09/12/19 00:00	09/16/19 08:00	
140-16648-12	K-2921 PPA CB INLET R3 M0010 BREAKTHROUGH XAD-2 RESIN TUBE	Air	09/12/19 00:00	09/16/19 08:00	

Job Narrative
140-16648-1

Sample Receipt

The samples were received on September 16, 2019 at 8:00 AM in good condition and properly preserved. The temperature of the cooler at receipt was 2.1º C.

Quality Control and Data Interpretation

Unless otherwise noted, all holding times, and QC criteria were met and the test results shown in this report meet all applicable NELAC requirements.

Method 0010/Method 3542 Sampling Train Preparation

Train fractions were extracted and prepared for analysis in TestAmerica's Knoxville laboratory. Extracts and condensate samples were forwarded to the Denver laboratory for HFPO-DA analysis. All results are reported in "Total ug" per sample.

LCMS

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Organic Prep

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Comments

Reporting Limits (RLs) and Method Detection Limits (MDLs) for the HFPO-DA used in this report were derived in Denver for reporting soils and water samples. Method 0010 sampling train matrix specific RLs and MDLs have not been established for HFPO-DA. The soil and water limits are expected to be reasonable approximations of the actual matrix specific limits, under these conditions.

Breakthrough from the Modified Method 0010 Sampling Train for PFAS compounds will be measured by the percentage (%) concentration of a specific PFAS target analyte determined to be present in the Breakthrough XAD-2 resin module of a test run. If the concentration of a specific PFAS compound is ≤30% of the sum of the concentrations determined for the other three (3) fractions of the sampling train, then sampling breakthrough is determined not to have occurred. Also, no breakthrough will be determined to have occurred if < 250 µg of a target analyte is collected on all fractions of a sampling train. Breakthrough the sampling train implies that sample loss through the train has occurred and results in a negative bias to the sample results.

LCMS

Analysis Batch: 464589

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
DLCK 280-464589/13	Lab Control Sample	Total/NA	Air	8321A	

Prep Batch: 470741

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16648-3	K-2905 PPA CB INLET R1 M0010 IMPINGERS 1	Total/NA	Air	None	
140-16648-7	K-2912 PPA CB INLET R2 M0010 IMPINGERS 1	Total/NA	Air	None	
140-16648-11	K-2919 PPA CB INLET R3 M0010 IMPINGERS 1	Total/NA	Air	None	
MB 280-470741/1-B	Method Blank	Total/NA	Air	None	
LCS 280-470741/2-B	Lab Control Sample	Total/NA	Air	None	

Prep Batch: 470787

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16648-2	K-2903,2904,2906 PPA CB INLET R1 M0010 BH	Total/NA	Air	None	
140-16648-4	K-2907 PPA CB INLET R1 M0010 BREAKTHRO	Total/NA	Air	None	
140-16648-6	K-2910,2911,2913 PPA CB INLET R2 M0010 BH	Total/NA	Air	None	
140-16648-8	K-2914 PPA CB INLET R2 M0010 BREAKTHRO	Total/NA	Air	None	
140-16648-10	K-2917,2918,2920 PPA CB INLET R3 M0010 BH	Total/NA	Air	None	
140-16648-12	K-2921 PPA CB INLET R3 M0010 BREAKTHRO	Total/NA	Air	None	
MB 280-470787/1-B	Method Blank	Total/NA	Air	None	
LCS 280-470787/2-B	Lab Control Sample	Total/NA	Air	None	

Cleanup Batch: 470796

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16648-3	K-2905 PPA CB INLET R1 M0010 IMPINGERS 1	Total/NA	Air	Split	470741
140-16648-7	K-2912 PPA CB INLET R2 M0010 IMPINGERS 1	Total/NA	Air	Split	470741
140-16648-11	K-2919 PPA CB INLET R3 M0010 IMPINGERS 1	Total/NA	Air	Split	470741
MB 280-470741/1-B	Method Blank	Total/NA	Air	Split	470741
LCS 280-470741/2-B	Lab Control Sample	Total/NA	Air	Split	470741

Prep Batch: 470909

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16648-1	K-2901,2902 PPA CB INLET R1 M0010 FH	Total/NA	Air	None	
140-16648-5	K-2908,2909 PPA CB INLET R2 M0010 FH	Total/NA	Air	None	
140-16648-9	K-2915,2916 PPA CB INLET R3 M0010 FH	Total/NA	Air	None	
MB 280-470909/1-B	Method Blank	Total/NA	Air	None	
LCS 280-470909/2-B	Lab Control Sample	Total/NA	Air	None	

Cleanup Batch: 471006

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16648-1	K-2901,2902 PPA CB INLET R1 M0010 FH	Total/NA	Air	Split	470909
140-16648-5	K-2908,2909 PPA CB INLET R2 M0010 FH	Total/NA	Air	Split	470909
140-16648-9	K-2915,2916 PPA CB INLET R3 M0010 FH	Total/NA	Air	Split	470909
MB 280-470909/1-B	Method Blank	Total/NA	Air	Split	470909
LCS 280-470909/2-B	Lab Control Sample	Total/NA	Air	Split	470909

Cleanup Batch: 471159

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16648-2	K-2903,2904,2906 PPA CB INLET R1 M0010 BH	Total/NA	Air	Split	470787
140-16648-4	K-2907 PPA CB INLET R1 M0010 BREAKTHRO	Total/NA	Air	Split	470787
140-16648-6	K-2910,2911,2913 PPA CB INLET R2 M0010 BH	Total/NA	Air	Split	470787
140-16648-8	K-2914 PPA CB INLET R2 M0010 BREAKTHRO	Total/NA	Air	Split	470787

LCMS (Continued)

Cleanup Batch: 471159 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16648-10	K-2917,2918,2920 PPA CB INLET R3 M0010 BH	Total/NA	Air	Split	470787
140-16648-12	K-2921 PPA CB INLET R3 M0010 BREAKTHRO	Total/NA	Air	Split	470787
MB 280-470787/1-B	Method Blank	Total/NA	Air	Split	470787
LCS 280-470787/2-B	Lab Control Sample	Total/NA	Air	Split	470787

Analysis Batch: 471376

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16648-3	K-2905 PPA CB INLET R1 M0010 IMPINGERS 1	Total/NA	Air	8321A	470796
140-16648-7	K-2912 PPA CB INLET R2 M0010 IMPINGERS 1	Total/NA	Air	8321A	470796
140-16648-11	K-2919 PPA CB INLET R3 M0010 IMPINGERS 1	Total/NA	Air	8321A	470796
MB 280-470741/1-B	Method Blank	Total/NA	Air	8321A	470796
LCS 280-470741/2-B	Lab Control Sample	Total/NA	Air	8321A	470796

Analysis Batch: 471377

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16648-1	K-2901,2902 PPA CB INLET R1 M0010 FH	Total/NA	Air	8321A	471006
140-16648-5	K-2908,2909 PPA CB INLET R2 M0010 FH	Total/NA	Air	8321A	471006
140-16648-9	K-2915,2916 PPA CB INLET R3 M0010 FH	Total/NA	Air	8321A	471006
MB 280-470909/1-B	Method Blank	Total/NA	Air	8321A	471006
LCS 280-470909/2-B	Lab Control Sample	Total/NA	Air	8321A	471006

Analysis Batch: 471601

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16648-2	K-2903,2904,2906 PPA CB INLET R1 M0010 BH	Total/NA	Air	8321A	471159
140-16648-4	K-2907 PPA CB INLET R1 M0010 BREAKTHRO	Total/NA	Air	8321A	471159
140-16648-6	K-2910,2911,2913 PPA CB INLET R2 M0010 BH	Total/NA	Air	8321A	471159
140-16648-8	K-2914 PPA CB INLET R2 M0010 BREAKTHRO	Total/NA	Air	8321A	471159
140-16648-10	K-2917,2918,2920 PPA CB INLET R3 M0010 BH	Total/NA	Air	8321A	471159
140-16648-12	K-2921 PPA CB INLET R3 M0010 BREAKTHRO	Total/NA	Air	8321A	471159
MB 280-470787/1-B	Method Blank	Total/NA	Air	8321A	471159
LCS 280-470787/2-B	Lab Control Sample	Total/NA	Air	8321A	471159

