

PFAS Destruction Testing at Veolia's Port Arthur Incinerator

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Executive Summary

PFAS incineration tests were performed in two campaigns in July and October 2024 at the Veolia Port Arthur, Texas facility to demonstrate that the facility can effectively destroy PFAS-contaminated waste with minimal release of PFAS into the environment.

The campaigns were performed at the Veolia RCRA incinerator in Port Arthur, Texas in collaboration with the stack testing company, AECOM. Eurofins laboratory was used for analysis of all solid and liquid samples and for stack gas samples obtained using EPA methods OTM-45 and OTM-50.

Four different streams were incinerated: A3F, PFAS-contaminated soil, spent activated carbon and CF4. The results of the testing were:

- Stack testing during PFAS incineration showed that PFAS were either non detect or emitted at very low levels ($< 2 \times 10^{-5}$ lb/hr) in normal conditions. For PFAS with high feed concentration, thermal treatment can remove or destroy up to 99.9999% of PFAS.
- CF4 incineration indicated a DRE of less than 50%, consistent with predictions that temperatures above 2,550 °F are necessary to destroy this compound.
- Products of incomplete combustion (PIC) listed in OTM-50 were either non-detect at stack, or close to Method Detection Limit (MDL). Tetrafluoromethane (three detections) was the only PIC measured at or above the Level of Quantification (LoQ) in these samples.
- For a majority of solid residues, no PFAS were detected. Only 7 solid samples out of 69 showed PFAS levels close to the MDL
- Liquid residues contained PFAS at ppt level due to background PFAS present in the process water, unrelated to PFAS incineration. This level remains very low and did not increase during PFAS incineration.
- HF measurement at the stack was within regulatory limits.

The results demonstrated high destruction and removal efficiency for PFAS compounds during the incineration process, with values up to 99.9999%. These findings suggest that hazardous waste incineration, when properly operated under high-temperature conditions, can effectively break down PFAS compounds. Notably, very few PICs were detected in any of the output streams, suggesting a complete mineralization of the PFAS compounds rather than partial decomposition. The consistent achievement of high DRE values across multiple test runs, coupled with the absence of PICs, provides strong confidence in the reliability of the thermal treatment process for PFAS destruction.

Analysis of solid residues and liquid residues showed relatively low to no detectable concentrations of PFAS compounds, further supporting the effectiveness of the thermal treatment process. The minimal presence of PFAS compounds in these residual streams indicates successful destruction rather than mere phase transfer of the contaminants.

These results present compelling evidence that high-temperature incineration is an effective solution for PFAS disposal, addressing a critical data gap in PFAS destruction methods as mentioned in the EPA 2024 guidance on the Destruction and Disposal of PFAS and Materials Containing PFAS. The comprehensive study demonstrated efficient PFAS destruction under normal operating conditions. These results conclusively demonstrate that high-temperature incineration at Port Arthur is a viable and environmentally responsible method for PFAS disposal.

The study demonstrates Veolia's commitment to innovation and leadership in addressing emerging environmental challenges. With minimal environmental releases, effective handling of various waste streams, and compliance with regulatory standards, this achievement reinforces Veolia's position as an industry leader committed to providing cutting-edge environmental solutions while ensuring the highest standards of environmental protection and customer service.

Note : There are more than 10,000 different PFAS in nature. Due to analytical limitations, the PFAS campaign conducted at Port Arthur focused on a limited list of 79 targeted PFAS listed in OTM-45, OTM-50 and EPA 1633.

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3. List of Acronyms and Abbreviations

AFFF - Aqueous Film Forming Foam
APCS - Air Pollution Control System
DE - Destruction Efficiency
DRE - Destruction and Removal Efficiency
DSCFM - Dry Standard Cubic Feet per Minute
GC/MS - Gas Chromatography/Mass Spectrometry
GPM - Gallons Per Minute
HAP - Hazardous Air Pollutant
LC/MS - Liquid Chromatography/Mass Spectrometry
LoQ - Limit of Quantification
MDL - Method Detection Limit
NTS - Non-Target Screening
PFCA - Perfluoroalkyl Carboxylic Acid
PFAS - Per- and Polyfluoroalkyl Substances
PFSA - Perfluoroalkyl Sulfonic Acid
PIC - Products of Incomplete Combustion
POHC - Principal Organic Hazardous Constituent
POP - Persistent Organic Pollutant defined by the Stockholm Convention
PPB - Parts Per Billion
PPT - Parts Per Trillion
QA/QC - Quality Assurance/Quality Control
SCC - Secondary Combustion Chamber
TCEQ - Texas Commission on Environmental Quality
TSCA - Toxic Substances Control Act
VFC - Volatile Fluorinated Compounds

4. Introduction

4.1 Background

In July and October 2024, a groundbreaking full-scale test of PFAS thermal treatment was conducted at Veolia RCRA-permitted hazardous waste combustor facility in Port Arthur, Texas. As one of North America's leading hazardous waste management service providers, Veolia initiated this testing to confront the growing issue of per- and poly-fluorinated alkyl substances (PFAS) in environmental media. The volume of PFAS-containing waste streams continues to surge across industries, presenting an urgent need for effective disposal solutions. As regulatory scrutiny intensifies and remediation efforts expand, stakeholders are increasingly seeking viable treatment options for these persistent compounds.

High-temperature incineration has emerged as a potentially promising disposal pathway, particularly given its demonstrated success in destroying other challenging chemical compounds. While the exceptional stability of PFAS molecules poses unique challenges due to the strength of the multiple carbon-fluorine (C-F) chemical bonds in these compounds, properly engineered thermal treatment systems could offer a practical approach to permanently eliminating these substances from the waste stream. This is especially relevant for concentrated PFAS wastes, such as aqueous film-forming foam (AFFF) stockpiles, where other treatment technologies may prove less effective or economically feasible.

In early 2024, the EPA released its *Guidance on the Destruction and Disposal of PFAS and Materials Containing PFAS*, and in that report acknowledged a lack of data on PFAS fate via incineration. The agency highlighted the need to evaluate destruction efficiency of targeted PFAS, along with the potential creation of products of incomplete combustion (PIC). In January 2024, the EPA released OTM-50, a new method to sample PFAS in air emissions and detect volatile short-chain PFAS that are thermally stable and could potentially form as PICs.

To bridge the knowledge gap regarding PFAS incineration, Veolia developed and implemented a comprehensive full-scale testing program to evaluate the efficiency of PFAS destruction via high temperature incineration. The test program was conducted in collaboration with AECOM to conduct PFAS stack testing, and Eurofins to perform laboratory analysis of the collected samples. Veolia also involved the EPA in the planning process and shared the protocol of its testing program as well as the results of the study.

In a significant demonstration of its technological leadership and innovative capabilities, Veolia implemented the cutting-edge OTM-50 sampling methodology for PFAS stack emissions testing at full-scale. This achievement marks a notable advancement in PFAS analysis, as OTM-50 represents the most recent and sophisticated approach to quantifying short-chain PFAS, or volatile fluorinated compounds (VFC) in air emissions. By mastering this newly developed sampling technique, Veolia has positioned itself at the forefront of environmental testing technology, showcasing its ability to adapt and implement emerging methodologies.

The test was performed at Veolia RCRA incinerator Port Arthur, TX, one of the three RCRA incineration facilities that Veolia owns and operates in the U.S.A. The two others are Gum Spring, AR, and Sauget, IL. Worldwide, Veolia owns or operates 51 hazardous waste incineration plants in 18 different countries. Prior to the US campaign, Veolia has already performed PFAS testing campaigns in other parts of the world: the company's European operations, in particular, has showcased state-of-the-art technology for PFAS treatment since 2022.

Note : There are more than 10,000 different PFAS in nature. Due to analytical limitations, the PFAS campaign conducted at Port Arthur focused on a limited list of 79 targeted PFAS listed in OTM-45,

OTM-50 and EPA 1633.

Therefore, all the findings and conclusions below are limited to this list of PFAS. When it is said that no PFAS was detected in a waste or at stack, or that a sample is PFAS-free, this means that none of the targeted PFAS were detected. It is possible that other PFAS were present in the waste/sample but could not be detected with today's analytical technique.

4.2 Test objectives

The data quality objective of the Veolia test program was to demonstrate the ability of the Port Arthur RCRA incinerator to destroy PFAS in the waste feed without releasing PICs in air emissions, or PFAS in the solid and liquid residues during normal process operating conditions. To demonstrate this, Veolia incinerated four different waste streams contaminated with PFAS in various concentrations.

The primary objective was to determine if PICs in the form of Volatile Fluorinated Compounds (VFC) are formed during PFAS incineration via OTM-50. OTM-50 is a new sampling method for PFAS released by the EPA in 2024 to detect PICs, that is to say short-chain PFAS or VFCs. PICs may form from PFAS incineration when their destruction is incomplete. OTM-50 sampling was performed at the stack during PFAS incineration. The absence of PICs measured at the stack indicates, within the limit of current analytical detection limits, that the degradation of PFAS is complete. This data supports complete mineralization of PFAS to HF.

The second objective was to establish the destruction and removal efficiency (DRE) for a list of targeted PFAS. DRE is defined by 40 Code of Federal Regulations [CFR] §264.343 as follows:

$$DRE = (1 - \text{Waste out}/\text{Waste in}) * 100$$

Where:

- Waste in = mass feed rate of PFAS in the waste stream feeding the incinerator
- Waste out = mass emission rate of the same PFAS present in exhaust emissions prior to release to the atmosphere

DRE is only calculated for medium to long-chain PFAS (C>4) listed in OTM-45 and EPA 1633, i.e. PFAS that can be measured both in the PFAS waste and at the stack.

A related objective was to study the total DRE from OTM-45 sampling. Total DRE is defined as follows:

$$\text{Total DRE}_{OTM\ 45} = (1 - \text{Sum of PFAS out}_{OTM\ 45}/\text{Sum of PFAS in}_{1633}) * 100$$

Where:

- $\text{Sum of PFAS out}_{OTM\ 45}$ is the sum of PFAS detected at the stack via OTM-45
- Sum of PFAS in is the sum of PFAS detected in the waste via EPA Method 1633 or EPA Method 537

In case of PFAS undetected at the stack or in the waste, the MDL is used in the calculations. In case of PFAS measured below the LoQ, the LoQ is used in the calculations.

The last objective was to calculate the Total Destruction Efficiency based on OTM-50, OTM-45 and PFAS detected in liquid and solid residues.

$$DE = (1 - (\text{PFAS in liq} + \text{PFAS in solids} + \text{PFAS in air})/\text{PFAS in}) * 100$$

Where:

- PFAS in = total mass feed rate of PFAS fed into the incinerator
- PFAS in air = total mass emission rate of PFAS present in exhaust emissions and detected via in OTM 45 or OTM 50.
- PFAS in liquids = total mass emission rate PFAS present in liquid residues
- PFAS in solids = mass emission rate PFAS present in solid residues

4.3. Incinerator and Process Description

Veolia Environmental Services Technical Solutions, L.L.C., (Veolia) operates a hazardous waste incinerator at their Port Arthur, Texas location. This incinerator processes hazardous materials in accordance with the Resource Conservation and Recovery Act (RCRA) Permit HW-50212, Air Permit 42450 from the Texas Commission on Environmental Quality (TCEQ), and a Toxic Substances Control Act (TSCA) permit from the United States Environmental Protection Agency (US EPA).

The following sections provide a description of the Veolia Port Arthur incineration system. Two process flow diagrams (PFD) are included in Figures 1 and 2. The PFD are a representation of the combustion and air pollution control systems and include all major process flow streams.

Description of Combustion System

The incinerator at the Port Arthur facility consists of waste receiving and waste feeding equipment, rotary kiln, an ash/slag removal system, a secondary combustion chamber (SCC), a quench tower, two acid gas absorbers, four cooling towers, a four-stage ionizing wet scrubber, a wet electrostatic precipitator, an induced draft fan, an exhaust stack, and a scrubber water treatment/recycle system.

Description of Rotary Kiln

The rotary kiln measures 60 feet in length and the slope of the kiln from inlet to ash discharge is approximately one degree. The nominal rotation speed is one rpm with an average solid residence time of approximately one hour. The shell of the kiln is 16 feet in outside diameter and is lined with refractory material which protects the carbon steel shell from the high temperatures of incineration. The inside diameter of the kiln with the insulation in place is approximately 14 feet. The kiln is normally operated under negative pressure maintained between zero- and one-inch water column vacuum to prevent fugitive emissions from the kiln ends. The kiln temperature is measured with three thermocouples inserted through the roof of the ash dropout chamber, approximately 4 feet past the end of the kiln.

Secondary Combustion Chamber Design

Hot flue gases from the transition section enter the cylindrical secondary combustion chamber (SCC) approximately 14 feet above the base of the tower. The SCC is 78 feet tall and equipped with eight burners evenly arranged around the perimeter of the SCC tower. The combustion gases are raised to the current, minimum temperature of 2,012 °F. The burners, which fire tangentially, are rated at 15 million Btu/hr each. The burners are dual fuel burners and have the capability to fire waste liquid and/or fossil fuel. The burners are equipped with external steam and air atomizers and natural gas fired pilot lights. A compressed gas cylinder feed system is designed to feed waste gases to the secondary combustion chamber. The SCC temperature is measured with three thermocouples inserted through the top of the hot cross-over duct between the SCC and quench, approximately 7.5 feet downstream of the SCC.

Quench Tower

Cooling of the combustion gases occurs in the quench tower. Three rows of water spray nozzles are arranged around the circumference of the tower and spray water directly into the hot combustion gas.

As the gas flows downward, it is cooled to an adiabatic saturation temperature of about 185°F. Water is supplied from the scrubber water recycle loops and from clean process water. A caustic solution is added to the quench water for initial neutralization of acid gases. The ash particulate collected by the water sprays falls to the bottom of the quench tower.

Air Pollution Control System

Removal of particulate matter and acid gases occur in the Air Pollution Control System (APCS). The APCS consists of the following equipment:

- Two parallel Acid Gas Absorbers;
- An Ionizing Wet Scrubber; and
- A Wet Electrostatic Precipitator.

Process Parameter Continuous Monitoring Systems

The incinerator uses process instruments, which include thermocouples, flowmeters, pH meters, and pressure transmitters to document compliance with applicable operating parameters. The process instruments continuously monitor and record operating parameters of the incinerator.

Veolia operates two identical EcoChem MC3 multi-component gas analyzers (one for compliance and one for redundancy). Each individual multi-component instrument analyzes the stack gas for O₂, CO, CO₂, SO₂ and HCl.

Incineration Residues

The liquid residues from incineration are injected into an on-site Class IV underground injection well after treatment. The three solid residues (ashes from the kiln, slag from the quench and SCC, and filter cake from the water treatment) are sent to an off-site Subtitle C landfill.

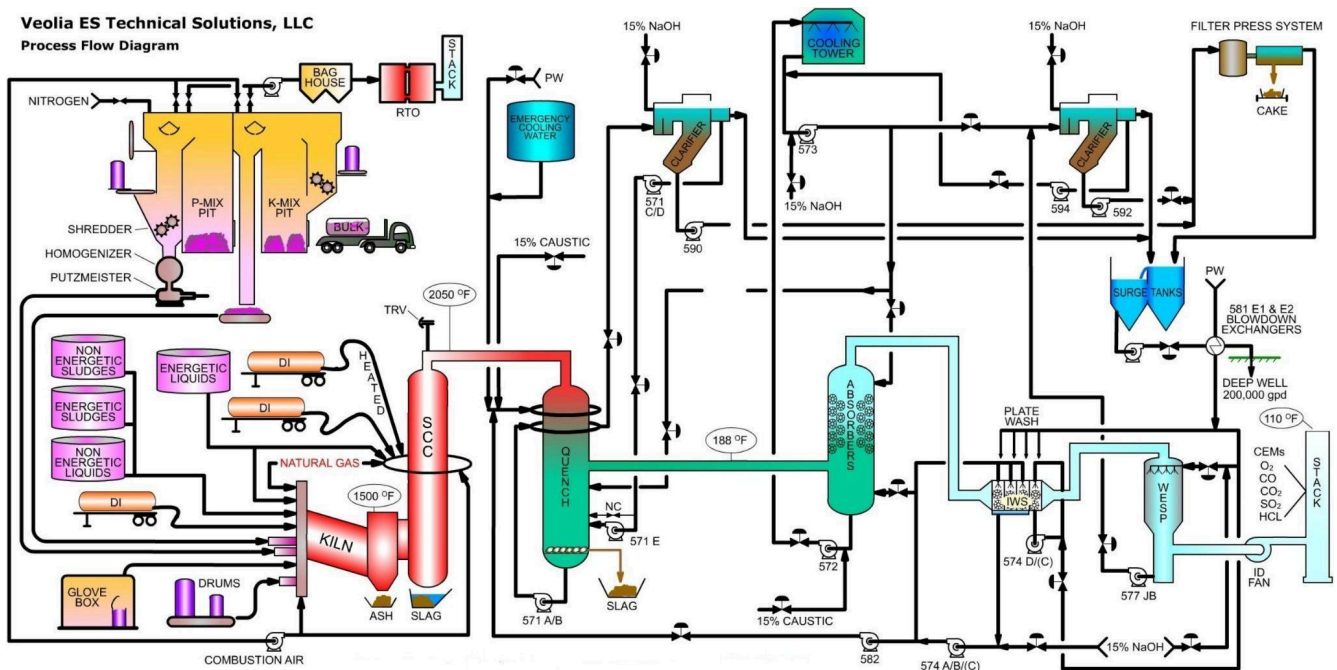


Figure 1 - Process Diagram at Port Arthur

5. Protocol and Sampling

The PFAS testing program at Port Arthur was performed in 2 campaigns :

Campaign	Date	Analysis	PFAS waste
Campaign 1	July 29 to August 5, 2024	Analysis of air emissions, liquid (blowdown) and solids (ashes, slag and filter cake)	AFFF (3 runs) AFFF-contaminated soil (3 runs)
Campaign 2	October 6th to October 24th, 2024	Analysis of air emissions, liquid (blowdown) and solids (ashes, slag and filter cake)	AFFF (2 runs) AFFF with lime injection (1 run) Contaminated soil (3 runs) Spent activated carbon (2 runs) Carbon tetrafluoride CF4 (1 run)

Campaign 1 & 2 were performed in collaboration with AECOM, a reputable stack testing company, who was tasked with performing OTM-45 & OTM-50¹ and HF sampling at stack. Eurofins USA performed the laboratory analysis on all matrix samples at their laboratory facilities in Knoxville, TN and Lancaster, PA.

Campaign 2 was performed in collaboration with the EPA. Veolia shared with EPA the protocol in advance and the results of the test. The testing program followed *EPA Guidance to Conduct PFAS Emissions Field Testing at Commercial Thermal Destruction Sources (Appendix A of the 2024 EPA guidance on PFAS waste disposal)*.

Before each new matrix, a baseline run was performed : liquid and solid residues are sampled, OTM-45, 50 and HF sampling is performed at the stack while no PFAS is incinerated in the kiln.

5.1. Sampling Procedure

All residues (liquid, solid and air emissions) were sampled for PFAS during PFAS incineration either during the run or at the end. The average duration of a run was between 3-4 hours. The list of sample points is provided below :

- 1 liquid sample at the end of the water treatment line at the end of each PFAS run and 24 hours afterwards when no PFAS has been incinerated in between.
- 3 solid samples: ashes in the kiln, slag from the SCC and quench, and the filtercake in the water treatment line. Solids are sampled once they have cooled (<24 hours after the run).
- 3 air emission samples at the stack: OTM-45, OTM-50 and HF samples were collected..

Parameter	Stream	Analytical Method	Sampling method
HF	Stack Gas	IC - EPA Method 26A	EPA Method 26A

¹ OTM-45 and OTM-50 are 2 sampling methods for PFAS developed by the EPA. OTM-45 targets 49 semi-volatile PFAS and OTM-50 targets 30 volatile non-polar PFAS.

PFAS	Stack Gas	LC – MS EPA Method 537 (modified)	OTM-45
VFC	Stack Gas	GC/MS - ASTM D5466-21	OTM-50
O ₂ , CO ₂	Stack Gas	Instrument Analyzers	EPA Method 3A
Moisture	Stack Gas	Gravimetric	EPA Method 4
Process water	Tap	LC – MS EPA Method 537 (modified)	S004
Liquid residues	Blowdowns	LC – MS EPA Method 537 (modified)	S004
Solid residues	Ashes, Slag, Filtercake	LC – MS EPA Method 537 (modified)	S007
PFAS	Waste Feeds	LC – MS EPA Method 537 (modified) or EPA Method 1633	

Table 1 - Summary of analytical and sampling methods

5.1.1. Waste Feed Sampling Procedures

Samples of the liquid and solid waste feed streams were collected in glass bottles or plastic containers by Veolia staff and handed to AECOM at the end of the program. Pre-cleaned bottles were purchased and used to collect the samples.

Liquid waste feed samples were collected using the tap sampling procedure specified in U.S. EPA Method S004, “*Sampling and Analysis Methods for Hazardous Waste Combustion.*” The sample tap was flushed each time (allowed to flow briefly) before the sample was collected to ensure that any stagnant accumulation of solids, or other contaminants that may be present in the tap, did not affect the sample integrity or its representation of the stream being sampled.

Solid waste feed samples were collected using the scoop sampling procedure specified in U.S. EPA Method S007, “*Sampling and Analysis Methods for Hazardous Waste Combustion.*” Samples of the bulk solid wastes (i.e., “regular wastes”) fed to the kiln were collected by Veolia personnel for each of the three test runs. In the case where multiple samples of “regular wastes” were collected, the average analysis result for each test run was utilized.

5.1.2. Stack Gas Sampling Procedures

The stack gas emissions were sampled for determination of the parameters indicated in **Table 2**. The sampling methods used are described below.

For all of the stack gas emission parameters measured using sampling trains (i.e., Method OTM-45, OTM-50 and Method 26A) a field blank sample was collected by assembling the sampling train, taking it to the stack sampling location, and then performing a leak check. The field blank was then recovered and analyzed in the same manner as actual samples. The primary purpose of the field blank samples is to evaluate any bias to sample results due to contamination of the sampling system and/or sampling media.

5.1.3. EPA Methods 2 and 4 (Flowrate and Moisture)

Concurrent with the performance of isokinetic sampling trains, measurements were made to determine gas velocity by EPA Method 2, and moisture by EPA Method 4.

5.1.4. EPA Method OTM-45 for PFAS

Samples of exhaust emissions of PFAS compounds were collected according to OTM-45 for determination of PFAS.

A schematic diagram of the sampling train is shown in **Figure 2-1**. According to this method, sample gas was removed isokinetically from the stack and passed through the following components:

- Glass (quartz) nozzle;
- Heated, glass (quartz)-lined probe;
- Heated glass-fiber filter with a glass filter support;
- Coil condenser;
- Sorbent trap containing XAD-2® resin;
- One short-stem Knockout impingers empty;
- Modified Greenburg-Smith impinger containing 100 mL of water;
- Greenburg-Smith impinger containing 100 mL of water;
- Modified Greenburg-Smith impinger containing 100 mL of water;
- Second sorbent trap containing XAD-2® resin; and
- Modified Greenburg-Smith impinger containing silica gel.

After sample collection, the sampling train was recovered to provide the following fractions:

- Solvent (5% ammonium hydroxide) rinse of the nozzle, probe and front half of the filter holder;
- Filter;
- 5% ammonium hydroxide rinse of back half of the filter holder, transfer line, and condenser;
- XAD-2® sorbent trap; and
- Condensate catch from Impingers 1 through 4;
- 5% ammonium hydroxide rinse of Impingers 1 through 4 and connecting glassware; and
- 2nd XAD-2® sorbent trap.

All samples, except the particulate filter were maintained cold and on ice prior to transportation. The particulate filter is stored at 68±5 °F and shipped unrefrigerated. These samples were shipped to the Eurofins Test America laboratory in Knoxville, TN, for analysis as follows:

- PFAS analysis using liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS) multiple reaction monitoring (MRM).

Sampling data sheets are presented in Appendix I (campaign 1) and II (campaign 2).

OTM-45 fractions were sent to Eurofins for analysis. Eurofins analysed separately the 4 fractions shown in Figure 2-1:

- Fraction 1 : #1 Filter and #2 Front Half Rinse
- Fraction 2 : #3 XAD1, #4 Back Half Rinse, #6 Impinger Rinse
- Fraction 3 : #5 Condensate and Impingers Water

- Fraction 4 : #7 Breakthrough XAD2

5.1.5. EPA Method OTM-50 for PICs in the form of Volatile Fluorinated Compounds (VFC)

Samples of exhaust emissions of PICs in the form of VFCs were collected according to OTM-50 for determination of volatile fluorinated compounds

A schematic diagram of the sampling train is shown in **Figure 2-2**. In this method, a gas sample is extracted from the gas stream and collected in an evacuated canister. Sample conditioning was necessary for sources with moisture content exceeding 3% volume/volume (v/v) or for sample gas temperatures above 250 °F. For Veolia sampling, sample conditioning is included due to the high moisture content in the gas stream. The stack sample passes through the following components:

- Heated, glass (quartz)-lined probe;
- Heated glass-fiber filter with a glass filter support;
- Perfluoroalkoxy (PFA) heated transfer line;
- One short-stem Knockout impingers empty;
- Mini impinger with open stem containing 15 mL of water;
- Mini impinger with tapered stem containing 15 mL of water;
- Mini impinger with tapered stem containing 15 mL of water;
- Mini impinger with open stem, empty; and
- Stainless steel canister.

After sample collection, the sampling train was recovered to provide the following fractions:

- Stainless steel canister.

These samples were transferred to the Eurofins Test America laboratory in Knoxville, TN, for analysis as follows:

- VFC analysis using gas chromatography coupled with mass spectrometry (GC/MS).

Sampling data sheets are presented in Appendix I (campaign 1) and II (campaign 2).

5.1.6. EPA Method 26A (HF)

Samples for the determination of HF in stack emissions were collected using a single sampling train meeting the requirements of EPA Method 26A. A schematic diagram of the sampling train is shown in **Figure 2-3**. This sample train consists of the following components:

- Glass (quartz) nozzle;
- Heated, glass (quartz)-lined probe;
- Heated Teflon mat filter with a Teflon filter support;
- Greenburg-Smith impinger containing 100 mL of 0.1 N H₂SO₄;
- Greenburg-Smith impinger containing 100 mL of 0.1 N H₂SO₄;
- Modified Greenburg-Smith impinger containing 100 mL of 0.1 N NaOH;
- Modified Greenburg-Smith impinger containing 100 mL of 0.1 N NaOH;
- Optional empty knockout impinger, modified Greenburg-Smith; and
- Modified Greenburg-Smith impinger containing silica gel.

These procedures require the isokinetic extraction of particulate matter on a filter maintained at a controlled temperature. In accordance with the requirements of EPA Method 26A, the filter and probe were kept at a temperature between 248°F and 273°F, and a Teflon-backed filter was used. A Teflon union was used to connect the quartz nozzle to the quartz probe liner.

Fluoride analysis was performed on the impinger contents using ion chromatography according to Method 26A.

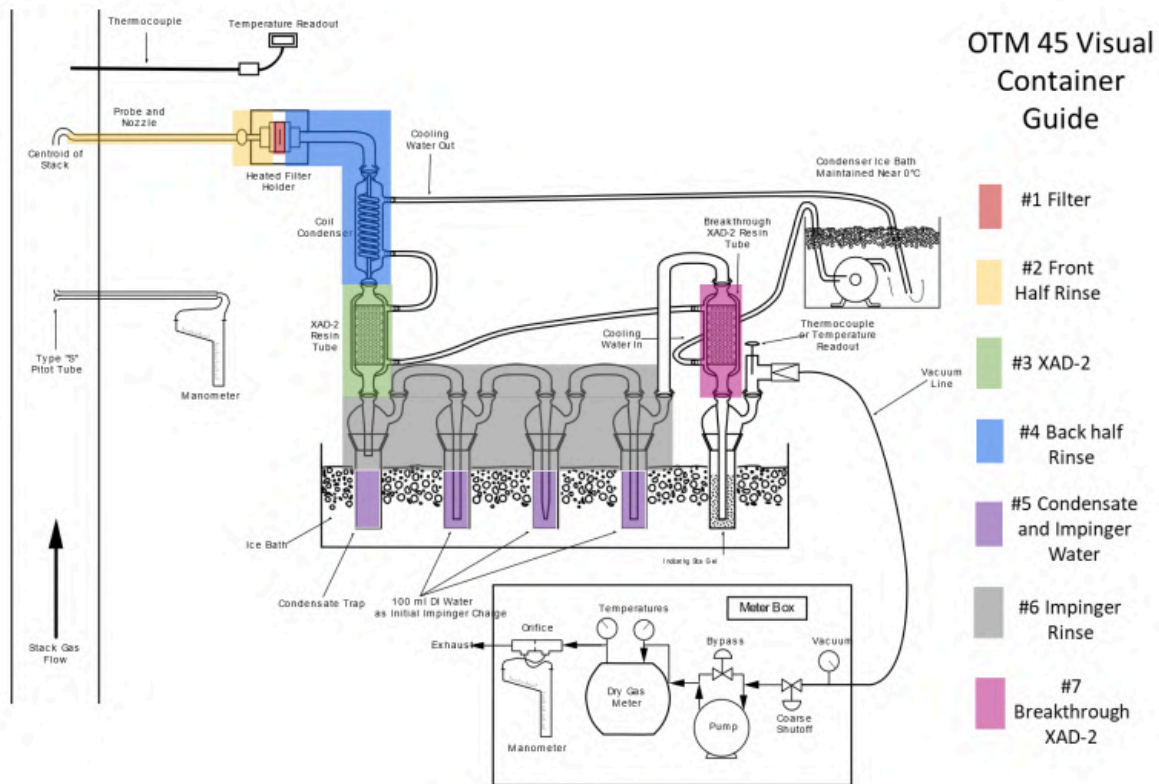


Figure 2-1 - OTM-45 sampling train

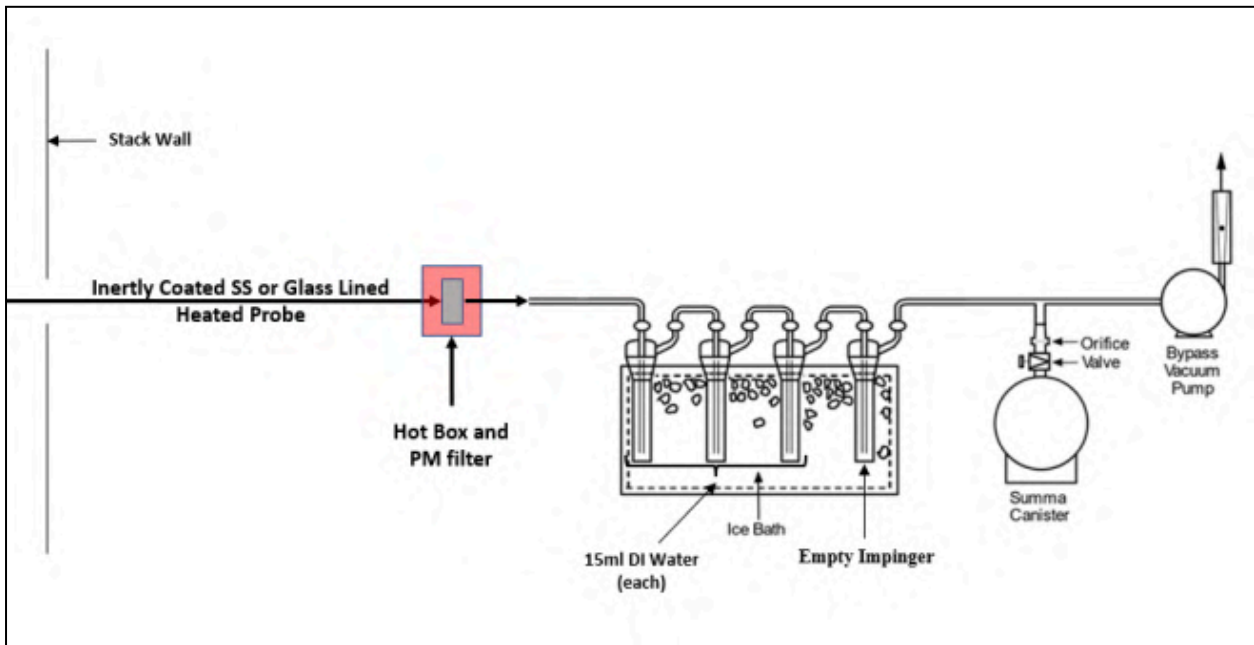


Figure 2-2 - OTM-50 sampling train

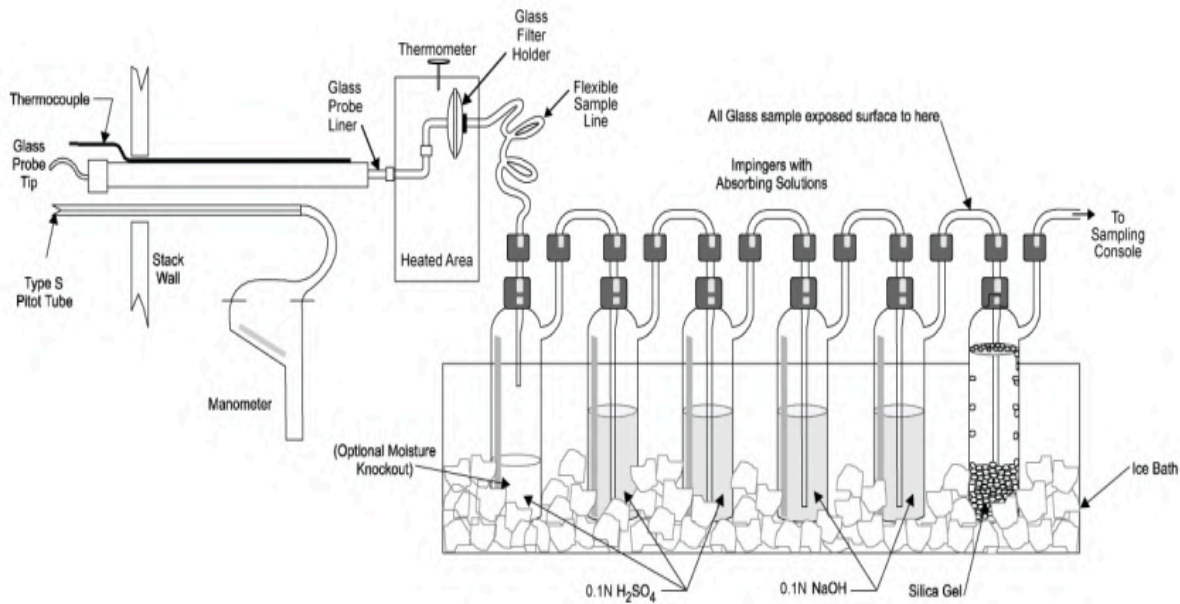


Figure 2-3 – Sampling Train Schematic – EPA Method 2

5.2. Operating conditions

The incinerator was operated under normal conditions in terms of temperature and residence time. In addition to the PFAS waste, regular waste was injected into the kiln, with the exception of waste with F content > 2%. Regular waste includes a wide variety of liquid and solid hazardous waste including waste with high H content like aqueous waste. A high ratio H/F is known to be useful to enhance HF formation and avoid incomplete PFAS destruction.

Tables 2-1 and 2-2 present additional information regarding the conditions evaluated in the final campaign phase. Table 2-3 summarizes the combustion conditions in the SCC during the test.

Date		Run	Avg Feedrate (lb/hr)	Stack Gas Flow (DSCFM)	Blowdown Flow (GPM)	SCC (Deg F)	Solid residual Generation (lb/hr)
7/31	Morning	Baseline	NA			2049 *	
7/31	Afternoon	AFFF #1	2420.8	28987.8	124.17		5403.3
8/01	Morning	AFFF #2	2175	30049	120.91		5403.3
8/01	Afternoon	AFFF #3	2235.2	29605.5	128.32		5403.3
8/03	Morning	Baseline	NA				
8/03	Afternoon	Soil #1	4824.7	28587	124.35		5584.2
8/04	Morning	Soil #2	3909.8	29143.7	115.51		5584.2
8/04	Morning	Soil #3	2936.9	28793.4	119.65		5584.2

Table 2-1 - Process data for the July campaign. * Temperature in the SCC is the average temperature during the test, temperature for each run is not available.

Date	Time	Run	Feed Rate (lb/h)	Stack Gas Flow (DSCFM)	Blowdown (GPM)	Kiln Face* (Deg F)	Kiln Exit* (Deg F)	SCC* (Deg F)	Solid residual generation (lb/hr)
10/9	Morning	Baseline	NA	29878	104.9	1550	1554	2034	6,618
10/9	Afternoon	A3F #1	2184	29521	96.5	1535	1572	2035	8,104
10/10	Afternoon	A3F #2	2294	29942	105.4	1706	1628	2042	8,410
10/12	Morning	Baseline	NA	29019	124.4	1559	1636	2058	9,225
10/12	Afternoon	A3F #3 lime	2378	28866	100	1532	1778	2055	8,165
10/14	Morning	Baseline	NA	29206	105.1	1492	1667	2048	10,935
10/14	Afternoon	Soil #1	4061	28688	108.6	1490	1673	2052	12,195
10/17	Morning	Baseline	NA	29931	115.6	1496	1568	2053	7,203
10/17	Afternoon	CF4	30.9	29730	99	1427	1717	2054	8,565
10/19	Morning	Baseline	NA	29723	103.3	1455	1643	2040	7,010
10/19	Afternoon	Carbon #1	2187	29387	105.2	1392	1689	2046	6,230
10/20	Morning	Carbon #2	2422	29668	105.9	1519	1644	2066	5,140
10/22	Morning	Baseline	NA	31208	96.8	1595	1643	2056	2,838
10/22	Afternoon	Soil #2	2565	29925	95.9	1414	1799	2049	6,745
10/23	Morning	Soil #3	3875	30253	104	1484	1697	2046	13,320

Table 2-2 - Process data for the October campaign. * indicates average temperature during test

Parameter	Campaign 1			Campaign 2		
	Min	Max	Average	Min	Max	Average
Residence time (calculated)	2.3 sec					
O2 at the stack - % dry (measured)	7.0	8.1	7.5	7.2	8.4	8.1
CO2 at the stack - % dry at the stack (measured)	9.1	10.2	9.7	9.1	9.9	9.3
Moisture at the stack - %v/v (measured)	7.7	8.7	8.0	5.5	7.2	6.2

Table 2-3 - Combustion Conditions in the SCC and at the stack

6. Quality Assurance/Quality Control

The primary objectives of the QA/QC effort were to control, assess, and document data quality. To accomplish these objectives, the QA/QC approach consisted of the following key elements:

- Definition of data quality objective that reflects the overall technical objectives of the measurement program (see section 4.2);
- Design of a sampling, analytical, QA/QC and data analysis system to meet those objectives;
- Evaluation of the performance of the measurement system; and
- Initiation of corrective action when measurement system performance does not meet the specifications

These QA procedures include sampling and analytical procedures, along with specified calibration requirements, QC checks, data reduction and validation procedures, and sample tracking. A review of analysis results for QA/QC samples and assessment of overall data quality is presented in this section.

The sections below present discussions of the QA/QC activities associated with sampling and analysis, as well as with data quality assessment.

6.1. Analysis of Waste Feeds for PFAS

Samples of waste feed materials were analyzed for PFAS using SW-846 Method 537 (Modified). These same samples were analyzed for PFAS using Liquid Chromatography/Tass Spectrometry. These samples were prepared for analysis using appropriate extraction or dilution techniques. Quality assurance and quality control activities associated with these analyses included:

- Sample handling and preservation;
- Preparation and analysis of samples within specified holding times;
- Preparation and analysis of laboratory blanks;

- Preparation and analysis of laboratory control samples;
- Preparation and analysis of samples collected in duplicate; and
- Preparation and analysis of matrix spike and matrix spike duplicate samples.

Review of these field-related QA/QC activities indicates that these data are supportable and usable. See the detailed data quality assessment in Appendix III (campaign 1) and IV (campaign 2). Any issues with the sample analysis were identified in the laboratory reports. Media checks were sufficient to qualify the data, and a sufficient number of reagents blanks were collected and analysed to further qualify the data.

6.2. Stack Gas

6.2.1. Isokinetic Sample Collection

The following isokinetic sampling trains were used for the collection of air emission compliance samples:

- Hydrogen fluoride using a sampling train meeting the requirements of EPA Method 26A; and
- PFAS in accordance with OTM-45.

