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May 28, 2025

Rick Kessler
Director
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RE: Revised/Final Per and Polyfluoroalkyl Substances (PFAS)
Investigation Workplan
Perdue Agribusiness, LLC
6906 Zion Church Road
Salisbury, MD
Langan Project No.: 220210101

Dear Mr. Kessler:

On behalf of Perdue AgriBusiness LLC (PAB), Langan Engineering and Environmental Services, LLC (Langan) is submitting the attached Revised/Final Per and Polyfluoroalkyl Substances (PFAS) Investigation Workplan (IWP) for PAB's Zion Church Road Facility (ZCR Facility) at 6906 Zion Church Road in Salisbury, Maryland. Langan submitted an IWP for the ZCR Facility on behalf of PAB on March 7, 2025. The Maryland Department of the Environment - Land Restoration Program (MDE-LRP) issued written questions and comments on the IWP on March 14, 2025 and participated in a virtual meeting to further discuss them on March 21, 2025. Langan submitted a Revised Workplan on April 10, 2025 to include PAB's comprehensive responses as an attachment to the Workplan. MDE-LRP issued additional written questions and comments on the Revised Workplan on May 7, 2025, requesting PAB's responses be incorporated into the body of the Workplan. The attached Revised/Final Workplan amends the April 10, 2025 Workplan to address MDE-LRP's additional questions and comments.

The IWP has been updated as follows to address and respond to the questions and comments issued by MDE-LRP on May 7, 2025:

- The tabulated historical sampling data and associated sample location figure that were previously provided to MDE in Attachment A of Langan's April 10 2025 submission have been incorporated into the Revised/Final IWP as Tables 1 through 5 and Figure 4. Additional contextual information previously provided in Attachment A will be incorporated into a forthcoming Site Investigation Report, as indicated in Section 6 of the Revised/Final IWP.
- The scope of the proposed investigation activities has been expanded to include surface water and sediment sampling in Peggy Branch at the two previously proposed stream gauge locations plus the "Block Gate" location, as indicated in Sections 4.8 and 4.9 of the Revised/Final IWP.

- The scope of the proposed investigation activities for AOI-1: Aqueous Film Forming Foam (AFFF) – Fire Suppression System has been expanded to include extensive soil and groundwater sampling within the exclusion zone associated with the Soybean Extraction Plant. This sampling will take place during a planned process shutdown that is scheduled to occur in August 2025. The scope also has been expanded to include additional soil sampling outside the exclusion zone to the north of the foam house, as well as sampling of process water from the "co-mingled manhole". The analytical schedule for water samples collected from the proposed monitoring wells and the co-mingled manhole has been expanded to include PFAS total oxidizable precursor (TOP) analysis. Pursuant to a discussion between Langan (Adam Hackenberg) and MDE-LRP (Brian Dietz) on May 23, 2025, these samples will not be analyzed for volatile organic compounds (VOCs) because the VOC of interest to MDE (hexane) is not a suspected soil or groundwater contaminant of concern at the ZCR Facility and is not included in a standard VOC analysis. These updates are reflected in Sections 4.2, 4.3, and 4.4 of the Revised/Final IWP.
- The scope of the proposed investigation for AOI-8: Former Spray Irrigation Field has been expanded to include: a) additional soil boring coverage across the spray field area, and b) a new water table monitoring well in the northwest corner of the spray field area. These updates are reflected in Sections 4.2 and 4.4 of the Revised/Final IWP.
- Langan has clarified that the scope of the technical memorandum described in Section 6 of the IWP will include electronic copies of laboratory reports generated by the investigation.
- Appendix C includes the documentation located at this juncture related to the acquisition and use of AFFF-containing materials at the ZCR facility.

As discussed with MDE-LRP on March 21, 2025, the investigation activities proposed in the IWP represent a next phase in what is expected to be an iterative investigative process. The investigation activities presented in the IWP focus on characterizing the presence/absence, types, and concentrations of PFAS in the identified PFAS Areas of Interest (AOIs), or representative portions thereof. In determining the current proposed scope and location of sampling, Langan prioritized soil sampling in the identified AOIs, additional groundwater sampling in several key areas, and acquisition of data needed to further characterize groundwater occurrence and movement at the ZCR Facility. PAB, in coordination with MDE, will use the results to determine the need for, and scope of, additional investigation activities in and around the identified PFAS AOIs to further assess and delineate PFAS in soil, groundwater, and other environmental media and/or to evaluate potential PFAS migration pathways.

Please do not hesitate to contact the undersigned should you have further questions or comments at 215.694.7549 or jsmith@Langan.com.

Sincerely,
Langan Engineering and Environmental Services, LLC

Jeffrey A. Smith

Jeffrey A. Smith, P.G.
Senior Associate

Enclosure(s): Revised/Final PFAS Investigation Workplan

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REVISED/FINAL PER AND POLYFLUOROALKYL SUBSTANCES (PFAS) INVESTIGATION WORKPLAN, PERDUE AGRIBUSINESS LLC ZION CHURCH ROAD FACILITY

for

Perdue AgriBusiness LLC
6906 Zion Church Road
Salisbury, Maryland

Prepared For:

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May 28, 2025
220210101

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1.0 INTRODUCTION

Langan Engineering and Environmental Services, LLC (Langan) has prepared this Revised/Final Per and Polyfluoroalkyl Substances (PFAS) Investigation Workplan (Workplan) on behalf of Perdue AgriBusiness LLC (PAB) to describe the scope and methods for the next phase of PFAS site investigation activities to be performed for the PAB facility located at 6906 Zion Church Road in Salisbury, Wicomico County, Maryland (the "Site or "Zion Church Road [ZCR] Facility"). A Site location map is included as Figure 1.

The purpose of the activities described in this Workplan is to assess the presence and concentrations of PFAS in soil and water in PFAS Areas of Interest (AOIs) identified in Langan's *Environmental Assessment of PFAS Report* dated January 21, 2025, to provide additional data to characterize the horizontal and vertical extent of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) (if and where detected) and further assess identified PFAS AOIs as potential primary or secondary sources of PFAS at the Site[1]. Detailed descriptions of the PFAS AOIs were provided in Langan's *Environmental Assessment of PFAS Report*. Figure 2 is a Site Plan Overview map, and Figure 3 indicates the locations of the identified PFAS AOIs. Data obtained under this Workplan will also be used to inform the development of guidelines and procedures for handling, reuse, management, and disposal of materials encountered during future construction activities at the ZCR facility in a manner that is protective of worker health and safety and the environment. Data obtained under this Workplan will also form the basis for recommendations, as appropriate, to further characterize the nature and extent of PFAS at the ZCR Facility as may be needed to determine if and where remedial actions may be appropriate, and if so, to support the eventual evaluation of remedial action alternatives.

Langan submitted a Workplan for the ZCR Facility on behalf of PAB, on March 7, 2025. The Maryland Department of the Environment - Land Restoration Program (MDE-LRP) issued written questions and comments on the Workplan on March 14, 2025 and participated in a virtual meeting to further discuss them on March 21, 2025. Langan submitted a Revised Workplan on April 10, 2025 to include PAB's comprehensive responses as an attachment to the Workplan.

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[1] The AFFF Fire Suppression System (AOI 1) is the only AOI that has been identified as a potential primary source of PFAS, i.e., a location where AFFF may been discharged directly to soil and/or groundwater through accidental historical discharges of AFFF. Current opinions are that the remaining AOIs could have been affected secondarily, if at all, by the discharge of potential AFFF-impacted process/wastewater or deposition/stockpiling of potential AFFF-impacted soil or sediment.

MDE-LRP issued written questions and comments on the Revised Workplan on May 7, 2025, requesting PAB's responses be incorporated into the body of the Workplan. This Revised/Final Workplan amends the April 10, 2025 Workplan to address MDE-LRP's questions and comments.

Initial sampling of groundwater and/or wastewater-related media already has been performed in the following PFAS AOIs, as described in Langan's *Environmental Assessment of PFAS Report*:

- AOI-1: Aqueous Film Forming Foam (AFFF) – Fire Suppression System
- AOI-4: Wastewater Treatment Facility Impoundments
- AOI-5: PFAS in Groundwater at the ZCR Facility
- AOI-6: Outfall 001 to Peggy Branch
- AOI-8: Former Spray Irrigation Field
- AOI-9: Former Spray Irrigation Forest

Tables 1 through 5 provide PFAS analytical results for samples that were previously collected at the ZCR Facility from monitoring wells; water supply wells; the facility's wastewater collection, conveyance, and treatment systems; treated wastewater effluent; and limited portions of fire suppression system piping (wipe samples). A sample location map and wipe sample location maps are provided as Figure 4 and Appendix A, respectively, and laboratory analytical reports are provided in Appendix B. Appendix C includes the documentation located at this juncture related to the acquisition and use of AFFF-containing materials at the ZCR facility. These historical data and details will be integrated with data obtained pursuant to this Workplan, and presented in a forthcoming PFAS Site Investigation Report (SIR). The SIR will include a conceptual site model (CSM) that will synthesize what is known or can be reasonably inferred, based on available data, regarding PFAS sources at the ZCR Facility, PFAS migration pathways, and potential receptors.

This Workplan includes proposed initial and/or additional soil, groundwater, process water, surface water, and/or sediment sampling in the following seven PFAS AOIs:

- AOI-1: Aqueous Film Forming Foam (AFFF) – Fire Suppression System
- AOI-2: Stockpiled Soil – Northwest
- AOI-3: Stockpiled Soil – East Central
- AOI-5: PFAS in Groundwater at the ZCR Facility
- AOI-6: Outfall 001 to Peggy Branch
- AOI-7: Dredge Spoils Deposits

- AOI-8: Former Spray Irrigation Field

This Workplan also includes the collection of water level data to assess the occurrence and movement of groundwater (AOI-5: PFAS in Groundwater at the ZCR Facility) on a site-wide basis, and to assess the potential interaction between groundwater and surface water at the Site.

The seven AOIs noted above are being prioritized for investigation either because: a) they have not been sampled for PFAS previously, and/or b) they overlap with areas where PFAS data are being sought to inform soil/materials management decisions to be made by PAB and MDE related to earth disturbing environmental and capital improvement projects at the Site.

Provided below is a summary of the specific scope and objectives of the activities described in this Workplan:

- Advance up to 66 soil borings and collect/analyze up to 447 soil samples to assess the distribution of PFAS (if and where present) in soil.
    - Additional soil samples will be collected from soil borings SB-1-1, SB-1-2, SB-1-3 and SB-1-4 in AOI-1 based on soil boring depth. Borings will be advanced to tool refusal or 80 feet below ground surface (bgs), whichever is encountered first.
- Analyze a subset of the soil samples using the synthetic precipitation leaching procedure (SPLP), to assess the potential for leaching of PFAS from soil to groundwater.
- Collect groundwater grab samples from four soil boring locations in AOI-1 to assess the vertical distribution of PFAS in groundwater (if and where present) at locations where permanent monitoring wells will be installed.
- Install and sample seven permanent water table monitoring wells to assess the concentrations of PFAS (if and where present) in shallow groundwater within (or adjacent to) the following three AOIs where groundwater has not previously been sampled: AOI-1, AOI-6 Outfall 001 to Peggy Branch, and AOI-7 Dredge Spoils Deposits. An additional monitoring well will also be installed in the northwestern portion of AOI-8 Former Spray Irrigation Field. This well will supplement existing monitoring wells MW-3, MW-4, MW-5, and MW-6 providing groundwater data coverage in the expected downgradient (northwestern) corner of AOI-8.
- Collect one process water sample from the comingled manhole in AOI-1 for PFAS.

- Collect one surface water sample to assess the concentrations of PFAS (if present) in standing water within the former borrow pit where dredge spoils removed from Peggy Branch were previously placed (AOI-7 Dredge Spoils Deposits).
- Collect three surface water and sediment samples along Peggy Branch to assess concentrations of PFAS (if present) in the surface water and sediment of Peggy Branch.
- Install four water level gauging stations for measuring surface water elevations at the proposed surface water sampling locations in the former borrow pit and Peggy Branch.
- Survey the horizontal and vertical positions of points where sampling or water level gauging are to be performed under this Workplan.
- Perform synoptic water level gauging at available gauging points including monitoring wells, water supply wells, and surface water gauging stations, to provide data needed to assess horizontal and vertical groundwater flow and interactions with surface water on a site-wide basis.

Section 2 of this Workplan summarizes the Site setting and geology/hydrogeology. Section 3 provides an overview of screening levels to be used for evaluating PFAS analytical data obtained per this Workplan. Sections 4, 5, 6, and 7 provide the sampling and analysis plan, quality assurance project plan, documentation plan, and schedule, respectively, for the identified scope of sampling. References are provided in Section 8.

2.0 SITE SETTING AND GEOLOGY/HYDROGEOLOGY

Provided below in Sections 2.1 and 2.2 are descriptions of the Site setting and geology/hydrogeology, respectively.

2.1 Site Setting

The ZCR Facility includes approximately 294 acres situated in a predominantly rural area to the east of Salisbury, Maryland at 6906 Zion Church Road. It is bounded to the west by the Salisbury Bypass (US Route 50) with residential properties beyond; to the north by Morris Leonard Road with residential, farm, and wooded/undeveloped properties beyond; to the east by Zion Church Road with residential, farm, mixed-use, and wooded/undeveloped properties beyond; and to the south by the Delmarva Central Railroad with residential and mixed-used properties beyond. The Site currently consists of a soybean processing plant, a feed mill, a boiler house, grain receiving and storage facilities, an edible soybean oil refinery, two hatcheries, a truck fleet garage, and related support facilities and operations. A Site plan depicting the Site boundaries and features is included as Figure 2. The 2019 United States Geological Survey (USGS) 7.5-minute quadrangle topographic map for Salisbury depicts the Site at elevations varying from approximately 40 to 60 feet above mean sea level (amsl). The regional topography is relatively flat, with ground surface elevation varying from approximately 15 to 60 feet amsl, and topography sloping downward to the west toward the Wicomico River, which is located approximately 3 miles west of the Site at its nearest point.

2.2 Geology and Hydrogeology

Wicomico County lies within the Atlantic Coastal Plain physiographic province, which is characterized by stratified sand, silt, and clay deposits thickening from a few feet to several thousand feet from west to east (USGS, 1997). The shallower sediments near the Site consist of unconsolidated marine, estuarian, and fluvial deposits. According to the U.S. Department of Agriculture’s (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) data for Wicomico County, soils at the Site consist primarily of high to moderately well-drained sands and loams with high infiltration rates.

The Site is located within the Upper Wicomico River drainage basin covering an area of about 70 square miles. Shallow groundwater flow is typically topographically influenced, as shallow groundwater tends to originate in areas of topographic highs and flow toward areas of topographic lows, such as rivers, stream valleys, ponds, and wetlands. Shallow groundwater flow at ZCR Facility was generally to the northwest towards Middle Neck Branch (Earth Data 2017) during the 2014-2016 time period.

Based on well logs and other information provided by PAB, and site reconnaissance observations, there are 12 monitoring wells and 13 water supply wells on the Site. Installation logs indicate that groundwater was encountered approximately 5 to 15 feet below ground surface (bgs).

The following summary of regional geology and hydrogeology was developed largely from regional water resource evaluations by the USGS (1997 and 2001). The regional geological framework near the City of Salisbury consists of the unconfined Salisbury Aquifer (combined Beaverdam Sand and Pensauken Formation; also known as the Columbia Aquifer) and the confined Manokin Formation (Aquifer) located below it. Both the Columbia and the Manokin Aquifers are underlain and separated by confining units.

Locally, the Columbia Aquifer directly underlies the Site. Based on well logs from newly installed water supply wells 100, 200, and 300 in the Manokin Aquifer (260 feet total depth each) at the ZCR Facility, the Columbia Aquifer consists primarily of coarse sand and gravel and extends to a depth below grade of about 115 feet. Below the Columbia Aquifer is a clay confining bed (lower confining bed) that is about 25 feet thick. Beneath the lower confining bed is the Manokin Aquifer, which is comprised of clayey/silty medium- to coarse-grained sand that extends to a depth of approximately 290 feet below grade (USGS, 1997). Beneath the Manokin Aquifer is the St. Marys Formation, consisting of clayey silt, silty clay, and very fine sand. The St. Marys Formation is considered the base of the local hydrogeological system for the purpose of this Workplan.

Based on a review of depth to groundwater measurements provided in two previous groundwater studies for the ZCR Facility (Earth Data 2017, Earth Data 2021), the depth to groundwater at the Site has varied (spatially and temporally) from about 6.6 to 15.6 feet bgs, with groundwater elevations fluctuating up to 2.5 feet seasonally and up to 5.6 feet over a span of years. During the most recent groundwater monitoring event in December 2024, involving six multi-level monitoring wells along the western boundary of the Site, depth to groundwater varied from 13.85 to 18.09 feet below top of casing (TOC) (10.73 to 16.49 feet bgs). It is noted that as of January 2025, approximately 75% or more of the state of Maryland was under drought conditions and in 2024 Wicomico County, MD recorded the 15th driest year to date over the past 130 years. As of May 2025, Wicomico County, MD is no longer under drought conditions.

3.0 SCREENING LEVELS

Samples collected under this Workplan will be analyzed for the method-specific list of 40 PFAS using USEPA Method 1633 and at some locations (AOI-1) Total Oxidizable Precursor (TOP)

Assay.[2,3] PFAS analytical data obtained will be evaluated by comparing concentrations to a variety of screening levels including Regional Screening Levels (RSLs) published by the United States Environmental Protection Agency (USEPA), Maximum Contaminant Levels (MCLs) established by the USEPA for public drinking water, site-specific values that may be developed using SPLP data, and concentrations or concentration ranges that are characteristic of global and regional background PFAS impacts. Tables 6A (soil) and 6B (groundwater) summarize USEPA values to be used as screening levels, along with method and laboratory method detection limits (MDLs), limits of quantitation (LOQs), and reporting limits (RLs) for the targeted PFAS analytes. Because federal and Maryland state screening levels for PFAS in sediment have not been established, sediment sample analytical results may be compared to any of screening levels previously mentioned (as a proxy) or others to be determined. The sediment sample results will be used to better understand concentrations of PFAS in Peggy Branch, informing the general CSM for the site. These levels are not proposed as clean-up or remediation standards, but will be used as preliminary reference values to screen and evaluate the data obtained under this Workplan The following sections provide additional details on screening levels and methods that will be used.

3.1 MDE Guidance and USEPA Regional Screening Levels (RSLs)

MDE has published guidance on clean-up standards in a document titled *State of Maryland Department of the Environment Cleanup Standards for Soil and Groundwater, October 2018, Interim Final Guidance (Update No. 3)* (hereafter "MDE Standards Guidance"). The standards published in this guidance are based on USEPA's Regional Screening Levels (RSLs). MDE's Standards Guidance does not include standards or screening levels for PFAS compounds; however, USEPA has published RSLs for several PFAS compounds[4]. As such, USEPA's most recent PFAS RSLs (November 2024) will be used to screen soil and groundwater analytical data obtained under this Workplan. The following USEPA RSLs will be used as screening levels under this Workplan, consistent with MDE's Standards Guidance:

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[2] This analytical method and analyte list is consistent with sampling previously performed by MDE at the ZCR Facility and is also consistent with monthly sampling of wastewater that is being performed by Perdue at MDE's request.

[3] Method 1633 (January 2024) will be used until such time as the laboratory adopts minor method revisions that were published in December 2024 as Method 1633A, at which time the revised method may be used.

[4] USEPA first published RSLs for one PFAS compound (perfluorobutane sulfonate and its potassium salt) in November 2014, and first published RSLs for other PFAS, including PFOA and PFOS, in May 2022. USEPA has updated its RSLs for PFAS since the initial publications.

- Industrial Soil RSLs corresponding to a cancer risk level of 1E-6 or a hazard quotient (HQ) of 0.1, whichever is lower.
- Resident Soil RSLs corresponding to a cancer risk level of 1E-6 or a HQ of 0.1, whichever is lower.
- Protection of Groundwater RSLs with a dilution attenuation factor (DAF) of 20.
- RSLs for Resident Tap Water, for PFAS compounds that do not have USEPA MCLs (see Section 3.2 below).

Additionally, consistent with MDE's Standards Guidance, analytical reporting limits (RLs) and/or limits of quantitation (LOQ) may be used as the screening levels where they are higher than the published health-based RSLs. As indicated on Table 6a some of USEPA's soil RSLs are lower than LOQs and/or RLs for the following PFAS compounds: perfluorooctanoic acid (PFOA), perfluorodecanoic acid (PFDA), perfluorohexanesulfonic acid (PFHxS), perfluorooctanesulfonic acid (PFOS), and hexafluoropropylene oxide dimer acid (HPFO-DA, aka "Gen-X"). As indicated on Table 6b, the Tap Water RSL for PFDA is also lower than the LOQ and RL.

3.2 USEPA MCLs for Public Drinking Water

USEPA's MCLs for PFAS in public drinking water, promulgated in April 2024,[5] will be used as groundwater screening levels for PFAS for which MCLs have been published, as follows:

Compound	**MCL**
PFOA	4.0 nanograms per liter (ng/L)
PFOS	4.0 ng/L
PFHxS	10 ng/L
PFNA	10 ng/L
HPFO-DA	10 ng/L
Mixtures containing two or more of PFHxS, PFNA, HPFO-DA, and PFBS	1 (unitless) Hazard Index[6]

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[5] USEPA has indicated an intention to amend or rescind certain MCLs in the future. Because of the likely timing of this action, however, it will not affect the proposed Workplan. Moreover, as noted, the MCLs are proposed as a reference to evaluate the data, not as a remediation standard.

[6] Hazard Index calculated using the method described in USEPA's Fact Sheet titled *Understanding the Final National Primary Drinking Water Regulation Hazard Index Maximum Contaminant Level*.

USEPA's MCLs apply to public drinking water supplies that are regulated under the federal Safe Drinking Water Act (SDWA).[7] They are not applicable or enforceable with respect to private drinking water supplies or to groundwater (in general). Nevertheless, as a conservative measure and in consideration of known potable usage of groundwater, USEPA's PFAS MCLs will be used as groundwater screening levels for data obtained under this Workplan.

3.3 Site-Specific Evaluation of the Soil-to-Groundwater Migration Pathway

Various methods may be used to evaluate PFAS leachability on a site-specific basis and to further develop site- and compound-specific soil concentration values that are protective of the migration to groundwater pathway. One of these methods involves application of the Synthetic Precipitation Leaching Procedure (SPLP). The SPLP is a sample preparation method (USEPA Method 1312) that is intended to simulate leaching of constituents from soil by infiltrating precipitation.

The scope of this Workplan includes the collection of two sample aliquots from each soil sampling interval, one for analysis of bulk PFAS concentrations using USEPA Method 1633, and the other to be held for PFAS leachability testing using the SPLP. It is anticipated that 15% to 20% of the soil samples analyzed for bulk PFAS concentrations will be subsequently chosen for further analysis using the SPLP. Samples will be selected for SPLP analysis following receipt and review of the bulk PFAS analytical results, with the objective of evaluating PFAS leachability representing a variety of locations, depths, and soil conditions, and a range of bulk PFAS concentrations (including the highest detected for each compound).

It is anticipated that paired bulk and SPLP PFAS concentration data will be evaluated using methods prescribed by other states, such as the New Jersey Department of Environmental Protection (NJDEP) in their guidance titled *Alternative Remediation Standards Technical Guidance for Soil and Soil Leachate for the Migration to Groundwater Exposure Pathway, May 2021, Version 1.0*. This guidance provides several methods for developing site-specific

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[7] It is noted that as of May 14, 2025 EPA has given notice of it's intent to revoke the MCLs for PFHxS, PFNA, HPFO-DA, and the Hazard Index. The effect of this change on screening levels will be considered if the proposed change takes effect.

migration to groundwater soil standards using paired bulk and SPLP PFAS soil data, including comparison of results to leachate screening levels, development and use of site-specific soil-water partition coefficients (K_d), and linear regression analysis.

3.4 Background Levels

The extended period of time during which PFAS have been produced and the many sources of PFAS released to the environment have resulted in low-level concentrations in most environmental media worldwide (ITRC 2023). For example, a global survey of anthropogenic background PFAS concentrations in soil found PFOS ranging from 0.003 to 162 micrograms per kilogram (ug/kg) and PFOA from 0.01 to 124 ug/kg (ITRC 2023; Brusseau et al. 2020). It should be noted that USEPA's soil RSLs for PFOS and PFOA are within (and in some cases below) the range of global background concentrations reported in these studies. A similar global survey of PFAS concentrations in groundwater from locations with no known sources identified arithmetic mean concentrations of 13 ng/L for PFOA and 46 ng/L for PFOS (Johnson et. al. 2022). These mean background concentrations are higher than USEPA's MCLs. There are a variety of common sources of PFAS to the environment, including non-point sources such as septic system effluent and the beneficial re-use/application of biosolids as agricultural soil amendments (MDE 2023). Non-point sources such as these may be particularly relevant in rural areas.

Representative background PFAS levels will be considered in the screening and evaluation of PFAS analytical data obtained under this Workplan. Data to be considered may include those from the studies referenced above and other published studies, along with data generated by MDE as part of their multi-year (2020 – 2022) study of PFAS in public water systems (PWS).

4.0 SAMPLING AND ANALYSIS PLAN

The following tasks will be performed as outlined in Section 1.0:

- Advance soil borings and collect/analyze samples to assess the distribution of PFAS (if and where present) in the AOIs being investigated.
- Analyze a subset of the soil samples using the SPLP to assess the potential for leaching of PFAS from soil to groundwater.

- Collect groundwater grab samples to assess the vertical distribution of PFAS in groundwater (if and where present) at locations where permanent monitoring wells will be installed in one AOI.
- Install and sample permanent water table monitoring wells to assess the concentrations of PFAS (if and where present) in shallow groundwater within four AOIs.
- Collect one process water sample from the co-mingled manhole to assess the concentrations of PFAS in process water.
- Collect one surface water sample to assess the concentrations of PFAS (if present) in standing water within the former borrow pit where dredge spoils from Peggy Branch were previously placed (AOI-7 Dredge Spoils Deposits).
- Collect three surface water and sediment samples along Peggy Branch to assess concentrations of PFAS (if present) in the surface water and sediment of Peggy Branch. Install water level gauging stations for measuring surface water elevations at the proposed surface water sampling locations in the former borrow pit and Peggy Branch.
- Survey the horizontal and vertical positions of points where sampling or water level gauging are to be performed.
- Perform synoptic water level gauging at available gauging points on a Site-wide basis including monitoring wells, water supply wells, and surface water gauging stations.

Figures 6A, 6B, 6C, 6D, and 6E indicate the locations of the soil borings, monitoring wells, surface water samples, process water sample, and gauging stations that are specified in this Workplan. Tables 7, 8, and 9 provide details regarding the soil, groundwater/surface water, and sediment samples, respectively, that are to be collected and analyzed under this Workplan. Sample collection and analysis will be performed in a manner consistent with this Workplan and the attached Quality Assurance Project Plan (QAPP) (Appendix F). Field sampling activities will be performed in a manner consistent with the attached Health and Safety Plan (HASP) (Appendix G) and SOPs (Appendix D).

The following sections provide additional details regarding the key elements of the Workplan and the scope of sampling and analysis to be performed.

4.1 Decontamination

Drilling and sampling equipment will be decontaminated before the initiation of field sampling activities and between sampling locations in a manner consistent with the SOPs outlined in Appendix D. Water to be used for initial decontamination washing and rinsing will be obtained from a source that is not expected to have detectable concentration of PFAS. This may include water that has been treated using one of PAB's on-site process water treatment systems. Prior to the initiation of field sampling activities, each source of decontamination water will be sampled and analyzed for the method-specific list of 40 PFAS using USEPA Method 1633. Final rinses of sampling devices will be performed using PFAS-free water provided by the analytical laboratory.

4.2 Soil Sample Collection and Analysis

This Workplan includes the advancement of up to 66 soil borings and collection of soil samples from up to 447 discrete sampling intervals. The soil boring locations are depicted on Figures 6A, 6B, 6C, 6D, and 6E. Table 7 summarizes the sampling/analytical plan for each soil boring including boring/sampling method(s), boring depths, and sampling depths/intervals. The planned soil borings will vary in depth from approximately 2 to 20 feet bgs, except in AOI-1, where a subset of soil borings will be advanced to a maximum depth of 80 feet bgs.

Soil boring/sampling will be performed in a manner consistent with the SOPs outlined in Appendix D. Soil borings will be advanced with hand augers and/or a direct push drill rig depending on the targeted sampling depths.

Prior to soil boring advancement, each boring location will be assessed for potential underground utility conflicts. This will include an evaluation of available utility as-built drawings, notification of the local one-call service (Miss Utility 811), and performance of a private subsurface utility survey using geophysical methods. Soil boring locations may be adjusted, based on the utility survey, so that they are more than 3 feet away from identified subsurface utilities.

The first five feet of each soil boring will be advanced using non-mechanized hand augers, as a "soft dig" method. The hand augers will be equipped with bucket augers that are at least 6 inches long and 3 inches diameter. Field sampling personnel will use two hand augers, alternating augers between half-foot intervals to minimize the potential for vertical borehole cross contamination. Hand augers will be decontaminated between each interval using methods described in the applicable SOP (Appendix D). Hand augers will be advanced to the depths specified in the Workplan or to a maximum of 5 feet bgs, whichever is less.

Soil borings deeper than 5 feet bgs will be advanced using a direct-push drill rig from the bottom of the hand auger borehole (i.e., 5 feet bgs) to the terminal borehole depth, as outlined in Table 7. Direct-push boring/sampling will be performed using dual-tube Macrocore® samplers equipped with acetate liners. Macrocore® samplers will be decontaminated between boring locations using method described in the applicable SOP (Appendix D).

Soil conditions will be logged continuously from the ground surface to the terminal depth of each boring. Soil conditions to be observed/recorded will include texture, color, and moisture content. Changes in stratigraphy will be noted, and soil will be classified in accordance with the Unified Soil Classification System (USCS) (Appendix E). A soil boring log will be prepared for each boring noting the date, drilling/sampling method(s), soil descriptions/classifications, depth of first water, field instrument readings, depths of samples collected for laboratory analysis, and other details.

A soil sample will be collected for laboratory analysis approximately every two feet within borings less than 20 feet bgs. For borings greater than 20 feet bgs, soil samples will be collected approximately every 10 feet from 20 feet bgs to the terminal depth of the boring. Samples will generally be collected from 0.0 to 0.5 feet bgs (or first six inches of sampleable soil), 1.5 to 2 feet bgs, and every two feet thereafter (e.g., 3.5 – 4.0 feet bgs, 5.5 – 6.0 feet bgs, etc.). Each soil sample will represent an approximate 6-inch vertical interval. Soil sampled from the targeted interval will be homogenized in the field before being placed in laboratory bottleware, as further described in the applicable SOP (Appendix D). Two sample aliquots will be collected from each specified sampling depth/interval. One aliquot will be analyzed for the method-specific list of 40 PFAS using USEPA Method 1633. The other aliquot will be held by the laboratory for potential SPLP extraction and analysis. Laboratory analysis will be performed by Pace (formerly Alpha) Analytical in Mansfield, Massachusetts.

During the collection of soil samples, one blind duplicate sample will be collected and analyzed for every 20 field samples or fraction thereof. Additionally, equipment blank (EB) samples will be collected and analyzed at a frequency of at least one per 20 field samples per type of sampling device[8], with a minimum of one per day per type of sampling device. One EB sample will be collected for each type of sampling device at the start of the field program, prior to the initiation of soil sampling at the Site. EB samples will be collected by pouring laboratory-provided PFAS-free water over/through the decontaminated sampling device and collecting the rinsate in laboratory-provided sample bottles. Duplicate and EB samples will be analyzed for the method-specific list of 40 PFAS using USEPA Method 1633.

Provided below is a more detailed summary of the soil sampling plan, including sampling objectives and rationale, organized by AOI.

AOI-1: Aqueous Film Forming Foam (AFFF) – Fire Suppression System

Thirty-two (32) soil borings will be advanced in this AOI. Sampling will occur during a planned Extraction Plant shutdown anticipated to occur in August 2025, as activities involving potential sparking or electrical discharges are not permitted within the exclusion zone surrounding the Hexane Tank Enclosure and Extraction Plant Containment Sump when the plant is operating. Soil borings will be advanced as follows (Figure 5A):

- SB-1-1. This boring will be advanced to a depth of approximately 7 feet below first observed groundwater (with an estimated total boring depth of 18 feet bgs). Upon completion, boring SB-1-1 will be converted to a monitoring well (MW-1-1). SB-1-1/MW-1-1 will be located near the “co-mingled manhole.” MDE’s previous sampling of process water from the co-mingled manhole on December 28, 2023, indicated detections of PFOS (998 ng/L), PFOA (24.9 ng/L), and various other PFAS. Data from SB-1-1 and MW-1-1 will be used to evaluate the concentrations of PFAS (if present) in soil and groundwater adjacent to the manhole, and the relationship (if any) between the water inside the manhole and the surrounding soil and groundwater.
- SB-1-2 through SB-1-4. These borings will be advanced to the depth of tool refusal or to 80 feet bgs, whichever is encountered first. Upon completion, these borings will be converted to monitoring wells (MW-1-2, MW-1-3 and MW-1-4). Data from

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[8] Hand auger samplers and direct-push Macrocore® samplers are considered to be different types of sampling devices.

SB-1-2 through SB-1-4 and MW-1-2 through MW-1-4 will be used to evaluate the concentrations of PFAS (if present) in soil and groundwater in AOI-1, and to further determine shallow groundwater flow direction in AOI-1 and at the ZCR Facility.

- SB-1-5 through SB-1-8. These borings will be advanced to a depth of approximately 7 feet below first observed groundwater (with an estimated total boring depth of 18 feet bgs). SB-1-5 through SB-1-8 are located around the Foam and Fire Pump House (Fire Station #3). The Foam and Fire Pump House (Fire Station #3) is approximately 50 feet to the north of the Hexane Tank Enclosure and Extraction Plant Containment Sump.
- SB-1-9. This boring will be advanced to a depth of approximately 5 feet bgs. SB-1-9 will be located inside the Foam and Fire Pump House (Fire Station #3) where the ground surface is finished with gravel that may have allowed for subsurface infiltration of historical accidental discharges of AFFF inside the Foam and Fire Pump House (if any).
- SB-1-10 through SB-1-13. These borings will be advanced to a depth of approximately 7 feet below first observed groundwater (with an estimated total boring depth of 18 feet bgs). SB-1-10 through SB-1-13 are located in the equipment laydown area north of the Foam and Fire Pump House (Fire Station #3).
- SB-1-14 through SB-1-22. These borings (except for SB-1-17) will be advanced to a depth of approximately 7 feet below first observed groundwater (with an estimated total boring depth of 18 feet bgs). SB-1-17 will be advanced to a depth of 5 feet bgs. SB-1-14 through SB-1-22 are located in the area of the Hexane Tank Enclosure and Extraction Plant Containment Sump, where historical accidental discharges of AFFF could have potentially fallen on the ground.
- SB-1-23 through SB-1-26. These borings will be advanced to a depth of approximately 7 feet below first observed groundwater (with an estimated total boring depth of 18 feet bgs). SB-1-23 through SB-1-26 are located at the extraction plant containment sump.
- SB-1-27 through SB-1-32. These borings will be advanced to a depth of approximately 7 feet below first observed groundwater (with an estimated total boring depth of 18 feet bgs). SB-1-27 through SB-1-32 are located in the exclusion zone around the soybean Extraction Plant building.

AOI-2: Stockpiled Soil – Northwest

Nine soil borings will be advanced in this AOI, as follows (Figure 5B):

- SB-2-1 through SB-2-6. These borings will be advanced through the soil stockpile to a depth corresponding with the surrounding grade. Accordingly, borings on the southern slope of the pile are expected to be 2 to 5 feet deep, and borings at the top of the pile are expected to be approximately 10 to 15 feet deep. SB-2-6 will be advanced through the middle of a separate smaller soil pile located adjacent to the south of the main pile. These soil borings will be used to assess and characterize the stockpiled soil.
- SB-2-7 through SB-2-9. These borings will be advanced along the southern edge of the soil stockpile in the adjacent former crop field, within the identified limit of disturbance (LOD) associated with PAB's planned rail expansion project. These borings will be advanced to depths of 2 feet bgs. They will be used to assess native near-surface soil adjacent to the soil stockpile.

AOI-3 Stockpiled Soil – East Central

One soil boring will be advanced in this AOI, as follows (Figure 5C):

- SB-3-1. This boring will be advanced through the soil stockpile to a depth corresponding with the surrounding grade, expected to be approximately 5 feet deep. This soil boring will be used to assess and characterize the stockpiled soil.

AOI-6 Outfall 001 to Peggy Branch

One soil boring will be advanced in this AOI, as follows (Figure 5D):

- SB-6-1. This boring will be advanced to a depth of approximately 7 feet below first observed groundwater (with an estimated total boring depth of 18 feet bgs). Upon completion, boring SB-6-1 will be converted to a monitoring well (MW-6-1). SB-6-1/MW-6-1 will be located west of Peggy Branch, between the PAB's grain storage area and refinery facilities, near a surface water gauging station (GS-6-1) that will be established on a footbridge crossing Peggy Branch. Soil data from SB-6-1 will be used to assess and characterize PFAS concentrations in an area of the Site where soil is not expected be affected by releases of AFFF.

AOI-7 Dredge Spoils Deposits

Four soil borings will be advanced in this AOI, as follows (Figure 5B):

- SB-7-1. This boring will be advanced to a depth of approximately 7 feet below first observed groundwater (with an estimated total boring depth of 20 feet bgs). Upon completion, boring SB-7-1 will be converted to a monitoring well (MW-7-1). SB-7-1/MW-7-1 will be located approximately 65 feet to the west of the former borrow pit. Data from SB-7-1 and MW-7-1 will be used to evaluate the concentrations of PFAS (if present) in soil and groundwater downgradient from the borrow pit, and the relationship between standing water in the borrow pit and the surrounding soil and groundwater.
- SB-7-2A through SB-7-2C. These borings will be advanced through the dredge spoils deposits located within the former borrow pit, to depths corresponding to the bottom of the borrow pit, expected to be approximately 4 to 6 feet deep. These soil borings will be used to assess and characterize the deposited dredge spoils.

AOI-8 Former Spray Irrigation Field

Nineteen (19) soil borings will be advanced in this AOI, as follows (Figure 5E):

- SB-8-1 will be advanced to a depth of approximately 12 feet below first observed groundwater (with an estimated total boring depth of 20 feet bgs). Upon completion, boring SB-8-1 will be converted to a monitoring well (MW-8-1).
- SB-8-2, SB-8-5, SB-8-6, SB-8-8 to SB-8-11 and SB-8-14. These borings will be advanced to depths of 2 feet bgs to assess the distribution of PFAS in near surface soil, within the spray area of the former spay irrigator.
- SB-8-3, SB-8-7, SB-8-12. These borings will be advanced to depths of 20 feet bgs to assess the distribution of PFAS in near surface soil, within the spray area of the former spay irrigator, and also to assess the vertical distribution of PFAS in soil from

the ground surface down to (and beneath) the anticipated depth of the water table (~6-13 feet bgs). SB-8-3 will be advanced adjacent to existing monitoring well MW-3, to evaluate the relationship between soil and groundwater concentrations in this area.

- SB-8-4, SB-8-15, and SB-8-18. These borings will be advanced to depths of 20 feet bgs to assess the distribution of PFAS in near surface soil, proximal to the southeastern portion of the former Spray Irrigation Field, within the footprint of PAB's planned wastewater treatment plant expansion. They will also be used to assess the vertical distribution of PFAS in soil from the ground surface down to (and beneath) the anticipated depth of the water table (~6-13 feet bgs). SB-8-4 will be advanced adjacent to existing monitoring well MW-4, to evaluate the relationship between soil and groundwater concentrations in this area.
- SB-8-13, SB-8-16, SB-8-17, and SB-8-19. These borings will be advanced to depths of 2 feet bgs to assess the distribution of PFAS in near surface soil, proximal to the southeastern portion of the former Spray Irrigation Field, within the footprint of PAB's planned wastewater treatment plant expansion.

4.3 Groundwater Grab Sample Collection and Analysis

Groundwater grab samples will be collected from four soil boring locations in AOI-1 – Aqueous Film Forming Foam (AFFF) – Fire Suppression System where soil borings and permanent monitoring wells will be installed (SB-1-1/MW-1-1, SB-1-2/MW-1-2, SB-1-3/MW-1-3 and SB-1-4/MW-1-4) (Figure 5A). Samples will be collected approximately every 10 feet from the water table to tool refusal or a maximum depth of 80 feet bgs, whichever is encountered first. The purpose of this sampling will be to characterize the vertical distribution of PFAS in groundwater, if and where present. Specific method(s) of sample collection will be determined and communicated to MDE prior to mobilization, along with a Standard Operating Procedure (SOP). This sampling will take place in August 2025 during the planned shut-down of the Extraction Plant.

4.4 Monitoring Well Installation and Development

Seven permanent water table monitoring wells will be installed to further assess the concentrations of PFAS (if and where present) in shallow groundwater within (or adjacent to) the following AOIs: AOI-1 AFFF – Fire Suppression System, AOI-6 Outfall 001 to Peggy Branch, AOI-7 Dredge Spoils Deposits, and AOI-8 Former Spray Irrigation Field. Monitoring wells have not previously been installed in AOI-1, AOI-6, and AOI-7. An additional monitoring well will be installed in the northwestern portion of AOI-8 Former Spray Irrigation Field. This well will supplement existing monitoring wells MW-3, MW-4, MW-5, and MW-6 providing groundwater data coverage in the expected downgradient (northwestern) corner of AOI-8. Monitoring wells will be installed in a manner consistent with the SOPs outlined in Appendix D.

Prior to borehole advancement, each well location will be assessed for potential underground utility conflicts. This will include an evaluation of available utility as-built drawings, notification of the local one-call service (Miss Utility 811), and performance of a private subsurface utility survey using geophysical methods. Well locations may be adjusted, based on the utility survey, so that they are more than 3 feet away from identified subsurface utilities.