Client Sample ID: K-2901,2902 PPA CB INLET R1 M0010 FH

Lab Sample ID: 140-16648-1

Date Collected: 09/11/19 00:00
Matrix: Air
Date Received: 09/16/19 08:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	217		2.50	0.270	ug/Sample		09/17/19 14:30	09/20/19 11:35	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*97*	*D*	*50 - 200*	*09/17/19 14:30*	*09/20/19 11:35*	*50*

Client Sample ID: K-2903,2904,2906 PPA CB INLET R1 M0010 BH

Lab Sample ID: 140-16648-2

Date Collected: 09/11/19 00:00
Matrix: Air
Date Received: 09/16/19 08:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	3.72		0.250	0.0500	ug/Sample		09/17/19 12:00	09/23/19 12:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*59*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:10*	*1*

Client Sample ID: K-2905 PPA CB INLET R1 M0010 IMPINGERS 1,2&3 COND

Lab Sample ID: 140-16648-3

Date Collected: 09/11/19 00:00
Matrix: Air
Date Received: 09/16/19 08:00
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	1.89		0.214	0.0109	ug/Sample		09/16/19 09:17	09/20/19 11:00	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*93*		*50 - 200*	*09/16/19 09:17*	*09/20/19 11:00*	*1*

Client Sample ID: K-2907 PPA CB INLET R1 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-16648-4

Date Collected: 09/11/19 00:00
Matrix: Air
Date Received: 09/16/19 08:00
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		09/17/19 12:00	09/23/19 12:13	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*63*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:13*	*1*

Client Sample ID: K-2908,2909 PPA CB INLET R2 M0010 FH

Lab Sample ID: 140-16648-5

Date Collected: 09/12/19 00:00
Matrix: Air
Date Received: 09/16/19 08:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	192		3.00	0.324	ug/Sample		09/17/19 14:30	09/20/19 11:39	20

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*100*	*D*	*50 - 200*	*09/17/19 14:30*	*09/20/19 11:39*	*20*

Client Sample ID: K-2910,2911,2913 PPA CB INLET R2 M0010 BH

Lab Sample ID: 140-16648-6

Date Collected: 09/12/19 00:00
Matrix: Air
Date Received: 09/16/19 08:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	4.73		0.300	0.0600	ug/Sample		09/17/19 12:00	09/23/19 12:17	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*69*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:17*	*1*

Client Sample ID: K-2912 PPA CB INLET R2 M0010 IMPINGERS 1,2&3 COND

Lab Sample ID: 140-16648-7

Date Collected: 09/12/19 00:00
Matrix: Air
Date Received: 09/16/19 08:00
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.198	J	0.202	0.0103	ug/Sample		09/16/19 09:17	09/20/19 11:03	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*92*		*50 - 200*	*09/16/19 09:17*	*09/20/19 11:03*	*1*

Client Sample ID: K-2914 PPA CB INLET R2 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-16648-8

Date Collected: 09/12/19 00:00
Matrix: Air
Date Received: 09/16/19 08:00
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		09/17/19 12:00	09/23/19 12:20	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*65*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:20*	*1*

Client Sample ID: K-2915,2916 PPA CB INLET R3 M0010 FH

Lab Sample ID: 140-16648-9

Date Collected: 09/12/19 00:00
Matrix: Air
Date Received: 09/16/19 08:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	126		2.50	0.270	ug/Sample		09/17/19 14:30	09/20/19 11:42	20

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*112*	*D*	*50 - 200*	*09/17/19 14:30*	*09/20/19 11:42*	*20*

Client Sample ID: K-2917,2918,2920 PPA CB INLET R3 M0010 BH

Lab Sample ID: 140-16648-10

Date Collected: 09/12/19 00:00
Matrix: Air
Date Received: 09/16/19 08:00
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	2.13		0.275	0.0550	ug/Sample		09/17/19 12:00	09/23/19 12:23	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*75*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:23*	*1*

Client Sample ID: K-2919 PPA CB INLET R3 M0010 IMPINGERS 1,2&3 COND

Lab Sample ID: 140-16648-11

Date Collected: 09/12/19 00:00
Matrix: Air
Date Received: 09/16/19 08:00
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.980		0.244	0.0124	ug/Sample		09/16/19 09:17	09/20/19 11:06	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*91*		*50 - 200*	*09/16/19 09:17*	*09/20/19 11:06*	*1*

Client Sample ID: K-2921 PPA CB INLET R3 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-16648-12

Date Collected: 09/12/19 00:00
Matrix: Air
Date Received: 09/16/19 08:00
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		09/17/19 12:00	09/23/19 12:27	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*69*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:27*	*1*

Default Detection Limits

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

Job ID: 140-16648-1

Method: 8321A - HFPO-DA

Prep: None

Analyte	RL	MDL	Units
HFPO-DA	0.00250	0.00128	ug/Sample

Method: 8321A - PFOA and PFOS

Prep: None

Analyte	RL	MDL	Units
HFPO-DA	0.0250	0.00270	ug/Sample
HFPO-DA	0.100	0.0200	ug/Sample

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ANALYTICAL REPORT

Job Number: 140-16649-1

Job Description: PPA Carbon Bed Outlet - M0010

Contract Number: LBIO-67048

For:
Chemours Company FC, LLC The
c/o AECOM
Sabre Building, Suite 300
4051 Ogletown Road
Newark, DE 19713

Attention: Michael Aucoin

Approved for release.
Courtney M Adkins
Project Manager I
9/24/2019 10:36 AM

Courtney M Adkins, Project Manager I
5815 Middlebrook Pike, Knoxville, TN, 37921
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09/24/2019

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Qualifiers

LCMS

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
X	Surrogate is outside control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

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

Job ID: 140-16649-1

Method	Method Description	Protocol	Laboratory
8321A	HFPO-DA	SW846	TAL DEN
8321A	PFOA and PFOS	SW846	TAL DEN
None	Leaching Procedure	TAL SOP	TAL DEN
None	Leaching Procedure for Condensate	TAL SOP	TAL DEN
None	Leaching Procedure for XAD	TAL SOP	TAL DEN
Split	Source Air Split	None	TAL DEN

Protocol References:

None = None

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TAL SOP = TestAmerica Laboratories, Standard Operating Procedure

Laboratory References:

TAL DEN = Eurofins TestAmerica, Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Sample Summary

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

Job ID: 140-16649-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
140-16649-1	Q-2101,2102 PPA CB OUTLET R1 M0010 FH	Air	09/11/19 00:00	09/16/19 08:46	
140-16649-2	Q-2103,2104,2106 PPA CB OUTLET R1 M0010 BH	Air	09/11/19 00:00	09/16/19 08:46	
140-16649-3	Q-2105 PPA CB OUTLET R1 M0010 IMPINGERS 1,2&3 COND	Air	09/11/19 00:00	09/16/19 08:46	
140-16649-4	Q-2107 PPA CB OUTLET R1 M0010 BREAKTHROUGH XAD-2 RESIN TUBE	Air	09/11/19 00:00	09/16/19 08:46	
140-16649-5	Q-2108,2109 PPA CB OUTLET R2 M0010 FH	Air	09/12/19 00:00	09/16/19 08:46	
140-16649-6	Q-2110,2111,2113 PPA CB OUTLET R2 M0010 BH	Air	09/12/19 00:00	09/16/19 08:46	
140-16649-7	Q-2112 PPA CB OUTLET R2 M0010 IMPINGERS 1,2&3 COND	Air	09/12/19 00:00	09/16/19 08:46	
140-16649-8	Q-2114 PPA CB OUTLET R2 M0010 BREAKTHROUGH XAD-2 RESIN TUBE	Air	09/12/19 00:00	09/16/19 08:46	
140-16649-9	Q-2115,2116 PPA CB OUTLET R3 M0010 FH	Air	09/12/19 00:00	09/16/19 08:46	
140-16649-10	Q-2117,2118,2920 PPA CB OUTLET R3 M0010 BH	Air	09/12/19 00:00	09/16/19 08:46	
140-16649-11	Q-2119 PPA CB OUTLET R3 M0010 IMPINGERS 1,2&3 COND	Air	09/12/19 00:00	09/16/19 08:46	
140-16649-12	Q-2121 PPA CB OUTLET R3 M0010 BREAKTHROUGH XAD-2 RESIN TUBE	Air	09/12/19 00:00	09/16/19 08:46	

Job Narrative
140-16649-1

Sample Receipt

The samples were received on September 16, 2019 at 8:00 AM in good condition and properly preserved. The temperature of the cooler at receipt was 1.9º C.

