



## PROPOSAL

Supplemental Work Plan at Building 430  
Truax Field  
Madison, Wisconsin

**Prepared for:**

Wisconsin Air National Guard  
Truax Air National Guard Base

ORIN Technologies, LLC. (ORIN), which has expertise in both in situ injection and bioremediation, has prepared this document for pilot scale injection for the Wisconsin Air National Guard (WI ANG) at Truax Field in Madison, Wisconsin.

A handwritten signature in black ink, appearing to read "Larry Kinsman". The signature is fluid and cursive, with a large, stylized initial "L".

Larry Kinsman, Geologist  
Principal  
ORIN Technologies, LLC



November 2, 2021

Michael T. Hinman, GS-12, WI ANG  
Architect, 115<sup>th</sup> Civil Engineering Squadron  
Madison WI

**Subject: Summary for Pilot Scale Injection for the Wisconsin Air National Guard in Madison, WI.**

Dear Michael,

ORIN Technologies, LLC. (ORIN) is pleased to present this summary for pilot scale injection for the Wisconsin Air National Guard (WI ANG) at Truax Field in Madison, Wisconsin.

### **Summary of Site Conditions**

WI ANG has requested ORIN to provide a cost estimate for treating groundwater contaminated with Per- and Polyfluoroalkyl Substances (PFAS). ORIN will target an area of approximately 1,600 square feet around building 430. The average depth to groundwater is approximately 7 feet below ground surface (ft bgs). The lithology within the targeted treatment interval is fine to coarse grained sand overlain by clayey sand with silts.

### **Groundwater Monitoring Plan**

ORIN intends to monitor groundwater for the following parameters: DO, pH, ORP, depth to water, conductivity, temperature, Wisconsin DNR (WDNR) approved list of PFAS compounds in groundwater, total organic fluorine, total organic fluoride, and dissolved calcium. The expected frequency of sampling will be 1 week post injection, 3 weeks post injection, 5 weeks post injection, and then monthly following the 5 week sampling date. The sampling will be primarily done on groundwater. Analysis on soil samples could be collected at a later date if additional funding is procured.

## Map of Injection area



## Map of Approximate Injection Locations





## **Location Reasoning for Pilot Study**

The following information is taken from the Site Investigation Report performed by Amec Foster Wheeler and completed in March 2019.

AFFF nozzle systems on fire department vehicles had been tested every six months in the grassy areas near Building 430. Nozzle test area 2 is located southwest of Building 430. AFFF released in porous green spaces has the potential to seep into the subsurface and groundwater.

## Soil Analytical Results

Seven soil samples (including one duplicate) were collected and analyzed from three borings advanced to a shallow (0.5 to 1 ft bgs) and deep (5 to 6.5 ft bgs) location. 02-SB01 from 0.5 to 1 and 6 to 6.5 ft bgs; 02-SB02 from 0.5 to 1 and 5 to 5.5 ft bgs; 02-SB03 from 0.5 to 1 and 6 to 6.5 ft bgs. Analytical results from soil samples indicate that the six PFAS analyzed for were detected above the laboratory reporting limit with three samples having PFOS concentrations exceeding HA criteria of 1.26 mg/kg. Sample 02-SB02-0.5-1 was found to have a PFOS concentration of 3.33 mg/kg and a PFOA concentration of 0.0141 mg/kg. Sample 02SB03-0.5-1 was found to have a PFOS concentration of 30.1J mg/kg and a PFOA concentration of 0.118 mg/kg. The duplicate to sample 02-SB02-0.5-1 was found to have a PFOS concentration of 36.8J mg/kg and a PFOA concentration of 0.151 mg/kg.

## Groundwater Analytical Results

One groundwater sample was collected from TW-02 (co-located with 02-SB01). TW-02 was drilled to a depth of 10 ft bgs with the well screen from 5 to 10 ft bgs. Groundwater was encountered at 7.17 ft bgs. Analytical results from the groundwater sample indicates that six PFAS were detected at concentrations above the laboratory detection limit, with two compounds exceeding USEPA Drinking Water HA of 0.07 µg/L. PFOS was detected at a concentration of 28.4 µg/L and PFOA was detected at a concentration of 0.349 µg/L. The combined PFOS and PFOA is 28.8 µg/L.

## Summary of Selected Pilot Study Area

A review of soil analytical data compared to screening criteria indicates no exceedances of USEPA RSL for PFBS and no exceedance of the USAF Guidance screening level for PFOA. PFOS in the shallow soil samples from 02-SB02 and 02-

SB03 as well as in the duplicate of 02-SB03 exceeded the USAF Guidance screening level.

A review of groundwater data compared to screening criteria indicates exceedances of the USEPA Drinking Water HA exist downgradient from this potential release location. This determination was made based on concentrations observed in TW-02, which was installed to assess groundwater conditions downgradient from potential release location. Given that groundwater flows to the east/southeast, groundwater with PFAS concentrations above the applicable screening criteria is potentially present off-Base to the east/south of this potential release location.

## Monitoring Well Installation



*Figure 1 Monitoring well installation by hollow stem auger. Image courtesy of Geoprobe.com*

Installation of monitoring wells will occur through hollow stem auger. The monitoring wells will be constructed of 2-inch schedule 40 PVC.



*Figure 2 Flush mount monitoring well.*

Monitoring wells can be finished with flush mount vaults and cement pads to protect the well and allow for minimal obstructions.



*Figure 3 Enclosed chemical mixing system.*



*Figure 4 BAM and PFAS Degrading Bacteria batch mixing.*

BAM and PFAS degrading bacteria will be mixed inside ORIN's enclosed injection trailers within 200-gallon batch tanks. Multiple tanks will be used to allow for continuous mixing and injecting.





**In-Situ Injection**



*Figure 5 ORIN injection trailer.*

ORIN will prepare and mix the treatment remedies inside enclosed trailers.



*Figure 6 DPT Direct Push Technology in-situ injection.*

BAM and PFAS degrading bacteria will be injected through Geoprobe Direct Puch Technology (DPT). ORIN will control the injection process using our custom designed injection head.

## Vacuum Extraction



*Figure 7 Vacuum extraction truck.*



*Figure 8 Vacuum extraction and in-situ injection.*



Vacuum extraction will be applied through adjacent monitoring wells. The extraction process will assist in distributing treatment solution through the impacted soil and groundwater. ORIN will utilize a vacuum extraction truck during implementation.

### **Summary of Bioremediation Process**

It is believed that, if successful, the in situ biological treatment of PFAS will be both more cost effective, less disruptive, and have a lower carbon footprint than alternative means of PFAS destruction, such as excavation and incineration of the soil. Specifically, this work will utilize microbes that are indigenous to the site which will be best adapted to the geochemical conditions found as well as the PFAS species present.

Microbes were previously isolated from surface water and sediment collected at the site. These microbes were testing in Fixed Earth's lab to validate performance and tested under field conditions to treat AFFF impacted water stored in tanks at the Dane County airport in summer/fall 2021. In our previous studies, it has been demonstrated that the microbes are capable of breaking the carbon-fluorine bond, resulting in the eventual destruction of PFAS molecules. This was validated through analysis of AFFF impacted water that was treated with microbes and compared to untreated controls. Analysis included a full suite of known PFAS compounds as well as non-targeted analysis of fluorinated compounds and by products, including analysis of total organic fluorine, total oxidable precursor, an open GC/MS scan for fluorinated volatile compounds, and detection of fluoride through a colorimetric assay.

As part of our ongoing research into the best application methods for these microbes, we have found that oxygen is required for PFAS biodegradation and that the formation of biofilms expedites biological activity against these compounds. The EKOGRID system will be utilized to provide the oxygen required for microbial activity, see EKOGRID section for additional details. It has also been found that the addition of BAM provides a nucleation site for biofilm formation. Bacteria are found to attach to a portion of the BAM particles and biofilm formation occurs from this point, forming biofilms that are adjacent to the BAM particle rather than encasing it. See Figure 9 for microscopic images of biofilm formation using the microbes isolated from the Dane County Airport. The addition of BAM with the microbes was found to greatly expedite PFAS removal in the pilot conducted at the airport where water was treated in totes. See Figure 10 for a comparison between water treated with microbes alone verses water treated with both microbes and BAM.

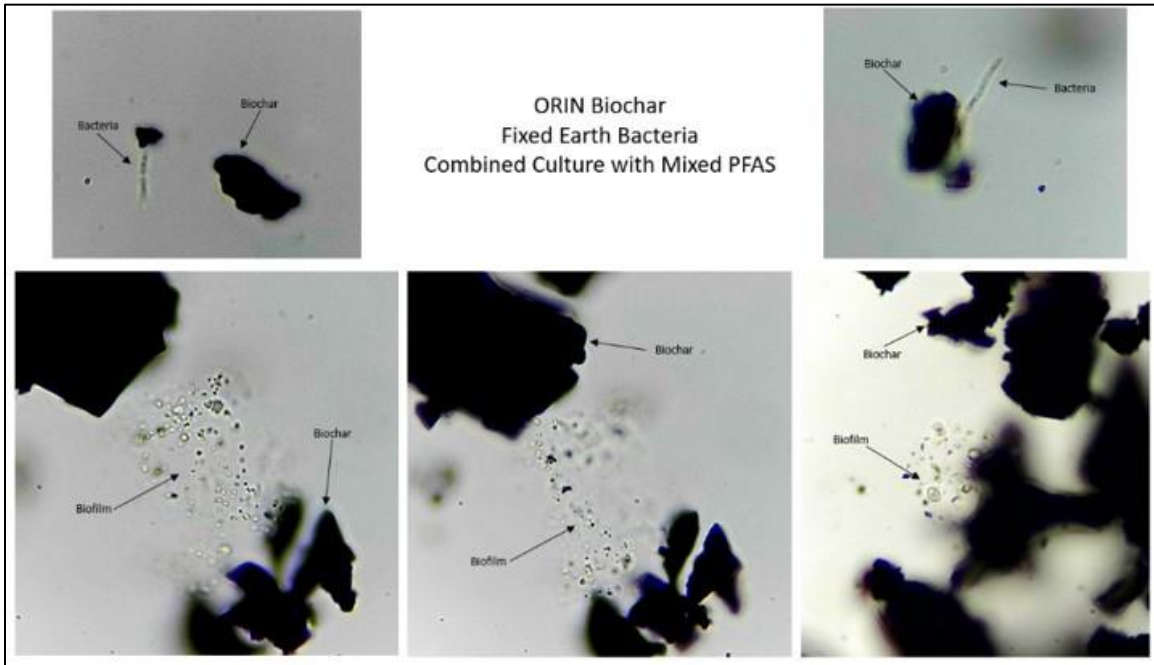


Figure 9. Biofilm formation adjacent to BAM particles.

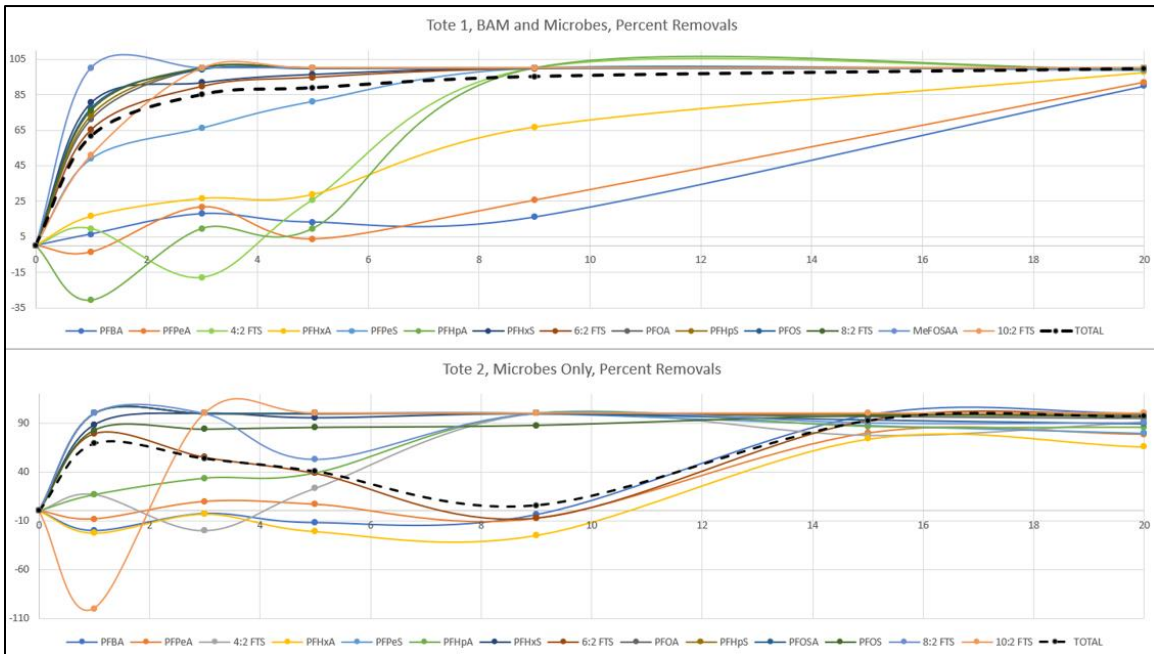
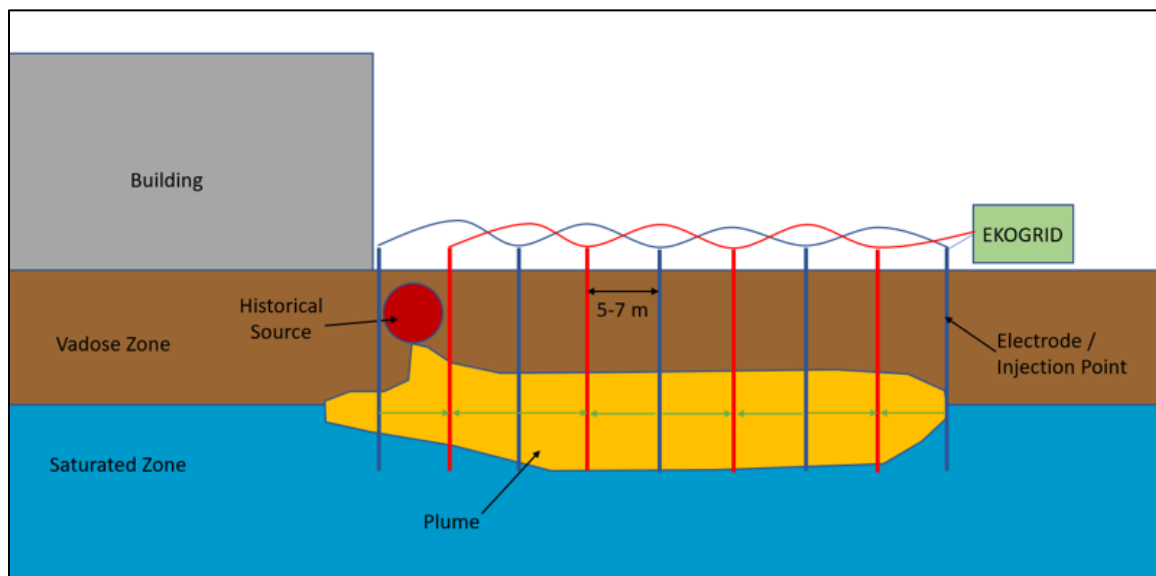


Figure 10. Removal of PFAS from AFFF impacted water using BAM and microbes.