The first five feet of each well bore will be advanced using “soft dig” techniques that may include hand-augering, air-knifing, and/or vacuum excavation. The monitoring wells will be advanced by an MDE-licensed well driller using 8-¼-inch outside diameter (OD) hollow stem augers. They will be constructed with 2-inch diameter schedule 40 PVC screens and risers with an annular space of approximately 3 inches between the screen/riser and borehole wall. Each well will be constructed with a 10-foot length of 0.01-inch slotted PVC well screen, and the annular space opposite the screen will be filled with an appropriately sized filter sand during auger removal. The top of the well screen will be positioned approximately 3 feet above the approximate water table elevation, which is to be determined from nearby wells and observations made during soil boring advancement and drilling. The filter sand will be emplaced from the bottom of the borehole to approximately 2 – 3 feet above the top of the well screen. Bentonite grout with no polymer additives will be used to seal the remaining annular space from the top of the filter sand to the ground surface. The monitoring wells will be completed with “stick-up” risers that extend 2 – 3 feet above the ground surface. Each well will be completed at the surface with a protective outer steel casing set around the riser in a concrete pad. Well risers (inner casings) will be equipped with lockable compression-type well-plugs (j-plugs), and outer protective casings will be equipped with lockable steel lids. Steel and concrete bollards will be installed around wells located in high traffic areas to protect them from damage. Additionally, a stainless steel well identification tag will be affixed to each well, and will be labeled with the well permit number, common name (e.g., MW-1-1), completion date, and other construction specifications.

After installation, each well will be developed by the driller using a submersible pump to remove fine sediment and establish water flow into the well. Development will be performed using surge and pump techniques, by moving the pump up and down in the water column during development. Wells will be developed until a clear discharge is achieved, with a minimum of five well volumes of water to be removed.

4.5 Gauging Station Installation

Four water level gauging stations will be established for measuring surface water elevations; one in the former borrow pit (GS-7-1) and three along Peggy Branch (GS-6-1, GS-6-2, and GS-6-3).

Gauging stations will be established in accordance with the SOPs outlined in Appendix D. The gauging stations will be established at the approximate locations identified on Figure 5D. Gauges will be established in locations with low turbulence and away from stream bends and other features that could hamper accurate water level measurements. A survey reference point will be identified and clearly marked with PFAS-free spray paint, stake or another identifying marker. An initial reading of depth to water from the survey reference point will be logged after installation. The survey reference point will be surveyed by a licensed surveyor as indicated in Section 4.6 below.

4.6 Location/Elevation Survey

The horizontal and vertical positions of sampling locations and gauging stations will be surveyed by a licensed surveyor. Horizontal positions will be surveyed with respect to the North American Datum of 1983, and vertical elevations will be surveyed with respect to the North American Datum of 1988. Horizontal positions will be given in longitude and latitude (decimal degrees), and vertical elevations will be given in feet above mean sea level (feet amsl). For soil borings, the survey will include ground surface elevation. For monitoring and water supply wells, the survey will include ground surface and the top of the inner well casing (at a point marked or to be marked on the well casing). For surface water gauging stations, the survey will include the elevation of a reference point to be identified and clearly marked.

4.7 Site-Wide Synoptic Water Level Gauging

Following the installation of monitoring wells (Section 4.4) and surface water gauging stations (Section 4.5), a round of synoptic water level gauging will be performed on a Site-wide basis, including all known and accessible monitoring wells, water supply wells, and surface water gauging stations. Depth to water will be measured to the nearest 0.01 foot from the surveyed reference points using an electronic water level sounder. Additionally, Langan will measure the bottom depths of monitoring and water supply wells for which construction logs are not available. Bottom depths will be measured from the surveyed reference points. The data from this gauging event will be used to further assess the occurrence and movement of groundwater on a site-wide basis, and to assess the relationships between groundwater and surface water. This assessment will include the preparation of potentiometric surface maps and the computation of horizontal and vertical hydraulic gradients.

4.8 Surface Water Sample Collection and Analysis

One surface water sample (WS-7-1) will be collected to assess the concentrations of PFAS (if present) in standing water within the former borrow pit where dredge spoils from Peggy Branch were previously placed (AOI-7 Dredge Spoils Deposits). Three surface water samples (WS-6-1 to WS-6-3) will be collected from the stream gauge locations (GS-6-1 to GS-6-3) along Peggy Branch. These samples will be collected to assess the concentrations of PFAS (if present) in the waters of Peggy Branch.

Surface water sample collection will be performed in a manner consistent with the SOPs outlined in Appendix D. Sample WS-7-1 will be collected by directly dipping the laboratory-provided bottles into the water and allowing the bottles to slowly fill, taking care not to create turbulence or stir-up sediment. Based on field-determined accessibility, samples WS-6-1 to WS-6-3 will be collected using the direct dip method previously described, or by using a telescoping pole sampler or bailer. Samples WS-6-1 to WS-6-3 will be collected beginning at the most downstream location. The samples from Peggy Branch will be collected starting at the most downstream location, and from there sampling will proceed upstream to avoid disturbing or affecting other areas to be sampled. Following sample collection, a calibrated multi-parameter water quality meter will be used to measure field water quality parameters including temperature, pH, specific conductivity, dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity.

The surface water samples will be analyzed for the method-specific list of 40 PFAS using USEPA Method 1633. Laboratory analysis will be performed by Pace (formerly Alpha) Analytical in Mansfield, Massachusetts. One blind duplicate surface water sample will be collected to evaluate the reproducibility of the analytical results.

4.9 Sediment Sample Collection and Analysis

Three sediment samples (SE-6-1 to SE-6-3) will be collected to assess PFAS concentrations (if present) in the stream sediment of Peggy Branch. The samples will be collected from the surface water gauging station locations (GS-6-1 to GS-6-3) along Peggy Branch.

Sediment sample collection will be performed in a manner generally consistent with the SOPs outlined in Appendix D. Sediment sampling devices will be field determined based on sediment surface conditions in the water body, accessibility and safety considerations. The sediment samples will be collected beginning at the most downstream location, moving upstream to avoid disturbing or affecting other areas to be sampled. The sediment samples will be analyzed for the method-specific list of 40 PFAS using USEPA Method 1633. Laboratory analysis will be performed by Pace (formerly Alpha) Analytical in Mansfield, Massachusetts.

During the collection of sediment samples, one blind duplicate sample will be collected and analyzed. Additionally, one EB sample will be collected for each type of sampling device at the start of the field program, prior to the initiation of sediment sampling at the Site. EB samples will be collected by pouring laboratory-provided PFAS-free water over/through the decontaminated sampling device and collecting the rinsate in laboratory-provided sample bottles. Duplicate and EB samples will be analyzed for the method-specific list of 40 PFAS using USEPA Method 1633.

4.10 Groundwater Sample Collection and Analysis

The newly installed monitoring wells (MW-1-1, MW-1-2, MW-1-3, MW-1-4, MW-6-1, MW-

7-1, and MW-8-1) will be sampled for PFAS approximately two weeks after installation to allow time for the wells to equilibrate with the surrounding groundwater. Groundwater sampling will be performed in a manner consistent with the SOPs outlined in Appendix D, using a modified low-flow purging and sampling method. Prior to purging, an initial depth to water measurement will be obtained from each well using an electronic water level sounder. The wells will be purged and sampled using a peristaltic pump. New/dedicated pump tubing will be used for each well. During purging, a multi-parameter water quality meter equipped with a flow-through cell will be used to measure field water quality parameters including temperature, pH, specific conductivity, DO, ORP, and turbidity. Purging will be performed at a flow rate of 250 mL per minute or less and will continue until the purging criteria are met, as indicated in the attached SOP (Appendix D). Reasonable steps should be taken to minimize turbidity, targeting less than 50 nephelometric turbidity units (NTU) and preferably less than 10 NTU. Once purging is complete, samples will be collected directly into the laboratory-provided sample bottles at the same flow rate used for purging. Samples will be labeled and stored on-Site between 2-6°C in a cooler or a secured, dedicated project refrigerator until the laboratory takes possession. Non-dedicated equipment such as water level sounders and water quality meters (and flow-through cells) will be decontaminated between wells per the SOPs in Appendix D.

One equipment blank (EB) sample will be collected by using a peristaltic pump equipped with new/dedicated tubing to transfer laboratory-provided PFAS free water into laboratory-provided sample bottles. One blind duplicate groundwater sample will be collected to evaluate the reproducibility of the analytical results.

The groundwater samples and associated quality control samples (EB and duplicate) will be analyzed for the method-specific list of 40 PFAS using USEPA Method 1633. Laboratory analysis will be performed by Pace (formerly Alpha) Analytical in Mansfield, Massachusetts.

4.11 Data Validation and Interpretation

Data validation will be performed in accordance with the applicable USEPA data quality SOPs for data validation and USEPA’s National Functional Guidelines for Organic and Inorganic Data Review. Tier 1 data validation (the equivalent of MDE’s Tier III validation and USEPA’s Stage 2A validation) will be performed to evaluate data quality. Langan Tier 2 data validation (the equivalent of USEPA's Stage 3 validation) will be performed as needed on select sample analyses based on laboratory case narrative notes and professional judgment.

Langan Tier 1 data validation is based on completeness and compliance checks of sample-related QC results including:

- Holding times;
- Sample preservation;
- Blank results (method, trip, and field blanks);
- Surrogate recovery compounds and extracted internal standards (as applicable);
- PFAS Isotope Dilution Standards;
- LCS and LCSD recoveries and relative percent difference (RPDs);
- MS and MSD recoveries and RPDs;
- Laboratory duplicate RPDs; and
- Field duplicate RPDs

In addition to the items outlined in Langan Tier 1 data validation, Langan Tier 2 data validation additionally includes:

- Lab QC samples (serial dilution and post-digestion spikes, as applicable);
- Instrument calibration; and
- Interference check standards

A Data Usability Assessment (DUA) will be prepared by the data validator and reviewed by the Quality Assurance Manager (QAM) before issuance. The DUA will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain-of-custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.

As described in Section 3, PFAS analytical data obtained under this Workplan will be evaluated by comparing them to a variety of levels and values including Regional Screening Levels (RSLs) published by the United States Environmental Protection Agency (USEPA), Maximum Contaminant Levels (MCLs) established by the USEPA for public drinking water, site-specific values that may be developed using SPLP data, and concentrations or concentration ranges that are characteristic of global and regional background PFAS impacts. These levels are not being proposed as clean-up or remediation standards, rather they will be used as preliminary reference values to screen and evaluate the data obtained.

These data will inform guidelines and procedures for handling, reuse, management, and disposal of materials encountered during future construction activities at the ZCR facility in a manner that is protective of construction worker health and safety and the environment. Data obtained under this Workplan will also form the basis for recommendations, as appropriate, to further characterize the nature and extent of PFAS at the ZCR Facility as may be needed to determine if and where remedial actions may be appropriate, and if so, to support the eventual evaluation remedial action alternatives.

5.0 QUALITY ASSURANCE PROJECT PLAN

A Quality Assurance Project Plan (QAPP) is attached to this Workplan as Appendix F.

6.0 REPORTING

Upon receipt and validation of the laboratory analytical data obtained under this Workplan, Langan will prepare a technical memorandum to summarize the investigation results and findings. The technical memorandum will include the following:

- Laboratory analytical data reports and tabulated laboratory analytical data screened against the values indicated in Section 3,
- Figures depicting the distribution of PFAS in soil, sediment, and surface water based on the data obtained, and
- Groundwater elevation and potentiometric surface maps that will be used to assess and interpret horizontal and vertical groundwater flow at the Site.

If appropriate, the technical memorandum will provide recommendations and a workplan for additional PFAS sampling to: 1) further delineate elevated concentration of PFAS (if and where present), 2) assess/characterize/monitor PFAS concentrations in other areas of the Site, and 3) support the development of a Materials Management Plan to guide future earthwork at the ZCR Facility.[9]

At the conclusion of any additional recommended soil sampling, and upon receipt and validation of the analytical results, Langan will prepare and submit a PFAS Site Investigation Report. This report will provide a detailed account of Langan's on-Site PFAS field sampling activities. It will include a chronology of PFAS assessment activities at the ZCR Facility since MDE's initial sampling in August 2023, and it will include a summary and compilation of relevant on-Site PFAS investigative data obtained for the Site since that time. The Site Investigation Report will also include a conceptual site model (CSM) that synthesizes what is known or can be reasonably inferred, based on available data, regarding PFAS sources at the ZCR Facility, PFAS migration pathways, and potential receptors. The Site Investigation Report and CSM will form the basis of recommendations, as appropriate, to further characterize the nature and extent of PFOA and PFOS at the ZCR Facility to a degree sufficient to: 1) assess the need for remedial actions, and 2) identify and evaluate potential short- and long-term remedial actions, if needed. It is expected that remedial action decisions will be based on identifying and mitigating exposure and migration pathways and on prioritizing areas where PFAS concentrations in soil exceed applicable screening levels by an order of magnitude. It is expected that further characterization of nature and extent of PFOA and PFOS will be performed as an iterative remedial investigation process.

Based on the PFAS Site Investigation results and previous sampling data, Langan will also propose an established monitoring well network and integrated, site-wide groundwater monitoring program that will be spatially diverse and represent key locations and depths.

7.0 IMPLEMENTATION SCHEDULE

Provided below is the anticipated schedule[10] for implementing the activities described in this Workplan. This schedule is also presented in the form of a Gannt chart as Figure 6. Langan expects that field activities will commence within two weeks of MDE's authorization, with the exception of field activities in AOI-1. Field activities in AOI-1 will occur during a planned Extraction

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[9] PAB may elect to perform additional soil sampling to meet objectives 2 and 3, as stated in this paragraph, prior to the conclusion of the activities described herein. If so, a brief workplan letter will be prepared and submitted to MDE prior the initiation of field sampling activities.

[10] The anticipated schedule is contingent on the availability of utility location and drilling contractors and on well permitting timelines.

Plant shutdown anticipated to occur in August 2025, as activities involving potential sparking or electrical discharges are not permitted within the exclusion zone surrounding the Hexane Tank Enclosure and Extraction Plant Containment Sump when the plant is operating.

Phase	Week No.	Planned Activities
Phase 1 – AOI-2, AOI-3, AOI-6, AOI-7, and AOI-8	1	• Subsurface utility location/clearance for borings • Hand auger soil boring/sampling (starting < 5 feet bgs) • Direct-push soil boring/sampling (depth > 5 feet bgs) • Soil sample analysis
	2	• Direct-push soil boring/sampling (depth > 5 feet bgs) • Soil sample analysis • Utility clearance (soft dig) for monitoring wells
	3	• Soil sample analysis • Monitoring well installation/development
	4	• Soil sample analysis • Soil sample data review and validation
	5	• Soil sample data review and validation • Select soil samples for SPLP analysis • Groundwater sampling (three new monitoring wells) • Surface water sampling • Sediment sampling • Surface water gauging station installation and survey locations
	6	• Select soil samples for SPLP analysis • Groundwater sample analysis • Surface water and sediment sample analysis
	7	• SPLP analysis • Groundwater sample analysis • Groundwater sample data validation • Surface water and sediment sample analysis • Surface water and sediment sample data validation
	8	• SPLP analysis • SPLP data validation • Groundwater sample data validation • Surface water and sediment sample data validation
	9	• SPLP validation

Phase	Week No.	Planned Activities
Phase 2 – AOI-1	1	• Subsurface utility location/clearance for borings • Hand auger soil boring/sampling (starting < 5 feet bgs) • Direct-push soil boring/sampling (depth > 5 feet bgs) • Soil sample analysis • Utility clearance (soft dig) for groundwater grab locations • Groundwater grab sampling • Groundwater grab sample analysis
	2	• Direct-push soil boring/sampling (depth > 5 feet bgs) • Soil sample analysis • Groundwater grab sample analysis • Groundwater grab sample data validation
	3	• Soil sample analysis • Groundwater grab sample data validation • Utility clearance (soft dig) for monitoring wells • Monitoring well installation/development
	4	• Soil sample analysis • Soil sample data review and validation • Groundwater sampling (four new monitoring wells) • Groundwater sample analysis
	5	• Soil sample data review and validation • Select soil samples for SPLP analysis • Groundwater sample analysis • Groundwater data validation
	6	• Select soil samples for SPLP analysis • Groundwater data validation
	7 & 8	• SPLP analysis
	9 & 10	• SPLP data validation
Phase 3 – Surface Water / Groundwater Gauging	1	• Surface water/groundwater gauging
Phase 4 - Reporting	1-12	• Technical memo preparation and submission to MDE

8.0 REFERENCES

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Tables

Table 1
Summary of PFAS Analytical Results for PAB Water Supply Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	**Abbreviation**	**CAS Number**	**USEPA Maximum Contaminant Levels (MCLs)**	**USEPA Tap Water Regional Screening Levels (ng/l)**	**Location**	**Well 1 and 2 Well House**					**Well 1 and 2 Well House**					**Well 1**					**Well 2**					**Well 3**					**Well 4**				
					Sample Name	**122-0021-CH02_122823**					**FB122-0021-CH02_122823**					**122-0021-WL06_122823**					**122-0021-WL02_122823**					**122-0021-WL04_122823**					**WI952907_073123**				
					Sample Description	**Sample collected from Well 1 Point of Entry**					**Field blank sample collected from Well 1 Point of Entry**					**Sample collected from Well 1**					**Sample collected from Well 2**					**Sample collected from Well 3**					**Sample collected from Well 4**				
					Sample Date	**12/28/2023**					**12/28/2023**					**12/28/2023**					**12/28/2023**					**12/28/2023**					**07/31/2023**				
					Analysis Method	**Method 533**					**Method 533**					**Method 533**					**Method 533**					**Method 533**					**Method 537.1**				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																			
Perfluoroalkyl sulfonic acids																																			
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	2.23			1	1	ND	U		1	1	1.77			1	1	0.63	J		1	1	ND	U		1	1	9.8		0.68	1.9	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	1.19	J		1.5	1	ND	U		1.5	1	1.42	J		1.5	1	0.443	J		1.5	1	ND	U		1.5	1	NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	6.09			2	1	ND	U		2	1	7.69			2	1	2.16			2	1	ND	U		2	1	***84***		0.42	1.9	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	0.529	J		1.5	1	ND	U		1.5	1	0.754	J		1.5	1	ND	U		1.5	1	ND	U		1.5	1	NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***13.6***			2.5	1	ND	U		2.5	1	***17.2***			2.5	1	***5.08***			2.5	1	*0.725*	J		2.5	1	***360***		*5*	19	10
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																																			
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	1.92			1.5	1	ND	U		1.5	1	1.92			1.5	1	0.956	J		1.5	1	0.652	J		1.5	1	NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	6.5			2	1	ND	U		2	1	6.26			2	1	1.77	J		2	1	0.721	J		2	1	NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	4.68			2.5	1	ND	U		2.5	1	3.92			2.5	1	1.43	J		2.5	1	ND	U		2.5	1	33		0.6	1.9	1
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	2.51			1.5	1	ND	U		1.5	1	2.53			1.5	1	0.728	J		1.5	1	0.497	J		1.5	1	13		0.5	1.9	1
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	***5.11***			1.5	1	ND	U		1.5	1	***4.63***			1.5	1	*1.62*			1.5	1	*1.62*			1.5	1	***19***		0.48	1.9	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U		2.5	1	ND	U		2.5	1	ND	U		2.5	1	ND	U		2.5	1	ND	U		2.5	1	ND	U	0.46	1.9	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U	0.57	1.9	1
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U	0.6	1.9	1
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U	0.6	1.9	1
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U	0.57	1.9	1
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA					NA					ND	U	0.62	1.9	1
Fluorotelomer carboxylic acids																																			
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																			
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																			
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U	0.59	1.9	1
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U	0.49	1.9	1
Perfluorooctane sulfonamides																																			
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Fluorotelomer sulfonic acids																																			
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	1.6			1.5	1	ND	U		1.5	1	1.47	J		1.5	1	0.586	J		1.5	1	ND	U		1.5	1	NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	NA				
Per- and Polyfluoroether carboxylic acids																																			
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	ND	U		2.5	1	ND	U		2.5	1	ND	U		2.5	1	ND	U		2.5	1	ND	U		2.5	1	NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U	0.59	1.9	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	ND	U		1	1	ND	U		1	1	ND	U		1	1	ND	U		1	1	ND	U		1	1	ND	U	0.47	1.9	1
Ether sulfonic acids																																			
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U	0.61	1.9	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U		1.5	1	ND	U	0.61	1.9	1

Table 1
Summary of PFAS Analytical Results for PAB Water Supply Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	Well 4					Well 4					Well 4					Well 5					New Colombia Well 6					New Colombia Well 7				
					Sample Name	POE-AG-9723-1_090723					POE-AG-9723-1-FB_ 090723					122-0021-WL07_122823					122-0021-WL08_122823					WI-22-0177_011823					WI-24-0143_ test_port_101024				
					Sample Description	Sample collected from Well 4					Field blank sample collected from Well 4					Sample collected from Well 4					Sample collected from Well 5					Sample collected from Well 6					Sample collected from Well 7				
					Sample Date	09/07/2023					09/07/2023					12/28/2023					12/28/2023					01/18/2023					10/10/2024				
					Analysis Method	Method 537.1					Method 537.1					Method 533					Method 533					Method 537.1					Method 533				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																			
Perfluoroalkyl sulfonic acids																																			
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	7.7		0.69	2	1	ND	U	0.68	1.9	1	0.415	J		1	1	1.54			1	1	5.5		0.68	1.9	1	ND	U		1.9	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	NA					NA					0.45	J		1.5	1	1.69			1.5	1	NA					ND	U		1.9	1
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	***67***		0.43	2	1	ND	U	0.42	1.9	1	2.29			2	1	5.73			2	1	17		0.42	1.9	1	ND	U		1.9	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	NA					NA					ND	U		1.5	1	ND	U		1.5	1	NA					ND	U		1.9	1
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***290***		*5.2*	20	10	ND	U	0.51	1.9	1	***23***			2.5	1	***14.2***			2.5	1	***15***		0.51	1.9	1	*3.1*			1.9	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																																			
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	NA					NA					0.631	J		1.5	1	0.916	J		1.5	1	NA					ND	U		1.9	1
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	NA					NA					2.54			2	1	1.91	J		2	1	NA					ND	U		1.9	1
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	25		0.62	2	1	ND	U	0.6	1.9	1	1.32	J		2.5	1	2.19	J		2.5	1	2.8		0.6	1.9	1	ND	U		1.9	1
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	10		0.51	2	1	ND	U	0.5	1.9	1	1.04	J		1.5	1	1.11	J		1.5	1	ND	U	0.5	1.9	1	ND	U		1.9	1
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	***15***		0.49	2	1	ND	U	0.48	1.9	1	*0.782*	J		1.5	1	*3.29*			1.5	1	ND	U	0.48	1.9	1	*2.1*			1.9	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U	0.47	2	1	ND	U	0.46	1.9	1	ND	U		2.5	1	ND	U		2.5	1	ND	U	0.46	1.9	1	ND	U		1.9	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	ND	U	0.59	2	1	ND	U	0.58	1.9	1	ND	U		2	1	ND	U		2	1	ND	U	0.57	1.9	1	ND	U		1.9	1
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	ND	U	0.62	2	1	ND	U	0.6	1.9	1	ND	U		1.5	1	ND	U		1.5	1	ND	U	0.6	1.9	1	ND	U		1.9	1
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	ND	U	0.62	2	1	ND	U	0.6	1.9	1	ND	U		1.5	1	ND	U		1.5	1	ND	U	0.6	1.9	1	ND	U		1.9	1
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	ND	U	0.59	2	1	ND	U	0.58	1.9	1	NA					NA					ND	U	0.57	1.9	1	NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	ND	U	0.64	2	1	ND	U	0.62	1.9	1	NA					NA					ND	U	0.62	1.9	1	NA				
Fluorotelomer carboxylic acids																																			
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																			
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																			
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	ND	U	0.61	2	1	ND	U	0.6	1.9	1	NA					NA					ND	U	0.59	1.9	1	NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	ND	U	0.5	2	1	ND	U	0.49	1.9	1	NA					NA					ND	U	0.49	1.9	1	NA				
Perfluorooctane sulfonamides																																			
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Fluorotelomer sulfonic acids																																			
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	NA					NA					ND	U		2	1	ND	U		2	1	NA					ND	U		1.9	1
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	NA					NA					4.76			1.5	1	0.419	J		1.5	1	NA					ND	U		1.9	1
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	NA					NA					0.664	J		1.5	1	ND	U		1.5	1	NA					ND	U		1.9	1
Per- and Polyfluoroether carboxylic acids																																			
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	NA					NA					ND	U		1.5	1	ND	U		1.5	1	NA					ND	U		1.9	1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	NA					NA					ND	U		2	1	ND	U		2	1	NA					ND	U		1.9	1
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	NA					NA					ND	U		2.5	1	ND	U		2.5	1	NA					ND	U		1.9	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	0.61	2	1	ND	U	0.6	1.9	1	ND	U		1.5	1	ND	U		1.5	1	ND	U	0.59	1.9	1	ND	U		1.9	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	ND	U	0.48	2	1	ND	U	0.47	1.9	1	ND	U		1	1	ND	U		1	1	ND	U	0.47	1.9	1	ND	U		1.9	1
Ether sulfonic acids																																			
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	NA					NA					ND	U		1.5	1	ND	U		1.5	1	NA					ND	U		1.9	1
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	ND	U	0.63	2	1	ND	U	0.61	1.9	1	ND	U		1.5	1	ND	U		1.5	1	ND	U	0.61	1.9	1	ND	U		1.9	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	ND	U	0.63	2	1	ND	U	0.61	1.9	1	ND	U		1.5	1	ND	U		1.5	1	ND	U	0.61	1.9	1	ND	U		1.9	1

Table 1
Summary of PFAS Analytical Results for PAB Water Supply Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	New Colombia Well 7					Well 100					Well 100					Well 100					Well 200					Well 300				
					Sample Name	WI-24-0143_ Field_Blank_101024					WI-23-0149_100_020124					WI-23-0149_100_ FTB_020124					WI-23-0149_030424					WI-23-0148_200					WI-23-0149_300				
					Sample Description	Field blank sample collected from Well 7					Sample collected from Well 100					Field blank sample collected from Well 100					Sample collected from Well 100					Sample collected from Well 200					Sample collected from Well 300				
					Sample Date	10/10/2024					02/01/2024					02/01/2024					03/04/2024					02/08/2024					12/21/2023				
					Analysis Method	Method 533					Method 533					Method 533					Method 533					Method 533					Method 533				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																			
Perfluoroalkyl sulfonic acids																																			
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	ND	U		1.9	1	ND	U	0.42	2	1	ND	U	0.42	2	1	ND	U	0.42	2	1	ND	U	0.4	1.9	1	ND	U	0.42	2	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.37	2	1	ND	U	0.37	2	1	ND	U	0.37	2	1	ND	U	0.35	1.9	1	ND	U	0.37	2	1
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	ND	U		1.9	1	ND	U	0.39	2	1	ND	U	0.39	2	1	ND	U	0.39	2	1	ND	U	0.37	1.9	1	ND	U	0.39	2	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.44	2	1	ND	U	0.44	2	1	ND	U	0.43	2	1	ND	U	0.42	1.9	1	ND	U	0.44	2	1
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	ND	U		1.9	1	ND	U	0.39	2	1	ND	U	0.39	2	1	ND	U	0.39	2	1	ND	U	0.37	1.9	1	ND	U	0.39	2	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																																			
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	ND	U		1.9	1	3.1		0.52	2	1	ND	U	0.52	2	1	ND	U	0.51	2	1	ND	U	0.5	1.9	1	ND	U	0.52	2	1
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.38	2	1	ND	U	0.38	2	1	ND	U	0.38	2	1	ND	U	0.36	1.9	1	ND	U	0.38	2	1
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	ND	U		1.9	1	ND	U	0.42	2	1	ND	U	0.42	2	1	ND	U	0.42	2	1	ND	U	0.4	1.9	1	ND	U	0.42	2	1
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.4	2	1	ND	U	0.4	2	1	ND	U	0.4	2	1	ND	U	0.38	1.9	1	ND	U	0.4	2	1
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	ND	U		1.9	1	ND	U	0.38	2	1	ND	U	0.38	2	1	ND	U	0.38	2	1	ND	U	0.36	1.9	1	ND	U	0.38	2	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U		1.9	1	ND	U	0.38	2	1	ND	U	0.38	2	1	ND	U	0.38	2	1	ND	U	0.36	1.9	1	ND	U	0.38	2	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	ND	U		1.9	1	ND	U	0.36	2	1	ND	U	0.36	2	1	ND	U	0.36	2	1	ND	U	0.34	1.9	1	ND	U	0.36	2	1
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	ND	U		1.9	1	ND	U	0.38	2	1	ND	U	0.38	2	1	ND	U	0.38	2	1	ND	U	0.36	1.9	1	ND	U	0.38	2	1
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	ND	U		1.9	1	ND	U	0.35	2	1	ND	U	0.35	2	1	ND	U	0.35	2	1	ND	U	0.33	1.9	1	ND	U	0.35	2	1
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA					NA					NA				
Fluorotelomer carboxylic acids																																			
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																			
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																			
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamides																																			
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA				
Fluorotelomer sulfonic acids																																			
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.56	2	1	ND	U	0.55	2	1	ND	U	0.55	2	1	ND	U	0.54	1.9	1	ND	U	0.56	2	1
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.68	2	1	ND	U	0.67	2	1	ND	U	0.67	2	1	ND	U	0.65	1.9	1	ND	U	0.67	2	1
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.57	2	1	ND	U	0.56	2	1	ND	U	0.56	2	1	ND	U	0.54	1.9	1	ND	U	0.57	2	1
Per- and Polyfluoroether carboxylic acids																																			
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.32	2	1	ND	U	0.32	2	1	ND	U	0.32	2	1	ND	U	0.31	1.9	1	ND	U	0.32	2	1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.35	2	1	ND	U	0.35	2	1	ND	U	0.35	2	1	ND	U	0.33	1.9	1	ND	U	0.35	2	1
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.93	2	1	ND	U	0.92	2	1	ND	U	0.92	2	1	ND	U	0.89	1.9	1	ND	U	0.92	2	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U		1.9	1	ND	U	0.53	2	1	ND	U	0.53	2	1	ND	U	0.52	2	1	ND	U	0.51	1.9	1	ND	U	0.53	2	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.4	2	1	ND	U	0.4	2	1	ND	U	0.4	2	1	ND	U	0.38	1.9	1	ND	U	0.4	2	1
Ether sulfonic acids																																			
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.45	2	1	ND	U	0.45	2	1	ND	U	0.44	2	1	ND	U	0.43	1.9	1	ND	U	0.45	2	1
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.45	2	1	ND	U	0.45	2	1	ND	U	0.44	2	1	ND	U	0.43	1.9	1	ND	U	0.45	2	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	ND	U		1.9	1	ND	U	0.51	2	1	ND	U	0.51	2	1	ND	U	0.5	2	1	ND	U	0.49	1.9	1	ND	U	0.51	2	1

Table 1
Summary of PFAS Analytical Results for PAB Water Supply Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	Well 300					Farm West					Farm West					Farm 10					Farm 12				
					Sample Name	122-0021-WL300_122823					WI-88-2299_012924					WI-88-2299_FTB_012924					WI-73-5940_012924					SW7240ZCR_012924				
					Sample Description	Sample collected from Well 300					Sample collected from residential style well, Farm West					Field blank sample collected from residential style well, Farm West					Sample collected from residential style well, Farm 10					Sample collected from residential style well, Farm 12				
					Sample Date	12/28/2023					01/29/2024					01/29/2024					01/29/2024					01/29/2024				
					Analysis Method	Method 1633					Method 533					Method 533					Method 533					Method 533				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																														
Perfluoroalkyl sulfonic acids																														
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	ND	U		1	1	2		0.4	1.9	1	ND	U	0.42	2	1	ND	U	0.41	1.9	1	ND	U	0.41	1.9	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	ND	U		1.5	1	ND	U	0.35	1.9	1	ND	U	0.37	2	1	ND	U	0.36	1.9	1	ND	U	0.36	1.9	1
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	ND	U		2	1	9.6		0.37	1.9	1	ND	U	0.39	2	1	ND	U	0.38	1.9	1	ND	U	0.38	1.9	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	ND	U		1.5	1	ND	U	0.42	1.9	1	ND	U	0.44	2	1	ND	U	0.43	1.9	1	ND	U	0.43	1.9	1
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	ND	U		2.5	1	***10***		0.37	1.9	1	ND	U	0.39	2	1	ND	U	0.38	1.9	1	ND	U	0.38	1.9	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																														
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	ND	U		1.5	1	ND	U	0.49	1.9	1	ND	U	0.52	2	1	ND	U	0.5	1.9	1	ND	U	0.5	1.9	1
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	ND	U		2	1	ND	U	0.36	1.9	1	ND	U	0.38	2	1	ND	U	0.37	1.9	1	ND	U	0.37	1.9	1
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	ND	U		2.5	1	ND	U	0.4	1.9	1	ND	U	0.42	2	1	ND	U	0.41	1.9	1	ND	U	0.41	1.9	1
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	ND	U		1.5	1	ND	U	0.38	1.9	1	ND	U	0.4	2	1	ND	U	0.39	1.9	1	ND	U	0.39	1.9	1
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	ND	U		1.5	1	ND	U	0.36	1.9	1	ND	U	0.38	2	1	ND	U	0.37	1.9	1	ND	U	0.37	1.9	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U		2.5	1	ND	U	0.36	1.9	1	ND	U	0.38	2	1	ND	U	0.37	1.9	1	ND	U	0.37	1.9	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	ND	U		2	1	ND	U	0.34	1.9	1	ND	U	0.36	2	1	ND	U	0.35	1.9	1	ND	U	0.35	1.9	1
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	ND	U		1.5	1	ND	U	0.36	1.9	1	ND	U	0.38	2	1	ND	U	0.37	1.9	1	ND	U	0.37	1.9	1
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	ND	U		1.5	1	ND	U	0.33	1.9	1	ND	U	0.35	2	1	ND	U	0.34	1.9	1	ND	U	0.34	1.9	1
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA					NA				
Fluorotelomer carboxylic acids																														
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																														
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																														
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA					NA				
Perfluorooctane sulfonamides																														
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA				
Fluorotelomer sulfonic acids																														
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	ND	U		2	1	ND	U	0.53	1.9	1	ND	U	0.56	2	1	ND	U	0.54	1.9	1	ND	U	0.54	1.9	1
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	ND	U		1.5	1	ND	U	0.65	1.9	1	ND	U	0.68	2	1	ND	U	0.66	1.9	1	ND	U	0.66	1.9	1
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	ND	U		1.5	1	ND	U	0.54	1.9	1	ND	U	0.57	2	1	ND	U	0.55	1.9	1	ND	U	0.55	1.9	1
Per- and Polyfluoroether carboxylic acids																														
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	ND	U		1.5	1	ND	U	0.3	1.9	1	ND	U	0.32	2	1	ND	U	0.31	1.9	1	ND	U	0.31	1.9	1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	ND	U		2	1	ND	U	0.33	1.9	1	ND	U	0.35	2	1	ND	U	0.34	1.9	1	ND	U	0.34	1.9	1
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	ND	U		2.5	1	ND	U	0.88	1.9	1	ND	U	0.93	2	1	ND	U	0.9	1.9	1	ND	U	0.9	1.9	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U		1.5	1	ND	U	0.5	1.9	1	ND	U	0.53	2	1	ND	U	0.51	1.9	1	ND	U	0.51	1.9	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	ND	U		1	1	ND	U	0.38	1.9	1	ND	U	0.4	2	1	ND	U	0.39	1.9	1	ND	U	0.39	1.9	1
Ether sulfonic acids																														
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	ND	U		1.5	1	ND	U	0.43	1.9	1	ND	UB	0.45	2	1	ND	U	0.44	1.9	1	ND	U	0.43	1.9	1
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	ND	U		1.5	1	ND	U	0.43	1.9	1	ND	U	0.45	2	1	ND	U	0.44	1.9	1	ND	U	0.43	1.9	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	ND	U		1.5	1	ND	U	0.48	1.9	1	ND	U	0.51	2	1	ND	U	0.5	1.9	1	ND	U	0.49	1.9	1

Table 1
Summary of PFAS Analytical Results for PAB Water Supply Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland

Notes:

EPA - Environmental Protection Agency
POE - Point of Entry
MCL - Maximum Contaminant Level
CAS - Chemical Abstract Service
NS - No standard
ng/l - Nanogram per liter (parts per trillion (ppt))
ND - Not detected
DUP - Duplicate sample collected for quality control purposes
Q - Qualifier
MDL - Method Detection Limit
RL - Reporting Limit
DF - Dilution Factor

Qualifiers:

J - The analyte was positively identified but the associated numerical value is approximate.
U – The analyte was not detected above the method detection limit, or the analyte detection is impacted by blank contamination and qualified as non-detect in accordance with the applicable validation guidelines.
UJ - The analyte was not detected at or above the method detection limit. The method detection limit may be imprecise because of potential low or indeterminate bias.