Quality Control and Data Interpretation

Unless otherwise noted, all holding times, and QC criteria were met and the test results shown in this report meet all applicable NELAC requirements.

Method 0010/Method 3542 Sampling Train Preparation

Train fractions were extracted and prepared for analysis in TestAmerica's Knoxville laboratory. Extracts and condensate samples were forwarded to the Denver laboratory for HFPO-DA analysis. All results are reported in "Total ug" per sample.

LCMS

Method 8321A: The Isotope Dilution Analyte (IDA) recovery associated with the following sample is below the method recommended limit: (MB 280-470787/13-B). Generally, data quality is not considered affected if the IDA signal-to-noise ratio is greater than 10:1, which is achieved for all IDA in the sample(s). All detection limits are below the lower calibration.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Comments

Reporting Limits (RLs) and Method Detection Limits (MDLs) for the HFPO-DA used in this report were derived in Denver for reporting soils and water samples. Method 0010 sampling train matrix specific RLs and MDLs have not been established for HFPO-DA. The soil and water limits are expected to be reasonable approximations of the actual matrix specific limits, under these conditions.

Breakthrough from the Modified Method 0010 Sampling Train for PFAS compounds will be measured by the percentage (%) concentration of a specific PFAS target analyte determined to be present in the Breakthrough XAD-2 resin module of a test run. If the concentration of a specific PFAS compound is ≤30% of the sum of the concentrations determined for the other three (3) fractions of the sampling train, then sampling breakthrough is determined not to have occurred. Also, no breakthrough will be determined to have occurred if < 250 µg of a target analyte is collected on all fractions of a sampling train. Breakthrough the sampling train implies that sample loss through the train has occurred and results in a negative bias to the sample results.

LCMS

Analysis Batch: 464589

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
DLCK 280-464589/13	Lab Control Sample	Total/NA	Air	8321A	

Prep Batch: 470741

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16649-3	Q-2105 PPA CB OUTLET R1 M0010 IMPINGERS	Total/NA	Air	None	
140-16649-7	Q-2112 PPA CB OUTLET R2 M0010 IMPINGERS	Total/NA	Air	None	
140-16649-11	Q-2119 PPA CB OUTLET R3 M0010 IMPINGERS	Total/NA	Air	None	
MB 280-470741/1-B	Method Blank	Total/NA	Air	None	
LCS 280-470741/2-B	Lab Control Sample	Total/NA	Air	None	

Prep Batch: 470787

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16649-2	Q-2103,2104,2106 PPA CB OUTLET R1 M0010	Total/NA	Air	None	
140-16649-4	Q-2107 PPA CB OUTLET R1 M0010 BREAKTHF	Total/NA	Air	None	
140-16649-6	Q-2110,2111,2113 PPA CB OUTLET R2 M0010	Total/NA	Air	None	
140-16649-8	Q-2114 PPA CB OUTLET R2 M0010 BREAKTHF	Total/NA	Air	None	
140-16649-10	Q-2117,2118,2920 PPA CB OUTLET R3 M0010	Total/NA	Air	None	
140-16649-12	Q-2121 PPA CB OUTLET R3 M0010 BREAKTHF	Total/NA	Air	None	
MB 280-470787/13-B	Method Blank	Total/NA	Air	None	
MB 280-470787/1-B	Method Blank	Total/NA	Air	None	
LCS 280-470787/2-B	Lab Control Sample	Total/NA	Air	None	

Cleanup Batch: 470796

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16649-3	Q-2105 PPA CB OUTLET R1 M0010 IMPINGERS	Total/NA	Air	Split	470741
140-16649-7	Q-2112 PPA CB OUTLET R2 M0010 IMPINGERS	Total/NA	Air	Split	470741
140-16649-11	Q-2119 PPA CB OUTLET R3 M0010 IMPINGERS	Total/NA	Air	Split	470741
MB 280-470741/1-B	Method Blank	Total/NA	Air	Split	470741
LCS 280-470741/2-B	Lab Control Sample	Total/NA	Air	Split	470741

Prep Batch: 470909

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16649-1	Q-2101,2102 PPA CB OUTLET R1 M0010 FH	Total/NA	Air	None	
140-16649-5	Q-2108,2109 PPA CB OUTLET R2 M0010 FH	Total/NA	Air	None	
140-16649-9	Q-2115,2116 PPA CB OUTLET R3 M0010 FH	Total/NA	Air	None	
MB 280-470909/1-B	Method Blank	Total/NA	Air	None	
LCS 280-470909/2-B	Lab Control Sample	Total/NA	Air	None	

Cleanup Batch: 471006

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16649-1	Q-2101,2102 PPA CB OUTLET R1 M0010 FH	Total/NA	Air	Split	470909
140-16649-5	Q-2108,2109 PPA CB OUTLET R2 M0010 FH	Total/NA	Air	Split	470909
140-16649-9	Q-2115,2116 PPA CB OUTLET R3 M0010 FH	Total/NA	Air	Split	470909
MB 280-470909/1-B	Method Blank	Total/NA	Air	Split	470909
LCS 280-470909/2-B	Lab Control Sample	Total/NA	Air	Split	470909

Cleanup Batch: 471159

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16649-2	Q-2103,2104,2106 PPA CB OUTLET R1 M0010	Total/NA	Air	Split	470787
140-16649-4	Q-2107 PPA CB OUTLET R1 M0010 BREAKTHF	Total/NA	Air	Split	470787
140-16649-6	Q-2110,2111,2113 PPA CB OUTLET R2 M0010	Total/NA	Air	Split	470787

LCMS (Continued)

Cleanup Batch: 471159 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16649-8	Q-2114 PPA CB OUTLET R2 M0010 BREAKTHF	Total/NA	Air	Split	470787
140-16649-10	Q-2117,2118,2920 PPA CB OUTLET R3 M0010	Total/NA	Air	Split	470787
140-16649-12	Q-2121 PPA CB OUTLET R3 M0010 BREAKTHF	Total/NA	Air	Split	470787
MB 280-470787/13-B	Method Blank	Total/NA	Air	Split	470787
MB 280-470787/1-B	Method Blank	Total/NA	Air	Split	470787
LCS 280-470787/2-B	Lab Control Sample	Total/NA	Air	Split	470787

Analysis Batch: 471376

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16649-3	Q-2105 PPA CB OUTLET R1 M0010 IMPINGER	Total/NA	Air	8321A	470796
140-16649-7	Q-2112 PPA CB OUTLET R2 M0010 IMPINGER	Total/NA	Air	8321A	470796
140-16649-11	Q-2119 PPA CB OUTLET R3 M0010 IMPINGER	Total/NA	Air	8321A	470796
MB 280-470741/1-B	Method Blank	Total/NA	Air	8321A	470796
LCS 280-470741/2-B	Lab Control Sample	Total/NA	Air	8321A	470796

Analysis Batch: 471377

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16649-1	Q-2101,2102 PPA CB OUTLET R1 M0010 FH	Total/NA	Air	8321A	471006
140-16649-5	Q-2108,2109 PPA CB OUTLET R2 M0010 FH	Total/NA	Air	8321A	471006
140-16649-9	Q-2115,2116 PPA CB OUTLET R3 M0010 FH	Total/NA	Air	8321A	471006
MB 280-470909/1-B	Method Blank	Total/NA	Air	8321A	471006
LCS 280-470909/2-B	Lab Control Sample	Total/NA	Air	8321A	471006