## EKOGRID

Figure 11 below shows a cross section of a typical remediation site. To remediate a typical site, we install perforated steel pipes on a 5-7 meter grid across the known impact area. The spacing between the pipes is determined by the electrical conductivity of the site (i.e. a high electrical conductivity allows for larger spacing). The perforations in the pipe allow them to be utilized both as electrodes for the EKOGRID technology, but to also serve as injection points for microbes and other amendments, as required.



*Figure 11. A typical remedial site using EKOGRID.*

Following the setup of the electrodes, microbes are injected into both the anodes and cathodes. The EKOGRID can work in two modes: Oxidation Mode in which an even alternating direct current (square wave) is applied to generate an aerobic environment through the hydrolysis of water or Pulsing Mode which allows the transfer of fluids from the anode to the cathode using electrokinetics. Following the injection of the microbes, the EKOGRID is configured to pulse and transfer the microbes throughout the soil and groundwater between the electrodes. This process may be repeated multiple times depending on site conditions.

Following the pulse transfer of the microbes, the EKOGRID is set to oxidation mode to generate the maximum amount of oxygen. During the remediation of the site, additional microbes may be injected at various times to address specific contaminants of concern or to expedite the process. In addition to microbes, we may inject nutrients and additives to expedite the process.



The EKOGRID system has been used to provide oxygen for bioremediation at over 30 in-situ remediation sites in Western Canada, primarily for the remediation of hydrocarbon compounds. Additionally, the system has been deployed by the inventors of the technology at sites on all seven continents to stimulate the remediation of a variety of compounds. The system has been deployed in a range of soil, groundwater, and geochemical conditions in Canada in which groundwater conditions were also monitored for changes in general chemistry. To our knowledge and based on the available data, no negative consequences occurred as a result of temporary oxygenation of otherwise anaerobic groundwater, including in glacial till soils containing high arsenic concentrations. Further, it is expected that the groundwater conditions will revert back to their natural state once the EKOGRID system has been decommissioned following remediation and the groundwater returns to stable anaerobic conditions.

## **Treatment Chemistry Descriptions**

### Bioavailable Absorbent Media

BAM is a sustainable, pyrolyzed, recycled cellulosic bio-mass product (>80% fixed carbon) derived from a proprietary blend of recycled organic materials with a high cation exchange. BAM has diverse pore sizes with a minimum total surface area of up to 1,133 square meters per gram or 127 acres/lb.

BAM has numerous synergistic qualities and is relatively affordable in large quantities for remediation purposes. BAM has the ability to provide ample usable surface area for maximizing microbial colonization and thereby an active microbial community. Due to its unique 'honeycomb' structure, BAM has the ability to provide increased pore space for the different strains of microbes. Most importantly, BAM's affinity for organic and inorganic compounds supports maximum contact (bioavailability through high sorbency) with microbes allowing for complete degradation.

The unique absorption capability of BAM prevents exterior surface microfilm buildup providing long term remediation capabilities. This allows BAM to absorb contaminants for more productive bio-attenuation of contaminants over a longer period of time. Granular Activated Carbon (GAC) primarily adsorbs contamination to the surface of the media, which then is subject to bio-film development, preventing further adsorption. As a result, BAM has been proven



to supply long term maintenance free remedial abilities over GAC. Laboratory tests have also shown that BAM has a significantly higher absorptive capacity than commercially available GAC products.

BAM's absorption ability or sponge like effect, comes from its unique and diverse honeycomb- structure. The shape creates pores or openings within the structure that allows for contaminants to be drawn in and retained within the pores. This unique ability prevents exterior surface microfilm buildup that allows BAM to continually absorb contaminants. Advantages include:

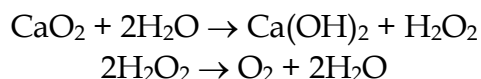
- Rapid absorption of contaminants.
- Pores provide extremely high surface area per gram of material creating a high Cation Exchange Capacity (CEC).
- Promotes microbial colonization's that biodegrade contaminants.

### Calcium Peroxide

Calcium peroxide releases oxygen over an extended time period to enhance the biodegradation of petroleum hydrocarbons and other biodegradable contaminants in soil and groundwater.

It is well documented that the release of oxygen in the subsurface environment enhances the biodegradation of contaminants. Based on extensive laboratory studies, the releases of oxygen can provide a useful and cost-effective mechanism for enhancing aerobic bioremediation.

Successful bioremediation of contamination via aerobic microbial respiration depends on a number of factors including the presence of appropriate microbes, nutrients, electron donors and terminal electron acceptors. In the aerobic metabolism of contaminants, oxygen acts as a terminal electron acceptor and contaminants act as electron donors, which are oxidized. Often, the limiting factor in aerobic bioremediation of contaminants is oxygen. Calcium peroxide provides oxygen by reacting with water. The reaction is:



### PFAS Degrading Bacteria

The carbon-fluorine (C-F) bond is one of the strongest single covalent bonds known. The presence of numerous C-F bonds in any given PFAS molecule makes





these compounds very difficult to degrade. As a result of their resilience, PFAS compounds have commonly become known as “forever chemicals” due to their persistence in the environment. PFAS compounds are generally considered to be resistant to biodegradation due to their chemical stability, although some limited biotransformations of PFAS are known in wastewater systems that typically lead to the formation of PFOS from other fluorinated compounds. ORIN/Fixed Earth Innovations has developed a method to obtain microbes that are capable of degrading PFAS substances in a timely manner that are native to the impacted site. The microbes are aerobic, which utilize low levels of oxygen for survival and their metabolic process.

The performance of the PFAS degrading microbes has been previously validated in multiple laboratory studies and in an in-situ field demonstration. The available data from these studies suggests that cleavage of the C-F bond occurs, resulting in complete mineralization of PFAS.

## Scope of Services

### DPT Injection

- Remedial treatment will utilize in-situ DPT.
- The targeted remedial area has a total footprint of approximately 1,600 ft<sup>2</sup>.
- Approximately 17 injection points will be utilized with the vertical extent of remediation extending from approximately 4 to 24 ft bgs.
- Injection points will be arranged in a barrier wall pattern on the upgradient side of the newly installed targeted well, and a grid like pattern down gradient.
- Inject an average of 200 gallons of 12.7% BAM Ultra and 1% calcium peroxide solution into each of the 17 DPT locations. A minimum of 2 gallons of microbial culture will be injected at each DPT location.
- Approximately 4-6 EKOGRID electrodes will be installed following the DPT injection.
- Injection will take approximately 1-2 days depending on unforeseen site and matrix conditions.
- Concentration and volume may vary depending on site conditions and targeted COC concentrations.



- ORIN will maintain field notes on the amount and concentration of chemical applied and any other related field observations.
- Demobilize field personnel and equipment from the site.
- A brief report describing the remediation, chemical amount used, other field information and observations regarding the remedial effort will be submitted to WI ANG after all field work is completed.

## **Health and Safety**

To ORIN, health and safety is not just a priority, it's a value. By being proactive instead of reactive, ORIN has learned to identify and listen to health and safety triggers, such as fatigue, emotion and rushing. ORIN reports near misses and lessons learned to help facilitate open discussions with clients and vendors alike about health and safety on our projects.

ORIN is ISN certified. ISN is a certification that ensures all members are up to date and compliant with safety standards and training in some of the most safety conscious industries. We pursued ISN certification to show our commitment to health and safety, and to ensure we meet even the most stringent requirements for companies we work with.

ORIN subscribes to Occupational Safety and Health Administration (OSHA)- and United States Environmental Protection Agency (USEPA)-mandated Health and Safety standards for protection of hazardous waste workers. Because of the wide range of potential exposures for our employees, ORIN must make conservative judgments as to potential health risks. The services outlined in this proposal are offered on the basis of providing Level D health and safety protection (Tyvek<sup>®</sup>, steel-toed boots, hard hats, nitrile gloves, hearing protection, eye protection, and air-purifying respirators). ORIN personnel will abide by the applicable OSHA guidelines for personal safety outlined in 29 CFR 1910.

Prior to daily commencement of injection activities, ORIN will conduct health and safety tailgate meetings with all applicable onsite personnel. The meetings will include but will not be limited to discussion of the work planned for the day and any potential hazards, changes in work assignment, any problems encountered during past operations, and any other pertinent health and safety issues.



We look forward to working with you on this project. If you have additional questions or comments, please feel free call our office at (608) 838-6699 or my cell at (563) 468-7645.

Sincerely,

Jacob Mirfield  
Project Manager  
ORIN Technologies, LLC.

*Disclaimer*

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# Appendix A

### PRLs 1, 2, and 3 ANALYTICAL RESULTS

Truax Field Air National Guard Base  
Madison, Wisconsin

### Legend

- Soil Boring
- Soil Boring and Temporary Well
- Assumed Groundwater Flow
- Potential AFFF PFOS/PFOA PRL (approximate)
- Installation Area (approximate)
- Approximate Pilot Well
- Approximate Injection Location

### Notes & Sources

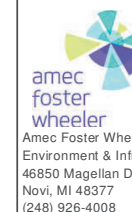
Notes:  
 AFFF = aqueous film forming foam  
 PRL = potential release location  
 PFC = perfluorinated compounds  
 PFOS = Perfluorooctanesulfonic acid  
 PFOA = Perfluorooctanoic acid  
 PFBS = Perfluorobutanesulfonic acid  
 PFHpA = Perfluorheptanoic acid  
 PFHxS = Perfluorhexanesulfonic acid  
 PFNA = Perfluorononanoic acid

**BOLD** text indicates a detection

**YELLOW** highlighted cells indicate a 0.07 µg/L Health Advisory Exceedance for PFOA/PFOS in groundwater and 1,260 µg/kg in soil.

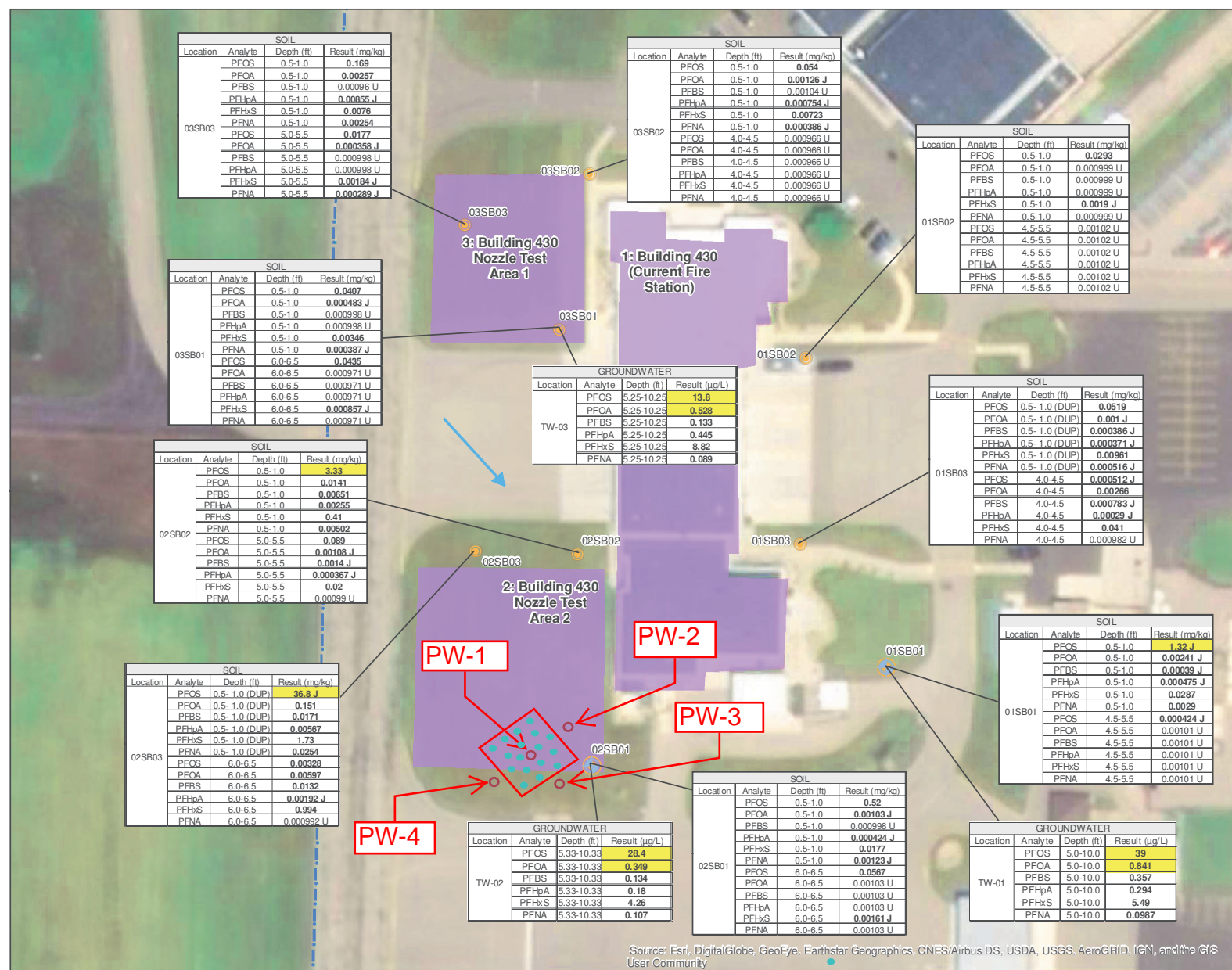
\* When duplicate was collected, the greater value is shown.

Sources: Potential AFFF PFC PRLs and Installation Area datalayers obtained from Figure 2 of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated February 2016.