Exceedance Summary:

Bold - Result exceeds EPA's Maximum Contaminant Levels (MCLs) for public drinking water
Italics - Result exceeds EPA's Tap Water Regional Screening Exceendence for tap water

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	**Location**	**MW-1**					**MW-1**					**MW-2**					**MW-2**					**MW-3**					**MW-3**					**MW-4**					**MW-4**				
					Sample Name	**MD0000060-MW-**					**FB-MD0000060-**					**MD0000060-MW-**					**FB-MD0000060-**					**MD0000060-MW-**					**FB-MD0000060-**					**MD0000060-MW-**					**FB-MD0000060-**				
					Sample Description	**Sample collected from MW-1**					**Field blank sample taken near MW-1**					**Sample collected from MW-2**					**Field blank sample taken near MW-2**					**Sample collected from MW-3**					**Field blank sample taken near MW-3**					**Sample collected from MW-4**					**Field blank sample taken near MW-4**				
					Sample Date	**12/28/2023**					**12/28/2023**					**12/28/2023**					**12/28/2023**					**12/28/2023**					**12/28/2023**					**12/28/2023**					**12/28/2023**				
					Analysis Method	**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																													
Perfluoroalkyl sulfonic acids																																													
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	160			2	1	ND	U		2	1	3.98			2	1	ND	U		2	1	187			2	1	ND	U		2	1	6.45			2	1	ND	U		2	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	142			8	1	ND	U		8	1	4.75	J		8	1	ND	U		8	1	242			8	1	ND	U		8	1	27.7			8	1	ND	U		8	1
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	***634***			2	1	ND	U		2	1	***26.7***			2	1	ND	U		2	1	***700***			2	1	ND	U		2	1	***240***			2	1	ND	U		2	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	54.1			2	1	ND	U		2	1	1.61	J		2	1	ND	U		2	1	57.1			2	1	ND	U		2	1	31.5			2	1	ND	U		2	1
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***425***	U		2	1	ND	U		2	1	***88***			2	1	ND	U		2	1	***1370***			2	1	ND	U		2	1	***709***			2	1	ND	U		2	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	1.95	J		2	1	ND	U		2	1	0.837	J		2	1	ND	U		2	1
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluoroalkyl carboxylic acids																																													
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	44.7			8	1	ND	U		8	1	0.95	J		8	1	ND	U		8	1	176			8	1	ND	U		8	1	1.88	J		8	1	ND	U		8	1
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	110			4	1	ND	U		4	1	2.28	J		4	1	ND	U		4	1	657			4	1	ND	U		4	1	8.8			4	1	ND	U		4	1
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	141			2	1	ND	U		2	1	1.76	J		2	1	ND	U		2	1	431			2	1	ND	U		2	1	16.7			2	1	ND	U		2	1
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	64.7			2	1	ND	U		2	1	1.57	J		2	1	ND	U		2	1	359			2	1	ND	U		2	1	6.08			2	1	ND	U		2	1
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	***38.6***			2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	***159***			2	1	ND	U		2	1	***6.27***			2	1	ND	U		2	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	3.19			2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Fluorotelomer carboxylic acids																																													
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1
Perfluorooctane sulfonamide ethanols																																													
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1
Perfluorooctane sulfonamidoacetic acids																																													
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorooctane sulfonamides																																													
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	0.246	J		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Fluorotelomer sulfonic acids																																													
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	1.1	J		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
Per- and Polyfluoroether carboxylic acids																																													
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
Ether sulfonic acids																																													
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	**Location**	**MW-5**					**MW-5**					**MW-6**					**MW-6**					**MW-1_W**					**MW-1_W**					**MW-1_W**					**MW-1_W**				
					Sample Name	**MD0000060-MW-**					**FB-MD0000060-**					**MD0000060-MW-**					**FB-MD0000060-**					**MW-1-1_071824**					**MW-1-2_071824**					**MW-1-3_071824**					**MW-1-4_071824**				
					Sample Description	**Sample collected from MW-5**					**Field blank sample taken near MW-5**					**Sample collected from MW-6**					**Field blank sample taken near MW-6**					**Sample collected from MW-1_W**					**Sample collected from MW-1_W**					**Sample collected from MW-1_W**					**Sample collected from MW-1_W**				
					Sample Date	**12/28/2023**					**12/28/2023**					**12/28/2023**					**12/28/2023**					**07/18/2024**					**07/18/2024**					**07/18/2024**					**07/18/2024**				
					Analysis Method	**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																													
Perfluoroalkyl sulfonic acids																																													
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	2.77			2	1	ND	U		2	1	4.18			2	1	ND	U		2	1	5.4		0.95	3.8	1	5.3		0.93	3.7	1	3.3	J	0.99	4	1	38		0.97	3.9	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	3.23	J		8	1	ND	U		8	1	3.08	J		8	1	ND	U		8	1	NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	**21.7**			2	1	ND	U		2	1	8.47			2	1	ND	U		2	1	**26**		0.98	3.8	1	**29**		0.96	3.7	1	**16**		1	4	1	***200***		1	3.9	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	1.05	J		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***6.01***			2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	***14***	I	0.95	3.8	1	***16***		0.93	3.7	1	***7.7***	I	0.99	4	1	***110***		0.97	3.9	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																																													
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	1.64	J		8	1	ND	U		8	1	5.12	J		8	1	ND	U		8	1	NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	1.23	J		4	1	ND	U		4	1	21.7			4	1	ND	U		4	1	NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	2.38			2	1	ND	U		2	1	13.5			2	1	ND	U		2	1	NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	1.76	J		2	1	ND	U		2	1	6.19			2	1	ND	U		2	1	NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	*1.43*	J		2	1	ND	U		2	1	*1.16*	J		2	1	ND	U		2	1	*2.8*	J	0.95	3.8	1	*3.4*	JI	0.93	3.7	1	*2.4*	JI	0.99	4	1	***12***		0.97	3.9	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U	0.95	3.8	1	ND	U	0.93	3.7	1	ND	U	0.99	4	1	ND	U	0.97	3.9	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
Fluorotelomer carboxylic acids																																													
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1	NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1	NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																													
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1	NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																													
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
Perfluorooctane sulfonamides																																													
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA					NA				
Fluorotelomer sulfonic acids																																													
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	3.19	J		8	1	ND	U		8	1	ND	U		8	1	1.91	J		8	1	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																																													
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U	3.8	*15*	1	ND	U	3.7	*15*	1	ND	U	4	*16*	1	ND	U	3.9	*16*	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	NA					NA					NA					NA				
Ether sulfonic acids																																													
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	NA					NA					NA					NA				

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	MW-1_W					MW-1_W					MW-1_W					MW-1_W				
					Sample Name	MW-1-5_071824					MW-1-5_DUP_071824					MW-1-6_071824					MW-1-7_071824				
					Sample Description	Sample collected from MW-1_W					Sample collected from MW-1_W					Sample collected from MW-1_W					Sample collected from MW-1_W				
					Sample Date	07/18/2024					07/18/2024					07/18/2024					07/18/2024				
					Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																									
Perfluoroalkyl sulfonic acids																									
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	4.4		0.94	3.8	1	4.4		0.95	3.8	1	4.1		0.39	1.6	1	3.1		0.68	2.7	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	**19**		0.98	3.8	1	**18.3**		0.98	3.8	1	**18**		0.41	1.6	1	**13**		0.7	2.7	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***4.8***	I	0.94	3.8	1	***5.73***	I	0.95	3.8	1	***4.9***	I	0.39	1.6	1	***4.8***	I	0.68	2.7	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																									
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	ND	U	0.94	3.8	1	ND	U	0.95	3.8	1	ND	U	0.39	1.6	1	ND	U	0.68	2.7	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U	0.94	3.8	1	ND	U	0.95	3.8	1	ND	U	0.39	1.6	1	ND	U	0.68	2.7	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA				
Fluorotelomer carboxylic acids																									
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																									
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																									
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamides																									
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA				
Fluorotelomer sulfonic acids																									
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																									
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	3.8	*15*	1	ND	U	3.8	*15*	1	ND	U	1.6	6.3	1	ND	U	2.7	*11*	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	NA					NA					NA					NA				
Ether sulfonic acids																									
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	NA					NA					NA					NA				

Analyte	Location	MW-1_W					MW-1_W					MW-1_W					MW-1_W				
	Sample Name	MW-1-1_123124					MW-1-2_123124					MW-1-3_123124					MW-1-4_123124				
	Sample Description	Sample collected from MW-1_W					Sample collected from MW-1_W					Sample collected from MW-1_W					Sample collected from MW-1_W				
	Sample Date	12/31/2024					12/31/2024					12/31/2024					12/31/2024				
	Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633				
	Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																					
Perfluoroalkyl sulfonic acids																					
Perfluorobutanesulfonic Acid (PFBS)	ng/l	ND	U	0.543	1.62	1	ND	U	0.49	1.46	1	ND	U	0.56	1.67	1	80.4		0.488	1.46	1
Perfluoropentansulfonic Acid (PFPeS)	ng/l	NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	ng/l	ND	U	0.543	1.62	1	ND	U	0.49	1.46	1	1.6	J	0.56	1.67	1	***505***		2.44	7.28	5
Perfluoroheptanesulfonic Acid (PFHpS)	ng/l	NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	ng/l	ND	U	0.543	1.62	1	ND	U	0.49	1.46	1	*0.618*	J	0.56	1.67	1	***264***		0.488	1.46	1
Perfluorononanesulfonic Acid (PFNS)	ng/l	NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	ng/l	NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	ng/l	NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																					
Perfluorobutanoic acid (PFBA)	ng/l	NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	ng/l	NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	ng/l	NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	ng/l	NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	ng/l	ND	U	0.543	1.62	1	ND	U	0.49	1.46	1	ND	U	0.56	1.67	1	***34.8***		0.488	1.46	1
Perfluorononanoic Acid (PFNA)	ng/l	ND	U	0.543	1.62	1	ND	U	0.49	1.46	1	ND	U	0.56	1.67	1	ND	U	0.488	1.46	1
Perfluorodecanoic Acid (PFDA)	ng/l	NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	ng/l	NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	ng/l	NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	ng/l	NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	ng/l	NA					NA					NA					NA				
Fluorotelomer carboxylic acids																					
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	ng/l	NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	ng/l	NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																					
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																					
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamides																					
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	ng/l	NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	ng/l	NA					NA					NA					NA				
Fluorotelomer sulfonic acids																					
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	ng/l	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	ng/l	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	ng/l	NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																					
Perfluoro-3-methoxypropanoic acid	ng/l	NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	ng/l	NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	ng/l	NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ng/l	ND	U	2.16	6.48	1	ND	U	1.95	5.86	1	ND	U	2.23	6.68	1	ND	U	1.94	5.82	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ng/l	NA					NA					NA					NA				
Ether sulfonic acids																					
Perfluoro(2-ethoxyethane)sulfonic acid	ng/l	NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	ng/l	NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	ng/l	NA					NA					NA					NA				

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	MW-1_W					MW-1_W					MW-1_W					MW-1_W					MW-2_W					MW-2_W					MW-2_W					MW-2_W				
					Sample Name	MW-1-5_123124					MW-1-6_123124					MW-1-7_123124					DUP-1_123124					MW-2-1_071824					MW-2-2_071824					MW-2-3_071824					MW-2-4_071824				
					Sample Description	Sample collected from MW-1_W					Sample collected from MW-1_W					Sample collected from MW-1_W					Sample collected from MW-1_W					Sample collected from MW-2_W					Sample collected from MW-2_W					Sample collected from MW-2_W					Sample collected from MW-2_W				
					Sample Date	12/31/2024					12/31/2024					12/31/2024					12/31/2024					07/18/2024					07/18/2024					07/18/2024					07/18/2024				
					Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																													
Perfluoroalkyl sulfonic acids																																													
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	3.18		0.478	1.43	1	3		0.58	1.73	1	ND	U	0.484	1.44	1	ND	U	0.506	1.51	1	8		0.4	1.6	1	25		0.4	1.6	1	87		0.82	3.3	1	35		0.92	3.7	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	**15.6**		0.478	1.43	1	**12.9**		0.58	1.73	1	2.17		0.484	1.44	1	2.21		0.506	1.51	1	***61***		0.41	1.6	1	***200***		0.42	1.6	1	***710***		0.84	3.3	1	***230***		0.95	3.7	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***5.82***		0.478	1.43	1	***5.23***		0.58	1.73	1	*1.35*	J	0.484	1.44	1	*1.19*	J	0.506	1.51	1	***23***		0.4	1.6	1	***67***	I	0.4	1.6	1	***210***	I	0.82	3.3	1	***140***		0.92	3.7	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																																													
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	ND	U	0.478	1.43	1	ND	U	0.58	1.73	1	ND	U	0.484	1.44	1	ND	U	0.506	1.51	1	***5.5***		0.4	1.6	1	***11***		0.4	1.6	1	***34***		0.82	3.3	1	***14***		0.92	3.7	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U	0.478	1.43	1	ND	U	0.58	1.73	1	ND	U	0.484	1.44	1	ND	U	0.506	1.51	1	0.77	J	0.4	1.6	1	0.54	J	0.4	1.6	1	ND	U	0.82	3.3	1	ND	U	0.92	3.7	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer carboxylic acids																																													
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																													
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																													
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamides																																													
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer sulfonic acids																																													
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																																													
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	1.91	5.71	1	ND	U	2.31	6.93	1	ND	U	1.93	5.78	1	ND	U	2.02	6.05	1	ND	U	1.6	6.4	1	ND	U	1.6	6.4	1	ND	U	3.3	*13*	1	ND	U	3.7	*15*	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Ether sulfonic acids																																													
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	MW-2_W					MW-2_W					MW-2_W					MW-2_W				
					Sample Name	MW-2-5_071824					MW-2-6_071824					MW-2-7_071824					MW-2-1_123124				
					Sample Description	Sample collected from MW-2_W					Sample collected from MW-2_W					Sample collected from MW-2_W					Sample collected from MW-2_W				
					Sample Date	07/18/2024					07/18/2024					07/18/2024					12/31/2024				
					Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																									
Perfluoroalkyl sulfonic acids																									
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	ND	U	1	4.1	1	ND	U	0.4	1.6	1	140		0.41	1.6	1	5.56		0.554	1.65	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	ND	U	1.1	4.1	1	ND	U	0.41	1.6	1	***340***		0.42	1.6	1	***55.5***		0.554	1.65	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	ND	U	1	*4.1*	1	ND	U	0.4	1.6	1	***140***		0.41	1.6	1	***18.8***		0.554	1.65	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																									
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	ND	U	1	*4.1*	1	ND	U	0.4	1.6	1	***16***		0.41	1.6	1	***4.78***		0.554	1.65	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U	1	4.1	1	ND	U	0.4	1.6	1	ND	U	0.41	1.6	1	ND	U	0.554	1.65	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA				
Fluorotelomer carboxylic acids																									
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																									
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																									
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamides																									
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA				
Fluorotelomer sulfonic acids																									
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																									
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	4.1	*16*	1	ND	U	1.6	6.4	1	ND	U	1.6	6.5	1	ND	U	2.21	6.61	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	NA					NA					NA					NA				
Ether sulfonic acids																									
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	NA					NA					NA					NA				

Analyte	MW-2_W					MW-2_W					MW-2_W					MW-2_W				
	MW-2-2_123124					MW-2-3_123124					MW-2-4_123124					MW-2-5_123124				
	Sample collected from MW-2_W					Sample collected from MW-2_W					Sample collected from MW-2_W					Sample collected from MW-2_W				
	12/31/2024					12/31/2024					12/31/2024					12/31/2024				
	Method 1633					Method 1633					Method 1633					Method 1633				
	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																				
Perfluoroalkyl sulfonic acids																				
Perfluorobutanesulfonic Acid (PFBS)	120		0.548	1.64	1	134		0.516	1.54	1	21.5		0.562	1.68	1	ND	U	0.527	1.57	1
Perfluoropentansulfonic Acid (PFPeS)	NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	***1150***		5.48	*16.4*	10	***1420***		5.16	*15.4*	10	***185***		0.562	1.68	1	ND	U	0.527	1.57	1
Perfluoroheptanesulfonic Acid (PFHpS)	NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	***293***		0.548	1.64	1	***331***		0.516	1.54	1	***79.4***		0.562	1.68	1	ND	U	0.527	1.57	1
Perfluorononanesulfonic Acid (PFNS)	NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																				
Perfluorobutanoic acid (PFBA)	NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	***62.7***		0.548	1.64	1	***70***		0.516	1.54	1	***10.5***		0.562	1.68	1	ND	U	0.527	1.57	1
Perfluorononanoic Acid (PFNA)	ND	U	0.548	1.64	1	ND	U	0.516	1.54	1	ND	U	0.562	1.68	1	ND	U	0.527	1.57	1
Perfluorodecanoic Acid (PFDA)	NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	NA					NA					NA					NA				
Fluorotelomer carboxylic acids																				
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																				
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																				
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NA					NA					NA					NA				
Perfluorooctane sulfonamides																				
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	NA					NA					NA					NA				
Fluorotelomer sulfonic acids																				
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																				
Perfluoro-3-methoxypropanoic acid	NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND	U	2.18	6.54	1	ND	U	2.06	6.16	1	ND	U	2.24	6.71	1	ND	U	2.1	6.29	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	NA					NA					NA					NA				
Ether sulfonic acids																				
Perfluoro(2-ethoxyethane)sulfonic acid	NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	NA					NA					NA					NA				

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	MW-2_W					MW-2_W					MW-3_W					MW-3_W					MW-3_W					MW-3_W					MW-3_W					MW-3_W				
					Sample Name	MW-2-6_123124					MW-2-7_123124					MW-3-1_071824					MW-3-2_071824					MW-3-3_071824					MW-3-4_071824					MW-3-5_071824					MW-3-6_071824				
					Sample Description	Sample collected from MW-2_W					Sample collected from MW-2_W					Sample collected from MW-3_W					Sample collected from MW-3_W					Sample collected from MW-3_W					Sample collected from MW-3_W					Sample collected from MW-3_W					Sample collected from MW-3_W				
					Sample Date	12/31/2024					12/31/2024					07/18/2024					07/18/2024					07/18/2024					07/18/2024					07/18/2024					07/18/2024				
					Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																													
Perfluoroalkyl sulfonic acids																																													
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	ND	U	0.522	1.56	1	ND	U	0.58	1.73	1	0.92	J	0.41	1.6	1	5		0.38	1.5	1	16		1.1	4.2	1	37		0.39	1.5	1	42		1.2	4.8	1	43		0.42	1.7	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	ND	U	0.522	1.56	1	ND	U	0.58	1.73	1	7.6		0.42	1.6	1	***24***		0.39	1.5	1	***78***		1.1	4.2	1	***220***		0.4	1.5	1	***140***		1.2	4.8	1	***140***		0.43	1.7	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	ND	U	0.522	1.56	1	ND	U	0.58	1.73	1	*2.7*	I	0.41	1.6	1	***21***		0.38	1.5	1	***66***		1.1	*4.2*	1	***140***		0.39	1.5	1	***150***		1.2	*4.8*	1	***150***		0.42	1.7	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																																													
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	ND	U	0.522	1.56	1	ND	U	0.58	1.73	1	*1.4*	J	0.41	1.6	1	*2.6*	I	0.38	1.5	1	***6.4***		1.1	*4.2*	1	***13***		0.39	1.5	1	***11***		1.2	*4.8*	1	***9.7***		0.42	1.7	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U	0.522	1.56	1	ND	U	0.58	1.73	1	ND	U	0.41	1.6	1	ND	U	0.38	1.5	1	ND	U	1.1	4.2	1	ND	U	0.39	1.5	1	ND	U	1.2	4.8	1	ND	U	0.42	1.7	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer carboxylic acids																																													
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																													
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																													
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamides																																													
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer sulfonic acids																																													
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																																													
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	2.08	6.24	1	ND	U	2.31	6.93	1	ND	U	1.6	6.5	1	ND	U	1.5	6.1	1	ND	U	4.2	*17*	1	ND	U	1.5	6.2	1	ND	U	4.8	*19*	1	ND	U	1.7	6.7	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Ether sulfonic acids																																													
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	MW-3_W					MW-3_W					MW-3_W					MW-3_W					MW-3_W					MW-3_W					MW-3_W					MW-3_W				
					Sample Name	MW-3-6_DUP_071824					MW-3-7_071824					MW-3-1_123124					MW-3-2_123124					MW-3-3_123124					MW-3-4_123124					MW-3-5_123124					MW-3-6_123124				
					Sample Description	Sample collected from MW-3_W					Sample collected from MW-3_W					Sample collected from MW-3_W					Sample collected from MW-3_W					Sample collected from MW-3_W					Sample collected from MW-3_W					Sample collected from MW-3_W					Sample collected from MW-3_W				
					Sample Date	07/18/2024					07/18/2024					12/31/2024					12/31/2024					12/31/2024					12/31/2024					12/31/2024					12/31/2024				
					Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																													
Perfluoroalkyl sulfonic acids																																													
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	41.6		0.47	1.9	1	10		0.94	3.8	1	ND	U	0.503	1.5	1	ND	U	0.525	1.57	1	ND	U	0.502	1.5	1	55.7		0.516	1.54	1	32.1		0.535	1.6	1	18.8		0.494	1.47	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	***136***		0.49	1.9	1	**35**		0.97	3.8	1	4.32		0.503	1.5	1	ND	U	0.525	1.57	1	1.08	J	0.502	1.5	1	***325***		0.516	1.54	1	***109***		0.535	1.6	1	***64.2***		0.494	1.47	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***151***		0.47	1.9	1	***45***		0.94	3.8	1	*1.63*		0.503	1.5	1	ND	U	0.525	1.57	1	*0.652*	J	0.502	1.5	1	***166***		0.516	1.54	1	***112***		0.535	1.6	1	***64.2***		0.494	1.47	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																																													
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	***9.43***		0.47	1.9	1	***5.1***		0.94	3.8	1	*1.67*		0.503	1.5	1	ND	U	0.525	1.57	1	*0.644*	J	0.502	1.5	1	***16.4***		0.516	1.54	1	***7.24***		0.535	1.6	1	***4.17***		0.494	1.47	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U	0.47	1.9	1	ND	U	0.94	3.8	1	ND	U	0.503	1.5	1	ND	U	0.525	1.57	1	ND	U	0.502	1.5	1	ND	U	0.516	1.54	1	ND	U	0.535	1.6	1	ND	U	0.494	1.47	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer carboxylic acids																																													
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																													
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																													
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamides																																													
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer sulfonic acids																																													
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																																													
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	1.9	7.6	1	ND	U	3.8	*15*	1	ND	U	2	6	1	ND	U	2.09	6.27	1	ND	U	2	5.99	1	ND	U	2.06	6.16	1	ND	U	2.13	6.39	1	ND	U	1.97	5.9	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Ether sulfonic acids																																													
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	MW-3_W					MW-4_W					MW-4_W					MW-4_W					MW-4_W					MW-4_W					MW-4_W					MW-4_W				
					Sample Name	MW-3-7_123124					MW-4-1_071824					MW-4-2_071824					MW-4-3_071824					MW-4-4_071824					MW-4-5_071824					MW-4-6_071824					MW-4-7_071824				
					Sample Description	Sample collected from MW-3_W					Sample collected from MW-4_W					Sample collected from MW-4_W					Sample collected from MW-4_W					Sample collected from MW-4_W					Sample collected from MW-4_W					Sample collected from MW-4_W					Sample collected from MW-4_W				
					Sample Date	12/31/2024					07/18/2024					07/18/2024					07/18/2024					07/18/2024					07/18/2024					07/18/2024					07/18/2024				
					Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																													
Perfluoroalkyl sulfonic acids																																													
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	3.52		0.484	1.44	1	67		0.4	1.6	1	79		0.41	1.6	1	160		1.1	4.4	1	*670*		2	7.8	5	570		2.1	8.4	5	ND	U	1.4	5.5	1	39		0.93	3.7	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	**12.4**		0.484	1.44	1	***140***		0.42	1.6	1	***160***		0.42	1.6	1	***340***		1.1	4.4	1	***1300***		2	7.8	5	***1300***		2.2	8.4	5	1.8	J	1.4	5.5	1	***110***		0.96	3.7	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***17.6***		0.484	1.44	1	***82***		0.4	1.6	1	***140***		0.41	1.6	1	***370***		1.1	*4.4*	1	***490***		2	*7.8*	5	***500***		2.1	*8.4*	5	*1.7*	J	1.4	*5.5*	1	***14***		0.93	3.7	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																																													
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	*1.68*		0.484	1.44	1	***9.4***		0.4	1.6	1	***13***		0.41	1.6	1	***28***		1.1	*4.4*	1	***72***		0.39	1.6	1	***59***		0.42	1.7	1	ND	U	1.4	*5.5*	1	***7.4***		0.93	3.7	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U	0.484	1.44	1	0.72	JI	0.4	1.6	1	0.87	JI	0.41	1.6	1	1.2	JI	1.1	4.4	1	0.94	J	0.39	1.6	1	0.64	JI	0.42	1.7	1	ND	U	1.4	5.5	1	ND	U	0.93	3.7	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer carboxylic acids																																													
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																													
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																													
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamides																																													
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer sulfonic acids																																													
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																																													
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	1.93	5.78	1	ND	U	1.6	6.5	1	ND	U	1.6	6.5	1	ND	U	4.4	*17*	1	ND	U	1.6	6.3	1	ND	U	1.7	6.8	1	ND	U	5.5	*22*	1	ND	U	3.7	*15*	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Ether sulfonic acids																																													
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	MW-4_W					MW-4_W					MW-4_W					MW-4_W					MW-4_W					MW-4_W					MW-4_W				
					Sample Name	MW-4-1_123024					MW-4-2_123024					MW-4-3_123024					MW-4-4_123024					MW-4-5_123024					MW-4-6_123024					MW-4-7_123024				
					Sample Description	Sample collected from MW-4_W					Sample collected from MW-4_W					Sample collected from MW-4_W					Sample collected from MW-4_W					Sample collected from MW-4_W					Sample collected from MW-4_W					Sample collected from MW-4_W				
					Sample Date	12/30/2024					12/30/2024					12/30/2024					12/30/2024					12/30/2024					12/30/2024					12/30/2024				
					Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																								
Perfluoroalkyl sulfonic acids																																								
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	14.4		0.576	1.72	1	22.2		0.526	1.57	1	291		0.516	1.54	1	592		4.98	14.9	10	556		5.08	15.2	10	443		2.7	8.04	5	31.1		0.552	1.65	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	***34.4***		0.576	1.72	1	***69.6***		0.526	1.57	1	***640***		5.16	*15.4*	10	***1490***		4.98	*14.9*	10	***1340***		5.08	*15.2*	10	***1220***		2.7	8.04	5	***102***		0.552	1.65	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***25.1***		0.576	1.72	1	***158***		0.526	1.57	1	***739***		*5.16*	*15.4*	10	***572***		*4.98*	*14.9*	10	***578***		*5.08*	*15.2*	10	***436***		0.539	1.61	1	***8.89***		0.552	1.65	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																																								
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	*2.56*		0.576	1.72	1	***9.76***		0.526	1.57	1	***57.5***		0.516	1.54	1	***86.6***		0.498	1.49	1	***77.4***		0.508	1.52	1	***64.7***		0.539	1.61	1	***6.24***		0.552	1.65	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U	0.576	1.72	1	1.39	J	0.526	1.57	1	1.42	J	0.516	1.54	1	0.907	J	0.498	1.49	1	0.758	J	0.508	1.52	1	0.668	J	0.539	1.61	1	ND	U	0.552	1.65	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer carboxylic acids																																								
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																								
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																								
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamides																																								
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer sulfonic acids																																								
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																																								
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	2.3	6.88	1	ND	U	2.1	6.28	1	ND	U	2.05	6.16	1	ND	U	1.98	5.95	1	ND	U	2.02	6.06	1	ND	U	2.15	6.44	1	ND	U	2.2	6.59	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Ether sulfonic acids																																								
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	MW-5_W					MW-5_W					MW-5_W					MW-5_W					MW-5_W					MW-5_W					MW-5_W				
					Sample Name	MW-5-1_071824					MW-5-2_071824					MW-5-3_071824					MW-5-4_071824					MW-5-5_071824					MW-5-6_071824					MW-5-7_071824				
					Sample Description	Sample collected from MW-5_W					Sample collected from MW-5_W					Sample collected from MW-5_W					Sample collected from MW-5_W					Sample collected from MW-5_W					Sample collected from MW-5_W					Sample collected from MW-5_W				
					Sample Date	07/18/2024					07/18/2024					07/18/2024					07/18/2024					07/18/2024					07/18/2024					07/18/2024				
					Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																								
Perfluoroalkyl sulfonic acids																																								
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	13		0.4	1.6	1	23		0.41	1.6	1	42		0.41	1.6	1	230		0.43	1.7	1	360		0.42	1.7	1	270		0.42	1.7	1	170		0.42	1.7	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	**31**		0.41	1.6	1	***52***		0.43	1.6	1	***99***		0.42	1.6	1	***570***		2.2	8.6	5	***780***		2.2	8.4	5	***630***		0.86	3.3	2	***440***		0.43	1.7	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***35***		0.4	1.6	1	***53***		0.41	1.6	1	***160***		0.41	1.6	1	***990***		2.1	*8.6*	5	***570***		2.1	*8.4*	5	***310***		0.42	1.7	1	***150***		0.42	1.7	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																																								
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	***5.1***		0.4	1.6	1	***7.3***		0.41	1.6	1	***14***		0.41	1.6	1	***72***		0.43	1.7	1	***54***		0.42	1.7	1	***34***		0.42	1.7	1	***21***		0.42	1.7	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	0.79	JI	0.4	1.6	1	1.1	J	0.41	1.6	1	1.3	J	0.41	1.6	1	2.8		0.43	1.7	1	1.1	J	0.42	1.7	1	ND	U	0.42	1.7	1	ND	U	0.42	1.7	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer carboxylic acids																																								
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																								
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																								
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamides																																								
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer sulfonic acids																																								
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																																								
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	1.6	6.3	1	ND	U	1.6	6.6	1	ND	U	1.6	6.5	1	ND	U	1.7	6.8	1	ND	U	1.7	6.7	1	ND	U	1.7	6.7	1	ND	U	1.7	6.7	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
Ether sulfonic acids																																								
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA				

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	MW-5_W					MW-5_W					MW-5_W					MW-5_W					MW-5_W					MW-5_W					MW-5_W					MW-5_W				
					Sample Name	**MW-5-7_DUP_071824**					**MW-5-1_123024**					**MW-5-2_123024**					**MW-5-3_123024**					**MW-5-4_123024**					**MW-5-5_123024**					**MW-5-6_123024**					**MW-5-7_123024**				
					Sample Description	**Sample collected from MW-5_W**					**Sample collected from MW-5_W**					**Sample collected from MW-5_W**					**Sample collected from MW-5_W**					**Sample collected from MW-5_W**					**Sample collected from MW-5_W**					**Sample collected from MW-5_W**					**Sample collected from MW-5_W**				
					Sample Date	**07/18/2024**					**12/30/2024**					**12/30/2024**					**12/30/2024**					**12/30/2024**					**12/30/2024**					**12/30/2024**					**12/30/2024**				
					Analysis Method	**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																													
Perfluoroalkyl sulfonic acids																																													
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	160		0.45	1.8	1	5.49		0.502	1.5	1	8.74		0.465	1.39	1	166		0.486	1.45	1	206		0.473	1.41	1	375		0.496	1.48	1	260		0.462	1.38	1	201		0.465	1.39	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	***450***		0.47	1.8	1	**11.4**		0.502	1.5	1	**18.5**		0.465	1.39	1	***463***		2.43	7.26	5	***578***		2.36	7.06	5	***868***		2.48	7.4	5	***756***		2.31	6.9	5	***583***		2.32	6.94	5
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***160***		0.45	1.8	1	***10.1***		0.502	1.5	1	***22***		0.465	1.39	1	***918***		2.43	*7.26*	5	***1060***		2.36	*7.06*	5	***866***		2.48	*7.4*	5	***389***		0.462	1.38	1	***230***		0.465	1.39	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																																													
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	***20***		0.45	1.8	1	*1.12*	J	0.502	1.5	1	*2*		0.465	1.39	1	***56***		0.486	1.45	1	***73.3***		0.473	1.41	1	***75***		0.496	1.48	1	***40.8***		0.462	1.38	1	***29.1***		0.465	1.39	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U	0.45	1.8	1	ND	U	0.502	1.5	1	ND	U	0.465	1.39	1	2.92		0.486	1.45	1	3.49		0.473	1.41	1	1.84		0.496	1.48	1	0.821	J	0.462	1.38	1	ND	U	0.465	1.39	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer carboxylic acids																																													
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																													
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																													
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamides																																													
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer sulfonic acids																																													
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																																													
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	1.8	7.3	1	ND	U	2	5.99	1	ND	U	1.85	5.55	1	ND	U	1.94	5.81	1	ND	U	1.88	5.65	1	ND	U	1.98	5.92	1	ND	U	1.84	5.52	1	ND	U	1.85	5.55	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Ether sulfonic acids																																													
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	MW-6_W					MW-6_W					MW-6_W					MW-6_W				
					Sample Name	MW-6-1_071824					MW-6-2_071824					MW-6-3_071824					MW-6-4_071824				
					Sample Description	Sample collected from MW-6_W					Sample collected from MW-6_W					Sample collected from MW-6_W					Sample collected from MW-6_W				
					Sample Date	07/18/2024					07/18/2024					07/18/2024					07/18/2024				
					Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																									
Perfluoroalkyl sulfonic acids																									
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	2.8		0.38	1.5	1	12		0.97	3.9	1	30		1.1	4.2	1	260		0.42	1.7	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	7.2		0.39	1.5	1	***29***		1	3.9	1	***81***		1.1	4.2	1	***700***		2.2	8.4	5
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***7.1***		0.38	1.5	1	***40***		0.97	3.9	1	***180***		1.1	*4.2*	1	***780***		2.1	*8.4*	5
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																									
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	*1*	J	0.38	1.5	1	***8***	I	0.97	3.9	1	***16***		1.1	*4.2*	1	***57***		0.42	1.7	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U	0.38	1.5	1	ND	U	0.97	3.9	1	1.6	J	1.1	4.2	1	3.3		0.42	1.7	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA				
Fluorotelomer carboxylic acids																									
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																									
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																									
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamides																									
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA				
Fluorotelomer sulfonic acids																									
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																									
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	1.5	6.1	1	ND	U	3.9	*16*	1	ND	U	4.2	*17*	1	ND	U	1.7	6.7	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	NA					NA					NA					NA				
Ether sulfonic acids																									
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	NA					NA					NA					NA				

Analyte	Abbreviation	Location	MW-6_W					MW-6_W					MW-6_W					MW-6_W				
		Sample Name	MW-6-5_071824					MW-6-6_071824					MW-6-7_071824					MW-6-7_DUP_071824				
		Sample Description	Sample collected from MW-6_W					Sample collected from MW-6_W					Sample collected from MW-6_W					Sample collected from MW-6_W				
		Sample Date	07/18/2024					07/18/2024					07/18/2024					07/18/2024				
		Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633				
		Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																						
Perfluoroalkyl sulfonic acids																						
Perfluorobutanesulfonic Acid (PFBS)	PFBS	ng/l	200		1.2	4.9	1	180		0.91	3.6	1	170		0.39	1.6	1	174		0.39	1.6	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	ng/l	NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	ng/l	***570***		1.3	4.9	1	***560***		0.94	3.6	1	***510***		0.81	3.1	2	***543***		0.81	3.2	2
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	ng/l	NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	ng/l	***84***		1.2	*4.9*	1	***95***		0.91	3.6	1	***130***		0.39	1.6	1	***146***		0.39	1.6	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	ng/l	NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	ng/l	NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	ng/l	NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																						
Perfluorobutanoic acid (PFBA)	PFBA	ng/l	NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	ng/l	NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	ng/l	NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	ng/l	NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	ng/l	***23***		1.2	*4.9*	1	***19***		0.91	3.6	1	***12***		0.39	1.6	1	***16.4***	F	0.39	1.6	1
Perfluorononanoic Acid (PFNA)	**PFNA**	ng/l	ND	U	1.2	4.9	1	ND	U	0.91	3.6	1	ND	U	0.39	1.6	1	ND	U	0.39	1.6	1
Perfluorodecanoic Acid (PFDA)	PFDA	ng/l	NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	ng/l	NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	ng/l	NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	ng/l	NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	ng/l	NA					NA					NA					NA				
Fluorotelomer carboxylic acids																						
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	ng/l	NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	ng/l	NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																						
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																						
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	ng/l	NA					NA					NA					NA				
Perfluorooctane sulfonamides																						
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	ng/l	NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	ng/l	NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	ng/l	NA					NA					NA					NA				
Fluorotelomer sulfonic acids																						
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	ng/l	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	ng/l	NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	ng/l	NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																						
Perfluoro-3-methoxypropanoic acid	PFMPA	ng/l	NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	ng/l	NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	ng/l	NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	ng/l	ND	U	4.9	*20*	1	ND	U	3.6	*15*	1	ND	U	1.6	6.3	1	ND	U	1.6	6.3	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	ng/l	NA					NA					NA					NA				
Ether sulfonic acids																						
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	ng/l	NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	ng/l	NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	ng/l	NA					NA					NA					NA				

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	MW-6_W					MW-6_W					MW-6_W					MW-6_W					MW-6_W					MW-6_W					MW-6_W					MW-6_W				
					Sample Name	MW-6-1_123024					MW-6-2_123024					DUP-1_123024					MW-6-3_123024					MW-6-4_123024					MW-6-5_123024					MW-6-6_123024					MW-6-7_123024				
					Sample Description	Sample collected from MW-6_W					Sample collected from MW-6_W					Sample collected from MW-6_W					Sample collected from MW-6_W					Sample collected from MW-6_W					Sample collected from MW-6_W					Sample collected from MW-6_W					Sample collected from MW-6_W				
					Sample Date	12/30/2024					12/30/2024					12/30/2024					12/30/2024					12/30/2024					12/30/2024					12/30/2024					12/30/2024				
					Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 1633				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																													
Perfluoroalkyl sulfonic acids																																													
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	3.66		0.49	1.46	1	17.7		0.524	1.56	1	18.8		0.49	1.46	1	30.3		0.543	1.62	1	227		0.468	1.4	1	207		0.527	1.57	1	204		0.521	1.56	1	224		0.524	1.56	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	8.92		0.49	1.46	1	***47.9***		0.524	1.56	1	***51.9***		0.49	1.46	1	***101***		0.543	1.62	1	***649***		2.34	6.99	5	***706***		2.63	7.86	5	***601***		2.61	7.78	5	***694***		2.62	7.82	5
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***6.35***		0.49	1.46	1	***68.1***		0.524	1.56	1	***60.5***		0.49	1.46	1	***198***		0.543	1.62	1	***866***		2.34	*6.99*	5	***160***		0.527	1.57	1	***181***		0.521	1.56	1	***79.2***		0.524	1.56	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroalkyl carboxylic acids																																													
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	*1.33*	J	0.49	1.46	1	***6.68***		0.524	1.56	1	***7.03***		0.49	1.46	1	***13.8***		0.543	1.62	1	***54***		0.468	1.4	1	***27.1***		0.527	1.57	1	***26.8***		0.521	1.56	1	***20.4***		0.524	1.56	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U	0.49	1.46	1	0.61	J	0.524	1.56	1	0.512	J	0.49	1.46	1	1.66		0.543	1.62	1	2.92		0.468	1.4	1	ND	U	0.527	1.57	1	ND	U	0.521	1.56	1	ND	U	0.524	1.56	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer carboxylic acids																																													
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																													
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																													
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctane sulfonamides																																													
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Fluorotelomer sulfonic acids																																													
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Per- and Polyfluoroether carboxylic acids																																													
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	1.95	5.85	1	ND	U	2.09	6.25	1	ND	U	1.95	5.85	1	ND	U	2.16	6.49	1	ND	U	1.87	5.59	1	ND	U	2.1	6.29	1	ND	U	2.08	6.22	1	ND	U	2.09	6.26	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
Ether sulfonic acids																																													
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	NA					NA					NA					NA					NA					NA					NA					NA				

Table 2
Summary of PFAS Analytical Results for PAB Groundwater Wells
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Notes:

EPA - Environmental Protection Agency
MCL - Maximum Contaminant Level
CAS - Chemical Abstract Service
NS - No standard
ng/l - Nanogram per liter (parts per trillion (ppt))
ND - Not detected
DUP - Duplicate sample collected for quality control purposes
Q - Qualifier
MDL - Method Detection Limit
RL - Reporting Limit
DF - Dilution Factor

Qualifiers:

J - The analyte was positively identified but the associated numerical value is approximate.

U – The analyte was not detected above the method detection limit, or the analyte detection is impacted by blank contamination and qualified as non-detect in accordance with the applicable validation guidelines.

UJ - The analyte was not detected at or above the method detection limit. The method detection limit may be imprecise because of potential low or indeterminate bias.