Analysis Batch: 471601

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16649-2	Q-2103,2104,2106 PPA CB OUTLET R1 M0010	Total/NA	Air	8321A	471159
140-16649-4	Q-2107 PPA CB OUTLET R1 M0010 BREAKTHF	Total/NA	Air	8321A	471159
140-16649-6	Q-2110,2111,2113 PPA CB OUTLET R2 M0010	Total/NA	Air	8321A	471159
140-16649-8	Q-2114 PPA CB OUTLET R2 M0010 BREAKTHF	Total/NA	Air	8321A	471159
140-16649-10	Q-2117,2118,2920 PPA CB OUTLET R3 M0010	Total/NA	Air	8321A	471159
140-16649-12	Q-2121 PPA CB OUTLET R3 M0010 BREAKTHF	Total/NA	Air	8321A	471159
MB 280-470787/13-B	Method Blank	Total/NA	Air	8321A	471159
MB 280-470787/1-B	Method Blank	Total/NA	Air	8321A	471159
LCS 280-470787/2-B	Lab Control Sample	Total/NA	Air	8321A	471159

Client Sample ID: Q-2101,2102 PPA CB OUTLET R1 M0010 FH

Lab Sample ID: 140-16649-1

Date Collected: 09/11/19 00:00
Date Received: 09/16/19 08:46
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	1.82		0.0749	0.00809	ug/Sample		09/17/19 14:30	09/20/19 11:45	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*100*		*50 - 200*	*09/17/19 14:30*	*09/20/19 11:45*	*1*

Client Sample ID: Q-2103,2104,2106 PPA CB OUTLET R1 M0010 BH

Lab Sample ID: 140-16649-2

Date Collected: 09/11/19 00:00
Date Received: 09/16/19 08:46
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	4.66		0.275	0.0550	ug/Sample		09/17/19 12:00	09/23/19 12:30	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*66*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:30*	*1*

Client Sample ID: Q-2105 PPA CB OUTLET R1 M0010 IMPINGERS 1,2&3 COND

Lab Sample ID: 140-16649-3

Date Collected: 09/11/19 00:00
Date Received: 09/16/19 08:46
Sample Container: Air Train

Matrix: Air

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.736		0.212	0.0108	ug/Sample		09/16/19 09:17	09/20/19 11:09	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*91*		*50 - 200*	*09/16/19 09:17*	*09/20/19 11:09*	*1*

Client Sample ID: Q-2107 PPA CB OUTLET R1 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-16649-4

Date Collected: 09/11/19 00:00
Date Received: 09/16/19 08:46
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		09/17/19 12:00	09/23/19 12:33	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*58*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:33*	*1*

Client Sample ID: Q-2108,2109 PPA CB OUTLET R2 M0010 FH
Lab Sample ID: 140-16649-5

Date Collected: 09/12/19 00:00
Matrix: Air
Date Received: 09/16/19 08:46
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	2.83		0.100	0.0108	ug/Sample		09/17/19 14:30	09/20/19 11:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*97*		*50 - 200*	*09/17/19 14:30*	*09/20/19 11:49*	*1*

Client Sample ID: Q-2110,2111,2113 PPA CB OUTLET R2 M0010 BH
Lab Sample ID: 140-16649-6

Date Collected: 09/12/19 00:00
Matrix: Air
Date Received: 09/16/19 08:46
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.172	J	0.275	0.0550	ug/Sample		09/17/19 12:00	09/23/19 12:40	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*73*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:40*	*1*

Client Sample ID: Q-2112 PPA CB OUTLET R2 M0010 IMPINGERS 1,2&3 COND
Lab Sample ID: 140-16649-7

Date Collected: 09/12/19 00:00
Matrix: Air
Date Received: 09/16/19 08:46
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.198	0.0101	ug/Sample		09/16/19 09:17	09/20/19 11:13	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*96*		*50 - 200*	*09/16/19 09:17*	*09/20/19 11:13*	*1*

Client Sample ID: Q-2114 PPA CB OUTLET R2 M0010 BREAKTHROUGH XAD-2 RESIN TUBE
Lab Sample ID: 140-16649-8

Date Collected: 09/12/19 00:00
Matrix: Air
Date Received: 09/16/19 08:46
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	1.41		0.200	0.0400	ug/Sample		09/17/19 12:00	09/23/19 12:43	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*65*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:43*	*1*

Client Sample ID: Q-2115,2116 PPA CB OUTLET R3 M0010 FH

Lab Sample ID: 140-16649-9

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:46
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	2.70		0.200	0.0216	ug/Sample		09/17/19 14:30	09/20/19 11:52	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*103*		*50 - 200*	*09/17/19 14:30*	*09/20/19 11:52*	*1*

Client Sample ID: Q-2117,2118,2920 PPA CB OUTLET R3 M0010 BH

Lab Sample ID: 140-16649-10

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:46
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.143	J	0.275	0.0550	ug/Sample		09/17/19 12:00	09/23/19 12:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*76*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:49*	*1*

Client Sample ID: Q-2119 PPA CB OUTLET R3 M0010 IMPINGERS 1,2&3 COND

Lab Sample ID: 140-16649-11

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:46
Sample Container: Air Train

Matrix: Air

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.264	0.0135	ug/Sample		09/16/19 09:17	09/20/19 11:16	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*97*		*50 - 200*	*09/16/19 09:17*	*09/20/19 11:16*	*1*

Client Sample ID: Q-2121 PPA CB OUTLET R3 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-16649-12

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:46
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.0473	J	0.200	0.0400	ug/Sample		09/17/19 12:00	09/23/19 12:53	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*63*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:53*	*1*

Default Detection Limits

Client: Chemours Company FC, LLC The
Job ID: 140-16649-1
Project/Site: PPA Carbon Bed Outlet - M0010

Method: 8321A - HFPO-DA

Prep: None

Analyte	RL	MDL	Units
HFPO-DA	0.00250	0.00128	ug/Sample

Method: 8321A - PFOA and PFOS

Prep: None

Analyte	RL	MDL	Units
HFPO-DA	0.0250	0.00270	ug/Sample
HFPO-DA	0.100	0.0200	ug/Sample

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ANALYTICAL REPORT

Job Number: 140-16650-1

Job Description: PPA Field QC - M0010

Contract Number: LBIO-67048

For:
Chemours Company FC, LLC The
c/o AECOM
Sabre Building, Suite 300
4051 Ogletown Road
Newark, DE 19713

Attention: Michael Aucoin

Approved for release.
Courtney M Adkins
Project Manager I
9/24/2019 10:42 AM

Courtney M Adkins, Project Manager I
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09/24/2019

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Definitions/Glossary

Client: Chemours Company FC, LLC The
Project/Site: PPA Field QC - M0010

Job ID: 140-16650-1

Qualifiers

LCMS

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
X	Surrogate is outside control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Chemours Company FC, LLC The
Project/Site: PPA Field QC - M0010

Job ID: 140-16650-1

Method	Method Description	Protocol	Laboratory
8321A	HFPO-DA	SW846	TAL DEN
8321A	PFOA and PFOS	SW846	TAL DEN
None	Leaching Procedure	TAL SOP	TAL DEN
None	Leaching Procedure for Condensate	TAL SOP	TAL DEN
None	Leaching Procedure for XAD	TAL SOP	TAL DEN
Split	Source Air Split	None	TAL DEN

Protocol References:

None = None

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TAL SOP = TestAmerica Laboratories, Standard Operating Procedure

Laboratory References:

TAL DEN = Eurofins TestAmerica, Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Sample Summary

Client: Chemours Company FC, LLC The
Project/Site: PPA Field QC - M0010

Job ID: 140-16650-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
140-16650-1	E-2540,2541 QC M0010 PPA CB FH BT	Air	09/12/19 00:00	09/16/19 08:00	
140-16650-2	E-2542,2543,2545 QC M0010 PPA CB BH BT	Air	09/12/19 00:00	09/16/19 08:00	
140-16650-3	E-2544 QC M0010 PPA CB IMPINGERS 1,2&3 COND BT	Air	09/12/19 00:00	09/16/19 08:00	
140-16650-4	E-2546 QC M0010 PPA CB BREAKTHROUGH XAD-2 RSIN TUBE BT	Air	09/12/19 00:00	09/16/19 08:00	
140-16650-5	E-2547 QC PPA CB DI WATER RB	Air	09/12/19 00:00	09/16/19 08:00	
140-16650-6	E-2548 QC PPA CB MEOH WITH 5% NH4OH RI	Air	09/12/19 00:00	09/16/19 08:00	
140-16650-7	E-2549 QC PPA CB COMBINED GLASSWARE RINSES (MEOH/5% NH4OH) PB	Air	09/12/19 00:00	09/16/19 08:00	
140-16650-8	A-6842 MEDIA CHECK XAD	Air	09/12/19 00:00	09/16/19 08:00	
140-16650-9	A-6843 MEDIA CHECK FILTER	Air	09/12/19 00:00	09/16/19 08:00	

Job Narrative
140-16650-1

Sample Receipt

The samples were received on September 16, 2019 at 8:00 AM in good condition and properly preserved. The temperature of the cooler at receipt was 1.8º C.