Quality assurance and quality control activities associated with the collection of these samples included:

- Collection of the specified volumes of stack gas over the specified duration;
- Collection of stack gas within 90-110 percent of isokinetic;
- Maintaining the probe, filter, and heated transfer line at the specified temperatures, as applicable;
- Maintaining the impinger exit and the condenser exit at the specified temperature, as applicable;
- Performing sampling train leak checks before sample collection, at port changes, and after sample collection;
- Performing pitot tube leak checks before and after sample collection; and
- Recording all data on pre-printed data sheets.

6.2.2. Non-Isokinetic Sample Collection

The following non-isokinetic sampling trains were used for the collection of air emission compliance samples:

- VFC using EPA Method OTM-50.

Quality assurance and quality control activities associated with the collection of these samples included:

- Collection of the specified volumes of stack gas over the specified duration;
- Maintaining the probe, filter, and heated transfer line at the specified temperatures, as applicable;
- Maintaining the impinger exit and the condenser exit at the specified temperature, as applicable;
- Performing sampling train leak checks before sample collection, at port changes, and after sample collection;
- Performing pitot tube leak checks before and after sample collection; and
- Recording all data on pre-printed data sheets.

6.2.3. Monitoring of Stack Gas for Oxygen and Carbon Dioxide

The stack gas was monitored for oxygen (O₂) and carbon dioxide (CO₂) according to EPA Methods 3A (O₂ and CO₂).

Quality assurance and quality control activities associated with continuous emission monitoring include:

- Use of calibration gas standards of known and acceptable quality;
- Use of calibration gas standards in the specified ranges;
- Performance of calibration error tests;
- Performance of system bias checks;
- Performance of zero and span drift checks; and
- Performance of a NOx analyzer converter efficiency check.

Review of these QA/QC activities indicates that these data are supportable and usable. See the data quality assessment in Appendix III (campaign 1) and IV (campaign 2). Copies of certifications of calibration gas standards; the raw data for continuous emission monitors is presented in Appendix V (campaign1) and VI (campaign 2).

7. Results and discussion

7.1. Campaign 1 : Incineration of A3F and PFAS-contaminated soil

Campaign 1 Summary :

Campaign 1 demonstrated that Port Arthur incinerator can efficiently treat PFAS waste and reach DRE at stack above 99.9999% for the most concentrated PFAS, including PFOS, PFHxS, PFHpS and PFPeS.

OTM-50 results demonstrated that no PICs were detected in any runs of the campaign, showing that PFAS mineralization was complete, within the limit of current analytical detection limits.

Solid residues were PFAS-free, or contained PFAS at levels close to the MDL.

Liquid residues contained PFAS at low levels (ppt), reflecting the background presence of PFAS in the pond water supplying the process water to the incinerator.

7.1.1. Waste analysis

Three different A3F were incinerated in three different runs, with PFAS feed rate in the kiln ranging from 8 g/hr to 188 g/hr. A3F profiles are in **Appendix VI**.

3 runs of contaminated soil were incinerated with a PFAS injection rate of 29 g/hr in the kiln. The solid mix was spiked with A3F to create the contaminated soil. The soil profile is in **Appendix VIII**.

7.1.2. Solid and liquid residues

No PFAS were detected in significant quantities in the solid residues. 2 PFAS (PFOSAm and 6:2 FTS) were detected at the MDL in the ashes and filtercake in 2 samples out of 18. Detailed results are provided in **Appendix IX-A and X-A**.

All blowdowns had the same PFAS concentration and signature. A dozen PFAS were detected at ppt level (Figure 3), that is to say at the order of magnitude of the EPA drinking water standard². Results were similar for samples collected during baseline (at the beginning of the campaign, before PFAS incineration) and in the samples collected after PFAS incineration.

Detecting PFAS at ppt level in the blowdown was unexpected. It was later explained by the background presence of PFAS in the pond water supplying the process water. This pond is supplied by rain water and is likely contaminated by PFAS from various industrial sources as Port Arthur is an industrial area. PFAS contamination in water bodies is not uncommon across the USA.

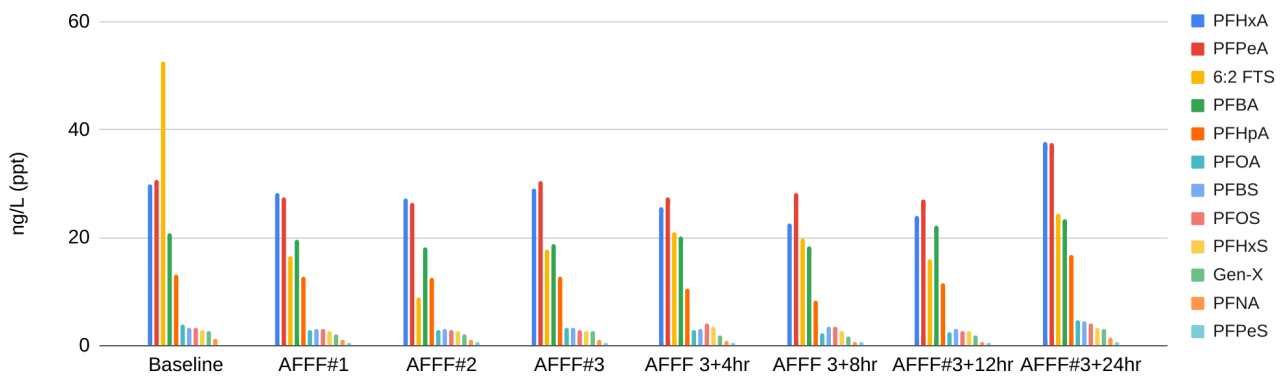


Figure 3 - PFAS detected in blowdowns during A3F incineration

This PFAS presence in liquid residues is due to PFAS background presence in the pond water used in the incinerator : the same signature of PFAS was observed in the process water and in the blowdown sampled during the baseline (without PFAS incineration), with PFAS being twice as concentrated in the blowdowns than in the pond water because of evaporation (Table 3-1). The only difference between the PFAS signature in the process water and blowdown is the presence of 6:2 FTS in the blowdown, detected in every run even during the baseline. During campaign 1, 6:2 FTS was not detected at the stack, so it seems unlikely that 6:2 FTS is a PIC generated during the incineration process. However, 6:2 FTS was detected at the stack in campaign 2. Port Arthur is currently studying the possibility that some equipment inside the incinerator releases PFAS during normal operations. Otherwise 6:2 FTS could be a residual PIC from previous PFAS incineration.

The process water comes from a nearby pond, supplied by rainfall. As many water sources in the USA, this pond is contaminated with PFAS at low level (< 100 ppt). Veolia was not aware that the pond water was contaminated with PFAS before performing the PFAS campaign and sampling process water. Veolia is currently studying PFAS removal technology to treat the pond water prior to injecting process water in the incinerator.

The process water sample was not collected during campaign 1 but 6 weeks after, when the first results of blowdowns were analysed. Therefore, PFAS contamination in process water during campaign 1 may have been slightly different. However, the second sample of process collected in

² EPA Maximum Contaminant Level : PFOA & PFOS : 4 ng/L each PFHxS, PFNA, HFPO-DA : ng/L

campaign 2 shows a similar PFAS signature and concentration compared to the one obtained for campaign 1, suggesting that PFAS contamination in the process water does not vary, at least over short time periods.

PFAS	Process water (ng/L)	Blowdown baseline (ng/L)
6:2 FTS	ND	52.6
PFBA	11.20	20.8
PFPeA	16.10	30.8
PFHxA	14.90	29.9
PFHpA	8.41	13.1
PFOA	2.88	3.88
PFNA	1.26	1.33
HFPO-DA	2.02	2.77
PFBS	1.81	3.33
PFHxS	1.49	2.84
PFOS	2.48	3.4

Table 3-1 : PFAS concentration in process water and blowdown baseline (ng/L). The column “blowdown baseline” is an average of the 2 baselines collected during campaign 1. All PFAS listed in EPA 1633 were tested but only the ones detected are shown in this table.

Table 3-2 shows the difference in PFAS concentration entering the incinerator via the process water, vs PFAS exiting the incinerator via the liquid residue (blowdowns). In all runs except Soil run#3, there are more PFAS entering via the process water than exiting in the liquid residues. That confirms that PFAS in the process water pass through the stack gases and are emitted at the stack.

	AFFF run 1	AFFF run 2	AFFF run 3	Soil run 1	Soil run 3
PFAS in process water entering the incinerator - PFAS in (lb/hr)	1.10E-05	1.07E-05	1.09E-05	9.67E-05	1.32E-04
PFAS in liquid residue exiting the incinerator - PFAS out (lb/hr)	8.22E-06	7.29E-06	8.44E-06	8.91E-05	2.02E-04
% PFAS out / PFAS in	74.73%	68.13%	77.43%	92.14%	153.03%

Table 3-2 : Comparison of PFAS flowrate in liquid entering and exiting the incinerator. Soil run 2 is not shown because process water flowrate was not measured.

Port Arthur is equipped with a wet flue gas treatment. The stack gases are in contact with process water after the incineration process, and it is possible that some PFAS transfer from water to stack gases after thermal treatment.

Detailed results for PFAS concentrations in liquid residues are provided in **Appendix IX-B (AFFF)** and **X-B (contaminated soil)**.

7.1.3. Air Emissions

7.1.3.1. PFAS Mass Emission Rate at Stack (OTM-45)

Table 4-1 and 4-2 present PFAS mass emission rate at the stack during campaign 1 for baselines, AFFF incineration and contaminated-soil incineration.

> Analysis of OTM-45 during baseline :

Analysis of PFAS flowrate at the stack during baseline tests shows that most of the OTM-45 listed PFAS are not detected at the stack.

In the baseline performed before AFFF was fed, 10 PFAS are detected at low level, close to the MDL during the baseline. These PFAS were PCFAs only, and 3 of them are present in the process water (PFPeA, PFHxA, PFOA) which could explain their detection at the stack. Among the 7 other PFAS (PFDA, PFDoA, perfluorohexadecanoic acid, perfluorooctadecanoic acid, PFTeA, PFTriA and PFUnA), perfluorohexadecanoic acid and perfluorooctadecanoic acid could not be measured in the process water due to analytical limitations and may be in the water.

There is no apparent reason to explain the presence of PFDA, PFDoA, PFTriA, PFUnA, PFTeA at the stack while no PFAS were incinerated during the baseline.

Results for the baseline before contaminated soil was fed were similar to the AFFF baseline except for the additional presence of PFHxS at the stack. PFHxS was not detected in the process water. Its measurement at the stack during the soil baseline was very close to the MDL.

> Analysis of OTM-45 mass emission rate during AFFF and contaminated soil incineration

During AFFF incineration, only 13 PFAS out of the 49 listed in OTM 45 were detected above MDL in at least one run. They are in bold in Table 4-1. They are exclusively PFCAs:

- PFBA, PFHpA, PFHxA, PFOA, PFPeA, PFNA, which are present in the process water. Their presence at the stack during AFFF incineration most likely comes from the process water.
- PFDA, PFDoA, PFTeA, PFTriA, PFUnA, perfluorooctadecanoic acid, perfluorohexadecanoic acid, which were detected during the AFFF baseline at the stack.

Comparison of OTM-45 between the baseline and AFFF or soil incineration shows that the same PFAS are detected at the stack, reflecting mainly the presence of PFAS in the process water.

Comparing total PFAS emission at the stack between baselines and PFAS incineration, OTM-45 results indicated higher total PFAS emissions for the PFAS waste incineration tests compared to baseline tests. However, given that PFAS were present in the water fed to the quench and wet scrubber downstream of the incineration process, these data are not considered conclusive.

PFAS	Baseline	Run 1		Run 2		Run 3	
	Stack emission (lb/hr)	Waste feed rate (lb/hr)	Stack emission (lb/hr)	Waste feed rate (lb/hr)	Stack emission (lb/hr)	Waste feed rate (lb/hr)	Stack emission (lb/hr)
PFBS	<0.000000083 DLL	0.024500	<0.000000075 DLL	0.002170	ND (0.000000076)	ND (0.000032)	<0.000000079 DLL
PFBA	<0.000000084 DLL	0.004730	<0.000000087 DLL	0.001080	0.000000589	0.000858	<0.000000080 DLL
PFDS	ND (0.000000025)	0.000173	ND (0.000000025)	0.000894	ND (0.000000025)	ND (0.000032)	ND (0.000000025)

PFDA	0.000000504	0.000180	0.000000183	0.000005	0.000000164	ND (0.000032)	<0.000000036
	ND		ND		ND		ND
PFDoS	(0.000000023)	0.000109	(0.000000022)	0.000025	(0.000000023)	ND (0.000032)	(0.000000023)
PFDoA	0.0000000649	0.000717	0.0000000805	ND (0.000043)	0.0000000718	0.000131	0.0000000116
	ND		ND		ND		ND
PFHpS	(0.000000028)	0.033400	(0.000000027)	0.000594	(0.000000027)	ND (0.000032)	(0.000000028)
PFHpA	<0.00000024 DLL	0.006120	0.0000000912	0.000561	0.0000000398	0.000295	0.000000130
Perfluorohexadecanoic acid	0.000000116	--	0.0000000727	--	0.0000000577	--	0.0000000442
	ND		ND		ND		<0.000000029
PFHxS	(0.000000028)	0.179000	(0.000000027)	0.018000	(0.000000028)	0.000396	DLL
PFHxA	0.000000104	0.022300	0.0000000605	0.004090	0.0000000338	0.006460	0.0000000339
	ND		ND		ND		ND
PFNS	(0.000000019)	0.000392	(0.000000019)	0.000763	(0.000000019)	ND (0.000032)	(0.000000019)
PFNA	<0.000000099						<0.000000075
	DLL	0.000228	0.0000000412	0.000644	0.0000000289	ND (0.000032)	DLL
Perfluorooctadecanoic acid	0.0000000880	--	0.0000000468	--	0.0000000501	--	0.0000000450
	ND		ND		ND		ND
FOSA	(0.000000025)	0.000228	(0.000000024)	0.000644	(0.000000025)	ND (0.000032)	(0.000000025)
	<0.000000042		<0.000000038		<0.000000035		<0.000000038
PFOS	DLL	0.007190	DLL	0.005830	DLL	0.004380	DLL
PFOA	0.000000101	0.000806	0.0000000782	0.000653	0.0000000378	0.000490	0.000000147
	ND		ND		ND		ND
PFPeS	(0.000000025)	0.000178	(0.000000024)	0.000144	(0.000000025)	0.000108	(0.000000025)
PFPeA	0.0000000696	0.000301	0.0000000329	0.000744	0.0000000271	0.000183	0.0000000821
PFTeA	0.0000000843	0.000070	0.0000000920	0.000006	0.0000000575	0.000004	0.0000000352
PFTriA	0.0000000919	0.000671	0.0000000825	0.000543	0.0000000658	0.000408	0.0000000223
							<0.000000036
PFUnA	0.0000000604	0.000622	0.000000116	0.000504	0.000000101	0.000379	DLL
	ND		ND		ND	ND	ND
9-Chloro.	(0.000000022)	ND (0.000059)	(0.000000021)	ND (0.000053)	(0.000000022)	(0.0000054)	(0.000000022)
	ND		ND		ND		ND
NEtFOSA	(0.000000066)	0.000865	(0.000000064)	ND (0.000043)	(0.000000066)	ND (0.000043)	(0.000000066)
	ND		ND		ND		ND
NEtFOSAA	(0.000000025)	--	(0.000000024)	--	(0.000000025)	--	(0.000000025)
	ND		ND		ND		ND
NMeFOSAA	(0.000000021)	ND (0.000047)	(0.000000020)	ND (0.000043)	(0.000000021)	ND (0.000043)	(0.000000021)
	<0.000000027	ND	ND	ND	ND	ND	ND
11-Chloro.	DLL	(0.0000059)	(0.000000025)	(0.0000053)	(0.000000026)	(0.0000054)	(0.000000026)
	ND		ND		ND		ND
NEtFOSE	(0.000000038)	0.000627	(0.000000037)	0.000396	(0.000000038)	ND (0.000043)	(0.000000038)
			ND		<0.0000017		<0.0000017
NMeFOSE	<0.0000017 DLL	0.000207	(0.0000016)	ND (0.000053)	DLL	ND (0.000054)	DLL
	ND		ND		ND		ND
PES	(0.000000022)	--	(0.000000021)	--	(0.000000022)	--	(0.000000022)
	ND		ND		ND		ND
PFECA	(0.000000032)	--	(0.000000031)	--	(0.000000031)	--	(0.000000032)
	ND		ND		ND		ND
PFECA	(0.000000028)	--	(0.000000027)	--	(0.000000028)	--	(0.000000028)
	ND		ND		<0.000000027	--	ND

	(0.000000025)		(0.000000025)		DLL		(0.000000025)
	ND		ND		ND		ND
PFECHS	(0.000000031)	--	(0.000000030)	--	(0.000000030)	--	(0.000000031)
	ND		ND		ND	ND	ND
DONA	(0.000000099)	ND (0.000059)	(0.000000096)	ND (0.000053)	(0.000000099)	(0.0000054)	(0.000000099)
	ND		ND		ND		ND
HFPO-DA	ND (0.0000010)	0.000006	(0.000000099)	ND (0.000043)	(0.0000010)	ND (0.000043)	(0.0000010)
	ND		ND		ND		ND
NMeFOSA	(0.000000071)	0.000264	(0.000000068)	ND (0.000043)	(0.000000070)	ND (0.000043)	(0.000000070)
	ND		ND		ND		ND
10:2 FTCA	(0.000000077)	--	(0.000000075)	--	(0.000000076)	--	(0.000000077)
	ND		ND		ND		ND
10:2 FTS	(0.000000033)	--	(0.000000032)	--	(0.000000032)	--	(0.000000033)
	ND		ND		ND	ND	ND
3:3 FTCA	(0.000000051)	ND (0.000012)	(0.000000049)	ND (0.000053)	(0.000000050)	(0.0000054)	(0.000000051)
	ND		ND		ND		ND
4:2 FTS	(0.000000012)	0.000035	(0.000000012)	0.000857	(0.000000012)	0.000380	(0.000000013)
	ND		ND		ND		ND
5:3 FTCA	(0.000000093)	0.000022	(0.000000090)	0.000091	(0.000000092)	0.000198	(0.000000093)
	ND		ND		ND		ND
6:2 FTCA	ND (0.00000011)	--	(0.00000011)	--	(0.00000011)	--	(0.00000011)
	ND		ND		ND		ND
6:2 FTS	ND (0.00000084)	0.004410	(0.00000080)	0.008680	(0.00000083)	0.010700	(0.00000083)
	ND		ND		ND		ND
6:2 FTUCA	(0.000000027)	--	(0.000000026)	--	(0.000000027)	--	(0.000000027)
	ND		ND		ND		ND
7:3 FTCA	(0.000000070)	ND (0.000013)	(0.000000068)	ND (0.000012)	(0.000000069)	0.000286	(0.000000070)
	ND		ND		ND		ND
8:2 FTCA	(0.000000066)	--	(0.000000064)	--	(0.000000065)	--	(0.000000066)
	ND		ND		ND		ND
8:2 FTS	(0.000000027)	0.002090	(0.000000026)	0.000097	(0.000000026)	0.001113	(0.000000027)
	ND		ND		ND		ND
8:2 FTUCA	(0.000000038)	--	(0.000000037)	--	(0.000000037)	--	(0.000000038)
Total PFAS (lb/hr)	1.36E-06	2.91E-01	9.33E-06	4.85E-02	7.74E-06	2.73E-02	7.90E-06

Table 4-1 - OTM-45 results for AFFF incineration in campaign 1. PFAS highlighted in blue were detected in the process water. Values in bold were PFAS detected above MDL in at least one of the OTM-45 fractions. ND means PFAS was not detected at the stack. DLL means that some portions of the sample were above the MDL, while the others were ND.

PFAS	Baseline	Run 1		Run 2		Run 3	
	Stack emission (lb/hr)	Feed rate (lb/hr)	Stack emission (lb/hr)	Waste feed rate (lb/hr)	Stack emission (lb/hr)	Waste feed rate (lb/hr)	Stack emission (lb/hr)
PFBS	ND (0.000000074)	0.00013800	<0.000000074 DLL	0.00011200	ND (0.000000074)	0.00008400	ND (0.000000073)
PFBA	<0.00000078 DLL	0.00036000	<0.00000077 DLL	0.00029200	<0.00000082 DLL	0.00021900	<0.00000085 DLL

PFDS	ND (0.000000025)	0.00000414	ND (0.000000025)	0.00000336	ND (0.000000025)	0.00000252	ND (0.000000024)
PFDA	0.00000007	0.00010500	0.00000012	0.00008480	0.00000024	0.00006370	<0.000000033 DLL
PFDoS	ND (0.000000022)	0.00000122	ND (0.000000022)	0.00000985	ND (0.000000022)	0.00000740	ND (0.000000022)
PFDoA	0.00000005	0.00000152	0.00000006	0.00000124	0.00000009	0.00000928	0.00000001
PFHpS	ND (0.000000027)	0.00035200	ND (0.000000027)	0.00028500	ND (0.000000027)	0.00021400	ND (0.000000027)
PFHpA	<0.00000022 DLL	0.00045400	0.00000024	0.00036800	0.00000082	0.00027700	ND (0.000000021)
Perfluorohexadecanoic acid	0.00000004	--	0.00000005	--	0.00000003	--	0.00000003
PFHxS	0.00000003	0.00101000	0.00000002	0.00081700	<0.000000028 DLL	0.00061400	0.00000001
PFHxA	0.00000011	0.00122000	0.00000023	0.00139000	0.00000071	0.00105000	0.00000013
PFNS	ND (0.000000019)	0.00000207	ND (0.000000019)	0.00000168	ND (0.000000019)	0.00000126	ND (0.000000019)
PFNA	<0.00000011 DLL	0.00000385	0.00000018	0.00000312	0.00000047	0.00000235	ND (0.000000071)
Perfluorooctadecanoic acid	<0.000000072 DLL	--	0.00000004	--	ND (0.000000064)	--	0.00000003
FOSA	ND (0.000000024)	0.00038700	ND (0.000000024)	0.00031400	ND (0.000000024)	0.00023600	ND (0.000000024)
PFOS	<0.000000037 DLL	0.00038700	<0.000000033 DLL	0.00058300	<0.000000033 DLL	0.00438000	<0.000000035 DLL
PFOA	0.00000011	0.00080600	0.00000023	0.00065300	0.00000079	0.00049000	0.00000006
PFPeS	ND (0.000000024)	0.00017800	ND (0.000000024)	0.00014400	0.00000001	0.00010800	0.00000001
PFPeA	0.00000005	0.00030100	0.00000015	0.00024400	0.00000045	0.00018300	0.00000003
PFTeA	0.00000004	0.00000700	0.00000004	0.00000567	0.00000007	0.00000426	0.00000002
PFTriA	0.00000006	0.00067100	0.00000005	0.00054300	0.00000009	0.00040800	0.00000001
PFUnA	0.00000007	0.00062200	0.00000007	0.00050400	0.00000014	0.00037900	ND (0.000000031)
9-Chloro.	ND (0.000000022)	ND(0.0000009 3)	ND (0.000000021)	ND(0.0000007 5)	ND (0.000000022)	ND(0.0000005 6)	ND (0.000000021)

NEtFOSA	ND (0.000000064)	0.00000550	ND (0.000000064)	0.00000446	ND (0.000000064)	0.00000335	ND (0.000000063)
NEtFOSAA	ND (0.000000025)	ND(0.00000093)	ND (0.000000024)	ND(0.00000075)	ND (0.000000024)	ND(0.00000056)	ND (0.000000024)
NMeFOSAA	ND (0.000000021)	ND(0.00000093)	ND (0.000000021)	ND(0.00000075)	ND (0.000000021)	ND(0.00000056)	ND (0.000000020)
11-Chloro.	ND (0.000000026)	ND(0.00000093)	ND (0.000000025)	ND(0.00000075)	ND (0.000000026)	ND(0.00000056)	ND (0.000000025)
NEtFOSE	ND (0.000000037)	0.00013800	ND (0.000000037)	0.00011200	ND (0.000000037)	0.00084300	ND (0.000000036)
NMeFOSE	ND (0.0000016)	0.00004380	ND (0.0000016)	0.00003550	ND (0.0000017)	0.00002670	ND (0.0000016)
PES	ND (0.000000022)	--	ND (0.000000022)	--	ND (0.000000022)	--	ND (0.000000021)
PFECA	ND (0.000000031)	--	ND (0.000000031)	--	<0.000000037 DLL	--	ND (0.000000031)
PFECA	ND (0.000000028)	--	ND (0.000000028)	--	ND (0.000000028)	--	ND (0.000000027)
PFECA	ND (0.000000025)	--	<0.000000025 DLL	--	<0.000000033 DLL	--	ND (0.000000024)
PFECHS	ND (0.000000030)	--	ND (0.000000030)	--	ND (0.000000030)	--	ND (0.000000029)
DONA	ND (0.000000096)	ND(0.00000093)	ND (0.000000095)	ND(0.00000075)	ND (0.000000096)	ND(0.00000056)	ND (0.000000094)
HFPO-DA	ND (0.00000100)	0.00045100	ND (0.00000099)	0.00036500	ND (0.0000010)	0.00027400	ND (0.00000098)
NMeFOSA	ND (0.000000068)	ND (0.0000023)	ND (0.000000068)	ND (0.0000019)	ND (0.000000068)	ND (0.0000014)	ND (0.000000067)
10:2 FTCA	ND (0.000000075)	--	ND (0.000000075)	--	ND (0.000000075)	--	ND (0.000000074)
10:2 FTS	ND (0.000000032)	--	ND (0.000000032)	--	ND (0.000000032)	--	<0.000000034 DLL
3:3 FTCA	ND (0.000000049)	0.00000156	ND (0.000000049)	0.00000127	ND (0.000000049)	0.00000952	ND (0.000000048)
4:2 FTS	ND (0.000000012)	0.00002310	ND (0.000000012)	0.00001870	ND (0.000000012)	0.00001400	ND (0.000000012)
5:3 FTCA	ND (0.000000091)	0.00029000	ND (0.000000090)	0.00002350	ND (0.000000091)	0.00001770	ND (0.000000089)
6:2 FTCA	ND (0.00000011)	--	ND (0.00000011)	--	ND (0.00000011)	--	ND (0.00000011)

6:2 FTS	ND (0.00000081)	0.01170000	ND (0.00000080)	0.00946000	ND (0.00000081)	0.00711000	ND (0.00000079)
6:2 FTUCA	ND (0.000000026)	--	ND (0.000000026)	--	ND (0.000000026)	--	ND (0.000000026)
7:3 FTCA	ND (0.000000068)	0.00000326	ND (0.000000068)	0.00000264	ND (0.000000068)	0.00000199	ND (0.000000067)
8:2 FTCA	ND (0.000000064)	--	ND (0.000000064)	--	ND (0.000000064)	--	ND (0.000000063)
8:2 FTS	ND (0.000000026)	0.00010500	ND (0.000000026)	0.00008480	ND (0.000000026)	0.00006370	<0.000000030 DLL
8:2 FTUCA	ND (0.000000037)	--	ND (0.000000037)	--	ND (0.000000037)	--	ND (0.000000037)
Total PFAS (lb/hr)	6.58E-06	1.98E-02	6.98E-06	1.65E-02	9.65E-06	1.71E-02	6.20E-06

Table 4-2 - OTM-45 results for contaminated soil incineration in campaign 1. PFAS highlighted in blue were detected in the process water. Values in bold were PFAS detected above MDL in at least one of the OTM-45 fractions. ND means PFAS was not detected at the stack. DLL means that some portions of the sample were above the MDL, while the others were ND.

> Comparison between total PFAS mass emission rate during baseline vs PFAS incineration.

Table 4-3 compares total PFAS mass emission rate at the stack between baseline and PFAS incineration. The OTM-45 results indicated higher total PFAS emissions for the PFAS waste incineration tests compared to baseline tests in Campaign 1. However, given that PFAS were present in the water fed to the quench and wet scrubber downstream of the incineration process, these data are not considered conclusive.

Campaign 1	Average Baseline	Average AFFF	Average Soil	Average AFFF & Soil
Total PFAS mass emission rate at the stack : OTM-45 (lb/hr)	3.97E-06	8.32E-06	7.61E-06	7.97E-06
Ratio PFAS incineration/Baseline		2.1	1.9	2.0

Table 4-3 : Total PFAS mass emission rate at the stack during baselines and PFAS incineration. Average baselines refers to the average total stack emission rate of PFAS observed during the 2 baselines in Campaign 1. Average AFFF (resp. Soil) refers to the average total stack emission rate of PFAS observed during the 3 runs of AFFF (resp. soil) in Campaign 1.

Figure 4-1 and 4-2 shows the PFAS signature at the stack (4-1) and in the 3 different AFFF feed streams (4-2). While the 3 incinerated AFFF samples have different PFAS composition (especially AFFF3 vs AFFF1 and AFFF2), the PFAS signature at the stack does not significantly vary to reflect AFFF signature. The same 13 PFCAs were detected in the process water and in the baseline. By comparison, the AFFFs are rich in PFHxS, 6:2 FTS, PFOS. The same result was observed for the contaminated soil. This suggests that AFFF and contaminated soil incineration produce similar PFAS emissions at the stack.

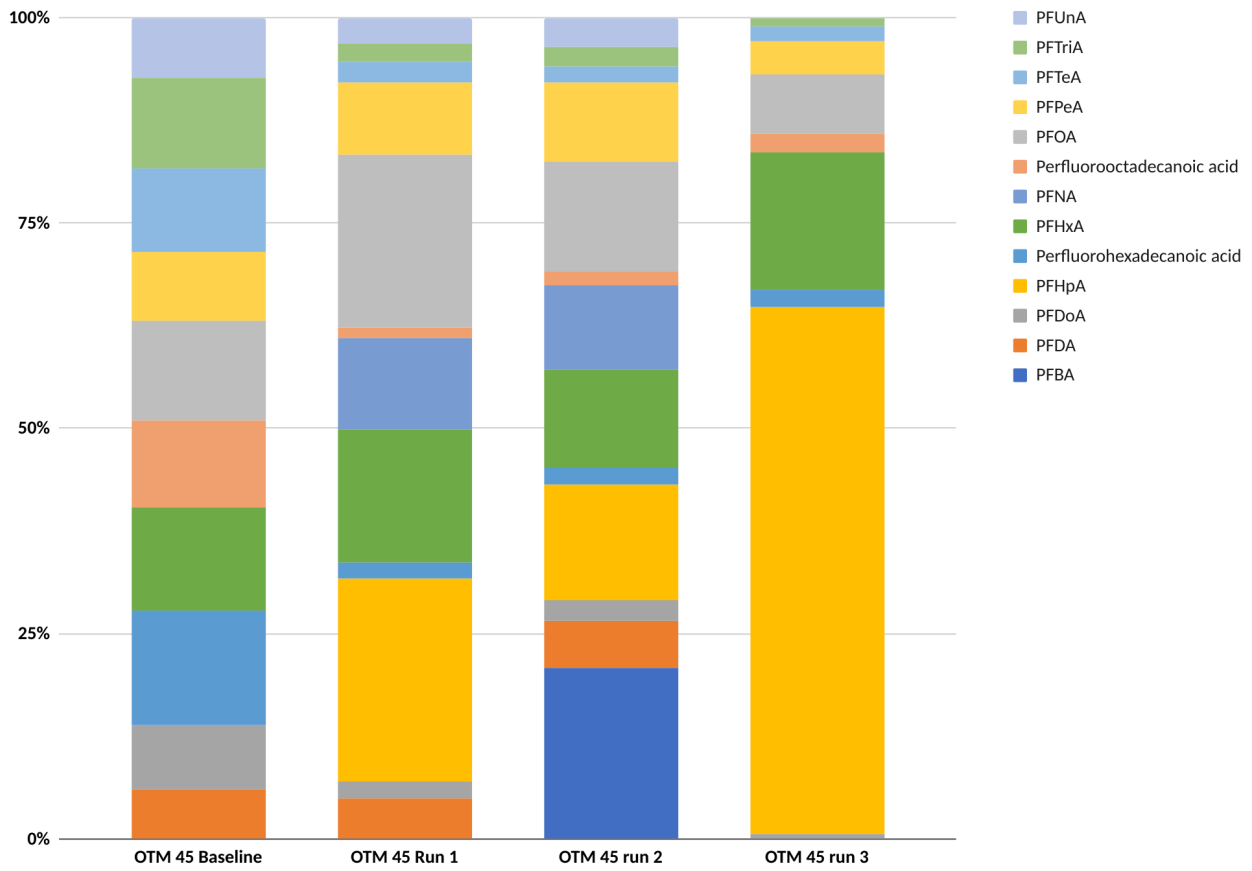


Figure 4-1 : PFAS signature at the stack (OTM-45) during AFFF incineration and baseline

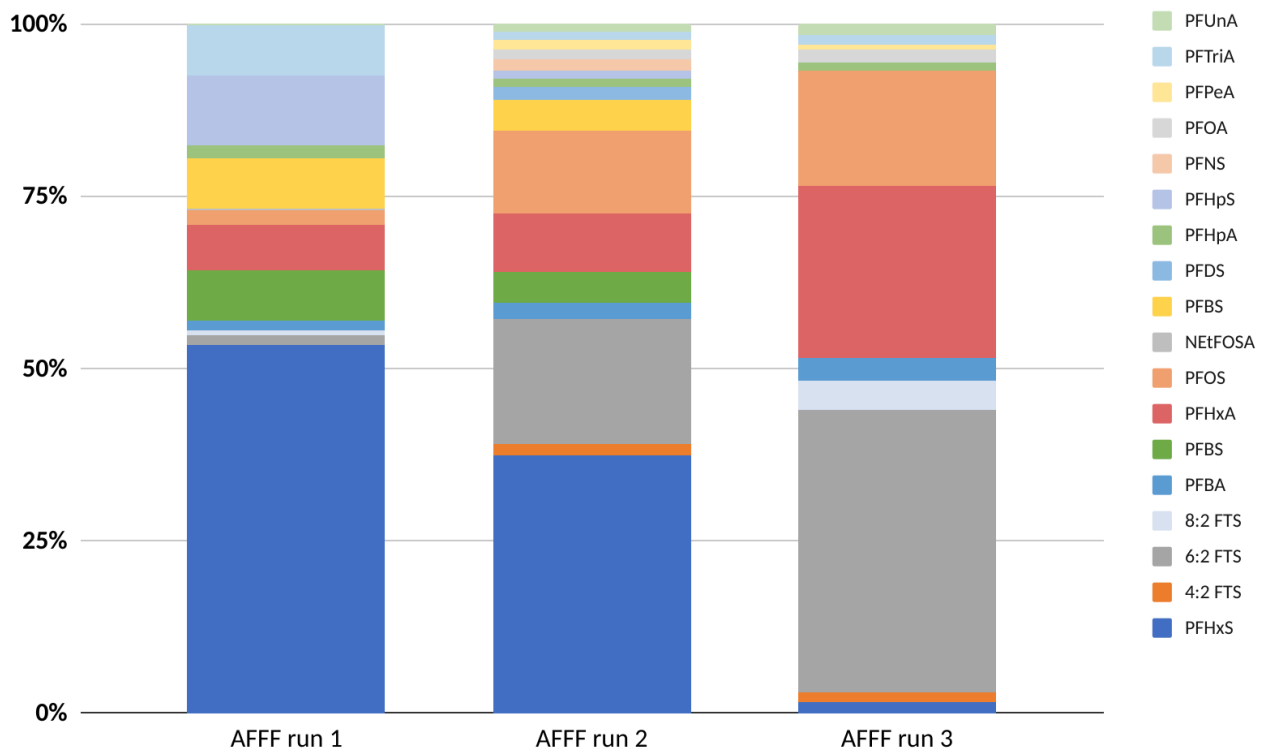


Figure 4-2 : PFAS signature in the AFFF

7.1.3.2. Destruction and Removal Efficiency

The DRE was computed for each run, as it is a parameter of interest to assess the performance of thermal treatment of PFAS according to the 2024 EPA interim guidance on destruction and disposal of PFAS material. When a PFAS is not detected at the stack, the MDL was used. When a PFAS is detected between the MDL and LoQ, the LoQ is used. This approach underestimates DRE.

DRE for the 6 runs of campaign 1 are provided in **Appendix XI (AFFF)** and **XII (contaminated soil)**. Table 5 gives an overview of the DRE obtained in AFFF run#1 for the 20 most concentrated PFAS. PFAS in blue were not detected at the stack, while PFAS in yellow were detected below the LoQ.

Of the 20 most concentrated PFAS in the waste, 14 were either undetected at the stack or below the LoQ. The 6 PFAS detected above the MDL at the stack include 4 coming from process water (PFHxA, PFOA, PFPeA, PFHpA). In conclusion, only 2 PFAS were detected at the stack above LoQ while present in the waste and not coming from process water (PFDA, PFDoA).

	AFFF TF Feed Stream	R1 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
Feed Rate	2,421		
Target Compounds	lb/hr	lb/hr	%
Perfluorohexanesulfonic acid (PFHxS)	0.179	0.000000027	> 99.9999
Perfluorooctanesulfonic acid (PFOS)	0.0436	0.000000038	> 99.9999
Perfluorobutanesulfonic acid (PFBS)	0.0245	0.000000075	> 99.9997
Perfluoroheptanesulfonic acid (PFHpS)	0.0232	0.000000027	> 99.9999
Perfluoropentanesulfonic acid (PFPeS)	0.0226	0.000000024	> 99.9999

Perfluorohexanoic acid (PFHxA)	0.0223	0.000000605	99.9973
Perfluorooctanoic acid (PFOA)	0.01790	0.00000078	99.9956
Perfluoropentanoic acid (PFPeA)	0.00593	0.00000033	99.9945
Perfluoroheptanoic acid (PFHpA)	0.00583	0.000000912	99.9844
Perfluorobutanoic acid (PFBA)	0.00443	0.00000087	> 99.9804
6:2 FTS	0.00426	0.00000080	> 99.9812
8:2 FTS	0.00197	0.000000026	> 99.9987
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.000455	0.000000037	> 99.9919
Perfluorononanesulfonic acid (PFNS)	0.000327	0.000000019	> 99.9942
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.000259	0.0000016	> 99.3822
Perfluorooctanesulfonamide (FOSA)	0.000223	0.000000024	> 99.9892
Perfluorodecanoic acid (PFDA)	0.000178	0.000000183	99.8972
Perfluorodecanesulfonic acid (PFDS)	0.000164	0.000000025	> 99.9848
Perfluorododecanesulfonic acid (PFDoS)	0.000087	0.000000022	> 99.9746
Perfluorododecanoic acid (PFDoA)	0.0000675	0.000000081	99.8807

Table 5 - DRE obtained for the 20 most concentrated PFAS in AFFF run #1. PFAS in blue were not detected at the stack, while PFAS in yellow were detected below the LoQ.

Figure 5 shows how the DRE increases with the PFAS feed rate in the kiln. This is, in part, an effect of the conservative approach to quantify PFAS not detected at the stack (considered as present at MDL). But the same correlation is observed for PFAS detected at the stack. There seems to be a residual level of PFAS detected at the stack, independent of the PFAS concentration in the waste. As an effect, DRE increases with the PFAS concentration in the waste. For the same feed rate, PFASs seem to have a higher DRE than PFCAs. This may be explained by the background presence of PFCAs in the process water.