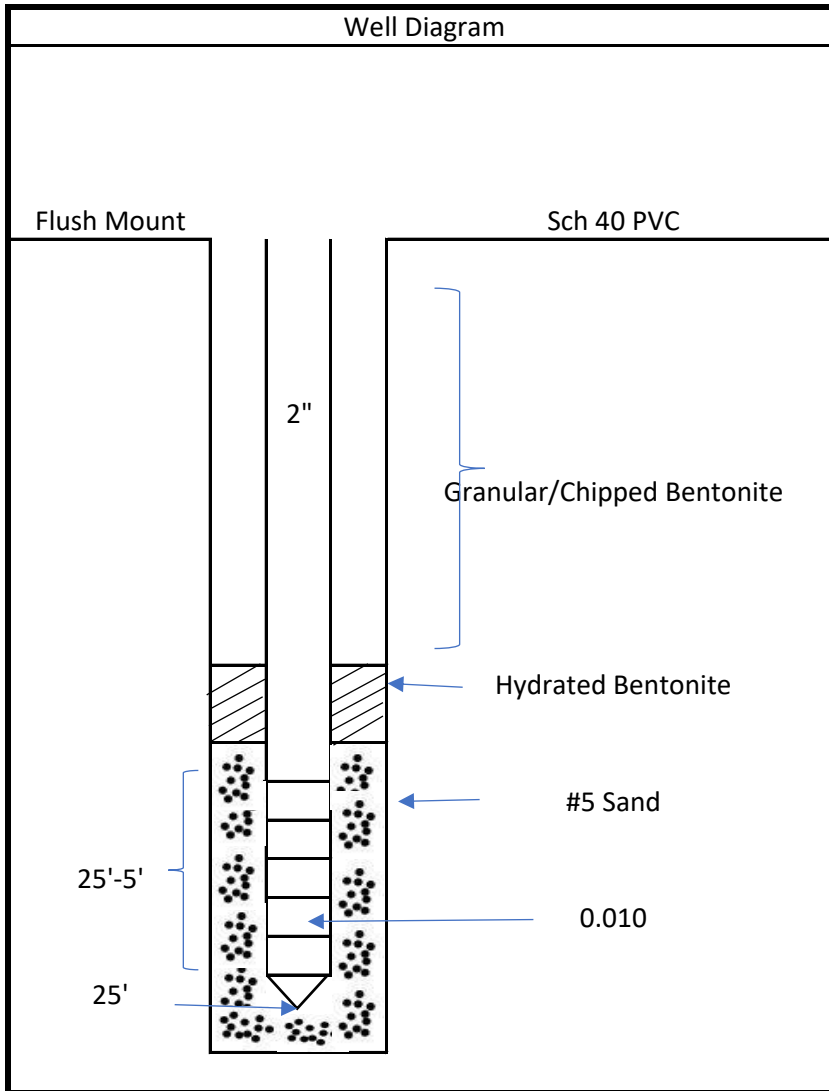
FIGURE

4



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

All pilot wells constructed in accordance with NR141



Note: Diagram not to scale

## Baseline Groundwater Parameters

	PW-1 10/26/21	PW-2 10/26/21	PW-3 10/26/21	PW-4 10/26/21
Depth to Water (ftbgs)	6.75	6.68	7.47	7.33
pH	6.88	6.94	7.03	7.09
ORP	21	22.8	42.9	57
DO (mg/L)	0.06	1.51	0.24	0.71
Conductivity (mS/cm)	0.983	0.805	0.85	0.768
Total Disolved Solids (ppm)	491	403	425	384
Temp. (°C)	15.49	16.98	15.64	15.74

*\*All measurements taken in a  
flowthrough cell*

## Baseline Groundwater Data

I Qualifier (result is estimated maximum possible concentration)					
J Qualifier (result less than RL greater than or equal to MDL)					
E qualifier (result exceeded calibration range)					
Analyte ng/l	PW-1 10/26/21	PW-2 10/26/21	PW-3 10/26/21	PW-4 10/26/21	
PFBA	350.0	390.0	210.0	390.0	
PFPeA	1,500.0	1,300.0	790.0	1,500.0	
PFBS	610.0	560.0	320.0	650.0	
4:2 FTS	50.0	20.0	37.0	51.0	
PFHxA	1,600.0	1,400.0	950.0	1,600.0	
PFPeS	930.0	880.0	420.0	1,000.0	
HFPO-DA	0.0	0.0	0.0	0.0	
PFHpA	510.0	380.0	340.0	510.0	
ADONA	0.0	0.0	0.0	0.0	
PFHxS	6,900.0	7,000.0	3,800.0	8,500.0	
6:2 FTS	3,500.0	1,400.0	2,600.0	3,100.0	
PFOA	1,500.0	560.0	1,000.0	1,100.0	
PFHpS	310.0	410.0	230.0	350.0	
PFNA	73.0	170.0	44.0	93.0	
PFOSA	18.0	8.2	0.0	88.0	
PFOS	14,000.0	16,000.0	12,000.0	18,000.0	
9Cl-PF3ONS	0.0	0.0	0.0	0.0	
PFDA	7.3	0.0	6.3	6.6	
8:2 FTS	670.0	150.0	860.0	350.0	
PFNS	0.0	0.0	0.0	0.0	
NMeFOSAA	0.0	0.0	5.7	0.0	
EtFOSAA	0.0	0.0	0.0	0.0	
PFUnA	0.0	0.0	0.0	0.0	
PFDS	0.0	0.0	0.0	0.0	
11Cl-PF3OUdS	0.0	0.0	0.0	0.0	
10:2 FTS	0.0	0.0	0.0	0.0	
PFDoA	0.0	0.0	0.0	0.0	
MeFOSA	0.0	0.0	0.0	0.0	
PFTTrDA	0.0	0.0	0.0	0.0	
PFDoS	0.0	0.0	0.0	0.0	
PFTeDA	0.0	0.0	0.0	0.0	
EtFOSA	0.0	0.0	0.0	0.0	
PFHxDA	0.0	0.0	0.0	0.0	
PFODA	0.0	0.0	0.0	0.0	
MeFOSE	0.0	0.0	0.0	0.0	
EtFOSE	0.0	0.0	0.0	0.0	
<b>TOTAL</b>	<b>32,528.3</b>	<b>30,628.2</b>	<b>23,613.0</b>	<b>37,288.6</b>	



## ANALYTICAL REPORT

Eurofins Lancaster Laboratories Env, LLC  
2425 New Holland Pike  
Lancaster, PA 17601  
Tel: (717)656-2300

Laboratory Job ID: 410-60722-1  
Client Project/Site: PFAS Analysis  
Revision: 1

For:  
ORIN Technologies LLC  
405 Investment Ct  
Verona, Wisconsin 53593

Attn: Jake Mirfield



Authorized for release by:  
11/2/2021 10:30:56 AM

Kristin Zeigler, Operations Support Specialist  
(717)556-9424  
[kristin.zeigler@eurofinset.com](mailto:kristin.zeigler@eurofinset.com)

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*Results relate only to the items tested and the sample(s) as received by the laboratory.*



Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.

- QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
  - Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
  - Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
- Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

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A handwritten signature in black ink, appearing to read "Kristin Zeigler".

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Kristin Zeigler  
Operations Support Specialist  
11/2/2021 10:30:56 AM



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# Definitions/Glossary

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

## Qualifiers

### LCMS

Qualifier	Qualifier Description
*5+	Isotope dilution analyte is outside acceptance limits, high biased.
E	Result exceeded calibration range.
I	Value is EMPC (estimated maximum possible concentration).
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

## Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
⌘	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

# Case Narrative

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

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## Job ID: 410-60722-1

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### Laboratory: Eurofins Lancaster Laboratories Env, LLC

#### Narrative

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#### Job Narrative 410-60722-1

#### Revision

The report being provided is a revision of the original report sent on 11/1/2021. The report (revision 1) is being revised due to: update needed to NCMs after job auto-sent to client.

#### Receipt

The samples were received on 10/27/2021 11:39 AM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperature of the cooler at receipt time was 5.4°C

#### PFAS

Method PFC\_IDA: Reporting limits were raised for the following samples: PW-1 (410-60722-1), PW-2 (410-60722-2), PW-3 (410-60722-3), PW-4 (410-60722-4) and Duplicate (410-60722-5) due to interference from the sample matrix.

Method PFC\_IDA: The result reported for target analyte perfluorooctanesulfonic acid (PFOS) in sample: PW-2 (410-60722-2) is above the calibration range of the instrument and should be considered estimated.

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



# Detection Summary

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

## Client Sample ID: PW-1

## Lab Sample ID: 410-60722-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorohexanoic acid	1600		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoroheptanoic acid	510		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorooctanoic acid	1500		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorononanoic acid	73		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorodecanoic acid	7.3	J	17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorobutanesulfonic acid	610		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoropentanesulfonic acid	930		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoroheptanesulfonic acid	310		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorooctanesulfonamide	18		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorobutanoic acid	350		43	17	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoropentanoic acid	1500		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
8:2 Fluorotelomer sulfonic acid	670		26	8.6	ng/L	10		EPA 537 (Mod)	Total/NA
4:2 Fluorotelomer sulfonic acid	50		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorohexanesulfonic acid - DL	6900		170	43	ng/L	100		EPA 537 (Mod)	Total/NA
Perfluorooctanesulfonic acid - DL	14000		170	43	ng/L	100		EPA 537 (Mod)	Total/NA
6:2 Fluorotelomer sulfonic acid - DL	3500		430	170	ng/L	100		EPA 537 (Mod)	Total/NA

## Client Sample ID: PW-2

## Lab Sample ID: 410-60722-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorohexanoic acid	1400		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoroheptanoic acid	380		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorooctanoic acid	560		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorononanoic acid	170		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorobutanesulfonic acid	560		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoropentanesulfonic acid	880		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoroheptanesulfonic acid	410		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorooctanesulfonamide	8.2	J	17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorobutanoic acid	390		42	17	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoropentanoic acid	1300		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
8:2 Fluorotelomer sulfonic acid	150		25	8.4	ng/L	10		EPA 537 (Mod)	Total/NA
4:2 Fluorotelomer sulfonic acid	20		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
6:2 Fluorotelomer sulfonic acid	1400		42	17	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorohexanesulfonic acid - DL	7000		170	42	ng/L	100		EPA 537 (Mod)	Total/NA
Perfluorooctanesulfonic acid - DL	16000	E	170	42	ng/L	100		EPA 537 (Mod)	Total/NA

## Client Sample ID: PW-3

## Lab Sample ID: 410-60722-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorohexanoic acid	950		17	4.1	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoroheptanoic acid	340		17	4.1	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorooctanoic acid	1000		17	4.1	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorononanoic acid	44		17	4.1	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorodecanoic acid	6.3	J I	17	4.1	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorobutanesulfonic acid	320		17	4.1	ng/L	10		EPA 537 (Mod)	Total/NA
NMeFOSAA	5.7	J I	17	5.0	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoropentanesulfonic acid	420		17	4.1	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoroheptanesulfonic acid	230		17	4.1	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorobutanoic acid	210		41	17	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoropentanoic acid	790		17	4.1	ng/L	10		EPA 537 (Mod)	Total/NA
8:2 Fluorotelomer sulfonic acid	860		25	8.3	ng/L	10		EPA 537 (Mod)	Total/NA
4:2 Fluorotelomer sulfonic acid	37		17	4.1	ng/L	10		EPA 537 (Mod)	Total/NA

This Detection Summary does not include radiochemical test results.

Eurofins Lancaster Laboratories Env, LLC

# Detection Summary

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

## Client Sample ID: PW-3 (Continued)

Lab Sample ID: 410-60722-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorohexanesulfonic acid - DL	3800		170	41	ng/L	100		EPA 537 (Mod)	Total/NA
Perfluorooctanesulfonic acid - DL	12000		170	41	ng/L	100		EPA 537 (Mod)	Total/NA
6:2 Fluorotelomer sulfonic acid - DL	2600		410	170	ng/L	100		EPA 537 (Mod)	Total/NA

## Client Sample ID: PW-4

Lab Sample ID: 410-60722-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorohexanoic acid	1600		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoroheptanoic acid	510		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorooctanoic acid	1100		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorononanoic acid	93		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorodecanoic acid	6.6	J	17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorobutanesulfonic acid	650		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoropentanesulfonic acid	1000		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoroheptanesulfonic acid	350		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorooctanesulfonamide	88		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorobutanoic acid	390		42	17	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoropentanoic acid	1500		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
8:2 Fluorotelomer sulfonic acid	350		25	8.3	ng/L	10		EPA 537 (Mod)	Total/NA
4:2 Fluorotelomer sulfonic acid	51		17	4.2	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorohexanesulfonic acid - DL	8500		170	42	ng/L	100		EPA 537 (Mod)	Total/NA
Perfluorooctanesulfonic acid - DL	18000		170	42	ng/L	100		EPA 537 (Mod)	Total/NA
6:2 Fluorotelomer sulfonic acid - DL	3100		420	170	ng/L	100		EPA 537 (Mod)	Total/NA

## Client Sample ID: Duplicate

Lab Sample ID: 410-60722-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorohexanoic acid	1500		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoroheptanoic acid	530		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorooctanoic acid	1500		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorononanoic acid	78		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorodecanoic acid	6.9	J	17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorobutanesulfonic acid	480		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoropentanesulfonic acid	790		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoroheptanesulfonic acid	260		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorooctanesulfonamide	14	J	17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorobutanoic acid	300		43	17	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluoropentanoic acid	1200		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
8:2 Fluorotelomer sulfonic acid	760		26	8.6	ng/L	10		EPA 537 (Mod)	Total/NA
4:2 Fluorotelomer sulfonic acid	41		17	4.3	ng/L	10		EPA 537 (Mod)	Total/NA
Perfluorohexanesulfonic acid - DL	6800		170	43	ng/L	100		EPA 537 (Mod)	Total/NA
Perfluorooctanesulfonic acid - DL	12000		170	43	ng/L	100		EPA 537 (Mod)	Total/NA
6:2 Fluorotelomer sulfonic acid - DL	3400		430	170	ng/L	100		EPA 537 (Mod)	Total/NA

## Client Sample ID: Trip

Lab Sample ID: 410-60722-6

No Detections.

This Detection Summary does not include radiochemical test results.

Eurofins Lancaster Laboratories Env, LLC

# Client Sample Results

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

**Client Sample ID: PW-1**  
Date Collected: 10/26/21 11:36  
Date Received: 10/27/21 11:39

**Lab Sample ID: 410-60722-1**  
Matrix: Water

**Method: EPA 537 (Mod) - EPA 537 Isotope Dilution**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanoic acid	1600		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluoroheptanoic acid	510		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluorooctanoic acid	1500		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluorononanoic acid	73		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluorodecanoic acid	7.3	J	17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluorotridecanoic acid	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluorotetradecanoic acid	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluorobutanesulfonic acid	610		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
NEtFOSAA	ND		26	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
NMeFOSAA	ND		17	5.1	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluoropentanesulfonic acid	930		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluoroheptanesulfonic acid	310		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluorononanesulfonic acid	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluorodecanesulfonic acid	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluorooctanesulfonamide	18		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluorobutanoic acid	350		43	17	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluoropentanoic acid	1500		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
HFPODA	ND		26	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
DONA	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
9CI-PF3ONS	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
11CI-PF3OUdS	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluoroundecanoic acid	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
Perfluorododecanoic acid	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10
8:2 Fluorotelomer sulfonic acid	670		26	8.6	ng/L		10/28/21 18:35	11/01/21 16:09	10
4:2 Fluorotelomer sulfonic acid	50		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:09	10

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-4:2 FTS	127		20 - 187	10/28/21 18:35	11/01/21 16:09	10
M2-8:2 FTS	145		34 - 182	10/28/21 18:35	11/01/21 16:09	10
M2-6:2 FTS	136		29 - 189	10/28/21 18:35	11/01/21 16:09	10
13C5 PFHxA	114		31 - 142	10/28/21 18:35	11/01/21 16:09	10
13C4 PFHpA	96		30 - 144	10/28/21 18:35	11/01/21 16:09	10
13C8 PFOA	110		49 - 127	10/28/21 18:35	11/01/21 16:09	10
13C9 PFNA	121		47 - 136	10/28/21 18:35	11/01/21 16:09	10
13C6 PFDA	109		47 - 128	10/28/21 18:35	11/01/21 16:09	10
13C7 PFUnA	106		40 - 135	10/28/21 18:35	11/01/21 16:09	10
13C2-PFDoDA	95		28 - 136	10/28/21 18:35	11/01/21 16:09	10
13C2 PFTeDA	86		10 - 144	10/28/21 18:35	11/01/21 16:09	10
13C3 PFBS	140		19 - 178	10/28/21 18:35	11/01/21 16:09	10
13C3 PFHxS	103		32 - 145	10/28/21 18:35	11/01/21 16:09	10
13C8 PFOS	117		49 - 126	10/28/21 18:35	11/01/21 16:09	10
d3-NMeFOSAA	94		32 - 151	10/28/21 18:35	11/01/21 16:09	10
d5-NEtFOSAA	97		37 - 164	10/28/21 18:35	11/01/21 16:09	10
13C8 FOSA	91		10 - 143	10/28/21 18:35	11/01/21 16:09	10
13C4 PFBA	114		41 - 132	10/28/21 18:35	11/01/21 16:09	10
13C5 PFPeA	132		33 - 155	10/28/21 18:35	11/01/21 16:09	10
13C3 HFPO-DA	105		20 - 153	10/28/21 18:35	11/01/21 16:09	10