Quality Control and Data Interpretation

Unless otherwise noted, all holding times, and QC criteria were met and the test results shown in this report meet all applicable NELAC requirements.

Method 0010/Method 3542 Sampling Train Preparation

Train fractions were extracted and prepared for analysis in TestAmerica's Knoxville laboratory. Extracts and condensate samples were forwarded to the Denver laboratory for HFPO-DA analysis. All results are reported in "Total ug" per sample.

LCMS

Method 8321A: The Isotope Dilution Analyte (IDA) recovery associated with the following sample is below the method recommended limit: (MB 280-470787/13-B). Generally, data quality is not considered affected if the IDA signal-to-noise ratio is greater than 10:1, which is achieved for all IDA in the sample(s). All detection limits are below the lower calibration.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Comments

Reporting Limits (RLs) and Method Detection Limits (MDLs) for the HFPO-DA used in this report were derived in Denver for reporting soils and water samples. Method 0010 sampling train matrix specific RLs and MDLs have not been established for HFPO-DA. The soil and water limits are expected to be reasonable approximations of the actual matrix specific limits, under these conditions.

Breakthrough from the Modified Method 0010 Sampling Train for PFAS compounds will be measured by the percentage (%) concentration of a specific PFAS target analyte determined to be present in the Breakthrough XAD-2 resin module of a test run. If the concentration of a specific PFAS compound is ≤30% of the sum of the concentrations determined for the other three (3) fractions of the sampling train, then sampling breakthrough is determined not to have occurred. Also, no breakthrough will be determined to have occurred if < 250 µg of a target analyte is collected on all fractions of a sampling train. Breakthrough the sampling train implies that sample loss through the train has occurred and results in a negative bias to the sample results.

LCMS

Analysis Batch: 464589

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
DLCK 280-464589/13	Lab Control Sample	Total/NA	Air	8321A	

Prep Batch: 470741

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16650-3	E-2544 QC M0010 PPA CB IMPINGERS 1,2&3 C	Total/NA	Air	None	
140-16650-5	E-2547 QC PPA CB DI WATER RB	Total/NA	Air	None	
MB 280-470741/1-B	Method Blank	Total/NA	Air	None	
LCS 280-470741/2-B	Lab Control Sample	Total/NA	Air	None	

Prep Batch: 470787

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16650-2	E-2542,2543,2545 QC M0010 PPA CB BH BT	Total/NA	Air	None	
140-16650-4	E-2546 QC M0010 PPA CB BREAKTHROUGH X	Total/NA	Air	None	
140-16650-6	E-2548 QC PPA CB MEOH WITH 5% NH4OH RI	Total/NA	Air	None	
140-16650-7	E-2549 QC PPA CB COMBINED GLASSWARE F	Total/NA	Air	None	
140-16650-8	A-6842 MEDIA CHECK XAD	Total/NA	Air	None	
MB 280-470787/13-B	Method Blank	Total/NA	Air	None	
MB 280-470787/1-B	Method Blank	Total/NA	Air	None	
LCS 280-470787/2-B	Lab Control Sample	Total/NA	Air	None	

Cleanup Batch: 470796

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16650-3	E-2544 QC M0010 PPA CB IMPINGERS 1,2&3 C	Total/NA	Air	Split	470741
140-16650-5	E-2547 QC PPA CB DI WATER RB	Total/NA	Air	Split	470741
MB 280-470741/1-B	Method Blank	Total/NA	Air	Split	470741
LCS 280-470741/2-B	Lab Control Sample	Total/NA	Air	Split	470741

Prep Batch: 470909

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16650-1	E-2540,2541 QC M0010 PPA CB FH BT	Total/NA	Air	None	
140-16650-9	A-6843 MEDIA CHECK FILTER	Total/NA	Air	None	
MB 280-470909/1-B	Method Blank	Total/NA	Air	None	
LCS 280-470909/2-B	Lab Control Sample	Total/NA	Air	None	

Cleanup Batch: 471006

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16650-1	E-2540,2541 QC M0010 PPA CB FH BT	Total/NA	Air	Split	470909
140-16650-9	A-6843 MEDIA CHECK FILTER	Total/NA	Air	Split	470909
MB 280-470909/1-B	Method Blank	Total/NA	Air	Split	470909
LCS 280-470909/2-B	Lab Control Sample	Total/NA	Air	Split	470909

Cleanup Batch: 471159

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16650-2	E-2542,2543,2545 QC M0010 PPA CB BH BT	Total/NA	Air	Split	470787
140-16650-4	E-2546 QC M0010 PPA CB BREAKTHROUGH X	Total/NA	Air	Split	470787
140-16650-6	E-2548 QC PPA CB MEOH WITH 5% NH4OH RI	Total/NA	Air	Split	470787
140-16650-7	E-2549 QC PPA CB COMBINED GLASSWARE F	Total/NA	Air	Split	470787
140-16650-8	A-6842 MEDIA CHECK XAD	Total/NA	Air	Split	470787
MB 280-470787/13-B	Method Blank	Total/NA	Air	Split	470787
MB 280-470787/1-B	Method Blank	Total/NA	Air	Split	470787
LCS 280-470787/2-B	Lab Control Sample	Total/NA	Air	Split	470787

LCMS

Analysis Batch: 471376

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16650-3	E-2544 QC M0010 PPA CB IMPINGERS 1,2&3 C	Total/NA	Air	8321A	470796
140-16650-5	E-2547 QC PPA CB DI WATER RB	Total/NA	Air	8321A	470796
MB 280-470741/1-B	Method Blank	Total/NA	Air	8321A	470796
LCS 280-470741/2-B	Lab Control Sample	Total/NA	Air	8321A	470796

Analysis Batch: 471377

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16650-1	E-2540,2541 QC M0010 PPA CB FH BT	Total/NA	Air	8321A	471006
140-16650-9	A-6843 MEDIA CHECK FILTER	Total/NA	Air	8321A	471006
MB 280-470909/1-B	Method Blank	Total/NA	Air	8321A	471006
LCS 280-470909/2-B	Lab Control Sample	Total/NA	Air	8321A	471006

Analysis Batch: 471601

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-16650-2	E-2542,2543,2545 QC M0010 PPA CB BH BT	Total/NA	Air	8321A	471159
140-16650-4	E-2546 QC M0010 PPA CB BREAKTHROUGH X	Total/NA	Air	8321A	471159
140-16650-6	E-2548 QC PPA CB MEOH WITH 5% NH4OH RI	Total/NA	Air	8321A	471159
140-16650-7	E-2549 QC PPA CB COMBINED GLASSWARE F	Total/NA	Air	8321A	471159
140-16650-8	A-6842 MEDIA CHECK XAD	Total/NA	Air	8321A	471159
MB 280-470787/13-B	Method Blank	Total/NA	Air	8321A	471159
MB 280-470787/1-B	Method Blank	Total/NA	Air	8321A	471159
LCS 280-470787/2-B	Lab Control Sample	Total/NA	Air	8321A	471159

Client Sample ID: E-2540,2541 QC M0010 PPA CB FH BT

Lab Sample ID: 140-16650-1

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.112		0.0244	0.00264	ug/Sample		09/17/19 14:30	09/20/19 11:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*98*		*50 - 200*	*09/17/19 14:30*	*09/20/19 11:55*	*1*

Client Sample ID: E-2542,2543,2545 QC M0010 PPA CB BH BT

Lab Sample ID: 140-16650-2

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.198	J	0.225	0.0450	ug/Sample		09/17/19 12:00	09/23/19 12:56	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*59*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:56*	*1*