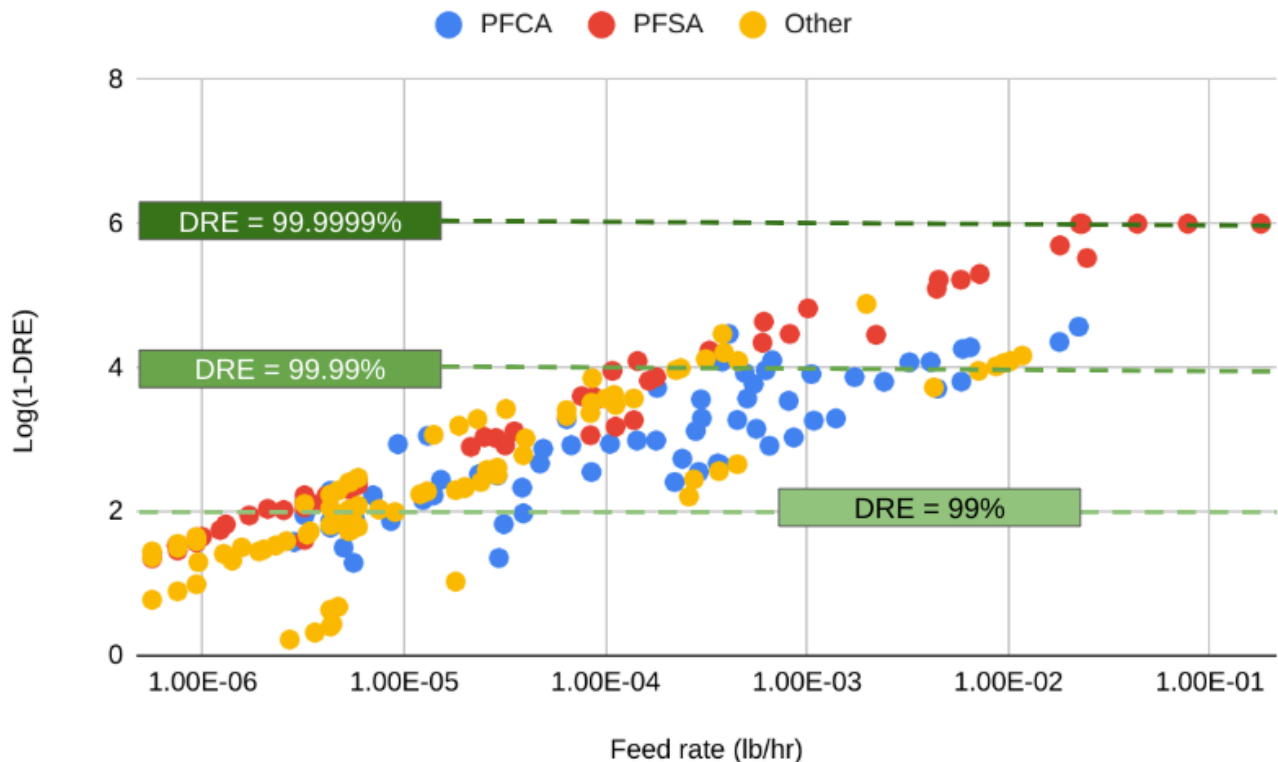


Figure 5 - Relation between DRE and feed rate. Log scale used for feed rate in the x-axis.

DRE > 99.9999% was obtained for the 4 of the 5 most concentrated PFAS : PFOS, PFHxS, PFPeS and PFHpS. For the 3 PFAS classified as Persistent Organic Pollutant (POP) according to Stockholm convention (PFOS,PFOA,PFHxS), the DRE was above 99.99% and even above 99.9999% for 2 of them (PFOS, PFHxS). PFOS and PFOA are also listed as hazardous substances under CERCLA.

Because of the stack gas contamination from process water, the DRE are artificially lower than they should be for the following PFAS: PFHxA, PFPeA, PFHpA, PFOA, HFPO-DA, PFHxS, PFOS, PFBA, and PFBS. **Table 6** shows the total DRE for OTM 45³ obtained during campaign 1 for each run.

	A3F #1	A3F #2	A3F #3	Soil#1	Soil#2	Soil #3
PFAS feedrate (lb/hr)	0.3575	0.1236	0.0187	0.0265	0.0215	0.0161
Total DRE from OTM 45 train	99.9974%	99.9937%	99.9584%	99.9741%	99.9540%	99.9613%

Table 6 - Total DRE for the 6 runs of campaign 1

7.1.3.3. Products of Incomplete Destruction (OTM-50)

OTM-50 is a sampling method to trap and detect 30 PICs, that is to say, volatile short-chain PFAS potentially formed during AFFF or contaminated soil incineration. OTM-50 results were negative for all runs, showing that either no PICs were formed during the incineration process, or they were present at levels below the MDL. OTM-50 measurements for campaign 1 are presented in **Appendix XII**.

7.1.4. Total Destruction Efficiency

The Total Destruction Efficiency was computed for each run, as described in section 4.2. When a PFAS was not detected in the liquid, solid residue or at the stack, the MDL is used. When a PFAS was detected below the LoQ, the LoQ was used.

The total DE for the A3F and contaminated soil runs were very low or even negative (ranging from negative to 74%). This is due to the high MDL for OTM-50 (0.01 lb/hr to 0.1 lb/hr). The PFAS concentration in the waste was sometimes lower than the MDL for OTM-50. This demonstrates the need to improve detection levels for OTM-50 to align them with EPA Methods 537 and 1633.

The comparison between PFAS mass emission rate in the process water (PFAS entering the incinerator) vs PFAS mass emission rate in the blowdown (PFAS exiting the incinerator) shows that there is a transmission of PFAS from the process water to the stack gas. PFAS mass emission rate in the process water is higher than in the blowdown.

7.1.5 HF Measurements

HF measurements are available in **Appendix XIV** for campaign 1. HWC MACT standards for existing hazardous waste incinerators from §63.1219 applicable to the incinerator at Veolia’s Port Arthur facility require HF at the stack to be below 32 ppmv, dry, at 7% O₂. HF remained below the regulatory limit during campaign 1 testing.

7.1.6. Non Targeted Screening

Veolia has developed its own methodology to perform Non Targeted Screening (NTS) analysis on some of the pre-test samples. The objective of this innovative methodology is to detect PFAS that are not targeted in OTM-45 and OTM-50. It was developed by a Veolia R&D team based in France.

³

Veolia has looked for non-targeted PFAS in the AFFF used in run#1, and in the OTM-45 fractions of run #1 and the related baseline run.

Prior to non-targeted screening, sample preparation must be as non-selective as possible. The analysis was performed on AFFF after dilution and on OTM-45 fractions, which allows the extraction of a wide range of PFAS.

The non-targeted screening approach uses Liquid Chromatography coupled to High-Resolution Mass Spectrometry (LC/HRMS) as the analytical technique. It was performed on an Exploris 120 system (Thermo Scientific).

For the detection part, two acquisition methods are used to maximize the amount of recorded information and enable efficient data processing:

- Fullscan ESI+/ESI- R 60,000 for peak detection
- Fullscan ESI+/ESI- + DDA-MS2 (Data-dependent analysis) for identification.

All samples are analyzed in triplicates with both methods. Data processing is the most complex part of non-targeted screening analyses. A complete workflow in three main campaigns was developed using Compound Discoverer software (Thermo Scientific):

- Pre-processing for peak detection
- Signal prioritization to isolate data corresponding to potential PFAS compounds
 - Number of Fluorine in proposed molecular formulas
 - KMD (Kendrick Mass Defect) to identify homologue series
 - PFAS-specific fragments
- Annotation or identification of prioritized signals
 - Use of spectral libraries
 - In-silico fragmentation
 - Comparison with literature data

NTS results on the AFFF used in run #1

To test the reliability of the NTS method developed by Veolia, results from NTS (performed by Veolia) were compared with targeted analysis (performed by Eurofins) for the AFFF. If the NTS method is valid, it should detect all the targeted compounds detected by Eurofins.

It appears that most of the compounds detected in targeted analysis are also detected in NTS. 6 out of 32 detected in the targeted analysis were not detected in the NTS. One PFAS listed in the targeted analysis was not detected by Eurofins but by the NTS.

Analyte	Targeted Analysis	NTS Analysis	Suspect Analysis	Analyte	Targeted Analysis	NTS Analysis	Suspect Analysis
Perfluorohexanesulfonic acid (PFHxS)				Perfluorononanoic acid (PFNA)			
Perfluorooctanesulfonic acid (PFOS)				N-ethylperfluorooctane sulfonamide (NETFOSA)			
Perfluoropentanesulfonic acid (PFPeS)				1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)			
Perfluoroheptanesulfonic acid (PFHpS)				Perfluorotetradecanoic acid (PFTeDA)			
Perfluorohexanoic acid (PFHxA)				N-methylperfluorooctane sulfonamide (NMeFOSA)			
Perfluorooctanoic acid (PFOA)				Perfluoro-4-methoxybutanoic acid (PFMBA)			
Perfluoropentanoic acid (PFPeA)				3-Perfluoropentylpropanoic acid (5:3 FTCA)			
Perfluoroheptanoic acid (PFHpA)				Perfluoro-3-methoxypropanoic acid (PFMePA)			
Perfluorobutanoic acid (PFBA)				Perfluorotridecanoic acid (PFTrDA)			
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)				Perfluoroundecanoic acid (PFUnA)			
Perfluorobutanesulfonic acid (PFBS)				Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)			
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)				N-ethylperfluorooctanesulfonamidoacetic acid (NETFOSAA)			
N-ethylperfluorooctane sulfonamidoethanol (NETFOSE)				N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)			
Perfluorononanesulfonic acid (PFNS)				Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)			
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)				4,8-Dioxa-3H-perfluorononanoic acid (DONA)			
Perfluorooctanesulfonamide (PFOSAm)				Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)			
Perfluorodecanoic acid (PFDA)				9-Chlorohexadecafluoro-3-oxanonan-1-sulfonic acid (9Cl-PF3ONS)			
Perfluorodecanesulfonic acid (PFDS)				11-Chloroeicosafluoro-3-oxaundecan-1-sulfonic acid (11Cl-PF3OUdS)			
Perfluorododecanesulfonic acid (PFDoS)				3-Perfluoropropylpropanoic acid (3:3 FTCA)			
Perfluorododecanoic acid (PFDoA)							

Table 7 - comparing PFAS detected in the targeted analysis (Eurofins) vs NTS (Veolia)

In total, 321 compounds suspected to be PFAS were detected in the AFFF, many more than the 32 detected in the targeted analysis. Among the 20 compounds with the highest intensities in the NTS, only 5 are in the targeted analysis. However, for the LC/HRMS used for NTS, the intensity can be different for compounds at the same concentration, as it is not fully proportional to concentration.

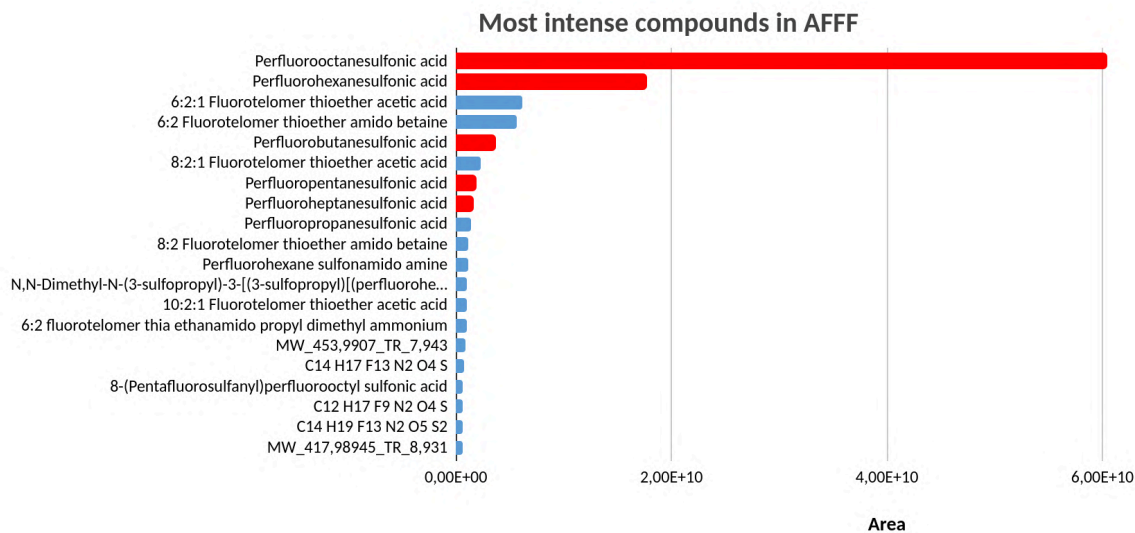


Figure 6 - Results of NTS for AFFF. The compounds with the highest intensity according to NTS. In red, compounds were also detected in the targeted analysis.

NTS results on OTM-45 fractions (air emissions)

PFAS detected in OTM-45 fractions from AFFF incineration were compared to PFAS detected in OTM-45 fractions from the baseline run. Only 8 PFAS compounds were detected in the OTM-45 fractions from AFFF incineration exclusive of being detected in the baseline. All these compounds had very low responses, indicating low concentration. None of the most intense compounds detected in the AFFF were detected in the OTM-45 fractions.

	Fraction 1		Fraction 2		Fraction 3		Fraction 4		Presence in AFFF solution
	Specific to Run with AFFF	Common to Run with and without AFFF	Specific to Run with AFFF	Common to Run with and without AFFF	Specific to Run with AFFF	Common to Run with and without AFFF	Specific to Run with AFFF	Common to Run with and without AFFF	
(Perfluoroheptyl)(sulfonlamino)acetic acid									No
Bisphenol AF									No
MW_1379.81621@RT_11.861									No
MW_165.95489@RT_0.661									Yes
MW_197.99153@RT_4.872									Yes
MW_394.98705@RT_9.191									No
MW_443.93372@RT_7.576	3*								No
MW_453.99070@RT_7.943									Yes
MW_507.96432@RT_8.292									No
MW_517.98348@RT_9.606									Yes
MW_670.96845@RT_10.031									No
MW_724.43756@RT_10.777									No
Perfluorobutanesulfonic acid									Yes
Perfluorobutanoic acid									Yes
Perfluorodecanoic acid			4*						Yes
Perfluorododecanoic acid									Yes
Perfluoroheptanoic acid									Yes
Perfluorohexanoic acid									Yes
Perfluorononanoic acid									Yes
Perfluorooctanoic acid									Yes
Perfluoropentanoic acid									Yes
Perfluoroundecanoic acid			3*						Yes

Table 8 - Results of NTS for OTM 45 fractions from AFFF incineration and from the baseline. MW means “molecular weight” : in that case, a PFAS is identified but its formula is unknown.

Conclusions

NTS shows that more PFAS were present in the AFFF than the 32 PFAS detected in the targeted analysis. Results show that these non-targeted PFAS were not detected in OTM-45 fractions, which suggests they were destroyed during the incineration process, as observed for targeted PFAS. It must be noted, however, as the OTM-45 sampling and sample preparation used for the NTS are selective to semi-volatile PFAS (boiling point > 212°F), it is possible that some PFAS are emitted in the air but not trapped in OTM-45.

7.2. Campaign 2 : Incineration of A3F, contaminated soil, CF4 and spent carbon

Campaign 2 summary :

Campaign 2 confirms campaign 1 results.

In a majority of runs (11 out of 15), no PICs were detected via OTM-50. CF4 was detected in three runs : during the CF4 run, a baseline run and an AFFF incineration run. In these 2 latter runs, the CF4 level is close to the MDL. The source of the CF4 in the latter two tests is unclear. It is unlikely to form as a PIC due to the high H/F ratio in the SCC during these tests. The incineration test where CF4 was fed into the SCC indicated a DRE of less than 50%, consistent with predictions that temperatures above 2,550 F are necessary to destroy this compound. Another OTM-50 PFAS was detected during a baseline at a level close to MDL. It is unlikely to be a PIC due to its low thermal stability (polyfluoroether) and is more likely a contaminant from the analytical laboratory.

DRE > 99.999% is reached for PFOS in 3 runs. The waste streams incinerated in this campaign are less concentrated in PFAS than during campaign 1 which explains why the 99.999% could not be reached.

Solid residues are PFAS-free, or contain PFAS at levels close to MDL.

Liquid residues contain PFAS at low level (ppt), reflecting the background presence of PFAS on the pond water supplying the process water of the incinerator.

Contrary to campaign 1, a contamination issue is suspected in the OTM-45 results: 4 runs contained background >C10 PFAS detected in OTM-45 fractions, whose source is still under investigation.

7.2.1. Waste Analysis

Four waste streams were injected separately: A3F, spent carbon, AFFF-contaminated soil and CF4. Waste profiles are available in **Appendix XV for AFFF, spent carbon and AFFF-contaminated soil**.

Run 2 and 3 of A3F were performed with the same A3F but under different conditions. In run 3, lime was injected at 2 gpm, simultaneously with A3F injection, to study its ability to enhance PFAS destruction.

7.2.2. Solid and Liquid Residues

In the solid residues, no PFAS was detected in significant quantities. All slag and filtercake samples were PFAS-free. PFAS were detected in four samples of ashes, with detection level close to MDL. Detailed results of these 4 samples are available in **Appendix XVII. Table 10** gives a summary of the results for PFAS in solid residues.

	Baseline	Run 1	Baseline 2	Run 2	Run 3 ⁴
A3F	ashes : PFAS detected close to MDL filtercake : ND slag : ND	ashes : ND slag : ND Filter cake : ND	ashes : PFAS detected close to MDL filtercake : ND slag : ND	ashes : PFAS detected close to MDL filtercake : ND slag : ND	ashes : ND slag : ND Filter cake : ND
Carbon	ashes : ND slag : ND Filter cake : ND	ashes : ND slag : ND Filter cake : ND	N/A	ashes : ND slag : ND Filter cake : ND	N/A
CF4	Ashes : ND Filter cake : ND Slag : ND	Ashes : ND Filter cake : ND Slag : ND	N/A	N/A	N/A
Contaminated soil	ashes : PFAS detected close to MDL filtercake : ND slag : ND	Ashes : ND Filter cake : ND Slag : ND	Ashes : ND Filter cake : ND Slag : ND	Ashes : ND Filter cake : ND Slag : ND	Ashes : ND Filter cake : ND Slag : ND

Table 9 - PFAS analysis in solid residues of the campaign 2

For the liquid residues, 20 blowdown samples were collected. 16 had the same signature and PFAS concentration as observed in the campaign 1, while 4 of them had PFAS levels above 200 ppt (A3F

⁴ In run#3 A3F, lime is injected simultaneously to A3F injection

baseline #1, A3F run#2, A3F run3+24hr, carbon run#2+24 hr). Three of these samples were collected at a time when no PFAS were being incinerated. It is unclear whether these results come from laboratory background or from PFAS in the blowdown water that is transferred from the stack gas. The profile of these 4 atypical samples is available in **Figure 7**.

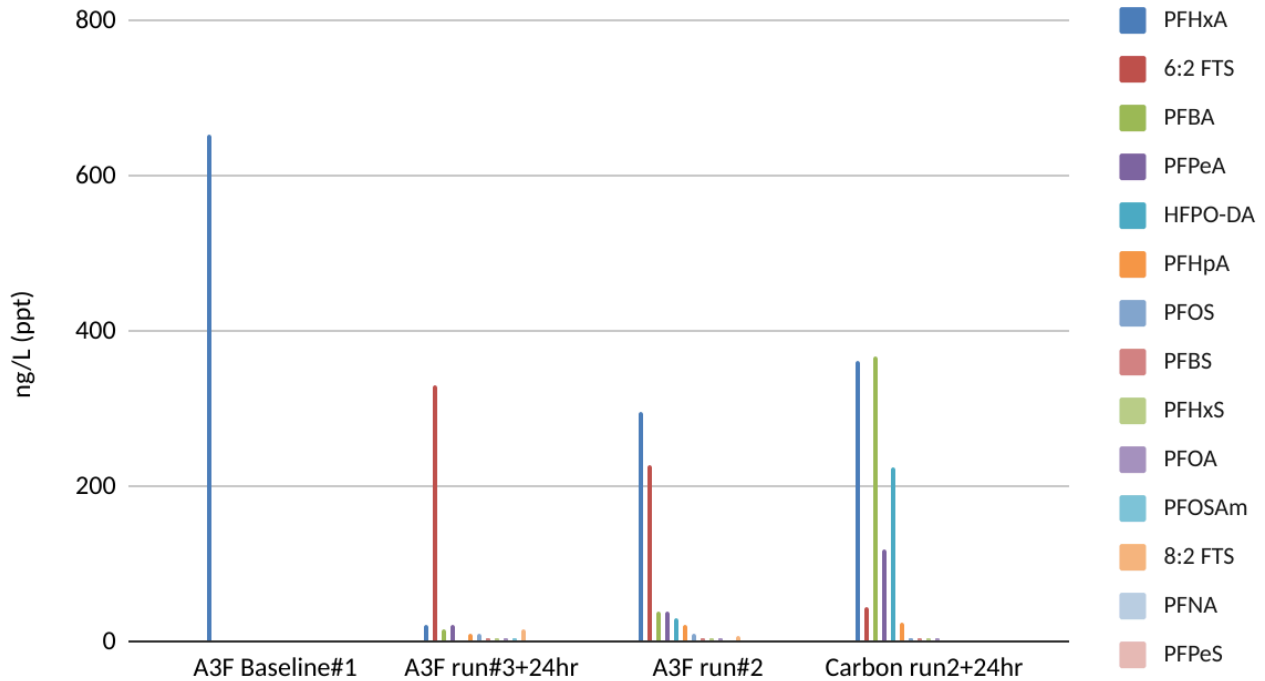


Figure 7 - Profile of the atypical samples of blowdowns obtained in campaign 2

In the 16 other blowdown samples, the same results as in campaign 1 were obtained. Because of background PFAS presence in the pond water, a dozen PFAS were detected at ppt level, both in the baseline sampled at the beginning of the campaign (before PFAS incineration), and in the samples collected during PFAS incineration. PFAS are twice to four times more concentrated in the blowdowns than in the pond water because of evaporation. Results for the typical blowdown samples are shown in **Figure 8**.

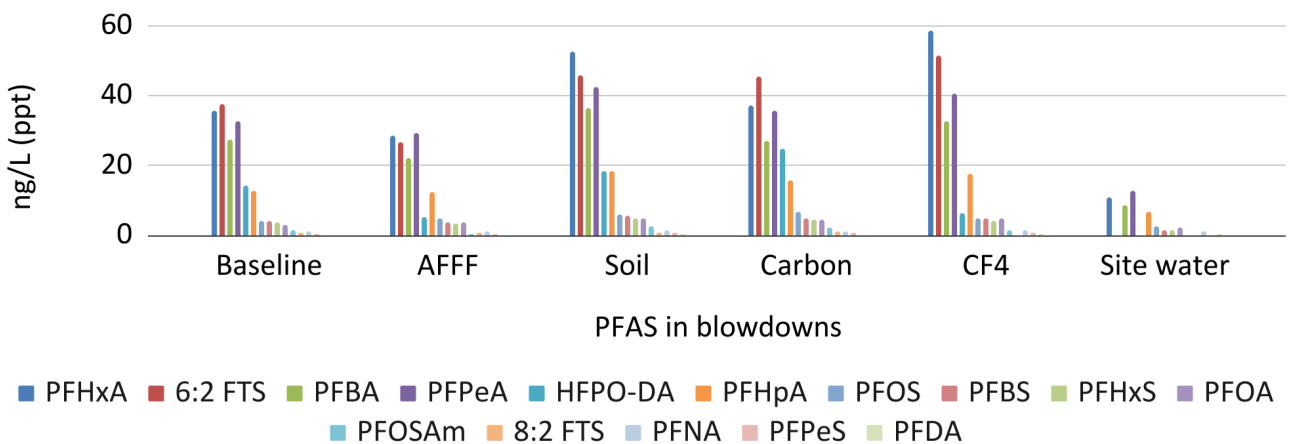


Figure 8 - PFAS signature in the blowdown (left) vs process water (on the right side of the graph)

Table 10 shows the results for process water collected in campaign 1 and 2. PFAS concentration in process water is similar in campaign 1 and 2, which means that the PFAS concentrations in the pond water are stable. The only differences are :

- the detection of PFDA in campaign 2 at very low level (<1 ppt), undetected in campaign 1
- the detection of HFPO-DA in campaign 1 at very low level (<3 ppt) undetected in campaign 2

PFAS	Concentration process water campaign 1 (ng/L)	Concentration process water campaign 2 (ng/L)	Concentration in blowdown baseline campaign 2 (ng/L)
PFHxA	14.90	11.1	35.73
PFBA	11.20	8.57	27.50
PFPeA	16.10	12.9	32.61
PFHpA	8.41	6.81	12.80
PFOS	2.48	2.57	4.10
PFBS	1.81	1.36	4.14
PFHxS	1.49	1.53	3.78
PFOA	2.88	2.11	2.89
PFNA	1.26	1.21	1.02
PFDA	ND (0.293)	0.344	ND (0.292)
HFPO-DA	2.02	ND (1.56)	14.14
6:2 FTS	ND (1.07)	ND (1.07)	37.59
PFOSAm	ND (0.293)	ND (0.293)	1.56
8:2 FTS	ND (0.586)	ND (0.586)	0.86
PFPeS	ND (0.293)	ND (0.293)	0.57

Table 10 - PFAS concentration in process water in campaign 1 and 2 and in the blowdown baseline in campaign 2. All PFAS listed in EPA 1633 were tested but only the ones detected are shown. Concentration in the blowdown baseline in campaign 2 is an average of all the baselines collected, excluding the 1st baseline collected during AFFF incineration which is considered not representative.

In campaign 2, the only differences between the PFAS signature in the process water and blowdown is the presence of:

- **6:2 FTS** in the blowdown - could be a PIC from previous PFAS incineration or from the PFAS campaign.
- **HFPO-DA** - was detected in every blowdown sample, and was also detected in the process water during campaign 1 but not campaign 2. It is likely that this was a false negative and HFPO-DA was also in the process water during the campaign 2 at very low level, maybe non detectable. Evaporation during the process makes it detectable in the blowdown.
- **8:2 FTS, PFOSAm and PFPeS** were found in low quantities (1 ppt or less, very close to MDL) in some blowdowns but not the process water. It is possible that they were also present in the process water below MDL, or that there was a false positive in the blowdowns samples.

Detailed results for PFAS concentration in liquid residues for Campaign 2 are available in **Appendix XVI**.

7.2.3. Air Emissions

7.2.3.1. PFAS Mass Emission Rate at Stack (OTM-45)

The following OTM-45 samples were collected during the campaign 2, with 2 patterns emerging :

- **Pattern 1** : PFAS concentration & signature at stack is similar to campaign 1. PFAS < C10 were found at stack at < 2 10⁻⁵ lb/hr in total. PFAS signature at the stack reflects the PFAS signature in process water.
- **Pattern 2** : High concentration at stack for C>10 PFAS: PFDA, PFUnA, PFDoA, PFTriA, PFTeA. Total PFAS emissions < 9.5 10⁻⁵ lb/hr)

Runs	Comment on OTM-45 results
A3F Baseline#1	Pattern 1
A3F run#1	Pattern 2
A3F run #2	Pattern 1
A3F Baseline #2	Pattern 1
A3F run#3 (lime)	Pattern 1
Soil Baseline #1	Pattern 1
Soil run #1	Pattern 2
Carbon baseline #1	Pattern 1
Carbon run #1	Pattern 2
Carbon run #2	Pattern 1
CF4 baseline	Pattern 1
CF4 run#1	Pattern 1
Soil baseline #2	Pattern 1
Soil run#2	Pattern 1
Soil run #3	Pattern 2

Table 11 -Repartition of each run to pattern 1 and 2

Table 12 shows the PFAS stack emissions (OTM-45) for the different baselines performed prior to each incineration test. Two baselines were performed for AFFF because there were 2 conditions (with and without lime). Two baselines were performed for contaminated soil because run#2 and run#3 were performed 5 days after run#1 because of equipment damage.

The 6 baseline runs were similar in terms of PFAS signature and PFAS stack emissions. Compared to the baseline tests in campaign 1, there are the same dominant PFAS, with the additional presence of FOSA, NEtFOSE, NMeFOSA, 6:2 FTS and 6:2 FTUCA at very low levels close to MDL.

PFAS	Baseline before AFFF #1	Baseline before AFFF #2	Baseline before Soil #1	Baseline before Soil #2	Baseline before Carbon	Baseline before CF4
PFBS	0.000000601	0.000000482	0.000000463	0.000000497	0.00000049	0.000000585
PFBA	0.0000007150	0.0000007620	0.000000573	0.000000821	0.000000521	0.000000400
PFDS	ND (0.000000018)	0.0000003860	ND (0.000000018)	ND (0.000000018)	ND (0.000000018)	ND (0.000000018)
PFDA	0.0000001480	0.0000002500	0.000000324	0.000000995	0.000000515	0.000000118
PFDoS	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)
PFDoA	0.0000000787	0.0000001280	0.000000171	0.000000446	0.000000252	0.0000000628
PFHpS	ND (0.000000023)	ND (0.000000023)	ND (0.000000023)	ND (0.000000023)	ND (0.000000023)	ND (0.000000023)
PFHpA	0.0000005390	0.0000006590	0.000000692	0.00000164	0.000000890	0.000000382
Perfluorohexadecanoic acid	0.0000000283	0.0000000542	0.0000000710	0.000000206	0.000000133	0.0000000267
PFHxS	0.0000000168	0.0000000123	0.0000000162	0.0000000115	0.000000011	<0.000000019 DLL
PFHxA	0.0000005770	0.0000006340	0.000000556	0.00000108	0.000000585	0.000000379
PFNS	ND (0.000000017)	ND (0.000000017)	ND (0.000000017)	ND (0.000000017)	ND (0.000000017)	ND (0.000000018)
PFNA	0.0000002720	0.0000004280	0.000000526	0.00000160	0.000000800	0.000000220
Perfluorooctadecanoic acid	<0.000000034 DLL	0.0000000154	0.0000000263	0.0000000656	0.000000031	ND (0.000000029)
FOSA	<0.000000077 DLL	<0.000000079 DLL	<0.000000077 DLL	<0.000000075 DLL	<0.000000079 DLL	<0.000000078 DLL
PFOS	0.0000000971	0.0000000480	0.0000000646	<0.000000049 DLL	<0.000000046 DLL	0.0000000213
PFOA	0.0000006080	0.0000006770	0.000000704	0.00000170	0.000000899	0.000000319
PFPeS	ND (0.000000013)	ND (0.000000013)	ND (0.000000013)	ND (0.000000013)	ND (0.000000013)	ND (0.000000013)
PFPeA	0.0000004290	0.0000004630	0.000000385	0.000000717	0.000000422	0.000000193
PFTeA	0.0000000783	0.0000001260	0.000000135	0.000000348	0.000000216	0.0000000590
PFTriA	0.0000000652	0.0000001180	0.000000152	0.000000445	0.000000238	0.0000000506
PFUnA	0.0000000922	0.0000001530	0.000000189	0.000000667	0.000000352	0.0000000706
9-chloro.	ND (0.000000017)	ND (0.000000017)	ND (0.000000017)	ND (0.000000017)	ND (0.000000017)	ND (0.000000017)
NEtFOSA	ND (0.000000039)	ND (0.000000039)	ND (0.000000040)	ND (0.000000040)	ND (0.000000039)	<0.000000041 DLL
NEtFOSAA	ND (0.000000025)	ND (0.000000025)	ND (0.000000025)	ND (0.000000025)	ND (0.000000025)	ND (0.000000025)
NMeFOSAA	ND (0.000000027)	ND (0.000000027)	ND (0.000000028)	ND (0.000000028)	ND (0.000000027)	ND (0.000000028)
11-chloro.	ND (0.000000023)	ND (0.000000023)	ND (0.000000023)	ND (0.000000023)	ND (0.000000023)	ND (0.000000023)
NEtFOSE	ND (0.000000039)	ND (0.000000038)	ND (0.000000039)	ND (0.000000039)	ND (0.000000039)	0.0000000193
NMeFOSE	ND (0.000000021)	<0.00000022 DLL	<0.00000022 DLL	<0.00000022 DLL	ND (0.00000022)	<0.00000024 DLL
PES	ND (0.000000020)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)	ND (0.000000020)	ND (0.000000020)
PFECA	<0.000000030 DLL	<0.000000031 DLL	<0.000000033 DLL	0.0000000206	<0.000000030 DLL	ND (0.000000027)
PFECA	ND (0.000000030)	ND (0.000000030)	ND (0.000000030)	ND (0.000000030)	ND (0.000000030)	ND (0.000000030)
PFECA	ND (0.000000058)	ND (0.000000058)	ND (0.000000058)	<0.000000065 DLL	ND (0.000000058)	ND (0.000000059)
PFECHS	ND (0.000000026)	ND (0.000000026)	ND (0.000000027)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)
DONA	ND (0.000000031)	ND (0.000000031)	ND (0.000000032)	ND (0.000000031)	ND (0.000000031)	ND (0.000000031)
HFPO-DA	ND (0.000000037)	ND (0.000000037)	ND (0.000000037)	ND (0.000000037)	ND (0.000000037)	ND (0.000000038)
NMeFOSA	0.0000004070	0.0000001190	0.0000000942	0.0000000427	0.000000048	0.0000000755
10:2 FTCA	ND (0.000000011)	ND (0.000000011)	ND (0.000000011)	ND (0.000000011)	ND (0.000000011)	ND (0.000000011)
10:2 FTS	ND (0.000000036)	ND (0.000000036)	ND (0.000000037)	ND (0.000000037)	ND (0.000000037)	ND (0.000000037)
3:3 FTCA	ND (0.000000046)	ND (0.000000046)	ND (0.000000047)	ND (0.000000047)	ND (0.000000046)	ND (0.000000047)
4:2 FTS	ND (0.000000014)	ND (0.000000014)	ND (0.000000015)	ND (0.000000015)	ND (0.000000014)	ND (0.000000015)
5:3 FTCA	ND (0.000000063)	ND (0.000000064)	ND (0.000000064)	ND (0.000000064)	ND (0.000000063)	ND (0.000000064)
6:2 FTCA	ND (0.000000091)	ND (0.000000091)	ND (0.000000092)	ND (0.000000092)	ND (0.000000091)	ND (0.000000092)
6:2 FTS	<0.00000024 DLL	<0.00000023 DLL	<0.00000030 DLL	<0.00000024 DLL	0.000000148	0.000000973
6:2 FTUCA	<0.000000025 DLL	ND (0.000000019)	<0.000000021 DLL	ND (0.000000019)	ND (0.000000019)	<0.000000024 DLL
7:3 FTCA	ND (0.000000054)	ND (0.000000055)	ND (0.000000055)	ND (0.000000055)	ND (0.000000055)	ND (0.000000055)
8:2 FTCA	ND (0.000000079)	ND (0.000000079)	ND (0.000000080)	ND (0.000000080)	ND (0.000000079)	ND (0.000000080)
8:2 FTS	ND (0.000000024)	ND (0.000000024)	ND (0.000000025)	ND (0.000000025)	ND (0.000000024)	ND (0.000000024)
8:2 FTUCA	ND (0.000000031)	ND (0.000000032)	ND (0.000000032)	ND (0.000000032)	ND (0.000000031)	ND (0.000000032)
Total PFAS (lb/hr)	6.18E-06	7.00E-06	6.74E-06	1.28E-05	7.86E-06	5.18E-06

Table 12 - PFAS emissions at the stack (OTM-45) during baselines. *PFAS highlighted in blue were detected in the process water. Values in bold when PFAS was detected above MDL in at least one of the OTM-45 fractions.*

Tables 13-1 to 13-4 presents PFAS mass emission rate at stack based on OTM-45 for the four different PFAS-containing wastes: AFFF, contaminated soil, carbon, and CF4.

PFAS	Run 1		Run 2		Run 3	
	Waste feed rate (lb/hr)	Stack emission (lb/hr)	Waste feed rate (lb/hr)	Stack emission (lb/hr)	Waste feed rate (lb/hr)	Stack emission (lb/hr)
PFBS	0.0000612000	0.0000001190	0.0001220000	0.0000000745	0.0001270000	0.0000000606
PFBA	0.0000725000	0.0000004360	0.0004010000	0.0000009040	0.0004160000	0.0000004470
PFDS	ND (0.0000052)	ND (0.000000018)	ND (0.0000057)	ND (0.000000018)	ND (0.0000059)	ND (0.000000019)
PFDA	0.0000125000	0.0000005170	0.0001120000	0.0000004880	0.0001160000	0.0000001220
PFDoS	ND (0.0000052)	ND (0.000000025)	ND (0.0000057)	ND (0.000000025)	ND (0.0000059)	ND (0.000000027)
PFDoA	0.0000053700	0.0000017200	0.0000447000	0.0000001830	0.0000464000	0.0000002420
PFHpS	0.0000143000	ND (0.000000023)	0.0000255000	ND (0.000000023)	0.0000264000	<0.000000026 DLL
PFHpA	0.0000319000	0.0000002250	0.0001100000	0.0000014300	0.0001140000	0.0000002300
Perfluorohexadecanoic acid	--	0.0000019900	--	0.0000000396	--	0.0000001260
PFHxS	0.0005680000	0.0000000097	0.0012800000	0.0000000158	0.0013200000	0.0000000378
PFHxA	0.0007450000	0.0000003300	0.0023200000	0.0000011500	0.0024000000	0.0000002280
PFNS	ND (0.0000052)	ND (0.000000017)	ND (0.0000057)	ND (0.000000017)	ND (0.0000059)	ND (0.000000018)
PFNA	ND (0.0000052)	0.0000003180	0.0000182000	0.0000009920	0.0000189000	0.0000001280
Perfluorooctadecanoic acid	--	0.0000005490	--	<0.000000038 DLL	--	0.0000000595
FOSA	0.0000240000	<0.000000078 DLL	0.0000661000	<0.000000078 DLL	0.0000685000	<0.000000079 DLL
PFOS	0.0030800000	0.0000000478	0.0085300000	0.0000000837	0.0088500000	0.0000005860
PFOA	0.0001200000	0.0000002600	0.0004820000	0.0000013900	0.0004990000	0.0000008870
PFPeS	0.0000775000	ND (0.000000013)	0.0002520000	ND (0.000000013)	0.0002620000	0.0000000074
PFPeA	0.0000505000	0.0000002190	0.0002660000	0.0000007220	0.0002760000	0.0000001700
PFTeA	ND (0.0000052)	0.0000003050	0.0000165000	0.0000001650	0.0000171000	0.0000002750
PFTriA	0.0000059400	0.00000025300	0.0000116000	0.0000001580	0.0000120000	0.0000002800
PFUnA	0.0000099600	0.0000008970	0.0000759000	0.0000002480	0.0000787000	0.0000001610
9-chloro.	ND (0.0000052)	ND (0.000000017)	ND (0.0000057)	ND (0.000000017)	ND (0.0000059)	ND (0.000000017)
NEtFOSA	ND (0.000011)	ND (0.000000039)	ND (0.000011)	ND (0.000000039)	ND (0.000012)	ND (0.000000041)
NEtFOSAA	0.0000073400	ND (0.000000025)	0.0000340000	ND (0.000000025)	0.0000352000	ND (0.000000026)
NMeFOSAA	ND (0.0000063)	ND (0.000000027)	ND (0.0000069)	ND (0.000000027)	ND (0.0000071)	ND (0.000000028)
11-chloro.	ND (0.0000052)	ND (0.000000023)	ND (0.0000057)	ND (0.000000023)	ND (0.0000059)	ND (0.000000024)
NEtFOSE	ND (0.000011)	ND (0.000000038)	0.0000243000	ND (0.000000038)	0.0000252000	ND (0.000000040)
NMeFOSE	ND (0.000011)	ND (0.000000021)	ND (0.000011)	ND (0.000000021)	ND (0.000012)	<0.00000023 DLL
PES	--	ND (0.000000020)	--	ND (0.000000020)	--	ND (0.000000021)
PFECA	--	ND (0.000000027)	--	0.0000000171	--	ND (0.000000029)
PFECA	--	ND (0.000000030)	--	ND (0.000000030)	--	ND (0.000000031)
PFECA	--	ND (0.000000058)	--	ND (0.000000058)	--	ND (0.000000060)
PFECHS	--	ND (0.000000026)	--	ND (0.000000026)	--	ND (0.000000027)
DONA	ND (0.0000052)	ND (0.000000031)	ND (0.0000057)	ND (0.000000031)	ND (0.0000059)	ND (0.000000032)
HFPO-DA	0.0000227000	ND (0.000000037)	0.0000202000	ND (0.000000037)	0.0000210000	ND (0.000000038)
NMeFOSA	ND (0.000011)	0.0000000713	ND (0.000011)	0.0000001140	ND (0.000012)	0.0000001460
10:2 FTCA	--	ND (0.000000011)	--	ND (0.000000011)	--	ND (0.000000011)
10:2 FTS	--	ND (0.000000036)	--	ND (0.000000036)	--	ND (0.000000038)
3:3 FTCA	ND (0.0000031)	ND (0.000000046)	ND (0.0000034)	ND (0.000000046)	ND (0.0000036)	ND (0.000000048)
4:2 FTS	0.0000151000	ND (0.000000014)	0.0000150000	ND (0.000000014)	0.0000156000	ND (0.000000015)
5:3 FTCA	0.0000024500	ND (0.000000063)	0.0001150000	ND (0.000000063)	0.0001190000	ND (0.000000066)
6:2 FTCA	--	ND (0.000000090)	--	ND (0.000000090)	--	ND (0.000000094)
6:2 FTS	0.0050900000	<0.00000022 DLL	0.0061900000	<0.00000023 DLL	0.0064200000	<0.00000021 DLL
6:2 FTUCA	--	<0.000000023 DLL	--	0.0000000128	--	ND (0.000000020)
7:3 FTCA	ND (0.0000031)	ND (0.000000054)	0.0000278000	ND (0.000000054)	0.0000288000	ND (0.000000057)
8:2 FTCA	--	ND (0.000000079)	--	ND (0.000000079)	--	ND (0.000000083)
8:2 FTS	0.0003280000	ND (0.000000024)	0.0016700000	ND (0.000000024)	0.0017300000	ND (0.000000025)
8:2 FTUCA	--	ND (0.000000031)	--	ND (0.000000032)	--	ND (0.000000033)
Total PFAS (lb/hr)	1.04E-02	1.52E-05	2.23E-02	1.01E-05	2.31E-02	6.15E-06

Table 13-1: PFAS emissions at the stack (OTM-45) from AFFF incineration. Run 1 and 2: AFFF incineration. Run 3: AFFF incineration with lime injection. PFAS highlighted in blue were detected in the process water. Values in bold when PFAS was detected above MDL in at least one OTM-45 fractions. DLL means that some portions of the sample were above the MDL, while others were below the detection limit (ND).