# Client Sample Results

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

**Client Sample ID: PW-1**  
Date Collected: 10/26/21 11:36  
Date Received: 10/27/21 11:39

**Lab Sample ID: 410-60722-1**  
Matrix: Water

**Method: EPA 537 (Mod) - EPA 537 Isotope Dilution - DL**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	6900		170	43	ng/L		10/28/21 18:35	11/01/21 11:42	100
Perfluorooctanesulfonic acid	14000		170	43	ng/L		10/28/21 18:35	11/01/21 11:42	100
6:2 Fluorotelomer sulfonic acid	3500		430	170	ng/L		10/28/21 18:35	11/01/21 11:42	100
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	179		29 - 189				10/28/21 18:35	11/01/21 11:42	100
13C3 PFHxS	135		32 - 145				10/28/21 18:35	11/01/21 11:42	100
13C8 PFOS	120		49 - 126				10/28/21 18:35	11/01/21 11:42	100

**Client Sample ID: PW-2**  
Date Collected: 10/26/21 12:10  
Date Received: 10/27/21 11:39

**Lab Sample ID: 410-60722-2**  
Matrix: Water

**Method: EPA 537 (Mod) - EPA 537 Isotope Dilution**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanoic acid	1400		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluoroheptanoic acid	380		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluorooctanoic acid	560		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluorononanoic acid	170		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluorodecanoic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluorotridecanoic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluorotetradecanoic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluorobutanesulfonic acid	560		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
NEtFOSAA	ND		25	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
NMeFOSAA	ND		17	5.1	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluoropentanesulfonic acid	880		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluoroheptanesulfonic acid	410		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluorononanesulfonic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluorodecanesulfonic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluorooctanesulfonamide	8.2 J		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluorobutanoic acid	390		42	17	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluoropentanoic acid	1300		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
HFPODA	ND		25	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
DONA	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
9CI-PF3ONS	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
11CI-PF3OUdS	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluoroundecanoic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
Perfluorododecanoic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
8:2 Fluorotelomer sulfonic acid	150		25	8.4	ng/L		10/28/21 18:35	11/01/21 16:22	10
4:2 Fluorotelomer sulfonic acid	20		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:22	10
6:2 Fluorotelomer sulfonic acid	1400		42	17	ng/L		10/28/21 18:35	11/01/21 16:22	10
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
M2-4:2 FTS	123		20 - 187				10/28/21 18:35	11/01/21 16:22	10
M2-8:2 FTS	98		34 - 182				10/28/21 18:35	11/01/21 16:22	10
M2-6:2 FTS	97		29 - 189				10/28/21 18:35	11/01/21 16:22	10
13C5 PFHxA	97		31 - 142				10/28/21 18:35	11/01/21 16:22	10
13C4 PFHpA	87		30 - 144				10/28/21 18:35	11/01/21 16:22	10
13C8 PFOA	101		49 - 127				10/28/21 18:35	11/01/21 16:22	10
13C9 PFNA	112		47 - 136				10/28/21 18:35	11/01/21 16:22	10
13C6 PFDA	95		47 - 128				10/28/21 18:35	11/01/21 16:22	10

# Client Sample Results

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

**Client Sample ID: PW-2**  
Date Collected: 10/26/21 12:10  
Date Received: 10/27/21 11:39

**Lab Sample ID: 410-60722-2**  
Matrix: Water

**Method: EPA 537 (Mod) - EPA 537 Isotope Dilution (Continued)**

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C7 PFluA	91		40 - 135	10/28/21 18:35	11/01/21 16:22	10
13C2-PFDoDA	85		28 - 136	10/28/21 18:35	11/01/21 16:22	10
13C2 PFTeDA	82		10 - 144	10/28/21 18:35	11/01/21 16:22	10
13C3 PFBS	102		19 - 178	10/28/21 18:35	11/01/21 16:22	10
13C3 PFHxS	79		32 - 145	10/28/21 18:35	11/01/21 16:22	10
13C8 PFOS	149	*5+	49 - 126	10/28/21 18:35	11/01/21 16:22	10
d3-NMeFOSAA	87		32 - 151	10/28/21 18:35	11/01/21 16:22	10
d5-NEtFOSAA	86		37 - 164	10/28/21 18:35	11/01/21 16:22	10
13C8 FOSA	96		10 - 143	10/28/21 18:35	11/01/21 16:22	10
13C4 PFBA	103		41 - 132	10/28/21 18:35	11/01/21 16:22	10
13C5 PFPeA	103		33 - 155	10/28/21 18:35	11/01/21 16:22	10
13C3 HFPO-DA	108		20 - 153	10/28/21 18:35	11/01/21 16:22	10

**Method: EPA 537 (Mod) - EPA 537 Isotope Dilution - DL**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	7000		170	42	ng/L		10/28/21 18:35	10/29/21 18:08	100
Perfluorooctanesulfonic acid	16000	E	170	42	ng/L		10/28/21 18:35	10/29/21 18:08	100

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 PFHxS	117		32 - 145	10/28/21 18:35	10/29/21 18:08	100
13C8 PFOS	186	*5+	49 - 126	10/28/21 18:35	10/29/21 18:08	100

**Client Sample ID: PW-3**  
Date Collected: 10/26/21 12:40  
Date Received: 10/27/21 11:39

**Lab Sample ID: 410-60722-3**  
Matrix: Water

**Method: EPA 537 (Mod) - EPA 537 Isotope Dilution**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanoic acid	950		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluoroheptanoic acid	340		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluorooctanoic acid	1000		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluorononanoic acid	44		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluorodecanoic acid	6.3	J I	17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluorotridecanoic acid	ND		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluorotetradecanoic acid	ND		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluorobutanesulfonic acid	320		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
NEtFOSAA	ND		25	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
NMeFOSAA	5.7	J I	17	5.0	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluoropentanesulfonic acid	420		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluoroheptanesulfonic acid	230		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluorononanesulfonic acid	ND		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluorodecanesulfonic acid	ND		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluorooctanesulfonamide	ND		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluorobutanoic acid	210		41	17	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluoropentanoic acid	790		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
HFPODA	ND		25	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
DONA	ND		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
9CI-PF3ONS	ND		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
11CI-PF3OUdS	ND		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluoroundecanoic acid	ND		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Perfluorododecanoic acid	ND		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10

# Client Sample Results

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

**Client Sample ID: PW-3**  
Date Collected: 10/26/21 12:40  
Date Received: 10/27/21 11:39

**Lab Sample ID: 410-60722-3**  
Matrix: Water

**Method: EPA 537 (Mod) - EPA 537 Isotope Dilution (Continued)**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
8:2 Fluorotelomer sulfonic acid	860		25	8.3	ng/L		10/28/21 18:35	11/01/21 16:34	10
4:2 Fluorotelomer sulfonic acid	37		17	4.1	ng/L		10/28/21 18:35	11/01/21 16:34	10
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
M2-4:2 FTS	130		20 - 187				10/28/21 18:35	11/01/21 16:34	10
M2-8:2 FTS	135		34 - 182				10/28/21 18:35	11/01/21 16:34	10
M2-6:2 FTS	116		29 - 189				10/28/21 18:35	11/01/21 16:34	10
13C5 PFHxA	105		31 - 142				10/28/21 18:35	11/01/21 16:34	10
13C4 PFHpA	100		30 - 144				10/28/21 18:35	11/01/21 16:34	10
13C8 PFOA	103		49 - 127				10/28/21 18:35	11/01/21 16:34	10
13C9 PFNA	117		47 - 136				10/28/21 18:35	11/01/21 16:34	10
13C6 PFDA	107		47 - 128				10/28/21 18:35	11/01/21 16:34	10
13C7 PFUnA	96		40 - 135				10/28/21 18:35	11/01/21 16:34	10
13C2-PFDoDA	86		28 - 136				10/28/21 18:35	11/01/21 16:34	10
13C2 PFTeDA	82		10 - 144				10/28/21 18:35	11/01/21 16:34	10
13C3 PFBS	113		19 - 178				10/28/21 18:35	11/01/21 16:34	10
13C3 PFHxS	100		32 - 145				10/28/21 18:35	11/01/21 16:34	10
13C8 PFOS	104		49 - 126				10/28/21 18:35	11/01/21 16:34	10
d3-NMeFOSAA	94		32 - 151				10/28/21 18:35	11/01/21 16:34	10
d5-NEtFOSAA	95		37 - 164				10/28/21 18:35	11/01/21 16:34	10
13C8 FOSA	97		10 - 143				10/28/21 18:35	11/01/21 16:34	10
13C4 PFBA	115		41 - 132				10/28/21 18:35	11/01/21 16:34	10
13C5 PFPeA	112		33 - 155				10/28/21 18:35	11/01/21 16:34	10
13C3 HFPO-DA	90		20 - 153				10/28/21 18:35	11/01/21 16:34	10

**Method: EPA 537 (Mod) - EPA 537 Isotope Dilution - DL**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	3800		170	41	ng/L		10/28/21 18:35	11/01/21 12:04	100
Perfluorooctanesulfonic acid	12000		170	41	ng/L		10/28/21 18:35	11/01/21 12:04	100
6:2 Fluorotelomer sulfonic acid	2600		410	170	ng/L		10/28/21 18:35	11/01/21 12:04	100
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	179		29 - 189				10/28/21 18:35	11/01/21 12:04	100
13C3 PFHxS	126		32 - 145				10/28/21 18:35	11/01/21 12:04	100
13C8 PFOS	129	*5+	49 - 126				10/28/21 18:35	11/01/21 12:04	100

**Client Sample ID: PW-4**  
Date Collected: 10/26/21 13:00  
Date Received: 10/27/21 11:39

**Lab Sample ID: 410-60722-4**  
Matrix: Water

**Method: EPA 537 (Mod) - EPA 537 Isotope Dilution**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanoic acid	1600		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluoroheptanoic acid	510		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluorooctanoic acid	1100		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluorononanoic acid	93		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluorodecanoic acid	6.6 J		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluorotridecanoic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluorotetradecanoic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluorobutanesulfonic acid	650		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
NEtFOSAA	ND		25	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
NMeFOSAA	ND		17	5.0	ng/L		10/28/21 18:35	11/01/21 16:46	10

Eurofins Lancaster Laboratories Env, LLC

# Client Sample Results

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

**Client Sample ID: PW-4**  
Date Collected: 10/26/21 13:00  
Date Received: 10/27/21 11:39

**Lab Sample ID: 410-60722-4**  
Matrix: Water

## Method: EPA 537 (Mod) - EPA 537 Isotope Dilution (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluoropentanesulfonic acid	1000		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluoroheptanesulfonic acid	350		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluorononanesulfonic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluorodecanesulfonic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluorooctanesulfonamide	88		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluorobutanoic acid	390		42	17	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluoropentanoic acid	1500		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
HFPODA	ND		25	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
DONA	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
9CI-PF3ONS	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
11CI-PF3OUdS	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluoroundecanoic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Perfluorododecanoic acid	ND		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
8:2 Fluorotelomer sulfonic acid	350		25	8.3	ng/L		10/28/21 18:35	11/01/21 16:46	10
4:2 Fluorotelomer sulfonic acid	51		17	4.2	ng/L		10/28/21 18:35	11/01/21 16:46	10
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
M2-4:2 FTS	116		20 - 187				10/28/21 18:35	11/01/21 16:46	10
M2-8:2 FTS	115		34 - 182				10/28/21 18:35	11/01/21 16:46	10
M2-6:2 FTS	108		29 - 189				10/28/21 18:35	11/01/21 16:46	10
13C5 PFHxA	97		31 - 142				10/28/21 18:35	11/01/21 16:46	10
13C4 PFHpA	83		30 - 144				10/28/21 18:35	11/01/21 16:46	10
13C8 PFOA	95		49 - 127				10/28/21 18:35	11/01/21 16:46	10
13C9 PFNA	104		47 - 136				10/28/21 18:35	11/01/21 16:46	10
13C6 PFDA	92		47 - 128				10/28/21 18:35	11/01/21 16:46	10
13C7 PFUnA	95		40 - 135				10/28/21 18:35	11/01/21 16:46	10
13C2-PFDoDA	78		28 - 136				10/28/21 18:35	11/01/21 16:46	10
13C2 PFTeDA	76		10 - 144				10/28/21 18:35	11/01/21 16:46	10
13C3 PFBS	100		19 - 178				10/28/21 18:35	11/01/21 16:46	10
13C3 PFHxS	91		32 - 145				10/28/21 18:35	11/01/21 16:46	10
13C8 PFOS	109		49 - 126				10/28/21 18:35	11/01/21 16:46	10
d3-NMeFOSAA	84		32 - 151				10/28/21 18:35	11/01/21 16:46	10
d5-NEtFOSAA	93		37 - 164				10/28/21 18:35	11/01/21 16:46	10
13C8 FOSA	98		10 - 143				10/28/21 18:35	11/01/21 16:46	10
13C4 PFBA	104		41 - 132				10/28/21 18:35	11/01/21 16:46	10
13C5 PFPeA	96		33 - 155				10/28/21 18:35	11/01/21 16:46	10
13C3 HFPO-DA	100		20 - 153				10/28/21 18:35	11/01/21 16:46	10

## Method: EPA 537 (Mod) - EPA 537 Isotope Dilution - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	8500		170	42	ng/L		10/28/21 18:35	11/01/21 12:15	100
Perfluorooctanesulfonic acid	18000		170	42	ng/L		10/28/21 18:35	11/01/21 12:15	100
6:2 Fluorotelomer sulfonic acid	3100		420	170	ng/L		10/28/21 18:35	11/01/21 12:15	100
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	183		29 - 189				10/28/21 18:35	11/01/21 12:15	100
13C3 PFHxS	112		32 - 145				10/28/21 18:35	11/01/21 12:15	100
13C8 PFOS	118		49 - 126				10/28/21 18:35	11/01/21 12:15	100

# Client Sample Results

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

**Client Sample ID: Duplicate**

**Lab Sample ID: 410-60722-5**

Date Collected: 10/26/21 11:36

Matrix: Water

Date Received: 10/27/21 11:39

**Method: EPA 537 (Mod) - EPA 537 Isotope Dilution**

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanoic acid	1500		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluoroheptanoic acid	530		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluorooctanoic acid	1500		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluorononanoic acid	78		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluorodecanoic acid	6.9	J	17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluorotridecanoic acid	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluorotetradecanoic acid	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluorobutanesulfonic acid	480		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
NEtFOSAA	ND		26	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
NMeFOSAA	ND		17	5.1	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluoropentanesulfonic acid	790		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluoroheptanesulfonic acid	260		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluorononanesulfonic acid	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluorodecanesulfonic acid	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluorooctanesulfonamide	14	J	17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluorobutanoic acid	300		43	17	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluoropentanoic acid	1200		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
HFPODA	ND		26	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
DONA	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
9CI-PF3ONS	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
11CI-PF3OUdS	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluoroundecanoic acid	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
Perfluorododecanoic acid	ND		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10
8:2 Fluorotelomer sulfonic acid	760		26	8.6	ng/L		10/28/21 18:35	11/01/21 16:57	10
4:2 Fluorotelomer sulfonic acid	41		17	4.3	ng/L		10/28/21 18:35	11/01/21 16:57	10