Client Sample ID: E-2544 QC M0010 PPA CB IMPINGERS 1,2&3 COND BT

Lab Sample ID: 140-16650-3

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.00250	0.000128	ug/Sample		09/16/19 09:17	09/20/19 11:19	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*109*		*50 - 200*	*09/16/19 09:17*	*09/20/19 11:19*	*1*

Client Sample ID: E-2546 QC M0010 PPA CB BREAKTHROUGH XAD-2 RSIN TUBE BT

Lab Sample ID: 140-16650-4

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:00
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		09/17/19 12:00	09/23/19 12:59	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*59*		*50 - 200*	*09/17/19 12:00*	*09/23/19 12:59*	*1*

Client Sample ID: E-2547 QC PPA CB DI WATER RB

Lab Sample ID: 140-16650-5

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.00250	0.000128	ug/Sample		09/16/19 09:17	09/20/19 11:22	1

Client Sample ID: E-2547 QC PPA CB DI WATER RB

Lab Sample ID: 140-16650-5

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:00
Sample Container: Air Train

Matrix: Air

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	105		50 - 200	09/16/19 09:17	09/20/19 11:22	1

Client Sample ID: E-2548 QC PPA CB MEOH WITH 5% NH4OH RB

Lab Sample ID: 140-16650-6

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:00
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		0.0244	0.00489	ug/Sample		09/17/19 12:00	09/23/19 13:02	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	97		50 - 200	09/17/19 12:00	09/23/19 13:02	1

Client Sample ID: E-2549 QC PPA CB COMBINED GLASSWARE RINSES (MEOH/5% NH4OH) PB

Lab Sample ID: 140-16650-7

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	**0.00600**	**J**	0.0244	0.00489	ug/Sample		09/17/19 12:00	09/23/19 13:06	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	98		50 - 200	09/17/19 12:00	09/23/19 13:06	1

Client Sample ID: A-6842 MEDIA CHECK XAD

Lab Sample ID: 140-16650-8

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:00
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		09/17/19 12:00	09/23/19 13:09	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	68		50 - 200	09/17/19 12:00	09/23/19 13:09	1

Client Sample ID: A-6843 MEDIA CHECK FILTER

Lab Sample ID: 140-16650-9

Date Collected: 09/12/19 00:00
Date Received: 09/16/19 08:00
Sample Container: Air Train

Matrix: Air

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	**0.0450**		0.0244	0.00264	ug/Sample		09/17/19 14:30	09/20/19 11:58	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	97		50 - 200	09/17/19 14:30	09/20/19 11:58	1

Default Detection Limits

Client: Chemours Company FC, LLC The
Project/Site: PPA Field QC - M0010

Job ID: 140-16650-1

Method: 8321A - HFPO-DA

Prep: None

Analyte	RL	MDL	Units
HFPO-DA	0.00250	0.00128	ug/Sample

Method: 8321A - PFOA and PFOS

Prep: None

Analyte	RL	MDL	Units
HFPO-DA	0.0250	0.00270	ug/Sample
HFPO-DA	0.100	0.0200	ug/Sample

APPENDIX D
SAMPLE CALCULATIONS

SAMPLE CALCULATIONS FOR
HFPO DIMER ACID (METHOD 0010)

Client: Chemours | **Plant: Fayetteville, NC**
Test Number: Run 3 | **Test Date: 09/12/19**
Test Location: PPA CB Inlet | **Test Period: 0846-1029**

1. HFPO Dimer Acid concentration, lbs/dscf.

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

$$Conc1 = \frac{129.1 \times 2.2046 \times 10\text{-}9}{55.920}$$

Conc1 = 5.09E-09

Where:

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

Conc1 = PPA Carbon Bed Inlet 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 = 129.1 / (55.920 x 0.02832)

Conc2 = 8.15E+01

Where:

Conc2 = PPA Carbon Bed Inlet 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.

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

$MR1_{(Inlet)}$ = 5.09E-09 x 11305 x 60

$MR1_{(Inlet)}$ = 3.45E-03

Where:

$MR1_{(Inlet)}$ = PPA Carbon Bed Inlet HFPO Dimer Acid mass emission rate, lbs/hr.

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

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

$MR2_{(Inlet)}$ = 3.45E-03 x 453.59 /3600

$MR2_{(Inlet)}$ = 4.35E-04

Where:

$MR2_{(Inlet)}$ = PPA Carbon Bed Inlet 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

PPA CARBON BED INLET

Client: Chemours	Facility: Fayetteville, NC
Test Number: Run 3	Test Date: 09/12/19
Test Location: PPA CB Inlet	Test Period: 0846-1029

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

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

$$Vm(std) = \frac{17.64 \times 0.9944 \times 58.439 \times \left(30.15 + \frac{1.221}{13.6} \right)}{94.33 + 460} = 55.920$$

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.

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

$$Vw(std) = (0.04707 \times 10.0) + (0.04715 \times 11.7) = 1.02$$

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

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

$$bws = \frac{1.02}{1.02 + 55.920} = 0.018$$

Where:

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

4. Mole fraction of dry gas.

$$Md = 1 - bws$$

$$Md = 1 - 0.018 = 0.982$$

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.

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

$$MWs = (28.84 \times 0.982) +(18 (1 - 0.982)) = 28.64$$

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.

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

$$Vs = 85.49 \times 0.84 \times 0.54712 \times \left(\frac{544}{30.00 \times 28.64} \right)^{\wedge}1/2 = 31.3$$

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.

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

$$Qs(act) = 60 \times 31.3 \times 6.31 = 11839$$

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.

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

$$Qs(std) = 17.64 \times 0.982 \times \frac{30.00}{544.3} \times 11839$$

$$Qs(std) = 11305$$

Where:

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

10. Isokinetic variation calculated from intermediate values, percent.

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

$$I = \frac{17.327 \times 544 \times 55.920}{31.3 \times 96 \times 30.00 \times 0.982 \times (0.250)\text{^}2} = 95.4$$

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

SAMPLE CALCULATIONS FOR
HFPO DIMER ACID (METHOD 0010)

Client: Chemours | **Plant: Fayetteville, NC**
Test Number: Run 1 | **Test Date: 09/11/19**
Test Location: PPA CBed Outlet | **Test Period: 0832-1019**

1. HFPO Dimer Acid concentration, lbs/dscf.

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

$$Conc1 = \frac{7.2 \times 2.2046 \times 10\text{-}9}{44.901}$$

Conc1 = 3.54E-10

Where:

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

Conc1 = 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 = 7.2 / (44.901 x 0.02832)

Conc2 = 5.67

Where:

Conc2 = 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.

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

$MR1_{(Inlet)}$ = 3.54E-10 x 11278 x 60

$MR1_{(Inlet)}$ = 2.40E-04

Where:

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

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

$MR2_{(Inlet)}$ = $MR1_{(Inlet)}$ x 453.59 / 3600

$MR2_{(Inlet)}$ = 2.40E-04 x 453.59 /3600

$MR2_{(Inlet)}$ = 3.02E-05

Where:

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

453.59 = Conversion factor from pounds to grams.

3600 = Conversion factor from hours to seconds.

5. HFPO Dimer Acid Removal Efficiency, %

$$RE = \frac{MR1_{(Inlet)} - MR1_{(Outlet)}}{MR1_{(Inlet)}}$$

$$RE = \frac{(5.93E\text{-}03) - (2.40E\text{-}04)}{5.93E\text{-}03}$$

RE = 96.0

Where:

RE = Carbon Bed Removal Efficiency.

$MR1_{(Inlet)}$ = Carbon Bed Inlet HFPO Dimer Acid mass rate, lbs/hr.

$MR1_{(Outlet)}$ = Carbon Bed Outlet HFPO Dimer Acid mass rate, lbs/hr.

EXAMPLE CALCULATIONS FOR
VOLUMETRIC FLOW AND MOISTURE AND ISOKINETICS

Client: Chemours	Facility: Fayetteville, NC
Test Number: Run 1	Test Date: 09/11/19
Test Location: PPA-Carbon Bed Outlet	Test Period: 0832-1019

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

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

$$Vm(std) = \frac{17.64 \times 0.9979 \times 45.454 \times \left(30.26 + \frac{0.686}{13.6} \right)}{80.13 + 460} = 44.901$$

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.