PFAS	Run 1		Run 2		Run 3	
	Waste feed rate (lb/hr)	Stack emissions (lb/hr)	Waste feed rate (lb/hr)	Stack emissions (lb/hr)	Waste feed rate (lb/hr)	Stack emissions (lb/hr)
PFBS	ND (0.00016)	<0.00000097 DLL	0.000149	0.000000455	0.000226	<0.00000010 DLL
PFBA	ND (0.00032)	<0.0000010 DLL	0.000459	0.000000792	0.000694	<0.0000010 DLL
PFDS	ND (0.000081)	ND (0.000000035)	0.00000295	ND (0.000000018)	0.00000446	ND (0.000000035)
PFDA	ND (0.000081)	0.00000406	0.0000457	0.00000138	0.0000690	0.00000427
PFDoS	ND (0.000081)	ND (0.000000059)	0.00000103	ND (0.000000025)	0.00000156	ND (0.000000059)
PFDoA	ND (0.000081)	0.0000168	0.0000214	0.000000525	0.0000323	0.0000162
PFHpS	ND (0.000081)	ND (0.000000045)	0.0000173	ND (0.000000023)	0.0000261	ND (0.000000046)
PFHpA	0.000127	0.000000715	0.000107	0.00000350	0.000162	0.000000725
Perfluorohexadecanoic acid	--	0.00000778	--	0.000000189	--	0.00000474
PFHxS	ND (0.000081)	ND (0.000000033)	0.000913	0.000000128	0.00138	<0.000000034 DLL
PFHxA	0.000439	0.000000575	0.000929	0.00000197	0.00140	0.000000435
PFNS	ND (0.000081)	ND (0.000000038)	0.000000575	ND (0.000000017)	0.000000868	ND (0.000000038)
PFNA	ND (0.000081)	0.00000203	0.0000272	0.00000288	0.0000411	0.00000228
Perfluorooctadecanoic acid	--	0.00000107	--	0.0000000972	--	0.000000251
FOSA	ND (0.000081)	<0.00000021 DLL	0.00000862	<0.000000074 DLL	0.0000130	<0.00000021 DLL
PFOS	0.000364	ND (0.000000074)	0.00634	0.000000445	0.00957	<0.000000076 DLL
PFOA	0.000135	0.00000109	0.000243	0.00000374	0.000367	0.00000106
PFPeS	ND (0.000081)	ND (0.000000022)	0.000188	ND (0.000000013)	0.000284	ND (0.000000022)
PFPeA	ND (0.000081)	0.000000415	0.000159	0.00000101	0.000240	0.000000272
PFTeA	ND (0.000081)	0.0000248	0.00000705	0.000000459	0.0000107	0.0000233
PFTriA	ND (0.000081)	0.0000223	0.00000772	0.000000542	0.0000117	0.0000212
PFUnA	ND (0.000081)	0.00000809	0.00000421	0.000000834	0.00000635	0.00000893
9-chloro.	ND (0.000081)	ND (0.000000034)	ND (0.000000048)	ND (0.000000017)	ND (0.000000072)	ND (0.000000034)
NEtFOSA	ND (0.00020)	ND (0.000000087)	ND (0.0000012)	ND (0.000000039)	ND (0.00000018)	ND (0.000000088)
NEtFOSAA	ND (0.000081)	ND (0.000000054)	0.00000196	ND (0.000000025)	0.00000296	ND (0.000000054)
NMeFOSAA	ND (0.000081)	ND (0.000000059)	ND (0.000000048)	ND (0.000000027)	ND (0.000000072)	ND (0.000000059)
11-chloro.	ND (0.000081)	ND (0.000000044)	ND (0.000000048)	ND (0.000000023)	ND (0.000000072)	ND (0.000000044)
NEtFOSE	ND (0.00020)	ND (0.000000096)	0.00000305	ND (0.000000038)	0.00000461	ND (0.000000097)
NMeFOSE	ND (0.00020)	ND (0.000000026)	0.000111	<0.00000023 DLL	0.000167	ND (0.000000026)
PES	--	ND (0.000000034)	--	ND (0.000000020)	--	ND (0.000000034)
PFECA	--	ND (0.000000040)	--	0.000000298	--	ND (0.000000040)
PFECA	--	ND (0.000000059)	--	ND (0.000000030)	--	ND (0.000000059)
PFECA	--	ND (0.00000014)	--	<0.000000062 DLL	--	ND (0.00000014)
PFECHS	--	ND (0.000000041)	--	ND (0.000000026)	--	ND (0.000000040)
DONA	ND (0.000081)	ND (0.000000064)	ND (0.000000048)	ND (0.000000031)	ND (0.000000072)	ND (0.000000064)
HFPO-DA	ND (0.00041)	ND (0.000000072)	0.0000127	ND (0.000000037)	0.0000192	ND (0.000000073)
NMeFOSA	ND (0.00020)	<0.000000098 DLL	ND (0.0000012)	0.000000321	ND (0.00000018)	<0.00000010 DLL
10:2 FTCA	--	ND (0.000000024)	--	ND (0.000000011)	--	ND (0.000000025)
10:2 FTS	--	ND (0.000000071)	--	ND (0.000000036)	--	ND (0.000000071)
3:3 FTCA	ND (0.000081)	ND (0.000000088)	0.00000125	ND (0.000000046)	0.00000189	ND (0.000000088)
4:2 FTS	ND (0.00024)	ND (0.000000029)	0.00000492	ND (0.000000014)	0.00000744	ND (0.000000029)
5:3 FTCA	ND (0.000081)	ND (0.000000011)	0.00000184	ND (0.000000063)	0.0000278	ND (0.000000011)
6:2 FTCA	--	ND (0.000000020)	--	ND (0.000000090)	--	ND (0.000000020)
6:2 FTS	0.00108	ND (0.000000022)	0.00212	<0.00000020 DLL	0.00320	ND (0.000000023)
6:2 FTUCA	--	ND (0.000000035)	--	ND (0.000000019)	--	ND (0.000000035)
7:3 FTCA	ND (0.000081)	ND (0.000000011)	0.00000492	ND (0.000000054)	0.00000744	ND (0.000000011)
8:2 FTCA	--	ND (0.000000017)	--	ND (0.000000079)	--	ND (0.000000017)
8:2 FTS	0.000322	ND (0.000000045)	0.000318	ND (0.000000024)	0.000480	ND (0.000000045)
8:2 FTUCA	--	ND (0.000000052)	--	ND (0.000000032)	--	ND (0.000000052)
Total PFAS (lb/hr)	6.18E-03	9.45E-05	1.22E-02	2.00E-05	1.85E-02	8.85E-05

Table 13-2 - PFAS emissions at the stack (OTM-45) from Contaminated Soil Incineration. PFAS highlighted in blue were detected in the process water. Values in bold when PFAS was detected

above MDL in at least one OTM-45 fractions. DLL means that some portions of the sample were above the MDL, while others were below the detection limit (ND).

PFAS	Run 1		Run 2	
	Waste feed rate (lb/hr)	Stack emission (lb/hr)	Waste feed rate (lb/hr)	Stack emission (lb/hr)
PFBS	0.000053400	<0.000000094 DLL	0.000059100	0.000000050
PFBA	0.000196000	<0.00000099 DLL	0.000217000	0.000000345
PFDS	0.000000249	ND (0.000000035)	0.000000276	ND (0.000000018)
PFDA	0.000017100	0.000003010	0.000019000	0.000000109
	ND (0.00000020)			
PFDoS		ND (0.000000058)	ND (0.00000022)	ND (0.000000026)
PFDoA	0.000003850	0.000012000	0.000004260	0.000000140
PFHpS	0.000024900	ND (0.000000045)	0.000027600	ND (0.000000023)
PFHpA	0.000077200	0.000000560	0.000085500	0.000000236
Perfluorohexadecanoic acid	--	0.000005220	--	0.000000062
PFHxS	0.000562000	<0.000000034 DLL	0.000622000	0.000000012
PFHxA	0.000286000	0.000000340	0.000317000	0.000000190
PFNS	0.000000332	ND (0.000000038)	0.000000368	ND (0.000000017)
PFNA	0.000056000	0.000001420	0.000062000	0.000000145
Perfluorooctadecanoic acid	--	0.000000257	--	<0.000000030 DLL
FOSA	0.000003130	<0.00000021 DLL	0.000003460	<0.000000084 DLL
PFOS	0.001210000	<0.000000088 DLL	0.001340000	0.000000046
PFOA	0.000700000	0.000000796	0.000775000	0.000000380
PFPeS	0.000056200	ND (0.000000021)	0.000062200	ND (0.000000013)
PFPeA	0.000078300	0.000000236	0.000086700	0.000000133
PFTeA	0.000001390	0.000019100	0.000001540	0.000000142
PFTriA	0.000000879	0.000018200	0.000000974	0.000000154
PFUnA	0.000003350	0.000006050	0.000003710	0.000000114
	ND (0.00000020)			
9-chloro.		ND (0.000000034)	ND (0.00000022)	ND (0.000000017)
	ND (0.00000051)			
NEtFOSA		ND (0.000000087)	ND (0.00000056)	ND (0.000000039)
	ND (0.00000020)			
NEtFOSAA		ND (0.000000053)	ND (0.00000022)	ND (0.000000025)
	ND (0.00000020)			
NMeFOSAA		ND (0.000000059)	ND (0.00000022)	ND (0.000000027)
	ND (0.00000020)			
11-chloro.		ND (0.000000044)	ND (0.00000022)	ND (0.000000023)
NEtFOSE	0.000000575	ND (0.000000096)	0.000000637	ND (0.000000039)
	ND (0.00000051)			
NMeFOSE		ND (0.00000025)	ND (0.00000056)	<0.00000023 DLL
PES	--	ND (0.000000033)	--	ND (0.000000020)
PFECA	--	ND (0.000000040)	--	ND (0.000000027)
PFECA	--	ND (0.000000058)	--	ND (0.000000030)
PFECA	--	ND (0.00000014)	--	ND (0.000000058)
PFECHS	--	ND (0.000000040)	--	ND (0.000000026)
	ND (0.00000020)			
DONA		ND (0.000000064)	ND (0.00000022)	ND (0.000000031)
HFPO-DA	0.002670000	ND (0.00000072)	0.002950000	ND (0.00000037)
	ND (0.00000051)			
NMeFOSA		<0.000000096 DLL	ND (0.00000056)	0.000000089
10:2 FTCA	--	ND (0.00000024)	--	ND (0.00000011)
10:2 FTS	--	ND (0.000000070)	--	ND (0.000000037)
3:3 FTCA	0.000005380	ND (0.000000087)	0.000005960	ND (0.000000046)
4:2 FTS	0.000003430	ND (0.000000028)	0.000003800	ND (0.000000014)
5:3 FTCA	0.000004480	ND (0.00000011)	0.000004970	ND (0.000000063)
6:2 FTCA	--	ND (0.00000020)	--	ND (0.000000091)
6:2 FTS	0.000359000	ND (0.00000022)	0.000397000	<0.00000024 DLL
6:2 FTUCA	--	ND (0.000000034)	--	ND (0.000000019)
7:3 FTCA	0.000000733	ND (0.00000011)	0.000000811	ND (0.000000055)
8:2 FTCA	--	ND (0.00000017)	--	ND (0.000000080)
8:2 FTS	0.000085700	ND (0.000000044)	0.000094900	ND (0.000000024)
8:2 FTUCA	--	ND (0.000000051)	--	ND (0.000000032)
Total PFAS (lb/hr)	6.46E-03	7.20E-05	7.15E-03	4.33E-06

Table 13-3 - PFAS emissions at the stack (OTM-45) from Spent Activated Carbon Incineration. PFAS highlighted in blue were detected in the process water. Values in bold when PFAS was detected above MDL in at least one OTM-45 fractions. DLL means that some portions of the sample were above the MDL, while others were below the detection limit (ND).

PFAS	Baseline stack emission (lb/hr)	CF4 run Stack emission (lb/hr)
PFBS	0.000000585	0.000000475
PFBA	0.000000400	0.000000250
PFDS	ND (0.000000018)	ND (0.000000018)
PFDA	0.000000118	0.000000243
PFDoS	ND (0.000000026)	ND (0.000000025)
PFDoA	0.000000628	0.000000268
PFHpS	ND (0.000000023)	ND (0.000000023)
PFHpA	0.000000382	<0.00000013 DLL
Perfluorohexadecanoic acid	0.000000267	<0.00000038 DLL
PFHxS	<0.00000019 DLL	0.000000163
PFHxA	0.000000379	0.000000118
PFNS	ND (0.000000018)	ND (0.000000017)
PFNA	0.000000220	0.000000337
Perfluorooctadecanoic acid	ND (0.000000029)	ND (0.000000029)
FOSA	<0.00000078 DLL	<0.00000075 DLL
PFOS	0.000000213	0.000000189
PFOA	0.000000319	0.000000158
PFPeS	ND (0.000000013)	0.0000000602
PFPeA	0.000000193	0.0000000481
PFTeA	0.000000590	0.000000305
PFTrIA	0.000000506	0.000000265
PFUnA	0.000000706	0.000000235
9-chloro.	ND (0.000000017)	ND (0.000000017)
NETFOSA	<0.00000041 DLL	ND (0.000000039)
NETFOSAA	ND (0.000000025)	ND (0.000000025)
NMeFOSAA	ND (0.000000028)	ND (0.000000027)
11-chloro.	ND (0.000000023)	ND (0.000000023)
NETFOSE	0.000000193	ND (0.000000038)
NMeFOSE	<0.00000024 DLL	<0.00000022 DLL
PES	ND (0.000000020)	ND (0.000000020)
PFECA	ND (0.000000027)	ND (0.000000027)
PFECA	ND (0.000000030)	ND (0.000000029)
PFECA	ND (0.000000059)	ND (0.000000057)
PFECHS	ND (0.000000026)	ND (0.000000026)
DONA	ND (0.000000031)	ND (0.000000031)
HFPO-DA	ND (0.000000038)	ND (0.000000037)
NMeFOSA	0.000000755	0.000000249
10:2 FTCA	ND (0.000000011)	ND (0.000000011)
10:2 FTS	ND (0.000000037)	ND (0.000000036)
3:3 FTCA	ND (0.000000047)	ND (0.000000046)
4:2 FTS	ND (0.000000015)	ND (0.000000014)
5:3 FTCA	ND (0.000000064)	ND (0.000000063)
6:2 FTCA	ND (0.000000092)	ND (0.000000090)
6:2 FTS	0.000000973	<0.00000025 DLL
6:2 FTUCA	<0.00000024 DLL	<0.00000019 DLL
7:3 FTCA	ND (0.000000055)	ND (0.000000054)
8:2 FTCA	ND (0.000000080)	ND (0.000000078)
8:2 FTS	ND (0.000000024)	ND (0.000000024)
8:2 FTUCA	ND (0.000000032)	ND (0.000000031)
Total PFAS (lb/hr)	5.18E-06	3.14E-06

Table 13-4 : PFAS emissions at the stack (OTM-45) for CF4 incineration. PFAS highlighted in blue were detected in the process water. Values in bold when PFAS was detected above MDL in at least one OTM-45 fractions. DLL means that some portions of the sample were above the MDL, while others were below the detection limit (ND).

Pattern 1: AFFF run 2 &3, soil #2, carbon #2 → PFAS emission < 2.10⁻⁵ lb/hr and PFAS signature at the stack during PFAS incineration similar to baseline

As in the campaign 1, even if the PFAS containing wastes fed in the kiln had different signatures, the PFAS signature at stack is the same for all runs. The same 6 PFAS are found at stack substantially above MDL in all runs: PFBA, PFHpA, PFHxA, PFNA, PFOA, PFPeA. These PFAS are also found in the PFAS-contaminated process water entering the incinerator, and in contact with the stack gases after thermal treatment.

As in the campaign 1, the flowrate at the stack of these 6 PFAS is higher during PFAS incineration than during the baseline.

Figure 9-1 shows the PFAS stack emissions for pattern 1.

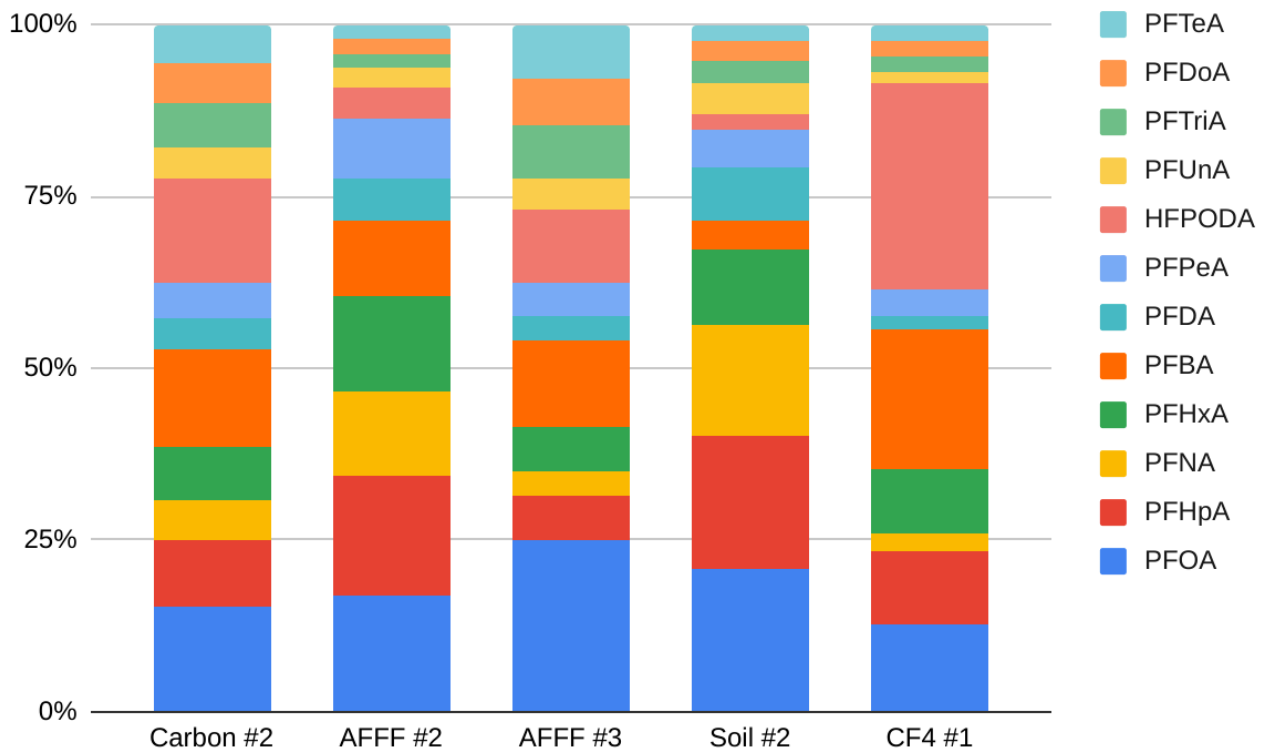


Figure 9-1 - PFAS stack emission observed in pattern 1 (OTM-45). For readability, only the 12 dominant PFAS are represented.

Comments on lime injection during the A3F runs:

The same AFFF was incinerated in run 2 and 3, but in run 3, lime was injected during AFFF incineration. Lime injection decreases PFAS stack emission for PFAS with less than 7 carbons like PFBA, PFHxA, PFPeA. Stack emission for these PFAS in AFFF run 3 (lime injection) is lower than in run 2 (without lime) and lower than the baseline. The lime effect on PFAS with C>7 is less certain. PFOA emissions decrease with lime but PFOS, PFTeA, PFTriA, PFDoA emissions increase. Lime was not tested for PFAS content, but according to manufacturer description there is no PFAS in it. Overall, lime injection decreases total PFAS emissions at the stack to a small degree, PFAS emissions at the stack are 1.10⁻⁵ lb/hr without lime injection (AFFF run 2) and 6.15.10⁻⁶ lb/hr with

lime injection (AFFF run 3). The impact of lime was only tested in one run; more tests should be performed to confirm the results.

Comments on the carbon run :

PFAS mass emission rate at stack during the carbon incineration run was lower than the baseline. A possible explanation could be an effect of unique surfaces provided by the activated carbon that may enhance PFAS degradation during incineration.

Pattern 2: AFFF run#1, carbon #1, soil #1 & #3

Figure 9-2 shows the PFAS stack emissions for 4 runs that showed a different PFAS signature (pattern 2) and concentration than the one established during campaign 1. There were: AFFF#1, Soil#1, Carbon#1, and Soil#3. In these runs, high emissions of long chain PFAS like perfluorohexadecanoic acid (C16), PFDoA (C12), PFTeA (C14), PFTriA (C13), PFUnA (C11) and perfluorohexane (C6) were detected at the stack. These 4 runs have the same PFAS signature at stack while the other runs involving AFFF, carbon, soil and CF4 and all baseline runs had PFAS signatures consistent with pattern 1.

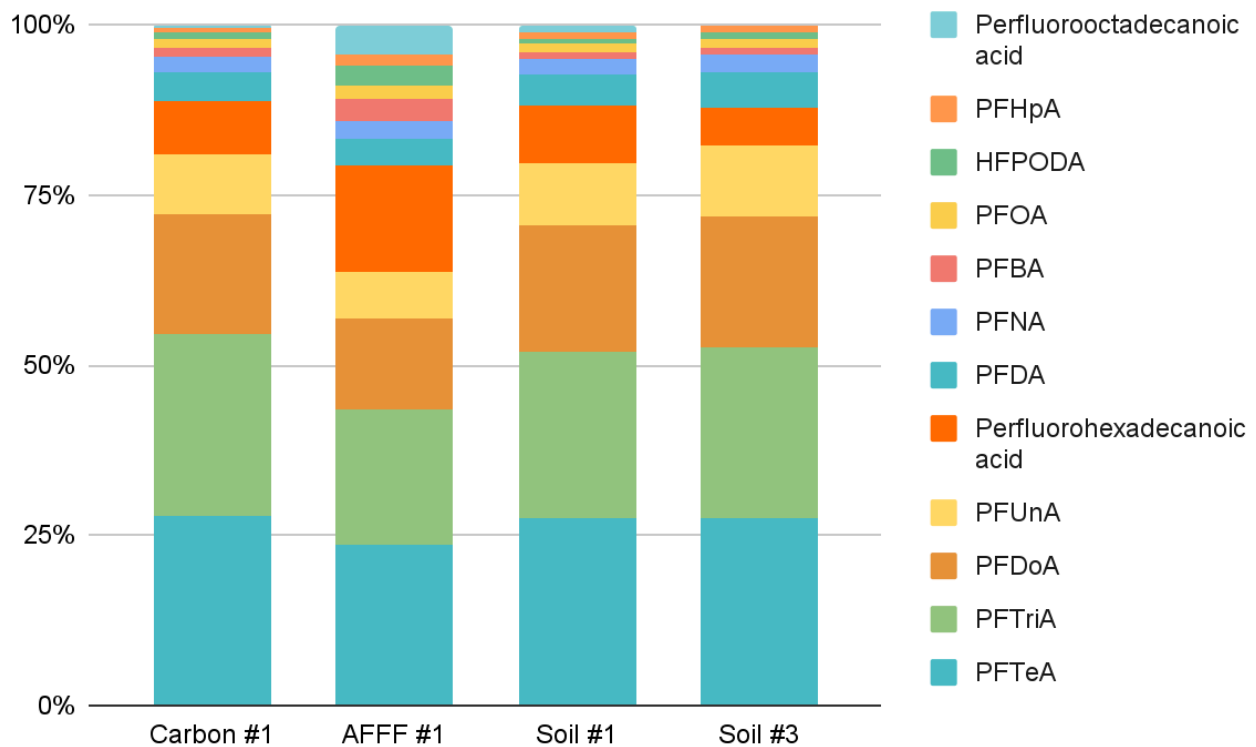


Figure 9-2 - PFAS stack emission observed in pattern 2 (OTM-45). For readability, only the 12 dominant PFAS are represented.

For carbon run#1 and run#2, the same carbon mix was incinerated, but very different OTM-45 results were obtained (run#2 gave pattern 1 while run#1 showed pattern 2). This is the same for soil#2 and soil#3. The same soil mix was used but with a different pattern at the stack. These inconsistencies confirm that pattern #2 is likely contaminated by background PFAS. The source of this background PFAS presence is unknown. It is unlikely that emissions from PFAS with C>10 (pattern 2) are PICs from PFAS incineration, because campaign 1 has shown that the incinerator can efficiently destroy PFAS with C<9 like PFOS, PFHxS, PFPeS.

> Comparing PFAS incineration vs baseline in Campaign 2

Table 14 compares the total PFAS mass emission rate at the stack (OTM-45 results) during baseline vs PFAS incineration in Campaign 2.

As in campaign 1, the OTM-45 results indicated higher total PFAS emissions for the PFAS waste incineration tests (excluding the CF4 tests) compared to baseline tests in campaign 2. However, given that PFAS was present in the water fed to the quench and wet scrubber downstream of the incineration process, these data are not considered conclusive.

Campaign 2	Average Baseline	Average AFFF	Average soil	Average carbon	CF4
Total PFAS mass emission rate at the stack : OTM-45 (lb/hr)	7.63E-06	1.05E-05	6.77E-05	3.82E-05	3.14E-06
Ratio PFAS incineration/Baseline		1.4	8.9	5.0	0.4

Table 14 : Total PFAS mass emission rate at the stack during baselines and PFAS incineration. Average baselines refers to the average total stack emission rate of PFAS observed during the 6 baselines in Campaign 2. Average AFFF, average soil, and average carbon refers to the average total stack emission rate of PFAS observed during the runs of AFFF, contaminated soil and spent activated carbon in Campaign 2.

7.2.3.2. Destruction and Removal Efficiency

Tables 15 and 16 present the DRE and total DRE measured in campaign 2. Overall, total DRE >98% were measured in all runs, despite the background presence of long-chain PFAS (pattern 2) from unknown sources. PFAS concentrations in the waste streams in campaign 2 are lower than in campaign 1, leading to lower DRE.

PFAS	AFFF run#1	AFFF # 2	AFFF # 3	Soil # 1	Soil # 2	Soil # 3	Carbon # 1	Carbon # 2
PFAS feed rate (lb/hr)	0.0105	0.0223	0.0231	0.0065	0.0123	0.0186	0.0065	0.0072
Total DRE (%)	99.8552%	99.9547%	99.9734%	98.5462%	99.8374%	99.5242%	98.8923%	99.9399%

Table 15 - Total DRE obtained during campaign 2

PFAS	AFF run #1			AFF run #2			AFF run #3			Soil run #1		
	PFAS feed rate (lb/hr)	DRE %	Non-detected at stack	PFAS feed rate (lb/hr)	DRE %	Non-detected at stack	PFAS feed rate (lb/hr)	DRE %	Non-detected at stack	PFAS feed rate (lb/hr)	DRE %	Non-detected at stack
PBS	0.0000612	99.8056		0.0001220	99.9389		0.0001270	99.9523		0.00016*	99.9394	DLL
PBA	0.0000725	99.3986		0.0004010	99.7746		0.0004160	99.8925		0.00032*	99.6875	DLL
PDS	0.0000052*	99.6538	nd	0.0000057*	99.6842	nd	0.0000059*	99.6780	nd	0.000081*	99.9568	nd
PDA	0.0000125	99.8640		0.0001120	99.5643		0.0001160	99.8948		0.000081*	94.9877	
PDoS	0.0000052*	99.5192	nd	0.0000057*	99.5614	nd	0.0000059*	99.5424	nd	0.000081*	99.9272	nd
PDoA	0.0000054	67.9702		0.0000447	99.5906		0.0000464	99.4784		0.000081*	79.2593	
PHpS	0.0000143	99.8392	nd	0.0000255	99.9098	nd	0.0000264	99.9015	DLL	0.000081*	99.9444	nd
PHpA	0.0000319	99.2947		0.0001100	98.7000		0.0001140	99.7982		0.0001270	99.4370	
PHhS	0.00005680	99.9983		0.0012800	99.9988		0.0013200	99.9971		0.000081*	99.9593	nd
PHhA	0.00007450	99.9557		0.0023200	99.9504		0.0024000	99.9905		0.0004390	99.8690	
PFNS	0.0000052*	99.6731	nd	0.0000057*	99.7018	nd	0.0000059*	99.6949	nd	0.000081*	99.9531	nd
PFNA	0.000005*	93.8846		0.0000182	94.5495		0.0000189	99.3228		0.000081*	97.4938	
FOA	0.0000240	99.6750	DLL	0.0000661	99.8820	DLL	0.0000685	99.8847	DLL	0.000081*	99.7407	DLL
PFOS	0.0030800	99.9984		0.0085300	99.9990		0.0088500	99.9934		0.0003640	99.9797	nd
FOA	0.0001200	99.7833		0.0004820	99.7116		0.0004990	99.8222		0.0001350	99.1926	
PFPeS	0.0000775	99.9832	nd	0.0002520	99.9948	nd	0.0002620	99.9972		0.000081*	99.9728	nd
PFPeA	0.0000505	99.5663		0.0002660	99.7286		0.0002760	99.9384		0.000081*	99.4877	
FTeA	0.000005*	41.3462		0.0000165	99.0000		0.0000171	98.3918		0.000081*	69.3827	
FTriA	0.0000059	57.4074		0.0000116	98.6379		0.0000120	97.6667		0.000081*	72.4691	
FUnA	0.0000100	90.9940		0.0000759	99.6733		0.0000787	99.7954		0.000081*	90.0123	
9-chloro.	0.0000052*	99.6731	nd	0.0000057*	99.7018	nd	0.0000059*	99.7119	nd	0.000081*	99.9580	nd
NiFOSA	0.000011*	99.6455	nd	0.000011*	99.6455	nd	0.000012*	99.6583	nd	0.00020*	99.9565	nd
NiFOSAA	0.000011*	99.7727	nd	0.0000243	99.8971	nd	0.0000252	99.8968	nd	0.00020*	99.9730	nd
NiFOSAAA	0.0000073	99.6322	nd	0.0000340	99.9206	nd	0.0000352	99.9205	nd	0.000081*	99.9272	nd
11-chloro.	0.0000052*	99.5577	nd	0.0000057*	99.5965	nd	0.0000059*	99.5932	nd	0.000081*	99.9457	nd
NiFOfSE	0.000011*	99.6545	nd	0.000011*	99.6545	nd	0.000012*	99.6667	nd	0.00020*	99.9520	nd
NiFOfSE	0.0000063*	96.6667	nd	0.0000069*	96.9565	nd	0.0000071*	96.7606	DLL	0.000081*	99.6790	nd
NONA	0.0000052*	99.4038	nd	0.0000057*	99.4561	nd	0.0000059*	99.4576	nd	0.000081*	99.9210	nd
NiFPO-DA	0.0000227	98.3700	nd	0.0000202	98.1683	nd	0.0000210	98.1905	nd	0.0004100	99.8244	nd
NiFPOSA	0.000011*	99.3518	nd	0.000011*	98.9636	nd	0.000012*	98.7833	nd	0.00020*	99.9510	DLL
3β FTCA	0.0000031*	98.5161	nd	0.0000034*	98.6471	nd	0.0000036*	98.6667	nd	0.000081*	99.8914	nd
4β FTCS	0.0000151	99.9073	nd	0.0000150	99.9067	nd	0.0000156	99.9038	nd	0.00024*	99.9879	nd
5β FTCA	0.0000025	97.4286	nd	0.0001150	99.9452	nd	0.0001190	99.9445	nd	0.000081*	99.8642	nd
6β FTCS	0.00050900	99.9957	DLL	0.0061900	99.9963	DLL	0.0064200	99.9967	DLL	0.0010800	99.9796	nd
7β FTCA	0.0000031*	98.2581	nd	0.0000278	99.8058	nd	0.0000288	99.8021	nd	0.000081*	99.8642	nd
8β FTCS	0.0003280	99.9927	nd	0.0016700	99.9986	nd	0.0017300	99.9986	nd	0.0003220	99.9860	nd
NFDHA	0.0000021*	--		0.0000023*	--		0.0000024*	--		0.000081*	--	
PFESA	0.0000021*	--		0.0000023*	--		0.0000024*	--		0.000081*	--	
PFMPA	0.0000021*	--		0.0000023*	--		0.0000024*	--		0.000081*	--	
PFMBA	0.0000021*	--		0.0000023*	--		0.0000024*	--		0.000081*	--	
Total (lb/hr)	1.05E-02			2.23E-02			2.31E-02			6.50E-03		

Table 16-1 - DRE for campaign 2. Part 1. PFAS highlighted in blue were detected in the process water. *indicates that values were below the MDL or the LoQ. ND indicates PFAS was not detected at the stack. DLL indicates that the PFAS was detected above MDL in one of the OTM-45 fractions while the others were ND.

PFAS	Soil run #2			Soil run#3			Carbon run #1			Carbon run #2		
	PFAS feed rate (lb/hr)	DRE %	Non-detected at stack	PFAS feed rate (lb/hr)	DRE %	Non-detected at stack	PFAS feed rate (lb/hr)	DRE %	Non-detected at stack	PFAS feed rate (lb/hr)	DRE %	Non-detected at stack
PFBs	0.0001490	99.9695		0.0002280	99.9558	DLL	0.0000534	99.8240	DLL	0.0000591	99.9161	
PFBa	0.0004590	99.8275		0.0006940	99.8559	DLL	0.0001960	99.4949	DLL	0.0002170	99.8410	
PFDS	0.0000030	99.3898	nd	0.0000045	99.2152	nd	0.0000002	85.9438	nd	0.0000003	93.4783	nd
PFDA	0.0000457	96.9803		0.0000690	93.8116		0.0000171	82.3977		0.0000190	99.4263	
PFDoS	0.0000010	97.5728	nd	0.0000016	96.2179	nd	0.00000020*	71.0000	nd	0.00000022*	88.1818	nd
PFDoA	0.0000214	97.5467		0.0000323	49.8452		0.0000039	**		0.0000043	96.7136	
PFHpS	0.0000173	99.8671	nd	0.0000261	99.8238	nd	0.0000249	99.8193	nd	0.0000276	99.9167	nd
PFHpA	0.0001070	96.7290		0.0001620	99.5525		0.0000772	99.2746		0.0000855	99.7240	
PFHs	0.0009130	99.9986		0.0013800	99.9975	DLL	0.0005620	99.9940	DLL	0.0006220	99.9982	
PFHvA	0.0009290	99.7879		0.0014000	99.9689		0.0002860	99.8811		0.0003170	99.9401	
PFNS	0.0000006	97.0435	nd	0.0000009	95.6221	nd	0.0000003	88.5542	nd	0.0000004	95.3804	nd
PFNA	0.0000272	89.4118		0.0000411	94.4526		0.0000560	97.4643		0.0000620	99.7661	
FOSA	0.0000086	99.1415	DLL	0.0000130	98.3846	DLL	0.0000031	93.2907	DLL	0.0000035	97.5723	DLL
PFOS	0.0063400	99.9993		0.0095700	99.9992	DLL	0.0012100	99.9927	DLL	0.0013400	99.9966	
PFOA	0.0002430	98.4609		0.0003670	99.7112		0.0007000	99.8863		0.0007750	99.9510	
PFPeS	0.0001880	99.9931	nd	0.0002840	99.9923	nd	0.0000562	99.9626	nd	0.0000622	99.9791	nd
PFPeA	0.0001590	99.3648		0.0002400	99.8867		0.0000783	99.6986		0.0000987	99.8466	
PFTeA	0.0000071	93.4894		0.0000107	**		0.0000014	**		0.0000015	90.7792	
PFTrIA	0.0000077	92.9793		0.0000117	**		0.0000009	**		0.0000010	84.1889	
PFUnA	0.0000042	80.1900		0.0000064	**		0.0000034	**		0.0000037	96.9272	
9-chloro.	0.00000048*	96.4583	nd	0.00000072*	95.2778	nd	0.0000020*	83.0000	nd	0.0000022*	92.2727	nd
NEFOSA	0.00000120*	96.7500	nd	0.00000190*	95.1111	nd	0.00000051*	82.9412	nd	0.00000056*	93.0357	nd
NEFOSAA	0.0000031	99.1803	nd	0.0000046	98.8286	nd	0.0000006	90.7826	nd	0.0000006	96.0754	nd
NMeFOSAA	0.0000020	98.6224	nd	0.0000030	98.0088	nd	0.0000020*	78.0000	nd	0.0000022*	87.7273	nd
11-chloro.	0.00000048*	95.2083	nd	0.00000072*	93.8889	nd	0.00000020*	81.1765	nd	0.00000022*	89.5455	nd
NEFOSE	0.0001110	99.9658	nd	0.0001670	99.9419	nd	0.00000051*	81.1765	nd	0.00000056*	93.0357	nd
NMeFOSE	0.00000048*	52.0833	DLL	0.00000072*	63.8889	nd	0.00000020*	**	nd	0.00000022*	**	DLL
DONA	0.00000048*	93.5417	nd	0.00000072*	91.1111	nd	0.00000020*	68.0000	nd	0.00000022*	85.9091	nd
HFPO-DA	0.0000127	97.0866	nd	0.0000192	96.1979	nd	0.0026700	99.9730	nd	0.0029500	99.9875	nd
NMeFOSA	0.00000120*	97.3250		0.00000180*	94.4444	DLL	0.00000051*	81.1765	DLL	0.00000056*	84.1071	
3:3 FTCA	0.0000013	96.3200	nd	0.0000019	95.3439	nd	0.0000054	98.3829	nd	0.0000060	99.2282	nd
4:2 FTS	0.0000049	99.7154	nd	0.0000074	99.6102	nd	0.0000034	99.1837	nd	0.0000038	99.6316	nd
5:3 FTCA	0.0000184	99.8576	nd	0.0000278	99.6043	nd	0.0000045	97.5446	nd	0.0000050	98.7324	nd
6:2 FTS	0.0021200	99.9906	DLL	0.0003200	99.9928	nd	0.0003590	99.9887	nd	0.0003970	99.9895	DLL
7:3 FTCA	0.0000049	98.9024	nd	0.0000074	98.5215	nd	0.0000007	84.9832	nd	0.0000008	93.2182	nd
8:2 FTS	0.00003180	99.9925	nd	0.0004800	99.9906	nd	0.0000857	99.9487	nd	0.0000949	99.9747	nd
NFDHA	0.0000400	**		0.0000604	**		0.0000258	**		0.0000286	**	
PFEESA	0.00000048*	**		0.00000072*	**		0.00000020*	**		0.00000022*	**	
PFMPA	0.0000346	**		0.0000523	**		0.0000049	**		0.0000054	**	
PFMBA	0.0000014	**		0.0000021	**		0.0000015	**		0.0000016	**	
Total (lb/hr)	1.23E-02			1.86E-02			6.49E-03			7.18E-03		

Table 16-2 - DRE for campaign 2. Part 2. PFAS highlighted in blue were detected in the process water. *indicates that values were below the MDL or the LoQ. ND indicates PFAS was not detected at the stack. DLL indicates that the PFAS was detected above MDL in one of the OTM-45 fractions while the others were ND.

Tables 16-1 and 16-2 shows that a large number of PFAS were undetected at the stack, despite being detected in the PFAS waste. Eight PFAS including 8:2 FTS, 7:3 FTCA, 5:3 FTCA, 4:2 FTS, HFPO-DA, NETFOSE, NETFOSAA and PFDS were systematically not detected at the stack. DRE for PFOS was >99.999% in 3 runs. DRE >99.9999% could not be reached because of the limited PFOS concentration in campaign 2.