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-4:2 FTS	113		20 - 187	10/28/21 18:35	11/01/21 16:57	10
M2-8:2 FTS	115		34 - 182	10/28/21 18:35	11/01/21 16:57	10
M2-6:2 FTS	115		29 - 189	10/28/21 18:35	11/01/21 16:57	10
13C5 PFHxA	94		31 - 142	10/28/21 18:35	11/01/21 16:57	10
13C4 PFHpA	79		30 - 144	10/28/21 18:35	11/01/21 16:57	10
13C8 PFOA	92		49 - 127	10/28/21 18:35	11/01/21 16:57	10
13C9 PFNA	105		47 - 136	10/28/21 18:35	11/01/21 16:57	10
13C6 PFDA	91		47 - 128	10/28/21 18:35	11/01/21 16:57	10
13C7 PFUnA	86		40 - 135	10/28/21 18:35	11/01/21 16:57	10
13C2-PFDoDA	75		28 - 136	10/28/21 18:35	11/01/21 16:57	10
13C2 PFTeDA	71		10 - 144	10/28/21 18:35	11/01/21 16:57	10
13C3 PFBS	109		19 - 178	10/28/21 18:35	11/01/21 16:57	10
13C3 PFHxS	86		32 - 145	10/28/21 18:35	11/01/21 16:57	10
13C8 PFOS	102		49 - 126	10/28/21 18:35	11/01/21 16:57	10
d3-NMeFOSAA	83		32 - 151	10/28/21 18:35	11/01/21 16:57	10
d5-NEtFOSAA	90		37 - 164	10/28/21 18:35	11/01/21 16:57	10
13C8 FOSA	93		10 - 143	10/28/21 18:35	11/01/21 16:57	10
13C4 PFBA	108		41 - 132	10/28/21 18:35	11/01/21 16:57	10
13C5 PFPeA	100		33 - 155	10/28/21 18:35	11/01/21 16:57	10
13C3 HFPO-DA	90		20 - 153	10/28/21 18:35	11/01/21 16:57	10

# Client Sample Results

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

## Client Sample ID: Duplicate

Date Collected: 10/26/21 11:36

Date Received: 10/27/21 11:39

## Lab Sample ID: 410-60722-5

Matrix: Water

### Method: EPA 537 (Mod) - EPA 537 Isotope Dilution - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanesulfonic acid	6800		170	43	ng/L		10/28/21 18:35	11/01/21 12:26	100
Perfluorooctanesulfonic acid	12000		170	43	ng/L		10/28/21 18:35	11/01/21 12:26	100
6:2 Fluorotelomer sulfonic acid	3400		430	170	ng/L		10/28/21 18:35	11/01/21 12:26	100
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	153		29 - 189				10/28/21 18:35	11/01/21 12:26	100
13C3 PFHxS	115		32 - 145				10/28/21 18:35	11/01/21 12:26	100
13C8 PFOS	124		49 - 126				10/28/21 18:35	11/01/21 12:26	100

## Client Sample ID: Trip

Date Collected: 10/26/21 13:20

Date Received: 10/27/21 11:39

## Lab Sample ID: 410-60722-6

Matrix: Water

### Method: EPA 537 (Mod) - EPA 537 Isotope Dilution

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanoic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluoroheptanoic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorooctanoic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorononanoic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorodecanoic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorotridecanoic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorotetradecanoic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorobutanesulfonic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorohexanesulfonic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorooctanesulfonic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
NEtFOSAA	ND		2.6	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
NMeFOSAA	ND		1.8	0.53	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluoropentanesulfonic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluoroheptanesulfonic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorononanesulfonic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorodecanesulfonic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorooctanesulfonamide	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorobutanoic acid	ND		4.4	1.8	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluoropentanoic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
HFPODA	ND		2.6	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
DONA	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
9CI-PF3ONS	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
11CI-PF3OUdS	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluoroundecanoic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
Perfluorododecanoic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
8:2 Fluorotelomer sulfonic acid	ND		2.6	0.88	ng/L		10/28/21 18:35	11/01/21 12:37	1
4:2 Fluorotelomer sulfonic acid	ND		1.8	0.44	ng/L		10/28/21 18:35	11/01/21 12:37	1
6:2 Fluorotelomer sulfonic acid	ND		4.4	1.8	ng/L		10/28/21 18:35	11/01/21 12:37	1
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
M2-4:2 FTS	116		20 - 187				10/28/21 18:35	11/01/21 12:37	1
M2-8:2 FTS	122		34 - 182				10/28/21 18:35	11/01/21 12:37	1
M2-6:2 FTS	119		29 - 189				10/28/21 18:35	11/01/21 12:37	1
13C5 PFHxA	106		31 - 142				10/28/21 18:35	11/01/21 12:37	1
13C4 PFHpA	110		30 - 144				10/28/21 18:35	11/01/21 12:37	1
13C8 PFOA	107		49 - 127				10/28/21 18:35	11/01/21 12:37	1

Eurofins Lancaster Laboratories Env, LLC

# Client Sample Results

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

**Client Sample ID: Trip**

**Lab Sample ID: 410-60722-6**

**Date Collected: 10/26/21 13:20**

**Matrix: Water**

**Date Received: 10/27/21 11:39**

**Method: EPA 537 (Mod) - EPA 537 Isotope Dilution (Continued)**

<i>Isotope Dilution</i>	<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
13C9 PFNA	101		47 - 136	10/28/21 18:35	11/01/21 12:37	1
13C6 PFDA	104		47 - 128	10/28/21 18:35	11/01/21 12:37	1
13C7 PFUnA	114		40 - 135	10/28/21 18:35	11/01/21 12:37	1
13C2-PFDoDA	102		28 - 136	10/28/21 18:35	11/01/21 12:37	1
13C2 PFTeDA	107		10 - 144	10/28/21 18:35	11/01/21 12:37	1
13C3 PFBS	115		19 - 178	10/28/21 18:35	11/01/21 12:37	1
13C3 PFHxS	115		32 - 145	10/28/21 18:35	11/01/21 12:37	1
13C8 PFOS	106		49 - 126	10/28/21 18:35	11/01/21 12:37	1
d3-NMeFOSAA	99		32 - 151	10/28/21 18:35	11/01/21 12:37	1
d5-NEtFOSAA	118		37 - 164	10/28/21 18:35	11/01/21 12:37	1
13C8 FOSA	101		10 - 143	10/28/21 18:35	11/01/21 12:37	1
13C4 PFBA	107		41 - 132	10/28/21 18:35	11/01/21 12:37	1
13C5 PFPeA	105		33 - 155	10/28/21 18:35	11/01/21 12:37	1
13C3 HFPO-DA	108		20 - 153	10/28/21 18:35	11/01/21 12:37	1

# Isotope Dilution Summary

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

## Method: EPA 537 (Mod) - EPA 537 Isotope Dilution

Matrix: Water

Prep Type: Total/NA

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	M242FTS (20-187)	M282FTS (34-182)	M262FTS (29-189)	13C5PHA (31-142)	C4PFHA (30-144)	C8PFOA (49-127)	C9PFNA (47-136)	C6PFDA (47-128)
410-60722-1 - DL	PW-1			179					
410-60722-1	PW-1	127	145	136	114	96	110	121	109
410-60722-2 - DL	PW-2								
410-60722-2	PW-2	123	98	97	97	87	101	112	95
410-60722-3 - DL	PW-3			179					
410-60722-3	PW-3	130	135	116	105	100	103	117	107
410-60722-4 - DL	PW-4			183					
410-60722-4	PW-4	116	115	108	97	83	95	104	92
410-60722-5 - DL	Duplicate			153					
410-60722-5	Duplicate	113	115	115	94	79	92	105	91
410-60722-6	Trip	116	122	119	106	110	107	101	104
LCS 410-188425/2-A	Lab Control Sample	111	103	99	95	103	98	97	98
LCS 410-188425/3-A	Lab Control Sample Dup	123	115	107	110	115	110	117	113
MB 410-188425/1-A	Method Blank	100	98	95	90	93	95	101	94

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	13C7PUA (40-135)	PFDODA (28-136)	PFTDA (10-144)	C3PFBS (19-178)	C3PFHS (32-145)	C8PFOS (49-126)	d3NMFOS (32-151)	d5NEFOS (37-164)
410-60722-1 - DL	PW-1					135	120		
410-60722-1	PW-1	106	95	86	140	103	117	94	97
410-60722-2 - DL	PW-2					117	186 *5+		
410-60722-2	PW-2	91	85	82	102	79	149 *5+	87	86
410-60722-3 - DL	PW-3					126	129 *5+		
410-60722-3	PW-3	96	86	82	113	100	104	94	95
410-60722-4 - DL	PW-4					112	118		
410-60722-4	PW-4	95	78	76	100	91	109	84	93
410-60722-5 - DL	Duplicate					115	124		
410-60722-5	Duplicate	86	75	71	109	86	102	83	90
410-60722-6	Trip	114	102	107	115	115	106	99	118
LCS 410-188425/2-A	Lab Control Sample	99	92	98	100	96	100	96	91
LCS 410-188425/3-A	Lab Control Sample Dup	109	103	110	113	109	114	111	112
MB 410-188425/1-A	Method Blank	90	85	83	95	90	97	88	90

		Percent Isotope Dilution Recovery (Acceptance Limits)			
Lab Sample ID	Client Sample ID	PFOSA (10-143)	PFBA (41-132)	PFPeA (33-155)	HFPODA (20-153)
410-60722-1 - DL	PW-1				
410-60722-1	PW-1	91	114	132	105
410-60722-2 - DL	PW-2				
410-60722-2	PW-2	96	103	103	108
410-60722-3 - DL	PW-3				
410-60722-3	PW-3	97	115	112	90
410-60722-4 - DL	PW-4				
410-60722-4	PW-4	98	104	96	100
410-60722-5 - DL	Duplicate				
410-60722-5	Duplicate	93	108	100	90
410-60722-6	Trip	101	107	105	108
LCS 410-188425/2-A	Lab Control Sample	86	93	98	96
LCS 410-188425/3-A	Lab Control Sample Dup	98	106	112	117
MB 410-188425/1-A	Method Blank	86	92	92	100



# Isotope Dilution Summary

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

## Surrogate Legend

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M242FTS = M2-4:2 FTS  
M282FTS = M2-8:2 FTS  
M262FTS = M2-6:2 FTS  
13C5PHA = 13C5 PFHxA  
C4PFHA = 13C4 PFHpA  
C8PFOA = 13C8 PFOA  
C9PFNA = 13C9 PFNA  
C6PFDA = 13C6 PFDA  
13C7PUA = 13C7 PFUnA  
PFDoDA = 13C2-PFDoDA  
PFTDA = 13C2 PFTeDA  
C3PFBS = 13C3 PFBS  
C3PFHS = 13C3 PFHxS  
C8PFOS = 13C8 PFOS  
d3NMFOS = d3-NMeFOSAA  
d5NEFOS = d5-NEtFOSAA  
PFOSA = 13C8 FOSA  
PFBA = 13C4 PFBA  
PFPeA = 13C5 PFPeA  
HFPODA = 13C3 HFPO-DA

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# QC Sample Results

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

## Method: EPA 537 (Mod) - EPA 537 Isotope Dilution

**Lab Sample ID: MB 410-188425/1-A**  
**Matrix: Water**  
**Analysis Batch: 188713**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**  
**Prep Batch: 188425**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexanoic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluoroheptanoic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorooctanoic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorononanoic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorodecanoic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorotridecanoic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorotetradecanoic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorobutanesulfonic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorohexanesulfonic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorooctanesulfonic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
NEtFOSAA	ND		3.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
NMeFOSAA	ND		2.0	0.60	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluoropentanesulfonic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluoroheptanesulfonic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorononanesulfonic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorodecanesulfonic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorooctanesulfonamide	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorobutanoic acid	ND		5.0	2.0	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluoropentanoic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
HFPODA	ND		3.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
DONA	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
9CI-PF3ONS	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
11CI-PF3OUdS	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluoroundecanoic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
Perfluorododecanoic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
8:2 Fluorotelomer sulfonic acid	ND		3.0	1.0	ng/L		10/28/21 18:35	10/29/21 17:13	1
4:2 Fluorotelomer sulfonic acid	ND		2.0	0.50	ng/L		10/28/21 18:35	10/29/21 17:13	1
6:2 Fluorotelomer sulfonic acid	ND		5.0	2.0	ng/L		10/28/21 18:35	10/29/21 17:13	1

Isotope Dilution	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-4:2 FTS	100		20 - 187	10/28/21 18:35	10/29/21 17:13	1
M2-8:2 FTS	98		34 - 182	10/28/21 18:35	10/29/21 17:13	1
M2-6:2 FTS	95		29 - 189	10/28/21 18:35	10/29/21 17:13	1
13C5 PFHxA	90		31 - 142	10/28/21 18:35	10/29/21 17:13	1
13C4 PFHpA	93		30 - 144	10/28/21 18:35	10/29/21 17:13	1
13C8 PFOA	95		49 - 127	10/28/21 18:35	10/29/21 17:13	1
13C9 PFNA	101		47 - 136	10/28/21 18:35	10/29/21 17:13	1
13C6 PFDA	94		47 - 128	10/28/21 18:35	10/29/21 17:13	1
13C7 PFUnA	90		40 - 135	10/28/21 18:35	10/29/21 17:13	1
13C2-PFDoDA	85		28 - 136	10/28/21 18:35	10/29/21 17:13	1
13C2 PFTeDA	83		10 - 144	10/28/21 18:35	10/29/21 17:13	1
13C3 PFBS	95		19 - 178	10/28/21 18:35	10/29/21 17:13	1
13C3 PFHxS	90		32 - 145	10/28/21 18:35	10/29/21 17:13	1
13C8 PFOS	97		49 - 126	10/28/21 18:35	10/29/21 17:13	1
d3-NMeFOSAA	88		32 - 151	10/28/21 18:35	10/29/21 17:13	1
d5-NEtFOSAA	90		37 - 164	10/28/21 18:35	10/29/21 17:13	1
13C8 FOSA	86		10 - 143	10/28/21 18:35	10/29/21 17:13	1
13C4 PFBA	92		41 - 132	10/28/21 18:35	10/29/21 17:13	1

# QC Sample Results

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

## Method: EPA 537 (Mod) - EPA 537 Isotope Dilution (Continued)

**Lab Sample ID: MB 410-188425/1-A**  
**Matrix: Water**  
**Analysis Batch: 188713**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**  
**Prep Batch: 188425**

<i>Isotope Dilution</i>	<i>MB MB</i>		<i>Limits</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
	<i>%Recovery</i>	<i>Qualifier</i>				
13C5 PFPeA	92		33 - 155	10/28/21 18:35	10/29/21 17:13	1
13C3 HFPO-DA	100		20 - 153	10/28/21 18:35	10/29/21 17:13	1

**Lab Sample ID: LCS 410-188425/2-A**  
**Matrix: Water**  
**Analysis Batch: 188713**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**  
**Prep Batch: 188425**