Exceedance Summary:

Bold - Result exceeds EPA's Maximum Contaminant Levels (MCLs) for public drinking water
Italics - Result exceeds EPA's Tap Water Regional Screening Exceendence for tap water

Table 3
Summary of PFAS Analytical Results for PAB Wastewater
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	Hatchery 2 Influent Wastewater					Boiler Room Effluent Wastewater					Truck Wash Bay Wastewater					Soybean Process Pit Wastewater					Oil Refinery Wash Bay Wastewater					Oil Refinery Process Pit Influent Wastewater					Oil Refinery Process Pit Influent Wastewater					Comingled Manhole				
					Sample Name	HATCHERY_2_020724					BOILER_ROOM_020724					GARAGE_WASHBAY_020724					SBP_PIT_020724					OR_WASHBAY_020724					MD0000060-INF1_122823					FB-MD0000060-INF1_122823					MD0000060-INF2_122823				
					Sample Description	Sample collected from Sanitary influent					Sample collected from Boiler Room Effluent					Sample collected from Truck Washbay					Sample collected from Soybean Crush Plant Pit					Sample collected from Soybean Oil Refinery Washbay					Sample collected from Soybean Oil Refinary Process Pit Sump					Field blank sample collected near Soybean Oil Refinary Process Pit					Sample collected from Comingled Manhole				
					Sample Date	02/07/2024					02/07/2024					02/07/2024					02/07/2024					02/07/2024					12/28/2023					12/28/2023					12/28/2023				
					Analysis Method	Method 537 IDA					Method 537 IDA					Method 537 IDA					Method 537 IDA					Method 537 IDA					Method 1633					Method 1633					Method 1633				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																													
Perfluoroalkyl sulfonic acids																																													
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	1.5	J	0.25	1.7	1	3.2		0.26	1.7	1	1.9		0.25	1.7	1	1.1	J	0.26	1.7	1	ND	U	3	20	1	1.57	J		2	1	ND	U		2	1	11			2	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	1.5	J	0.25	1.7	1	2.4		0.26	1.7	1	1.5	J	0.25	1.7	1	0.62	J	0.26	1.7	1	ND	U	3	20	1	10.3			8	1	ND	U		8	1	12			8	1
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	9.8		0.17	1.7	1	**16**		0.17	1.7	1	9.1		0.17	1.7	1	3		0.17	1.7	1	6.4	J	2	*20*	1	4.45			2	1	ND	U		2	1	***91.1***			2	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	0.33	J	0.25	1.7	1	0.87	J	0.26	1.7	1	0.28	J	0.25	1.7	1	ND	U	0.26	1.7	1	ND	U	3	20	1	0.882	J		2	1	ND	U		2	1	16			2	1
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***25***	I	0.42	1.7	1	***26***		0.43	1.7	1	***50***		0.41	1.7	1	***24***		0.43	1.7	1	***12***	J	*5*	*20*	1	***11.1***			2	1	ND	U		2	1	***998***			2	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U		2	1	ND	U		2	1	3.07			2	1
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluoroalkyl carboxylic acids																																													
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	88		0.84	1.7	1	ND	U	0.86	1.7	1	74		0.83	1.7	1	93		0.86	1.7	1	ND	U	10	20	1	61.6			8	1	ND	U		8	1	11.4			8	1
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	ND	U	0.25	1.7	1	3.4		0.26	1.7	1	13		0.25	1.7	1	3.9		0.26	1.7	1	4.8	J	3	20	1	7.89			4	1	ND	U		4	1	52.7			4	1
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	8.4		0.84	1.7	1	6.4	I	0.86	1.7	1	22	I	0.83	1.7	1	15	I	0.86	1.7	1	30	I	10	20	1	15.6			2	1	ND	U		2	1	45.3			2	1
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	2.5		0.25	1.7	1	1.7		0.26	1.7	1	3.7		0.25	1.7	1	1.1	J	0.26	1.7	1	ND	U	3	20	1	ND	U		2	1	ND	U		2	1	13.7			2	1
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	**4**		0.25	1.7	1	*3*		0.26	1.7	1	***5.6***		0.25	1.7	1	*1.6*	J	0.26	1.7	1	*3.4*	J	3	*20*	1	***4.64***			2	1	ND	U		2	1	***24.9***			2	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	0.35	J	0.17	1.7	1	ND	U	0.17	1.7	1	1.3	J	0.17	1.7	1	0.36	J	0.17	1.7	1	ND	U	2	*20*	1	4.38			2	1	ND	U		2	1	2.1			2	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	ND	U	0.25	1.7	1	ND	U	0.26	1.7	1	*0.75*	J	0.25	1.7	1	*0.35*	J	0.26	1.7	1	ND	U	3	20	1	ND	U		2	1	ND	U		2	1	*3.48*			2	1
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	ND	U	0.25	1.7	1	ND	U	0.26	1.7	1	0.32	J	0.25	1.7	1	ND	U	0.26	1.7	1	ND	U	3	20	1	1.53	J		2	1	ND	U		2	1	ND	U		2	1
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	ND	U	0.34	1.7	1	ND	U	0.34	1.7	1	ND	U	0.33	1.7	1	ND	U	0.35	1.7	1	ND	U	4	20	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	NA					NA					NA					NA					NA					ND	U		2	1	ND	U		2	1	ND	U		2	1
Fluorotelomer carboxylic acids																																													
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U		10	1	ND	U		10	1	ND	U		10	1
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U		50	1	ND	U		50	1	ND	U		50	1
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U		50	1	ND	U		50	1	ND	U		50	1
Perfluorooctane sulfonamide ethanols																																													
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U		20	1	ND	U		20	1	ND	U		20	1
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	NA					NA					NA					NA					NA					16.9	J		20	1	ND	U		20	1	ND	U		20	1
Perfluorooctane sulfonamidoacetic acids																																													
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U		2	1	ND	U		2	1	ND	U		2	1
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorooctane sulfonamides																																													
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	NA					NA					NA					NA					NA					0.51	J		2	1	ND	U		2	1	ND	U		2	1
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	NA					NA					NA					NA					NA					ND	U		2	1	ND	U		2	1	0.747	J		2	1
Fluorotelomer sulfonic acids																																													
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	ND	U	0.42	1.7	1	ND	U	0.43	1.7	1	ND	U	0.41	1.7	1	ND	U	0.43	1.7	1	ND	U	5	20	1	5.69	J		8	1	ND	U		8	1	ND	U		8	1
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	2.3		0.42	1.7	1	1.4	J	0.43	1.7	1	3.4		0.41	1.7	1	2.7		0.43	1.7	1	ND	U	5	20	1	ND	U		8	1	ND	U		8	1	206			8	1
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	ND	U	0.5	1.7	1	ND	U	0.51	1.7	1	0.95	J	0.5	1.7	1	2.5		0.52	1.7	1	ND	U	6	20	1	ND	U		8	1	ND	U		8	1	67.4			8	1
Per- and Polyfluoroether carboxylic acids																																													
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	ND	U	0.25	1.7	1	ND	U	0.26	1.7	1	ND	U	0.25	1.7	1	ND	U	0.26	1.7	1	ND	U	3	20	1	14.6			4	1	ND	U		4	1	ND	U		4	1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	ND	U	0.25	1.7	1	ND	U	0.26	1.7	1	ND	U	0.25	1.7	1	ND	U	0.26	1.7	1	ND	U	3	20	1	1.13	J		4	1	ND	U		4	1	ND	U		4	1
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	ND	U	0.25	1.7	1	ND	U	0.26	1.7	1	ND	U	0.25	1.7	1	ND	U	0.26	1.7	1	ND	U	3	20	1	13.1			10	1	ND	U		10	1	ND	U		10	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	0.34	1.7	1	ND	U	0.34	1.7	1	ND	U	0.33	1.7	1	ND	U	0.35	1.7	1	ND	U	4	*20*	1	*4.21*	J		8	1	ND	U		8	1	ND	U		8	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	ND	U	0.42	1.7	1	ND	U	0.43	1.7	1	ND	U	0.41	1.7	1	ND	U	0.43	1.7	1	ND	U	5	20	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
Ether sulfonic acids																																													
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	ND	U	0.25	1.7	1	ND	U	0.26	1.7	1	ND	U	0.25	1.7	1	ND	U	0.26	1.7	1	ND	U	3	20	1	ND	U		10	1	ND	U		10	1	ND	U		10	1
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	ND	U	0.42	1.7	1	ND	U	0.43	1.7	1	ND	U	0.41	1.7	1	ND	U	0.43	1.7	1	ND	U	5	20	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	ND	U	0.42	1.7	1	ND	U	0.43	1.7	1	ND	U	0.41	1.7	1	ND	U	0.43	1.7	1	ND	U	5	20	1	ND	U		4	1	ND	U		4	1	ND	U		4	1

Table 3
Summary of PFAS Analytical Results for PAB Wastewater
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	Comingled Manhole					Comingled Manhole					Main Lift Station Influent Wastewater					Main Lift Station Influent Wastewater					Main Lift Station Influent Wastewater					Emergency Lagoon Sludge					Emergency Lagoon Water					Sewage Sludge Pile				
					Sample Name	FB-MD0000060-INF2_122823					CMANHOLE_WB_121324					MD0000060-INF-PW_080823					MD0000060-INF3_122823					FB-MD0000060-INF3_122823					EMERGENCY_LAGOON_SLUDGE_020724					EMERGENCY_LAGOON_WW_020724					SANITARY_SLUDGE_SL_020724				
					Sample Description	Field blank sample collected near Comingled Manhole					Sample collected from Comingled Manhole					Sample taken from Main Lift Station Influent					Sample taken from Main Lift Station Influent					Field blank sample taken from Main Lift Station Influent					Sample collected from Emergency Lagoon sludge					Sample collected from Emergency Lagoon Waste Water					Sample collected from Sewage Sludge				
					Sample Date	12/28/2023					12/13/2024					08/08/2023					12/28/2023					12/28/2023					02/07/2024					02/07/2024					02/07/2024				
					Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633					Method 1633					Method 537 IDA					Method 537 IDA					Method 537 IDA				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																													
Perfluoroalkyl sulfonic acids																																													
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	ND	U		2	1	3.34		0.506	1.51	1	19.8			2	1	3.01			2	1	ND	U		2	1	4.3		0.27	1.8	1	4.6		0.25	1.6	1	5.8		0.32	2.2	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	ND	U		8	1	2.01		0.506	1.51	1	22.2			8	1	4.12	J		8	1	ND	U		8	1	7		0.27	1.8	1	ND	U	0.25	1.6	1	4.5		0.32	2.2	1
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	ND	U		2	1	**16.7**		0.506	1.51	1	***147***			2	1	8.01			2	1	ND	U		2	1	***45***		0.18	1.8	1	***49***		0.16	1.6	1	**32**		0.22	2.2	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	ND	U		2	1	1.51		0.506	1.51	1	17.7			2	1	0.634	J		2	1	ND	U		2	1	2.4		0.27	1.8	1	2.4		0.25	1.6	1	1.8	J	0.32	2.2	1
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	ND	U		2	1	***42***		0.506	1.51	1	***1500***			2	1	***13.9***			2	1	ND	U		2	1	***96***		0.45	1.8	1	***110***		0.41	1.6	1	***110***		0.54	2.2	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	0.619	J		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA				
Perfluoroalkyl carboxylic acids																																													
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	ND	U		8	1	3.49	J	2.01	6.04	1	47.9			8	1	ND	U		8	1	ND	U		8	1	32		0.91	1.8	1	ND	U	0.82	1.6	1	80		1.1	2.2	1
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	ND	U		4	1	11.6		1	3.02	1	72.5			4	1	7.23			4	1	ND	U		4	1	71		0.27	1.8	1	72		0.25	1.6	1	390		0.32	2.2	1
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	ND	U		2	1	7.46		0.506	1.51	1	65.6			2	1	5.28			2	1	ND	U		2	1	60		0.91	1.8	1	58		0.82	1.6	1	300		1.1	2.2	1
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	ND	U		2	1	ND	U	5.06	15.1	10	28.1			2	1	8.11			2	1	ND	U		2	1	34		0.27	1.8	1	35		0.25	1.6	1	120		0.32	2.2	1
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	ND	U		2	1	***7.12***		0.506	1.51	1	***33.2***			2	1	***4.53***			2	1	ND	U		2	1	***38***		0.27	1.8	1	***33***		0.25	1.6	1	***110***		0.32	2.2	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	4.68			2	1	ND	U		2	1	ND	U		2	1	*8.9*		0.18	1.8	1	*9.2*		0.16	1.6	1	***12***		0.22	2.2	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	*3.46*			2	1	ND	U		2	1	ND	U		2	1	*5.5*		0.27	1.8	1	*4.8*		0.25	1.6	1	*2*	J	0.32	2.2	1
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	0.93	J	0.27	1.8	1	0.88	J	0.25	1.6	1	ND	U	0.32	2.2	1
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	1.02	J		2	1	ND	U		2	1	ND	U		2	1	ND	U	0.36	1.8	1	ND	U	0.33	1.6	1	ND	U	0.43	2.2	1
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA				
Fluorotelomer carboxylic acids																																													
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	ND	U		10	1	ND	U	2.51	7.55	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	NA					NA					NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	ND	U		50	1	ND	U	12.6	37.7	1	ND	U		50	1	ND	U		50	1	ND	U		50	1	NA					NA					NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	ND	U		50	1	ND	U	12.6	37.7	1	ND	U		50	1	ND	U		50	1	ND	U		50	1	NA					NA					NA				
Perfluorooctane sulfonamide ethanols																																													
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	ND	U		20	1	ND	U	5.06	15.1	1	ND	U		20	1	ND	U		20	1	ND	U		20	1	NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	ND	U		20	1	ND	U	5.06	15.1	1	ND	U		20	1	ND	U		20	1	ND	U		20	1	NA					NA					NA				
Perfluorooctane sulfonamidoacetic acids																																													
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA				
Perfluorooctane sulfonamides																																													
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	0.45	J		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	ND	U		2	1	ND	U	0.506	1.51	1	0.881	J		2	1	ND	U		2	1	ND	U		2	1	NA					NA					NA				
Fluorotelomer sulfonic acids																																													
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	ND	U		8	1	ND	UJ	2.01	6.04	1	3.21	J		8	1	ND	U		8	1	ND	U		8	1	ND	U	0.45	1.8	1	ND	U	0.41	1.6	1	ND	U	0.54	2.2	1
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	ND	U		8	1	ND	UJ	4.54	6.04	1	355			8	1	1.44	J		8	1	ND	U		8	1	53		0.45	1.8	1	47		0.41	1.6	1	64		0.54	2.2	1
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	ND	U		8	1	ND	U	2.01	6.04	1	75.1			8	1	ND	U		8	1	ND	U		8	1	16		0.54	1.8	1	12		0.49	1.6	1	1.1	J	0.65	2.2	1
Per- and Polyfluoroether carboxylic acids																																													
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	ND	U		4	1	ND	U	1	3.02	1	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U	0.27	1.8	1	ND	U	0.25	1.6	1	ND	U	0.32	2.2	1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	ND	U		4	1	ND	U	1	3.02	1	1.13	J		4	1	ND	U		4	1	ND	U		4	1	ND	U	0.27	1.8	1	ND	U	0.25	1.6	1	ND	U	0.32	2.2	1
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	ND	U		10	1	ND	U	1	3.02	1	18.3			10	1	ND	U		10	1	ND	U		10	1	24	I	0.27	1.8	1	ND	U	0.25	1.6	1	1.2	JI	0.32	2.2	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U		8	1	ND	U	2.01	6.04	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U	0.36	1.8	1	ND	U	0.33	1.6	1	0.52	JI	0.43	2.2	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	ND	U		8	1	ND	U	2.01	6.04	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U	0.45	1.8	1	ND	U	0.41	1.6	1	ND	U	0.54	2.2	1
Ether sulfonic acids																																													
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	ND	U		10	1	ND	U	1	3.02	1	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U	0.27	1.8	1	ND	U	0.25	1.6	1	ND	U	0.32	2.2	1
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	ND	U		8	1	ND	U	2.01	6.04	1	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U	0.45	1.8	1	ND	U	0.41	1.6	1	ND	U	0.54	2.2	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	ND	U		4	1	ND	U	2.01	6.04	1	ND	U		8	1	ND	U		4	1	ND	U		4	1	ND	U	0.45	1.8	1	ND	U	0.41	1.6	1	ND	U	0.54	2.2	1

Table 3
Summary of PFAS Analytical Results for PAB Wastewater
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	USEPA Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	DAF Influent					DAF Effluent					DAF Effluent					DAF Sludge				
					Sample Name	MD0000060-INF-WW_080823					MD0000060-SOL2_122823					FB-MD0000060-SOL2_122823					DAF_SLUDGE_SL_020724				
					Sample Description	Sample collected from Influent Waste Water					Sample collected from DAF effluent					Field blank sample collected near DAF effluent					Sample collected from DAF sludge				
					Sample Date	08/08/2023					12/28/2023					12/28/2023					02/07/2024				
					Analysis Method	Method 1633					Method 1633					Method 1633					Method 537 IDA				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																									
Perfluoroalkyl sulfonic acids																									
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	45.3			2	1	4.32			2	1	ND	U		2	1	4.8	J	3	20	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	75.4			8	1	4.43	J		8	1	ND	U		8	1	8.2	JI	3	20	1
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	***319***			2	1	**22.6**			2	1	ND	U		2	1	***55***		2	*20*	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	56.5			2	1	2.24			2	1	ND	U		2	1	4.9	J	3	20	1
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	***1670***			2	1	***49.5***			2	1	ND	U		2	1	***360***		*5*	*20*	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA				
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA				
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	NA				
Perfluoroalkyl carboxylic acids																									
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	78.9			8	1	3.87	J		8	1	ND	U		8	1	23		10	20	1
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	460			4	1	14.1			4	1	ND	U		4	1	26		3	20	1
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	186			2	1	11.6			2	1	ND	U		2	1	27		10	20	1
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	99			2	1	4.91			2	1	ND	U		2	1	11	J	3	20	1
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	***160***			2	1	***8.45***			2	1	ND	U		2	1	***18***	J	3	*20*	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	***20.7***			2	1	ND	U		2	1	ND	U		2	1	4.7	J	2	*20*	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	*7.5*			2	1	ND	U		2	1	ND	U		2	1	*3*	J	3	20	1
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U	3	20	1
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	1.39	J		2	1	ND	U		2	1	ND	U		2	1	ND	U	4	20	1
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	1.49	J		2	1	ND	U		2	1	ND	U		2	1	NA				
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	1.01	J		2	1	ND	U		2	1	ND	U		2	1	NA				
Fluorotelomer carboxylic acids																									
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	ND	U		10	1	ND	U		10	1	ND	U		10	1	NA				
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	ND	U		50	1	ND	U		50	1	ND	U		50	1	NA				
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	ND	U		50	1	ND	U		50	1	ND	U		50	1	NA				
Perfluorooctane sulfonamide ethanols																									
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	ND	U		20	1	ND	U		20	1	ND	U		20	1	NA				
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	173			20	1	ND	U		20	1	ND	U		20	1	NA				
Perfluorooctane sulfonamidoacetic acids																									
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	0.57	J		2	1	ND	U		2	1	ND	U		2	1	NA				
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	0.617	J		2	1	ND	U		2	1	ND	U		2	1	NA				
Perfluorooctane sulfonamides																									
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	0.568	J		2	1	ND	U		2	1	ND	U		2	1	NA				
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	1.19	J		2	1	ND	U		2	1	ND	U		2	1	NA				
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	4.05			2	1	ND	U		2	1	ND	U		2	1	NA				
Fluorotelomer sulfonic acids																									
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U	5	20	1
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	24.1			8	1	48.5			8	1	3.71	J		8	1	46		5	20	1
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	6.3	J		8	1	2.66	J		8	1	ND	U		8	1	14	J	6	20	1
Per- and Polyfluoroether carboxylic acids																									
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	ND	U		4	1	2.69	J		4	1	ND	U		4	1	ND	U	3	20	1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U	3	20	1
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U	3	20	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U	4	*20*	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U	5	20	1
Ether sulfonic acids																									
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U	3	20	1
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U	5	20	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	ND	U		8	1	ND	U		4	1	ND	U		4	1	ND	U	5	20	1

Analyte	Location	RAS Effluent					RAS Effluent					Outfall 001 Sampling Chamber					Outfall 001 End of Pipe				
	Sample Name	MD0000060-SOL1_122823					FB-MD0000060-SOL1_122823					MD0000060-EFF_080823					MD0000060-EFF_122823				
	Sample Description	Sample collected from RAS effluent					Field blank sample collected near RAS effluent					Sample collected from Outfall 001 Sampling Chamber					Sample collected from Outfall 001 effluent				
	Sample Date	12/28/2023					12/28/2023					08/08/2023					12/28/2023				
	Analysis Method	Method 1633					Method 1633					Method 1633					Method 1633				
	Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																					
Perfluoroalkyl sulfonic acids																					
Perfluorobutanesulfonic Acid (PFBS)	ng/l	6.75			2	1	ND	U		2	1	61			2	1	3.88			2	1
Perfluoropentansulfonic Acid (PFPeS)	ng/l	4.81	J		8	1	ND	U		8	1	63			8	1	4.45	J		8	1
Perfluorohexanesulfonic Acid (PFHxS)	ng/l	***43.7***			2	1	ND	U		2	1	***319***			2	1	**23.4**			2	1
Perfluoroheptanesulfonic Acid (PFHpS)	ng/l	7.21			2	1	ND	U		2	1	22.8			2	1	3.03			2	1
Perfluorooctanesulfonic Acid (PFOS)	ng/l	***433***			2	1	ND	U		2	1	***694***			2	1	***123***			2	1
Perfluorononanesulfonic Acid (PFNS)	ng/l	0.434	J		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorodecanesulfonic Acid (PFDS)	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorododecanesulfonic Acid (PFDoS)	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluoroalkyl carboxylic acids																					
Perfluorobutanoic acid (PFBA)	ng/l	25.5			8	1	ND	U		8	1	59.6			8	1	8.74			8	1
Perfluoropentanoic Acid (PFPeA)	ng/l	170			4	1	ND	U		4	1	275			4	1	39.9			4	1
Perfluorohexanoic Acid (PFHxA)	ng/l	49.4			2	1	ND	U		2	1	163			2	1	21.6			2	1
Perfluoroheptanoic acid (PFHpA)	ng/l	109			2	1	ND	U		2	1	61			2	1	14.4			2	1
Perfluorooctanoic Acid (PFOA)	ng/l	***147***			2	1	ND	U		2	1	***40.5***			2	1	***4.4***			2	1
Perfluorononanoic Acid (PFNA)	ng/l	***38.4***			2	1	ND	U		2	1	3.3			2	1	ND	U		2	1
Perfluorodecanoic Acid (PFDA)	ng/l	*6.91*			2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluoroundecanoic Acid (PFUnA)	ng/l	0.896	J		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorododecanoic Acid (PFDoA)	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorotridecanoic Acid (PFTrDA)	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorotetradecanoic Acid (PFTeDA)	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Fluorotelomer carboxylic acids																					
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	ng/l	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	ng/l	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	ng/l	ND	U		50	1	ND	U		50	1	ND	U		50	1	ND	U		50	1
Perfluorooctane sulfonamide ethanols																					
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	ng/l	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	ng/l	ND	U		20	1	ND	U		20	1	ND	U		20	1	ND	U		20	1
Perfluorooctane sulfonamidoacetic acids																					
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorooctane sulfonamides																					
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	ng/l	ND	U		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	ng/l	0.395	J		2	1	ND	U		2	1	ND	U		2	1	ND	U		2	1
Perfluorooctanesulfonamide (PFOSA)	ng/l	0.56	J		2	1	ND	U		2	1	0.275	J		2	1	ND	U		2	1
Fluorotelomer sulfonic acids																					
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	ng/l	3.02	J		8	1	ND	U		8	1	4.25	J		8	1	ND	U		8	1
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
Per- and Polyfluoroether carboxylic acids																					
Perfluoro-3-methoxypropanoic acid	ng/l	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1
Perfluoro-4-methoxybutanoic acid	ng/l	ND	U		4	1	ND	U		4	1	ND	U		4	1	ND	U		4	1
Nonafluoro-3,6-dioxaheptanoic acid	ng/l	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
Ether sulfonic acids																					
Perfluoro(2-ethoxyethane)sulfonic acid	ng/l	ND	U		10	1	ND	U		10	1	ND	U		10	1	ND	U		10	1
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	ng/l	ND	U		8	1	ND	U		8	1	ND	U		8	1	ND	U		8	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	ng/l	ND	U		4	1	ND	U		4	1	ND	U		8	1	ND	U		4	1

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Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	**Abbreviation**	**CAS Number**	**USEPA Maximum Contaminant Levels (MCLs)**	**USEPA Tap Water Regional Screening Levels (ng/l)**	**Location**	**Outfall 001 End of Pipe**					**Outfall 001 Sampling Chamber**					**Outfall 001 Sampling Chamber**					**Outfall 001 Sampling Chamber**					**Outfall 001 Sampling Chamber**					**Outfall 001 Sampling Chamber**				
					Sample Name	**FB-MD0000060-EFF001_122823**					**WWTP_EFFLUENT_WB_112024**					**WWTP_OUTFALL001_GDPTOC_C1_121724**					**WWTP_OUTFALL001_GDPTOC_C2_121724**					**WWTP_OUTFALL001_GDPTOC_ C1_011525**					**WWTP_OUTFALL001_GDPTOC_C1_021225**				
					Sample Description	**Field blank sample collected near Outfall 001 effluent**					**Sample collected from Outfall 001 Sampling Chamber**					**Sample collected from Outfall 001 effluent**					**Sample collected from Outfall 001 effluent**					**Sample collected from Outfall 001 effluent**					**Sample collected from Outfall 001 effluent**				
					Sample Date	**12/28/2023**					**11/20/2024**					**12/17/2024**					**12/17/2024**					**01/15/2025**					**2/12/2025**				
					Analysis Method	**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**					**Method 1633**				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																			
Perfluoroalkyl sulfonic acids																																			
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	ND	U		2	1	6.25		0.535	1.6	1	3.9		0.496	1.48	1	4.43		0.491	1.46	1	2.74		0.501	1.5	1	3.02		0.514	1.53	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	ND	U		8	1	3.56		0.535	1.6	1	3.07		0.496	1.48	1	3.22		0.491	1.46	1	1.6		0.501	1.5	1	2.12		0.514	1.53	1
Perfluorohexanesulfonic Acid (PFHxS)	**PFHxS**	355-46-4	10	39	ng/l	ND	U		2	1	**25.4**		0.535	1.6	1	**21.7**		0.496	1.48	1	**20.8**		0.491	1.46	1	**10.9**		0.501	1.5	1	**16**		0.514	1.53	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	ND	U		2	1	1.32	J	0.535	1.6	1	1.47	J	0.496	1.48	1	1.44	J	0.491	1.46	1	0.59	J	0.501	1.5	1	0.759	J	0.514	1.53	1
Perfluorooctanesulfonic Acid (PFOS)	**PFOS**	1763-23-1	4	0.2	ng/l	ND	U		2	1	***39.4***		0.535	1.6	1	***47.7***		0.496	1.48	1	***48.8***		0.491	1.46	1	***19.2***		0.501	1.5	1	***27.9***		0.514	1.53	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
Perfluoroalkyl carboxylic acids																																			
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	ND	U		8	1	6.44		2.13	6.39	1	5.54	J	1.98	5.93	1	5.88		1.96	5.86	1	3.6	J	2	5.98	1	6.32		2.05	6.13	1
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	ND	U		4	1	21.1		1.06	3.2	1	20.6		0.986	2.96	1	21		0.974	2.93	1	11.7		0.994	2.99	1	22.4		1.02	3.07	1
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	ND	U		2	1	10.6		0.535	1.6	1	11.7		0.496	1.48	1	11.9		0.491	1.46	1	6.3		0.501	1.5	1	11.1		0.514	1.53	1
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	ND	U		2	1	8.31	J	5.35	16	10	6.35		0.496	1.48	1	6.27		0.491	1.46	1	2.87		0.501	1.5	1	5.1		0.514	1.53	1
Perfluorooctanoic Acid (PFOA)	**PFOA**	335-67-1	4	0.0027	ng/l	ND	U		2	1	***5.31***		0.535	1.6	1	***6.77***		0.496	1.48	1	***6.82***		0.491	1.46	1	*3.63*		0.501	1.5	1	***5***		0.514	1.53	1
Perfluorononanoic Acid (PFNA)	**PFNA**	375-95-1	10	5.9	ng/l	ND	U		2	1	0.807	J	0.535	1.6	1	0.719	J	0.496	1.48	1	1.04	J	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
Fluorotelomer carboxylic acids																																			
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3FTCA	356-02-5	NS	NS	ng/l	ND	U		10	1	ND	U	2.66	7.99	1	ND	U	2.47	7.41	1	ND	U	2.44	7.32	1	ND	U	2.49	7.48	1	ND	U	2.55	7.66	1
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	ND	U		50	1	ND	U	13.3	39.9	1	ND	U	12.4	37	1	ND	U	12.2	36.6	1	ND	U	12.5	37.4	1	ND	U	12.8	38.3	1
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	ND	U		50	1	ND	U	13.3	39.9	1	ND	U	12.4	37	1	ND	U	12.2	36.6	1	ND	U	12.5	37.4	1	ND	U	12.8	38.3	1
Perfluorooctane sulfonamide ethanols																																			
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	ND	U		20	1	ND	U	5.35	16	1	ND	U	4.96	14.8	1	ND	U	4.91	14.6	1	ND	U	5.01	15	1	ND	U	5.14	15.3	1
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	ND	U		20	1	ND	U	5.35	16	1	ND	U	4.96	14.8	1	ND	U	4.91	14.6	1	ND	U	5.01	15	1	ND	U	5.14	15.3	1
Perfluorooctane sulfonamidoacetic acids																																			
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	UJ	0.501	1.5	1	ND	U	0.514	1.53	1
Perfluorooctane sulfonamides																																			
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	ND	U		2	1	ND	U	0.535	1.6	1	ND	U	0.496	1.48	1	ND	U	0.491	1.46	1	ND	U	0.501	1.5	1	ND	U	0.514	1.53	1
Fluorotelomer sulfonic acids																																			
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	ND	U		8	1	ND	U	2.13	6.39	1	ND	UJ	1.98	5.93	1	ND	U	1.96	5.86	1	ND	U	2	5.98	1	ND	UJ	2.05	6.13	1
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	ND	U		8	1	ND	U	4.81	6.39	1	ND	UJ	4.46	5.93	1	ND	U	4.41	5.86	1	ND	U	4.5	5.98	1	ND	U	4.61	6.13	1
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	ND	U		8	1	ND	U	2.13	6.39	1	ND	U	1.98	5.93	1	ND	U	1.96	5.86	1	ND	U	2	5.98	1	ND	U	2.05	6.13	1
Per- and Polyfluoroether carboxylic acids																																			
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	ND	U		4	1	ND	U	1.06	3.2	1	ND	U	0.986	2.96	1	ND	U	0.974	2.93	1	ND	U	0.994	2.99	1	ND	U	1.02	3.07	1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	ND	U		4	1	ND	U	1.06	3.2	1	ND	U	0.986	2.96	1	ND	U	0.974	2.93	1	ND	U	0.994	2.99	1	ND	U	1.02	3.07	1
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	ND	U		10	1	ND	U	1.06	3.2	1	ND	U	0.986	2.96	1	ND	U	0.974	2.93	1	ND	U	0.994	2.99	1	ND	U	1.02	3.07	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U		8	1	ND	U	2.13	6.39	1	ND	U	1.98	5.93	1	ND	U	1.96	5.86	1	ND	U	2	5.98	1	ND	U	2.05	6.13	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	ND	U		8	1	ND	U	2.13	6.39	1	ND	U	1.98	5.93	1	ND	U	1.96	5.86	1	ND	U	2	5.98	1	ND	U	2.05	6.13	1
Ether sulfonic acids																																			
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	ND	U		10	1	ND	U	1.06	3.2	1	ND	U	0.986	2.96	1	ND	U	0.974	2.93	1	ND	U	0.994	2.99	1	ND	U	1.02	3.07	1
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	ND	U		8	1	ND	U	2.13	6.39	1	ND	U	1.98	5.93	1	ND	U	1.96	5.86	1	ND	U	2	5.98	1	ND	U	2.05	6.13	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	ND	U		4	1	ND	U	2.13	6.39	1	ND	U	1.98	5.93	1	ND	U	1.96	5.86	1	ND	U	2	5.98	1	ND	U	2.05	6.13	1

Table 3
Summary of PFAS Analytical Results for PAB Wastewater
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Notes:

EPA - Environmental Protection Agency
WWTP - Wastewaste Treatment Plant
POE - Point of Entry
DAF - Dissolved Air Flotation
RAS - Return Activated Sludge
PW - Process Water
WW - Waste Water
OR - Oil Refinery
MCL - Maximum Contaminant Level
CAS - Chemical Abstract Service
NS - No standard
ng/l - Nanogram per liter (parts per trillion (ppt))
ND - Not detected
DUP - Duplicate sample collected for quality control purposes
Q - Qualifier
MDL - Method Detection Limit
RL - Reporting Limit
DF - Dilution Factor

Qualifiers:

J - The analyte was positively identified but the associated numerical value is approximate.
U – The analyte was not detected above the method detection limit, or the analyte detection is impacted by blank contamination and qualified as non-detect in accordance with the applicable validation guidelines.
UJ - The analyte was not detected at or above the method detection limit. The method detection limit may be imprecise because of potential low or indeterminate bias.

Exceedance Summary:

Bold - Result exceeds EPA's Maximum Contaminant Levels (MCLs) for public drinking water
Italics - Result exceeds EPA's Tap Water Regional Screening Exceendence for tap water

Table 4
Expanded PFAS Analytical Results for Wastewater
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	EPA's Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	Hatchery 2 Influent Wastewater					Boiler Room Effluent Wastewater					Truck Wash Bay Wastewater					Soybean Process Pit Wastewater				
					Sample Name	HATCHERY_2_032024					BOILER_ROOM_032024					GARAGE_WASHBAY_032024					SBP_PIT_032024				
					Sample Date	03/20/2024					03/20/2024					03/20/2024					03/20/2024				
					Sample Description	Sample collected from Sanitary influent					Sample collected from Boiler Room Effluent					Sample taken from Truck Washbay					Sample collected from Soybean Crush Plant Pit				
					Analysis Method	Method 537 IDA					Method 537 IDA					Method 537 IDA					Method 537 IDA				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																									
Perfluoroalkyl sulfonic acids																									
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	2.1		0.26	1.7	1	4.3		0.26	1.8	1	4.8		0.26	1.7	1	2.1		0.26	1.8	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	1.2	J	0.26	1.7	1	2.6		0.26	1.8	1	2.1	I	0.26	1.7	1	1.3	J	0.26	1.8	1
Perfluorohexanesulfonic Acid (PFHxS)	PFHxS	355-46-4	10	39	ng/l	**11**		0.17	1.7	1	***19***		0.18	1.8	1	**18**		0.17	1.7	1	5.9		0.18	1.8	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	0.43	J	0.26	1.7	1	1.1	J	0.26	1.8	1	0.34	J	0.26	1.7	1	0.4	JI	0.26	1.8	1
Perfluorooctanesulfonic Acid (PFOS)	PFOS	1763-23-1	4	0.2	ng/l	***19***		0.44	1.7	1	***41***		0.44	1.8	1	***47***		0.43	1.7	1	***25***		0.44	1.8	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1	2.5		0.26	1.7	1	ND	U	0.26	1.8	1
Perfluoroalkyl carboxylic acids																									
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	84		0.87	1.7	1	12		0.88	1.8	1	34		0.85	1.7	1	38		0.88	1.8	1
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	7.3		0.26	1.7	1	5.3		0.26	1.8	1	8.9		0.26	1.7	1	8.3		0.26	1.8	1
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	8.8		0.87	1.7	1	9	I	0.88	1.8	1	18		0.85	1.7	1	14	I	0.88	1.8	1
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	2.6		0.26	1.7	1	2.5		0.26	1.8	1	7.9		0.26	1.7	1	2		0.26	1.8	1
Perfluorooctanoic Acid (PFOA)	PFOA	335-67-1	4	0.0027	ng/l	***5.2***		0.26	1.7	1	***4.4***		0.26	1.8	1	***9.9***		0.26	1.7	1	*2.5*		0.26	1.8	1
Perfluorononanoic Acid (PFNA)	PFNA	375-95-1	10	5.9	ng/l	0.33	J	0.17	1.7	1	ND	U	0.18	1.8	1	0.92	J	0.17	1.7	1	0.24	J	0.18	1.8	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	ND	U	0.34	1.7	1	ND	U	0.35	1.8	1
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	ND	U	0.34	1.7	1	ND	U	0.35	1.8	1
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	0.37	J	0.34	1.7	1	ND	U	0.35	1.8	1
Fluorotelomer carboxylic acids																									
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3 FTCA	356-02-5	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	0.78	JI	0.44	1.7	1	ND	U	0.44	1.8	1	0.65	J	0.43	1.7	1	ND	U	0.44	1.8	1
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	ND	U	0.96	1.7	1	ND	U	0.97	1.8	1	ND	U	0.94	1.7	1	ND	U	0.97	1.8	1
Perfluorooctane sulfonamide ethanols																									
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	2.7		0.34	1.7	1	ND	U	0.35	1.8	1
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	45		0.34	1.7	1	ND	U	0.35	1.8	1
Perfluorooctane sulfonamidoacetic acids																									
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	ND	U	0.34	1.7	1	ND	U	0.35	1.8	1
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
Perfluorooctane sulfonamides																									
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	ND	U	0.61	1.7	1	ND	U	0.62	1.8	1	ND	U	0.6	1.7	1	ND	U	0.62	1.8	1
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	ND	U	0.34	1.7	1	ND	U	0.35	1.8	1
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1
Fluorotelomer sulfonic acids																									
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	2.5		0.44	1.7	1	2.6		0.44	1.8	1	8.1		0.43	1.7	1	1.7	J	0.44	1.8	1
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	ND	U	0.52	1.7	1	ND	U	0.53	1.8	1	0.9	J	0.51	1.7	1	0.95	J	0.53	1.8	1

Table 4
Expanded PFAS Analytical Results for Wastewater
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	EPA's Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	Hatchery 2 Influent Wastewater					Boiler Room Effluent Wastewater					Truck Wash Bay Wastewater					Soybean Process Pit Wastewater				
					Sample Name	HATCHERY_2_032024					BOILER_ROOM_032024					GARAGE_WASHBAY_032024					SBP_PIT_032024				
					Sample Date	03/20/2024					03/20/2024					03/20/2024					03/20/2024				
					Sample Description	Sample collected from Sanitary influent					Sample collected from Boiler Room Effluent					Sample taken from Truck Washbay					Sample collected from Soybean Crush Plant Pit				
					Analysis Method	Method 537 IDA					Method 537 IDA					Method 537 IDA					Method 537 IDA				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																									
Per- and Polyfluoroalkyl carboxylic acids																									
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	8.6		0.26	1.7	1	ND	U	0.26	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	0.35	1.7	1	0.38	JI	0.35	1.8	1	1.2	J	0.34	1.7	1	1.2	JI	0.35	1.8	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
Ether sulfonic acids																									
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
Expanded Per- and Polyfluoroalkyl Substances																									
10:2 Fluorotelomer Carboxylic Acid 10:2 Fluorotelomer Carboxylic Acid	10:2 FTCA	53826-13-4	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
10:2 Fluorotelomer Unsaturated Carboxylic Acid	10:2 FTUCA	70887-94-4	NS	NS	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	ND	U	0.34	1.7	1	ND	U	0.35	1.8	1
1h,1h,2h,2h-Perfluorododecanesulfonic Acid (10:2)	10:2 FTS	120226-60-0	NS	NS	ng/l	ND	U	0.7	1.7	1	ND	U	0.7	1.8	1	0.69	J	0.68	1.7	1	0.75	J	0.7	1.8	1
-3(Methoxy)tetrafluoropropionic acid		93449-21-9	NS	NS	ng/l	240		0.52	1.7	1	ND	U	0.53	1.8	1	ND	U	0.51	1.7	1	6.7		0.53	1.8	1
-4(2-carboxy-1, 1,2,2-tetrafluoroethoxy)-2,2,3,3,4,5,5,5-octafluoro-pentanoic acid		2416366-22-6	NS	NS	ng/l	25		4.4	17	10	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	18		0.44	1.8	1
6:2 Fluorotelomer Carboxylic Acid	6:2 FTCA	53826-12-3	NS	NS	ng/l	ND	U	0.61	1.7	1	ND	U	0.62	1.8	1	2.5		0.6	1.7	1	ND	U	0.62	1.8	1
6:2 Fluorotelomer Unsaturated Carboxylic Acid	6:2 FTUCA	70887-88-6	NS	NS	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	1.9		0.34	1.7	1	1.2	J	0.35	1.8	1
8:2 Fluorotelomer Carboxylic Acid	8:2 FTCA	27854-31-5	NS	NS	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	ND	U	0.34	1.7	1	ND	U	0.35	1.8	1
8:2 Fluorotelomer Unsaturated Carboxylic Acid	8:2 FTUCA	70887-84-2	NS	NS	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	ND	U	0.34	1.7	1	ND	U	0.35	1.8	1
Nafion Byproduct 1	PFESA-BP1	29311-67-9	NS	NS	ng/l	ND	U	0.52	1.7	1	ND	U	0.53	1.8	1	ND	U	0.51	1.7	1	ND	U	0.53	1.8	1
Nafion Byproduct 2	PFESA-BP2	749836-20-2	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
Nafion Byproduct 4	PFESA-BP4	2416366-18-0	NS	NS	ng/l	ND	U	0.61	1.7	1	ND	U	0.62	1.8	1	ND	U	0.6	1.7	1	3.6		0.62	1.8	1
Nafion Byproduct 5	PFESA-BP5	2416366-19-1	NS	NS	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	ND	U	0.34	1.7	1	ND	U	0.35	1.8	1
Nafion Byproduct 6	PFESA-BP6	2416366-21-5	NS	NS	ng/l	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1
Perfluoro-2-methoxyacetic acid	PFMOAA	674-13-5	NS	NS	ng/l	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1	2.3		0.26	1.7	1	ND	U	0.26	1.8	1
Perfluoro-3,5,7,9,11-pentaoxadodecanoic acid	PFO5DoA	39492-91-6	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
perfluoro-3,5,7,9-tetraoxadecanoic acid	PFO4DA	39492-90-5	NS	NS	ng/l	ND	U	0.7	1.7	1	ND	U	0.7	1.8	1	ND	U	0.68	1.7	1	ND	U	0.7	1.8	1
perfluoro-3,5,7-trioxaoctanoic acid	PFO3OA	39492-89-2	NS	NS	ng/l	ND	U	0.87	1.7	1	ND	U	0.88	1.8	1	ND	U	0.85	1.7	1	ND	U	0.88	1.8	1
perfluoro-3,5-dioxahexanoic acid	PFO2HxA	39492-88-1	NS	NS	ng/l	18		0.61	1.7	1	ND	U	0.62	1.8	1	ND	U	0.6	1.7	1	22		0.62	1.8	1
Perfluoro-4-ethylcyclohexanesulfonic acid	PFEtCHxS	133201-07-7	NS	NS	ng/l	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.8	1
Perfluoro-4-isopropoxybutanoic acid	PF5OHxA	801212-59-9	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
Perfluoroethoxsypropanoic acid	Hydro-EVE Acid	773804-62-9	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
Perfluoroethoxypropionic acid	EVE Acid	69087-46-3	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
Perfluoroethoxypropyl carboxylic acid	PEPA	267239-61-2	NS	NS	ng/l	ND	U	0.52	1.7	1	ND	U	0.53	1.8	1	150		5.1	17	10	ND	U	0.53	1.8	1
Perfluoroethoxysulfonic acid		801209-99-4	NS	NS	ng/l	ND	U	0.35	1.7	1	ND	U	0.35	1.8	1	ND	U	0.34	1.7	1	ND	U	0.35	1.8	1
Perfluorohexadecanoic Acid	PFHxDA	67905-19-5	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
Perfluoromethoxypropyl carboxylic acid	PMPA	13140-29-9	NS	NS	ng/l	95		0.52	1.7	1	ND	U	0.53	1.8	1	1.2	J	0.51	1.7	1	5.1		0.53	1.8	1
Perfluorooctadecanoic Acid	PFODA	16517-11-6	NS	NS	ng/l	ND	U	0.44	1.7	1	ND	U	0.44	1.8	1	ND	U	0.43	1.7	1	ND	U	0.44	1.8	1
Perfluoropropanesulfonic acid	PFPrS	423-41-6	NS	NS	ng/l	22		0.35	1.7	1	1.1	J	0.35	1.8	1	6.8		0.34	1.7	1	0.95	J	0.35	1.8	1
Perfluoropropionic acid	PFPrA	422-64-0	NS	NS	ng/l	140		44	87	10	9.1		4.4	8.8	1	72		4.3	8.5	1	7.9	J	4.4	8.8	1