PFAS with DRE inferior to 99% were :

- PFDA - detected in the process water, stack gas likely contaminated with PFDA from process water
- PFDoA - contamination issue suspected in AFFF run #1, soil run #3 and carbon run #1. Very low concentration in waste for soil run #2 leads to low DRE.
- PFHpA - detected in the process water, stack gas likely contaminated with PFHpA from process water
- PFNA - detected in the process water, stack gas likely contaminated with PFNA from process water
- FOSA - very low concentration in waste for soil run 3 and carbon 1,2 leads to low DRE.
- PFOA - DRE close to 99%, PFOA detected at the stack likely from process water rather than waste incineration
- PFTeA - contamination issue suspected in carbon run 1 and soil run 3. Low concentration in soil run#2 leads to low DRE.
- PFTriA - contamination issue suspected in AFFF run#1, soil run 3 and carbon run #1. Very low concentration in waste for AFFF run 2 and 3 and carbon 2 and soil 2 leads to low DRE.
- PFUnA - contamination issue suspected in AFFF run#1 and carbon run#1. Very low concentration in waste for carbon 2 and soil 2 leads to low DRE.
- NMeFOSA - very low concentration in waste in soil run 2 leads to low DRE

7.2.3.3 Products of Incomplete Destruction (OTM-50)

PICs measured from OTM-50 sampling were detected in 3 runs out of 13. Detailed OTM-50 tables are available in **Appendix XVIII**.

	Baseline	Run 1	Run2	Run 3
A3F	Blank #1: C5 detected at 9.9×10^{-5} lb/hr (MDL: 8.4×10^{-5} lb/hr)	ND	ND	CF4 detected at 5.1×10^{-3} lb/hr (MDL : 4.4×10^{-4} ;b/hr)
	Blank #2: CF4 detected at 2.4×10^{-3} lb/hr (MDL : 4.4×10^{-4} lb/hr)			

Carbon	ND	ND	ND	N/A
CF4	ND	CF4 detected at 17.6 lb/hr	N/A	N/A
Contaminated soil	ND	ND	ND	ND

Table 17 - OTM-50 results in campaign 2. ND means no OTM-50 PFAS was detected at stack during the run. N/A indicates no additional run was performed

The baseline for AFF #1 could be a false positive as no PFAS was supposed to be incinerated at that time.

CF4 was detected in the baseline performed before AFFF run #3 and during AFFF run #3. The high H/F ratio reached in the incinerator prevents CF4 formation during PFAS incineration. The detection of CF4 during these 2 runs could be a false positive, as the level is close to the MDL.

CF4 was also detected at stack during CF4 incineration. The DRE for CF4 is 43%. According to literature, CF4 destruction requires a temperature > 2500 F, while the incinerator temperature is 2040 F in the SCC. The fact that 43% of the CF4 was destroyed suggests that in some parts of the incinerator, temperatures above 2500 F are reached.

OTM-50 results show that in most runs, no PICs were detected at stack during the campaign 2.

The C5 compound detected in AFFF baseline run#1 is a polyfluorinated ether. It is a very unlikely PIC due to its low thermal stability and is more likely a contaminant from the analytical laboratory.

7.2.4 HF measurement.

HF measures are available in **Appendix XIX** for campaign 2. HWC MACT standards for existing hazardous waste incinerators from §63.1219 applicable to the incinerator at Veolia’s Port Arthur facility require HF at the stack to be below 32 ppmv, dry, at 7% O2. HF remained well below the regulatory limit during PFAS incineration.

7.2.5 Total Destruction Efficiency

The Total Destruction Efficiency was computed for each run, as described in 4.3. When PFAS was not detected in the liquid, solid residue or at stack, the MDL is used. When a PFAS is detected below the LoQ, the LoQ is used.

The total DE for all runs were very low or even negative. This is due to the high MDL for OTM-50 (0.01 lb/hr to 0.1 lb/hr). The PFAS concentration in the waste was sometimes lower than the MDL for OTM-50. This demonstrates the need to improve detection levels for OTM-50 to align them with EPA Method 537 and EPA Method 1633.

7.3 Conclusions and Recommendations for Further Study

The results demonstrated high destruction and removal efficiency for PFAS compounds during the incineration process, with values up to 99.9999%. These findings suggest that hazardous waste incineration, when properly operated under high-temperature conditions, can effectively break down PFAS compounds. Notably, a single VFC, CF4, was detected in one sample near the LOQ,

suggesting a complete mineralization of the PFAS compounds rather than partial decomposition. The consistent achievement of high DRE values across multiple test runs, coupled with the absence of PICs, provides strong confidence in the reliability of the thermal treatment process for PFAS destruction.

Analysis of solid residues and liquid residues showed relatively low to no concentrations of PFAS compounds, further supporting the effectiveness of the thermal treatment process. The minimal presence of PFAS compounds in these residual streams indicates successful destruction rather than mere phase transfer of the contaminants.

Initial findings from this Veolia PFAS incineration campaign have brought to light several important challenges that warrant further investigation. One significant hurdle remains finding waste streams with sufficiently high PFAS concentrations to demonstrate DRE higher than 99.9999%.

The current detection limits of samples obtained from OTM-50 are significantly higher than samples analyzed from OTM-45, making it difficult to quantify thermally stable, short-chain PFAS in the gaseous emissions. This limitation severely impacts the ability to calculate total PFAS destruction efficiency compared to DRE calculations of the PFAS being fed to the incinerator.

A significant challenge encountered during the study was the detection of background PFAS in some OTM-45 fractions. The source of this PFAS presence remains unclear and this observation highlights the complexity of PFAS sampling near industrial sources and the need for more comprehensive monitoring strategies.

While the targeted analysis of 79 PFAS compounds listed in OTM-45 and OTM-50 provides valuable insights, the potential presence of unknown PFAS necessitates the implementation of non-targeted analytical approaches. Such comprehensive screening would help identify previously uncharacterized PFAS compounds and transformation products that may form during the incineration process. This broader analytical scope would provide a more complete understanding of the treatment effectiveness and potential environmental implications.

An interesting avenue for future research would be investigating the potential catalytic effect of lime on PFAS destruction. As lime is commonly used in air pollution control systems for acid gas removal, understanding its role in PFAS decomposition mechanisms could provide valuable insights into process optimization. Preliminary results suggest that the presence of lime in the system might enhance PFAS destruction through surface-mediated or catalytic effects, potentially allowing for more efficient treatment at lower temperatures or shorter residence times. This knowledge could lead to improved treatment efficiencies and inform future design modifications of incineration systems.

Appendix I - Isokinetic and Non-Isokinetic Data Sheets for Campaign 1

Appendix II - Isokinetic and Non-Isokinetic Data Sheets for Campaign 2

Appendix III - Data quality assessment for Campaign 1

Appendix IV - Data quality assessment for Campaign 2

Appendix V - Calibration data for Campaign 1

Appendix VI - Calibration data for Campaign 1

Appendix VII - PFAS concentration in AFFF in Campaign 1

Non-detected PFAS (ND) are considered to be at MDL.

Parameter	Units	C1-R1	C1-R2	C1-R3
Date Tested	-	7/31/2024	8/1/2024	8/1/2024
Sample Collection Time	minutes	180	180	180
Waste Input Rate - Liquid A3F (lb/hr)	lb/hr	2,421	2,175	2,235
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)		ND (0.0000059)	ND (0.0000053)	ND (0.0000054)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)		0.00209	0.0000968	0.000113
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)		0.0000353	0.0000857	0.000380
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)		0.00441	0.00868	0.0102
3-Perfluoroheptylpropanoic acid (7:3 FTCA)		ND (0.000013)	ND (0.000012)	0.0000286
3-Perfluoropentylpropanoic acid (5:3 FTCA)		0.0000220	0.00000905	0.0000198
3-Perfluoropropylpropanoic acid (3:3 FTCA)		0.00000612	ND (0.0000053)	ND (0.0000054)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)		ND (0.0000059)	ND (0.0000053)	ND (0.0000054)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)		ND (0.0000059)	ND (0.0000053)	ND (0.0000054)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)		0.00000586	ND (0.0000043)	ND (0.0000043)
N-ethylperfluorooctane sulfonamide (NEtFOSA)		0.0000685	ND (0.0000043)	ND (0.0000043)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)		0.000627	0.0000396	ND (0.0000043)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)		0.0000207	ND (0.0000053)	ND (0.0000054)
N-methylperfluorooctane sulfonamide (NMeFOSA)		0.0000458	ND (0.0000075)	ND (0.0000075)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)		0.000264	0.0000181	ND (0.0000043)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)		ND (0.0000047)	ND (0.0000043)	ND (0.0000043)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)		ND (0.0000035)	ND (0.0000032)	ND (0.0000032)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)		0.00000625	ND (0.0000032)	ND (0.0000032)
Perfluoro-3-methoxypropanoic acid (PFMPA)		0.0000154	ND (0.0000032)	ND (0.0000032)
Perfluoro-4-methoxybutanoic acid (PFMBA)		0.0000231	ND (0.0000032)	ND (0.0000032)
Perfluorobutanesulfonic acid (PFBS)	lb/hr	0.0245	0.00217	ND (0.0000032)
Perfluorobutanoic acid (PFBA)		0.00453	0.00108	0.000858
Perfluorodecanesulfonic acid (PFDS)		0.000173	0.0000894	ND (0.0000032)
Perfluorodecanoic acid (PFDA)		0.000180	0.00000518	ND (0.0000032)
Perfluorododecanesulfonic acid (PFDoS)		0.000109	0.0000250	ND (0.0000032)
Perfluorododecanoic acid (PFDoA)		0.0000717	ND (0.0000043)	0.0000131
Perfluoroheptanesulfonic acid (PFHpS)		0.0334	0.000594	ND (0.0000032)
Perfluoroheptanoic acid (PFHpA)		0.00612	0.000561	0.0000295
Perfluorohexanesulfonic acid (PFHxS)		0.179	0.0180	0.00000396
Perfluorohexanoic acid (PFHxA)		0.0223	0.00409	0.00646
Perfluorononanesulfonic acid (PFNS)		0.000392	0.0000763	ND (0.0000032)
Perfluorononanoic acid (PFNA)		0.0000409	0.00000561	0.00000284
Perfluorooctanesulfonamide (PFOSAm)		0.000228	0.0000644	ND (0.0000032)
Perfluorooctanesulfonic acid (PFOS)		0.0835	0.0776	0.0000317
Perfluorooctanoic acid (PFOA)		0.0179	0.00241	0.000143
Perfluoropentanesulfonic acid (PFPeS)		0.0266	0.00450	ND (0.0000032)
Perfluoropentanoic acid (PFPeA)		0.00603	0.00322	0.000297
Perfluorotetradecanoic acid (PFTeDA)		0.0000295	ND (0.0000043)	0.00000474
Perfluorotridecanoic acid (PFTrDA)		0.0000180	0.0000492	ND (0.0000043)
Perfluoroundecanoic acid (PFUnA)		0.00000932	0.0000472	ND (0.0000032)

Appendix VIII - PFAS concentration in contaminated soil used in Campaign 1

Non-detected PFAS (ND) are considered to be at MDL.

Parameter	Units	C2-R1	C2-R2	C2-R3
Date Tested	-	8/3/2024	8/4/2024	8/4/2024
Sample Collection Time	minutes	240	240	240
Waste Input Rate - Liquid Contaminated Soil (lb/hr)	lb/hr	4,825	3,910	2,937
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUd5)		ND(0.00000093)	ND(0.00000075)	ND(0.00000056)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)		0.000105	0.0000848	0.0000637
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)		0.0000231	0.0000187	0.0000140
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)		0.0117	0.00946	0.00711
3-Perfluoroheptylpropanoic acid (7:3 FTCA)		0.00000326	0.00000264	0.00000199
3-Perfluoropentylpropanoic acid (5:3 FTCA)		0.0000290	0.0000235	0.0000177
3-Perfluoropropylpropanoic acid (3:3 FTCA)		0.00000156	0.00000127	0.000000952
4,8-Dioxa-3H-perfluorononanoic acid (DONA)		ND(0.00000093)	ND(0.00000075)	ND(0.00000056)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)		ND(0.00000093)	ND(0.00000075)	ND(0.00000056)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)		0.000451	0.000365	0.000274
N-ethylperfluorooctane sulfonamide (NEtFOSA)		0.00000550	0.00000446	0.00000335
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)		0.000138	0.000112	0.0000843
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)		ND(0.00000093)	ND(0.00000075)	ND(0.00000056)
N-methylperfluorooctane sulfonamide (NMeFOSA)		ND (0.0000023)	ND (0.0000019)	ND (0.0000014)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)		0.00000438	0.00000355	0.00000267
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)		ND(0.00000093)	ND(0.00000075)	ND(0.00000056)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)		0.0000120	0.00000974	0.00000731
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)		ND(0.00000093)	ND(0.00000075)	ND(0.00000056)
Perfluoro-3-methoxypropanoic acid (PFMPA)		0.00000310	0.00000251	0.00000189
Perfluoro-4-methoxybutanoic acid (PFMBA)		ND(0.00000093)	ND(0.00000075)	ND(0.00000056)
Perfluorobutanesulfonic acid (PFBS)	lb/hr	0.000138	0.000112	0.0000840
Perfluorobutanoic acid (PFBA)		0.000360	0.000292	0.000219
Perfluorodecanesulfonic acid (PFDS)		0.00000414	0.00000336	0.00000252
Perfluorodecanoic acid (PFDA)		0.000105	0.0000848	0.0000637
Perfluorododecanesulfonic acid (PFDoS)		0.00000122	0.000000985	0.000000740
Perfluorododecanoic acid (PFDoA)		0.0000152	0.0000124	0.00000928
Perfluoroheptanesulfonic acid (PFHpS)		0.0000352	0.0000285	0.0000214
Perfluoroheptanoic acid (PFHpA)		0.000454	0.000368	0.000277
Perfluorohexanesulfonic acid (PFHxS)		0.00101	0.000817	0.000614
Perfluorohexanoic acid (PFHxA)		0.00172	0.00139	0.00105
Perfluorononanesulfonic acid (PFNS)		0.00000207	0.00000168	0.00000126
Perfluorononanoic acid (PFNA)		0.0000385	0.0000312	0.0000235
Perfluorooctanesulfonamide (PFOSAm)		0.000387	0.000314	0.000236
Perfluorooctanesulfonic acid (PFOS)		0.00719	0.00583	0.00438
Perfluorooctanoic acid (PFOA)		0.000806	0.000653	0.000490
Perfluoropentanesulfonic acid (PFPeS)		0.000178	0.000144	0.000108
Perfluoropentanoic acid (PFPeA)		0.000301	0.000244	0.000183
Perfluorotetradecanoic acid (PFTeDA)		0.00000700	0.00000567	0.00000426
Perfluorotridecanoic acid (PFTrDA)		0.000671	0.000543	0.000408
Perfluoroundecanoic acid (PFUnA)		0.000622	0.000504	0.000379

Appendix IX-A PFAS concentration in solid residues from AFFF incineration Campaign 1

Non-detected PFAS (ND) are considered to be at MDL.

Parameter	C1-R1	C1-R2	C1-R3
Date Tested	7/31/2024	8/1/2024	8/1/2024
Sample Collection Time	13:45	18:45, 4:00	18:30
Waste Input Rate - Solids (lb/hr)	5,403	5,403	5,403
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (0.0000092)	ND (0.0000094)	ND (0.0000095)
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (0.0000092)	ND (0.0000094)	ND (0.0000095)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ND (0.0000092)	ND (0.0000094)	ND (0.0000095)
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND (0.000015)	ND (0.000016)	ND (0.000016)
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (0.0000077)	ND (0.0000079)	ND (0.0000079)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (0.0000077)	ND (0.0000079)	ND (0.0000079)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (0.0000077)	ND (0.0000079)	ND (0.0000079)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (0.0000077)	ND (0.0000079)	ND (0.0000079)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluorobutanesulfonic acid (PFBS)	ND (0.0000062)	ND (0.0000063)	ND (0.0000063)
Perfluorobutanoic acid (PFBA)	ND (0.000012)	ND (0.000013)	ND (0.000013)
Perfluorodecanesulfonic acid (PFDS)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluorodecanoic acid (PFDA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluorododecanesulfonic acid (PFDoS)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluorododecanoic acid (PFDoA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluoroheptanoic acid (PFHpA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluorohexanesulfonic acid (PFHxS)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluorohexanoic acid (PFHxA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluorononanesulfonic acid (PFNS)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluorononanoic acid (PFNA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluorooctanesulfonamide (PFOSAm)	<0.0000032 DLL	<0.0000034 DLL	ND (0.0000032)
Perfluorooctanesulfonic acid (PFOS)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluorooctanoic acid (PFOA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluoropentanesulfonic acid (PFPeS)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluoropentanoic acid (PFPeA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluorotetradecanoic acid (PFTeDA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluorotridecanoic acid (PFTrDA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)
Perfluoroundecanoic acid (PFUnA)	ND (0.0000031)	ND (0.0000031)	ND (0.0000032)

Appendix IX-B PFAS concentration in liquid residues (blowdowns) from AFFF incineration (campaign 1)

Non-detected PFAS (ND) are considered to be at MDL.

Parameter	C1-R1	C1-R2	C1-R3
Date Tested	7/31/2024	8/1/2024	8/1/2024
Sample Collection Time	13:45	18:45	18:30
Waste Input Rate - Liquid (gal/hr)	7,450	7,255	7,699
11-Chloroicosafauro-3-oxaundecane-1-sulfonic acid (11CI-PF3OUdS)	ND (0.000000031)	ND (0.000000029)	ND (0.000000031)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (0.000000037)	ND (0.000000035)	ND (0.000000038)
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (0.000000031)	ND (0.000000029)	ND (0.000000031)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	0.00000104	0.000000542	0.00000125
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.000000068)	ND (0.000000064)	ND (0.000000069)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.000000031)	ND (0.000000029)	ND (0.000000031)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.000000031)	0.0000000306	ND (0.000000031)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.000000031)	ND (0.000000029)	ND (0.000000031)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CI-PF3ONS)	ND (0.000000031)	ND (0.000000029)	ND (0.000000031)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.000000131	0.000000130	0.000000146
N-ethylperfluorooctane sulfonamide (NETFOSA)	ND (0.000000025)	ND (0.000000023)	ND (0.000000025)
N-ethylperfluorooctane sulfonamidoethanol (NETFOSE)	ND (0.000000025)	ND (0.000000023)	ND (0.000000025)
N-ethylperfluorooctanesulfonamidoacetic acid (NETFOSAA)	ND (0.000000031)	ND (0.000000029)	ND (0.000000031)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (0.000000043)	ND (0.000000041)	ND (0.000000044)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (0.000000025)	ND (0.000000023)	ND (0.000000025)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.000000025)	ND (0.000000023)	ND (0.000000025)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.000000018)	ND (0.000000018)	ND (0.000000019)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	ND (0.000000018)	ND (0.000000018)	ND (0.000000019)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.000000018)	ND (0.000000018)	ND (0.000000019)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.000000018)	ND (0.000000018)	ND (0.000000019)
Perfluorobutanesulfonic acid (PFBS)	0.000000190	0.000000191	0.000000213
PFBA	0.00000122	0.00000110	0.00000126
Perfluorodecanesulfonic acid (PFDS)	ND (0.000000018)	ND (0.000000018)	ND (0.000000019)
Perfluorodecanoic acid (PFDA)	ND (0.000000018)	ND (0.000000018)	ND (0.000000019)
Perfluorododecanesulfonic acid (PFDoS)	ND (0.000000018)	ND (0.000000018)	ND (0.000000019)
Perfluorododecanoic acid (PFDoA)	ND (0.000000025)	ND (0.000000023)	ND (0.000000025)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.000000018)	ND (0.000000018)	ND (0.000000019)
PFHpA	0.000000796	0.000000757	0.000000695
Perfluorohexanesulfonic acid (PFHxS)	0.000000171	0.000000162	0.000000179
PFHxA	0.00000175	0.00000165	0.00000163
Perfluorononanesulfonic acid (PFNS)	ND (0.000000018)	ND (0.000000018)	ND (0.000000019)
PFNA	0.0000000647	0.0000000702	0.0000000561
Perfluorooctanesulfonamide (PFOSAm)	ND (0.000000018)	ND (0.000000018)	0.0000000188
Perfluorooctanesulfonic acid (PFOS)	0.000000200	0.000000179	0.000000205
PFOA	0.000000183	0.000000174	0.000000177
Perfluoropentanesulfonic acid (PFPeS)	0.0000000338	0.0000000325	0.0000000439
PFPeA	0.00000170	0.0000016	0.00000183
Perfluorotetradecanoic acid (PFTeDA)	ND (0.000000025)	0.000000023	ND (0.000000025)
Perfluorotridecanoic acid (PFTrDA)	ND (0.000000025)	0.000000023	ND (0.000000025)
Perfluoroundecanoic acid (PFUnA)	ND (0.000000018)	0.000000018	ND (0.000000019)

Appendix X-A : PFAS concentration in solid residues from contaminated soil incineration (campaign 1)

Non-detected PFAS (ND) are considered to be at MDL.

Parameter	C2-R1	C2-R2	C2-R3
Date Tested	8/3/2024	8/4/2024	8/4/2024
Sample Collection Time	13:15	19:00	19:15
Waste Input Rate - Solids (lb/hr)	5,584	5,584	5,584
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (0.0000098)	ND (0.0000096)	ND (0.0000095)
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (0.0000098)	ND (0.0000096)	ND (0.0000095)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ND (0.0000098)	ND (0.0000096)	ND (0.0000095)
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND (0.000016)	ND (0.000016)	ND (0.000016)
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (0.0000081)	ND (0.0000080)	ND (0.0000079)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (0.0000081)	ND (0.0000080)	ND (0.0000079)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (0.0000081)	ND (0.0000080)	ND (0.0000079)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (0.0000081)	ND (0.0000080)	ND (0.0000079)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorobutanesulfonic acid (PFBS)	ND (0.0000065)	ND (0.0000064)	ND (0.0000063)
Perfluorobutanoic acid (PFBA)	ND (0.000013)	ND (0.000013)	ND (0.000013)
Perfluorodecanesulfonic acid (PFDS)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorodecanoic acid (PFDA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorododecanesulfonic acid (PFDoS)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorododecanoic acid (PFDoA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluoroheptanoic acid (PFHpA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorohexanesulfonic acid (PFHxS)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorohexanoic acid (PFHxA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorononanesulfonic acid (PFNS)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorononanoic acid (PFNA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorooctanesulfonamide (PFOSAm)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorooctanesulfonic acid (PFOS)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorooctanoic acid (PFOA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluoropentanesulfonic acid (PFPeS)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluoropentanoic acid (PFPeA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorotetradecanoic acid (PFTeDA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluorotridecanoic acid (PFTrDA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)
Perfluoroundecanoic acid (PFUnA)	ND (0.0000033)	ND (0.0000032)	ND (0.0000032)

Appendix X-B : PFAS concentration in liquid residues from contaminated soil incineration (campaign 1)

Non-detected PFAS (ND) are considered to be at MDL.

Parameter	C2-R1	C2-R2	C2-R3
Date Tested	8/3/24 – 8/4/24	8/4/2024	8/4/24 – 8/5/24
Sample Collection Time	13:15, 19:00, 22:30, 02:30	19:15	23:15, 03:15, 07:15, 19:15
Waste Input Rate - Liquid (gal/hr)	7,461	6,931	7,179
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.00000012)	ND (0.000000028)	ND (0.00000011)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	0.000000194	ND (0.000000034)	0.000000365
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	<0.00000013 DLL	ND (0.000000028)	0.000000119
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	0.0000461	0.00000821	0.000151
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.00000027)	ND (0.000000061)	ND (0.00000025)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.00000012)	ND (0.000000028)	ND (0.00000011)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.00000012)	ND (0.000000028)	ND (0.00000011)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.00000012)	ND (0.000000028)	ND (0.00000011)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.00000012)	ND (0.000000028)	ND (0.00000011)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.00000150	0.000000179	0.00000139
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (0.000000097)	ND (0.000000022)	ND (0.000000089)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (0.000000097)	ND (0.000000022)	ND (0.000000089)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.00000012)	ND (0.000000028)	ND (0.00000011)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (0.00000017)	ND (0.000000039)	0.000000113
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (0.000000097)	ND (0.000000022)	ND (0.000000089)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.000000097)	ND (0.000000022)	ND (0.000000089)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.000000072)	ND (0.000000017)	<0.000000068 DLL
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	ND (0.000000072)	ND (0.000000017)	ND (0.000000067)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.000000072)	ND (0.000000017)	ND (0.000000067)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.000000072)	ND (0.000000017)	ND (0.000000067)
Perfluorobutanesulfonic acid (PFBS)	0.00000114	0.000000222	0.000000908
Perfluorobutanoic acid (PFBA)	0.00000634	0.00000127	0.00000740
Perfluorodecanesulfonic acid (PFDS)	ND (0.000000072)	ND (0.000000017)	ND (0.000000067)
Perfluorodecanoic acid (PFDA)	0.0000000413	ND (0.000000017)	<0.000000072 DLL
Perfluorododecanesulfonic acid (PFDoS)	ND (0.000000072)	ND (0.000000017)	<0.000000071 DLL
Perfluorododecanoic acid (PFDoA)	ND (0.000000097)	ND (0.000000022)	ND (0.000000089)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.000000072)	ND (0.000000017)	ND (0.000000067)
Perfluoroheptanoic acid (PFHpA)	0.00000511	0.000000706	0.00000555
Perfluorohexanesulfonic acid (PFHxS)	0.000000857	0.000000199	0.000000719
Perfluorohexanoic acid (PFHxA)	0.0000131	0.00000178	0.0000188
Perfluorononanesulfonic acid (PFNS)	ND (0.000000072)	ND (0.000000017)	ND (0.000000067)
Perfluorononanoic acid (PFNA)	0.000000342	0.0000000508	0.000000162
Perfluorooctanesulfonamide (PFOSAm)	0.000000305	0.000000152	0.0000000527
Perfluorooctanesulfonic acid (PFOS)	0.000000973	0.000000227	0.000000723
Perfluorooctanoic acid (PFOA)	0.00000106	0.000000165	0.00000104
Perfluoropentanesulfonic acid (PFPeS)	0.000000187	0.0000000334	0.000000155
Perfluoropentanoic acid (PFPeA)	0.00000920	0.00000182	0.0000114
Perfluorotetradecanoic acid (PFTeDA)	ND (0.000000097)	ND (0.000000022)	0.0000000611
Perfluorotridecanoic acid (PFTrDA)	ND (0.000000097)	ND (0.000000022)	<0.000000090 DLL
Perfluoroundecanoic acid (PFUnA)	ND (0.000000072)	ND (0.000000017)	ND (0.000000067)

Appendix XI-A OTM-45 and DRE for the AFFF run#1 in campaign 1

	AFFF TF Feed Stream	R1 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
Feed Rate	2,421		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.0245	0.000000075*	>99.9997
Perfluorobutanoic acid (PFBA)	0.00443	0.00000087*	>99.9804
Perfluorodecanesulfonic acid (PFDS)	0.000164	0.000000025*	>99.9848
Perfluorodecanoic acid (PFDA)	0.000178	0.000000183	99.8972
Perfluorododecanesulfonic acid (PFDoS)	0.000087	0.000000022*	>99.9746
Perfluorododecanoic acid (PFDoA)	0.0000675	0.000000081	99.8807
Perfluoroheptanesulfonic acid (PFHps)	0.0334	0.000000027*	>99.9999
Perfluoroheptanoic acid (PFHpA)	0.00583	0.000000912	99.9844
Perfluorohexadecanoic acid	--	0.000000073	--
Perfluorohexanesulfonic acid (PFHxS)	0.179	0.000000027*	>99.9999
Perfluorohexanoic acid (PFHxA)	0.0223	0.000000605	99.9973
Perfluorononanesulfonic acid (PFNS)	0.000327	0.000000019*	>99.9942
Perfluorononanoic acid (PFNA)	0.0000409	0.000000041	98.9927
Perfluorooctadecanoic acid	--	0.000000047*	--
Perfluorooctanesulfonamide (FOSA)	0.000223	0.000000024*	>99.9892
Perfluorooctanesulfonic acid (PFOS)	0.0835	0.000000038*	>99.9999
Perfluorooctanoic acid (PFOA)	0.01790	0.000000078	99.9956
Perfluoropentanesulfonic acid (PFPeS)	0.0266	0.000000024*	>99.9999
Perfluoropentanoic acid (PFPeA)	0.00603	0.000000033	99.9945
Perfluorotetradecanoic acid (PFTeA)	0.0000295	0.00000001	99.6881
Perfluorotridecanoic acid (PFTriA)	0.000018	0.000000008	99.5417
Perfluoroundecanoic acid (PFUnA)	0.00000932	0.000000012	98.7554
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.0000059*	0.000000021*	>99.6441
N-ethylperfluoro-1-octanesulfonamide	0.0000685	0.000000064*	>99.9066
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.0000047*	0.000000024*	>99.4894
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.0000207	0.000000020*	>99.9034
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.0000059*	0.000000025*	>99.5763
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.000455	0.000000037*	>99.9919
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.000264	0.00000016*	>99.3939
PES	--	0.000000021*	--
PFECA A	--	0.000000031*	--
PFECA B	--	0.000000027*	--
PFECA F	--	0.000000025*	--
PFECHS	--	0.000000030*	--
DONA	0.0000059*	0.000000096*	>98.3729
HFPO-DA	0.00000586	0.000000099*	>83.1058
NMeFOSA	0.0000458	0.000000068*	>99.8515
10:2 FTCA	--	0.000000075*	--
10:2 FTS	--	0.000000032*	--
3:3 FTCA	0.00000612	0.000000049*	>99.1993
4:2 FTS	0.0000353	0.000000012*	>99.9660
5:3 FTCA	0.000022	0.000000090*	>99.5909
6:2 FTCA	--	0.000000110*	--

6:2 FTS	0.00426	0.00000080*	>99.9812
6:2 FTUCA	--	0.000000026*	--
7:3 FTCA	0.000013*	0.000000068*	>99.4769
8:2 FTCA	--	0.000000064*	--
8:2 FTS	0.00197	0.000000026*	>99.9987
8:2 FTUCA	--	0.000000037*	--
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	0.0000035*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	0.00000625	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000154	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.0000231	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ.

For DRE calculation, PFAS not detected in the waste are considered to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XI-B OTM-45 and DRE for the AFFF run#2 in campaign 1

Feed Rate	AFFF TF Feed Stream	R2 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	2,175		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.0022	0.000000076*	>99.9965
Perfluorobutanoic acid (PFBA)	0.00108	0.00000059*	99.9455
Perfluorodecanesulfonic acid (PFDS)	0.000089	0.000000025*	>99.9720
Perfluorodecanoic acid (PFDA)	0.000005	0.000000164	96.8340
Perfluorododecanesulfonic acid (PFDoS)	0.000025	0.000000023*	>99.9080
Perfluorododecanoic acid (PFDoA)	0.0000043*	0.000000072	>98.3302
Perfluoroheptanesulfonic acid (PFHpS)	0.0006	0.000000027*	>99.9955
Perfluoroheptanoic acid (PFHpA)	0.00056	0.000000398	99.9291
Perfluorohexadecanoic acid	--	0.000000058	--
Perfluorohexanesulfonic acid (PFHxS)	0.018	0.000000028*	>99.9998
Perfluorohexanoic acid (PFHxA)	0.0041	0.000000338	99.9917
Perfluorononanesulfonic acid (PFNS)	0.000076	0.000000019*	>99.9751
Perfluorononanoic acid (PFNA)	0.0000056	0.000000029	94.8485
Perfluorooctadecanoic acid	--	0.000000050*	--
Perfluorooctanesulfonamide (FOSA)	0.000064	0.000000025*	>99.9612
Perfluorooctanesulfonic acid (PFOS)	0.0776	0.000000035*	>100.0000
Perfluorooctanoic acid (PFOA)	0.00241	0.000000038	99.9843
Perfluoropentanesulfonic acid (PFPeS)	0.0045	0.000000025*	>99.9994
Perfluoropentanoic acid (PFPeA)	0.00322	0.000000027	99.9916
Perfluorotetradecanoic acid (PFTeA)	0.0000043*	0.00000001	98.6628
Perfluorotridecanoic acid (PFTriA)	0.000049	0.000000007	99.8663
Perfluoroundecanoic acid (PFUnA)	0.00004720	0.000000010	99.7860
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.0000053*	0.000000022*	>99.5849
N-ethylperfluoro-1-octanesulfonamide	0.0000043*	0.000000066*	>98.4651
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.0000043*	0.000000025*	>99.4186
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.0000053*	0.000000021*	>99.6038
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.0000053*	0.000000026*	>99.5094
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.000040	0.000000038*	>99.9040
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.000018	0.00000017*	>90.6077
PES	--	0.000000022*	--
PFECA A	--	0.000000031*	--
PFECA B	--	0.000000028*	--
PFECA F	--	0.000000027*	--
PFECHS	--	0.000000030*	--
DONA	0.0000053*	0.000000099*	>98.1321
HFPO-DA	0.0000043*	0.000000100*	>76.7442
NMeFOSA	0.0000075*	0.000000070*	>99.0667
10:2 FTCA	--	0.000000076*	--
10:2 FTS	--	0.000000032*	--
3:3 FTCA	0.0000053*	0.000000050*	>99.0566
4:2 FTS	0.0000857	0.000000012*	>99.9860
5:3 FTCA	0.000009	0.000000092*	>98.9834
6:2 FTCA	--	0.000000110*	--
6:2 FTS	0.00868	0.000000083*	>99.9904
6:2 FTUCA	--	0.000000027*	--
7:3 FTCA	0.000012*	0.000000069*	>99.4250
8:2 FTCA	--	0.000000065*	--

8:2 FTS	0.00010	0.000000026*	>99.9731
8:2 FTUCA	--	0.000000037*	--
Nonafluoro-3,6-dioxahexanoic acid (NFDHA)	0.0000032*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	0.0000032*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000032*	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.0000032*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XI-C OTM-45 and DRE for the AFFF run#3 in campaign 1

Feed Rate	AFFF TF Feed Stream	R3 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	2,235		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.0000032*	0.000000079*	>97.5313
Perfluorobutanoic acid (PFBA)	0.000858	0.00000080*	>99.9068
Perfluorodecanesulfonic acid (PFDS)	0.0000032*	0.000000025*	>99.2188
Perfluorodecanoic acid (PFDA)	0.0000032*	0.000000036*	>98.8750
Perfluorododecanesulfonic acid (PFDoS)	0.0000032*	0.000000023*	>99.2813
Perfluorododecanoic acid (PFDoA)	0.0000131	0.000000012*	99.9115
Perfluoroheptanesulfonic acid (PFHpS)	0.0000032*	0.000000028*	>99.1250
Perfluoroheptanoic acid (PFHpA)	0.0000295	0.000001300*	95.5932
Perfluorohexadecanoic acid	--	0.000000044*	--
Perfluorohexanesulfonic acid (PFHxS)	0.00000396	0.000000029*	>99.2677
Perfluorohexanoic acid (PFHxA)	0.00646	0.000000339*	99.9948
Perfluorononanesulfonic acid (PFNS)	0.0000032*	0.000000019*	>99.4063
Perfluorononanoic acid (PFNA)	0.00000284	0.000000075*	>97.3592
Perfluorooctadecanoic acid	--	0.000000045*	--
Perfluorooctanesulfonamide (FOSA)	0.0000032*	0.000000025*	>99.2188
Perfluorooctanesulfonic acid (PFOS)	0.0000317	0.000000038*	>99.8801
Perfluorooctanoic acid (PFOA)	0.000143	0.000000147*	99.8972
Perfluoropentanesulfonic acid (PFPeS)	0.0000032*	0.000000025*	>99.2188
Perfluoropentanoic acid (PFPeA)	0.000297	0.000000082*	99.9724
Perfluorotetradecanoic acid (PFTeA)	0.0000032*	0.000000035*	98.9000
Perfluorotridecanoic acid (PFTriA)	0.0000043*	0.000000022*	99.4814
Perfluoroundecanoic acid (PFUnA)	0.0000032*	0.000000036*	98.8750
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.0000054*	0.000000022*	>99.5926
N-ethylperfluoro-1-octanesulfonamide	0.0000043*	0.000000066*	>98.4651
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.0000043*	0.000000025*	>99.4186
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.0000054*	0.000000021*	>99.6111
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.0000054*	0.000000026*	>99.5185
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.0000043*	0.000000038*	>99.1163
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.0000043*	0.00000017*	>60.4651
PES	--	0.000000022*	--
PFECA A	--	0.000000032*	--
PFECA B	--	0.000000028*	--
PFECA F	--	0.000000025*	--
PFECHS	--	0.000000031*	--
DONA	0.0000054*	0.000000099*	>98.1667
HFPO-DA	0.0000043*	0.00000010*	>76.7442
NMeFOSA	0.0000075*	0.000000070*	>99.0667
10:2 FTCA	--	0.000000077*	--
10:2 FTS	--	0.000000033*	--
3:3 FTCA	0.0000054*	0.000000051*	>99.0556
4:2 FTS	0.0003800	0.000000013*	>99.9966
5:3 FTCA	0.000020	0.000000093*	>99.5303
6:2 FTCA	--	0.000000011*	--
6:2 FTS	0.0102	0.000000083*	>99.9919
6:2 FTUCA	--	0.000000027*	--
7:3 FTCA	0.000029*	0.000000070*	>99.7552
8:2 FTCA	--	0.000000066*	--

8:2 FTS	0.00011	0.000000027*	>99.9761
8:2 FTUCA	--	0.000000038*	--
Nonafluoro-3,6-dioxahexanoic acid (NFDHA)	0.0000032*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	0.0000032*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000032*	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.0000032*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XII-A OTM-45 and DRE for the contaminated soil run#1 in campaign 1

Feed Rate	Cont. Soil Feed Stream	R1 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	4,825		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.000138	0.000000074*	>99.9464
Perfluorobutanoic acid (PFBA)	0.00036	0.00000077*	>99.7861
Perfluorodecanesulfonic acid (PFDS)	0.0000041	0.000000025*	>99.3961
Perfluorodecanoic acid (PFDA)	0.000105	0.000000120	99.8857
Perfluorododecanesulfonic acid (PFDoS)	0.00000122	0.000000022*	>98.1967
Perfluorododecanoic acid (PFDoA)	0.0000152	0.0000000551	99.6375
Perfluoroheptanesulfonic acid (PFHpS)	0.0000352	0.000000027*	>99.9233
Perfluoroheptanoic acid (PFHpA)	0.00045	0.000000242	99.9467
Perfluorohexadecanoic acid	--	0.0000000488	--
Perfluorohexanesulfonic acid (PFHxS)	0.00101	0.0000000156	99.9985
Perfluorohexanoic acid (PFHxA)	0.00172	0.000000233	99.9865
Perfluorononanesulfonic acid (PFNS)	0.0000021	0.000000019*	>99.0821
Perfluorononanoic acid (PFNA)	0.0000385	0.000000179	99.5351
Perfluorooctadecanoic acid	--	0.0000000361	--
Perfluorooctanesulfonamide (FOSA)	0.000387	0.000000024*	>99.9938
Perfluorooctanesulfonic acid (PFOS)	0.0072	0.000000033*	>99.9995
Perfluorooctanoic acid (PFOA)	0.00081	0.000000233	99.9711
Perfluoropentanesulfonic acid (PFPeS)	0.000178	0.000000024*	>99.9865
Perfluoropentanoic acid (PFPeA)	0.00030	0.000000152	99.9495
Perfluorotetradecanoic acid (PFTeA)	0.0000070	0.0000000416	99.4057
Perfluorotridecanoic acid (PFTriA)	0.000671	0.0000000528	99.9921
Perfluoroundecanoic acid (PFUnA)	0.000622	0.0000000678	99.9891
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.00000093*	0.000000021*	>97.7419
N-ethylperfluoro-1-octanesulfonamide	0.0000055	0.000000064*	>98.8364
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.00000093*	0.000000024*	>97.4194
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.00000093*	0.000000021*	>97.7419
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.00000093*	0.000000025*	>97.3118
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.000138	0.000000037*	>99.9732
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.0000044	0.00000016*	>63.4703
PES	--	0.000000022*	--
PFECA A	--	0.000000031*	--
PFECA B	--	0.000000028*	--
PFECA F	--	0.000000025*	--
PFECHS	--	0.000000030*	--
DONA	0.00000093*	0.000000095*	>89.7849
HFPO-DA	0.000451	0.000000099*	>99.7805
NMeFOSA	0.00000230*	0.000000068*	>97.0435
10:2 FTCA	--	0.000000075*	--
10:2 FTS	--	0.000000032*	--
3:3 FTCA	0.00000156	0.000000049*	>96.8590
4:2 FTS	0.0000231	0.000000012*	>99.9481
5:3 FTCA	0.000029	0.000000090*	>99.6897
6:2 FTCA	--	0.000000011*	--
6:2 FTS	0.0117	0.000000080*	>99.9932
6:2 FTUCA	--	0.000000026*	--
7:3 FTCA	0.0000033*	0.000000068*	>97.9141
8:2 FTCA	--	0.000000064*	--