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

$$Vw(std) = (0.04707 \times 16.0) + (0.04715 \times 11.3) = 1.29$$

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

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

$$bws = \frac{1.29}{1.29 + 44.901} = 0.028$$

Where:

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

4. Mole fraction of dry gas.

Md = 1 - bws

Md = 1 - 0.028 = 0.972

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 0.972) +(18 (1 - 0.972)) = 28.53

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.

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

$$Vs = 85.49 \times 0.84 \times 0.70377 \times \left(\frac{543}{30.35 \times 28.53} \right)^{\wedge}1/2 = 40.0$$

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.

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

$$Qs(act) = 60 \times 40.0 \times 4.90 = 11765$$

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.

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

$$Qs(std) = 17.64 \times 0.972 \times \frac{30.35}{542.9} \times 11765$$

$$Qs(std) = 11278$$

Where:

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

10. Isokinetic variation calculated from intermediate values, percent.

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

$$I = \frac{17.327 \times 543 \times 44.901}{40.0 \times 96 \times 30.35 \times 0.972 \times (0.190)^{\wedge}2} = 103.2$$

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

APPENDIX E
EQUIPMENT CALIBRATION RECORDS

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** 22 | **Ambient Temp** 72

Date 29-Jul-19 | **Wet Test Meter Number** P-2952 | **Temp Reference Source** Thermocouple Simulator (Accuracy +/- 1°F)

Dry Gas Meter Number 15550528

Baro Press, in Hg (Pb)	29.88

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	836.525	72.0	72.00	72.00	73.0	12.5	1.0037	1.7605
		841.510		74.00	74.00				
		4.985		73.00	73.00				
1.0	5.0	842.500	72.0	74.00	74.00	74.0	9.0	1.0023	1.8218
		847.495		74.00	74.00				
		4.995		74.00	74.00				
1.5	10.0	848.472	72.0	75.00	75.00	75.5	14.8	1.0000	1.8423
		858.501		76.00	76.00				
		10.029		75.50	75.50				
2.0	10.0	859.524	72.0	75.00	75.00	75.5	13.0	0.9941	1.8952
		869.600		76.00	76.00				
		10.076		75.50	75.50				
3.0	10.0	870.662	72.0	77.00	77.00	77.5	10.70	0.9893	1.9187
		880.800		78.00	78.00				
		10.138		77.50	77.50				
							Average	**0.9979**	**1.8477**

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	33	33	32	33	33		32.8	-0.2%
212	212	213	211	211	211		211.6	0.1%
932	933	933	933	933	932		932.8	-0.1%
1832	1833	1833	1833	1832	1832		1832.6	0.0%

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

2 - Acceptable Temperature Difference less than 1.5 %

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

Y Factor Calibration Check Calculation

MODIFIED METHOD 0010 TEST TRAIN

PPA STACK

METER BOX NO. 22

09/11/19 and 09/12/19

	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(^{o}R)			
Tm = Average dry gas meter temperature , deg F.	80.1	96.6	80.8

$$Tma = Ts + 460$$

$$Tma = 80.13 + 460$$

Tma =	540.13	556.58	540.83

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	0.69	0.68	0.66
Pb = Barometric Pressure, in Hg.	30.26	30.28	30.16

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

$$Pm = 30.26 + (0.685833333333333 / 13.6)$$

Pm =	30.31	30.33	30.21

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.	45.454	45.992	44.900
Y = Dry gas meter calibration factor (based on full calibration)	0.9979	0.9979	0.9979
Delta H@ = Dry Gas meter orifice calibration coefficient, in. H2O.	1.8477	1.8477	1.8477
avg SQRT Delta H = Avg SQRT press. drop across the orifice meter during sampling , in. H_2O	0.8255	0.8195	0.8105
O = Total sampling time, minutes.	96	96	96

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

$$Yqa = (96.00 / 45.45) * SQRT (0.0319 * 540.13 * 29) / (1.85 * 30.31 * 28.84) * 0.83$$

$$Yqa = 2.112 * SQRT 499.670 / 1,614.925 * 0.83$$

Yqa =	0.970	0.966	0.966

Diff = Absolute difference between Yqa and Y	2.80	3.20	3.20

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

$$Diff = ((0.9979 - 0.970) / 0.9979) * 100$$

Average Diff = 3.07

Allowable = 5.0

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

Calibrator MDW | **Meter Box Number** 24 | **Ambient Temp** 72

Date 17-Aug-18 | **Wet Test Meter Number** P-2952 | **Temp Reference Source** Thermocouple Simulator (Accuracy +/- 1°F)

Dry Gas Meter Number 17087363

Baro Press, in Hg (Pb)	29.68

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	5.00	165.901	72.0	76.00	76.00	76.5	12.8	0.9917	1.8463
		170.979		77.00	77.00				
		5.078		76.50	76.50				
1.0	5.0	173.050	72.0	77.00	77.00	77.5	9.1	1.0024	1.8629
		178.077		78.00	78.00				
		5.027		77.50	77.50				
1.5	10.0	179.100	72.0	78.00	78.00	78.5	15.1	0.9948	1.9199
		189.237		79.00	79.00				
		10.137		78.50	78.50				
2.0	10.0	190.250	72.0	79.00	79.00	79.0	13.2	0.9928	1.9544
		200.405		79.00	79.00				
		10.155		79.00	79.00				
3.0	10.0	201.439	72.0	80.00	80.00	80.0	11.0	0.9901	2.0320
		211.615		80.00	80.00				
		10.176		80.00	80.00				
							Average	**0.9944**	**1.9231**

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	931	930	928	930	928		929.4	0.2%
1832	1828	1831	1832	1828	1830		1829.8	0.1%

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

2 - Acceptable Temperature Difference less than 1.5 %

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

Y Factor Calibration Check Calculation

MODIFIED METHOD 0010 TEST TRAIN

PPA CARBON BED INLET

METER BOX NO. 24

09/11/2019 + 09/12/2019

	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(^{o}R)			
Tm = Average dry gas meter temperature , deg F.	90.0	98.3	94.3

$$Tma = Ts + 460$$

$$Tma = 90.04 + 460$$

Tma =	550.04	558.29	554.33

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	1.16	1.22	1.22
Pb = Barometric Pressure, in Hg.	30.30	30.30	30.15

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

$$Pm = 30.3 + (1.1625 / 13.6)$$

Pm =	30.39	30.39	30.24

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.	56.988	59.224	58.439
Y = Dry gas meter calibration factor (based on full calibration)	0.9944	0.9944	0.9944
Delta H@ = Dry Gas meter orifice calibration coefficient, in. H2O.	1.9231	1.9231	1.9231
avg SQRT Delta H = Avg SQRT press. drop across the orifice meter during sampling , in. H_2O	1.0661	1.0910	1.0886
O = Total sampling time, minutes.	96	96	96

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

$$Yqa = (96.00 / 56.99) * SQRT (0.0319 * 550.04 * 29) / (1.92 * 30.39 * 28.84) * 1.07$$

$$Yqa = 1.685 * SQRT\ 508.844 / 1,685.263 * 1.07$$

Yqa =	0.9868	0.9790	0.9889

Diff = Absolute difference between Yqa and Y	0.76	1.55	0.55

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

$$Diff = ((0.9944 - 0.987) / 0.9944) * 100$$

Average Diff = 0.95

Allowable = 5.0

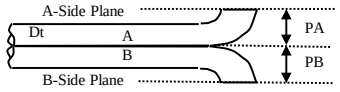
Type S Pitot Tube Inspection Data Form

Pitot Tube Identification Number: **P-711**

Inspection Date 5/30/18 Individual Conducting Inspection SR

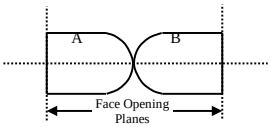
If all Criteria PASS
Cp is equal to 0.84

		PASS/FAIL
Distance to A Plane (PA) - inches	0.458	PASS
Distance to B Plane (PB) - inches	0.458	PASS
Pitot OD (D_t) - inches	0.375	