Table 4
Expanded PFAS Analytical Results for Wastewater
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	EPA's Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	**Location**	**Oil Refinery Wash Bay Wastewater**					**Comingled Manhole**					**Emergency Lagoon Sludge**					**Emergency Lagoon Wastewater**					**Sewage Sludge Pile**					**DAF Sludge**				
					Sample Name	**OR_WASHBAY_032024**					**COMBINED_FLOW_TO_MLS_032024**					**EL_SLUDGE_032024**					**EL_WW_032024**					**SANITARY_SLUDGE_032024**					**DAF_SLUDGE_032024**				
					Sample Date	**03/20/2024**					**03/20/2024**					**03/20/2024**					**03/20/2024**					**03/20/2024**					**03/20/2024**				
					Sample Description	**Sample collected from Soybean Oil Refinery Washbay**					**Sample collected from the Comingled Manhole**					**Sample collected from Emergency Lagoon sludge**					**Sample collected from Emergency Lagoon wastewater**					**Sample taken from Sewage Sludge Pile**					**Sample collected from DAF sludge**				
					Analysis Method	**Method 537 IDA**					**Method 537 IDA**					**Method 537 IDA**					**Method 537 IDA**					**Method 537 IDA**					**Method 537 IDA**				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																			
Perfluoroalkyl sulfonic acids																																			
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	NS	600	ng/l	1.8	J	0.29	1.9	1	8.6		0.27	1.8	1	5		0.26	1.7	1	5.1		0.26	1.7	1	6.8		0.39	2.6	1	5.6		0.36	2.4	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	NS	NS	ng/l	1.1	J	0.29	1.9	1	6.6		0.27	1.8	1	5.5		0.26	1.7	1	4.8		0.26	1.7	1	6.7		0.39	2.6	1	7.8		0.36	2.4	1
Perfluorohexanesulfonic Acid (PFHxS)	PFHxS	355-46-4	10	39	ng/l	8.9		0.19	1.9	1	***44***		0.18	1.8	1	***55***		0.17	1.7	1	***52***		0.17	1.7	1	***44***		0.26	2.6	1	***51***	I	0.24	2.4	1
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	NS	NS	ng/l	0.35	J	0.29	1.9	1	2.8		0.27	1.8	1	2.3		0.26	1.7	1	2.7		0.26	1.7	1	2.6		0.39	2.6	1	4.8	I	0.36	2.4	1
Perfluorooctanesulfonic Acid (PFOS)	PFOS	1763-23-1	4	0.2	ng/l	***19***		0.48	1.9	1	***190***		0.45	1.8	1	***150***		0.44	1.7	1	***130***		0.44	1.7	1	***170***		0.65	2.6	1	***210***		0.6	2.4	1
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	NS	NS	ng/l	ND	U	0.29	1.9	1	ND	U	0.27	1.8	1	0.28	J	0.26	1.7	1	ND	U	0.26	1.7	1	ND	U	0.39	2.6	1	ND	U	0.36	2.4	1
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	NS	NS	ng/l	ND	U	0.29	1.9	1	ND	U	0.27	1.8	1	0.34	J	0.26	1.7	1	ND	U	0.26	1.7	1	ND	U	0.39	2.6	1	ND	U	0.36	2.4	1
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	NS	NS	ng/l	ND	U	0.29	1.9	1	ND	U	0.27	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.7	1	ND	U	0.39	2.6	1	0.36	J	0.36	2.4	1
Perfluoroalkyl carboxylic acids																																			
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	NS	1800	ng/l	51		0.96	1.9	1	12		0.91	1.8	1	63		0.87	1.7	1	24		0.87	1.7	1	67		1.3	2.6	1	85		1.2	2.4	1
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	NS	NS	ng/l	4.5		0.29	1.9	1	8.5		0.27	1.8	1	60		0.26	1.7	1	63		0.26	1.7	1	310		0.39	2.6	1	34		0.36	2.4	1
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	NS	990	ng/l	14	I	0.96	1.9	1	16		0.91	1.8	1	73		0.87	1.7	1	60		0.87	1.7	1	230		1.3	2.6	1	34		1.2	2.4	1
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	NS	NS	ng/l	2.7		0.29	1.9	1	3.8		0.27	1.8	1	28		0.26	1.7	1	27		0.26	1.7	1	110		0.39	2.6	1	10		0.36	2.4	1
Perfluorooctanoic Acid (PFOA)	PFOA	335-67-1	4	0.0027	ng/l	***4.8***		0.29	1.9	1	***8.1***		0.27	1.8	1	***36***		0.26	1.7	1	***33***		0.26	1.7	1	***130***		0.39	2.6	1	***14***		0.36	2.4	1
Perfluorononanoic Acid (PFNA)	PFNA	375-95-1	10	5.9	ng/l	ND	U	0.19	1.9	1	0.31	J	0.18	1.8	1	***12***		0.17	1.7	1	***11***		0.17	1.7	1	***16***		0.26	2.6	1	2.9		0.24	2.4	1
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	NS	0.004	ng/l	ND	U	0.29	1.9	1	ND	U	0.27	1.8	1	*8.2*		0.26	1.7	1	*5.9*		0.26	1.7	1	3.8		0.39	2.6	1	2	J	0.36	2.4	1
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	NS	600	ng/l	ND	U	0.29	1.9	1	ND	U	0.27	1.8	1	1.9		0.26	1.7	1	1.3	J	0.26	1.7	1	ND	U	0.39	2.6	1	ND	U	0.36	2.4	1
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	NS	100	ng/l	ND	U	0.38	1.9	1	ND	U	0.36	1.8	1	0.48	J	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	ND	U	0.48	2.4	1
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	NS	NS	ng/l	ND	U	0.38	1.9	1	ND	U	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	ND	U	0.48	2.4	1
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	NS	2000	ng/l	ND	U	0.38	1.9	1	ND	U	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	ND	U	0.48	2.4	1
Fluorotelomer carboxylic acids																																			
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	3:3 FTCA	356-02-5	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	1.3	J	0.44	1.7	1	0.93	J	0.44	1.7	1	4.5		0.65	2.6	1	ND	U	0.6	2.4	1
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	5:3FTCA	914637-49-3	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	2.6	I	0.44	1.7	1	1.4	JI	0.44	1.7	1	14		0.65	2.6	1	ND	U	0.6	2.4	1
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	7:3FTCA	812-70-4	NS	NS	ng/l	ND	U	1.1	1.9	1	ND	U	1	1.8	1	1.1	J	0.96	1.7	1	ND	U	0.96	1.7	1	ND	U	1.4	2.6	1	5.5		1.3	2.4	1
Perfluorooctane sulfonamide ethanols																																			
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	NS	NS	ng/l	0.77	J	0.38	1.9	1	1.1	J	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	ND	U	0.48	2.4	1
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	NS	NS	ng/l	ND	U	0.38	1.9	1	ND	U	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	1.1	J	0.52	2.6	1	ND	U	0.48	2.4	1
Perfluorooctane sulfonamidoacetic acids																																			
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	NS	NS	ng/l	ND	U	0.38	1.9	1	ND	U	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	ND	U	0.48	2.4	1
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	ND	U	0.44	1.7	1	ND	U	0.44	1.7	1	ND	U	0.65	2.6	1	ND	U	0.6	2.4	1
Perfluorooctane sulfonamides																																			
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	NS	NS	ng/l	ND	U	0.67	1.9	1	ND	U	0.63	1.8	1	2.5		0.61	1.7	1	ND	U	0.61	1.7	1	ND	U	0.91	2.6	1	ND	U	0.84	2.4	1
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	NS	NS	ng/l	ND	U	0.38	1.9	1	ND	U	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	ND	U	0.48	2.4	1
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	NS	NS	ng/l	ND	U	0.29	1.9	1	ND	U	0.27	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.7	1	4		0.39	2.6	1	ND	U	0.36	2.4	1
Fluorotelomer sulfonic acids																																			
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	1.8	I	0.44	1.7	1	0.5	JI	0.44	1.7	1	ND	U	0.65	2.6	1	0.78	JI	0.6	2.4	1
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	NS	NS	ng/l	2.2		0.48	1.9	1	7.3		0.45	1.8	1	27		0.44	1.7	1	25		0.44	1.7	1	64		0.65	2.6	1	23		0.6	2.4	1
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	NS	NS	ng/l	ND	U	0.58	1.9	1	1.6	J	0.54	1.8	1	13		0.52	1.7	1	8.3		0.52	1.7	1	2.9		0.78	2.6	1	9.5		0.72	2.4	1

Table 4
Expanded PFAS Analytical Results for Wastewater
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Analyte	Abbreviation	CAS Number	EPA's Maximum Contaminant Levels (MCLs)	USEPA Tap Water Regional Screening Levels (ng/l)	Location	Oil Refinery Wash Bay Wastewater					Comingled Manhole					Emergency Lagoon Sludge					Emergency Lagoon Wastewater					Sewage Sludge Pile					DAF Sludge				
					Sample Name	OR_WASHBAY_032024					COMBINED_FLOW_TO_MLS_032024					EL_SLUDGE_032024					EL_WW_032024					SANITARY_SLUDGE_032024					DAF_SLUDGE_032024				
					Sample Date	03/20/2024					03/20/2024					03/20/2024					03/20/2024					03/20/2024					03/20/2024				
					Sample Description	Sample collected from Soybean Oil Refinery Washbay					Sample collected from the Comingled Manhole					Sample collected from Emergency Lagoon sludge					Sample collected from Emergency Lagoon wastewater					Sample taken from Sewage Sludge Pile					Sample collected from DAF sludge				
					Analysis Method	Method 537 IDA					Method 537 IDA					Method 537 IDA					Method 537 IDA					Method 537 IDA					Method 537 IDA				
					Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																																			
Per- and Polyfluoroalkyl carboxylic acids																																			
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NS	NS	ng/l	0.36	J	0.29	1.9	1	ND	U	0.27	1.8	1	1.4	J	0.26	1.7	1	1.8		0.26	1.7	1	ND	U	0.39	2.6	1	16		0.36	2.4	1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NS	NS	ng/l	ND	U	0.29	1.9	1	ND	U	0.27	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.7	1	ND	U	0.39	2.6	1	0.54	J	0.36	2.4	1
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NS	NS	ng/l	ND	U	0.29	1.9	1	ND	U	0.27	1.8	1	ND	U	0.26	1.7	1	0.69	JI	0.26	1.7	1	0.59	JI	0.39	2.6	1	31	I	0.36	2.4	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPO-DA	13252-13-6	10	1.5	ng/l	ND	U	0.38	1.9	1	0.67	J	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	0.88	JI	0.48	2.4	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	ND	U	0.44	1.7	1	ND	U	0.44	1.7	1	ND	U	0.65	2.6	1	ND	U	0.6	2.4	1
Ether sulfonic acids																																			
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NS	NS	ng/l	ND	U	0.29	1.9	1	ND	U	0.27	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.7	1	ND	U	0.39	2.6	1	ND	U	0.36	2.4	1
9-Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	ND	U	0.44	1.7	1	ND	U	0.44	1.7	1	ND	U	0.65	2.6	1	ND	U	0.6	2.4	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	ND	U	0.44	1.7	1	ND	U	0.44	1.7	1	ND	U	0.65	2.6	1	ND	U	0.6	2.4	1
Expanded Per- and Polyfluoroalkyl Substances																																			
10:2 Fluorotelomer Carboxylic Acid 10:2 Fluorotelomer Carboxylic Acid	10:2 FTCA	53826-13-4	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	ND	U	0.44	1.7	1	ND	U	0.44	1.7	1	ND	U	0.65	2.6	1	ND	U	0.6	2.4	1
10:2 Fluorotelomer Unsaturated Carboxylic Acid	10:2 FTUCA	70887-94-4	NS	NS	ng/l	ND	U	0.38	1.9	1	ND	U	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	ND	U	0.48	2.4	1
1h,1h,2h,2h-Perfluorododecanesulfonic Acid (10:2)	10:2 FTS	120226-60-0	NS	NS	ng/l	ND	U	0.77	1.9	1	ND	U	0.73	1.8	1	3.8	I	0.7	1.7	1	1.3	JI	0.7	1.7	1	ND	U	1	2.6	1	1	J	0.96	2.4	1
-3(Methoxy)tetrafluoropropionic acid		93449-21-9	NS	NS	ng/l	29		0.58	1.9	1	ND	U	0.54	1.8	1	11		0.52	1.7	1	3.8		0.52	1.7	1	1.1	J	0.78	2.6	1	6.8		0.72	2.4	1
-4(2-carboxy-1, 1,2,2-tetrafluoroethoxy)-2,2,3,3,4,5,5,5-octafluoro-pentanoic acid		2416366-22-6	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	13		0.44	1.7	1	12		0.44	1.7	1	ND	U	0.65	2.6	1	470		0.6	2.4	1
6:2 Fluorotelomer Carboxylic Acid	6:2 FTCA	53826-12-3	NS	NS	ng/l	ND	U	0.67	1.9	1	ND	U	0.63	1.8	1	ND	U	0.61	1.7	1	ND	U	0.61	1.7	1	ND	U	0.91	2.6	1	ND	U	0.84	2.4	1
6:2 Fluorotelomer Unsaturated Carboxylic Acid	6:2 FTUCA	70887-88-6	NS	NS	ng/l	ND	U	0.38	1.9	1	ND	U	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	1.3	J	0.48	2.4	1
8:2 Fluorotelomer Carboxylic Acid	8:2 FTCA	27854-31-5	NS	NS	ng/l	ND	U	0.38	1.9	1	ND	U	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	ND	U	0.48	2.4	1
8:2 Fluorotelomer Unsaturated Carboxylic Acid	8:2 FTUCA	70887-84-2	NS	NS	ng/l	ND	U	0.38	1.9	1	ND	U	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	ND	U	0.48	2.4	1
Nafion Byproduct 1	PFESA-BP1	29311-67-9	NS	NS	ng/l	ND	U	0.58	1.9	1	ND	U	0.54	1.8	1	ND	U	0.52	1.7	1	ND	U	0.52	1.7	1	ND	U	0.78	2.6	1	ND	U	0.72	2.4	1
Nafion Byproduct 2	PFESA-BP2	749836-20-2	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	ND	U	0.44	1.7	1	ND	U	0.44	1.7	1	ND	U	0.65	2.6	1	ND	U	0.6	2.4	1
Nafion Byproduct 4	PFESA-BP4	2416366-18-0	NS	NS	ng/l	ND	U	0.67	1.9	1	ND	U	0.63	1.8	1	5		0.61	1.7	1	ND	U	0.61	1.7	1	4.5		0.91	2.6	1	18		0.84	2.4	1
Nafion Byproduct 5	PFESA-BP5	2416366-19-1	NS	NS	ng/l	ND	U	0.38	1.9	1	ND	U	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	ND	U	0.48	2.4	1
Nafion Byproduct 6	PFESA-BP6	2416366-21-5	NS	NS	ng/l	ND	U	0.29	1.9	1	ND	U	0.27	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.7	1	ND	U	0.39	2.6	1	ND	U	0.36	2.4	1
Perfluoro-2-methoxyacetic acid	PFMOAA	674-13-5	NS	NS	ng/l	0.34	J	0.29	1.9	1	ND	U	0.27	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.7	1	ND	U	0.39	2.6	1	ND	U	0.36	2.4	1
Perfluoro-3,5,7,9,11-pentaoxadodecanoic acid	PFO5DoA	39492-91-6	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	ND	U	0.44	1.7	1	ND	U	0.44	1.7	1	ND	U	0.65	2.6	1	ND	U	0.6	2.4	1
perfluoro-3,5,7,9-tetraoxadecanoic acid	PFO4DA	39492-90-5	NS	NS	ng/l	ND	U	0.77	1.9	1	ND	U	0.73	1.8	1	ND	U	0.7	1.7	1	ND	U	0.7	1.7	1	ND	U	1	2.6	1	ND	U	0.96	2.4	1
perfluoro-3,5,7-trioxaoctanoic acid	PFO3OA	39492-89-2	NS	NS	ng/l	ND	U	0.96	1.9	1	ND	U	0.91	1.8	1	ND	U	0.87	1.7	1	ND	U	0.87	1.7	1	ND	U	1.3	2.6	1	ND	U	1.2	2.4	1
perfluoro-3,5-dioxahexanoic acid	PFO2HxA	39492-88-1	NS	NS	ng/l	68		0.67	1.9	1	6.7		0.63	1.8	1	25		0.61	1.7	1	14		0.61	1.7	1	2.1	J	0.91	2.6	1	11		0.84	2.4	1
Perfluoro-4-ethylcyclohexanesulfonic acid	PFEtCHxS	133201-07-7	NS	NS	ng/l	ND	U	0.29	1.9	1	ND	U	0.27	1.8	1	ND	U	0.26	1.7	1	ND	U	0.26	1.7	1	ND	U	0.39	2.6	1	ND	U	0.36	2.4	1
Perfluoro-4-isopropoxybutanoic acid	PF5OHxA	801212-59-9	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	ND	U	0.44	1.7	1	ND	U	0.44	1.7	1	ND	U	0.65	2.6	1	ND	U	0.6	2.4	1
Perfluoroethoxsypropanoic acid	Hydro-EVE Acid	773804-62-9	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	ND	U	0.44	1.7	1	ND	U	0.44	1.7	1	ND	U	0.65	2.6	1	ND	U	0.6	2.4	1
Perfluoroethoxypropionic acid	EVE Acid	69087-46-3	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	ND	U	0.44	1.7	1	ND	U	0.44	1.7	1	ND	U	0.65	2.6	1	ND	U	0.6	2.4	1
Perfluoroethoxypropyl carboxylic acid	PEPA	267239-61-2	NS	NS	ng/l	1.1	J	0.58	1.9	1	1.6	J	0.54	1.8	1	1.7		0.52	1.7	1	1.8		0.52	1.7	1	42		0.78	2.6	1	23		0.72	2.4	1
Perfluoroethoxysulfonic acid		801209-99-4	NS	NS	ng/l	ND	U	0.38	1.9	1	ND	U	0.36	1.8	1	ND	U	0.35	1.7	1	ND	U	0.35	1.7	1	ND	U	0.52	2.6	1	ND	U	0.48	2.4	1
Perfluorohexadecanoic Acid	PFHxDA	67905-19-5	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	ND	U	0.44	1.7	1	ND	U	0.44	1.7	1	ND	U	0.65	2.6	1	ND	U	0.6	2.4	1
Perfluoromethoxypropyl carboxylic acid	PMPA	13140-29-9	NS	NS	ng/l	7.3		0.58	1.9	1	ND	U	0.54	1.8	1	60		0.52	1.7	1	38		0.52	1.7	1	19		0.78	2.6	1	54		0.72	2.4	1
Perfluorooctadecanoic Acid	PFODA	16517-11-6	NS	NS	ng/l	ND	U	0.48	1.9	1	ND	U	0.45	1.8	1	ND	U	0.44	1.7	1	ND	U	0.44	1.7	1	ND	U	0.65	2.6	1	ND	U	0.6	2.4	1
Perfluoropropanesulfonic acid	PFPrS	423-41-6	NS	NS	ng/l	4.9		0.38	1.9	1	3.7		0.36	1.8	1	3.4		0.35	1.7	1	3.1		0.35	1.7	1	2.7		0.52	2.6	1	5.9		0.48	2.4	1
Perfluoropropionic acid	PFPrA	422-64-0	NS	NS	ng/l	9	J	4.8	9.6	1	110		4.5	9.1	1	15		4.4	8.7	1	18		4.4	8.7	1	37		6.5	13	1	12		6	12	1

Table 4
Expanded PFAS Analytical Results for Wastewater
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Notes:

EPA - Environmental Protection Agency
WWTP - Wastewaste Treatment Plant
POE - Point of Entry
DAF - Dissolved Air Flotation
RAS - Return Activated Sludge
PW - Process Water
WW - Waste Water
OR - Oil Refinery
MCL - Maximum Contaminant Level
CAS - Chemical Abstract Service
NS - No standard
ng/l - Nanogram per liter (parts per trillion (ppt))
ND - Not detected
DUP - Duplicate sample collected for quality control purposes
Q - Qualifier
MDL - Method Detection Limit
RL - Reporting Limit
DF - Dilution Factor
IDA - Initial Demonstration of Accuracy

Qualifiers:

J - The analyte was positively identified but the associated numerical value is approximate.
U – The analyte was not detected above the method detection limit, or the analyte detection is impacted by blank contamination and qualified as non-detect in accordance with the applicable validation guidelines.
UJ - The analyte was not detected at or above the method detection limit. The method detection limit may be imprecise because of potential low or indeterminate bias.

Exceedance Summary:

Bold - Result exceeds EPA's Maximum Contaminant Levels (MCLs) for public drinking water
Italics - Result exceeds EPA's Tap Water Regional Screening Exceendence for tap water

Table 5
Summary of PFAS Analytical Results for PAB
Wipe Samples of AFFF System Piping
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland

Analyte	Abbreviation	CAS Number	Location	AFFF System					AFFF System					AFFF System					AFFF System					AFFF System				
			Sample Name	**W-1_060324**					**W-2_060324**					**W-3_060324**					**W-4_060324**					**W-5_060324**				
			Sample Description	**Wipe sample collected from the AFFF System**					**Wipe sample collected from the AFFF System**					**Wipe sample collected from the AFFF System**					**Wipe sample collected from the AFFF System**					**Wipe sample collected from the AFFF System**				
			Sample Date	**06/03/2024**					**06/03/2024**					**06/03/2024**					**06/03/2024**					**06/03/2024**				
			Analysis Method	**Method 537M**					**Method 537M**					**Method 537M**					**Method 537M**					**Method 537M**				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Per- and Polyfluoroalkyl Substances																												
Perfluoroalkyl sulfonic acids																												
Perfluorobutanesulfonic Acid (PFBS)	PFBS	375-73-5	ng/wipe	54		4	4	10	260		4	4	10	ND	U	4	4	10	58		0.4	0.4	1	17		0.4	0.4	1
Perfluoropentansulfonic Acid (PFPeS)	PFPeS	2706-91-4	ng/wipe	140		4	4	10	190		4	4	10	ND	U	4	4	10	160		0.4	0.4	1	45		0.4	0.4	1
Perfluorohexanesulfonic Acid (PFHxS)	PFHxS	355-46-4	ng/wipe	1,400		4	4	10	1,400		4	4	10	43		4	4	10	7,900		40	40	100	2,300		40	40	100
Perfluoroheptanesulfonic Acid (PFHpS)	PFHpS	375-92-8	ng/wipe	160		4	4	10	240		4	4	10	14		4	4	10	730		4	4	10	190		0.4	0.4	1
Perfluorooctanesulfonic Acid (PFOS)	PFOS	1763-23-1	ng/wipe	31,000	E	40	40	100	41,000	E	40	40	100	4,200		40	40	100	130,000	E	40	40	100	110,000	E	40	40	100
Perfluorononanesulfonic Acid (PFNS)	PFNS	68259-12-1	ng/wipe	110		4	4	10	54		4	4	10	16		4	4	10	130		0.4	0.4	1	130		4	4	10
Perfluorodecanesulfonic Acid (PFDS)	PFDS	335-77-3	ng/wipe	130		4	4	10	55		4	4	10	25		4	4	10	120		4	4	10	120		4	4	10
Perfluorododecanesulfonic Acid (PFDoS)	PFDoS	79780-39-5	ng/wipe	200		4	4	10	97		4	4	10	40		4	4	10	86		0.4	0.4	1	89		0.4	0.4	1
Perfluoroalkyl carboxylic acids																												
Perfluorobutanoic acid (PFBA)	PFBA	375-22-4	ng/wipe	520		4	4	10	920		4	4	10	64		4	4	10	630		4	4	10	490		4	4	10
Perfluoropentanoic Acid (PFPeA)	PFPeA	2706-90-3	ng/wipe	740		4	4	10	1,400		4	4	10	86		4	4	10	1,200		4	4	10	880		4	4	10
Perfluorohexanoic Acid (PFHxA)	PFHxA	307-24-4	ng/wipe	4,000		40	40	100	9,200		40	40	100	430		4	4	10	16,000		40	40	100	9,300		40	40	100
Perfluoroheptanoic acid (PFHpA)	PFHpA	375-85-9	ng/wipe	890		4	4	10	1,900		4	4	10	110		4	4	10	3,000		40	40	100	1,600		4	4	10
Perfluorooctanoic Acid (PFOA)	PFOA	335-67-1	ng/wipe	1,200		4	4	10	2,000		4	4	10	240		4	4	10	9,600		40	40	100	5,500		40	40	100
Perfluorononanoic Acid (PFNA)	PFNA	375-95-1	ng/wipe	250		4	4	10	470		4	4	10	57		4	4	10	1,000		4	4	10	460		4	4	10
Perfluorodecanoic Acid (PFDA)	PFDA	335-76-2	ng/wipe	760		4	4	10	520		4	4	10	190		4	4	10	1,800		40	40	100	1,400		4	4	10
Perfluoroundecanoic Acid (PFUnA)	PFUnA	2058-94-8	ng/wipe	170		4	4	10	91		4	4	10	25		4	4	10	200		0.4	0.4	1	100		0.4	0.4	1
Perfluorododecanoic Acid (PFDoA)	PFDoA	307-55-1	ng/wipe	550		4	4	10	110		4	4	10	89		4	4	10	490		4	4	10	310		4	4	10
Perfluorotridecanoic Acid (PFTrDA)	PFTrDA	72629-94-8	ng/wipe	52		4	4	10	18		4	4	10	5.6		4	4	10	79		0.4	0.4	1	35		0.4	0.4	1
Perfluorotetradecanoic Acid (PFTeDA)	PFTeDA	376-06-7	ng/wipe	89		4	4	10	21		4	4	10	13		4	4	10	110		0.4	0.4	1	68		0.4	0.4	1
Perfluorohexadecanoic Acid	PFHxDA	67905-19-5	ng/wipe	25		4	4	10	4.6		4	4	10	ND	U	4	4	10	29		0.4	0.4	1	18		0.4	0.4	1
Perfluorooctadecanoic Acid	PFODA	16517-11-6	ng/wipe	5.2		4	4	10	ND	U	4	4	10	ND	U	4	4	10	6.5		0.4	0.4	1	4.7		0.4	0.4	1
Perfluorooctane sulfonamide ethanols																												
N-methyl Perfluorooctanesulfonamidoethanol (NMeFOSE)	NMeFOSE	24448-09-7	ng/wipe	30		4	4	10	4		4	4	10	ND	U	4	4	10	180		0.4	0.4	1	390		4	4	10
N-ethyl Perfluorooctanesulfonamidoethanol (NEtFOSE)	NEtFOSE	1691-99-2	ng/wipe	ND	U	4	4	10	ND	U	4	4	10	ND	U	4	4	10	12		0.4	0.4	1	19		0.4	0.4	1
Perfluorooctane sulfonamidoacetic acids																												
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	NMeFOSAA	2355-31-9	ng/wipe	15		4	4	10	ND	U	4	4	10	ND	U	4	4	10	12		0.4	0.4	1	29		0.4	0.4	1
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	NEtFOSAA	2991-50-6	ng/wipe	ND	U	4	4	10	ND	U	4	4	10	ND	U	4	4	10	0.63	I	0.4	0.4	1	1.2		0.4	0.4	1
Perfluorooctane sulfonamides																												
N-methyl Perfluorooctanesulfonamide (NMeFOSA)	NMeFOSA	31506-32-8	ng/wipe	16		4	4	10	ND	U	4	4	10	ND	U	4	4	10	17		0.4	0.4	1	30		0.4	0.4	1
N-ethyl Perfluorooctanesulfonamide (NEtFOSA)	NEtFOSA	4151-50-2	ng/wipe	ND	U	4	4	10	ND	U	4	4	10	ND	U	4	4	10	1.2		0.4	0.4	1	1.5		0.4	0.4	1
Perfluorooctanesulfonamide (PFOSA)	PFOSA	754-91-6	ng/wipe	3,100		40	40	100	180		4	4	10	140		4	4	10	2,300		40	40	100	1,400		4	4	10
Fluorotelomer sulfonic acids																												
1H,1H,2H,2H-Perfluorohexane Sulfonic Acid (4:2FTS)	4:2FTS	757124-72-4	ng/wipe	ND	U	4	4	10	ND	U	4	4	10	ND	U	4	4	10	8.2		0.4	0.4	1	6		0.4	0.4	1
1H,1H,2H,2H-Perfluorooctane Sulfonic Acid (6:2FTS)	6:2FTS	27619-97-2	ng/wipe	3,300		40	40	100	2,800		40	40	100	1,100		4	4	10	4,900		40	40	100	4,900		40	40	100
1H,1H,2H,2H-Perfluorodecane Sulfonic Acid (8:2FTS)	8:2FTS	39108-34-4	ng/wipe	3,100		40	40	100	1,200		40	40	100	1,900		40	40	100	4,100		40	40	100	4,400		40	40	100
1h,1h,2h,2h-Perfluorododecanesulfonic Acid (10:2)	10:2	120226-60-0	ng/wipe	2,200		40	40	100	850		4	4	10	1,700		4	4	10	1,800		40	40	100	1,300		40	40	100

Table 5
Summary of PFAS Analytical Results for PAB
Wipe Samples of AFFF System Piping
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland

Notes:

EPA - Environmental Protection Agency
MCL - Maximum Contaminant Level
CAS - Chemical Abstract Service
NS - No standard
ng/l - Nanogram per liter (parts per trillion (ppt))
ND - Not detected
DUP - Duplicate sample collected for quality control purposes
Q - Qualifier
MDL - Method Detection Limit
RL - Reporting Limit
DF - Dilution Factor

Qualifiers:

J - The analyte was positively identified but the associated numerical value is approximate.
U – The analyte was not detected above the method detection limit, or the analyte detection is impacted by blank contamination and qualified as non-detect in accordance with the applicable validation guidelines.
UJ - The analyte was not detected at or above the method detection limit. The method detection limit may be imprecise because of potential low or indeterminate bias.
E - Result exceeded calibration range

Table 6a
PFAS Compounds and Screening Levels for Soil and Soil to Groundwater
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Target Analyte Name	Abbreviation	CAS Number	Family	Carbon Chain Length	USEPA Industrial Soil RSLs (ug/kg)	USEPA Residential Soil RSLs (ug/kg)	USEPA Soil-to-Groundwater RSLs based on USEPA MCLs (DAF=20)[1] (ug/kg)	USEPA Soil-to-Groundwater RSLs based on USEPA Tap Water RSLs (DAF=20)[1] (ug/kg)	EPA Method 1633 Solid MDL (ug/kg)	EPA Method 1633 Solid LOQ Range (ug/kg)	Pace Analytical Soil MDL (ug/kg)	Pace Analytical Soil RL (ug/kg)
Carboxylates												
Perfluorobutanoic acid	PFBA	375-22-4	Carboxylate	4	120000	7800	–	13	0.15	0.64-1.6	0.06664	0.2
Perfluoropentanoic acid	PFPeA	2706-90-3	Carboxylate	5	–	–	–	–	0.07	0.32-0.8	0.06664	0.2
Perfluorohexanoic acid	PFHxA	307-24-4	Carboxylate	6	41000	3200	–	4.78	0.06	0.16-0.4	0.06664	0.2
Perfluoroheptanoic acid	PFHpA	375-85-9	Carboxylate	7	–	–	–	–	0.05	0.16-0.4	0.06664	0.2
Perfluorooctanoic acid	PFOA	335-67-1	Carboxylate	8	0.078^{ab}	0.019^{ab}	1.22	0.000806^{ab}	0.07	0.16-0.4	0.2664	0.8
Perfluorononanoic acid	PFNA	375-95-1	Carboxylate	9	250	19	0.84	0.494	0.14	0.16-1.3	0.06664	0.2
Perfluorodecanoic acid	PFDA	335-76-2	Carboxylate	10	0.16^{ab}	0.013^{ab}	–	0.0001624^{ab}	0.06	0.16-0.4	0.06664	0.2
Perfluoroundecanoic acid	PFUnA	2058-94-8	Carboxylate	11	25000	1900	–	89.8	0.12	0.16-0.5	0.06664	0.2
Perfluorododecanoic acid	PFDoA	307-55-1	Carboxylate	12	4100	320	–	342	0.06	0.16-0.4	0.06664	0.2
Perfluorotridecanoic acid	PFTrDA	72629-94-8	Carboxylate	13	–	–	–	–	0.07	0.16-0.4	0.1336	0.4
Perfluorotetradecanoic acid	PFTeDA	376-06-7	Carboxylate	14	82000	6300	–	18780	0.05	0.16-0.4	0.06664	0.2
Sulfonates												
Perfluorobutanesulfonic acid	PFBS	375-73-5	Sulfonate	4	25000	1900	–	6.02	0.05	0.16-0.4	0.06664	0.2
Perfluoropentansulfonic acid	PFPeS	2706-91-4	Sulfonate	5	–	–	–	–	0.08	0.16-0.4	0.06664	0.2
Perfluorohexanesulfonic acid	PFHxS	355-46-4	Sulfonate	6	1600	130	0.084^{ab}	0.334	0.08	0.16-0.4	0.06664	0.2
Perfluoroheptanesulfonic acid	PFHpS	375-92-8	Sulfonate	7	–	–	–	–	0.07	0.16-0.4	0.06664	0.2
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Sulfonate	8	8.2	0.63	0.6	0.0306^{ab}	0.07	0.16-0.4	0.06664	0.2
Perfluorononanesulfonic acid	PFNS	68259-12-1	Sulfonate	9	–	–	–	–	0.07	0.16-0.4	0.06664	0.2
Perfluorodecanesulfonic acid	PFDS	335-77-3	Sulfonate	10	–	–	–	–	0.08	0.16-0.4	0.06664	0.2
Perfluorododecanesulfonic acid	PFDoS	79780-39-5	Sulfonate	11	–	–	–	–	0.06	0.16-0.4	0.06664	0.2
Fluorotelomer sulfonic acids												
1*H*,1*H*, 2*H*, 2*H*-Perfluorohexane sulfonic acid	4:2FTS	757124-72-4	Fluorotelomer sulfonic acids	6	–	–	–	–	0.2	0.64-1.5	0.2664	0.8
1*H*,1*H*, 2*H*, 2*H*-Perfluorooctane sulfonic acid	6:2FTS	27619-97-2	Fluorotelomer sulfonic acids	8	–	–	–	–	0.39	0.64-1.5	0.2664	0.8
1*H*,1*H*, 2*H*, 2*H*-Perfluorodecane sulfonic acid	8:2FTS	39108-34-4	Fluorotelomer sulfonic acids	10	–	–	–	–	0.31	0.64-1.5	0.2664	0.8
Perfluorooctane sulfonamides												
Perfluorooctanesulfonamide	PFOSA	754-91-6	Perfluorooctane sulfonamides	8	–	–	–	–	0.04	0.16-0.4	0.06664	0.2
N-methyl perfluorooctanesulfonamide	NMeFOSA	31506-32-8	Perfluorooctane sulfonamides	8	–	–	–	–	0.07	0.16-0.4	0.06664	0.2
N-ethyl perfluorooctanesulfonamide	NEtFOSA	4151-50-2	Perfluorooctane sulfonamides	8	–	–	–	–	0.07	0.16-0.4	0.06664	0.2
Perfluorooctane sulfonamidoacetic acids												
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9	Perfluorooctane sulfonamidoacetic acids	8	–	–	–	–	0.08	0.16-0.4	0.06664	0.2
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6	Perfluorooctane sulfonamidoacetic acids	8	–	–	–	–	0.08	0.16-0.4	0.0856	0.2
Perfluorooctane sulfonamide ethanols												
N-methyl perfluorooctanesulfonamidoethanol	NMeFOSE	24448-09-7	Perfluorooctane sulfonamide ethanols	8	–	–	–	–	0.36	1.6-4.0	0.6664	2
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1691-99-2	Perfluorooctane sulfonamide ethanols	8	–	–	–	–	0.35	1.6-4.0	0.6664	2
Per- and Polyfluoroether carboxylic acids												
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6	Per- and Polyfluoroether carboxylic acids	3	350	23	0.2^{ab}	0.0296^{ab}	0.25	0.64-1.6	0.2664	0.8
4,8-Dioxa-3*H*-perfluorononanoic acid	ADONA	919005-14-4	Per- and Polyfluoroether carboxylic acids	3	–	–	–	–	0.23	0.64-1.5	0.1336	0.4
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	Per- and Polyfluoroether carboxylic acids	4	–	–	–	–	0.07	0.32-0.8	0.1336	0.4
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	Per- and Polyfluoroether carboxylic acids	5	–	–	–	–	0.05	0.32-0.8	0.1336	0.4
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	Per- and Polyfluoroether carboxylic acids	5	–	–	–	–	0.2	0.32-0.8	0.2664	0.8
Ether sulfonic acids												
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1	Ether sulfonic acids	3	–	–	–	–	0.22	0.64-1.5	0.2664	0.8
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9	Ether sulfonic acids	3	–	–	–	–	0.18	0.64-1.5	0.2664	0.8
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	Ether sulfonic acids	5	–	–	–	–	0.08	0.32-0.7	0.1336	0.4
Fluorotelomer carboxylic acids												
3-Perfluoropropyl propanoic acid	3:3FTCA	356-02-5	Fluorotelomer carboxylic acids	3	–	–	–	–	0.23	0.8-5.0	1.664	5
2*H*,2*H*,3*H*,3*H*-Perfluorooctanoic acid	5:3FTCA	914637-49-3	Fluorotelomer carboxylic acids	3	–	–	–	–	0.86	4-10	1.664	5
3-Perfluoroheptyl propanoic acid	7:3FTCA	812-70-4	Fluorotelomer carboxylic acids	3	–	–	–	–	0.87	4-10	0.3336	1

Notes
This table includes PFAS tested for by USEPA Method 1633
-- No Screening Level Listed
USEPA: United States Environmental Protection Agency
RSL: Regional Screening Level
MCL: Maximum Contaminant Level
LOQ: Limit of Quantitation
MDL: Method Detection Limit
RL: Reporting Limit
DAF: Dilution Attenuation Factor
ug/kg: micrograms per kilogram
[1] - Consistent with Maryland Department of the Environment (MDE) Protection of Groundwater Cleanup Standards for Soil, a Dilution/Attenuation Factor of 20 is applied to the USEPA soil-to-groundwater migration RSLs.

a. Value is less than or equal to USEPA Method 1633 Solid LOQ Range
b. Value is less than or equal to Pace Analytical Soil RL

Sources
1 - United States Environmental Protection Agency. (2025). Per- and Polyfluoroalkyl Substances (PFAS); Final PFAS National Primary Drinking Water Regulation.
2 - United States Environmental Protection Agency. (2024). Regional Screening Levels (RSLs), TR=1E-06, THQ=0.1.
3 - United States Environmental Protection Agency. (2024). Method 1633 - Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS.
4 - Pace Analytical. (2025).PFAS via USEPA 1633 (SOIL)

Table 6b
PFAS Compounds and Screening Levels for Potable and Groundwater
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

Target Analyte Name	Abbreviation	CAS Number	Family	Carbon Chain Length	USEPA MCL for Public Drinking Water (ng/l)	USEPA Tap Water Regional Screening Levels (ng/l)	USEPA Method 1633 Aqueous MDL (ng/l)	USEPA Method 1633 Aqueous LOQ Range (ng/l)	Pace Analytical SPLP MDL (ng/l)	Pace Analytical SPLP RL (ng/l)	Preferred Groundwater Screening Levels (ng/l)
Carboxylates											
Perfluorobutanoic acid	PFBA	375-22-4	Carboxylate	4	–	1800	0.79	4-16	2.136	6.40	1800
Perfluoropentanoic acid	PFPeA	2706-90-3	Carboxylate	5	–	–	0.54	2-8	1.064	3.20	–
Perfluorohexanoic acid	PFHxA	307-24-4	Carboxylate	6	–	990	0.46	1-4	0.536	1.6	990
Perfluoroheptanoic acid	PFHpA	375-85-9	Carboxylate	7	–	–	0.37	1-4	0.536	1.6	–
Perfluorooctanoic acid	PFOA	335-67-1	Carboxylate	8	4	0.0027[ab]	0.54	1-4	0.536	1.6	4[c]
Perfluorononanoic acid	PFNA	375-95-1	Carboxylate	9	10	5.9	0.45	1-4	0.536	1.6	10[c]
Perfluorodecanoic acid	PFDA	335-76-2	Carboxylate	10	–	0.004[ab]	0.52	1-4	0.536	1.6	0.004
Perfluoroundecanoic acid	PFUnA	2058-94-8	Carboxylate	11	–	600	0.45	1-4	0.536	1.6	600
Perfluorododecanoic acid	PFDoA	307-55-1	Carboxylate	12	–	100	0.4	1-4	0.536	1.6	100
Perfluorotridecanoic acid	PFTrDA	72629-94-8	Carboxylate	13	–	–	–	–	–	–	–
Perfluorotetradecanoic acid	PFTeDA	376-06-7	Carboxylate	14	–	2000	0.49	1-4	0.536	1.6	2000
Sulfonates											
Perfluorobutanesulfonic acid	PFBS	375-73-5	Sulfonate	4	–	600	0.37	1-4	0.536	1.6	600
Perfluoropentansulfonic acid	PFPeS	2706-91-4	Sulfonate	5	–	–	0.5	1-4	0.536	1.6	–
Perfluorohexanesulfonic acid	PFHxS	355-46-4	Sulfonate	6	10	39	0.54	1-4	0.536	1.6	10[c]
Perfluoroheptanesulfonic acid	PFHpS	375-92-8	Sulfonate	7	–	–	–	–	–	–	–
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Sulfonate	8	4	0.2[ab]	0.63	1-4	0.536	1.6	4[c]
Perfluorononanesulfonic acid	PFNS	68259-12-1	Sulfonate	9	–	–	0.47	1-4	0.536	1.6	–
Perfluorodecanesulfonic acid	PFDS	335-77-3	Sulfonate	10	–	–	0.6	1-4	0.536	1.6	–
Perfluorododecanesulfonic acid	PFDoS	79780-39-5	Sulfonate	11	–	–	0.6	1-4	0.536	1.6	–
Fluorotelomer sulfonic acids											
1*H*,1*H*, 2*H*, 2*H*-	4:2FTS	757124-72-4	Fluorotelomer sulfonic acids	6	–	–	1.69	4-15	2.136	6.4	–
1*H*,1*H*, 2*H*, 2*H*-	8:2FTS	39108-34-4	Fluorotelomer sulfonic acids	10	–	–	2.45	4-15	2.136	6.4	–
1*H*,1*H*, 2*H*, 2*H*-Perfluorooctane	6:2FTS	27619-97-2	Fluorotelomer sulfonic acids	8	–	–	2.5	4-15	4.816	6.4	–
Perfluorooctane sulfonamides											
Perfluorooctanesulfonamide	PFOSA	754-91-6	Perfluorooctane sulfonamides	8	–	–	0.32	1-4	0.536	1.6	–
N-ethyl	NEtFOSA	4151-50-2	Perfluorooctane sulfonamides	8	–	–	0.43	1-4	0.536	1.6	–
N-methyl	NMeFOSA	31506-32-8	Perfluorooctane sulfonamides	8	–	–	0.45	1-4	0.536	1.6	–
Perfluorooctane sulfonamidoacetic acids											
N-ethyl	NEtFOSAA	2991-50-6	Perfluorooctane sulfonamidoacetic acids	8	–	–	0.68	1-4	0.536	1.6	–
N-methyl	NMeFOSAA	2355-31-9	Perfluorooctane sulfonamidoacetic acids	8	–	–	0.59	1-4	0.536	1.6	–
Perfluorooctane sulfonamide ethanols											
N-methyl	NMeFOSE	24448-09-7	Perfluorooctane sulfonamide ethanols	8	–	–	3.81	10-40	5.36	16	–
N-ethyl	NEtFOSE	1691-99-2	Perfluorooctane sulfonamide ethanols	8	–	–	4.84	10-40	5.36	16	–
Per- and Polyfluoroether											
Hexafluoropropylene oxide	HFPO-DA	13252-13-6	Per- and Polyfluoroether carboxylic acids	3	10	1.5[ab]	0.51	2-8	2.136	6.4	10[c]
4,8-Dioxa-3*H*-perfluorononanoic	ADONA	919005-14-4	Per- and Polyfluoroether carboxylic acids	3	–	–	0.5	2-8	2.136	6.4	–
Perfluoro-3-methoxypropanoic	PFMPA	377-73-1	Per- and Polyfluoroether carboxylic acids	4	–	–	1.46	4-16	1.064	3.2	–
Perfluoro-4-methoxybutanoic	PFMBA	863090-89-5	Per- and Polyfluoroether carboxylic acids	5	–	–	1.41	4-15	1.064	3.2	–
Nonafluoro-3,6-dioxaheptanoic	NFDHA	151772-58-6	Per- and Polyfluoroether carboxylic acids	5	–	–	0.75	2-7	1.064	3.2	–
Ether sulfonic acids											
9-Chlorohexadecafluoro-3-	9Cl-PF3ONS	756426-58-1	Ether sulfonic acids	3	–	–	1.38	4-15	2.136	6.4	–
11-Chloroeicosafluoro-3-	11Cl-PF3OUdS	763051-92-9	Ether sulfonic acids	3	–	–	1.67	4-15	2.136	6.4	–
Perfluoro(2-	PFEESA	113507-82-7	Ether sulfonic acids	5	–	–	1.17	2-8	1.064	3.2	–
Fluorotelomer carboxylic acids											
3-Perfluoropropyl propanoic acid	3:3FTCA	356-02-5	Fluorotelomer carboxylic acids	3	–	–	2.47	5-20	2.664	8	–
2*H*,2*H*,3*H*,3*H*-	5:3FTCA	914637-49-3	Fluorotelomer carboxylic acids	3	–	–	9.59	25-100	13.36	40	–
3-Perfluoroheptyl propanoic acid	7:3FTCA	812-70-4	Fluorotelomer carboxylic acids	3	–	–	8.71	25-100	13.36	40	–