8:2 FTS	0.00011	0.000000026*	>99.9752
8:2 FTUCA	--	0.000000037*	--
Nonafluoro-3,6-dioxahexanoic acid (NFDHA)	0.0000120*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	0.00000093*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000031	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.00000093*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XII-B OTM-45 and DRE for the contaminated soil run#2 in campaign 1

Feed Rate	Cont. Soil Feed Stream	R2 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	3,910		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.000112	0.000000074*	>99.9339
Perfluorobutanoic acid (PFBA)	0.00029	0.00000082*	>99.7192
Perfluorodecanesulfonic acid (PFDS)	0.00000336	0.000000025*	>99.2560
Perfluorodecanoic acid (PFDA)	0.000085	0.000000239	99.7182
Perfluorododecanesulfonic acid (PFDoS)	0.00000099	0.000000022*	>97.7665
Perfluorododecanoic acid (PFDoA)	0.0000124	0.0000000855	99.3105
Perfluoroheptanesulfonic acid (PFHpS)	0.0000285	0.000000027*	>99.9053
Perfluoroheptanoic acid (PFHpA)	0.000037	0.0000000818	99.7777
Perfluorohexadecanoic acid	--	0.0000000345	--
Perfluorohexanesulfonic acid (PFHxS)	0.00082	0.000000028*	>99.9966
Perfluorohexanoic acid (PFHxA)	0.00139	0.0000000706	99.9492
Perfluorononanesulfonic acid (PFNS)	0.0000017	0.000000019*	>98.8690
Perfluorononanoic acid (PFNA)	0.0000312	0.0000000465	98.5096
Perfluorooctadecanoic acid	--	0.000000064*	--
Perfluorooctanesulfonamide (FOSA)	0.000314	0.000000024*	>99.9924
Perfluorooctanesulfonic acid (PFOS)	0.0058	0.000000033*	>99.9994
Perfluorooctanoic acid (PFOA)	0.00065	0.0000000793	99.8786
Perfluoropentanesulfonic acid (PFPeS)	0.000144	0.0000000116	99.9919
Perfluoropentanoic acid (PFPeA)	0.00024	0.0000000450	99.8156
Perfluorotetradecanoic acid (PFTeA)	0.0000057	0.0000000711	98.7460
Perfluorotridecanoic acid (PFTriA)	0.000543	0.0000000919	99.9831
Perfluoroundecanoic acid (PFUnA)	0.000504	0.000000135	99.9732
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.00000075*	0.000000022*	>97.0667
N-ethylperfluoro-1-octanesulfonamide	0.0000045	0.000000064*	>98.5650
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.00000075*	0.000000024*	>96.8000
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.00000075*	0.000000021*	>97.2000
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.00000075*	0.000000026*	>96.5333
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.000112	0.000000037*	>99.9670
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.0000036	0.00000017*	>52.1127
PES	--	0.000000022*	--
PFECA A	--	0.000000037*	--
PFECA B	--	0.000000028*	--
PFECA F	--	0.000000033*	--
PFECHS	--	0.000000030*	--
DONA	0.00000075*	0.000000096*	>87.2000
HFPO-DA	0.000365	0.00000100*	>99.7260
NMeFOSA	0.00000190*	0.000000068*	>96.4211
10:2 FTCA	--	0.000000075*	--
10:2 FTS	--	0.000000032*	--
3:3 FTCA	0.00000127	0.000000049*	>96.1417
4:2 FTS	0.00000187	0.000000012*	>99.9358
5:3 FTCA	0.000024	0.000000091*	>99.6128
6:2 FTCA	--	0.000000011*	--
6:2 FTS	0.0095	0.000000081*	>99.9914
6:2 FTUCA	--	0.000000026*	--
7:3 FTCA	0.0000026*	0.000000068*	>97.4242
8:2 FTCA	--	0.000000064*	--

8:2 FTS	0.000085	0.000000026*	>99.9693
8:2 FTUCA	--	0.000000037*	--
Nonafluoro-3,6-dioxahexanoic acid (NFDHA)	0.0000097*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	0.0000075*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000025	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.0000075*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XII-C OTM-45 and DRE for the contaminated soil run#3 in campaign 1

Feed Rate	Cont. Soil Feed Stream	R3 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	2,937		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.000084	0.000000073*	>99.9131
Perfluorobutanoic acid (PFBA)	0.00022	0.000000085*	>99.6119
Perfluorodecanesulfonic acid (PFDS)	0.00000252	0.000000024*	>99.0476
Perfluorodecanoic acid (PFDA)	0.000064	0.000000033*	>99.9482
Perfluorododecanesulfonic acid (PFDoS)	0.00000074	0.000000022*	>97.0270
Perfluorododecanoic acid (PFDoA)	0.0000093	0.0000000107	99.8847
Perfluoroheptanesulfonic acid (PFHpS)	0.0000214	0.000000003*	>99.8738
Perfluoroheptanoic acid (PFHpA)	0.00028	0.000000021*	>99.9242
Perfluorohexadecanoic acid	--	0.0000000285	--
Perfluorohexanesulfonic acid (PFHxS)	0.00061	0.0000000140	99.9977
Perfluorohexanoic acid (PFHxA)	0.00105	0.0000000129	99.9877
Perfluorononanesulfonic acid (PFNS)	0.0000013	0.000000019*	>98.4921
Perfluorononanoic acid (PFNA)	0.0000235	0.000000071*	>99.6979
Perfluorooctadecanoic acid	--	0.0000000287	--
Perfluorooctanesulfonamide (FOSA)	0.000236	0.000000024*	>99.9898
Perfluorooctanesulfonic acid (PFOS)	0.0044	0.000000035*	>99.9992
Perfluorooctanoic acid (PFOA)	0.00049	0.0000000576	99.9882
Perfluoropentanesulfonic acid (PFPeS)	0.000108	0.0000000120	99.9889
Perfluoropentanoic acid (PFPeA)	0.00018	0.0000000349	99.9809
Perfluorotetradecanoic acid (PFTeA)	0.0000043	0.0000000220	99.4836
Perfluorotridecanoic acid (PFTriA)	0.000408	0.0000000139	99.9966
Perfluoroundecanoic acid (PFUnA)	0.000379	0.000000031*	>99.9918
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.00000056*	0.000000021*	>96.2500
N-ethylperfluoro-1-octanesulfonamide	0.0000034	0.000000063*	>98.1194
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.00000056*	0.000000024*	>95.7143
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.00000056*	0.000000020*	>96.4286
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.00000056*	0.000000025*	>95.5357
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.000084	0.000000036*	>99.9573
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.0000027	0.00000016*	>40.0749
PES	--	0.000000021*	--
PFECA A	--	0.000000031*	--
PFECA B	--	0.000000027*	--
PFECA F	--	0.000000024*	--
PFECHS	--	0.000000029*	--
DONA	0.00000056*	0.000000094*	>83.2143
HFPO-DA	0.000274	0.000000098*	>99.6423
NMeFOSA	0.00000140*	0.000000067*	>95.2143
10:2 FTCA	--	0.000000074*	--
10:2 FTS	--	0.000000034*	--
3:3 FTCA	0.00000095	0.000000048*	>94.9580
4:2 FTS	0.0000140	0.000000012*	>99.9143
5:3 FTCA	0.000018	0.000000089*	>99.4972
6:2 FTCA	--	0.000000011*	--
6:2 FTS	0.0071	0.000000079*	>99.9889
6:2 FTUCA	--	0.000000026*	--
7:3 FTCA	0.0000020*	0.000000067*	>96.6332
8:2 FTCA	--	0.000000063*	--

8:2 FTS	0.000064	0.000000030*	>99.9529
8:2 FTUCA	--	0.000000037*	--
Nonafluoro-3,6-dioxahexanoic acid (NFDHA)	0.0000073*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	0.00000056*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000019	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.00000056*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XIII - A OTM-50 tables for AFFF - baseline run in campaign 1

Parameter	Units	BL-R1
Date Tested	-	07/31/2024
Sample Collection Time	minutes	180
Gas Volume Collected	dscf	12.690
Volumetric Flow Rate	dscfm	34.447
1,1,1,2,2-Pentafluoroethane (HFC-125)	lb/hr	ND (0.0027)
1,1,1-Trifluoroethane		ND (0.0019)
1,1,2-Trichloro-1,2,2-trifluoroethane		ND (0.0043)
1H-Heptafluoropropane		ND (0.0046)
1H-Nonafluorobutane		ND (0.0050)
1H-Perfluoroheptane		ND (0.0084)
1H-Perfluorohexane		ND (0.0073)
1H-Perfluorooctane		ND (0.0096)
1H-Perfluoropentane		ND (0.0062)
2H-Perfluoro-5-methyl-3,6-dioxanonane (E2)		ND (0.010)
Chlorodifluoromethane		ND (0.0020)
Chlorotrifluoroethene		ND (0.0026)
Chlorotrifluoromethane		ND (0.0024)
Decafluorobutane		ND (0.0054)
Difluoromethane (HFC-32)		ND (0.0012)
Dodecafluoropentane		ND (0.0066)
Ethane, 1,1,1,2-tetrafluoro- Fluoromethane		ND (0.0023)
Heptafluoropropyl 1,2,2,2-tetrafluoroethyl ether		ND (0.00078)
Hexadecafluoroheptane		ND (0.0065)
Hexafluoroethane		ND (0.0088)
Hexafluoropropene		ND (0.0031)
Hexafluoropropylene oxide		ND (0.0034)
Octadecafluorooctane		ND (0.0038)
Octafluorocyclobutane (FC-C318)		ND (0.0100)
Octafluorocyclopentene (FC-C1418)		ND (0.0046)
Octafluoropropane		ND (0.0048)
Tetradecafluorohexane		ND (0.0043)
Tetrafluoroethene		ND (0.0077)
Trichlorofluoromethane		ND (0.0023)
Trifluoromethane		ND (0.0031)
Vinyl Fluoride		ND (0.0016)
Tetrafluoromethane		ND (0.0010)
Tetrafluoromethane	ND (0.010)	

Appendix XIII - B OTM-50 tables for AFFF - run #1 and 2 and 3 in campaign 1

Parameter	Units	C1-R1	C1-R2	C1-R3
Date Tested	-	7/31/2024	8/1/2024	8/1/2024
Sample Collection Time	minute s	180	180	180
Gas Volume Collected	dscf	12.200	12.490	12.610
Volumetric Flow Rate	dscfm	32,923	34,582	34,142
1,1,1,2,2-Pentafluoroethane (HFC-125)	lb/hr	ND (0.0017)	ND (0.0015)	ND (0.0019)
1,1,1-Trifluoroethane		ND (0.0012)	ND (0.0010)	ND (0.0013)
1,1,2-Trichloro-1,2,2-trifluoroethane		ND (0.0026)	ND (0.0023)	ND (0.0030)
1H-Heptafluoropropane		ND (0.0028)	ND (0.0025)	ND (0.0032)
1H-Nonafluorobutane		ND (0.0031)	ND (0.0027)	ND (0.0035)
1H-Perfluoroheptane		ND (0.0051)	ND (0.0045)	ND (0.0059)
1H-Perfluorohexane		ND (0.0044)	ND (0.0039)	ND (0.0051)
1H-Perfluorooctane		ND (0.0058)	ND (0.0052)	ND (0.0067)
1H-Perfluoropentane		ND (0.0038)	ND (0.0033)	ND (0.0043)
2H-Perfluoro-5-methyl-3,6-dioxanonane (E2)		ND (0.0063)	ND (0.0056)	ND (0.0072)
Chlorodifluoromethane		ND (0.0012)	ND (0.0011)	ND (0.0014)
Chlorotrifluoroethene		ND (0.0016)	ND (0.0014)	ND (0.0018)
Chlorotrifluoromethane		ND (0.0015)	ND (0.0013)	ND (0.0017)
Decafluorobutane		ND (0.0033)	ND (0.0029)	ND (0.0038)
Difluoromethane (HFC-32)		ND (0.00072)	ND (0.00064)	ND (0.00082)
Dodecafluoropentane		ND (0.0040)	ND (0.0035)	ND (0.0046)
Ethane, 1,1,1,2-tetrafluoro- Fluoromethane		ND (0.0014)	ND (0.0013)	ND (0.0016)
Heptafluoropropyl 1,2,2,2-tetrafluoroethyl ether		ND (0.00047)	ND (0.00042)	ND (0.00054)
Hexadecafluoroheptane		ND (0.0040)	ND (0.0035)	ND (0.0045)
Hexafluoroethane		ND (0.0054)	ND (0.0048)	ND (0.0061)
Hexafluoropropene		ND (0.0019)	ND (0.0017)	ND (0.0022)
Hexafluoropropylene oxide		ND (0.0021)	ND (0.0018)	ND (0.0024)
Hexafluoropropylene oxide		ND (0.0023)	ND (0.0020)	ND (0.0026)
Octadecafluorooctane		ND (0.0061)	ND (0.0054)	ND (0.0069)
Octafluorocyclobutane (FC-C318)		ND (0.0028)	ND (0.0025)	ND (0.0032)
Octafluorocyclopentene (FC-C1418)		ND (0.0029)	ND (0.0026)	ND (0.0034)
Octafluoropropane		ND (0.0026)	ND (0.0023)	ND (0.0030)
Tetradecafluorohexane		ND (0.0047)	ND (0.0042)	ND (0.0054)
Tetrafluoroethene		ND (0.0014)	ND (0.0012)	ND (0.0016)
Trichlorofluoromethane		ND (0.0019)	ND (0.0017)	ND (0.0022)
Trifluoromethane		ND (0.00097)	ND (0.00086)	ND (0.0011)
Vinyl Fluoride		ND (0.00064)	ND (0.00057)	ND (0.00073)
Tetrafluoromethane		ND (0.0061)	ND (0.0054)	ND (0.0070)

Appendix XIII - C OTM-50 tables for contaminated soil - baseline run in campaign 1

Parameter	Units	C2-BL-R1
Date Tested	-	08/03/2024
Sample Collection Time	minutes	240
Gas Volume Collected	dscf	18.370
Volumetric Flow Rate	dscfm	32,866
1,1,1,2,2-Pentafluoroethane (HFC-125)	lb/hr	ND (0.0021)
1,1,1-Trifluoroethane		ND (0.0015)
1,1,2-Trichloro-1,2,2-trifluoroethane		ND (0.0033)
1H-Heptafluoropropane		ND (0.0035)
1H-Nonafluorobutane		ND (0.0038)
1H-Perfluoroheptane		ND (0.0064)
1H-Perfluorohexane		ND (0.0056)
1H-Perfluorooctane		ND (0.0073)
1H-Perfluoropentane		ND (0.0047)
2H-Perfluoro-5-methyl-3,6-dioxanonane (E2)		ND (0.0078)
Chlorodifluoromethane		ND (0.0015)
Chlorotrifluoroethene		ND (0.0020)
Chlorotrifluoromethane		ND (0.0018)
Decafluorobutane		ND (0.0041)
Difluoromethane (HFC-32)		ND (0.00090)
Dodecafluoropentane		ND (0.0050)
Ethane, 1,1,1,2-tetrafluoro-Fluoromethane		ND (0.0018)
Heptafluoropropyl 1,2,2,2-tetrafluoroethyl ether		ND (0.0050)
Hexadecafluoroheptane		ND (0.0067)
Hexafluoroethane		ND (0.0024)
Hexafluoropropene		ND (0.0026)
Hexafluoropropylene oxide		ND (0.0029)
Octadecafluorooctane		ND (0.0076)
Octafluorocyclobutane (FC-C318)		ND (0.0035)
Octafluorocyclopentene (FC-C1418)		ND (0.0037)
Octafluoropropane		ND (0.0033)
Tetradecafluorohexane		ND (0.0059)
Tetrafluoroethene		ND (0.0017)
Trichlorofluoromethane		ND (0.0024)
Trifluoromethane		ND (0.0012)
Vinyl Fluoride		ND (0.00080)
Tetrafluoromethane		ND (0.0077)

Appendix XIII-D : OTM-50 tables for contaminated soil - run 1,2,3 in campaign 1

Parameter	Units	C2-R1	C2-R2	C2-R3
Date Tested	-	8/3/2024	8/4/2024	8/4/2024
Sample Collection Time	minutes	240	240	240
Gas Volume Collected	dscf	18.730	18.860	20.080
Volumetric Flow Rate	dscfm	33,565	33,554	32,572
1,1,1,2,2-Pentafluoroethane (HFC-125)	lb/hr	ND (0.0022)	ND (0.0021)	ND (0.0025)
1,1,1-Trifluoroethane		ND (0.0015)	ND (0.0014)	ND (0.0017)
1,1,2-Trichloro-1,2,2-trifluoroethane		ND (0.0034)	ND (0.0032)	ND (0.0038)
1H-Heptafluoropropane		ND (0.0036)	ND (0.0034)	ND (0.0041)
1H-Nonafluorobutane		ND (0.0040)	ND (0.0038)	ND (0.0045)
1H-Perfluoroheptane		ND (0.0067)	ND (0.0063)	ND (0.0076)
1H-Perfluorohexane		ND (0.0058)	ND (0.0055)	ND (0.0065)
1H-Perfluorooctane		ND (0.0076)	ND (0.0072)	ND (0.0086)
1H-Perfluoropentane		ND (0.0049)	ND (0.0046)	ND (0.0055)
2H-Perfluoro-5-methyl-3,6-dioxanonane (E2)		ND (0.0082)	ND (0.0077)	ND (0.0092)
Chlorodifluoromethane		ND (0.0016)	ND (0.0015)	ND (0.0018)
Chlorotrifluoroethene		ND (0.0021)	ND (0.0020)	ND (0.0023)
Chlorotrifluoromethane		ND (0.0019)	ND (0.0018)	ND (0.0021)
Decafluorobutane		ND (0.0043)	ND (0.0041)	ND (0.0049)
Difluoromethane (HFC-32)		ND (0.00095)	ND (0.00089)	ND (0.0011)
Dodecafluoropentane		ND (0.0052)	ND (0.0049)	ND (0.0059)
Ethane, 1,1,1,2-tetrafluoro-		ND (0.0019)	ND (0.0017)	ND (0.0021)
Fluoromethane		ND (0.00062)	ND (0.00058)	ND (0.00070)
Heptafluoropropyl 1,2,2,2-tetrafluoroethyl ether		ND (0.0052)	ND (0.0049)	ND (0.0058)
Hexadecafluoroheptane		ND (0.0071)	ND (0.0066)	ND (0.0079)
Hexafluoroethane		ND (0.0025)	ND (0.0024)	ND (0.0028)
Hexafluoropropene		ND (0.0027)	ND (0.0026)	ND (0.0031)
Hexafluoropropylene oxide		ND (0.0030)	ND (0.0028)	ND (0.0034)
Octadecafluorooctane		ND (0.0080)	ND (0.0075)	ND (0.0090)
Octafluorocyclobutane (FC-C318)		ND (0.0036)	ND (0.0034)	ND (0.0041)
Octafluorocyclopentene (FC-C1418)		ND (0.0039)	ND (0.0036)	ND (0.0043)
Octafluoropropane		ND (0.0034)	ND (0.0032)	ND (0.0038)
Tetradecafluorohexane		ND (0.0061)	ND (0.0058)	ND (0.0069)
Tetrafluoroethene		ND (0.0018)	ND (0.0017)	ND (0.0020)
Trichlorofluoromethane		ND (0.0025)	ND (0.0023)	ND (0.0028)
Trifluoromethane		ND (0.0013)	ND (0.0012)	ND (0.0014)
Vinyl Fluoride		ND (0.00084)	ND (0.00079)	ND (0.00094)
Tetrafluoromethane		ND (0.0080)	ND (0.0075)	ND (0.0090)

Appendix XIV -A : Method 26A HF Results for baseline and AFFF run 1,2,3 in Campaign 1

Run No.		BL	1	2	3	
Date		31-Jul-24	31-Jul-24	01-Aug-24	01-Aug-24	
Start Time	Units	09:25	15:26	09:00	14:50	
Stop Time		13:20	18:47	12:40	18:15	AVGS
Sampling Parameters --						
Barometric Pressure	in. Hg	30.01	30.01	30.09	30.07	30.05
Volume Metered	dcf	95.878	98.949	100.239	100.290	98.839
Volume of Gas Collected	dscf	91.247	94.426	95.629	95.241	94.136
Moisture	% v/v	8.1	8.0	7.7	7.8	7.9
O ₂ at Stack	% dry	7.72	7.02	7.18	7.46	7.35
CO ₂ at Stack	% dry	9.98	10.16	10.01	9.14	9.82
Avg. Stack Temp.	°F	108	109	108	109	108
Stack Flowrate	dscfm	32,073	32,054	32,974	33,301	32,600
Isokinetics	%	102	105	104	102	103
HF Emission Results --						
Total HF Detected Acid Imp	µg	< 131.0	< 139.0	< 135.0	< 130.0	< 133.8
Total HF Detected Alkaline Imp	µg	< 187.0	< 168.0	< 179.0	< 184.0	< 179.5
Total HF Concentration	ppm	< 0.148	< 0.138	< 0.139	< 0.140	< 0.141
Conc. @ 7% O ₂	ppm	< 0.156	< 0.138	< 0.141	< 0.144	< 0.145
HF Emission Rate	lb/hr	< 0.015	< 0.014	< 0.014	< 0.015	< 0.014

Appendix XIV-B : Method 26A HF Results for baseline and contaminated soil run 1,2,3 in Campaign 1

Run No.		BL	1	2	3	
Date		03-Aug-24	03-Aug-24	04-Aug-24	04-Aug-24	
Start Time	Units	08:45	14:25	09:20	14:25	
Stop Time		13:07	18:50	13:35	18:40	AVGS
Sampling Parameters --						
Barometric Pressure	in. Hg	29.96	29.91	29.90	29.89	29.92
Volume Metered	dcf	136.380	125.097	123.140	118.601	125.805
Volume of Gas Collected	dscf	130.369	117.583	119.215	112.153	119.830
Moisture	% v/v	8.1	8.7	7.8	8.1	8.2
O ₂ at Stack	% dry	7.66	8.14	7.23	7.43	7.62
CO ₂ at Stack	% dry	9.98	9.28	9.85	9.53	9.66
Avg. Stack Temp.	°F	109	111	107	109	109
Stack Flowrate	dscfm	34,770	31,307	32,001	29,775	31,963
Isokinetics	%	101	101	100	101	101
HF Emission Results --						
Total HF Detected Acid Imp	µg	< 131.0	< 139.0	< 135.0	< 130.0	< 133.8
Total HF Detected Alkaline Imp	µg	< 187.0	< 168.0	< 179.0	< 184.0	< 179.5
Total HF Concentration	ppm	< 0.103	< 0.111	< 0.112	< 0.119	< 0.111
Conc. @ 7% O ₂	ppm	< 0.108	< 0.120	< 0.113	< 0.122	< 0.116
HF Emission Rate	lb/hr	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011

Appendix XV - A Waste profile, OTM-45 and DRE for AFFF run #1 in campaign 2

Feed Rate	AFFF TF Feed Stream	R1 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	2,184		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.000061	0.000000119	>99.8056
Perfluorobutanoic acid (PFBA)	0.00007	0.000000436	>99.3986
Perfluorodecanesulfonic acid (PFDS)	0.000052*	0.000000018*	>99.6538
Perfluorodecanoic acid (PFDA)	0.000013	0.000000517	>95.8640
Perfluorododecanesulfonic acid (PFDoS)	0.000052*	0.000000025*	>99.5192
Perfluorododecanoic acid (PFDoA)	0.000005	0.000001720	>67.9702
Perfluoroheptanesulfonic acid (PFHpS)	0.000014	0.000000023*	>99.8392
Perfluoroheptanoic acid (PFHpA)	0.000032	0.000000225	>99.2947
Perfluorohexadecanoic acid	--	0.000001990	--
Perfluorohexanesulfonic acid (PFHxS)	0.000568	0.000000010	>99.9983
Perfluorohexanoic acid (PFHxA)	0.00075	0.000000330	>99.9557
Perfluorononanesulfonic acid (PFNS)	0.000052*	0.000000017*	>99.6731
Perfluorononanoic acid (PFNA)	0.000005*	0.000000032	>93.8846
Perfluorooctadecanoic acid	--	0.000000549*	--
Perfluorooctanesulfonamide (FOSA)	0.000024	0.000000078*	>99.6750
Perfluorooctanesulfonic acid (PFOS)	0.0031	0.000000048	>99.9984
Perfluorooctanoic acid (PFOA)	0.00012	0.000000026	>99.7833
Perfluoropentanesulfonic acid (PFPeS)	0.000078	0.000000013*	>99.9832
Perfluoropentanoic acid (PFPeA)	0.000051	0.000000022	>99.5663
Perfluorotetradecanoic acid (PFTeA)	0.000005*	0.000000305	>41.3462
Perfluorotridecanoic acid (PFTriA)	0.000006	0.000000253	>57.4074
Perfluoroundecanoic acid (PFUnA)	0.000010	0.000000090	>90.9940
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.000052*	0.000000017*	>99.6731
N-ethylperfluoro-1-octanesulfonamide	0.000011*	0.000000039*	>99.6455
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.000011*	0.000000025*	>99.7727
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.000007	0.000000027*	>99.6322
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.000052*	0.000000023*	>99.5577
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.000011*	0.000000038*	>99.6545
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.0000063*	0.000000021*	>96.6667
PES	--	0.000000020*	--
PFECA A	--	0.000000027*	--
PFECA B	--	0.000000030*	--
PFECA F	--	0.000000058*	--
PFECHS	--	0.000000026*	--
DONA	0.000052*	0.000000031*	>99.4038
HFPO-DA	0.000023	0.000000037*	>98.3700
NMeFOSA	0.000011*	0.000000071	>99.3518
10:2 FTCA	--	0.000000011*	--
10:2 FTS	--	0.000000004*	--
3:3 FTCA	0.0000031*	0.000000046*	>98.5161
4:2 FTS	0.000015	0.000000014*	>99.9073
5:3 FTCA	0.000002	0.000000063*	>97.4286
6:2 FTCA	--	0.000000090*	--
6:2 FTS	0.0051	0.000000220*	>99.9957
6:2 FTUCA	--	0.000000023*	--
7:3 FTCA	0.0000031*	0.000000054*	>98.2581
8:2 FTCA	--	0.000000079*	--

8:2 FTS	0.0003	0.000000024*	>99.9927
8:2 FTUCA	--	0.000000031*	--
Nonafluoro-3,6-dioxahexanoic acid (NFDHA)	0.0000021*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	0.0000021*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000021*	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.0000021*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XV - B Waste profile, OTM-45 and DRE for AFFF run #2 in campaign 2

Feed Rate	AFFF TF Feed Stream	R2 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	2,294		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.000122	0.000000075	>99.9389
Perfluorobutanoic acid (PFBA)	0.00040	0.000000904	>99.7746
Perfluorodecanesulfonic acid (PFDS)	0.000057*	0.00000018*	>99.6842
Perfluorodecanoic acid (PFDA)	0.000112	0.000000488	>99.5643
Perfluorododecanesulfonic acid (PFDoS)	0.000057*	0.00000025*	>99.5614
Perfluorododecanoic acid (PFDoA)	0.000045	0.000000183	>99.5906
Perfluoroheptanesulfonic acid (PFHpS)	0.000026	0.00000023*	>99.9098
Perfluoroheptanoic acid (PFHpA)	0.000110	0.000001430	>98.7000
Perfluorohexadecanoic acid	--	0.000000040	--
Perfluorohexanesulfonic acid (PFHxS)	0.001280	0.000000016	>99.9988
Perfluorohexanoic acid (PFHxA)	0.00232	0.000001150	>99.9504
Perfluorononanesulfonic acid (PFNS)	0.000057*	0.000000017*	>99.7018
Perfluorononanoic acid (PFNA)	0.000018*	0.000000099	>94.5495
Perfluorooctadecanoic acid	--	0.000000038*	--
Perfluorooctanesulfonamide (FOSA)	0.000066	0.000000078*	>99.8820
Perfluorooctanesulfonic acid (PFOS)	0.0085	0.000000084	>99.9990
Perfluorooctanoic acid (PFOA)	0.00048	0.00000139	>99.7116
Perfluoropentanesulfonic acid (PFPeS)	0.000252	0.000000013*	>99.9948
Perfluoropentanoic acid (PFPeA)	0.000266	0.000000072	>99.7286
Perfluorotetradecanoic acid (PFTeA)	0.000017*	0.000000017	>99.0000
Perfluorotridecanoic acid (PFTriA)	0.000012	0.000000016	>98.6379
Perfluoroundecanoic acid (PFUnA)	0.000076	0.000000025	>99.6733
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.000057*	0.000000017*	>99.7018
N-ethylperfluoro-1-octanesulfonamide	0.000011*	0.000000039*	>99.6455
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.000024*	0.000000025*	>99.8971
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.000034	0.000000027*	>99.9206
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.000057*	0.000000023*	>99.5965
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.000011*	0.000000038*	>99.6545
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.000069*	0.000000021*	>96.9565
PES	--	0.000000020*	--
PFECA A	--	0.000000017*	--
PFECA B	--	0.000000030*	--
PFECA F	--	0.000000058*	--
PFECHS	--	0.000000026*	--
DONA	0.000057*	0.000000031*	>99.4561
HFPO-DA	0.000020	0.000000037*	>98.1683
NMeFOSA	0.000011*	0.000000014	>98.9636
10:2 FTCA	--	0.000000011*	--
10:2 FTS	--	0.000000004*	--
3:3 FTCA	0.000034*	0.000000046*	>98.6471
4:2 FTS	0.000015	0.000000014*	>99.9067
5:3 FTCA	0.000115	0.000000063*	>99.9452
6:2 FTCA	--	0.000000090*	--
6:2 FTS	0.0062	0.000000230*	>99.9963
6:2 FTUCA	--	0.000000013*	--
7:3 FTCA	0.000028*	0.000000054*	>99.8058
8:2 FTCA	--	0.000000079*	--

8:2 FTS	0.0017	0.000000024*	>99.9986
8:2 FTUCA	--	0.000000032*	--
Nonafluoro-3,6-dioxahexanoic acid (NFDHA)	0.0000023*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	0.0000023*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000023*	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.0000023*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XV - C Waste profile, OTM-45 and DRE for AFFF run #3 in campaign 2

Feed Rate	AFFF+ TF Feed Stream	R1 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	2,378		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.000127	0.000000061	>99.9523
Perfluorobutanoic acid (PFBA)	0.00042	0.000000447	>99.8925
Perfluorodecanesulfonic acid (PFDS)	0.0000059*	0.000000019*	>99.6780
Perfluorodecanoic acid (PFDA)	0.000116	0.000000122	>99.8948
Perfluorododecanesulfonic acid (PFDoS)	0.0000059*	0.000000027*	>99.5424
Perfluorododecanoic acid (PFDoA)	0.000046	0.000000242	>99.4784
Perfluoroheptanesulfonic acid (PFHpS)	0.000026	0.000000026*	>99.9015
Perfluoroheptanoic acid (PFHpA)	0.000114	0.000000230	>99.7982
Perfluorohexadecanoic acid	--	0.000000126	--
Perfluorohexanesulfonic acid (PFHxS)	0.001320	0.000000038	>99.9971
Perfluorohexanoic acid (PFHxA)	0.00240	0.000000228	>99.9905
Perfluorononanesulfonic acid (PFNS)	0.0000059*	0.000000018*	>99.6949
Perfluorononanoic acid (PFNA)	0.000019*	0.000000013	>99.3228
Perfluorooctadecanoic acid	--	0.000000060*	--
Perfluorooctanesulfonamide (FOSA)	0.000069	0.000000079*	>99.8847
Perfluorooctanesulfonic acid (PFOS)	0.0089	0.000000586	>99.9934
Perfluorooctanoic acid (PFOA)	0.00050	0.000000089	>99.8222
Perfluoropentanesulfonic acid (PFPeS)	0.000262	0.000000007*	>99.9972
Perfluoropentanoic acid (PFPeA)	0.000276	0.000000017	>99.9384
Perfluorotetradecanoic acid (PFTeA)	0.000017*	0.000000028	>98.3918
Perfluorotridecanoic acid (PFTriA)	0.000012	0.000000028	>97.6667
Perfluoroundecanoic acid (PFUnA)	0.000079	0.000000016	>99.7954
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.0000059*	0.000000017*	>99.7119
N-ethylperfluoro-1-octanesulfonamide	0.000012*	0.000000041*	>99.6583
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.000025*	0.000000026*	>99.8968
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.000035	0.000000028*	>99.9205
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.0000059*	0.000000024*	>99.5932
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.000012*	0.000000040*	>99.6667
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.0000071*	0.000000023*	>96.7606
PES	--	0.000000021*	--
PFECA A	--	0.000000029*	--
PFECA B	--	0.000000031*	--
PFECA F	--	0.000000060*	--
PFECHS	--	0.000000027*	--
DONA	0.0000059*	0.000000032*	>99.4576
HFPO-DA	0.000021	0.000000038*	>98.1905
NMeFOSA	0.000012*	0.000000146	>98.7833
10:2 FTCA	--	0.00000011*	--
10:2 FTS	--	0.000000038*	--
3:3 FTCA	0.0000036*	0.000000048*	>98.6667
4:2 FTS	0.000016	0.000000015*	>99.9038
5:3 FTCA	0.000119	0.000000066*	>99.9445
6:2 FTCA	--	0.000000094*	--
6:2 FTS	0.0064	0.000000210*	>99.9967
6:2 FTUCA	--	0.000000020*	--
7:3 FTCA	0.000029*	0.000000057*	>99.8021
8:2 FTCA	--	0.000000083*	--

8:2 FTS	0.0017	0.000000025*	>99.9986
8:2 FTUCA	--	0.000000033*	--
Nonafluoro-3,6-dioxahexanoic acid (NFDHA)	0.0000024*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	0.0000024*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000024*	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.0000024*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XV - D Waste profile, OTM-45 and DRE for contaminated soil run #1 in campaign 2

Feed Rate	MX Solid Feed Stream	R1 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	4,061		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.00016*	0.000000097*	>99.9394
Perfluorobutanoic acid (PFBA)	0.00032*	0.0000010*	>99.6875
Perfluorodecanesulfonic acid (PFDS)	0.000081*	0.000000035*	>99.9568
Perfluorodecanoic acid (PFDA)	0.000081*	0.000004060	>94.9877
Perfluorododecanesulfonic acid (PFDoS)	0.000081*	0.000000059*	>99.9272
Perfluorododecanoic acid (PFDoA)	0.000081*	0.000016800	>79.2593
Perfluoroheptanesulfonic acid (PFHpS)	0.000081*	0.000000045*	>99.9444
Perfluoroheptanoic acid (PFHpA)	0.000127	0.000000715	>99.4370
Perfluorohexadecanoic acid	--	0.000007780	--
Perfluorohexanesulfonic acid (PFHxS)	0.000081*	0.000000033*	>99.9593
Perfluorohexanoic acid (PFHxA)	0.00044	0.000000575	>99.8690
Perfluorononanesulfonic acid (PFNS)	0.000081*	0.000000038*	>99.9531
Perfluorononanoic acid (PFNA)	0.000081*	0.00000203	>97.4938
Perfluorooctadecanoic acid	--	0.000001070*	--
Perfluorooctanesulfonamide (FOSA)	0.000081*	0.00000021*	>99.7407
Perfluorooctanesulfonic acid (PFOS)	0.0004	0.000000074	>99.9797
Perfluorooctanoic acid (PFOA)	0.00014	0.00000109	>99.1926
Perfluoropentanesulfonic acid (PFPeS)	0.000081*	0.000000022*	>99.9728
Perfluoropentanoic acid (PFPeA)	0.000081*	0.000000042	>99.4877
Perfluorotetradecanoic acid (PFTeA)	0.000081*	0.00002480	>69.3827
Perfluorotridecanoic acid (PFTriA)	0.000081*	0.00002230	>72.4691
Perfluoroundecanoic acid (PFUnA)	0.000081*	0.00000809	>90.0123
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.000081*	0.000000034*	>99.9580
N-ethylperfluoro-1-octanesulfonamide	0.00020*	0.000000087*	>99.9565
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.00020*	0.000000054*	>99.9730
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.000081*	0.000000059*	>99.9272
11-Chloroeicosafuoro-3-oxaundecane-1-sulfonic acid	0.000081*	0.000000044*	>99.9457
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.00020*	0.000000096*	>99.9520
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.000081*	0.00000026*	>99.6790
PES	--	0.000000034*	--
PFECA A	--	0.000000040*	--
PFECA B	--	0.000000059*	--
PFECA F	--	0.00000014*	--
PFECHS	--	0.000000041*	--
DONA	0.000081*	0.000000064*	>99.9210
HFPO-DA	0.00041	0.000000072*	>99.8244
NMeFOSA	0.00020*	0.000000098*	>99.9510
10:2 FTCA	--	0.00000024*	--
10:2 FTS	--	0.000000071*	--
3:3 FTCA	0.000081*	0.000000088*	>99.8914
4:2 FTS	0.00024*	0.000000029*	>99.9879
5:3 FTCA	0.000081*	0.000000110*	>99.8642
6:2 FTCA	--	0.000000200*	--
6:2 FTS	0.0011	0.000000220*	>99.9796

6:2 FTUCA	--	0.000000035*	--
7:3 FTCA	0.000081*	0.000000110*	>99.8642
8:2 FTCA	--	0.000000170*	--
8:2 FTS	0.0003	0.000000045*	>99.9860
8:2 FTUCA	--	0.000000052*	--
Nonafluoro-3,6-dioxahexanoic acid (NFDHA)	0.000081*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	0.000081*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.000081*	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.000081*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XV -E Waste profile, OTM-45 and DRE for contaminated soil run #2 in campaign 2

Feed Rate	MX Feed Stream	R1 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	2,565		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.0001490000	0.000000046	>99.9695
Perfluorobutanoic acid (PFBA)	0.00046	0.000000792	>99.8275
Perfluorodecanesulfonic acid (PFDS)	0.0000030*	0.000000018*	>99.3898
Perfluorodecanoic acid (PFDA)	0.000046	0.000001380	>96.9803
Perfluorododecanesulfonic acid (PFDoS)	0.00000103*	0.000000025*	>97.5728
Perfluorododecanoic acid (PFDoA)	0.000021	0.000000525	>97.5467
Perfluoroheptanesulfonic acid (PFHpS)	0.000017	0.000000023*	>99.8671
Perfluoroheptanoic acid (PFHpA)	0.000107	0.000003500	>96.7290
Perfluorohexadecanoic acid	--	0.000000189	--
Perfluorohexanesulfonic acid (PFHxS)	0.000913	0.000000013	>99.9986
Perfluorohexanoic acid (PFHxA)	0.00093	0.000001970	>99.7879
Perfluorononanesulfonic acid (PFNS)	0.0000006*	0.000000017*	>97.0435
Perfluorononanoic acid (PFNA)	0.000027*	0.00000288	>89.4118
Perfluorooctadecanoic acid	--	0.000000097*	--
Perfluorooctanesulfonamide (FOSA)	0.000009	0.000000074*	>99.1415
Perfluorooctanesulfonic acid (PFOS)	0.0063	0.000000045	>99.9993
Perfluorooctanoic acid (PFOA)	0.0002	0.00000374	>98.4609
Perfluoropentanesulfonic acid (PFPeS)	0.000188	0.000000013*	>99.9931
Perfluoropentanoic acid (PFPeA)	0.000159	0.00000101	>99.3648
Perfluorotetradecanoic acid (PFTeA)	0.000007*	0.000000046	>93.4894
Perfluorotridecanoic acid (PFTriA)	0.000008	0.000000054	>92.9793
Perfluoroundecanoic acid (PFUnA)	0.000004	0.000000083	>80.1900
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.00000048*	0.000000017*	>96.4583
N-ethylperfluoro-1-octanesulfonamide	0.00000120*	0.000000039*	>96.7500
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.000003*	0.000000025*	>99.1803
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.00000196*	0.000000027*	>98.6224
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.00000048*	0.000000023*	>95.2083
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.00011100*	0.000000038*	>99.9658
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.00000048*	0.000000023*	>52.0833
PES	--	0.000000020*	--
PFECA A	--	0.000000030*	--
PFECA B	--	0.000000030*	--
PFECA F	--	0.000000062*	--
PFECHS	--	0.000000026*	--
DONA	0.00000048*	0.000000031*	>93.5417
HFPO-DA	0.000013	0.000000037*	>97.0866
NMeFOSA	0.00000120*	0.000000032	>97.3250
10:2 FTCA	--	0.00000011*	--
10:2 FTS	--	0.00000004*	--
3:3 FTCA	0.0000013*	0.000000046*	>96.3200
4:2 FTS	0.000005	0.000000014*	>99.7154
5:3 FTCA	0.000018	0.000000063*	>99.6576
6:2 FTCA	--	0.000000090*	--
6:2 FTS	0.0021	0.000000200*	>99.9906
6:2 FTUCA	--	0.000000019*	--
7:3 FTCA	0.0000049*	0.000000054*	>98.9024
8:2 FTCA	--	0.000000079*	--