<i>Analyte</i>	<i>Spike Added</i>	<i>LCS Result</i>	<i>LCS Qualifier</i>	<i>Unit</i>	<i>D</i>	<i>%Rec</i>	<i>%Rec.</i>
							<i>Limits</i>
Perfluorohexanoic acid	25.6	25.2		ng/L		98	66 - 137
Perfluoroheptanoic acid	25.6	25.8		ng/L		101	66 - 141
Perfluorooctanoic acid	25.6	24.4		ng/L		95	65 - 136
Perfluorononanoic acid	25.6	26.3		ng/L		103	65 - 140
Perfluorodecanoic acid	25.6	25.4		ng/L		99	63 - 137
Perfluorotridecanoic acid	25.6	24.6		ng/L		96	58 - 146
Perfluorotetradecanoic acid	25.6	24.9		ng/L		97	64 - 141
Perfluorobutanesulfonic acid	22.7	20.8		ng/L		92	65 - 132
Perfluorohexanesulfonic acid	23.3	23.2		ng/L		99	60 - 128
Perfluorooctanesulfonic acid	23.7	23.3		ng/L		98	51 - 126
NEtFOSAA	25.6	27.6		ng/L		108	54 - 134
NMeFOSAA	25.6	25.7		ng/L		100	58 - 143
Perfluoropentanesulfonic acid	24.0	23.6		ng/L		98	71 - 136
Perfluoroheptanesulfonic acid	24.4	24.4		ng/L		100	67 - 135
Perfluorononanesulfonic acid	24.6	25.7		ng/L		104	67 - 137
Perfluorodecanesulfonic acid	24.7	22.9		ng/L		93	61 - 134
Perfluorooctanesulfonamide	25.6	25.0		ng/L		98	55 - 130
Perfluorobutanoic acid	25.6	24.9		ng/L		97	62 - 156
Perfluoropentanoic acid	25.6	23.1		ng/L		90	72 - 139
HFPODA	25.6	26.1		ng/L		102	37 - 147
DONA	24.2	24.3		ng/L		100	49 - 158
9Cl-PF3ONS	23.8	22.2		ng/L		93	52 - 135
11Cl-PF3OUdS	23.8	21.2		ng/L		89	45 - 134
Perfluoroundecanoic acid	25.6	24.6		ng/L		96	62 - 138
Perfluorododecanoic acid	25.6	25.0		ng/L		98	63 - 140
8:2 Fluorotelomer sulfonic acid	24.5	23.3		ng/L		95	56 - 140
4:2 Fluorotelomer sulfonic acid	23.9	21.7		ng/L		91	59 - 130
6:2 Fluorotelomer sulfonic acid	24.3	24.9		ng/L		103	57 - 137

<i>Isotope Dilution</i>	<i>LCS LCS</i>		<i>Limits</i>
	<i>%Recovery</i>	<i>Qualifier</i>	
M2-4:2 FTS	111		20 - 187
M2-8:2 FTS	103		34 - 182
M2-6:2 FTS	99		29 - 189
13C5 PFHxA	95		31 - 142
13C4 PFHpA	103		30 - 144
13C8 PFOA	98		49 - 127
13C9 PFNA	97		47 - 136
13C6 PFDA	98		47 - 128
13C7 PFUnA	99		40 - 135
13C2-PFDoDA	92		28 - 136
13C2 PFTeDA	98		10 - 144

# QC Sample Results

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

## Method: EPA 537 (Mod) - EPA 537 Isotope Dilution (Continued)

**Lab Sample ID: LCS 410-188425/2-A**  
**Matrix: Water**  
**Analysis Batch: 188713**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**  
**Prep Batch: 188425**

<i>Isotope Dilution</i>	<i>LCS %Recovery</i>	<i>LCS Qualifier</i>	<i>Limits</i>
13C3 PFBS	100		19 - 178
13C3 PFHxS	96		32 - 145
13C8 PFOS	100		49 - 126
d3-NMeFOSAA	96		32 - 151
d5-NEtFOSAA	91		37 - 164
13C8 FOSA	86		10 - 143
13C4 PFBA	93		41 - 132
13C5 PFPeA	98		33 - 155
13C3 HFPO-DA	96		20 - 153

**Lab Sample ID: LCSD 410-188425/3-A**  
**Matrix: Water**  
**Analysis Batch: 188713**

**Client Sample ID: Lab Control Sample Dup**  
**Prep Type: Total/NA**  
**Prep Batch: 188425**

<i>Analyte</i>	<i>Spike Added</i>	<i>LCSD Result</i>	<i>LCSD Qualifier</i>	<i>Unit</i>	<i>D</i>	<i>%Rec</i>	<i>%Rec. Limits</i>	<i>RPD</i>	<i>RPD Limit</i>
Perfluorohexanoic acid	25.6	24.9		ng/L		97	66 - 137	1	30
Perfluoroheptanoic acid	25.6	24.5		ng/L		96	66 - 141	5	30
Perfluorooctanoic acid	25.6	25.0		ng/L		98	65 - 136	3	30
Perfluorononanoic acid	25.6	24.6		ng/L		96	65 - 140	7	30
Perfluorodecanoic acid	25.6	24.5		ng/L		96	63 - 137	3	30
Perfluorotridecanoic acid	25.6	24.3		ng/L		95	58 - 146	1	30
Perfluorotetradecanoic acid	25.6	26.0		ng/L		101	64 - 141	4	30
Perfluorobutanesulfonic acid	22.7	20.9		ng/L		92	65 - 132	1	30
Perfluorohexanesulfonic acid	23.3	23.5		ng/L		101	60 - 128	1	30
Perfluorooctanesulfonic acid	23.7	23.4		ng/L		99	51 - 126	0	30
NEtFOSAA	25.6	26.3		ng/L		103	54 - 134	4	30
NMeFOSAA	25.6	24.5		ng/L		96	58 - 143	5	30
Perfluoropentanesulfonic acid	24.0	22.4		ng/L		93	71 - 136	5	30
Perfluoroheptanesulfonic acid	24.4	25.4		ng/L		104	67 - 135	4	30
Perfluorononanesulfonic acid	24.6	26.1		ng/L		106	67 - 137	2	30
Perfluorodecanesulfonic acid	24.7	25.2		ng/L		102	61 - 134	10	30
Perfluorooctanesulfonamide	25.6	24.2		ng/L		94	55 - 130	3	30
Perfluorobutanoic acid	25.6	25.2		ng/L		98	62 - 156	1	30
Perfluoropentanoic acid	25.6	23.3		ng/L		91	72 - 139	1	30
HFPODA	25.6	26.1		ng/L		102	37 - 147	0	30
DONA	24.2	25.6		ng/L		106	49 - 158	5	30
9Cl-PF3ONS	23.8	22.5		ng/L		94	52 - 135	1	30
11Cl-PF3OUdS	23.8	21.3		ng/L		89	45 - 134	1	30
Perfluoroundecanoic acid	25.6	25.3		ng/L		99	62 - 138	3	30
Perfluorododecanoic acid	25.6	25.8		ng/L		101	63 - 140	3	30
8:2 Fluorotelomer sulfonic acid	24.5	25.2		ng/L		103	56 - 140	8	30
4:2 Fluorotelomer sulfonic acid	23.9	22.6		ng/L		95	59 - 130	4	30
6:2 Fluorotelomer sulfonic acid	24.3	28.7		ng/L		118	57 - 137	14	30

<i>Isotope Dilution</i>	<i>LCS %Recovery</i>	<i>LCS Qualifier</i>	<i>Limits</i>
M2-4:2 FTS	123		20 - 187
M2-8:2 FTS	115		34 - 182
M2-6:2 FTS	107		29 - 189
13C5 PFHxA	110		31 - 142

Eurofins Lancaster Laboratories Env, LLC

# QC Sample Results

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

## Method: EPA 537 (Mod) - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: LCSD 410-188425/3-A  
Matrix: Water  
Analysis Batch: 188713

Client Sample ID: Lab Control Sample Dup  
Prep Type: Total/NA  
Prep Batch: 188425

<i>Isotope Dilution</i>	<i>LCSD LCSD</i>		<i>Limits</i>
	<i>%Recovery</i>	<i>Qualifier</i>	
13C4 PFHpA	115		30 - 144
13C8 PFOA	110		49 - 127
13C9 PFNA	117		47 - 136
13C6 PFDA	113		47 - 128
13C7 PFUnA	109		40 - 135
13C2-PFDoDA	103		28 - 136
13C2 PFTeDA	110		10 - 144
13C3 PFBS	113		19 - 178
13C3 PFHxS	109		32 - 145
13C8 PFOS	114		49 - 126
d3-NMeFOSAA	111		32 - 151
d5-NEtFOSAA	112		37 - 164
13C8 FOSA	98		10 - 143
13C4 PFBA	106		41 - 132
13C5 PFPeA	112		33 - 155
13C3 HFPO-DA	117		20 - 153

# QC Association Summary

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

## LCMS

### Prep Batch: 188425

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-60722-1 - DL	PW-1	Total/NA	Water	EPA 537 (mod)	
410-60722-1	PW-1	Total/NA	Water	EPA 537 (mod)	
410-60722-2	PW-2	Total/NA	Water	EPA 537 (mod)	
410-60722-2 - DL	PW-2	Total/NA	Water	EPA 537 (mod)	
410-60722-3 - DL	PW-3	Total/NA	Water	EPA 537 (mod)	
410-60722-3	PW-3	Total/NA	Water	EPA 537 (mod)	
410-60722-4 - DL	PW-4	Total/NA	Water	EPA 537 (mod)	
410-60722-4	PW-4	Total/NA	Water	EPA 537 (mod)	
410-60722-5 - DL	Duplicate	Total/NA	Water	EPA 537 (mod)	
410-60722-5	Duplicate	Total/NA	Water	EPA 537 (mod)	
410-60722-6	Trip	Total/NA	Water	EPA 537 (mod)	
MB 410-188425/1-A	Method Blank	Total/NA	Water	EPA 537 (mod)	
LCS 410-188425/2-A	Lab Control Sample	Total/NA	Water	EPA 537 (mod)	
LCSD 410-188425/3-A	Lab Control Sample Dup	Total/NA	Water	EPA 537 (mod)	

### Analysis Batch: 188713

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-60722-2 - DL	PW-2	Total/NA	Water	EPA 537 (Mod)	188425
MB 410-188425/1-A	Method Blank	Total/NA	Water	EPA 537 (Mod)	188425
LCS 410-188425/2-A	Lab Control Sample	Total/NA	Water	EPA 537 (Mod)	188425
LCSD 410-188425/3-A	Lab Control Sample Dup	Total/NA	Water	EPA 537 (Mod)	188425

### Analysis Batch: 189298

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-60722-1 - DL	PW-1	Total/NA	Water	EPA 537 (Mod)	188425
410-60722-3 - DL	PW-3	Total/NA	Water	EPA 537 (Mod)	188425
410-60722-4 - DL	PW-4	Total/NA	Water	EPA 537 (Mod)	188425
410-60722-5 - DL	Duplicate	Total/NA	Water	EPA 537 (Mod)	188425
410-60722-6	Trip	Total/NA	Water	EPA 537 (Mod)	188425

### Analysis Batch: 189391

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-60722-1	PW-1	Total/NA	Water	EPA 537 (Mod)	188425
410-60722-2	PW-2	Total/NA	Water	EPA 537 (Mod)	188425
410-60722-3	PW-3	Total/NA	Water	EPA 537 (Mod)	188425
410-60722-4	PW-4	Total/NA	Water	EPA 537 (Mod)	188425
410-60722-5	Duplicate	Total/NA	Water	EPA 537 (Mod)	188425

# Lab Chronicle

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

**Client Sample ID: PW-1**  
**Date Collected: 10/26/21 11:36**  
**Date Received: 10/27/21 11:39**

**Lab Sample ID: 410-60722-1**  
**Matrix: Water**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	EPA 537 (mod)	DL		188425	10/28/21 18:35	ZWK6	ELLE
Total/NA	Analysis	EPA 537 (Mod)	DL	100	189298	11/01/21 11:42	ZG8V	ELLE
Total/NA	Prep	EPA 537 (mod)			188425	10/28/21 18:35	ZWK6	ELLE
Total/NA	Analysis	EPA 537 (Mod)		10	189391	11/01/21 16:09	PY4D	ELLE

**Client Sample ID: PW-2**  
**Date Collected: 10/26/21 12:10**  
**Date Received: 10/27/21 11:39**

**Lab Sample ID: 410-60722-2**  
**Matrix: Water**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	EPA 537 (mod)	DL		188425	10/28/21 18:35	ZWK6	ELLE
Total/NA	Analysis	EPA 537 (Mod)	DL	100	188713	10/29/21 18:08	JVK6	ELLE
Total/NA	Prep	EPA 537 (mod)			188425	10/28/21 18:35	ZWK6	ELLE
Total/NA	Analysis	EPA 537 (Mod)		10	189391	11/01/21 16:22	PY4D	ELLE

**Client Sample ID: PW-3**  
**Date Collected: 10/26/21 12:40**  
**Date Received: 10/27/21 11:39**

**Lab Sample ID: 410-60722-3**  
**Matrix: Water**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	EPA 537 (mod)	DL		188425	10/28/21 18:35	ZWK6	ELLE
Total/NA	Analysis	EPA 537 (Mod)	DL	100	189298	11/01/21 12:04	ZG8V	ELLE
Total/NA	Prep	EPA 537 (mod)			188425	10/28/21 18:35	ZWK6	ELLE
Total/NA	Analysis	EPA 537 (Mod)		10	189391	11/01/21 16:34	PY4D	ELLE

**Client Sample ID: PW-4**  
**Date Collected: 10/26/21 13:00**  
**Date Received: 10/27/21 11:39**

**Lab Sample ID: 410-60722-4**  
**Matrix: Water**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	EPA 537 (mod)	DL		188425	10/28/21 18:35	ZWK6	ELLE
Total/NA	Analysis	EPA 537 (Mod)	DL	100	189298	11/01/21 12:15	ZG8V	ELLE
Total/NA	Prep	EPA 537 (mod)			188425	10/28/21 18:35	ZWK6	ELLE
Total/NA	Analysis	EPA 537 (Mod)		10	189391	11/01/21 16:46	PY4D	ELLE

**Client Sample ID: Duplicate**  
**Date Collected: 10/26/21 11:36**  
**Date Received: 10/27/21 11:39**

**Lab Sample ID: 410-60722-5**  
**Matrix: Water**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	EPA 537 (mod)	DL		188425	10/28/21 18:35	ZWK6	ELLE
Total/NA	Analysis	EPA 537 (Mod)	DL	100	189298	11/01/21 12:26	ZG8V	ELLE
Total/NA	Prep	EPA 537 (mod)			188425	10/28/21 18:35	ZWK6	ELLE
Total/NA	Analysis	EPA 537 (Mod)		10	189391	11/01/21 16:57	PY4D	ELLE

# Lab Chronicle

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

**Client Sample ID: Trip**

**Lab Sample ID: 410-60722-6**

**Date Collected: 10/26/21 13:20**

**Matrix: Water**

**Date Received: 10/27/21 11:39**

<u>Prep Type</u>	<u>Batch Type</u>	<u>Batch Method</u>	<u>Run</u>	<u>Dilution Factor</u>	<u>Batch Number</u>	<u>Prepared or Analyzed</u>	<u>Analyst</u>	<u>Lab</u>
Total/NA	Prep	EPA 537 (mod)			188425	10/28/21 18:35	ZWK6	ELLE
Total/NA	Analysis	EPA 537 (Mod)		1	189298	11/01/21 12:37	ZG8V	ELLE

**Laboratory References:**

ELLE = Eurofins Lancaster Laboratories Env, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

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# Accreditation/Certification Summary

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

## Laboratory: Eurofins Lancaster Laboratories Env, LLC

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
Michigan	State	9930	01-31-22