Notes

- This table includes PFAS tested for by USEPA Method 1633
– No Screening Level Listed
USEPA: United States Environmental Protection Agency
RSL: Regional Screening Level
MCL: Maximum Contaminant Level
LOQ: Limit of Quantitation
RL: Reporting Limit
MDL: Method Detection Limit
DAF: Dilution Attenuation Factor
SPLP: Synthetic Precipitation Leaching Procedure
ng/l: nanograms per liter

a. Value is less than or equal to USEPA Method 1633 Aqueous LOQ Range
b. Value is less than or equal to Pace Analytical SPLP RL
c. USEPA MCL will be used as the preferred screening level

Sources

1 - United States Environmental Protection Agency. (2025). Per- and Polyfluoroalkyl Substances (PFAS); Final PFAS National Primary Drinking Water Regulation.
2 - United States Environmental Protection Agency. (2024). Regional Screening Levels (RSLs) - Resident Tap Water, TR=1E-06, THQ=0.1.
3 - United States Environmental Protection Agency. (2024). Method 1633 - Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS.
4 - Pace Analytical. (2025). SPLP PFAS via EPA 1312/EPA 1633 (SOIL)
5 - Pace Analytical. (2025). PFAS via EPA 1633 (WATER)

Table 7
Soil Sampling and Analytical Plan
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

PFAS Area of Interest (AOI)	Boring ID	Sample ID	Sampling Method	Approximate X-Coordinate[1]	Approximate Y-Coordinate[1]	Approximate Topographic Surface Elevation[2]	Boring Depth	Sample Depth	Maximum Number of Samples	Analyses
AOI 1 - Aqueous Film Forming Foam (AFFF) – Fire Suppression System	SB-1-1	SB-1-1-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383994720	-75.529742360	45.96	80 ft. bgs or tool refusal	Every 2 feet. After 20 feet increase to every 10 feet	TBD	Method 1633 - Full 40 Compound List SPLP for Selected Samples and PFAS Compounds
	SB-1-2	SB-1-2-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383773090	-75.529330850	46.06	80 ft. bgs or tool refusal	Every 2 feet. After 20 feet increase to every 10 feet	TBD	
	SB-1-3	SB-1-3-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383598000	-75.529558740	46.82	80 ft. bgs or tool refusal	Every 2 feet. After 20 feet increase to every 10 feet	TBD	
	SB-1-4	SB-1-4-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383491760	-75.529251420	46.72	80 ft. bgs or tool refusal	Every 2 feet. After 20 feet increase to every 10 feet	TBD	
	SB-1-5	SB-1-5-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.384040470	-75.529421340	45.18	18 ft. bgs.	Every 2 feet	10	
	SB-1-6	SB-1-6-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.384058400	-75.529492360	45.24	18 ft. bgs.	Every 2 feet	10	
	SB-1-7	SB-1-7-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.384019310	-75.529570020	45.51	18 ft. bgs.	Every 2 feet	10	
	SB-1-8	SB-1-8-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383972200	-75.529485780	45.51	18 ft. bgs.	Every 2 feet	10	
	SB-1-9	SB-1-9-depth_YYYYMMDD	Hand auger	38.384015470	-75.529491390	45.37	5 ft. bgs.*	Every ~1.5 feet	3	
	SB-1-10	SB-1-10-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.384196690	-75.529393800	45.28	18 ft. bgs.	Every 2 feet	10	
	SB-1-11	SB-1-11-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.384167120	-75.529482510	45.41	18 ft. bgs.	Every 2 feet	10	
	SB-1-12	SB-1-12-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.384141490	-75.529568240	45.54	18 ft. bgs.	Every 2 feet	10	
	SB-1-13	SB-1-13-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.384109510	-75.529690940	45.80	18 ft. bgs.	Every 2 feet	10	
	SB-1-14	SB-1-14-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383898220	-75.529604740	45.87	18 ft. bgs.	Every 2 feet	10	
	SB-1-15	SB-1-15-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383815160	-75.529599220	46.16	18 ft. bgs.	Every 2 feet	10	
	SB-1-16	SB-1-16-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383705480	-75.529547700	46.56	18 ft. bgs.	Every 2 feet	10	
	SB-1-17	SB-1-17-depth_YYYYMMDD	Hand auger	38.383944320	-75.529349140	45.51	5 ft. bgs.*	Every ~1.5 feet	3	
	SB-1-18	SB-1-18-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383895460	-75.529485180	45.57	18 ft. bgs.	Every 2 feet	10	
	SB-1-19	SB-1-19-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383791380	-75.529480090	46.16	18 ft. bgs.	Every 2 feet	10	
	SB-1-20	SB-1-20-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383900770	-75.529276380	45.77	18 ft. bgs.	Every 2 feet	10	
	SB-1-21	SB-1-21-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383901860	-75.529147350	45.70	18 ft. bgs.	Every 2 feet	10	
	SB-1-22	SB-1-22-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383775220	-75.529143480	46.13	18 ft. bgs.	Every 2 feet	10	
	SB-1-23	SB-1-23-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383818700	-75.529387530	45.96	18 ft. bgs.	Every 2 feet	10	
	SB-1-24	SB-1-24-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383771590	-75.529430550	46.46	18 ft. bgs.	Every 2 feet	10	
	SB-1-25	SB-1-25-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383728800	-75.529383830	46.13	18 ft. bgs.	Every 2 feet	10	
	SB-1-26	SB-1-26-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383774630	-75.529383350	45.47	18 ft. bgs.	Every 2 feet	10	
	SB-1-27	SB-1-27-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383614000	-75.529118330	46.49	18 ft. bgs.	Every 2 feet	10	
	SB-1-28	SB-1-28-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383570490	-75.529228260	46.52	18 ft. bgs.	Every 2 feet	10	
	SB-1-29	SB-1-29-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383510760	-75.529134880	46.92	18 ft. bgs.	Every 2 feet	10	
	SB-1-30	SB-1-30-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383434560	-75.529086610	47.11	18 ft. bgs.	Every 2 feet	10	
	SB-1-31	SB-1-31-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383494180	-75.529710030	46.59	18 ft. bgs.	Every 2 feet	10	
	SB-1-32	SB-1-32-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383421630	-75.529636410	47.05	18 ft. bgs.	Every 2 feet	10	
AOI 2 - Stockpiled Soil - Northwest	SB-2-1	SB-2-1-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.388564130	-75.540410260	43.64	~10 - 15 ft. bgs (to native soil)	Every 2 feet	9	Method 1633 - Full 40 Compound List SPLP for Selected Samples and PFAS Compounds
	SB-2-2	SB-2-2-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.388479300	-75.540621540	53.51	~10 - 15 ft. bgs (to native soil)	Every 2 feet	9	
	SB-2-3	SB-2-3-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.388355990	-75.540439840	58.37	~10 - 15 ft. bgs (to native soil)	Every 2 feet	9	
	SB-2-4	SB-2-4-depth_YYYYMMDD	Hand Auger	38.388188150	-75.540370930	48.13	~2 - 5 ft. bgs. (to native soil)	Every 2 feet	4	
	SB-2-5	SB-2-5-depth_YYYYMMDD	Hand Auger	38.388057420	-75.540284560	43.80	~2 - 5 ft. bgs. (to native soil)	Every 2 feet	4	
	SB-2-6	SB-2-6-depth_YYYYMMDD	Hand Auger	38.387886090	-75.540291230	43.73	~4 ft. bgs. (to native soil)	Every 2 feet	3	
	SB-2-7	SB-2-7-depth_YYYYMMDD	Hand Auger	38.388092020	-75.540655090	43.70	~2 ft. bgs.	0.0 - 0.5 ft bgs, 1.5 - 2 ft bgs	2	
	SB-2-8	SB-2-8-depth_YYYYMMDD	Hand Auger	38.387996480	-75.540463710	43.80	~2 ft. bgs.	0.0 - 0.5 ft bgs, 1.5 - 2 ft bgs	2	
	SB-2-9	SB-2-9-depth_YYYYMMDD	Hand Auger	38.387696750	-75.540283300	44.98	~2 ft. bgs.	0.0 - 0.5 ft bgs, 1.5 - 2 ft bgs	2	
AOI 3 - Stockpiled Soil - East-Central	SB-3-1	SB-3-1-depth_YYYYMMDD	Hand Auger	38.387040840	-75.530235390	50.10	~5 ft. bgs. (thickness of pile)	Every 2 feet	4	Method 1633 - Full 40 Compound List SPLP for Selected Samples and PFAS Compounds
AOI 6 - Outfall 001 to Peggy's Branch	SB-6-1	SB-6-1-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.381863450	-75.533435240	43.57	~18 ft. bgs.	Every 2 feet	10	Method 1633 - Full 40 Compound List SPLP for Selected Samples and PFAS Compounds
AOI 7 - Dredge Spoils Deposits	SB-7-1	SB-7-1-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.387580610	-75.540046940	47.51	20 ft. bgs.	Every 2 feet	10	Method 1633 - Full 40 Compound List SPLP for Selected Samples and PFAS Compounds
	SB-7-2A	SB-7-2A-depth_YYYYMMDD	Hand auger	38.387617550	-75.539472410	41.70	~4 - 6 ft. bgs. (to pit bottom)	Every 2 feet	4	
	SB-7-2B	SB-7-2B-depth_YYYYMMDD	Hand auger	38.387498580	-75.539639050	39.17	~4 - 6 ft. bgs. (to pit bottom)	Every 2 feet	4	
	SB-7-2C	SB-7-2C-depth_YYYYMMDD	Hand auger	38.387346790	-75.539732830	41.90	~4 - 6 ft. bgs. (to pit bottom)	Every 2 feet	4	
AOI 8 - Former Spray Irrigation Field	SB-8-1	SB-8-1-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.386007500	-75.537501620	42.68	20 ft. bgs.	~2 feet	11	Method 1633 - Full 40 Compound List SPLP for Selected Samples and PFAS Compounds
	SB-8-2	SB-8-2-depth_YYYYMMDD	Hand Auger	38.385869790	-75.532362450	49.02	5 ft. bgs.	~2 feet	2	
	SB-8-3	SB-8-3-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.386418060	-75.533768940	46.03	20 ft. bgs.	~2 feet	11	
	SB-8-4	SB-8-4-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.384757590	-75.531894830	44.91	20 ft. bgs.	~2 feet	11	
	SB-8-5	SB-8-5-depth_YYYYMMDD	Hand Auger	38.385259280	-75.533443610	45.01	5 ft. bgs.	~2 feet	2	
	SB-8-6	SB-8-6-depth_YYYYMMDD	Hand Auger	38.384577820	-75.536518750	42.72	5 ft. bgs.	~2 feet	2	
	SB-8-7	SB-8-7-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.384577390	-75.534636130	43.90	20 ft. bgs.	~2 feet	11	
	SB-8-8	SB-8-8-depth_YYYYMMDD	Hand Auger	38.385834250	-75.534764920	45.14	5 ft. bgs.	~2 feet	2	
	SB-8-9	SB-8-9-depth_YYYYMMDD	Hand Auger	38.383735770	-75.535759210	44.91	5 ft. bgs.	~2 feet	2	
	SB-8-10	SB-8-10-depth_YYYYMMDD	Hand Auger	38.383814670	-75.533617040	46.62	5 ft. bgs.	~2 feet	2	
	SB-8-11	SB-8-11-depth_YYYYMMDD	Hand Auger	38.383228760	-75.534580760	49.61	5 ft. bgs.	~2 feet	2	
	SB-8-12	SB-8-12-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.382762310	-75.536467620	44.88	20 ft. bgs.	~2 feet	11	
	SB-8-13	SB-8-13-depth_YYYYMMDD	Hand Auger	38.384740830	-75.532592140	47.87	5 ft. bgs.	~2 feet	2	
	SB-8-14	SB-8-14-depth_YYYYMMDD	Hand Auger	38.385244280	-75.536115210	44.06	5 ft. bgs.	~2 feet	2	
	SB-8-15	SB-8-15-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.384446840	-75.532971570	48.75	20 ft. bgs.	~2 feet	11	
	SB-8-16	SB-8-16-depth_YYYYMMDD	Hand Auger	38.384244920	-75.532551660	48.06	5 ft. bgs.	~2 feet	2	
	SB-8-17	SB-8-17-depth_YYYYMMDD	Hand Auger	38.383997210	-75.532947770	48.26	5 ft. bgs.	~2 feet	2	
	SB-8-18	SB-8-18-depth_YYYYMMDD	Hand auger and Direct push soil sampler	38.383780200	-75.532506200	45.14	20 ft. bgs.	~2 feet	11	
	SB-8-19	SB-8-19-depth_YYYYMMDD	Hand Auger	38.383787210	-75.532064690	44.09	5 ft. bgs.	~2 feet	2	

Notes:

- [1] Coordinates were generated using ArcGIS Pro, provided b
- [2] National Oceanic and Atmospheric Administration (NOAA) Digital Coast Data Access Viewer. Custom processing of "2020 - 2021 USGS Lidar: Southeast MD". Charleston, SC: NOAA Office for Coastal Management. Accessed Oct 08, 2024 at https://coast.noaa.gov/dataviewer.
- One equipment blank (EB) sample will be collected at a frequence of one per 20 field samples per type of sampling device, with a minimum of one per day per type of sampling device. Sample IDs for each EB sample will be named as follows: "EB-#-YYYYMMDD"
- Duplicate samples will be collected at a frequency of one duplicate sample per day or one duplicate sample per 20 regular samples, whichever is more frequent. Sample IDs for each duplicate sample will be named as follows: "DUP=#-YYYYMMDD"

* : Boring depth based on feet below bottom of concrete
TBD: To be determined based on drilling conditions. Boring will be advanced unti refusal is encountered.

Table 8
Groundwater and Process Water Sampling Plan
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

PFAS Area of Interest (AOI)	Monitoring Well/ Gauging Station ID	Sample ID	Sampling Method	Approximate X-Coordinate[1]	Approximate Y-Coordinate[1]	Approximate Topographic Surface Elevation[2]	Maximum Number of Samples	Analyses
AOI 1 - Aqueous Film Forming Foam (AFFF) – Fire Suppression System	MW-1-1	MW-1-1_YYYYMMDD	Low-Flow Purge with Peristaltic Pump	38.38399472	-75.52974236	45.96	1	Method 1633 - Full 40 compound list and TOP Assay
	MW-1-2	MW-1-2_YYYYMMDD	Low-Flow Purge with Peristaltic Pump	38.38377309	-75.52933085	46.06	1	
	MW-1-3	MW-1-3_YYYYMMDD	Low-Flow Purge with Peristaltic Pump	38.383598	-75.52955874	46.82	1	
	MW-1-4	MW-1-4_YYYYMMDD	Low-Flow Purge with Peristaltic Pump	38.38349176	-75.52925142	46.72	1	
	Comingled Manhole	CMANHOLE_YYYYMMDD	Dip Sample/Bailer	38.383971	-75.529754	46.22	1	
AOI 6 - Outfall 001 to Peggy's Branch	MW-6-1	MW-6-1_YYYYMMDD	Low-Flow Purge with Peristaltic Pump	38.38186345	-75.53343524	43.57	1	Method 1633 - Full 40 compound list
AOI 7 - Dredge Spoils Pile	MW-7-1	MW-7-1_YYYYMMDD	Low-Flow Purge with Peristaltic Pump	38.38758061	-75.54004694	47.51	1	Method 1633 - Full 40 compound list
AOI - 8 Former Spray Irrigation Field	MW-8-1	MW-8-1_YYYYMMDD	Low-Flow Purge with Peristaltic Pump	38.3860075	-75.53750162	42.68	1	Method 1633 - Full 40 compound list

Notes:

- [1]Coordinates were generated using ArcGIS Pro, provided by Langan’s Esri Software Licensing
- [2]National Oceanic and Atmospheric Administration (NOAA) Digital Coast Data Access Viewer. Custom processing of "2020 - 2021 USGS Lidar: Southeast MD". Charleston, SC: NOAA Office for Coastal Management. Accessed Oct 08, 2024 at https://coast.noaa.gov/dataviewer.
- One blind duplicate surface water sample will be collected to evaluate the reproducibility of the analytical results.
- One equipment blank (EB) sample will be collected by using a peristaltic pump equipped with new/dedicated tubing to transfer laboratory-provided PFAS free water into laboratory-provided sample bottles.
- One blind duplicate groundwater sample will be collected to evaluate the reproducibility of the analytical results.

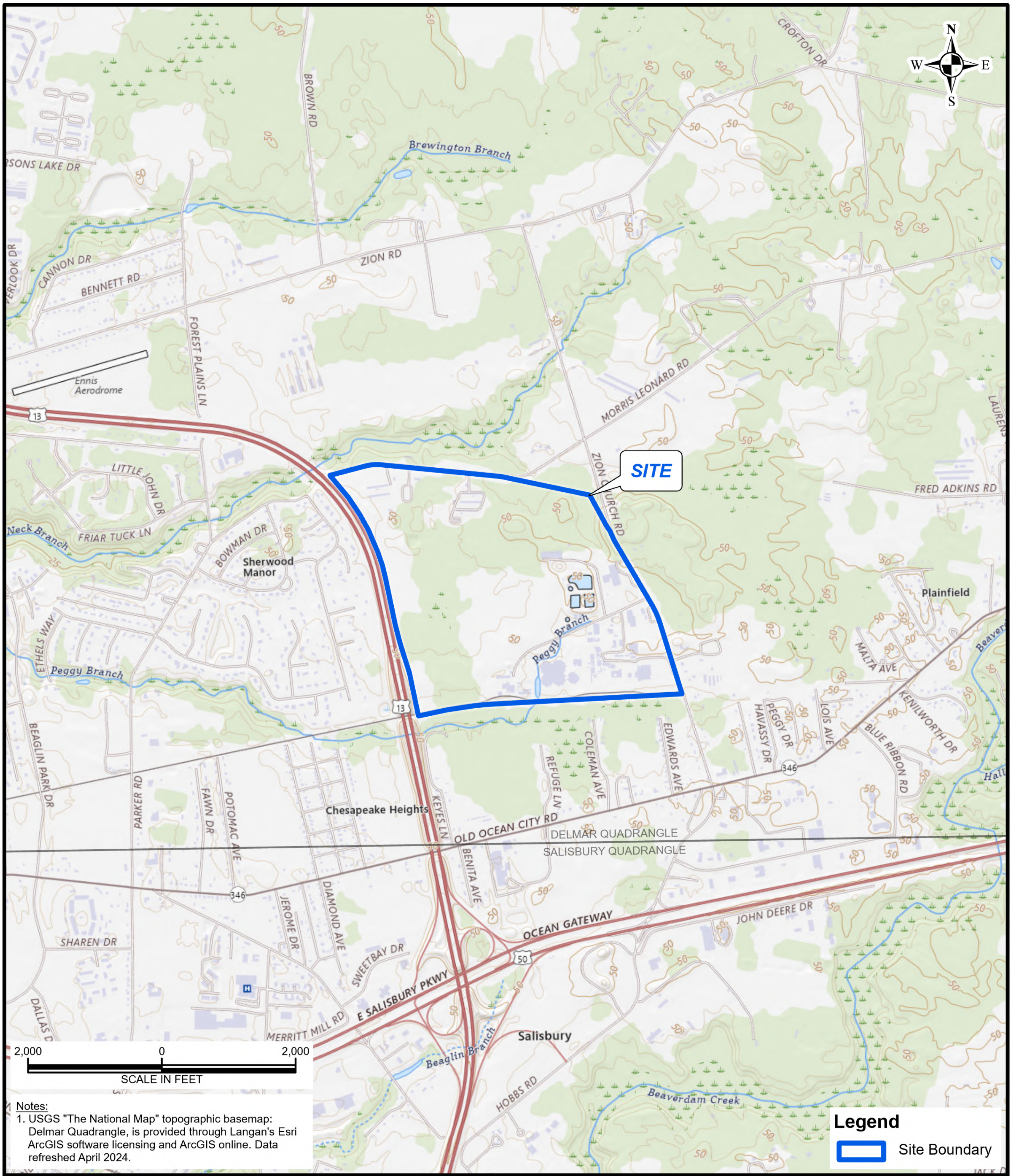
Table 9
Surface Water and Sediment Sampling Plan
Perdue AgriBusiness
6909 Zion Church Road, Salisbury, Maryland
Langan Project No.: 220210101

PFAS Area of Interest (AOI)	Gauging Station / Surface Water / Sediment Sample ID	Sample ID	Sampling Method	Approximate X-Coordinate[1]	Approximate Y-Coordinate[1]	Maximum Number of Samples	Analyses
AOI 6 - Outfall 001 to Peggy's Branch	WS-6-1	WS-6-1_YYYYMMDD	Dip Sample/Bailer	38.381854870	-75.533312980	1	Method 1633 - Full 40 compound list
	WS-6-2	WS-6-2_YYYYMMDD	Dip Sample/Bailer	38.383513400	-75.532110070	1	
	WS-6-3	WS-6-3_YYYYMMDD	Dip Sample/Bailer	38.384146320	-75.530330950	1	
	SE-6-1	SE-6-1-depth_YYYYMMDD	Stainless Steel Dredge or Scoop	38.381959350	-75.533306200	1	
	SE-6-2	SE-6-2-depth_YYYYMMDD	Stainless Steel Dredge or Scoop	38.383537280	-75.532100430	1	
	SE-6-3	SE-6-3_depth-YYYYMMDD	Stainless Steel Dredge or Scoop	38.384121370	-75.530381030	1	
AOI 7 - Dredge Spoils Pile	WS-7-1	WS-7-1_YYYYMMDD	Dip Sample/Bailer	38.38753673	-75.53936037	1	Method 1633 - Full 40 compound list

Notes:

- [1] Coordinates were generated using ArcGIS Pro, provided by Langan's Esri Software Licensing
- One equipment blank (EB) sample will be collected at a frequence of one per 20 field samples per type of sampling device, with a minimum of one per day per type of sampling device. Sample IDs for each EB sample will be named as follows: "EB-#-YYYYMMDD"
- Duplicate samples will be collected at a frequency of one duplicate sample per day or one duplicate sample per 20 regular samples, whichever is more frequent. Sample IDs for each duplicate sample will be named as follows: "DUP=#-YYYYMMDD"

Figures



2,000 0 2,000

SCALE IN FEET

Notes:
1. USGS "The National Map" topographic basemap: Delmar Quadrangle, is provided through Langan's Esri ArcGIS software licensing and ArcGIS online. Data refreshed April 2024.

Legend

▭	Site Boundary

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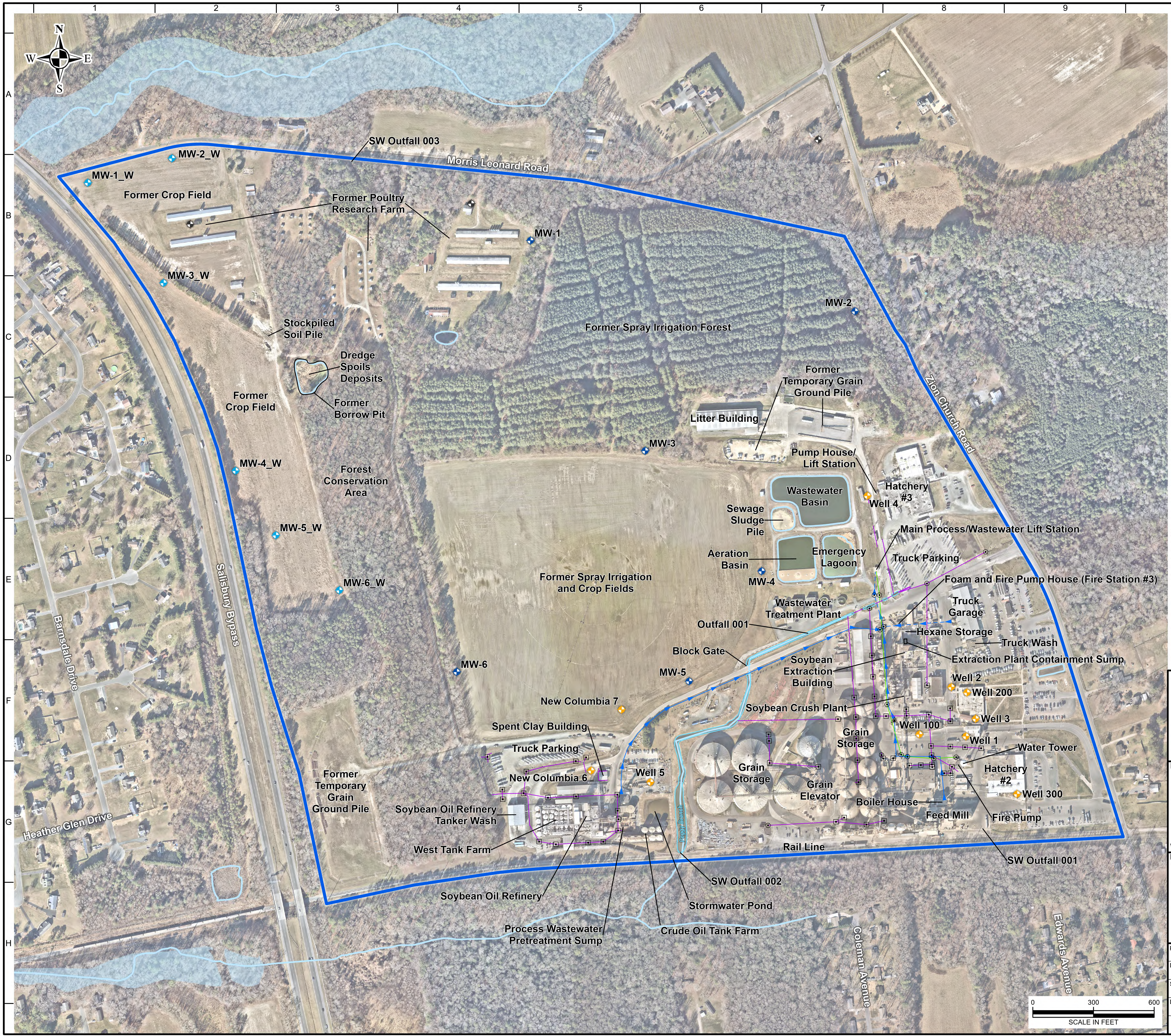
Project	Figure Title	Project No.	Figure
PERDUE AGRIBUSINESS, LLC SALISBURY WICOMICO COUNTY MARYLAND	**SITE LOCATION MAP**	220210101 Date: 2/5/2025 Scale: 1"=2,000' Drawn By: SH	1

Path: \\langan.com\data\PHL\data1\220210101\Project Data\ArcGIS\APRX\220210101\220210101_2025.aprx Date: 2/5/2025 Time: 5:12 PM User: shennessy



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Legend

- PFAS Monitoring Well Location (MW-1_W through MW-6_W)
- Spray Irrigation Monitoring Well Location (MW-1 through MW-6)
- PAB Water Supply Well Location
- Out of Service PAB Residential Style Water Supply Well Location
- ▲ Lift Station
- ⊙ Manhole
- ▣ Inlet
- Storm Drain
- Sanitary Sewer
- Approximate Location of Process Wastewater Line (Dashed Where Inferred)
- Streams and Waterbody Boundaries
- Subject Property Boundary
- Peggy Branch
- Waterbody - Swamp/Marsh

Notes:

1. All site feature locations are approximate.
2. Imagery provided through Langan's subscription to Nearmap.com. Flown 2/9/2024.
3. Utilities provided by Control Point Associates, Inc., "Perdue - Phase 2" field sketch figures. Prepared 3/9/2024.
4. Approximate location of process wastewater line provided by personal communication with Greg Ingraham, ZRC Wastewater, Perdue AgriBusiness LLC, via. Email dated 11/20/2024.
5. Feature labels are based on information obtained during Langan site visits on 11/12/2024 and 1/8/2025, and on POWER Engineers, Inc. "Site Plan with Oil Storage Locations," prepared 4/16/2018, and Perdue Agribusiness LLC "Stormwater Pollution Prevention Plan, SP3 Figure 5," prepared 2/16/2024.
6. Well locations are from: Earth Data's "2021 Groundwater Study Report," prepared 1/2021; Earth Data's report titled "Results of Temporary PFAS Monitoring Well Installation and Testing at PAB" dated September 2024 (see report figure titled "Perdue AgriBusiness LLC Monitoring Wells" dated 8/23/2024); and well records and location sketches provided by PAB.
7. Streams and waterbody boundaries provided by Wicomico County, City of Salisbury, Department of Information Services: GIS Division.
8. Waterbodies provided by the USGS National Hydrography Dataset (NHD).

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Project

PERDUE AGRIBUSINESS, LLC

SALISBURY

WICOMICO COUNTY MARYLAND

Drawing Title

SITE PLAN OVERVIEW

Project No. 220210101	Figure 2
Date 2/14/2025	
Scale 1"=300'	
Drawn By SH	

Legend

- 🟥 PFAS Areas of Interest
- 🟦 Subject Property Boundary
- ☐ Wicomico County Parcel Boundary

PFAS AOI Number	PFAS AOI Name
PFAS AOI 1	AFFF Fire Suppression System
PFAS AOI 2	Stockpiled Soil - Northwest
PFAS AOI 3	Stockpiled Soil - East-Central
PFAS AOI 4	Wastewater Treatment Facility Impoundments
PFAS AOI 5	PFAS in Groundwater at the ZCR Facility
PFAS AOI 6	Outfall 001 to Peggy Branch
PFAS AOI 7	Dredge Spoils Deposits
PFAS AOI 8	Former Spray Irrigation Field
PFAS AOI 9	Former Spray Irrigation Forest

800 0 800

SCALE IN FEET

Notes:

1. Imagery is provided through Langan's subscription to Nearmap.com. Flown 2/23/2025.
2. Parcel data was provided by Wicomico County GIS on 1/14/2025.
3. The PFAS Area of Interest 1 and 2 boundaries have been updated since the submittal of Langan's Environmental Assessment of PFAS Report dated January 21, 2025.

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Project

PERDUE AGRIBUSINESS, LLC

SALISBURY

WICOMICO COUNTY MARYLAND

Figure Title

PFAS AREAS OF INTEREST

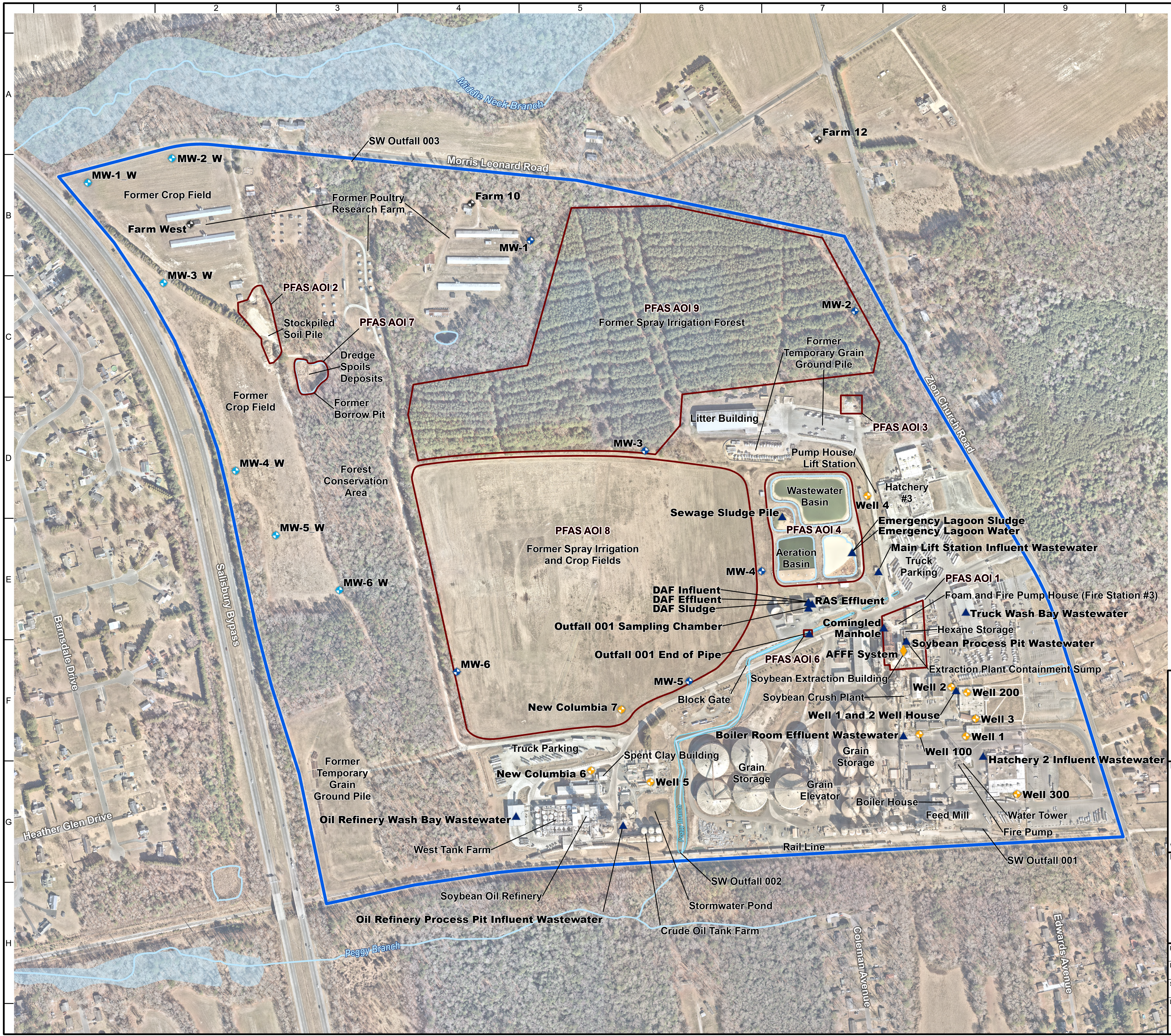
Project No. 220210100

Date 5/22/2025

Scale 1"=800'

Drawn By SH

Figure 3



N
W E
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Legend

PFAS Sample Locations:

- PFAS Monitoring Well Location (MW-1_W through MW-6_W)
- Spray Irrigation Monitoring Well Location (MW-1 through MW-6)
- PAB Water Supply Well Location
- Out of Service PAB Residential Style Water Supply Well Location
- ▲ Wastewater Sample Location
- ◆ Wipe Sample Location
- Subject Property Boundary
- PFAS Areas of Interest
- Peggy Branch
- Streams and Waterbody Boundaries
- Waterbody - Swamp/Marsh

Notes:
1. All site feature locations are approximate.
2. Imagery provided through Langan's subscription to Nearmap.com. Flown 2/23/2025.
3. Feature labels are based on information obtained during Langan site visits on 11/12/2024 and 1/8/2025, and on POWER Engineers, Inc. "Site Plan with Oil Storage Locations," prepared 4/16/2018, and Perdue Agribusiness LLC "Stormwater Pollution Prevention Plan, SP3 Figure 5," prepared 2/16/2024.
4. Well locations are from: Earth Data's "2021 Groundwater Study Report," prepared 1/2021; Earth Data's report titled "Results of Temporary PFAS Monitoring Well Installation and Testing at PAB" dated September 2024 (see report figure titled "Perdue AgriBusiness LLC Monitoring Wells" dated 8/23/2024); and well records and location sketches provided by PAB.
5. Wipe and wastewater sample locations are qualified or georeferenced from maps provided by the Maryland Department of the Environment.
6. Streams and waterbody boundaries provided by Wicomico County, City of Salisbury, Department of Information Services: GIS Division.
7. Waterbodies provided by the USGS National Hydrography Dataset (NHD).
8. The PFAS Area of Interest 1 and 2 boundaries have been updated since the submittal of Langan's Environmental Assessment of PFAS Report dated January 21, 2025.

0 300 600
SCALE IN FEET

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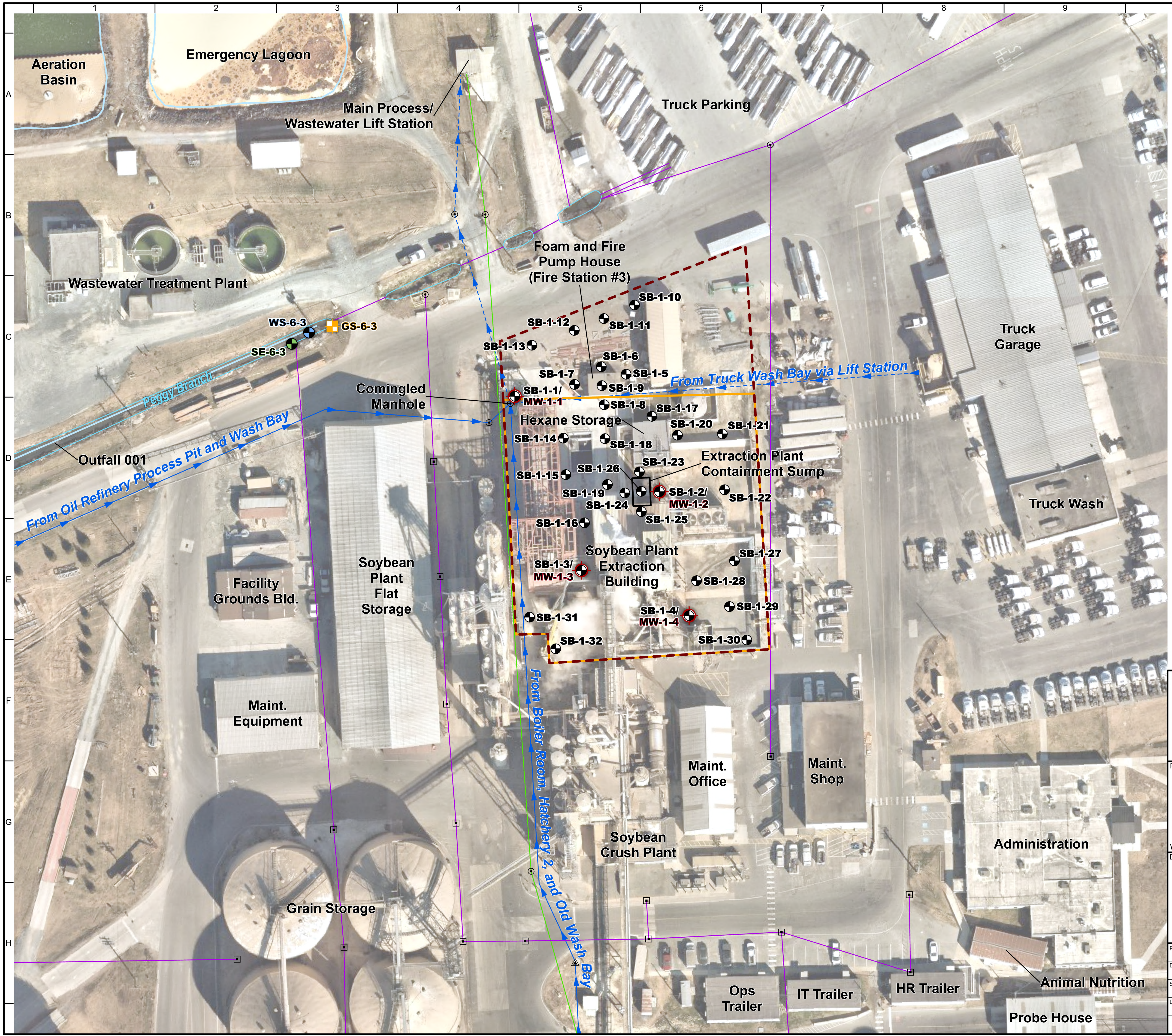
Project
PERDUE AGRIBUSINESS, LLC
SALISBURY
WICOMICO COUNTY MARYLAND

Drawing Title
HISTORICAL SAMPLING LOCATIONS

Project No. 220210101	Figure 4
Date 5/22/2025	
Scale 1"=300'	
Drawn By SH	

Path: \\langan.com\data\PHL\data1\220210101\Project Data\ArcGIS\APRX\220210101\220210101_2025.aprx Date: 5/22/2025 User: shennessy Time: 4:31 PM



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Legend

- ⊕ Proposed Soil Sample Location
- ⊕ Proposed Surface Water Sample Location
- ⊕ Proposed Sediment Sample Location
- ▣ Proposed Gauging Station
- ⊕ Proposed Monitoring Well Location
- ▲ Lift Station
- ⊙ Manhole
- ▣ Inlet
- — Streams and Waterbody Boundaries
- — Storm Drain
- — Sanitary Sewer
- → Approximate Location of Process Wastewater Line (Dashed Where Inferred)
- ▭ PFAS Area of Interest 1
- ▭ Exclusion Area

Notes:
1. All site feature locations are approximate.
2. Imagery provided through Langan's subscription to Nearmap.com. Flown 2/23/2025.
3. Utilities provided by Control Point Associates, Inc., "Perdue - Phase 2" field sketch figures. Prepared 3/9/2024.
4. Approximate location of process wastewater line provided by Personal communication with Greg Ingraham, ZRC Wastewater, Perdue AgriBusiness LLC, via. Email dated 11/20/2024.
5. Feature labels are based on information obtained during Langan site visits on 11/12/2024 and 1/8/2025, and on POWER Engineers, Inc. "Site Plan with Oil Storage Locations," prepared 4/16/2018, and Perdue Agribusiness LLC "Stormwater Pollution Prevention Plan, SP3 Figure 5," prepared 2/16/2024.
6. Streams and waterbody boundaries provided by Wicomico County, City of Salisbury, Department of Information Services: GIS Division.
7. The PFAS Area of Interest 1 boundary has been updated since the submittal of Langan's Environmental Assessment of PFAS Report dated January 21, 2025.