8:2 FTS	0.0003	0.000000024*	>99.9925
8:2 FTUCA	--	0.000000032*	--
Nonafluoro-3,6-dioxahexanoic acid (NFDHA)	0.0000400*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	0.00000048*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000346*	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.0000014*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XV - F : Waste profile, OTM-45 and DRE for contaminated soil run #3 in campaign 2

Feed Rate	MX Feed Stream	R2 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	3,875		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.0002260000	0.00000010*	>99.9558
Perfluorobutanoic acid (PFBA)	0.00069	0.0000010*	>99.8559
Perfluorodecanesulfonic acid (PFDS)	0.0000045*	0.000000035*	>99.2152
Perfluorodecanoic acid (PFDA)	0.000069	0.000004270	>93.8116
Perfluorododecanesulfonic acid (PFDoS)	0.00000156*	0.000000059*	>96.2179
Perfluorododecanoic acid (PFDoA)	0.000032	0.000016200	>49.8452
Perfluoroheptanesulfonic acid (PFHpS)	0.000026	0.000000046*	>99.8238
Perfluoroheptanoic acid (PFHpA)	0.000162	0.000000725	>99.5525
Perfluorohexadecanoic acid	--	0.000004740	--
Perfluorohexanesulfonic acid (PFHxS)	0.001380	0.000000034*	>99.9975
Perfluorohexanoic acid (PFHxA)	0.00140	0.000000435	>99.9689
Perfluorononanesulfonic acid (PFNS)	0.0000009*	0.000000038*	>95.6221
Perfluorononanoic acid (PFNA)	0.000041*	0.00000228	>94.4526
Perfluorooctadecanoic acid	--	0.000000251*	--
Perfluorooctanesulfonamide (FOSA)	0.000013	0.00000021*	>98.3846
Perfluorooctanesulfonic acid (PFOS)	0.0096	0.000000076	>99.9992
Perfluorooctanoic acid (PFOA)	0.0004	0.00000106	>99.7112
Perfluoropentanesulfonic acid (PFPeS)	0.000284	0.000000022*	>99.9923
Perfluoropentanoic acid (PFPeA)	0.000240	0.000000027	>99.8867
Perfluorotetradecanoic acid (PFTeA)	0.000011*	0.00002330	**
Perfluorotridecanoic acid (PFTriA)	0.000012	0.00002120	**
Perfluoroundecanoic acid (PFUnA)	0.000006	0.00000893	**
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.00000072*	0.000000034*	>95.2778
N-ethylperfluoro-1-octanesulfonamide	0.00000180*	0.000000088*	>95.1111
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.000005*	0.000000054*	>98.8286
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.00000296*	0.000000059*	>98.0068
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.00000072*	0.000000044*	>93.8889
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.00016700*	0.000000097*	>99.9419
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.00000072*	0.000000026*	>63.8889
PES	--	0.000000034*	--
PFECA A	--	0.000000040*	--
PFECA B	--	0.000000059*	--
PFECA F	--	0.000000014*	--
PFECHS	--	0.000000040*	--
DONA	0.00000072*	0.000000064*	>91.1111
HFPO-DA	0.000019	0.000000073*	>96.1979
NMeFOSA	0.00000180*	0.000000010*	>94.4444
10:2 FTCA	--	0.000000025*	--
10:2 FTS	--	0.000000071*	--
3:3 FTCA	0.0000019*	0.000000088*	>95.3439
4:2 FTS	0.000007	0.000000029*	>99.6102
5:3 FTCA	0.000028	0.000000011*	>99.6043
6:2 FTCA	--	0.000000020*	--
6:2 FTS	0.0032	0.000000023*	>99.9928
6:2 FTUCA	--	0.000000035*	--
7:3 FTCA	0.0000074*	0.000000011*	>98.5215
8:2 FTCA	--	0.000000017*	--

8:2 FTS	0.0005	0.000000045*	>99.9906
8:2 FTUCA	--	0.000000052*	--
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	0.0000604*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	0.00000072*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000523*	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.0000021*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XV - G : Waste profile, OTM-45 and DRE for spent carbon run #1 in campaign 2

Feed Rate	MX Feed Stream	R1 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	2,187		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.0000534000	0.000000094	>99.8240
Perfluorobutanoic acid (PFBA)	0.00020	0.000000990	>99.4949
Perfluorodecanesulfonic acid (PFDS)	0.0000002*	0.000000035*	>85.9438
Perfluorodecanoic acid (PFDA)	0.000017	0.000003010	>82.3977
Perfluorododecanesulfonic acid (PFDoS)	0.00000020*	0.000000058*	>71.0000
Perfluorododecanoic acid (PFDoA)	0.000004	0.000012000	**
Perfluoroheptanesulfonic acid (PFHpS)	0.000025	0.000000045*	>99.8193
Perfluoroheptanoic acid (PFHpA)	0.000077	0.000000560	>99.2746
Perfluorohexadecanoic acid	--	0.000005220	--
Perfluorohexanesulfonic acid (PFHxS)	0.000562	0.000000034	>99.9940
Perfluorohexanoic acid (PFHxA)	0.00029	0.000000340	>99.8811
Perfluorononanesulfonic acid (PFNS)	0.0000003*	0.000000038*	>88.5542
Perfluorononanoic acid (PFNA)	0.000056*	0.00000142	>97.4643
Perfluorooctadecanoic acid	--	0.000000257*	--
Perfluorooctanesulfonamide (FOSA)	0.000003	0.000000210*	>93.2907
Perfluorooctanesulfonic acid (PFOS)	0.0012	0.000000088	>99.9927
Perfluorooctanoic acid (PFOA)	0.0007	0.000000080	>99.8863
Perfluoropentanesulfonic acid (PFPeS)	0.000056	0.000000021*	>99.9626
Perfluoropentanoic acid (PFPeA)	0.000078	0.000000024	>99.6986
Perfluorotetradecanoic acid (PFTeA)	0.000001*	0.00001910	**
Perfluorotridecanoic acid (PFTriA)	0.000001	0.00001820	**
Perfluoroundecanoic acid (PFUnA)	0.000003	0.00000605	**
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.00000020*	0.000000034*	>83.0000
N-ethylperfluoro-1-octanesulfonamide	0.00000051*	0.000000087*	>82.9412
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.000001*	0.000000053*	>90.7826
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.00000020*	0.000000059*	>70.5000
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.00000020*	0.000000044*	>78.0000
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.00000051*	0.000000096*	>81.1765
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.00000020*	0.000000025*	**
PES	--	0.000000033*	--
PFECA A	--	0.000000040*	--
PFECA B	--	0.000000058*	--
PFECA F	--	0.000000140*	--
PFECHS	--	0.000000040*	--
DONA	0.00000020*	0.000000064*	>68.0000
HFPO-DA	0.002670	0.000000072*	>99.9730
NMeFOSA	0.00000051*	0.000000096	>81.1765
10:2 FTCA	--	0.00000024*	--
10:2 FTS	--	0.00000007*	--
3:3 FTCA	0.0000054*	0.000000087*	>98.3829
4:2 FTS	0.000003	0.000000028*	>99.1837
5:3 FTCA	0.000004	0.000000110*	>97.5446
6:2 FTCA	--	0.000000200*	--
6:2 FTS	0.0004	0.000000220*	>99.9387
6:2 FTUCA	--	0.000000034*	--
7:3 FTCA	0.0000007*	0.000000110*	>84.9932
8:2 FTCA	--	0.000000170*	--

8:2 FTS	0.0001	0.000000044*	>99.9487
8:2 FTUCA	--	0.000000051*	--
Nonafluoro-3,6-dioxahexanoic acid (NFDHA)	0.0000258*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	0.00000020*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000049*	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.0000015*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XV - H : Waste profile, OTM-45 and DRE for spent carbon run #2 in campaign 2

Feed Rate	MX Feed Stream	R2 Stack Emissions	DRE
	Avg lb/hr	lb/hr	
	2,422		
Target Compounds	lb/hr	lb/hr	%
Perfluorobutanesulfonic acid (PFBS)	0.0000591000	0.000000050	>99.9161
Perfluorobutanoic acid (PFBA)	0.00022	0.000000345	>99.8410
Perfluorodecanesulfonic acid (PFDS)	0.0000003*	0.000000018*	>93.4783
Perfluorodecanoic acid (PFDA)	0.000019	0.000000109	>99.4263
Perfluorododecanesulfonic acid (PFDoS)	0.00000022*	0.000000026*	>88.1818
Perfluorododecanoic acid (PFDoA)	0.000004	0.000000140	>96.7136
Perfluoroheptanesulfonic acid (PFHpS)	0.000028	0.000000023*	>99.9167
Perfluoroheptanoic acid (PFHpA)	0.000086	0.000000236	>99.7240
Perfluorohexadecanoic acid	--	0.000000062	--
Perfluorohexanesulfonic acid (PFHxS)	0.000622	0.000000012	>99.9982
Perfluorohexanoic acid (PFHxA)	0.00032	0.000000190	>99.9401
Perfluorononanesulfonic acid (PFNS)	0.0000004*	0.000000017*	>95.3804
Perfluorononanoic acid (PFNA)	0.000062*	0.000000015	>99.7661
Perfluorooctadecanoic acid	--	0.000000030*	--
Perfluorooctanesulfonamide (FOSA)	0.000003	0.000000084*	>97.5723
Perfluorooctanesulfonic acid (PFOS)	0.0013	0.000000046	>99.9966
Perfluorooctanoic acid (PFOA)	0.0008	0.000000038	>99.9510
Perfluoropentanesulfonic acid (PFPeS)	0.000062	0.000000013*	>99.9791
Perfluoropentanoic acid (PFPeA)	0.000087	0.000000013	>99.8466
Perfluorotetradecanoic acid (PFTeA)	0.000002*	0.000000014	>90.7792
Perfluorotridecanoic acid (PFTriA)	0.000001	0.000000015	>84.1889
Perfluoroundecanoic acid (PFUnA)	0.000004	0.000000011	>96.9272
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	0.00000022*	0.000000017*	>92.2727
N-ethylperfluoro-1-octanesulfonamide	0.00000056*	0.000000039*	>93.0357
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.000001*	0.000000025*	>96.0754
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.00000022*	0.000000027*	>87.7273
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	0.00000022*	0.000000023*	>89.5455
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	0.00000056*	0.000000039*	>93.0357
2-(N-methylperfluoro-1-octanesulfonamido) ethanol	0.00000022*	0.000000023*	**
PES	--	0.000000020*	--
PFECA A	--	0.000000027*	--
PFECA B	--	0.000000030*	--
PFECA F	--	0.000000058*	--
PFECHS	--	0.000000026*	--
DONA	0.00000022*	0.000000031*	>85.9091
HFPO-DA	0.002950	0.000000037*	>99.9875
NMeFOSA	0.00000056*	0.000000089	>84.1071
10:2 FTCA	--	0.000000011*	--
10:2 FTS	--	0.000000004*	--
3:3 FTCA	0.0000060*	0.000000046*	>99.2282
4:2 FTS	0.000004	0.000000014*	>99.6316
5:3 FTCA	0.000005	0.000000063*	>98.7324
6:2 FTCA	--	0.000000091*	--
6:2 FTS	0.0004	0.000000240*	>99.9395
6:2 FTUCA	--	0.000000019*	--
7:3 FTCA	0.0000008*	0.000000055*	>93.2182
8:2 FTCA	--	0.000000080*	--

8:2 FTS	0.0001	0.000000024*	>99.9747
8:2 FTUCA	--	0.000000032*	--
Nonafluoro-3,6-dioxahexanoic acid (NFDHA)	0.0000286*	--	--
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	0.00000022*	--	--
Perfluoro-3-methoxypropanoic acid (PFMPA)	0.0000054*	--	--
Perfluoro-4-methoxybutanoic acid (PFMBA)	0.0000016*	--	--

* Values are below the MDL or have a qualifier for values above the MDL but below the LoQ. For DRE calculation, PFAS not detected in the waste are assumed to be at MDL level in the waste. PFAS detected below the MDL and LoQ are assumed to be at LoQ in the waste. In those cases, DRE is shown with >.

Appendix XVI - A : PFAS concentrations in liquid residues from AFFF incineration for baseline (CA-BL), run 1 (CA-R1) and 2 (CA-R2) in campaign 2

PFAS flowrates are in lb/hr. When a PFAS is non-detected, it is considered to be at MDL. 24 hrs means that sample was taken 24 hours after the end of the run

Parameter	CA-BL	CA-R1	CA-R2	CA-R2-24H4
Date Tested	10/09/2024	45574	45575	10/10/2024
Sample Collection Time (minutes)	240	240	240	240
Waste Input Rate - Liquid A3F (lb/hr)	52,492.0	48288.6	52742.16	52,742.2
11-Chloroeicosafuoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.000013)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (0.000025)	ND (0.000000028)	0.000000386	0.000000818
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (0.000013)	ND (0.000000024)	0.0000000290	0.0000000294
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ND (0.00011)	0.000000739	0.0000121	0.0000174
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.000077)	ND (0.000000052)	ND (0.000000056)	ND (0.000000056)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.000051)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.000077)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.000013)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.000013)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND (0.000025)	0.000000151	0.00000161	0.000000129
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (0.000025)	ND (0.000000019)	ND (0.000000020)	ND (0.000000020)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (0.000025)	ND (0.000000019)	ND (0.000000020)	ND (0.000000020)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.000013)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (0.000025)	ND (0.000000033)	ND (0.000000036)	ND (0.000000036)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (0.000025)	ND (0.000000019)	ND (0.000000020)	ND (0.000000020)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.000015)	ND (0.000000019)	ND (0.000000020)	ND (0.000000020)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.0000051)	ND (0.000000014)	ND (0.000000015)	ND (0.000000015)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	ND (0.0000051)	ND (0.000000014)	ND (0.000000015)	ND (0.000000015)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.0000051)	ND (0.000000014)	ND (0.000000015)	ND (0.000000015)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.0000051)	ND (0.000000014)	ND (0.000000015)	ND (0.000000015)
Perfluorobutanesulfonic acid (PFBS)	ND (0.000013)	0.000000152	0.000000164	0.000000147
Perfluorobutanoic acid (PFBA)	ND (0.000051)	0.000000966	0.00000198	0.000000886
Perfluorodecanesulfonic acid (PFDS)	ND (0.000013)	ND (0.000000014)	ND (0.000000015)	ND (0.000000015)
Perfluorodecanoic acid (PFDA)	ND (0.000013)	ND	0.0000000360	0.0000000291

		(0.000000014)		
Perfluorododecanesulfonic acid (PFDoS)	ND (0.000013)	ND (0.000000014)	ND (0.000000015)	ND (0.000000015)
Perfluorododecanoic acid (PFDoA)	ND (0.000013)	ND (0.000000019)	ND (0.000000020)	ND (0.000000020)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.000013)	ND (0.000000014)	ND (0.000000015)	ND (0.000000015)
Perfluoroheptanoic acid (PFHpA)	ND (0.000013)	0.000000473	0.00000117	0.000000564
Perfluorohexanesulfonic acid (PFHxS)	ND (0.000013)	0.000000141	0.000000199	0.000000199
Perfluorohexanoic acid (PFHxA)	0.0000343	0.00000128	0.0000155	0.00000120
Perfluorononanesulfonic acid (PFNS)	ND (0.000013)	ND (0.000000014)	ND (0.000000015)	ND (0.000000015)
Perfluorononanoic acid (PFNA)	ND (0.000013)	0.0000000589	0.0000000828	0.0000000622
Perfluorooctanesulfonamide (PFOSAm)	ND (0.000018)	ND (0.000000014)	0.0000000601	0.000000159
Perfluorooctanesulfonic acid (PFOS)	ND (0.000025)	0.000000235	0.000000472	0.000000549
Perfluorooctanoic acid (PFOA)	ND (0.000013)	0.000000133	0.000000254	0.000000238
Perfluoropentanesulfonic acid (PFPeS)	ND (0.000013)	0.0000000226	0.0000000257	0.0000000270
Perfluoropentanoic acid (PFPeA)	ND (0.000013)	0.00000136	0.00000205	0.00000117
Perfluorotetradecanoic acid (PFTeDA)	ND (0.000013)	ND (0.000000019)	ND (0.000000020)	ND (0.000000020)
Perfluorotridecanoic acid (PFTrDA)	ND (0.000013)	ND (0.000000019)	ND (0.000000020)	ND (0.000000020)
Perfluoroundecanoic acid (PFUnA)	ND (0.000013)	ND (0.000000014)	ND (0.000000015)	ND (0.000000015)

Appendix XVI - B : PFAS concentrations in liquid residues from AFFF incineration for baseline (CA+-BL) and run#1 (CA+-R1) AFFF + lime

PFAS flowrates are in lb/hr. When a PFAS is non-detected, it is assumed to be at MDL. 24 hrs means that sample was taken 24 hours after the end of the run

Parameter	CA+-BL	CA+-R1	CA+-R1 24Hr
Date Tested	10/12/2024	12/10/2024	12/10/2024
Sample Collection Time (Minutes)	240	240	240
Waste Input Rate - Liquid A3F (lb/hr)	62,249.8	50,040	50,040
11-Chloroeicosafuoro-3-oxaundecane-1-sulfonic acid (11CI-PF3OUdS)	ND (0.00000030)	ND (0.00000025)	ND (0.00000024)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (0.00000036)	ND (0.00000030)	0.000000366
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (0.00000030)	ND (0.00000025)	ND (0.00000024)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	0.00000277	0.00000105	0.00000210
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.00000066)	ND (0.00000055)	ND (0.00000053)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.00000030)	ND (0.00000025)	ND (0.00000024)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.00000030)	ND (0.00000025)	ND (0.00000024)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.00000030)	ND (0.00000025)	ND (0.00000024)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CI-PF3ONS)	ND (0.00000030)	ND (0.00000025)	ND (0.00000024)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.00000164	ND (0.00000080)	0.000000387
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (0.00000024)	ND (0.00000020)	ND (0.00000019)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (0.00000024)	ND (0.00000020)	ND (0.00000019)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.00000030)	ND (0.00000025)	ND (0.00000024)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (0.00000042)	ND (0.00000035)	ND (0.00000034)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (0.00000024)	ND (0.00000020)	ND (0.00000019)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.00000024)	ND (0.00000020)	ND (0.00000019)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.00000018)	ND (0.00000015)	ND (0.00000015)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	ND (0.00000018)	ND (0.00000015)	ND (0.00000015)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.00000018)	ND (0.00000015)	ND (0.00000015)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.00000018)	ND (0.00000015)	ND (0.00000015)
Perfluorobutanesulfonic acid (PFBS)	0.000000171	0.000000265	0.000000146
Perfluorobutanoic acid (PFBA)	0.00000174	0.00000121	0.00000111
Perfluorodecanesulfonic acid (PFDS)	ND (0.00000018)	ND (0.00000015)	ND (0.00000015)
Perfluorodecanoic acid (PFDA)	ND	ND (0.00000015)	ND

	(0.000000018)		(0.000000015)
Perfluorododecanesulfonic acid (PFDoS)	ND (0.000000018)	ND (0.00000015)	ND (0.000000015)
Perfluorododecanoic acid (PFDoA)	ND (0.000000024)	ND (0.00000020)	ND (0.000000019)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.000000018)	ND (0.00000015)	ND (0.000000015)
Perfluoroheptanoic acid (PFHpA)	0.000000853	0.000000726	0.000000656
Perfluorohexanesulfonic acid (PFHxS)	0.000000169	0.000000212	0.000000162
Perfluorohexanoic acid (PFHxA)	0.00000252	0.00000149	0.00000150
Perfluorononanesulfonic acid (PFNS)	ND (0.000000018)	ND (0.00000015)	ND (0.000000015)
Perfluorononanoic acid (PFNA)	0.0000000722	ND (0.00000010)	0.0000000560
Perfluorooctanesulfonamide (PFOSAm)	0.0000000214	ND (0.00000015)	0.0000000172
Perfluorooctanesulfonic acid (PFOS)	0.000000219	ND (0.00000025)	0.000000231
Perfluorooctanoic acid (PFOA)	0.000000213	0.000000249	0.000000163
Perfluoropentanesulfonic acid (PFPeS)	0.0000000240	ND (0.00000015)	0.0000000227
Perfluoropentanoic acid (PFPeA)	0.00000214	0.00000163	0.00000137
Perfluorotetradecanoic acid (PFTeDA)	ND (0.000000024)	ND (0.00000020)	ND (0.000000019)
Perfluorotridecanoic acid (PFTrDA)	ND (0.000000024)	ND (0.00000020)	ND (0.000000019)
Perfluoroundecanoic acid (PFUnA)	ND (0.000000018)	ND (0.00000015)	ND (0.000000015)

Appendix XVI - C : PFAS concentrations in liquid residues from contaminated soil incineration for baseline #1 (CS-BL) and run#1 (CS-R1)

PFAS flowrates are in lb/hr. When a PFAS is non-detected, it is assumed to be at MDL. 24 hrs means that sample was taken 24 hours after the end of the run

Parameter	CS-BL	CS-R1
Date Tested	10/14/2024	14/10/2024
Sample Collection Time (Minutes)	240	240
Waste Input Rate - Liquid A3F (lb/hr)	52,592.0	54,343
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.000000026)	ND (0.000000027)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (0.000000031)	0.0000000492
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (0.000000026)	ND (0.000000027)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	0.00000280	0.00000452
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.000000057)	ND (0.000000059)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.000000026)	ND (0.000000027)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.000000026)	ND (0.000000027)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.000000026)	ND (0.000000027)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.000000026)	ND (0.000000027)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.000000621	0.000000685
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (0.000000021)	ND (0.000000022)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (0.000000021)	ND (0.000000022)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.000000026)	ND (0.000000027)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (0.000000036)	ND (0.000000038)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (0.000000021)	ND (0.000000022)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.000000021)	ND (0.000000022)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.000000016)	ND (0.000000016)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	ND (0.000000016)	ND (0.000000016)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.000000016)	ND (0.000000016)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.000000016)	ND (0.000000016)
Perfluorobutanesulfonic acid (PFBS)	0.000000165	0.000000262
Perfluorobutanoic acid (PFBA)	0.000000114	0.000000169
Perfluorodecanesulfonic acid (PFDS)	ND (0.000000016)	ND (0.000000016)
Perfluorodecanoic acid (PFDA)	ND (0.000000016)	0.0000000190
Perfluorododecanesulfonic acid (PFDoS)	ND (0.000000016)	ND (0.000000016)
Perfluorododecanoic acid (PFDoA)	ND (0.000000021)	ND (0.000000022)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.000000016)	ND (0.000000016)
Perfluoroheptanoic acid (PFHpA)	0.000000631	0.000000115

Perfluorohexanesulfonic acid (PFHxS)	0.000000160	0.000000247
Perfluorohexanoic acid (PFHxA)	0.00000177	0.00000304
Perfluorononanesulfonic acid (PFNS)	ND (0.000000016)	ND (0.000000016)
Perfluorononanoic acid (PFNA)	0.0000000320	0.0000000864
Perfluorooctanesulfonamide (PFOSAm)	ND (0.000000016)	0.0000000490
Perfluorooctanesulfonic acid (PFOS)	0.000000129	0.000000347
Perfluorooctanoic acid (PFOA)	0.000000114	0.000000280
Perfluoropentanesulfonic acid (PFPeS)	0.0000000241	0.0000000417
Perfluoropentanoic acid (PFPeA)	0.00000145	0.00000233
Perfluorotetradecanoic acid (PFTeDA)	ND (0.000000021)	ND (0.000000022)
Perfluorotridecanoic acid (PFTrDA)	ND (0.000000021)	ND (0.000000022)
Perfluoroundecanoic acid (PFUnA)	ND (0.000000016)	ND (0.000000016)

Appendix XVI - D : PFAS concentrations in liquid residues from contaminated soil incineration for baseline #2 (CCS2-BL) and run#2 (CCS2-R1) and #3 (CCS2-R2)

PFAS flowrates are in lb/hr. When a PFAS is non-detected, it is assumed to be at MDL. 24 hrs means that sample was taken 24 hours after the end of the run

Parameter	CCS2-BL	CCS2-R1	CCS2-R2	CCS2-R2-24Hr
Date Tested	10/22/2024	22/10/2024	23/10/2024	23/10/2024
Sample Collection Time (Minutes)	240	240	240	240
Waste Input Rate - Liquid A3F (lb/hr)	48,438.7	47,988	52,042	52,042
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11CI-PF3OUdS)	ND (0.000000024)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (0.000000029)	ND (0.000000029)	ND (0.000000031)	ND (0.000000031)
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (0.000000024)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	0.000000906	0.00000154	0.00000178	0.00000173
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.000000053)	ND (0.000000052)	ND (0.000000057)	ND (0.000000056)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.000000024)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.000000024)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.000000024)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9CI-PF3ONS)	ND (0.000000024)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.000000620	0.00000123	0.00000105	0.000000817
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (0.000000019)	ND (0.000000019)	ND (0.000000021)	ND (0.000000021)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (0.000000019)	ND (0.000000019)	ND (0.000000021)	ND (0.000000021)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.000000024)	ND (0.000000024)	ND (0.000000026)	ND (0.000000026)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (0.000000034)	ND (0.000000033)	ND (0.000000036)	ND (0.000000036)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (0.000000019)	ND (0.000000019)	ND (0.000000021)	ND (0.000000021)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.000000019)	ND (0.000000019)	ND (0.000000021)	ND (0.000000021)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.000000014)	ND (0.000000014)	ND (0.000000016)	ND (0.000000015)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	ND (0.000000014)	ND (0.000000014)	ND (0.000000016)	ND (0.000000015)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.000000014)	ND (0.000000014)	ND (0.000000016)	ND (0.000000015)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.000000014)	ND (0.000000014)	ND (0.000000016)	ND (0.000000015)
Perfluorobutanesulfonic acid (PFBS)	0.000000275	0.000000272	0.000000285	0.000000440
Perfluorobutanoic acid (PFBA)	0.00000163	0.00000178	0.00000208	0.00000173
Perfluorodecanesulfonic acid (PFDS)	ND (0.000000014)	ND (0.000000014)	ND (0.000000016)	ND (0.000000015)

Perfluorodecanoic acid (PFDA)	ND (0.000000014)	0.0000000198	0.0000000189	0.0000000296
Perfluorododecanesulfonic acid (PFDoS)	ND (0.000000014)	ND (0.000000014)	ND (0.000000016)	ND (0.000000015)
Perfluorododecanoic acid (PFDoA)	ND (0.000000019)	ND (0.000000019)	ND (0.000000021)	ND (0.000000021)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.000000014)	ND (0.000000014)	ND (0.000000016)	ND (0.000000015)
Perfluoroheptanoic acid (PFHpA)	0.000000562	0.000000619	0.000000843	0.00000117
Perfluorohexanesulfonic acid (PFHxS)	0.000000228	0.000000217	0.000000253	0.000000366
Perfluorohexanoic acid (PFHxA)	0.00000171	0.00000230	0.00000284	0.00000264
Perfluorononanesulfonic acid (PFNS)	ND (0.000000014)	ND (0.000000014)	ND (0.000000016)	ND (0.000000015)
Perfluorononanoic acid (PFNA)	0.0000000543	0.0000000600	0.0000000796	0.000000109
Perfluorooctanesulfonamide (PFOSAm)	0.000000178	0.000000197	0.000000196	0.000000115
Perfluorooctanesulfonic acid (PFOS)	0.000000272	0.000000249	0.000000316	0.000000368
Perfluorooctanoic acid (PFOA)	0.000000150	0.000000163	0.000000220	0.000000316
Perfluoropentanesulfonic acid (PFPeS)	0.0000000314	0.0000000322	0.0000000396	0.0000000755
Perfluoropentanoic acid (PFPeA)	0.00000174	0.00000192	0.00000215	0.00000227
Perfluorotetradecanoic acid (PFTeDA)	ND (0.000000019)	ND (0.000000019)	ND (0.000000021)	ND (0.000000021)
Perfluorotridecanoic acid (PFTrDA)	ND (0.000000019)	ND (0.000000019)	ND (0.000000021)	ND (0.000000021)
Perfluoroundecanoic acid (PFUnA)	ND (0.000000014)	ND (0.000000014)	ND (0.000000016)	ND (0.000000015)

Appendix XVI - E : PFAS concentrations in liquid residues from spent carbon incineration for baseline (CC-BL) and run 1 (CC-R1) and run 2 (CC-R2)

PFAS flowrates are in lb/hr. When a PFAS is non-detected, it is assumed to be at MDL. 24 hrs means that sample was taken 24 hours after the end of the run

Parameter	CC-BL	CC-R1	CC-R2	CC-R2-24Hr
Date Tested	10/19/2024	19/10/2024	20/10/2024	20/10/2024
Sample Collection Time (Minutes)	240	240	240	240
Waste Input Rate - Liquid A3F (lb/hr)	51,691.3	52,642	52,992	52,992
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (0.000000031)	0.0000000616	0.0000000657	ND (0.000000031)
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)	0.0000000444
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	0.00000178	0.00000240	0.00000250	0.00000233
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.000000057)	ND (0.000000057)	ND (0.000000058)	ND (0.000000058)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.000000359	0.00000130	0.000000594	0.0000118
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)	ND (0.000000026)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (0.000000036)	ND (0.000000037)	ND (0.000000037)	ND (0.000000037)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)

Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)	0.0000000404
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)
Perfluorobutanesulfonic acid (PFBS)	0.000000257	0.000000264	0.000000257	0.000000245
Perfluorobutanoic acid (PFBA)	0.00000139	0.00000143	0.00000140	0.00000194
Perfluorodecanesulfonic acid (PFDS)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)
Perfluorodecanoic acid (PFDA)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)	0.0000000252
Perfluorododecanesulfonic acid (PFDoS)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)
Perfluorododecanoic acid (PFDoA)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)
Perfluoroheptanoic acid (PFHpA)	0.000000724	0.000000832	0.000000832	0.00000121
Perfluorohexanesulfonic acid (PFHxS)	0.000000239	0.000000241	0.000000242	0.000000205
Perfluorohexanoic acid (PFHxA)	0.00000176	0.00000197	0.00000208	0.00000192
Perfluorononanesulfonic acid (PFNS)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)
Perfluorononanoic acid (PFNA)	0.0000000625	0.0000000658	0.0000000684	0.0000000938
Perfluorooctanesulfonamide (PFOSAm)	0.0000000347	0.000000119	0.0000000546	0.0000000228
Perfluorooctanesulfonic acid (PFOS)	0.000000248	0.000000355	0.000000397	0.000000226
Perfluorooctanoic acid (PFOA)	ND (0.000000016)	0.000000231	0.000000243	0.000000286
Perfluoropentanesulfonic acid (PFPeS)	0.0000000419	0.0000000417	0.0000000390	0.0000000319
Perfluoropentanoic acid (PFPeA)	0.00000171	0.00000188	0.00000182	0.00000631
Perfluorotetradecanoic acid (PFTeDA)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)
Perfluorotridecanoic acid (PFTrDA)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)	ND (0.000000021)
Perfluoroundecanoic acid (PFUnA)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)	ND (0.000000016)

Appendix XVI - F : PFAS concentrations in liquid residues from CF4 for baseline (CW+BL) and run 1 (CW-R1)

PFAS flowrates are in lb/hr. When a PFAS is non-detected, it is assumed to be at MDL. 24 hrs means that sample was taken 24 hours after the end of the run

Parameter	CW+BL	CW+R1	CW+R24Hr
Date Tested	10/17/2024	17/10/2024	17/10/2024
Sample Collection Time	240	240	240
Waste Input Rate - Liquid A3F (lb/hr)	57,846.2	49,540	49,540
11-Chloroeicosafuoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.000000029)	ND (0.000000025)	ND (0.000000024)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (0.000000034)	ND (0.000000029)	ND (0.000000029)
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (0.000000029)	ND (0.000000025)	ND (0.000000024)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	0.00000688	0.00000256	0.000000931
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.000000063)	ND (0.000000054)	ND (0.000000054)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.000000029)	ND (0.000000025)	ND (0.000000024)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.000000029)	ND (0.000000025)	ND (0.000000024)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.000000029)	ND (0.000000025)	ND (0.000000024)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.000000029)	ND (0.000000025)	ND (0.000000024)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	0.000000499	0.000000318	0.000000252
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (0.000000023)	ND (0.000000020)	ND (0.000000020)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (0.000000023)	ND (0.000000020)	ND (0.000000020)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.000000029)	ND (0.000000025)	ND (0.000000024)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (0.000000040)	ND (0.000000034)	ND (0.000000034)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (0.000000023)	ND (0.000000020)	ND (0.000000020)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.000000023)	ND (0.000000020)	ND (0.000000020)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.000000017)	ND (0.000000015)	ND (0.000000015)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	ND (0.000000017)	ND (0.000000015)	ND (0.000000015)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.000000017)	ND (0.000000015)	ND (0.000000015)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.000000017)	ND (0.000000015)	ND (0.000000015)
Perfluorobutanesulfonic acid (PFBS)	0.000000296	0.000000238	0.000000236
Perfluorobutanoic acid (PFBA)	0.00000316	0.00000163	0.00000134
Perfluorodecanesulfonic acid (PFDS)	ND (0.000000017)	ND (0.000000015)	ND (0.000000015)
Perfluorodecanoic acid (PFDA)	0.0000000263	0.0000000186	ND

			(0.000000015)
Perfluorododecanesulfonic acid (PFDoS)	ND (0.000000017)	ND (0.000000015)	ND (0.000000015)
Perfluorododecanoic acid (PFDoA)	ND (0.000000023)	ND (0.000000020)	ND (0.000000020)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.000000017)	ND (0.000000015)	ND (0.000000015)
Perfluoroheptanoic acid (PFHpA)	0.00000119	0.000000882	0.000000624
Perfluorohexanesulfonic acid (PFHxS)	0.000000239	0.000000209	0.000000188
Perfluorohexanoic acid (PFHxA)	0.00000717	0.00000290	0.00000185
Perfluorononanesulfonic acid (PFNS)	ND (0.000000017)	ND (0.000000015)	ND (0.000000015)
Perfluorononanoic acid (PFNA)	0.0000000966	0.0000000733	0.0000000505
Perfluorooctanesulfonamide (PFOSAm)	0.0000000576	0.0000000807	0.000000124
Perfluorooctanesulfonic acid (PFOS)	0.000000285	0.000000238	0.000000188
Perfluorooctanoic acid (PFOA)	0.000000344	0.000000251	0.000000161
Perfluoropentanesulfonic acid (PFPeS)	0.0000000452	0.0000000356	0.0000000338
Perfluoropentanoic acid (PFPeA)	0.00000349	0.00000202	0.00000166
Perfluorotetradecanoic acid (PFTeDA)	ND (0.000000023)	ND (0.000000020)	ND (0.000000020)
Perfluorotridecanoic acid (PFTrDA)	ND (0.000000023)	ND (0.000000020)	ND (0.000000020)
Perfluoroundecanoic acid (PFUnA)	ND (0.000000017)	ND (0.000000015)	ND (0.000000015)

Appendix XVII - A : PFAS in solid residues from AFFF incineration for Baseline (BL-R1), run #1 (CA-R1) and run #2 (CA-R2) for AFFF incineration.

Units for PFAS in ng/g

When a PFAS is non-detected, it is considered to be at MDL.

Parameter	BL-R1	CA-R1	CA-R2
Date Tested	10/09/2024	9/10/2024	10/10/2024
Sample Collection Time (minutes)	240	240	240
11-Chloroeicosafuoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.58)	ND (0.58)	ND (0.59)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (1.7)	ND (1.7)	ND (1.8)
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (1.7)	ND (1.7)	ND (1.8)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ND (1.7)	ND (1.7)	ND (1.8)
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.59)	ND (0.58)	ND (0.59)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.59)	ND (0.58)	ND (0.59)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.58)	ND (0.58)	ND (0.59)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.58)	ND (0.58)	ND (0.59)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.59)	ND (0.58)	ND (0.59)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND (2.9)	ND (2.9)	ND (2.9)
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (1.5)	ND (1.5)	ND (1.5)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (1.5)	ND (1.5)	ND (1.5)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.58)	ND (0.58)	ND (0.59)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (1.5)	ND (1.5)	ND (1.5)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (1.5)	ND (1.5)	ND (1.5)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.59)	ND (0.58)	ND (0.59)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.59)	ND (0.58)	ND (0.59)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	ND (0.59)	ND (0.58)	ND (0.59)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.58)	ND (0.58)	ND (0.59)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.58)	ND (0.58)	ND (0.59)
Perfluorobutanesulfonic acid (PFBS)	ND (1.2)	ND (1.2)	ND (1.2)
Perfluorobutanoic acid (PFBA)	ND (2.3)	ND (2.3)	ND (2.3)
Perfluorodecanesulfonic acid (PFDS)	ND (0.58)	ND (0.58)	ND (0.59)
Perfluorodecanoic acid (PFDA)	ND (0.58)	ND (0.58)	ND (0.59)
Perfluorododecanesulfonic acid (PFDoS)	ND (0.58)	ND (0.58)	ND (0.59)
Perfluorododecanoic acid (PFDoA)	ND (0.59)	ND (0.58)	ND (0.59)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.59)	ND (0.58)	ND (0.59)
Perfluoroheptanoic acid (PFHpA)	ND (0.58)	ND (0.58)	ND (0.59)
Perfluorohexanesulfonic acid (PFHxS)	ND (0.59)	ND (0.58)	ND (0.59)
Perfluorohexanoic acid (PFHxA)	ND (0.59)	ND (0.58)	0.593
Perfluorononanesulfonic acid (PFNS)	ND (0.59)	ND (0.58)	ND (0.59)
Perfluorononanoic acid (PFNA)	ND (0.59)	ND (0.58)	ND (0.59)
Perfluorooctanesulfonamide (PFOSAm)	ND (0.59)	ND (0.58)	0.668
Perfluorooctanesulfonic acid (PFOS)	ND (0.58)	ND (0.58)	ND (0.59)
Perfluorooctanoic acid (PFOA)	ND (0.59)	ND (0.58)	<0.59 DLL
Perfluoropentanesulfonic acid (PFPeS)	ND (0.58)	ND (0.58)	ND (0.59)
Perfluoropentanoic acid (PFPeA)	ND (0.58)	ND (0.58)	ND (0.59)
Perfluorotetradecanoic acid (PFTeDA)	ND (0.59)	ND (0.58)	ND (0.59)
Perfluorotridecanoic acid (PFTrDA)	ND (0.59)	ND (0.58)	ND (0.59)
Perfluoroundecanoic acid (PFUnA)	ND (0.58)	ND (0.58)	ND (0.59)

Appendix XVII-B : PFAS in solid residues for Baseline (BL), run #1 (CA-R1) for AFFF incineration with lime injection

Units for PFAS in ng/g. When a PFAS is non-detected, it is considered to be at MDL.