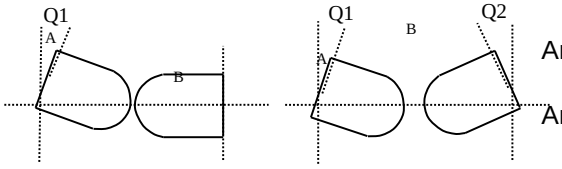


$1.05\ D_t < P < 1.5\ D_t$

PA must Equal PB



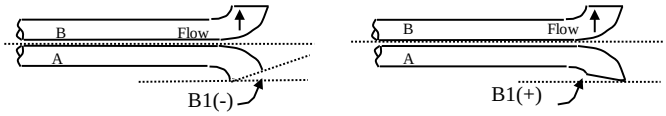
Are Open Faces Aligned Perpendicular to the Tube Axis — (●) YES ( ) NO — PASS



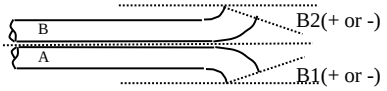
Angle of Q1 from vertical A Tube- degrees (absolute) 0 PASS

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

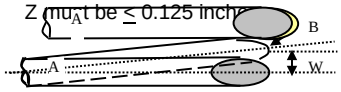


Angle of B1 from vertical B Tube- degrees (absolute) 0 PASS

B1 or B2 must be ≤ 5°

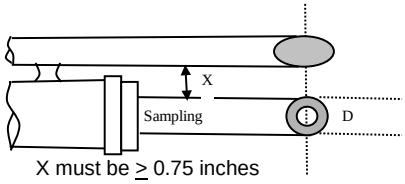
Horizontal offset between A and B Tubes (Z) - inches 0.009 PASS

Z must be ≤ 0.125 inches



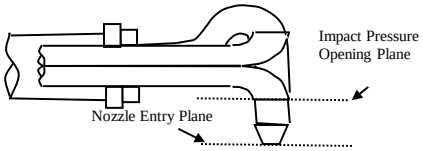
Vertical offset between A and B Tubes (W) - inches 0.026 PASS

W must be ≤ 0.03125 inches

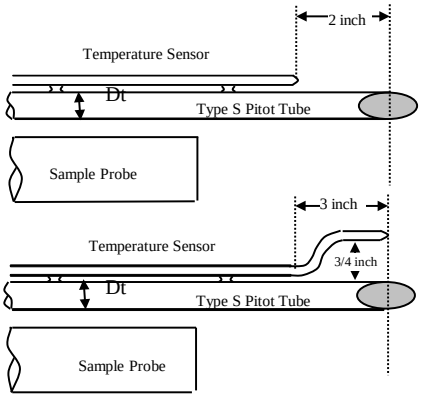


Distance between Sample Nozzle and Pitot (X) - inches 0.87 PASS

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

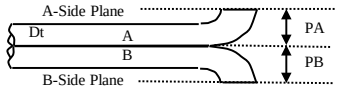
Type S Pitot Tube Inspection Data Form

Pitot Tube Identification Number: **P-712**

Inspection Date 5/30/18 Individual Conducting Inspection SR

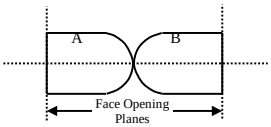
If all Criteria PASS
Cp is equal to 0.84

		PASS/FAIL
Distance to A Plane (PA) - inches	0.453	PASS
Distance to B Plane (PB) - inches	0.453	PASS
Pitot OD (D_t) - inches	0.375	

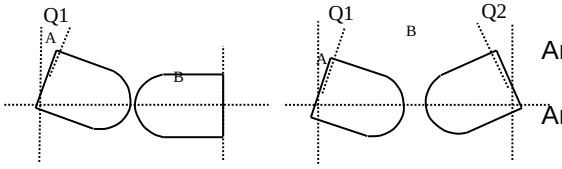


$1.05\ D_t < P < 1.5\ D_t$

PA must Equal PB



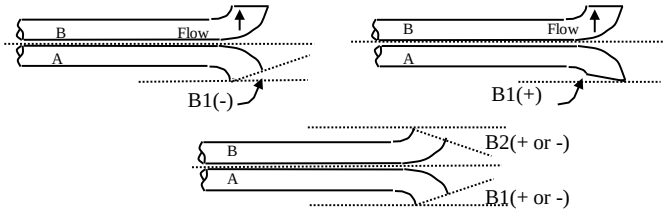
Are Open Faces Aligned Perpendicular to the Tube Axis — (●) YES ( ) NO — PASS



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°



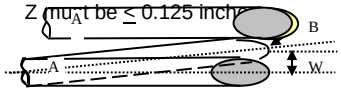
Angle of B1 from vertical A Tube- degrees (absolute) 0 PASS

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

B1 or B2 must be ≤ 5°

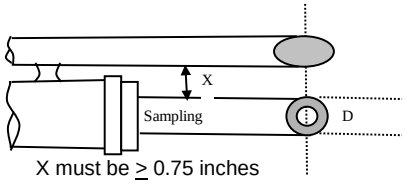
Horizontal offset between A and B Tubes (Z) - inches 0.005 PASS

Z must be ≤ 0.125 inches



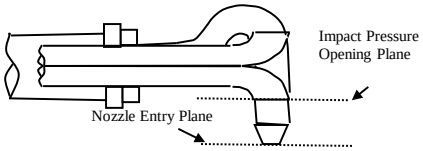
Vertical offset between A and B Tubes (W) - inches 0.018 PASS

W must be ≤ 0.03125 inches

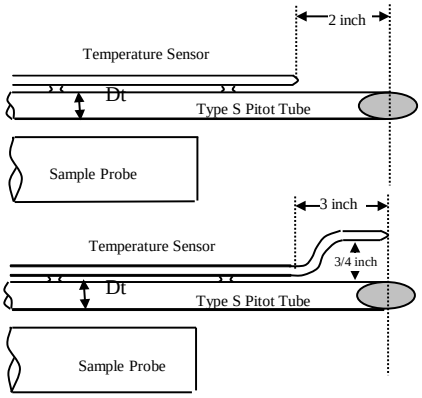


Distance between Sample Nozzle and Pitot (X) - inches NA

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 Specialty Gases
Airgas USA, LLC
6141 Easton Road
Bldg 1
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI79E15A00E4	Reference Number:	160-401424145-1
Cylinder Number:	ALM053372	Cylinder Volume:	150.5 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12019	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Feb 26, 2019

Expiration Date: Feb 26, 2027

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 %	9.020 %	G1	+/- 0.6% NIST Traceable	02/26/2019
OXYGEN	12.00 %	12.07 %	G1	+/- 0.3% NIST Traceable	02/26/2019
NITROGEN	Balance			-	

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	061507	K014984	13.94 % CARBON DIOXIDE/NITROGEN	0.57%	Jan 30, 2024
NTRM	16060507	CC401541	23.204 % OXYGEN/NITROGEN	0.2%	Dec 24, 2021

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
HORIBA VA5011 T5V6VU9P NDIR CO2	NDIR	Feb 12, 2019
SIEMENS OXYMAT 61 S01062 O2	PARAMAGNETIC	Feb 18, 2019

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:	82-401196512-1
Cylinder Number:	CC112489	Cylinder Volume:	157.2 CF
Laboratory:	124 - Riverton (SAP) - NJ	Cylinder Pressure:	2015 PSIG
PGVP Number:	B52018	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	May 12, 2018

Expiration Date: May 12, 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	17.00 %	17.05 %	G1	+/- 0.7% NIST Traceable	05/12/2018
OXYGEN	21.00 %	20.98 %	G1	+/- 0.5% NIST Traceable	05/12/2018
NITROGEN	Balance			-	

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060731	CC413777	16.939 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 08, 2019
NTRM	09061420	CC273671	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	Apr 19, 2018
Horiba MPA 510-O2-7TWMJ041	Paramagnetic	Apr 19, 2018

Triad Data Available Upon Request

Signature on file
Approved for Release

APPENDIX F
LIST OF PROJECT PARTICIPANTS

The following Weston employees participated in this project:

Paul Meeter	Senior Project Manager
Austin Squires	Team Member
Chris Hartsky	Team Member
Kris Ansley	Team Member
Matt Winkeler	Team Member
Nick Guarino	Team Member