0 50 100
SCALE IN FEET

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Project

PERDUE AGRIBUSINESS, LLC

SALISBURY

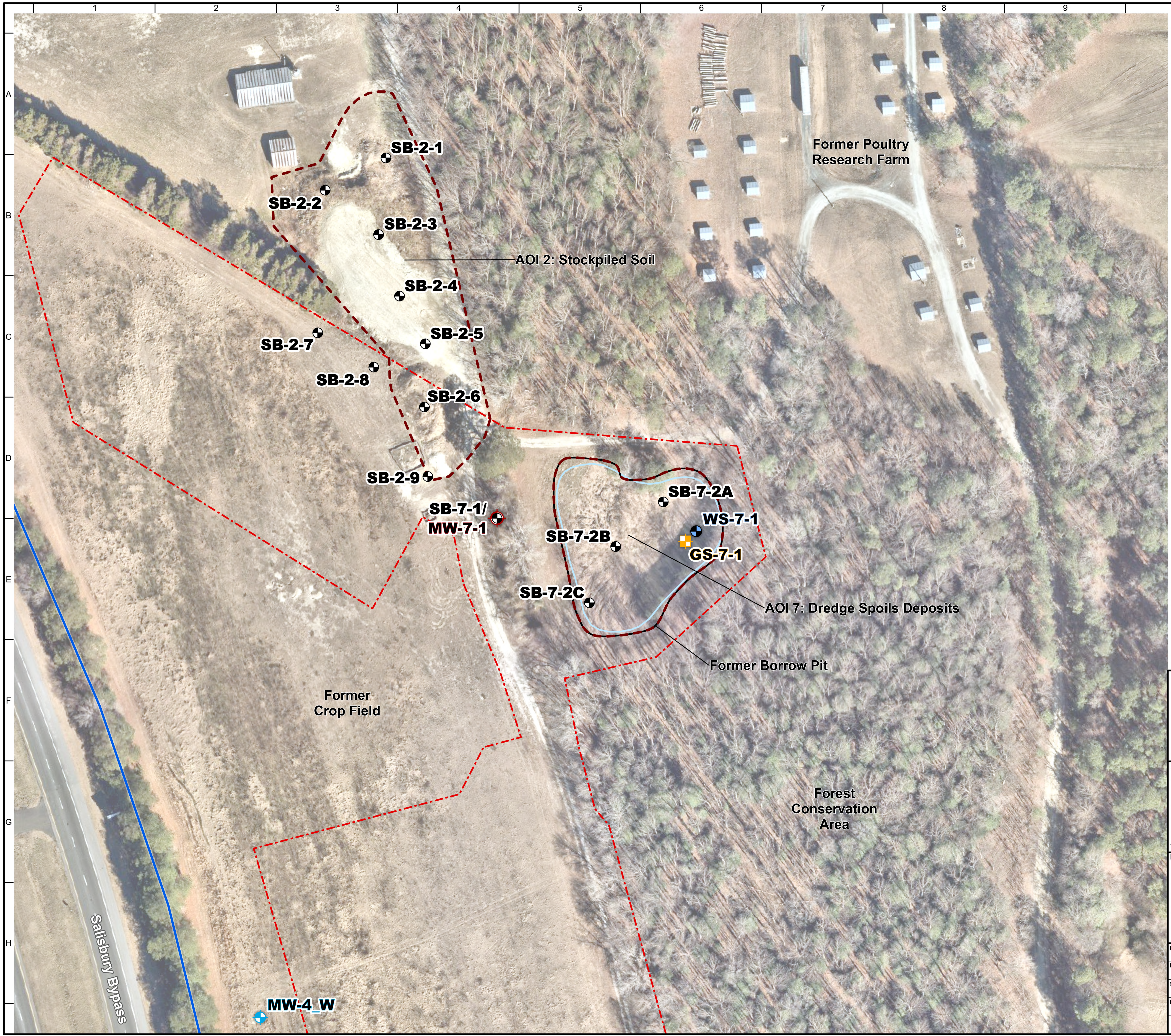
WICOMICO COUNTY MARYLAND

Drawing Title

PROPOSED SAMPLING LOCATIONS FOR AOI 1

Project No. 220210101	Figure 5A
Date 5/22/2025	
Scale 1"=50'	
Drawn By SH	

Path: \\langan.com\data\PHL\data1\220210101\Project Data\ArcGIS\APRX\220210101\220210101_2025.aprx Date: 5/22/2025 User: shennessy Time: 2:46 PM



Legend

- ● Proposed Soil Sample Location
- ● Proposed Surface Water Sample Location
- 🟧 Proposed Gauging Station
- ● Proposed Monitoring Well Location
- ● PFAS Monitoring Well Location
- — Streams and Waterbody Boundaries
- ▭ Subject Property Boundary
- ▭ PFAS Areas of Interest 2 & 7
- ▭ Limit of Disturbance

Notes:
1. All site feature locations are approximate.
2. Imagery provided through Langan's subscription to Nearmap.com. Flown 2/23/2025.
3. Feature labels are based on information obtained during Langan site visits on 11/12/2024 and 1/8/2025, and on POWER Engineers, Inc. "Site Plan with Oil Storage Locations," prepared 4/16/2018, and Perdue Agribusiness LLC "Stormwater Pollution Prevention Plan, SP3 Figure 5," prepared 2/16/2024.
4. Streams and waterbody boundaries provided by Wicomico County, City of Salisbury, Department of Information Services: GIS Division.
5. Limit of Disturbance is from the "Perdue Farms Site Plan" figure set, prepared by McCrone on 6/2024
6. Well location is from Earth Data's report titled "Results of Temporary PFAS Monitoring Well Installation and Testing at PAB" dated September 2024 (see report figure titled "Perdue AgriBusiness LLC Monitoring Wells" dated 8/23/2024). Well names were altered from the original names to distinguish between the two sets of wells on the PAB site.
7. The PFAS Area of Interest 2 boundary has been updated since the submittal of Langan's Environmental Assessment of PFAS Report dated January 21, 2025.

0 60 120
SCALE IN FEET

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Project

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SALISBURY

WICOMICO COUNTY MARYLAND

Drawing Title

PROPOSED SAMPLING LOCATIONS FOR AOI 2 & 7

Project No. 220210101
Date 5/22/2025
Scale 1"=60'
Drawn By SH
Figure 5B

Path: \\langan.com\data\PHL\data1\220210101\Project Data\ArcGIS\APRX\220210101\220210101_2025.aprx Date: 5/22/2025 User: shennessy Time: 2:41 PM

Legend

- ◉ Proposed Soil Sample Location
- Streams and Waterbody Boundaries
- ▭ Subject Property Boundary
- ⬚ PFAS Area of Interest 3

Notes:
1. All site feature locations are approximate.
2. Imagery provided through Langan's subscription to Nearmap.com. Flown 2/23/2025.
3. Feature labels are based on information obtained during Langan site visits on 11/12/2024 and 1/8/2025, and on POWER Engineers, Inc. "Site Plan with Oil Storage Locations," prepared 4/16/2018, and Perdue Agribusiness LLC "Stormwater Pollution Prevention Plan, SP3 Figure 5," prepared 2/16/2024.
4. Streams and waterbody boundaries provided by Wicomico County, City of Salisbury, Department of Information Services: GIS Division.

0 50 100
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Project

PERDUE AGRIBUSINESS, LLC

SALISBURY

WICOMICO COUNTY MARYLAND

Drawing Title

PROPOSED SAMPLING LOCATIONS FOR AOI 3

Project No.	Figure
220210101	5C
Date 5/22/2025	
Scale 1"=50'	
Drawn By SH	

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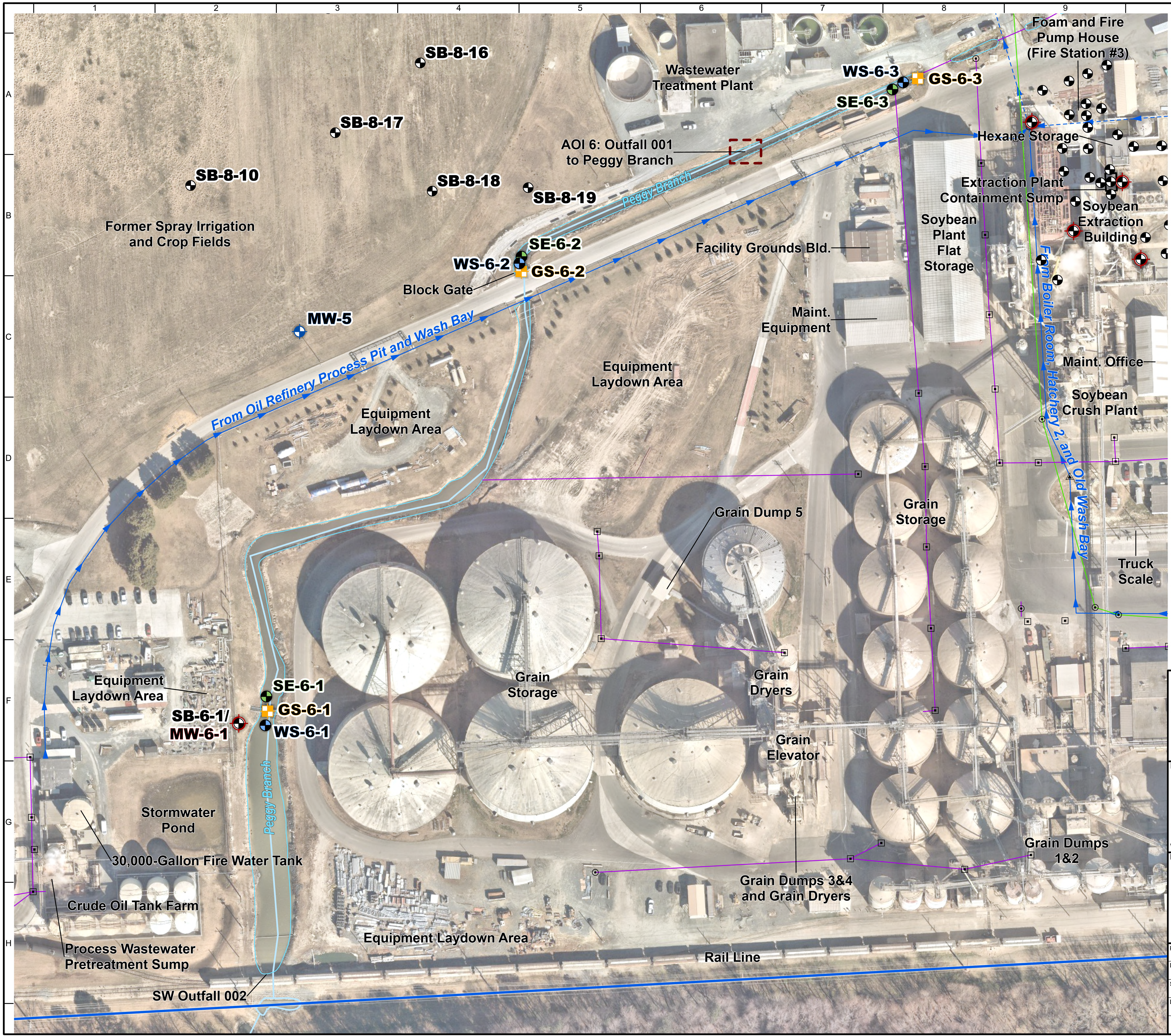

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Legend

- Proposed Soil Sample Location
- Proposed Surface Water Sample Location
- Proposed Sediment Sample Location
- Proposed Gauging Station
- Proposed Monitoring Well Location
- Spray Irrigation Monitoring Well Location
- ▲ Lift Station
- ⊙ Manhole
- ▣ Inlet
- Streams and Waterbody Boundaries
- Storm Drain
- Sanitary Sewer
- Approximate Location of Process Wastewater Line (Dashed Where Inferred)
- Subject Property Boundary
- PFAS Area of Interest 6

Notes:
1. All site feature locations are approximate.
2. Imagery provided through Langan's subscription to Nearmap.com. Flown 2/23/2025.
3. Feature labels are based on information obtained during Langan site visits on 11/12/2024 and 1/8/2025, and on POWER Engineers, Inc. "Site Plan with Oil Storage Locations," prepared 4/16/2018, and Perdue Agribusiness LLC "Stormwater Pollution Prevention Plan, SP3 Figure 5," prepared 2/16/2024.
4. Streams and waterbody boundaries provided by Wicomico County, City of Salisbury, Department of Information Services: GIS Division.
5. Approximate location of process wastewater line provided by Personal communication with Greg Ingraham, ZRC Wastewater, Perdue AgriBusiness LLC, via. Email dated 11/20/2024.

0 100 200
SCALE IN FEET

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Project

PERDUE AGRIBUSINESS, LLC

SALISBURY

WICOMICO COUNTY MARYLAND

Drawing Title

PROPOSED SAMPLING LOCATIONS FOR AOI 6

Project No. 220210101	Figure
Date 5/22/2025	5D
Scale 1"=80'	
Drawn By SH	

Legend

- ◐ Proposed Soil Sample Location
- ◐ Proposed Surface Water Sample Location
- ◐ Proposed Sediment Sample Location
- ▨ Proposed Gauging Station
- ◐ Proposed Monitoring Well Location
- ◐ Spray Irrigation Monitoring Well Location
- ▣ Inlet
- — Streams and Waterbody Boundaries
- — Storm Drain
- → Approximate Location of Process Wastewater Line (Dashed Where Inferred)
- ▭ PFAS Areas of Interest 8

Notes:
1. All site feature locations are approximate.
2. Imagery provided through Langan's subscription to Nearmap.com. Flown 2/23/2025.
3. Feature labels are based on information obtained during Langan site visits on 11/12/2024 and 1/8/2025, and on POWER Engineers, Inc. "Site Plan with Oil Storage Locations," prepared 4/16/2018, and Perdue Agribusiness LLC "Stormwater Pollution Prevention Plan, SP3 Figure 5," prepared 2/16/2024.
4. Streams and waterbody boundaries provided by Wicomico County, City of Salisbury, Department of Information Services: GIS Division.
5. Approximate location of process wastewater line provided by Personal communication with Greg Ingraham, ZRC Wastewater, Perdue AgriBusiness LLC, via. Email dated 11/20/2024.

0 100 200
SCALE IN FEET

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Project

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WICOMICO COUNTY MARYLAND

Drawing Title

PROPOSED
SAMPLING LOCATIONS
FOR AOI 8

Project No.	Figure
220210101	5E
Date 5/28/2025	
Scale 1"=100'	
Drawn By SH	

LANGAN

Path: \\langan.com\data\PHL\data1\220210101\Project Data\ArcGIS\APRX\220210101\220210101_2025.aprx Date: 5/28/2025 User: shennessy Time: 11:34 AM

Figure 6
Tentative Project Schedule
PAB Zion Church Road Salisbury, MD
June 2025 to September 2025

	Project Task/Activity	June. '25				July. '25				August. '25				September. '25				October. '25			
	Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	Phase 1 - AOI-2, AOI-3, AOI-6, AOI-7, and AOI-8																				
1A	· **Soil Sampling and Analysis**																				
	· Subsurface utility location/clearance for borings				🟩																
	· Hand auger soil boring/sampling (starting < 5 feet bgs)				🟩																
	· Direct-push soil boring/sampling (depth > 5 feet bgs)				🟩	🟩															
	· Soil sample analysis				🟩	🟩	🟩	🟩													
	· Soil sample data review and validation							🟩	🟩												
	· Select soil samples for SPLP analysis								🟩	🟩											
	· SPLP analysis										🟩	🟩									
	· SPLP data validation											🟩	🟩								
1B	· **Monitoring well Installation, Sampling, and Analysis**																				
	· Utility clearance (soft dig) for monitoring wells					🟩															
	· Monitoring well installation/development						🟩														
	· Groundwater sampling (three new monitoring wells)								🟩												
	· Groundwater sample analysis									🟩	🟩										
	· Groundwater sample data validation										🟩	🟩									
1C	· **Surface Water and Sediment Sampling and Analysis**																				
	· Surface water sampling								🟩												
	· Sediment sampling								🟩												
	· Surface water and sediment sample analysis									🟩	🟩										
	· Surface water and sediment sample data validation										🟩	🟩									
1D	· **Surface Water Gauging Stations Installation**																				
	· Install & Sample location survey								🟩												
	Phase 2 - AOI-1																				
2A	· **Soil Sampling and Analysis**																				
	· Subsurface utility location/clearance for borings									🟩											
	· Hand auger soil boring/sampling (starting < 5 feet bgs)									🟩											
	· Direct-push Soil Boring/Sampling (depth > 5 feet bgs)									🟩	🟩										
	· Soil sample analysis									🟩	🟩	🟩	🟩								
	· Review and Validate												🟩	🟩							
	· Select soil samples for SPLP analysis													🟩	🟩						
	· SPLP analysis															🟩	🟩				
	· SPLP data validation																	🟩	🟩		
2B	· **Groundwater Grab Sampling and Analysis**																				
	· Subsurface utility clearance (soft dig) for groundwater grab locations									🟩											
	· Groundwater grab sampling									🟩											
	· Groundwater grab sample analysis									🟩 RUSH TA	🟩 RUSH TA										
	· Groundwater grab sample data validation										🟩	🟩									
2C	· **Monitoring Well Installation, Sampling, and Analysis**																				
	· Utility clearance (soft dig) for monitoring wells											🟩									
	· Monitoring well installation/development											🟩									
	· Groundwater sampling (three new monitoring wells)												🟩								
	· Groundwater sample analysis												🟩	🟩							
	· Groundwater data validation													🟩	🟩						
	Phase 3 - Surface Water/Groundwater Gauging																				
3A	· **Surface Water/Groundwater Gauging**																				
	· Surface water/groundwater gauging												🟩								
	Phase 4 - Reporting																				
4A	· **Technical Memorandum Preparation**																				
	· Technical memo preparation and submission to MDE									🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩

Appendix A AFFF Wipe Sample Locations

Legend

⊙	Manhole
⊡	Inlet
―	Storm Drain
―	Sanitary Sewer
➤	Approximate Location of Process Wastewater Line (Dashed Where Inferred)
―	Streams and Waterbody Boundaries
▭	Location of AFFF Wipe Samples
⬚	PFAS Area of Interest 1

Notes:
1. All site feature locations are approximate.
2. Imagery provided through Langan's subscription to Nearmap.com. Flown 2/23/2025.
3. Utilities provided by Control Point Associates, Inc., "Perdue - Phase 2" field sketch figures. Prepared 3/9/2024.
4. Approximate location of process wastewater line provided by Personal communication with Greg Ingraham, ZRC Wastewater, Perdue AgriBusiness LLC, via. Email dated 11/20/2024.
5. Feature labels are based on information obtained during Langan site visits on 11/12/2024 and 1/8/2025, and on POWER Engineers, Inc. "Site Plan with Oil Storage Locations," prepared 4/16/2018, and Perdue Agribusiness LLC "Stormwater Pollution Prevention Plan, SP3 Figure 5," prepared 2/16/2024.
6. Streams and waterbody boundaries provided by Wicomico County, City of Salisbury, Department of Information Services: GIS Division.
7. The PFAS Area of Interest 1 boundary has been updated since the submittal of Langan's Environmental Assessment of PFAS Report dated January 21, 2025.

0 30 60
SCALE IN FEET

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Project

PERDUE
AGRIBUSINESS, LLC

SALISBURY

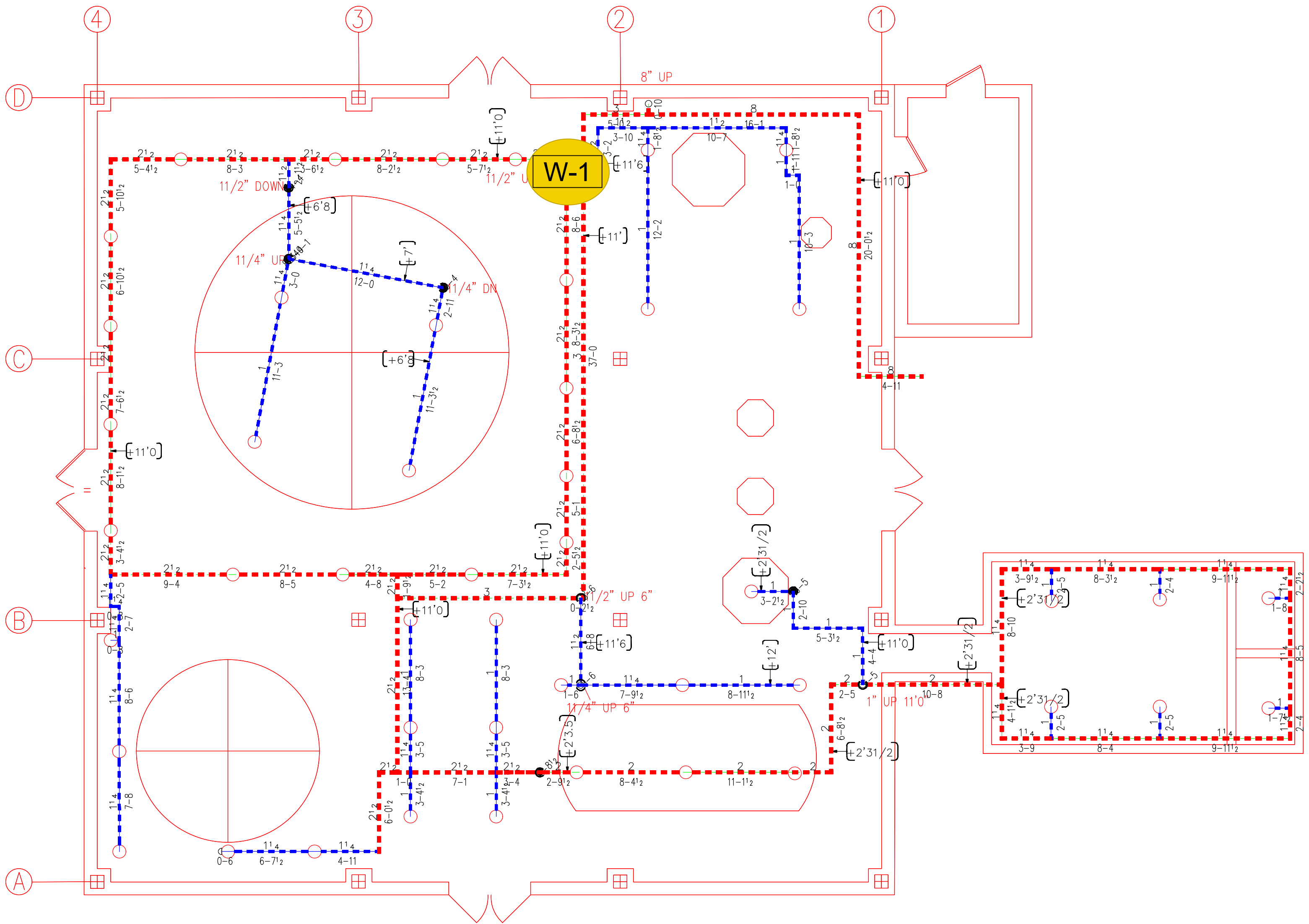
WICOMICO COUNTY MARYLAND

Drawing Title

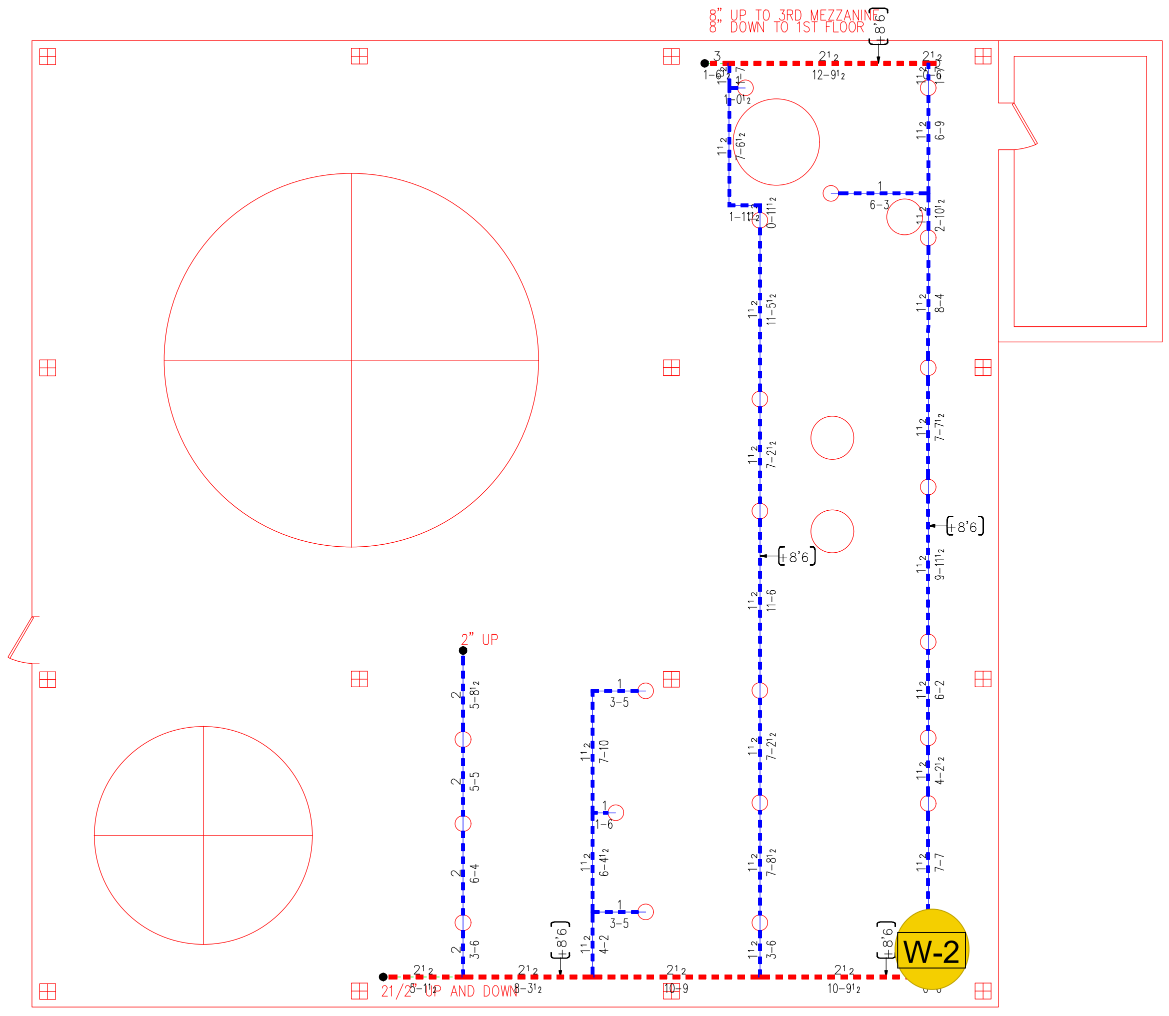
AFFF WIPE SAMPLE LOCATIONS

Project No.
220210101
Date
5/22/2025
Scale
1"=30'
Drawn By
SH

Figure
A-1



1ST FLOOR LEVEL



2ND FLOOR MEZZ LEVEL

AS-BUILTS

NO.	DATE	BY	
0			ARCH,FP,MECH,PL,ELEC, PERMIT BID SET

RESPONSIBILITY

WORK BY	DESCRIPTION OF WORK
SG	
☐	
☐	
☐	
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☐	
☐	

APPROVALS

☐ OUT ______ IN ______
☐ OUT ______ IN ______
☐ OUT ______ IN ______
☐ OUT ______ IN ______

SYSTEM INFO

SYS. #.	SYS. TYPE	VA. DIA.	TTL. SPK.	SYS. AREA

REVISIONS

NO.	DATE	BY	REVISION DESCRIPTION
1	6/5/21	REP	APPROVALS

SYMBOLS

[*13"]	PIPE ℄ TO BOTTOM OF DECK
[+12-4]	PIPE ℄ TO FINISHED FLOOR
F	WATER FLOW SWITCH
T	TAMPER SWITCH
S1	HYDRAULIC REFERENCE POINT
#1	BRANCHLINE / MAIN LABEL
A4	WELDED PIPE LABEL
⊣	CAP (THR'D OR GRV'D)
⊗	SYSTEM RISER
⊣⊢	COUPLING (THR'D OR GRV'D)
⊣▯⊢	FLANGED CONNECTION
⟷	2-WAY EARTHQUAKE BRACE
✛	4-WAY EARTHQUAKE BRACE
⊹	PIPE HANGER

IMPORTANT NOTICE TO USER

IN LOCALITIES SUBJECT TO FREEZING CONDITIONS, THE OWNER MUST MAINTAIN HEAT THROUGHOUT WET PIPE SPRINKLER SYSTEMS AREAS, AND IN ENCLOSURES WHERE DRY PIPE, DELUGE OR OTHER VALVES CONTROLLING WATER SUPPLIES TO SPRINKLER SYSTEMS ARE LOCATED.

HYDRAULIC DESIGN DATA

DESIGN AREA #	HAZARD CLASSIFICATION	DENSITY GPM/SQ.FT.	DESIGN AREA SQ. FT.	DES. AREA LENGTH FACTOR	INSIDE HOSE ALLOW.	OUTSIDE HOSE ALLOW.	# OF SPRINKLERS FLOWING	TOTAL SYSTEM REQUIREMENTS GPM	PSI	AT NODE

WATER SUPPLY INFO: STATIC PRESSURE PSI - RESIDUAL PRESSURE: PSI WITH GPM FLOWING
TEST LOCATION: BY: TEST DATE:

SPRINKLERS / NOZZLES

SYM.	QTY.	ORIENTATION	SPK FINISH	TEMP.	K-FACT	NPT	SIN	MANUFACT.	MODEL #	RESPONSE	ESCUTCHEON / SPRINKLER NOTE

TOTAL SPRINKLERS / NOZZLES THIS SHEET

SCALE: 1/4"=1'-0"
DRAWN BY: CMD
CHECKED BY: CD
CONTRACT WITH: PERDUE
CONTRACT NO: 650241457
DATE: 8/9/21
REV. #: 1

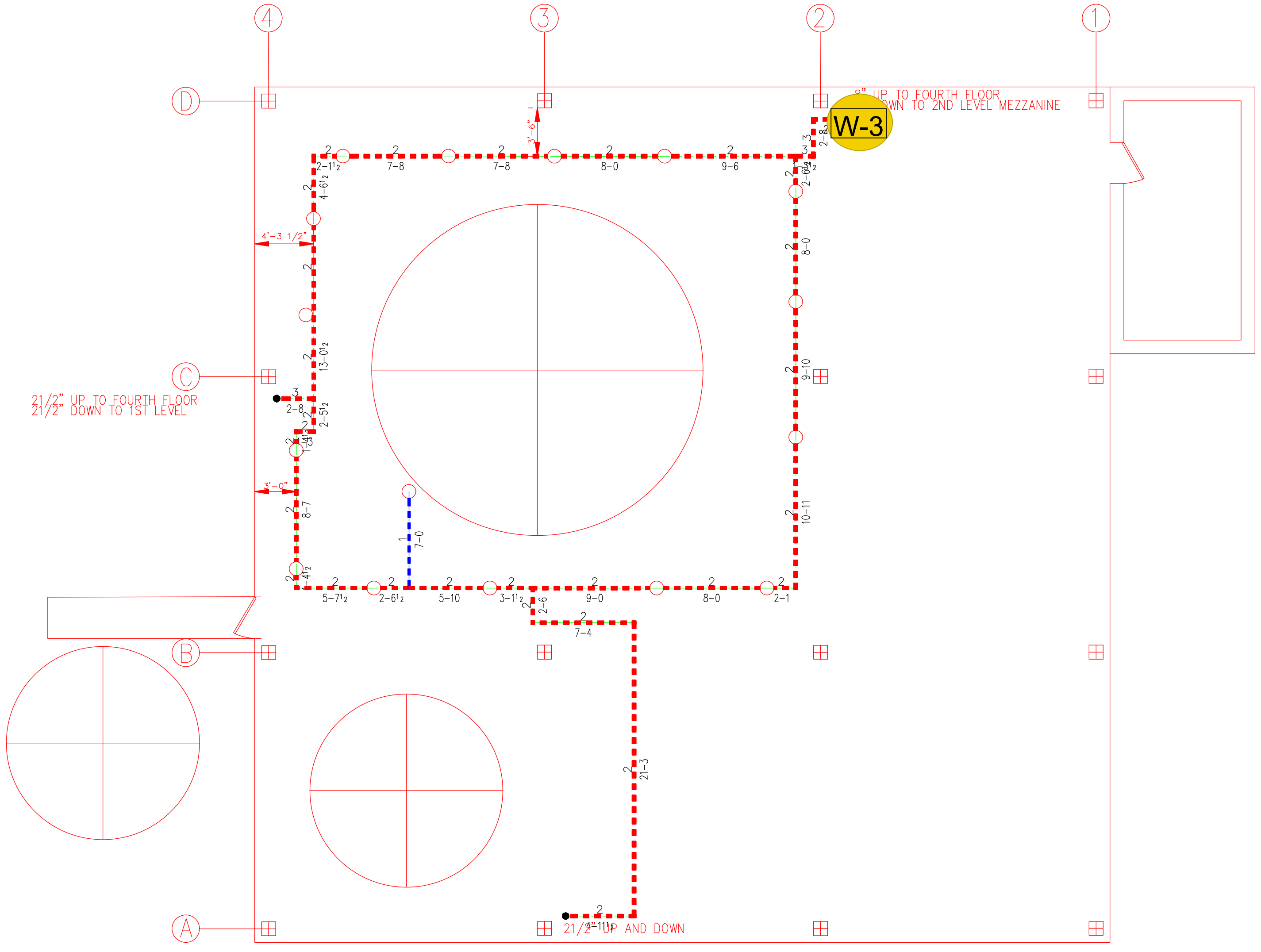
Johnson Controls

LOCAL OFFICE: 18 BOULDEN CIRCLE WILMINGTON, DE .

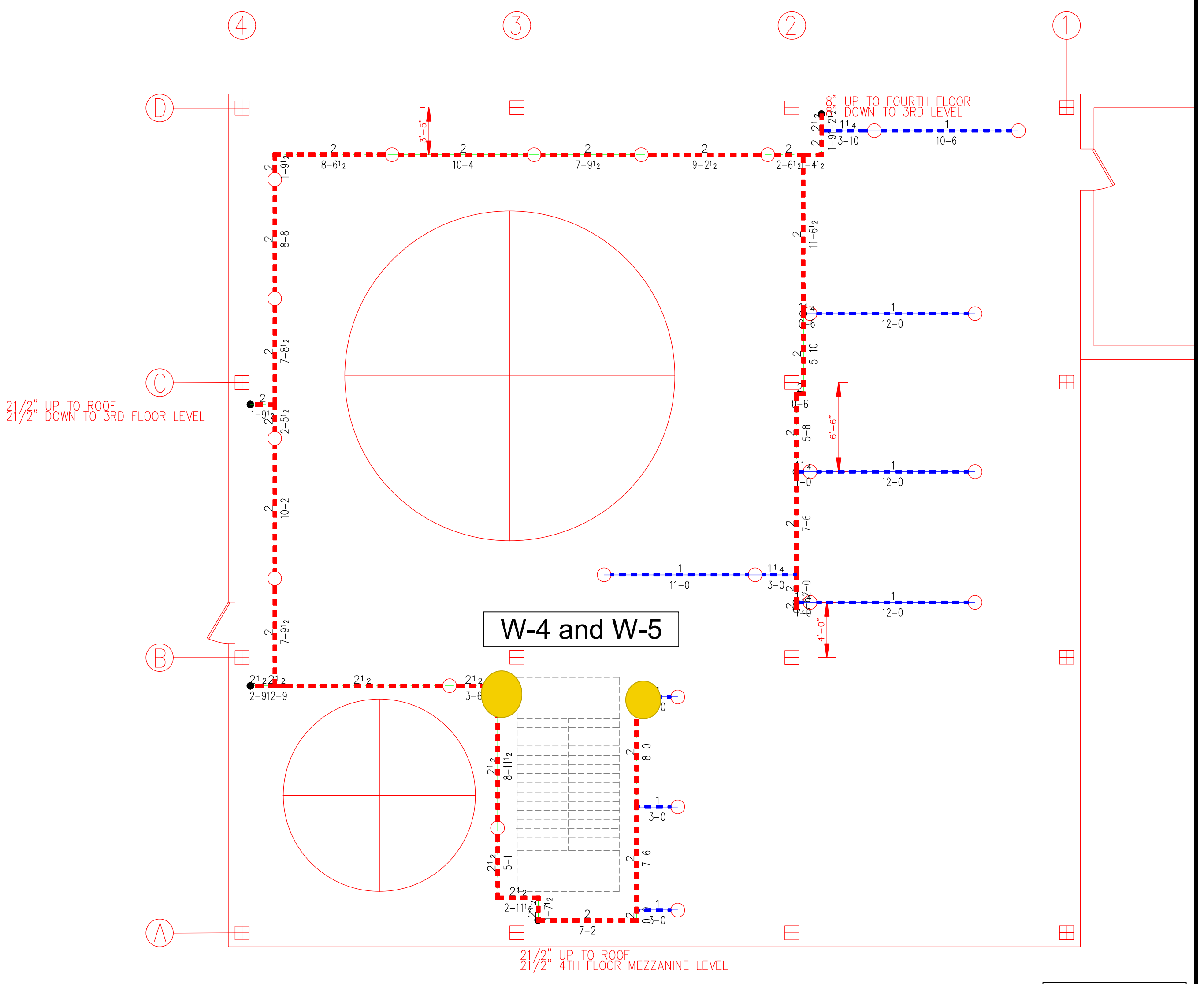
JOB NAME AND LOCATION:
PERDUE
SALISBURY SOY CRUSHING
6906 ZION CHURCH ROAD, SALISBURY, MD.

SHEET DESCRIPTION:
AS BUILT DRAWINGS

LATEST REV. DESCRIPTION: APPROVAL
DRAWING NO. FP-1



3RD FLOOR LEVEL



4TH FLOOR MEZZ LEVEL

AS-BUILTS

N

NO.	DATE	BY	
0			ARCH,FP,MECH,PL,ELEC, PERMIT BID SET

RESPONSIBILITY

WORK BY SG — DESCRIPTION OF WORK

☐
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APPROVALS

☐ OUT ______ IN ______
☐ OUT ______ IN ______
☐ OUT ______ IN ______
☐ OUT ______ IN ______

REVISIONS

NO.	DATE	BY	REVISION DESCRIPTION
1	6/5/21	REP	APPROVALS

SYSTEM INFO

SYS. #.	SYS. TYPE	VA. DIA.	TTL. SPK.	SYS. AREA

SYMBOLS

*13"	PIPE ℄ TO BOTTOM OF DECK
+12-4	PIPE ℄ TO FINISHED FLOOR
F	WATER FLOW SWITCH
T	TAMPER SWITCH
S1	HYDRAULIC REFERENCE POINT
#1	BRANCHLINE / MAIN LABEL
A4	WELDED PIPE LABEL
	CAP (THR'D OR GRV'D)
⊗	SYSTEM RISER
	COUPLING (THR'D OR GRV'D)
	FLANGED CONNECTION
	2-WAY EARTHQUAKE BRACE
	4-WAY EARTHQUAKE BRACE
	PIPE HANGER

IMPORTANT NOTICE TO USER

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IN LOCALITIES SUBJECT TO FREEZING CONDITIONS, THE OWNER MUST MAINTAIN HEAT THROUGHOUT WET PIPE SPRINKLER SYSTEMS AREAS, AND IN ENCLOSURES WHERE DRY PIPE, DELUGE OR OTHER VALVES CONTROLLING WATER SUPPLIES TO SPRINKLER SYSTEMS ARE LOCATED.

HYDRAULIC DESIGN DATA

DESIGN AREA #	HAZARD CLASSIFICATION	DENSITY GPM/SQ.FT.	DESIGN AREA SQ. FT.	DES. AREA LENGTH FACTOR	INSIDE HOSE ALLOW.	OUTSIDE HOSE ALLOW.	# OF SPRINKLERS FLOWING	TOTAL SYSTEM REQUIREMENTS GPM	PSI	AT NODE

WATER SUPPLY INFO: STATIC PRESSURE PSI - RESIDUAL PRESSURE: PSI WITH GPM FLOWING
TEST LOCATION: BY: TEST DATE:

SPRINKLERS / NOZZLES

SYM.	QTY.	ORIENTATION	SPK FINISH	TEMP.	K-FACT	NPT	SIN	MANUFACT.	MODEL #	RESPONSE	ESCUTCHEON / SPRINKLER NOTE

TOTAL SPRINKLERS / NOZZLES THIS SHEET

SCALE:	1/4"=1'-0"
DRAWN BY:	CMD
CHECKED BY:	CD
CONTRACT WITH:	PERDUE
CONTRACT NO:	650241457
DATE:	8/9/21
REV. #:	1

Johnson Controls

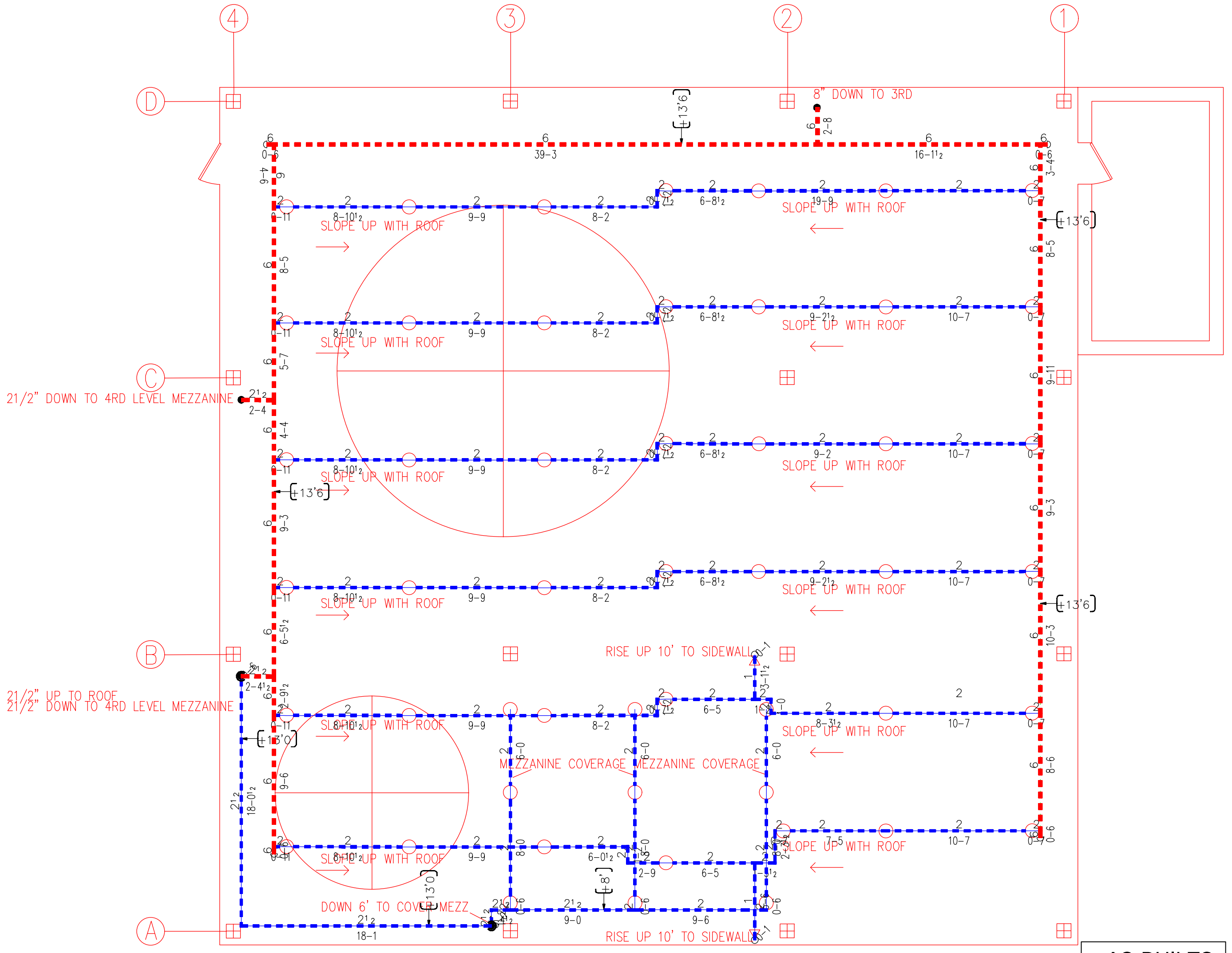
LOCAL OFFICE: 18 BOULDEN CIRCLE WILMINGTON, DE .