Parameter	CA+-BL	CA+-R1
Date Tested	10/12/2024	12/10/2024
Sample Collection Time	240	240
11-Chloroeicosafuoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.57)	ND (0.57)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (1.7)	ND (1.7)
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (1.7)	ND (1.7)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ND (1.7)	ND (1.7)
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.57)	ND (0.57)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.57)	ND (0.57)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.57)	ND (0.57)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.57)	ND (0.57)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.57)	ND (0.57)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND (2.8)	ND (2.9)
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (1.4)	ND (1.4)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (1.4)	ND (1.4)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.57)	ND (0.57)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (1.4)	ND (1.4)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (1.4)	ND (1.4)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.57)	ND (0.57)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.57)	ND (0.57)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	ND (0.57)	ND (0.57)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.57)	ND (0.57)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.57)	ND (0.57)
Perfluorobutanesulfonic acid (PFBS)	ND (1.1)	ND (1.1)
Perfluorobutanoic acid (PFBA)	ND (2.3)	ND (2.3)
Perfluorodecanesulfonic acid (PFDS)	ND (0.57)	ND (0.57)
Perfluorodecanoic acid (PFDA)	ND (0.57)	ND (0.57)
Perfluorododecanesulfonic acid (PFDoS)	ND (0.57)	ND (0.57)
Perfluorododecanoic acid (PFDoA)	ND (0.57)	ND (0.57)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.57)	ND (0.57)
Perfluoroheptanoic acid (PFHpA)	ND (0.57)	ND (0.57)
Perfluorohexanesulfonic acid (PFHxS)	ND (0.57)	ND (0.57)
Perfluorohexanoic acid (PFHxA)	ND (0.57)	ND (0.57)
Perfluorononanesulfonic acid (PFNS)	ND (0.57)	ND (0.57)
Perfluorononanoic acid (PFNA)	ND (0.57)	ND (0.57)
Perfluorooctanesulfonamide (PFOSAm)	0.354	ND (0.57)
Perfluorooctanesulfonic acid (PFOS)	ND (0.57)	ND (0.57)
Perfluorooctanoic acid (PFOA)	ND (0.57)	ND (0.57)
Perfluoropentanesulfonic acid (PFPeS)	ND (0.57)	ND (0.57)
Perfluoropentanoic acid (PFPeA)	ND (0.57)	ND (0.57)
Perfluorotetradecanoic acid (PFTeDA)	ND (0.57)	ND (0.57)
Perfluorotridecanoic acid (PFTrDA)	ND (0.57)	ND (0.57)
Perfluoroundecanoic acid (PFUnA)	ND (0.57)	ND (0.57)

Appendix XVII-C : PFAS in solid residues from contaminated soil for Baseline (CS-BL), run #1 (CS-R1)

Units for PFAS in ng/g. When a PFAS is non-detected, it is assumed to be at MDL.

Parameter	CS-BL	CS-R1
Date Tested	10/14/2024	14/10/2024
Sample Collection Time (Minutes)	180	180
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.57)	ND (0.57)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (0.57)	ND (0.57)
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (0.57)	ND (0.57)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ND (0.57)	ND (0.57)
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.57)	ND (0.57)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.57)	ND (0.57)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.57)	ND (0.57)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.57)	ND (0.57)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.57)	ND (0.57)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND (0.57)	ND (0.57)
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (0.57)	ND (0.57)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (0.57)	ND (0.57)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.57)	ND (0.57)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (0.57)	ND (0.57)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (0.57)	ND (0.57)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.57)	ND (0.57)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.57)	ND (0.57)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	ND (0.57)	ND (0.57)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.57)	ND (0.57)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.57)	ND (0.57)
Perfluorobutanesulfonic acid (PFBS)	ND (0.57)	ND (0.57)
Perfluorobutanoic acid (PFBA)	ND (0.57)	ND (0.57)
Perfluorodecanesulfonic acid (PFDS)	ND (0.57)	ND (0.57)
Perfluorodecanoic acid (PFDA)	ND (0.57)	ND (0.57)
Perfluorododecanesulfonic acid (PFDoS)	ND (0.57)	ND (0.57)
Perfluorododecanoic acid (PFDoA)	ND (0.57)	ND (0.57)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.57)	ND (0.57)
Perfluoroheptanoic acid (PFHpA)	ND (0.57)	ND (0.57)
Perfluorohexanesulfonic acid (PFHxS)	ND (0.57)	ND (0.57)
Perfluorohexanoic acid (PFHxA)	ND (0.57)	ND (0.57)
Perfluorononanesulfonic acid (PFNS)	ND (0.57)	ND (0.57)
Perfluorononanoic acid (PFNA)	ND (0.57)	ND (0.57)
Perfluorooctanesulfonamide (PFOSAm)	ND (0.57)	ND (0.57)
Perfluorooctanesulfonic acid (PFOS)	ND (0.57)	ND (0.57)
Perfluorooctanoic acid (PFOA)	ND (0.57)	ND (0.57)
Perfluoropentanesulfonic acid (PFPeS)	ND (0.57)	ND (0.57)
Perfluoropentanoic acid (PFPeA)	ND (0.57)	ND (0.57)
Perfluorotetradecanoic acid (PFTeDA)	ND (0.57)	ND (0.57)
Perfluorotridecanoic acid (PFTTrDA)	ND (0.57)	ND (0.57)
Perfluoroundecanoic acid (PFUnA)	ND (0.57)	ND (0.57)

Appendix XVII-D : PFAS in solid residues from contaminated soil for Baseline #2 (CCS2-BL), run #2 (CCS2-R1) and run #3 (CCS2-R3)

Units for PFAS in ng/g When a PFAS is non-detected, it is assumed to be at MDL.

Parameter	CCS2-BL	CCS2-R1	CCS2-R2
Date Tested	10/22/2024	22/10/2024	23/10/2024
Sample Collection Time (Minutes)	240	240	240
11-Chloroeicosafuoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.57)	ND (0.58)	ND (0.58)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (1.7)	ND (1.8)	ND (1.7)
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (1.7)	ND (1.8)	ND (1.7)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ND (1.7)	ND (1.8)	ND (1.7)
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.57)	ND (0.58)	ND (0.58)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.57)	ND (0.58)	ND (0.58)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.57)	ND (0.58)	ND (0.58)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.57)	ND (0.58)	ND (0.58)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.57)	ND (0.58)	ND (0.58)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND (2.8)	ND (2.9)	ND (2.9)
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (1.4)	ND (1.5)	ND (1.4)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (1.4)	ND (1.5)	ND (1.4)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.57)	ND (0.58)	ND (0.58)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (1.4)	ND (1.5)	ND (1.4)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (1.4)	ND (1.5)	ND (1.4)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.57)	ND (0.58)	ND (0.58)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEEESA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorobutanesulfonic acid (PFBS)	ND (1.1)	ND (1.2)	ND (1.2)
Perfluorobutanoic acid (PFBA)	ND (2.3)	ND (2.3)	ND (2.3)
Perfluorodecanesulfonic acid (PFDS)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorodecanoic acid (PFDA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorododecanesulfonic acid (PFDoS)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorododecanoic acid (PFDoA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluoroheptanoic acid (PFHpA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorohexanesulfonic acid (PFHxS)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorohexanoic acid (PFHxA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorononanesulfonic acid (PFNS)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorononanoic acid (PFNA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorooctanesulfonamide (PFOSAm)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorooctanesulfonic acid (PFOS)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorooctanoic acid (PFOA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluoropentanesulfonic acid (PFPeS)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluoropentanoic acid (PFPeA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorotetradecanoic acid (PFTeDA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluorotridecanoic acid (PFTrDA)	ND (0.57)	ND (0.58)	ND (0.58)
Perfluoroundecanoic acid (PFUnA)	ND (0.57)	ND (0.58)	ND (0.58)

Appendix XVII-E : PFAS in solid residues from spent carbon incineration for Baseline (CC-BL), run #1 (CC-R1) and run #2 (CC-R2)

Units for PFAS in ng/g. When a PFAS is non-detected, it is assumed to be at MDL.

Parameter	CC-BL	CC-R1	CC-R2
Date Tested	10/19/2024	10/19/2024	10/20/2024
Sample Collection Time (Minutes)	240	240	240
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.58)	ND (0.58)	ND (0.56)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (1.7)	ND (1.8)	ND (1.7)
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (1.7)	ND (1.8)	ND (1.7)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ND (1.7)	ND (1.8)	ND (1.7)
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.58)	ND (0.58)	ND (0.56)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.58)	ND (0.58)	ND (0.56)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.58)	ND (0.58)	ND (0.56)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.58)	ND (0.58)	ND (0.56)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.58)	ND (0.58)	ND (0.56)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND (2.9)	ND (2.9)	ND (2.8)
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (1.5)	ND (1.5)	ND (1.4)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (1.5)	ND (1.5)	ND (1.4)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.58)	ND (0.58)	ND (0.56)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (1.5)	ND (1.5)	ND (1.4)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (1.5)	ND (1.5)	ND (1.4)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.58)	ND (0.58)	ND (0.56)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluorobutanesulfonic acid (PFBS)	ND (1.2)	ND (1.2)	ND (1.1)
Perfluorobutanoic acid (PFBA)	ND (2.3)	ND (2.3)	ND (2.3)
Perfluorodecanesulfonic acid (PFDS)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluorodecanoic acid (PFDA)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluorododecanesulfonic acid (PFDoS)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluorododecanoic acid (PFDoA)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluoroheptanoic acid (PFHpA)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluorohexanesulfonic acid (PFHxS)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluorohexanoic acid (PFHxA)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluorononanesulfonic acid (PFNS)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluorononanoic acid (PFNA)	ND (0.58)	ND (0.58)	ND (0.56)

Perfluorooctanesulfonamide (PFOSAm)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluorooctanesulfonic acid (PFOS)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluorooctanoic acid (PFOA)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluoropentanesulfonic acid (PFPeS)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluoropentanoic acid (PFPeA)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluorotetradecanoic acid (PFTeDA)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluorotridecanoic acid (PFTrDA)	ND (0.58)	ND (0.58)	ND (0.56)
Perfluoroundecanoic acid (PFUnA)	ND (0.58)	ND (0.58)	ND (0.56)

Appendix XVII-F : PFAS in solid residues from CF4 incineration for Baseline (CW+-BL), run #1 (CW+-R1)

Units for PFAS in ng/g. When a PFAS is non-detected, it is assumed to be at MDL.

Parameter	CW+-BL	CW+-R1
Date Tested	10/17/2024	17/10/2024
Sample Collection Time (Minutes)	240	240
11-Chloroeicosafuoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ND (0.57)	ND (0.57)
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ND (1.7)	ND (1.7)
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ND (1.7)	ND (1.7)
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ND (1.7)	ND (1.7)
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ND (0.57)	ND (0.57)
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ND (0.57)	ND (0.57)
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ND (0.57)	ND (0.57)
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	ND (0.57)	ND (0.57)
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ND (0.57)	ND (0.57)
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND (2.8)	ND (2.9)
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ND (1.4)	ND (1.4)
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ND (1.4)	ND (1.4)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND (0.57)	ND (0.57)
N-methylperfluorooctane sulfonamide (NMeFOSA)	ND (1.4)	ND (1.4)
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ND (1.4)	ND (1.4)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND (0.57)	ND (0.57)
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ND (0.57)	ND (0.57)
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	ND (0.57)	ND (0.57)
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND (0.57)	ND (0.57)
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND (0.57)	ND (0.57)
Perfluorobutanesulfonic acid (PFBS)	ND (1.1)	ND (1.1)
Perfluorobutanoic acid (PFBA)	ND (2.3)	ND (2.3)
Perfluorodecanesulfonic acid (PFDS)	ND (0.57)	ND (0.57)
Perfluorodecanoic acid (PFDA)	ND (0.57)	ND (0.57)
Perfluorododecanesulfonic acid (PFDoS)	ND (0.57)	ND (0.57)
Perfluorododecanoic acid (PFDoA)	ND (0.57)	ND (0.57)
Perfluoroheptanesulfonic acid (PFHpS)	ND (0.57)	ND (0.57)
Perfluoroheptanoic acid (PFHpA)	ND (0.57)	ND (0.57)
Perfluorohexanesulfonic acid (PFHxS)	ND (0.57)	ND (0.57)
Perfluorohexanoic acid (PFHxA)	ND (0.57)	ND (0.57)
Perfluorononanesulfonic acid (PFNS)	ND (0.57)	ND (0.57)
Perfluorononanoic acid (PFNA)	ND (0.57)	ND (0.57)
Perfluorooctanesulfonamide (PFOSAm)	ND (0.57)	ND (0.57)
Perfluorooctanesulfonic acid (PFOS)	ND (0.57)	ND (0.57)
Perfluorooctanoic acid (PFOA)	ND (0.57)	ND (0.57)
Perfluoropentanesulfonic acid (PFPeS)	ND (0.57)	ND (0.57)
Perfluoropentanoic acid (PFPeA)	ND (0.57)	ND (0.57)
Perfluorotetradecanoic acid (PFTeDA)	ND (0.57)	ND (0.57)
Perfluorotridecanoic acid (PFTrDA)	ND (0.57)	ND (0.57)
Perfluoroundecanoic acid (PFUnA)	ND (0.57)	ND (0.57)

Appendix XVIII-A - OTM-50 table for Baseline (CA-BL), AFFF run#1 (CA-R1) and AFFF run#2 (CA-R2)

Parameter	Units	CA-BL	CA-R1	CA-R2
Date Tested	-	10/09/2024	9/10/2024	10/10/2024
Sample Collection Time	minutes	240	240	240
Gas Volume Collected	dscf	113.712	117.847	116.075
Volumetric Flow Rate	dscfm	32,608	33,480	32,776
1,1,1,2,2-Pentafluoroethane (HFC-125)	lb/hr	ND (0.000083)	ND (0.000084)	ND (0.000083)
1,1,1-Trifluoroethane		ND (0.00019)	ND (0.00019)	ND (0.00019)
1,1,2-Trichloro-1,2,2-trifluoroethane		ND (0.000048)	ND (0.000049)	ND (0.000048)
1H-Heptafluoropropane		ND (0.000040)	ND (0.000041)	ND (0.000040)
1H-Nonafluorobutane		ND (0.000084)	ND (0.000086)	ND (0.000084)
1H-Perfluoroheptane		ND (0.00012)	ND (0.00013)	ND (0.00012)
1H-Perfluorohexane		ND (0.000069)	ND (0.000071)	ND (0.000069)
1H-Perfluorooctane		ND (0.000091)	ND (0.000093)	ND (0.000091)
1H-Perfluoropentane		ND (0.00012)	ND (0.00013)	ND (0.00012)
2H-Perfluoro-5-methyl-3,6-dioxanonane (E2)		ND (0.00010)	ND (0.00010)	ND (0.00010)
Chlorodifluoromethane		ND (0.00012)	ND (0.00013)	ND (0.00012)
Chlorotrifluoroethene		ND (0.000037)	ND (0.000038)	ND (0.000037)
Chlorotrifluoromethane		ND (0.000089)	ND (0.000092)	ND (0.000090)
Decafluorobutane		ND (0.000062)	ND (0.000063)	ND (0.000062)
Difluoromethane (HFC-32)		ND (0.00011)	ND (0.00011)	ND (0.00011)
Dodecafluoropentane		ND (0.00017)	ND (0.00017)	ND (0.00017)
Ethane, 1,1,1,2-tetrafluoro-Fluoromethane		ND (0.000095)	ND (0.000097)	ND (0.000095)
Heptafluoropropyl 1,2,2,2-tetrafluoroethyl ether		0.0000996	ND (0.000087)	ND (0.000086)
Hexadecafluoroheptane		ND (0.000080)	ND (0.000082)	ND (0.000080)
Hexafluoroethane		ND (0.000044)	ND (0.000045)	ND (0.000044)
Hexafluoropropene		ND (0.000043)	ND (0.000044)	ND (0.000043)
Hexafluoropropylene oxide		ND (0.0034)	ND (0.0035)	ND (0.0034)
Octadecafluorooctane		ND (0.00010)	ND (0.00011)	ND (0.00010)
Octafluorocyclobutane (FC-C318)		ND (0.000041)	ND (0.000042)	ND (0.000041)
Octafluorocyclopentene (FC-C1418)		ND (0.000096)	ND (0.000098)	ND (0.000096)
Octafluoropropane		ND (0.000093)	ND (0.000095)	ND (0.000093)
Tetradecafluorohexane		ND (0.00016)	ND (0.00016)	ND (0.00015)
Tetrafluoroethene		ND (0.000038)	ND (0.000039)	ND (0.000038)
Trichlorofluoromethane		ND (0.00013)	ND (0.00013)	ND (0.00013)
Trifluoromethane		ND (0.00011)	ND (0.00011)	ND (0.00011)
Vinyl Fluoride		ND (0.000062)	ND (0.000063)	ND (0.000062)
Tetrafluoromethane		ND (0.00044)	ND (0.00045)	ND (0.00044)

Appendix XVIII-B - OTM-50 table for Baseline (CA+-BL), AFFF run#3 (CA+-R1)

Parameter	Units	CA+-BL	CA+-R1
Date Tested	-	10/12/2024	12/10/2024
Sample Collection Time	minutes	240	240
Gas Volume Collected	dscf	112.753	114.395
Volumetric Flow Rate	dscfm	31,960	33,486
1,1,1,2,2-Pentafluoroethane (HFC-125)	lb/hr	ND (0.000083)	ND (0.000084)
1,1,1-Trifluoroethane		ND (0.00019)	ND (0.00019)
1,1,2-Trichloro-1,2,2-trifluoroethane		ND (0.000048)	ND (0.000049)
1H-Heptafluoropropane		ND (0.000040)	ND (0.000041)
1H-Nonafluorobutane		ND (0.000084)	ND (0.000085)
1H-Perfluoroheptane		ND (0.00012)	ND (0.00012)
1H-Perfluorohexane		ND (0.000069)	ND (0.000070)
1H-Perfluorooctane		ND (0.000091)	ND (0.000092)
1H-Perfluoropentane		ND (0.00012)	ND (0.00012)
2H-Perfluoro-5-methyl-3,6-dioxanonane (E2)		ND (0.00010)	ND (0.00010)
Chlorodifluoromethane		ND (0.00012)	ND (0.00013)
Chlorotrifluoroethene		ND (0.000037)	ND (0.000038)
Chlorotrifluoromethane		ND (0.000089)	ND (0.000091)
Decafluorobutane		ND (0.000062)	ND (0.000063)
Difluoromethane (HFC-32)		ND (0.00011)	ND (0.00011)
Dodecafluoropentane		ND (0.00017)	ND (0.00017)
Ethane, 1,1,1,2-tetrafluoro-Fluoromethane		ND (0.000094)	ND (0.000096)
Heptafluoropropyl 1,2,2,2-tetrafluoroethyl ether		ND (0.000085)	ND (0.000087)
Hexadecafluoroheptane		ND (0.000080)	ND (0.000081)
Hexafluoroethane		ND (0.000044)	ND (0.000045)
Hexafluoropropene		ND (0.000043)	ND (0.000044)
Hexafluoropropylene oxide		ND (0.0034)	ND (0.0035)
Octadecafluorooctane		ND (0.00010)	ND (0.00011)
Octafluorocyclobutane (FC-C318)		ND (0.000041)	ND (0.000042)
Octafluorocyclopentene (FC-C1418)		ND (0.000096)	ND (0.000098)
Octafluoropropane		ND (0.000093)	ND (0.000095)
Tetradecafluorohexane		ND (0.00016)	ND (0.00016)
Tetrafluoroethene		ND (0.000038)	ND (0.000039)
Trichlorofluoromethane		ND (0.00013)	ND (0.00013)
Trifluoromethane		ND (0.00011)	ND (0.00011)
Vinyl Fluoride		ND (0.000062)	ND (0.000063)
Tetrafluoromethane		0.00239	0.00509

Appendix XVIII-C : OTM-50 table for baseline (CC-BL), carbon run#1 (CC-R1) and carbon run#2 (CC-R2)

Parameter	Units	CC-BL	CC-R1	CC-R2
Date Tested	-	10/19/2024	19/10/2024	20/10/2024
Sample Collection Time	minutes	240	240	240
Gas Volume Collected	dscf	114.613	114.081	117.867
Volumetric Flow Rate	dscfm	32,906	32,160	33,931
1,1,1,2,2-Pentafluoroethane (HFC-125)	lb/hr	ND (0.00013)	ND (0.00013)	ND (0.00014)
1,1,1-Trifluoroethane		ND (0.00029)	ND (0.00029)	ND (0.00032)
1,1,2-Trichloro-1,2,2-trifluoroethane		ND (0.000074)	ND (0.000073)	ND (0.000080)
1H-Heptafluoropropane		ND (0.000062)	ND (0.000061)	ND (0.000067)
1H-Nonafluorobutane		ND (0.00013)	ND (0.00013)	ND (0.00014)
1H-Perfluoroheptane		ND (0.00019)	ND (0.00019)	ND (0.00020)
1H-Perfluorohexane		ND (0.00011)	ND (0.00010)	ND (0.00011)
1H-Perfluorooctane		ND (0.00014)	ND (0.00014)	ND (0.00015)
1H-Perfluoropentane		ND (0.00019)	ND (0.00019)	ND (0.00020)
2H-Perfluoro-5-methyl-3,6-dioxanonane (E2)		ND (0.00016)	ND (0.00016)	ND (0.00017)
Chlorodifluoromethane		ND (0.00019)	ND (0.00019)	ND (0.00021)
Chlorotrifluoroethene		ND (0.000057)	ND (0.000056)	ND (0.000062)
Chlorotrifluoromethane		ND (0.00014)	ND (0.00014)	ND (0.00015)
Decafluorobutane		ND (0.000094)	ND (0.000094)	ND (0.00010)
Difluoromethane (HFC-32)		ND (0.00017)	ND (0.00017)	ND (0.00019)
Dodecafluoropentane		ND (0.00025)	ND (0.00025)	ND (0.00028)
Ethane, 1,1,1,2-tetrafluoro-Fluoromethane		ND (0.00014)	ND (0.00014)	ND (0.00016)
Heptafluoropropyl 1,2,2,2-tetrafluoroethyl ether		ND (0.00011)	ND (0.00011)	ND (0.00012)
Hexadecafluoroheptane		ND (0.00013)	ND (0.00013)	ND (0.00014)
Hexafluoroethane		ND (0.00012)	ND (0.00012)	ND (0.00013)
Hexafluoropropene		ND (0.000067)	ND (0.000067)	ND (0.000073)
Hexafluoropropene		ND (0.000066)	ND (0.000066)	ND (0.000072)
Hexafluoropropylene oxide		ND (0.0052)	ND (0.0052)	ND (0.0057)
Octadecafluorooctane		ND (0.00016)	ND (0.00016)	ND (0.00017)
Octafluorocyclobutane (FC-C318)		ND (0.000063)	ND (0.000063)	ND (0.000068)
Octafluorocyclopentene (FC-C1418)		ND (0.00015)	ND (0.00015)	ND (0.00016)
Octafluoropropane		ND (0.00014)	ND (0.00014)	ND (0.00015)
Tetradecafluorohexane		ND (0.00024)	ND (0.00023)	ND (0.00026)
Tetrafluoroethene		ND (0.000058)	ND (0.000058)	ND (0.000063)
Trichlorofluoromethane		ND (0.00020)	ND (0.00020)	ND (0.00022)
Trifluoromethane		ND (0.00017)	ND (0.00016)	ND (0.00018)
Vinyl Fluoride		ND (0.000094)	ND (0.000094)	ND (0.00010)
Tetrafluoromethane	ND (0.00068)	ND (0.00067)	ND (0.00073)	

Appendix XVIII-D : OTM-50 table for Baseline (CCS-BL) and contaminated soil run 1 (CCS-R1)

Parameter	Units	CCS-BL	CCS-R1
Date Tested	-	10/14/2024	14/10/2024
Sample Collection Time	minutes	240	240
1,1,1,2,2-Pentafluoroethane (HFC-125)	lb/hr	ND (0.000083)	ND (0.000081)
1,1,1-Trifluoroethane		ND (0.00019)	ND (0.00019)
1,1,2-Trichloro-1,2,2-trifluoroethane		ND (0.000048)	ND (0.000047)
1H-Heptafluoropropane		ND (0.000040)	ND (0.000039)
1H-Nonafluorobutane		ND (0.000084)	ND (0.000082)
1H-Perfluoroheptane		ND (0.00012)	ND (0.00012)
1H-Perfluorohexane		ND (0.000069)	ND (0.000068)
1H-Perfluorooctane		ND (0.000091)	ND (0.000089)
1H-Perfluoropentane		ND (0.00012)	ND (0.00012)
2H-Perfluoro-5-methyl-3,6-dioxanonane (E2)		ND (0.00010)	ND (0.00010)
Chlorodifluoromethane		ND (0.00013)	ND (0.00012)
Chlorotrifluoroethene		ND (0.000037)	ND (0.000036)
Chlorotrifluoromethane		ND (0.000090)	ND (0.000087)
Decafluorobutane		ND (0.000062)	ND (0.000060)
Difluoromethane (HFC-32)		ND (0.00011)	ND (0.00011)
Dodecafluoropentane		ND (0.00017)	ND (0.00016)
Ethane, 1,1,1,2-tetrafluoro-Fluoromethane		ND (0.000095)	ND (0.000093)
Heptafluoropropyl 1,2,2,2-tetrafluoroethyl ether		ND (0.00070)	ND (0.00069)
Hexadecafluoroheptane		ND (0.000086)	ND (0.000084)
Hexafluoroethane		ND (0.000080)	ND (0.000078)
Hexafluoropropene		ND (0.000044)	ND (0.000043)
Hexafluoropropylene oxide		ND (0.000043)	ND (0.000042)
Octadecafluorooctane		ND (0.0034)	ND (0.0033)
Octafluorocyclobutane (FC-C318)		ND (0.00010)	ND (0.00010)
Octafluorocyclopentene (FC-C1418)		ND (0.000041)	ND (0.000040)
Octafluoropropane		ND (0.000096)	ND (0.000094)
Tetradecafluorohexane		ND (0.000093)	ND (0.000091)
Tetrafluoroethene		ND (0.00015)	ND (0.00015)
Trichlorofluoromethane		ND (0.000038)	ND (0.000037)
Tetrafluoromethane		ND (0.00013)	ND (0.00013)
Trifluoromethane		ND (0.00011)	ND (0.00011)
Vinyl Fluoride	ND (0.000062)	ND (0.000060)	
Tetrafluoromethane	ND (0.00045)	ND (0.00043)	

Appendix XVIII- E : OTM-50 table for baseline (CCS2-BL), contaminated oil run#2 (CCS2-R1), contaminated soil run#3 (CCS2-R2)

Parameter	Units	CCS2-BL	CCS2-R1	CCS2-R2
Date Tested	-	10/22/2024	22/10/2024	23/10/2024
Sample Collection Time	minutes	240	240	240
Gas Volume Collected	dscf	118.352	113.312	114.699
Volumetric Flow Rate	dscfm	33,831	31,972	32,829
1,1,1,2,2-Pentafluoroethane (HFC-125)	lb/hr	ND (0.00014)	ND (0.00013)	ND (0.00012)
1,1,1-Trifluoroethane		ND (0.00031)	ND (0.00030)	ND (0.00028)
1,1,2-Trichloro-1,2,2-trifluoroethane		ND (0.000079)	ND (0.000076)	ND (0.000072)
1H-Heptafluoropropane		ND (0.000066)	ND (0.000063)	ND (0.000060)
1H-Nonafluorobutane		ND (0.00014)	ND (0.00013)	ND (0.00012)
1H-Perfluoroheptane		ND (0.00020)	ND (0.00019)	ND (0.00018)
1H-Perfluorohexane		ND (0.00011)	ND (0.00011)	ND (0.00010)
1H-Perfluorooctane		ND (0.00015)	ND (0.00014)	ND (0.00013)
1H-Perfluoropentane		ND (0.00020)	ND (0.00019)	ND (0.00018)
2H-Perfluoro-5-methyl-3,6-dioxanonane (E2)		ND (0.00017)	ND (0.00016)	ND (0.00015)
Chlorodifluoromethane		ND (0.00020)	ND (0.00020)	ND (0.00019)
Chlorotrifluoroethene		ND (0.000061)	ND (0.000059)	ND (0.000055)
Chlorotrifluoromethane		ND (0.00015)	ND (0.00014)	ND (0.00013)
Decafluorobutane		ND (0.00010)	ND (0.000097)	ND (0.000092)
Difluoromethane (HFC-32)		ND (0.00018)	ND (0.00018)	ND (0.00017)
Dodecafluoropentane		ND (0.00027)	ND (0.00026)	ND (0.00025)
Ethane, 1,1,1,2-tetrafluoro-Fluoromethane		ND (0.00015)	ND (0.00015)	ND (0.00014)
Heptafluoropropyl 1,2,2,2-tetrafluoroethyl ether		ND (0.00014)	ND (0.00013)	ND (0.00013)
Hexadecafluoroheptane		ND (0.00013)	ND (0.00013)	ND (0.00012)
Hexafluoroethane		ND (0.000072)	ND (0.000069)	ND (0.000065)
Hexafluoropropene		ND (0.000071)	ND (0.000068)	ND (0.000064)
Hexafluoropropylene oxide		ND (0.0056)	ND (0.0054)	ND (0.0051)
Octadecafluorooctane		ND (0.00017)	ND (0.00016)	ND (0.00015)
Octafluorocyclobutane (FC-C318)		ND (0.000067)	ND (0.000065)	ND (0.000061)
Octafluorocyclopentene (FC-C1418)		ND (0.00016)	ND (0.00015)	ND (0.00014)
Octafluoropropane		ND (0.00015)	ND (0.00015)	ND (0.00014)
Tetradecafluorohexane		ND (0.00025)	ND (0.00024)	ND (0.00023)
Tetrafluoroethene		ND (0.000062)	ND (0.000060)	ND (0.000057)
Trichlorofluoromethane		ND (0.00021)	ND (0.00020)	ND (0.00019)
Trifluoromethane		ND (0.00018)	ND (0.00017)	ND (0.00016)
Vinyl Fluoride		ND (0.00010)	ND (0.000097)	ND (0.000092)
Tetrafluoromethane		ND (0.00072)	ND (0.00070)	ND (0.00066)

Appendix XVIII-F : OTM-50 table for Baseline (CCF4-BL) and CF4 run (CCF4-R1)

Parameter	Units	CCF4-BL	CCF4-R1
Date Tested	-	10/17/2024	17/10/2024
Sample Collection Time	minutes	240	240
Gas Volume Collected	dscf	115.328	119.429
Volumetric Flow Rate	dscfm	33,597	33,976
1,1,1,2,2-Pentafluoroethane (HFC-125)	lb/hr	ND (0.00013)	ND (0.00013)
1,1,1-Trifluoroethane		ND (0.00029)	ND (0.00031)
1,1,2-Trichloro-1,2,2-trifluoroethane		ND (0.000074)	ND (0.000078)
1H-Heptafluoropropane		ND (0.000061)	ND (0.000065)
1H-Nonafluorobutane		ND (0.00013)	ND (0.00014)
1H-Perfluoroheptane		ND (0.00019)	ND (0.00020)
1H-Perfluorohexane		ND (0.00011)	ND (0.00011)
1H-Perfluorooctane		ND (0.00014)	ND (0.00015)
1H-Perfluoropentane		ND (0.00019)	ND (0.00020)
2H-Perfluoro-5-methyl-3,6-dioxanonane (E2)		ND (0.00016)	ND (0.00016)
Chlorodifluoromethane		ND (0.00019)	ND (0.00020)
Chlorotrifluoroethene		ND (0.000057)	ND (0.000060)
Chlorotrifluoromethane		ND (0.00014)	ND (0.00014)
Decafluorobutane		ND (0.000094)	ND (0.000099)
Difluoromethane (HFC-32)		ND (0.00017)	ND (0.00018)
Dodecafluoropentane		ND (0.00025)	ND (0.00027)
Ethane, 1,1,1,2-tetrafluoro-		ND (0.00014)	ND (0.00015)
Fluoromethane		ND (0.0011)	ND (0.0011)
Heptafluoropropyl 1,2,2,2-tetrafluoroethyl ether		ND (0.00013)	ND (0.00014)
Hexadecafluoroheptane		ND (0.00012)	ND (0.00013)
Hexafluoroethane		ND (0.000067)	ND (0.000071)
Hexafluoropropene		ND (0.000066)	ND (0.000070)
Hexafluoropropylene oxide		ND (0.0052)	ND (0.0055)
Octadecafluorooctane		ND (0.00016)	ND (0.00017)
Octafluorocyclobutane (FC-C318)		ND (0.000063)	ND (0.000066)
Octafluorocyclopentene (FC-C1418)		ND (0.00015)	ND (0.00015)
Octafluoropropane		ND (0.00014)	ND (0.00015)
Tetradecafluorohexane		ND (0.00024)	ND (0.00025)
Tetrafluoroethene		ND (0.000058)	ND (0.000061)
Trichlorofluoromethane		ND (0.00020)	ND (0.00021)
Trifluoromethane		ND (0.00016)	ND (0.00017)
Vinyl Fluoride		ND (0.000094)	ND (0.000099)
Tetrafluoromethane	ND (0.00068)	17.6	

Appendix XIX-A : Method 26A HF Results for baseline and AFFF run #2 and #3 in campaign 2

Run No.		BL	1	2	
Date		09-Oct-24	09-Oct-24	10-Oct-24	
Start Time	Units	08:30	13:45	14:30	
Stop Time		12:50	18:05	18:40	AVGS
Sampling Parameters --					
Barometric Pressure	in. Hg	29.93	29.92	29.99	29.95
Volume Metered	dcf	117.433	122.651	120.042	120.042
Volume of Gas Collected	dscf	113.774	117.257	114.596	115.209
Moisture	% v/v	6.6	6.9	5.8	6.4
O ₂ at Stack	% dry	7.82	7.27	7.48	7.52
CO ₂ at Stack	% dry	9.78	10.36	9.93	10.02
Avg. Stack Temp.	°F	101	104	104	103
Stack Flowrate	dscfm	32,670	33,241	32,929	32,947
Isokinetics	%	100	101	99	100
HF Emission Results --					
Total HF Detected Acid Imp	µg	< 76.5	< 95.7	< 77.7	< 83.3
Total HF Detected Alkaline Imp	µg	< 110.0	< 132.0	< 116.0	< 119.3
Total HF Concentration	ppm	< 0.069	< 0.082	< 0.072	< 0.074
Conc. @ 7% O ₂	ppm	< 0.074	< 0.084	< 0.074	< 0.077
HF Emission Rate	lb/hr	< 0.007	< 0.009	< 0.007	< 0.008

Appendix XIX-B : Method 26A HF Results for baseline (A+-BL) and AFFF run #3 (A+-R1) in campaign 2

Run No.		A+BL	A+R1	
Date		12-Oct-24	12-Oct-24	
Start Time	Units	08:15	13:35	
Stop Time		12:30	17:47	AVGS
<u>Sampling Parameters --</u>				
Barometric Pressure	in. Hg	30.09	30.11	30.10
Volume Metered	dcf	111.785	118.600	115.193
Volume of Gas Collected	dscf	107.824	114.745	111.285
Moisture	% v/v	7.0	7.0	7.0
O ₂ at Stack	% dry	7.60	7.06	7.33
CO ₂ at Stack	% dry	9.45	9.83	9.64
Avg. Stack Temp.	°F	103	104	104
Stack Flowrate	dscfm	30,493	32,670	31,582
Isokinetics	%	101	100	101
<u>HF Emission Results --</u>				
Total HF Detected Acid Imp	µg	< 83.9	< 79.7	< 81.8
Total HF Detected Alkaline Imp	µg	< 129.0	< 115.0	< 122.0
Total HF Concentration	ppm	< 0.084	< 0.072	< 0.078
Conc. @ 7% O ₂	ppm	< 0.087	< 0.072	< 0.080
HF Emission Rate	lb/hr	< 0.008	< 0.007	< 0.008

Appendix XV-C : Method 26A HF Results for baseline (CS-BL) and contaminated soil run #1 (Cs-R1) in campaign 2

Run No.		CS-BL	CS-R1	
Date		14-Oct-24	14-Oct-24	
Start Time	Units	08:05	14:45	
Stop Time		12:20	18:55	AVGS
Sampling Parameters --				
Barometric Pressure	in. Hg	30.06	30.04	30.05
Volume Metered	dcf	112.785	120.225	116.505
Volume of Gas Collected	dscf	110.187	115.689	112.938
Moisture	% v/v	7.0	7.3	7.1
O ₂ at Stack	% dry	7.19	7.26	7.23
CO ₂ at Stack	% dry	9.27	9.54	9.41
Avg. Stack Temp.	°F	104	106	105
Stack Flowrate	dscfm	31,456	32,840	32,148
Isokinetics	%	100	101	100
HF Emission Results --				
Total HF Detected Acid Imp	µg	< 81.3	< 78.5	< 79.9
Total HF Detected Alkaline Imp	µg	< 124.0	< 127.0	< 125.5
Total HF Concentration	ppm	< 0.079	< 0.075	< 0.077
Conc. @ 7% O ₂	ppm	< 0.080	< 0.077	< 0.078
HF Emission Rate	lb/hr	< 0.008	< 0.008	< 0.008

Appendix XIX-D : Method 26A HF Results for baseline (W+-BL) and CF4 run #1 (W+-R1) in campaign 2

Run No.		W+BL	W+R1	
Date		17-Oct-24	17-Oct-24	
Start Time	Units	09:05	14:15	
Stop Time		13:20	18:27	AVGS
<u>Sampling Parameters --</u>				
Barometric Pressure	in. Hg	30.22	30.21	30.22
Volume Metered	dcf	115.138	120.270	117.704
Volume of Gas Collected	dscf	115.104	120.264	117.684
Moisture	% v/v	5.5	5.8	5.6
O ₂ at Stack	% dry	8.40	8.40	8.40
CO ₂ at Stack	% dry	9.10	9.10	9.10
Avg. Stack Temp.	°F	96	98	97
Stack Flowrate	dscfm	33,082	34,380	33,731
Isokinetics	%	99	100	100
<u>HF Emission Results --</u>				
Total HF Detected Acid Imp	µg	< 79.3	< 77.6	< 78.5
Total HF Detected Alkaline Imp	µg	< 123.0	< 119.0	< 121.0
Total HF Concentration	ppm	< 0.074	< 0.069	< 0.072
Conc. @ 7% O ₂	ppm	< 0.083	< 0.077	< 0.080
HF Emission Rate	lb/hr	< 0.008	< 0.007	< 0.008

Appendix XIX-E : Method 26A HF Results for baseline (C-BL) and carbon run #1 #2 (C-1 and C-2) in campaign 2

Run No.		C-BL	C-1	C-2	
Date		19-Oct-24	19-Oct-24	20-Oct-24	
Start Time	Units	08:15	13:55	09:00	
Stop Time		12:30	18:10	13:16	AVGS
Sampling Parameters --					
Barometric Pressure	in. Hg	30.24	30.26	30.26	30.25
Volume Metered	dcf	116.898	118.024	113.235	116.052
Volume of Gas Collected	dscf	115.564	116.443	111.395	114.467
Moisture	% v/v	5.8	6.2	5.8	5.9
O ₂ at Stack	% dry	8.40	7.80	8.40	8.20
CO ₂ at Stack	% dry	9.10	9.90	9.10	9.37
Avg. Stack Temp.	°F	98	100	98	99
Stack Flowrate	dscfm	33,358	33,134	31,743	32,745
Isokinetics	%	99	100	100	100
HF Emission Results --					
Total HF Detected Acid Imp	µg	< 77.7	< 72.9	< 70.4	< 73.7
Total HF Detected Alkaline Imp	µg	< 127.0	< 218.0	< 108.0	< 151.0
Total HF Concentration	ppm	< 0.075	< 0.106	< 0.068	< 0.083
Conc. @ 7% O ₂	ppm	< 0.083	< 0.112	< 0.075	< 0.090
HF Emission Rate	lb/hr	< 0.008	< 0.011	< 0.007	< 0.008

Appendix XIX-F : Method 26A HF Results for baseline (CS2-BL) and contaminated soil run #2 #3 (CS-R1 and CS-R2) in campaign 2

Run No.		CS2 - BL	CS2-R1	CS2-R2	
Date		22-Oct-24	22-Oct-24	10-Oct-24	
Start Time	Units	10:00	15:05	08:25	
Stop Time		14:15	19:20	12:40	AVGS
<u>Sampling Parameters --</u>					
Barometric Pressure	in. Hg	30.10	30.08	30.12	30.10
Volume Metered	dcf	118.713	121.132	114.735	118.193
Volume of Gas Collected	dscf	115.259	118.882	110.602	114.914
Moisture	% v/v	7.2	6.9	6.2	6.8
O ₂ at Stack	% dry	8.40	7.80	8.40	8.20
CO ₂ at Stack	% dry	9.10	9.90	9.10	9.37
Avg. Stack Temp.	°F	104	103	100	102
Stack Flowrate	dscfm	32,882	33,680	31,459	32,674
Isokinetics	%	100	101	100	101
<u>HF Emission Results --</u>					
Total HF Detected Acid Imp	µg	< 82.6	< 82.3	< 72.2	< 79.0
Total HF Detected Alkaline Imp	µg	< 121.0	< 106.0	< 108.0	< 111.7
Total HF Concentration	ppm	< 0.075	< 0.067	< 0.069	< 0.070
Conc. @ 7% O ₂	ppm	< 0.083	< 0.071	< 0.077	< 0.077
HF Emission Rate	lb/hr	< 0.008	< 0.007	< 0.007	< 0.007

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