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
EPA 537 (Mod)	EPA 537 (mod)	Water	11CI-PF3OUdS
EPA 537 (Mod)	EPA 537 (mod)	Water	4:2 Fluorotelomer sulfonic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	6:2 Fluorotelomer sulfonic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	8:2 Fluorotelomer sulfonic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	9CI-PF3ONS
EPA 537 (Mod)	EPA 537 (mod)	Water	DONA
EPA 537 (Mod)	EPA 537 (mod)	Water	HFPODA
EPA 537 (Mod)	EPA 537 (mod)	Water	NEtFOSAA
EPA 537 (Mod)	EPA 537 (mod)	Water	NMeFOSAA
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorobutanesulfonic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorobutanoic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorodecanesulfonic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorodecanoic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorododecanoic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluoroheptanesulfonic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluoroheptanoic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorohexanesulfonic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorohexanoic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorononanesulfonic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorononanoic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorooctanesulfonamide
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorooctanesulfonic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorooctanoic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluoropentanesulfonic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluoropentanoic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorotetradecanoic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluorotridecanoic acid
EPA 537 (Mod)	EPA 537 (mod)	Water	Perfluoroundecanoic acid

# Method Summary

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

Method	Method Description	Protocol	Laboratory
EPA 537 (Mod)	EPA 537 Isotope Dilution	EPA	ELLE
EPA 537 (mod)	EPA 537 Isotope Dilution	EPA	ELLE

**Protocol References:**

EPA = US Environmental Protection Agency

**Laboratory References:**

ELLE = Eurofins Lancaster Laboratories Env, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300



# Sample Summary

Client: ORIN Technologies LLC  
Project/Site: PFAS Analysis

Job ID: 410-60722-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-60722-1	PW-1	Water	10/26/21 11:36	10/27/21 11:39
410-60722-2	PW-2	Water	10/26/21 12:10	10/27/21 11:39
410-60722-3	PW-3	Water	10/26/21 12:40	10/27/21 11:39
410-60722-4	PW-4	Water	10/26/21 13:00	10/27/21 11:39
410-60722-5	Duplicate	Water	10/26/21 11:36	10/27/21 11:39
410-60722-6	Trip	Water	10/26/21 13:20	10/27/21 11:39

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**Eurofins Lancaster Laboratories Env, LLC**

2425 New Holland Pike  
Lancaster, PA 17601  
Phone: 717-656-2300 Fax: 717-656-2681

**Chain of Custody Record**



**eurofins** Environment Testing America

<b>Client Information</b>		Sample: <u>Scott Craig</u>		Lab PM: Zeigler, Kristin M		COC No: 410-36628-11467.1											
Client Contact: Jake Mirfield		Phone: <u>608-445-0407</u>		E-Mail: kristin.zeigler@eurofinset.com		Page: Page 1 of 3											
Company: ORIN Technologies LLC		PWSID:		<b>Analysis Requested</b>													
Address: 405 Investment Ct		Due Date Requested:		<table border="1"> <tr> <td rowspan="5">Total Number of Containers</td> <td rowspan="5">Sample (Yes or No)</td> <td rowspan="5">PFC_IDA - M1 List 28 PFAS</td> <td rowspan="5">Total Organic Fluorine</td> <td rowspan="5">Fluoride</td> <td rowspan="5">Calcium</td> </tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> </table>				Total Number of Containers	Sample (Yes or No)	PFC_IDA - M1 List 28 PFAS	Total Organic Fluorine	Fluoride	Calcium				
Total Number of Containers	Sample (Yes or No)	PFC_IDA - M1 List 28 PFAS	Total Organic Fluorine											Fluoride	Calcium		
City: Verona		TAT Requested (days):															
State, Zip: WI, 53593		Compliance Project: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No															
Phone: 608-838-6699(Tel)		PO #: Purchase Order not required															
Email: jmirfield@orint.com		WO #:		<b>Preservation Codes:</b> A - HCL                      M - Hexane B - NaOH                    N - None C - Zn Acetate              O - AsNaO2 D - Nitric Acid              P - Na2O4S E - NaHSO4                 Q - Na2SO3 F - MeOH                     R - Na2S2O3 G - Amchlor                S - H2SO4 H - Ascorbic Acid         T - TSP Dodecahydrate I - Ice                         U - Acetone J - DI Water                V - MCAA K - EDTA                    W - pH 4-5 L - EDA                      Z - other (specify)													
Project Name: PFAS Analysis		Project #: 41007817															
Site: <u>WANG</u>		SSOW#:															
<b>Sample Identification</b>		Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=soil, BT=Tissue, A=Air)												
PW-1		10/20/21	1136	G	Water	N	X										
PW-2		10/20/21	1210		Water		X										
PW-3		10/20/21	1240		Water		X										
PW-4		10/20/21	1300		Water		X										
Duplicate		10/20/21	1136		Water		X										
Trip		10/20/21	1320		Water		X										
PW-2 5'		10/23/21	830	G	Soil		X										
PW-2 10'		10/23/21	845	G	Soil		X										
PW-4 4'		10/23/21	1150	G	Soil		X										
					Water												
<b>Possible Hazard Identification</b>				<b>Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)</b>													
<input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input type="checkbox"/> Radiological				<input type="checkbox"/> Return To Client <input type="checkbox"/> Disposal By Lab <input type="checkbox"/> Archive For _____ Months													
Deliverable Requested: I, II, III, IV, Other (specify)				Special Instructions/QC Requirements:													
Empty Kit Relinquished by:		Date:		Time:		Method of Shipment:											
Relinquished by: <u>J. Deere</u>		Date/Time: <u>10/20/21 1515</u>		Company:		Received by:											
Relinquished by: <u>Scott</u>		Date/Time: <u>10/20/21 1455</u>		Company:		Received by: <u>[Signature]</u>											
Relinquished by: <u>[Signature]</u>		Date/Time: <u>10/27/21 1139</u>		Company: <u>OL</u>		Received by: <u>[Signature]</u>											
Custody Seals Intact: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks: <u>5.4</u>													

AS.H



# SDS

# Safety Data Sheet

## Section I Chemical Product and Company Identification

Product Name	BAM
Synonyms	BAM Ultra
CAS Number	7440-44-0
Active Ingredients	Pyrolyzed Cellulosic Material
Recommended Use	Soil Stabilization, Remedial Activities
Restrictions on Use	None
Formulated by	ORIN Technologies, LLC
Address	405 Investment Court, Verona, WI 53593 USA
Emergency Phone Number	<b>8 AM-5PM CST:</b> 608-838-6699 <b>5 PM -8 AM CST, Weekends, Holidays:</b> 262-821-7024

## Section II Hazard(s) Identification



<b>Signal Word</b>	Warning		
<b>Hazard Statements</b>	May cause Respiratory Irritation May form combustible dust concentrations in air		
<b>Precautionary Statements - Prevention</b>	Do not breathe dust, fume, gas Wash thoroughly after handling Use only outdoors or in a well-ventilated area Wear gloves, eye, respiratory protection, face protection, and protective clothing		
<b>Precautionary Statement – Response</b>	IF ON SKIN – Wash with plenty of soap and water IF INHALED – Remove victim to fresh air and keep at rest position comfortable for breathing. IF IN EYES –Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue Rinsing Call a POISON CENTER or doctor if you feel unwell If skin irritation occurs: Get medical advice or attention. If eye irritation persists: Get medical advice or attention. If respiratory irritation persists: Get medical advice or attention. Take off contaminated clothing and wash before reuse.		
<b>Storage</b>	Store in a well ventilated place. Keep container tightly closed. Store in a secure manner.		
<b>Exposure Limits</b> ND	<b>Synergistic Products</b> ND	<b>Sensitization/Irritancy:</b> ND	<b>Carcinogenicity/Teratogenicity/ Mutagenicity/Reproductive Effects:</b> None Known

## Section III Composition and Information on Ingredients

Chemical Name	CAS#	wt/wt %
Carbon (Wood Derived)	7440-44-00	85-95 (dry basis)
Minerals (Wood Derived)	N/A	5-10 (dry basis)
Water	7780-20-0	20-40%

**Hazardous Ingredients: NONE**

Section IV First Aid Measures					
<b>Skin</b>		Prolonged contact with skin may result in slight irritation/redness in sensitive individuals. Seek medical attention if persists. Wash with soap and water. Not expected to be harmful under normal conditions of use.			
<b>Eyes</b>		May irritate the eyes and cause watering and redness in sensitive individuals. Rinse thoroughly with plenty of water to remove foreign bodies. Seek medical attention if persists.			
<b>Inhalation</b>		Inhalation of dust may irritate nose, throat, and lungs. May aggravate pre-existing conditions. Remove affected person to fresh air. Seek medical attention if persists.			
<b>Ingestion</b>		If suffering gastrointestinal discomfort, treat symptomatically. Do not ingest.			
Section V Fire-Fighting Measures					
<b>Flammability</b>		This product should not come into contact with naked flames.			
<b>Means of Extinguishing</b>		Foam, Water Spray, CO <sub>2</sub> , Dry Chemical			
<b>Advice for Fire Fighters</b>		Wear self-contained breathing apparatus for firefighting if necessary			
<b>Flashpoint</b>	NA	<b>Auto-Ignition Temperature</b>	ND		
<b>UEL</b>	NA	<b>TDG Flammability Class</b>	ND		
<b>LEL</b>	NA	<b>Hazardous Combustion Products</b>	NA		
Section VI Accidental Release Measures					
<b>Personal Precautions, Protective Equipment, Emergency Procedures</b>		Avoid dust formation. Avoid breathing vapors, mist, or gas. For personal protection, see Section 8			
<b>Environmental Precautions</b>		No specific environmental precautions required.			
<b>Methods and materials for Containment and Cleanup</b>		Sweep up and shovel. Keep in suitable, closed containers for disposal.			
<b>Reference for other sections</b>		For disposal, see section 13.			
Section VII Handling and Storage					
<b>Engineering Controls</b>		Ventilate			
<b>Leak or Spill Procedure</b>		Sweep up into suitable container. Prevent entry into waterways.			
<b>Handling Procedures and Equipment</b>		Avoid direct and prolonged contact with skin			
<b>Storage Requirements</b>		Store in a cool, well ventilated, dry place			
Section VIII Exposure Controls/Personal Protection					
<b>Personal Protective Equipment</b>		<b>Respiratory:</b> Proper dust masks should be worn if prolonged use of this product is expected. Use type N95 dust masks for nuisance levels. Use respirators and components tested and approved under appropriate government standards (NIOSH).			
		<b>Eyes:</b> Use of safety glasses recommended to avoid contact with eyes (NIOSH).			
		<b>Gloves:</b> Use of gloves recommended to avoid direct skin contact.			
Section IX Physical and Chemical Properties					
<b>Physical State</b>		Solid			
<b>Odor and Appearance</b>		Slightly earthy odor. Brown or black solid particles			
<b>Odor Threshold</b>	NDA	<b>Specific Gravity</b>	1.5-2.1 for solid matrix, bulk density varies.	<b>Evaporation Rate</b>	NDA
<b>Vapor Pressure</b>	NDA	<b>Vapor Density</b>	NDA	<b>Density</b>	Varies
<b>Boiling Point</b>	NA	<b>Freezing Point</b>	NDA	<b>pH</b>	7-9.5
<b>Flammability (solid, gas)</b>	May form combustible dust concentrations in air	<b>Explosive Properties Bar m/s</b>	K <sub>st</sub> = 32 +/- 30%	<b>Dust Explosion Class</b>	St 1
<b>Water Solubility</b>	Not soluble	<b>Auto Ignition Temp.</b>	NDA	<b>Relative Density</b>	NDA
<b>Partition Coefficient</b>	NDA	<b>Decomposition Temp.</b>	NDA	<b>Viscosity</b>	NDA

<b>Section X Stability and Reactivity</b>	
Chemical Stability: Stable	Incompatibility: Strong acids, alkalis, and oxidizing agents.
Conditions of Reactivity: NA	Hazardous Decomposition Products: Strong oxidizers such as ozone, liquid oxygen, chlorine, permanganate, etc. may result in rapid combustion. Avoid contact with strong acids.
<b>Section XI Toxicological Information</b>	
<b>No Data Available</b>	
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.	
<b>Section XII Ecological Information</b>	
<b>No Data Available</b>	
<b>Section XIII Disposal Considerations</b>	
Disposal	Sweep, vacuum or shovel material into labeled container. If at all possible, reuse product. Keep out of any bodies of water.
<b>Section XIV Transport Information</b>	
Shipping Information	Not regulated (DOT)
The information and recommendations set forth herein are presented in good faith and believed to be correct as of the date hereof. The information and recommendations are supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will ORIN Technologies, LLC. or any of its agents be responsible for damages of any nature whatsoever resulting from the use of or reliance upon the information and recommendations. No representations or warranties, either expressed or implied, of merchantability, fitness, or a particular purpose or of any other nature are made here under with respect to information or the product to which information refers.	
Preparation Date:	July, 2018 MAB
Reason for Revision:	Updated Field Values

# SAFETY DATA SHEET (SDS)



FIXED EARTH

## Section 1 - Product and Company Identification

**Product Name:** PFAS Degrading Bacteria – Liquid Culture

**Synonyms:** NA

**CAS Number:** NA

**Active Ingredients:** Live Bacterial Cultures (*Hydrogenophaga spp.*, *Flavobacterium spp.*)

**Recommended Use:** Remedial Activities, Soil Treatment, Wastewater Treatment

**Restrictions on Use:** Not to be used to treat potable water.

**Formulated by:** Fixed Earth Innovations Ltd.

**Address:** 8615 100 Street, Fort St John, BC, V1J 3W7

**Emergency Phone Number:** +1 888 617 3125

## Section 2 - Hazard Identification

**Signal Word:** Warning

**Hazard Statements:** May cause skin irritation

### Precautionary Statements – Prevention:

- Do not ingest;
- Wash thoroughly after handling;
- Wear gloves, eye protection, and protective clothing as required.

### Precautionary Statement – Response:

- IF ON SKIN: Wash with soap and water;
- IF INHALED: Move to fresh air and rest at a position comfortable for breathing;
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and continue rinsing.



Call a poison center or doctor if you feel unwell.

Get medical advice or attention if you feel unwell, if skin irritation occurs, if eye irritation persists, or if respiratory irritation persists.

Wash contaminated clothing before reuse.

**Storage:** Store in a cool dark location to maintain product viability. Store in a secure manner.

**Exposure Limits:** NA/Not Determined

**Synergistic Products:** NA

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Saskatoon, SK, S7S 1P2  
Phone: 306.291.3264

**FORT ST. JOHN**  
8615 100 Street  
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Phone: 250.329.5207



**Sensitization/Irritancy:** NA

**Carcinogenicity/Teratogenicity/Mutagenicity/Reproductive Effects:** None Known

### Section 3 - Composition and Information on Ingredients

Chemical Name	CAS Number	Weight Percentage
Water	7780-20-0	90-95
Bacterial Cells	NA	2-3 (wet basis)
Mineral Nutrients	NA	2-3 (wet basis)
Proprietary Surfactant Blend	NA	2-3 (wet basis)

**Hazardous Ingredients:** NONE

Note: This product contains beneficial microorganisms and their parts. Fixed Earth exclusively uses non-pathogenic beneficial microorganisms that are considered to be non-allergenic, non-irritating and non-sensitizing when used as directed. Exposure to very high levels of airborne microbial spores/cells may result in very rare respiratory impairments or cause an allergic reaction in sensitized individuals.

### Section 4 - First Aid Measures

**Skin:** Prolonged contact of concentrated product with skin may result in slight irritation/redness in sensitive individuals. Seek medical attention if irritation persists. Wash with soap and water. Not expected to be harmful under normal conditions of use.

**Eyes:** Concentrated product may irritate the eyes and cause watering and redness in sensitive individuals. Rinse thoroughly with plenty of water to remove foreign bodies. Seek medical attention if irritation persists.

**Inhalation:** Inhalation of droplets of concentrated product may irritate nose, throat, or lungs. May aggravate pre-existing conditions. Remove affected person to fresh air. Seek medical attention if irritation persists.

**Ingestion:** If suffering gastrointestinal discomfort, treat symptomatically. Not intended for human consumption.

### Section 5 - Fire Fighting Measures

**Flammability:** Product is not flammable.

**Means of Extinguishing:** Use means suitable for surrounding media.

**Advice for Fire Fighters:** Fight fire by means suitable for surrounding media and chemicals.

**Flashpoint:** NA

**Auto-Ignition Temperature:** Not Determined

**UEL:** NA

**LEL:** NA

**TDG Flammability Class:** NA

**Hazardous Combustion Products:** None

### Section 6 - Accidental Release Measures

**Personal Precautions, Protective Equipment, Emergency Procedures:** Avoid aerosol formation. Avoid inhalation of mists.



**Environmental Precautions:** Prevent uncontrolled release into surface water bodies.

**Methods and Materials for Cleanup:** Use sorbent material to collect free liquids. Store in closed containers until suitable disposal can be arranged.

**Reference for Other Sections:** For disposal, see Section 13.

## Section 7 - Handling and Storage

Store any unused product in original unopened containers at temperatures below 20 C (68 F) away from sunlight, drafts, and direct heat sources. Practice reasonable caution to avoid contact with this product. Avoid breathing dusts and mists if generated. Users should wash hands before eating, drinking, chewing gum, using tobacco or the toilet. Keep out of reach of children. Do not ship or store this product with food, feed, drugs or clothing.

## Section 8 - Exposure Controls/Personal Protection

**Engineering Controls:** Good ventilation is recommended. Avoid aerosol generation.

**Respiratory PPE:** Respiratory PPE is not required under normal use. Respiratory protection is recommended if product handling/use may result in aerosol or mist generation.

**Eye PPE:** Use of safety glasses is recommended to avoid direct contact with eyes.

**Gloves:** Use of gloves is required to avoid direct contact with skin.

## Section 9 - Physical and Chemical Properties

**Physical State:** Liquid.

**Odour and Appearance:** Blue liquid with slight fermentation odour.

<b>Odour Threshold:</b> Not Determined	<b>Specific Gravity:</b> 1.0-1.1	<b>Evaporation Rate:</b> Not Determined
<b>Vapour Pressure:</b> Not Determined	<b>Vapour Density:</b> Not Determined	<b>Density:</b> 1 g/cubic cm
<b>Boiling Point:</b> 100 C (212 F)	<b>Freezing Point:</b> 0 C (32 F)	<b>pH:</b> 5-8
<b>Water Soluble:</b> Water Miscible	<b>Explosive Properties:</b> None	<b>Dust Explosion Class:</b> NA
<b>Partition Coefficient:</b> Not Determined	<b>Auto Ignition Temperature:</b> Not Determined	<b>Relative Density:</b> Not Determined
<b>Flammability:</b> Non Flammable	<b>Decomposition Temp:</b> Boils before decomposing.	<b>Viscosity:</b> Comparable to water

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable

**Incompatibility:** Incompatible with chemicals that are water reactive. Biocides and fungicides may result in product deactivation.

**Conditions of Reactivity:** NA

**Hazardous Decomposition Products:** None Known



## Section 11 - Toxicological Information

**No data available.**

To the best of our knowledge, this product poses no immediate acute toxicity.

## Section 12 - Ecological Information

This product contains biological residual materials such as cell mass, enzymes, spore fragments, etc. Viable bacterial cells may remain present in solution and are prone to growth in the environment. We utilize a blend of indigenous microorganisms in this product formulation that pose negligible/no ecological risk if they enter the environment.

## Section 13 - Disposal Considerations

Sorbent materials that have become saturated with the product are suitable for disposal as contaminated waste and may require disposal in specialized landfills in accordance with local regulations. Check with local municipalities for special disposal considerations.

## Section 14 - Transport Information

Transport of this product is not regulated.

## Section 15 - Other Information

The information contained in this Safety Data Sheet is presented in good faith and is believed to be accurate as of the effective date shown above. However, no other warranty, expressed or implied, is given. Laws, regulations, and/or third party rights may prevent customers from importing, using, processing and/or reselling the products described herein in a given manner. Without separate written agreement between the customer and Fixed Earth to such effect this document does not constitute a representation or warranty of any kind and is subject to change without further notice.

**Prepared by:** T. Repas

**Effective Date:** March 2021



May 10, 2021

## Importation of Biological Materials - United States of America

This letter is to clarify the origin and species of biological materials being imported into the United States of America in May 2021 for utilization on a biological remediation pilot project in Madison, Wisconsin. The bacterial cultures being imported on this date for the aforementioned project were previously isolated from groundwater samples collected by Orin Technologies from the subject location in November 2020. The water samples were shipped to Fixed Earth's facility located in Fort St John, British Columbia where bacteria were isolated from media using proprietary methods.

Two microbial species were isolated in accordance with this process. The isolates were genetically identified as:

- *Hydrogenophaga palleroni*
- *Flavobacterium hibernum*

Based on available scientific literature, these organisms are not considered to be pathogenic to livestock or poultry.

If have questions regarding this letter or require additional information, please contact the undersigned at 250-329-5207.



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**Timothy Repas, M.Sc., P.Ag.**  
**President**

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# SAFETY DATA SHEET

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## 1. Chemical Product and Supplier Identification

**Product Name:** Calcium Peroxide

**Synonyms:** Calcium Dioxide, Calcium Superoxide

**Relevant uses:** Environmental application, water treatment and soil/ground oxidation.

**Recommended uses advised against:** Non known.

**Manufacturer:** Kingsfield China

**USA Branch:**

Kingsfield Inc.  
1 Dewolf Rd. Suite 210  
Old Tappan, NJ 07675  
Tel: 201-767-0414

**Emergency contact information:**

CHEMTREC Customer Service  
Tel: 1-800-262-8200 (within the U.S.)  
Tel: +1 703-741-5500 (from anywhere in the world)  
Email: chemtrec@chemtrec.com

## 2. Hazards Identification

### Classification of the substance or mixture

**GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Oxidizing solids (Category 3), H272  
Acute toxicity, Oral (Category 4), H302  
Serious skin burns, eye damage (Category 1), H314  
Serious eye damage (Category 1), H318  
Specific target organ toxicity-single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

### GHS Label elements, including precautionary statements

#### Pictogram



**Signal word** Danger

#### Hazard statements

H272	May intensify fire; oxidizer.
H314	Causes severe skin burns and eye damage
H302	Harmful if swallowed.
H318	Causes serious eye damage.
H335	May cause respiratory irritation.

#### Precautionary statements

P201	Obtain special instructions before use.
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# SAFETY DATA SHEET

P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat.
P220	Keep/Store away from clothing/combustible materials.
P221	Take any precaution to avoid mixing with combustibles.
P261	Avoid breathing dust/fume/gas/mist/vapors/spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/protective clothing/eye protection/face protection
P301+P312	IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.
P303+P361+P353	IF ON SKIN: Take off all contaminated clothing immediately. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER or doctor/physician.
P312	Call a POISON CENTER or doctor/physician if you feel unwell.
P321	Specific treatment (see the supplemental first aid instruction)
P330	Rinse mouth
P363	Wash contaminated clothing before reuse
P370+P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container to an approved waste disposal plant.

## Hazards not otherwise classified (HNOC) or not covered by GHS- none

Emergency Overview: Oxidizing agent, contact with other material may cause fire. Under fire conditions this material may decompose and release oxygen that intensifies fire.

### Potential Health Effects:

<b>General</b>	Irritating to mucous membrane and eyes.
<b>Inhalation</b>	Irritating to the respiratory tract.
<b>Eye Contact</b>	May cause irritation to the eyes; Risks of serious or permanent eye lesions.
<b>Skin Contact</b>	May cause skin irritation.
<b>Ingestion</b>	Irritation of the mouth and throat with nausea and vomiting.

## 3. Composition/Information on Ingredients

<b>Ingredients</b>	<b>Chemical Formula</b>	<b>CAS No.</b>	<b>Percentage</b>
Calcium Peroxide	CaO <sub>2</sub>	1305-79-9	Min.75.0
Calcium Hydroxide	Ca(OH) <sub>2</sub>	1305-62-0	Max.25.0

## 4. First-Aid Measures

<b>Inhalation</b>	Remove affected person to fresh air. Seek medical attention if effects persist.
<b>Eye Contact</b>	Flush eyes with running water for 15 minutes with eyelids held open. Seek specialist advice.
<b>Skin Contact</b>	Wash affected skin with soap and mild detergent and large amounts of water.
<b>Ingestion</b>	If the person is conscious and not convulsing, give 2-4 cupfuls of water to dilute the chemical and seek medical attention immediately. Do not induce vomiting.

## 5. Fire Fighting Measure

# SAFETY DATA SHEET

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**Flash Point:** Not applicable

**Flammability:** Not applicable

**Ignition Temperature:** Not applicable

**Danger of Explosion:** Non-explosive

**Extinguishing Media:** Water

**Fire Hazards:** Oxidizer. Storage vessels involved in a fire may vent gas or rupture due to internal pressure. Damp material may decompose exothermically and ignite combustibles. Oxygen release due to exothermic decomposition may support combustion. May ignite other combustible materials. Avoid contact with incompatible materials such as heavy metals, reducing agents, acids, bases, combustibles (wood, papers, cloths, etc.). Thermal decomposition releases oxygen and heat. Pressure bursts may occur due to gas evolution. Pressurization if confined when heated or decomposing. Containers may burst violently.

## Fire-Fighting Measures:

Evacuate all non-essential personnel

Wear protective clothing and self-contained breathing apparatus

Remain upwind of fire to avoid hazardous vapors and decomposition products

Use water spray to cool fire-exposed containers

## 6. Accidental Release Measures

**Spill Clean-up Procedures:** Oxidizer. Eliminate all sources of ignition. Evacuate unprotected personnel from equipment recommendations found in Section 8. Never exceed any occupational exposure limit. Shovel or sweep material into plastic bags or vented containers for disposal. Do not return spilled or contaminated material to inventory.

Flush remaining area with water to remove trace residue and dispose of properly. Avoid direct discharge to sewers and surface waters. Notify authorities if entry occurs. Do not touch or walk through spilled material. Keep away from combustibles (wood, paper, oils, etc.). Do not return any product to container because of the risk of contamination.

## 7. Handling and Storage

**Handling:** Avoid contact with eyes, skin, and clothing. Use with adequate ventilation. Do not swallow. Avoid breathing vapors, mists, or dust. Do not eat, drink, or smoke in work area. Prevent contact with combustible or organic materials. Label containers and keep them tightly closed when not in use. Wash thoroughly after handling.

**Storage:** Oxidizer. Store in a cool, well-ventilated area away from all sources of ignition and out of direct sunlight. Store in a dry location away from heat. Keep away from incompatible materials. Keep containers tightly closed. Do not store in unlabeled or mislabeled containers. Protect from moisture. Do not store near combustible materials. Keep containers well sealed, seal only with original vent cap. Ensure pressure relief and adequate ventilation. Store separately from organics and reducing materials. Avoid contamination, which may lead to decomposition.

## 8. Exposure Controls/Personal Protection

# SAFETY DATA SHEET

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**Engineering Controls:** General room ventilation is required. Local exhaust ventilation, process enclosures or other engineer controls may be needed to maintain airborne levels below recommended exposure limits. Avoid creating dust or mist. Maintain adequate ventilation. Do not use in closed or confined spaces. Keep levels below exposure limits. To determine exposure levels, monitoring should be performed regularly.

**Respiratory Protection:** For many conditions, no respiratory protection may be needed; however, in dusty or unknown atmospheres or when exposures exceed limit values, wear a NIOSH approved respirator.

**Eye/Face Protection:** Wear chemical safety goggles and a full-face shield while handling this product.

**Skin Protection:** Prevent contact with this product. Wear gloves and protective clothing depending on condition of use. Protective gloves: Chemical-resistant (Recommended materials: PVC, neoprene or rubber.)

**Other Protective Equipment:**

Eye-wash station

Safety shower

Impervious clothing

Rubber boots

**General Hygiene Considerations:** Wash with soap and water before meal times and at the end of each work shift. Good manufacturing practices require gross amounts of any chemical be removed from skin as soon as practical, especially before eating or smoking.

## 9. Physical and Chemical Properties

**Appearance:** White or yellowish powder

**Odor:** None

**Bulk Density:** 500~650 g/L

**Solubility in water:** Insoluble

**PH, 3% Solution:** Approx.12

**Decomposition Temperature:** Self-accelerating decomposition with oxygen release starting from 275 °C

## 10. Stability and Reactivity

**Stability:** Stable under normal conditions

**Conditions to Avoid:**

Water

Acids

Bases

Salts of heavy metals

Reducing agents



# SAFETY DATA SHEET

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Organic materials

Flammable substances

**Hazardous Decomposition Products:** Oxygen which supports combustion.

## 11. Toxicological Information

LD50 Oral: Min.2000 mg/kg, rat

LD50 Dermal: Min. 2000 mg/kg, rabbit

LD50 Inhalation: Min. 4580 mg/kg, rat

**Acute toxicity of over-exposure:** Dust is irritating to eyes, nose, throat and lungs.

**Chronic toxicity:** No known effect

**Carcinogenicity:** There are no known carcinogenic chemicals in this product.

## 12. Ecological Information

**Ecotoxicological Information:** Hazard to the environment is limited due to the product properties of no bioaccumulation, weak solubility and precipitation in aquatic environment.

**Chemical Fate Information:** As indicated by chemical properties oxygen is released into the environment.

## 13. Disposal Considerations

**Waste Treatment:** Dispose of in an approved waste facility operated by an authorized contractor in compliance with local regulations.

**Package Treatment:** The empty and clean containers are to be recycled or disposed of in conformity with local regulations.

## 14. Transport Information

### DOT (US)

UN number: 1457      Class:5.1      Packing group: II

Proper shipping name: Calcium Peroxide

Marine pollutant: No

Poison inhalation hazard: No

### TDG

UN number: 1457      Class:5.1      Packing group: II

Proper shipping name: Calcium Peroxide

Marine pollutant: No

Poison inhalation hazard: No

### ICAO/IATA

Oxidizers are prohibited from aircraft.

### IMDG

# SAFETY DATA SHEET

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UN number: 3377      Class:5.1      Packing group: II  
Proper shipping name: Calcium Peroxide  
Marine pollutant: No

## 15. Regulatory Information

### SARA 311/312 Hazard Categories

Acute health hazard	Yes
Chronic health hazard	No
Fire hazard	Yes
Sudden release of pressure hazard	No
Reactive hazard	No

SARA Section	Yes
SARA (313) Chemicals	No
EPA TSCA Inventory	Appears
Canadian WHMIS Classification	C, D2B
Canadian DSL	Appears
EINECS Inventory	Appears

## 16. Other Information

### Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute Toxicity
Eye Dam.	Serious eye damage
H272	May intensify fire; oxidizer.
H314	May cause severe skin burns and eye damage
H302	Harmful if swallowed
H318	Causes serious eye damage.
H335	May cause respiratory irritation.
Ox. Sol	Oxidizing solids.
STOT SE	Specific target organ toxicity-single exposure

### HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard:	1

### NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	1
Special hazard.I:	OX

**Disclaimer:** The data in this Safety Data Sheet is believed to be correct. However, since conditions of use are outside our control it should not be taken as a warranty of representation. This information is provided solely for your consideration, investigation and verification.

Effective Date: May 1, 2015