JOB NAME AND LOCATION:
PERDUE
SALISBURY SOY CRUSHING
6906 ZION CHURCH ROAD, SALISBURY, MD.

SHEET DESCRIPTION:
AS BUILT DRAWINGS

LATEST REV. DESCRIPTION: APPROVAL

DRAWING NO. FP-2



4TH/ROOF FLOOR LEVEL

AS-BUILTS

N

NO.	DATE	BY	
0			ARCH,FP,MECH,PL,ELEC, PERMIT BID SET

RESPONSIBILITY

WORK BY SG	DESCRIPTION OF WORK
☐	
☐	
☐	
☐	
☐	
☐	
☐	
☐	
☐	
☐	
☐	

APPROVALS

☐ OUT ______ IN ______
☐ OUT ______ IN ______
☐ OUT ______ IN ______
☐ OUT ______ IN ______

SYSTEM INFO

SYS. #	SYS. TYPE	VA. DIA.	TTL. SPK.	SYS. AREA

REVISIONS

NO.	DATE	BY	REVISION DESCRIPTION
1	6/5/21	REP	APPROVALS

SYMBOLS

- [*13"] PIPE ℄ TO BOTTOM OF DECK
- [+12-4] PIPE ℄ TO FINISHED FLOOR
- F WATER FLOW SWITCH
- T TAMPER SWITCH
- S1 HYDRAULIC REFERENCE POINT
- #1 BRANCHLINE / MAIN LABEL
- A4 WELDED PIPE LABEL
- CAP (THR'D OR GRV'D)
- ⊗ SYSTEM RISER
- COUPLING (THR'D OR GRV'D)
- FLANGED CONNECTION
- 2-WAY EARTHQUAKE BRACE
- 4-WAY EARTHQUAKE BRACE
- PIPE HANGER

IMPORTANT NOTICE TO USER

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HYDRAULIC DESIGN DATA

DESIGN AREA #	HAZARD CLASSIFICATION	DENSITY GPM/SQ.FT.	DESIGN AREA SQ. FT.	DES. AREA LENGTH FACTOR	INSIDE HOSE ALLOW.	OUTSIDE HOSE ALLOW.	# OF SPRINKLERS FLOWING	TOTAL SYSTEM REQUIREMENTS GPM	PSI	AT NODE

WATER SUPPLY INFO: STATIC PRESSURE PSI - RESIDUAL PRESSURE: PSI WITH GPM FLOWING

TEST LOCATION: BY: TEST DATE:

SPRINKLERS / NOZZLES

SYM.	QTY.	ORIENTATION	SPK FINISH	TEMP.	K-FACT	NPT	SIN	MANUFACT.	MODEL #	RESPONSE	ESCUTCHEON / SPRINKLER NOTE

TOTAL SPRINKLERS / NOZZLES THIS SHEET

SCALE: 1/4"=1'-0"
DRAWN BY: CMD
CHECKED BY: CD
CONTRACT WITH: PERDUE
CONTRACT NO: 650241457
DATE: 8/9/21
REV. #: 1

Johnson Controls

LOCAL OFFICE: 18 BOULDEN CIRCLE WILMINGTON, DE .

JOB NAME AND LOCATION:
PERDUE
SALISBURY SOY CRUSHING
6906 ZION CHURCH ROAD, SALISBURY, MD.

SHEET DESCRIPTION:
AS BUILT DRAWINGS

LATEST REV. DESCRIPTION: APPROVAL

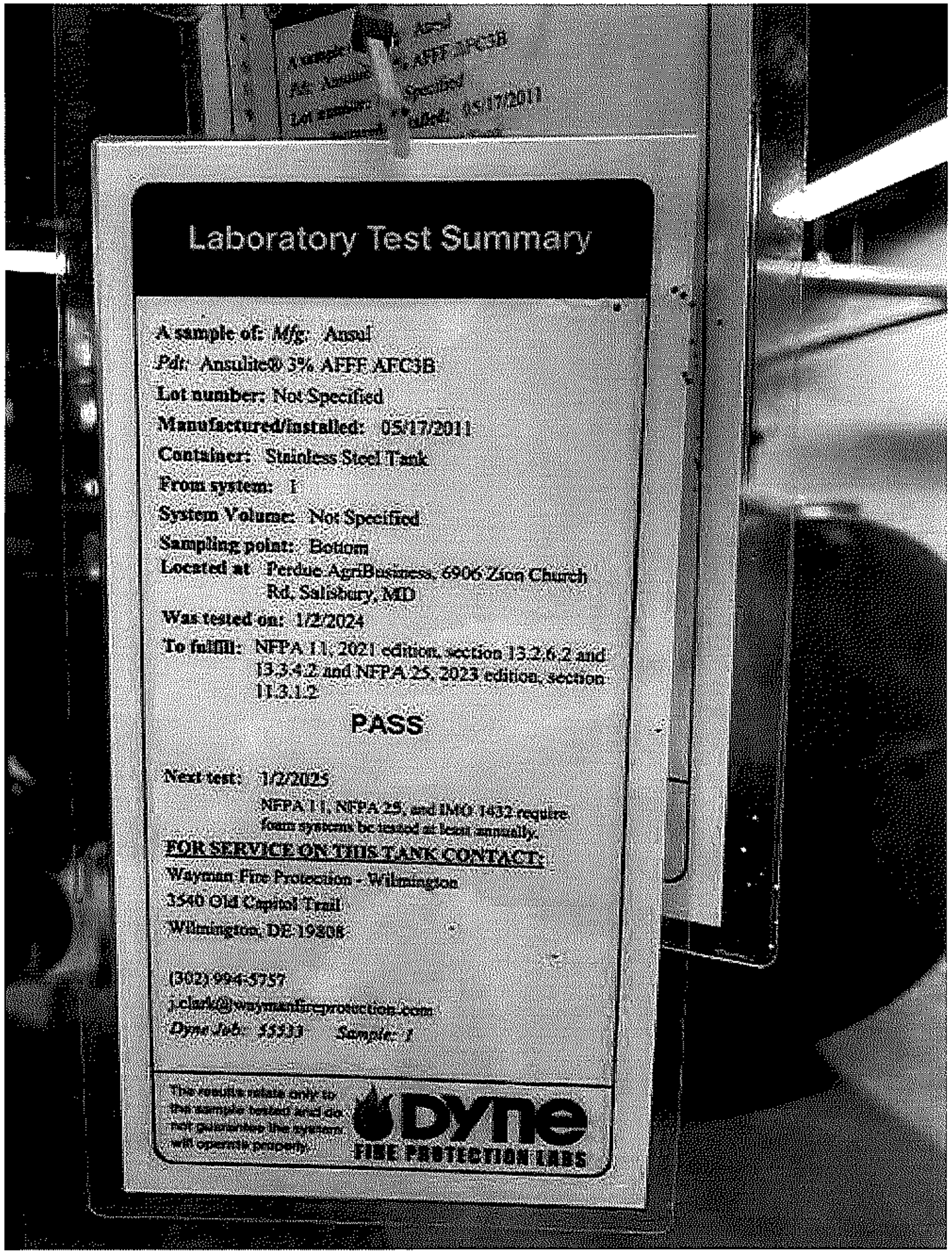
DRAWING NO. FP-2

Appendix B Historical Analytical Data

Laboratory Reports

LABORATORY ANALYTICAL DATA: SUBMITTED ON APRIL 10, 2024 IN A COMPRESSED ZIP FILE

Appendix C AFFF Purchases, Inventory and Uses



Laboratory Test Summary

A sample of: *Mfg:* Ansul
Pdt: Ansulite® 3% AFFF AFC3B
Lot number: Not Specified
Manufactured/installed: 05/17/2011
Container: Stainless Steel Tank
From system: I
System Volume: Not Specified
Sampling point: Bottom
Located at Perdue AgriBusiness, 6906 Zion Church Rd, Salisbury, MD
Was tested on: 1/2/2024
To fulfill: NFPA 11, 2021 edition, section 13.2.6.2 and 13.3.4.2 and NFPA 25, 2023 edition, section 11.3.1.2

PASS

Next test: 1/2/2025
NFPA 11, NFPA 25, and IMO 1432 require foam systems be tested at least annually.

FOR SERVICE ON THIS TANK CONTACT:
Wayman Fire Protection - Wilmington
3540 Old Capitol Trail
Wilmington, DE 19808

(302) 994-5757
j.clark@waymanfireprotection.com
Dyne Job: 55533 *Sample:* 1

The results relate only to the sample tested and do not guarantee the system will operate properly.

Dyne
FIRE PROTECTION LABS

The foam in this tank/container was tested and met quality condition testing in accordance with NFPA 11.

Date Tested: 6/13/2007
Job Number: 6902
Sample Number: 1
Type: 3% AFFF
Product: 3M™ FC-783F
Lot Number: Not Specified
Tank Number: 1
Sampling Point: Bottom
Date Purchased: Not Specified
Next Recommended Test Date: 6/13/2008

<u>FOR SERVICE ON THIS TANK CONTACT:</u>

Dyne Technologies

The foam in this tank/container was tested and met the following specification:

NFPA 11 Standard for Low Expansion Foam

Date Tested: 5/26/2010
Job Number: 11244
Sample Number: 1
Type: 3% AFFF
Product: BFC-3 Platinum
Lot Number: 30086
Tank Number: 1 Top
Sampling Point: Top
Date Purchased: 11/01/2007
Next Recommended Test Date: 5/26/2011

<u>FOR SERVICE ON THIS TANK CONTACT:</u>

This sample was tested and met the following specification:

NFPA 11 Standard for Low Expansion Foam

Salisbury SBP

Date Tested:	12/14/2012
Job Number:	16823
Sample Number:	3
Type:	3% AFFF
Product:	Ansulite® AFC-3A
Lot Number:	2218
Tank Number:	1
Sampling Point:	Bottom
Date Purchased:	11/13/2012
Next Recommended Test Date:	12/14/2013

FOR SERVICE ON THIS TANK CONTACT:

Dyne Technologies
2357 Ventura Drive, Suite 108
Woodbury, MN 55125
Toll Free: (800) 632-2304

This sample was tested and met the following specification:

NFPA 11 Standard for Low Expansion Foam

Salisbury SBP

Date Tested:	12/14/2012
Job Number:	16823
Sample Number:	1
Type:	3% AFFF
Product:	Ansulite® AFC-3A
Lot Number:	2218
Tank Number:	1
Sampling Point:	Top
Date Purchased:	11/13/2012
Next Recommended Test Date:	12/14/2013

FOR SERVICE ON THIS TANK CONTACT:

Dyne Technologies
2357 Ventura Drive, Suite 108
Woodbury, MN 55125
Toll Free: (800) 632-2304

This sample was tested and met the following specification:

NFPA 11 Std. for Low Expansion Foam ONLY USE IN LISTED SYSTEMS AND APPLICATIONS

Perdue Extraction

Date Tested: 4/15/2015
Job Number: 22518
Sample Number: 1
Type: 3% AFFF
Product: AFC-3A
Lot Number: 2419
Tank Number: Vertical Tank Conc
Sampling Point: Not Specified
Date Purchased: 07/01/2014
Next Recommended Test Date: 4/15/2016

<u>FOR SERVICE ON THIS TANK CONTACT:</u>

SIMPLEX GRINNELL - NEW CASTLE
17 MCCULLOUGH DRIVE
NEW CASTLE, DE 19702
(302) 325-6300

This sample was tested and met the following specification:

Water - Informational Only - No Pass/Fail

Perdue Extraction

Date Tested: 4/15/2015
Job Number: 22518
Sample Number: 2
Type: WATER
Product: System or Shell Water
Lot Number: Not Specified
Tank Number: Vertical Tank Water
Sampling Point: Not Specified
Date Purchased: Not Specified
Next Recommended Test Date: 4/15/2016

<u>FOR SERVICE ON THIS TANK CONTACT:</u>

SIMPLEX GRINNELL - NEW CASTLE
17 MCCULLOUGH DRIVE
NEW CASTLE, DE 19702
(302) 325-6300

This sample was tested and met the following specification:

NFPA 11 Std. for Low Expansion Foam ONLY USE IN LISTED SYSTEMS AND APPLICATIONS

Perdue Extraction

Date Tested:	4/15/2015
Job Number:	22518
Sample Number:	3
Type:	3% AFFF
Product:	AFC-3A
Lot Number:	2218
Tank Number:	Horizontal Tank Conc
Sampling Point:	Not Specified
Date Purchased:	11/13/2012
Next Recommended Test Date:	4/15/2016

FOR SERVICE ON THIS TANK CONTACT:

SIMPLEX GRINNELL - NEW CASTLE
17 MCCULLOUGH DRIVE
NEW CASTLE, DE 19702
(302) 325-6300

This sample was tested and met the following specification:

Water - Informational Only - No Pass/Fail

Perdue Extraction

Date Tested:	4/15/2015
Job Number:	22518
Sample Number:	4
Type:	WATER
Product:	System or Shell Water
Lot Number:	Not Specified
Tank Number:	Horizontal Tank Water
Sampling Point:	Not Specified
Date Purchased:	Not Specified
Next Recommended Test Date:	4/15/2016

FOR SERVICE ON THIS TANK CONTACT:

SIMPLEX GRINNELL - NEW CASTLE
17 MCCULLOUGH DRIVE
NEW CASTLE, DE 19702
(302) 325-6300

This sample was tested and met the following specification:

NFPA 11 Std. for Low Expansion Foam
ONLY USE IN LISTED SYSTEMS AND APPLICATIONS

Perdue Agribusiness

Date Tested: 10/4/2016
Job Number: 26998
Sample Number: 1
Type: 3% AFFF
Product: Ansulite® 3% AFFF AFC-3A
Lot Number: 2309
Tank Number: Horizontal Tank
Sampling Point: Bottom
Date Purchased: 05/01/2013

Next Recommended Test Date: 10/4/2017

<u>FOR SERVICE ON THIS TANK CONTACT:</u>

SIMPLEX GRINNELL - NEW CASTLE

17 MCCULLOUGH DRIVE
NEW CASTLE, DE 1970

This sample was tested and met the following specification:

NFPA 11 Std. for Low Expansion Foam
ONLY USE IN LISTED SYSTEMS AND APPLICATIONS

Perdue Agribusiness

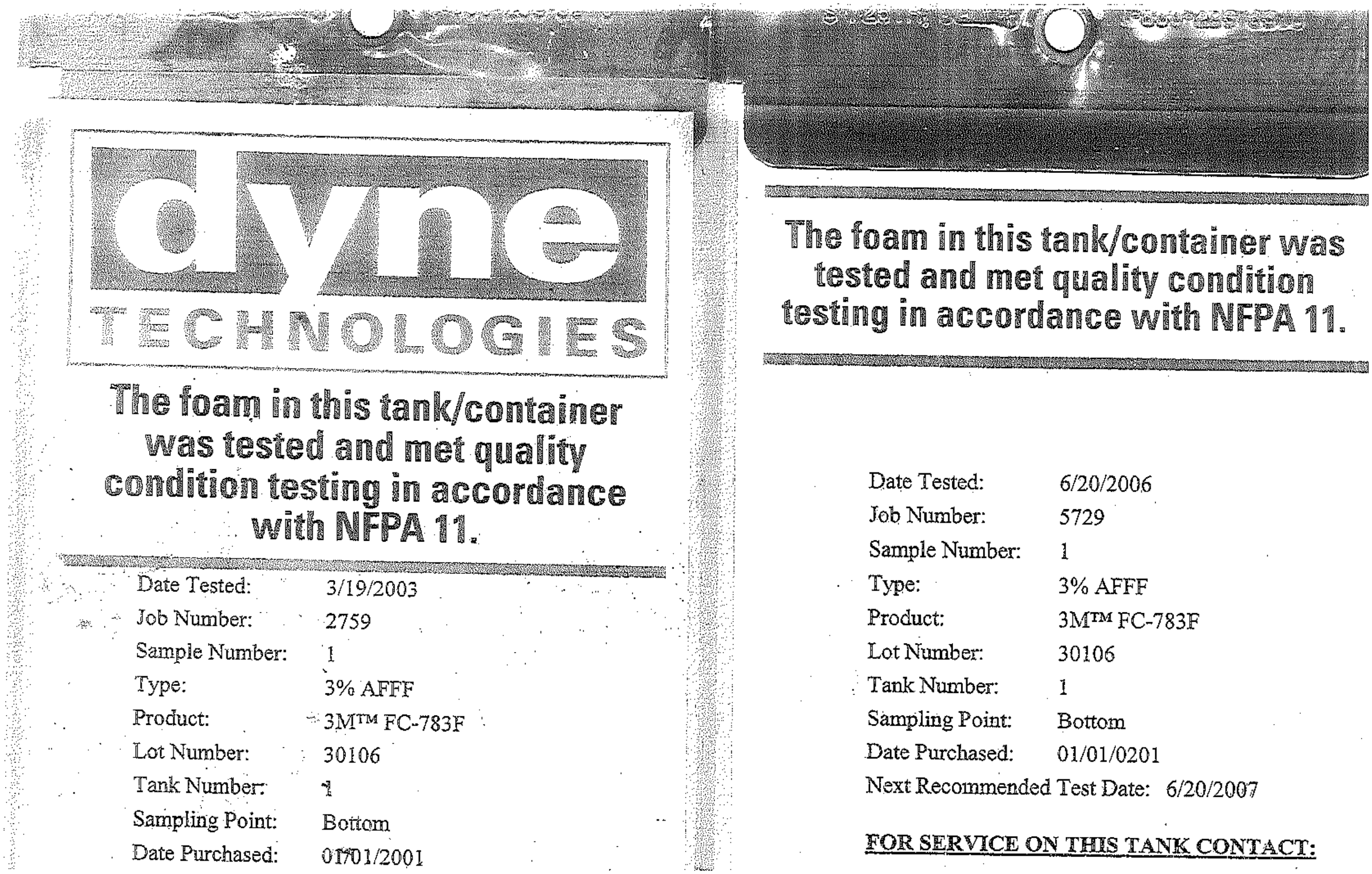
Date Tested: 10/4/2016
Job Number: 26998
Sample Number: 2
Type: 3% AFFF
Product: Ansulite® 3% AFFF AFC-3A
Lot Number: 2419
Tank Number: Vertical Tank
Sampling Point: Bottom
Date Purchased: 07/01/2014

Next Recommended Test Date: 10/4/2017

<u>FOR SERVICE ON THIS TANK CONTACT:</u>

SIMPLEX GRINNELL - NEW CASTLE

17 MCCULLOUGH DRIVE
NEW CASTLE, DE 19702



dyne TECHNOLOGIES

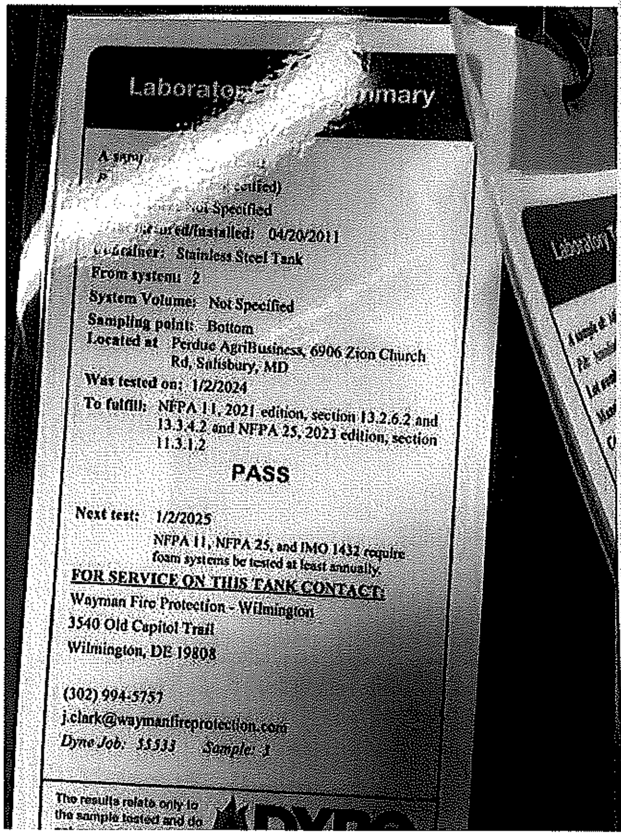
The foam in this tank/container was tested and met quality condition testing in accordance with NFPA 11.

Date Tested:	3/19/2003
Job Number:	2759
Sample Number:	1
Type:	3% AFFF
Product:	3M™ FC-783F
Lot Number:	30106
Tank Number:	1
Sampling Point:	Bottom
Date Purchased:	01/01/2001

The foam in this tank/container was tested and met quality condition testing in accordance with NFPA 11.

Date Tested:	6/20/2006
Job Number:	5729
Sample Number:	1
Type:	3% AFFF
Product:	3M™ FC-783F
Lot Number:	30106
Tank Number:	1
Sampling Point:	Bottom
Date Purchased:	01/01/0201
Next Recommended Test Date:	6/20/2007

FOR SERVICE ON THIS TANK CONTACT:



Laborato mmary

A sam

cified)

Specified

ured/Installed: 04/20/2011

ntainer: Stainless Steel Tank

From system: 2

System Volume: Not Specified

Sampling point: Bottom

Located at Perdue AgriBusiness, 6906 Zion Church Rd, Salisbury, MD

Was tested on: 1/2/2024

To fulfill: NFPA 11, 2021 edition, section 13.2.6.2 and 13.3.4.2 and NFPA 25, 2023 edition, section 11.3.1.2

PASS

Next test: 1/2/2025

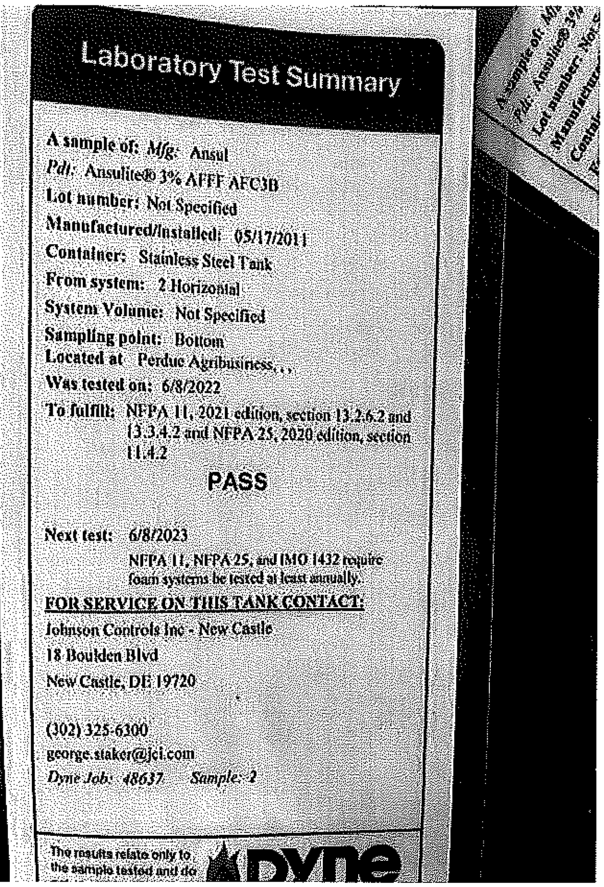
NFPA 11, NFPA 25, and IMO 1432 require foam systems be tested at least annually.

FOR SERVICE ON THIS TANK CONTACT:

Wayman Fire Protection - Wilmington
3540 Old Capitol Trail
Wilmington, DE 19808

(302) 994-5757
j.clark@waymanfireprotection.com
Dyne Job: 55533 *Sample:* 1

The results relate only to the sample tested and do



Laboratory Test Summary

A sample of: *Mfg:* Ansul
Pdt: Ansulite® 3% AFFF AFC3B
Lot number: Not Specified
Manufactured/Installed: 05/17/2011
Container: Stainless Steel Tank
From system: 2 Horizontal
System Volume: Not Specified
Sampling point: Bottom
Located at Perdue Agribusiness, . .
Was tested on: 6/8/2022
To fulfill: NFPA 11, 2021 edition, section 13.2.6.2 and 13.3.4.2 and NFPA 25, 2020 edition, section 11.4.2

PASS

Next test: 6/8/2023

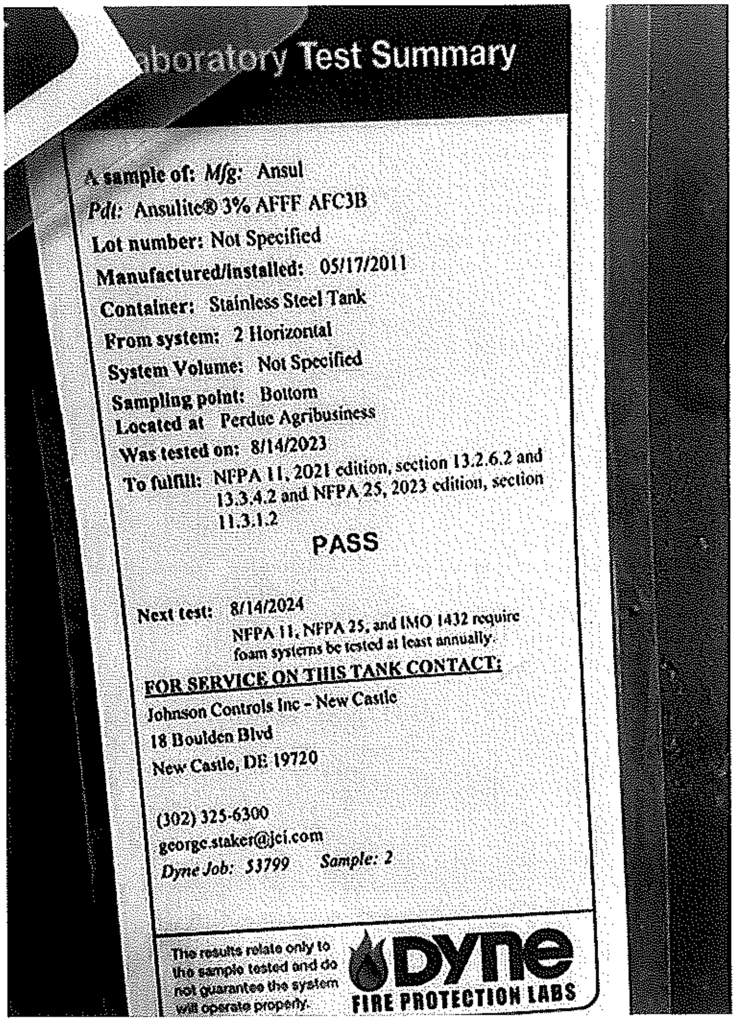
NFPA 11, NFPA 25, and IMO 1432 require foam systems be tested at least annually.

FOR SERVICE ON THIS TANK CONTACT:

Johnson Controls Inc - New Castle
18 Boulden Blvd
New Castle, DE 19720

(302) 325-6300
george.staker@jci.com
Dyne Job: 48637 *Sample:* 2

The results relate only to the sample tested and do



aboratory Test Summary

A sample of: *Mfg:* Ansul
Pdt: Ansulite® 3% AFFF AFC3B
Lot number: Not Specified
Manufactured/installed: 05/17/2011
Container: Stainless Steel Tank
From system: 2 Horizontal
System Volume: Not Specified
Sampling point: Bottom
Located at Perdue Agribusiness
Was tested on: 8/14/2023
To fulfill: NFPA 11, 2021 edition, section 13.2.6.2 and 13.3.4.2 and NFPA 25, 2023 edition, section 11.3.1.2

PASS

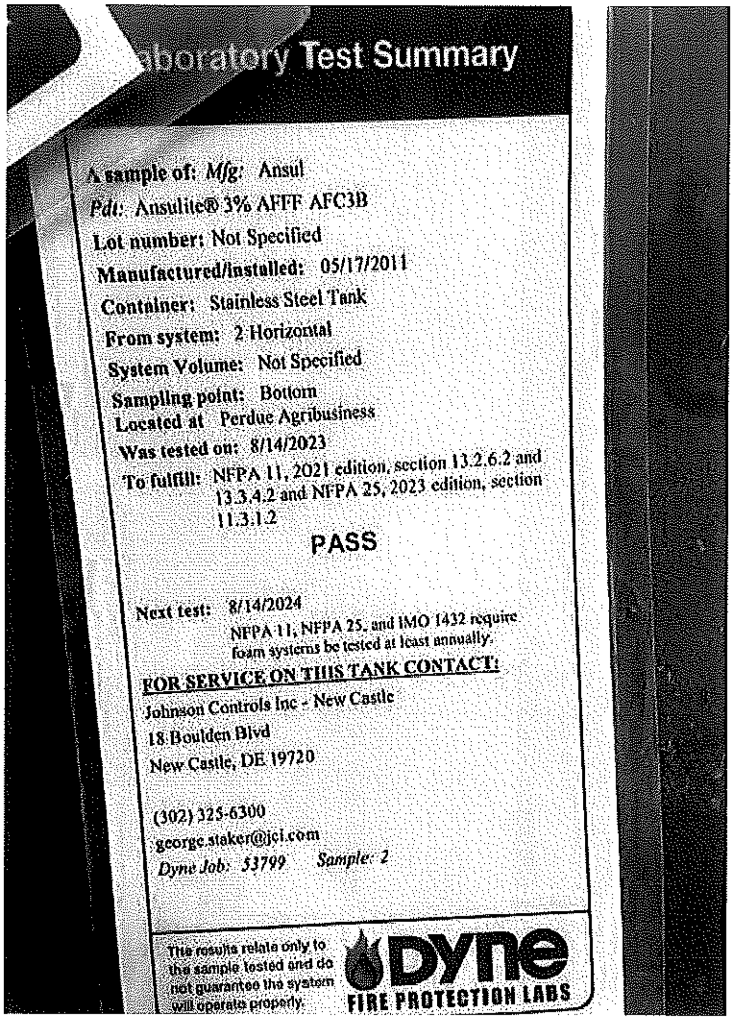
Next test: 8/14/2024
NFPA 11, NFPA 25, and IMO 1432 require foam systems be tested at least annually.

FOR SERVICE ON THIS TANK CONTACT:
Johnson Controls Inc - New Castle
18 Boulden Blvd
New Castle, DE 19720

(302) 325-6300
george.staker@jci.com
Dyne Job: 53799 *Sample:* 2

The results relate only to the sample tested and do not guarantee the system will operate properly.

Dyne
FIRE PROTECTION LABS



aboratory Test Summary

A sample of: *Mfg:* Ansul
Pdt: Ansulite® 3% AFFF AFC3B
Lot number: Not Specified
Manufactured/installed: 05/17/2011
Container: Stainless Steel Tank
From system: 2 Horizontal
System Volume: Not Specified
Sampling point: Bottom
Located at Perdue Agribusiness
Was tested on: 8/14/2023
To fulfill: NFPA 11, 2021 edition, section 13.2.6.2 and 13.3.4.2 and NFPA 25, 2023 edition, section 11.3.1.2

PASS

Next test: 8/14/2024
NFPA 11, NFPA 25, and IMO 1432 require foam systems be tested at least annually.

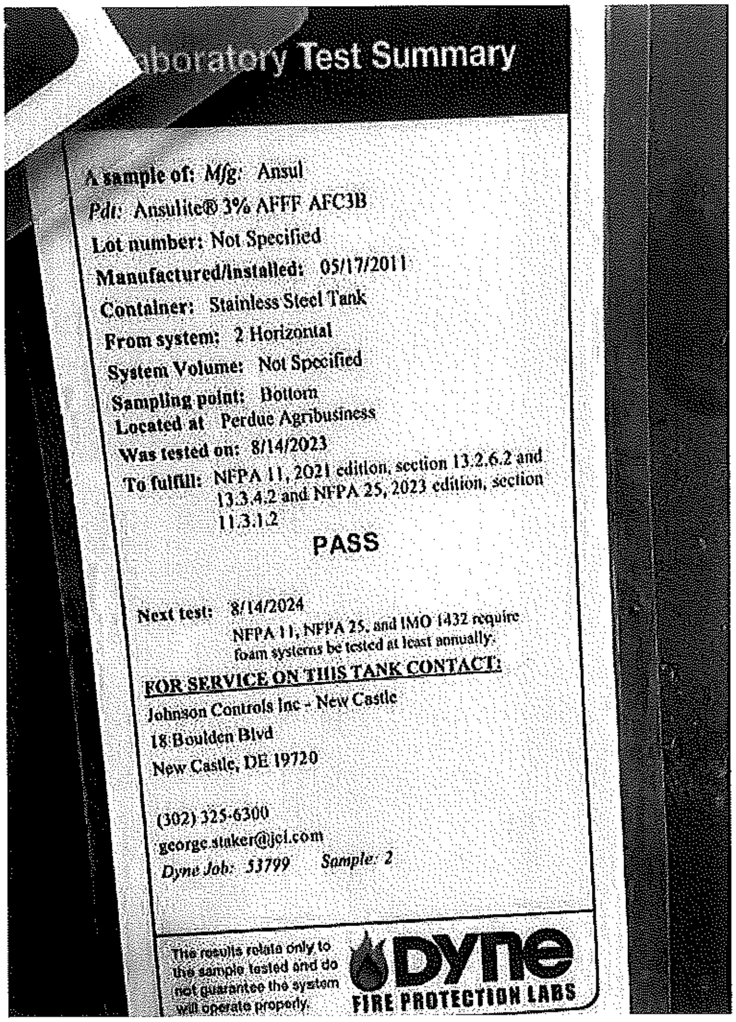
FOR SERVICE ON THIS TANK CONTACT:

Johnson Controls Inc - New Castle
18 Boulden Blvd
New Castle, DE 19720

(302) 325-6300
george.staker@jci.com
Dyne Job: 53799 *Sample:* 2

The results relate only to the sample tested and do not guarantee the system will operate properly.

Dyne
FIRE PROTECTION LABS



boratory Test Summary

A sample of: *Mfg:* Ansul
Pdt: Ansulite® 3% AFFF AFC3B
Lot number: Not Specified
Manufactured/installed: 05/17/2011
Container: Stainless Steel Tank
From system: 2 Horizontal
System Volume: Not Specified
Sampling point: Bottom
Located at Perdue Agribusiness
Was tested on: 8/14/2023
To fulfill: NFPA 11, 2021 edition, section 13.2.6.2 and 13.3.4.2 and NFPA 25, 2023 edition, section 11.3.1.2

PASS

Next test: 8/14/2024
NFPA 11, NFPA 25, and IMO 1432 require foam systems be tested at least annually.

FOR SERVICE ON THIS TANK CONTACT:

Johnson Controls Inc - New Castle
18 Boulden Blvd
New Castle, DE 19720

(302) 325-6300
george.staker@jci.com
Dyne Job: 53799 *Sample:* 2

The results relate only to the sample tested and do not guarantee the system will operate properly.

Dyne
FIRE PROTECTION LABS

Appendix D PFAS Investigation Standard Operating Procedures (SOPs)

VERSION 3.0
March 5, 2025

STANDARD OPERATING PROCEDURES
PFAS SOIL SAMPLE COLLECTION VIA DIRECT PUSH

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to describe soil-sampling methods using "Direct-Push" (DP) techniques, such as Geoprobe®, Enviro-core®, and cone penetrometer testing (CPT). DP technology is effective for application in unconsolidated formations consisting primarily of sand, silt, and clay with some gravel. DP machines advance sampling and logging tools into the subsurface using a percussion hammer and vehicle weight, sometimes to depths exceeding 100 ft. DP tools are not for use in consolidated rock like limestone, granite or gneiss. This procedure gives descriptions of equipment, field procedures, and quality assurance/quality control (QA/QC) procedures necessary to collect soil samples using DP techniques. The soil sampling techniques described in this SOP are generally suitable for samples analyzed for chemical characterization and physical classification tests. However, because of the narrow diameter of the DP probe, the resulting soil samples should generally be considered "disturbed" with respect to physical structure and may not be suitable for measuring sensitive physical parameters, such as strength and compressibility.

This SOP provides protocols and procedures for initial scoping/planning/preparation, pre-sampling procedures, sampling methods using DP techniques, post-sample collection procedures and documentation, other resources and considerations, and select reference materials. These are SOPs (i.e., typically applicable), which can be varied or changed as required, depending on site conditions, equipment limitations, or other procedural limitations, as encountered. In all instances, any deviations from the SOPs should be discussed with the field team leader/project manager before proceeding and the ultimate procedures should be documented.

2. Limitations

The procedures described herein should be followed to meet project data quality objectives. Note, however, that regulatory, client-specific, health & safety, or field conditions ("overriding conditions") may necessitate deviations from the procedures in this SOP to address such overriding conditions. Deviations should be documented in the final report for the associated phase of the project.

3. Health & Safety

When working on-site, comply with the project Health and Safety Plan (HASP) and Langan's Injury and Illness Prevention Program. Proper personal protection clothing and equipment (PPE) are to be worn as specified in the HASP and Job Safety Analysis (JSA).

4. Scope, Application, and Planning

Site-specific conditions may warrant modifying field practices performed in accordance with this SOP. Therefore, guidance provided in this SOP is presented in terms of general steps and strategies that should be applied when approaching an investigation involving soil sampling using DP techniques.

The project manager (PM) and field development team are responsible for providing the proposed soil sample locations. Coordinate site access with the client or site manager and ensure you have access to each soil sample location.

5. Methods

Common DP methods for the collection of soil samples include single-tube and dual-tube approaches. Single-tube methods use a single string of rods or casing to advance the sampler into the subsurface and samples are recovered incrementally as the boring is advanced. These methods are typically quicker and more efficient for shallow applications (<20 ft.) Samples are tripped out of the boring through the uncased borehole so formation collapse and cross contamination in non-cohesive and saturated formations may be problematic. However, closed piston, single-tube samplers can provide high-integrity samples under most formation conditions. Dual-tube samplers utilize concentric casings to advance the borings. The outer casing remains in place as the inner casing is used to trip out the sample as the boring is advanced incrementally. The outer casing prevents borehole collapse and generally reduces the potential for cross contamination between sampling intervals.

A certified driller will use the appropriate drilling equipment to advance the DP probe and sampler to the appropriate depth. The driller will retrieve the soil boring acetate liner from within the sampler. The Langan personnel will then log the lithology of the boring in the field book, boring log form, Collector App, etc., and screen the soil boring with a photoionization detector (PID) for volatile vapors, as prescribed in the site-specific work plan(s). Once the analytical sample intervals and method(s) have been confirmed, volatile organic compounds (VOCs) samples will be collected first, and the remaining analytical samples will be collected using clean, stainless steel or disposal spoons from the prescribed sample interval.

Pre-Sampling Preparation:

1. Review the sampling plan, QAPP, and site-specific instructions and documents.
2. Sign the HASP; have the subcontractor review and sign the HASP if hired by Langan.
3. Before the field work begins, complete the Langan Safe Work Certificate (SWC) which provides a summary of the daily work tasks, identification of potential hazards associated with the work tasks and measures employees should follow to mitigate potential hazards.

4. Verify that personnel are aware of and adhere to protocols to minimize PFAS cross-contamination. See Recommended Environmental PFAS Sampling SOP for expanded guidance.
5. Confirm the drilling subcontractor does not use lubricants or decontamination fluids containing PFAS.
6. If not already calibrated by the environmental equipment rental company, turn on and calibrate PID in accordance with the manufacturer's instructions, and record calibration in the field book.

DP Soil Sampling Protocol:

1. Upon arrival, document site conditions (e.g., nearby activities, presence of standing water, ground surface materials), weather, and any potential sources of cross-contamination (including PFAS-related considerations such as site equipment or materials that may contain fluoropolymers).
2. Direct the driller where to advance the soil boring and at what depth the soil boring should be advanced. This information is based on site-specific work plan(s). Wear proper head (hard hat), eye, hearing, and hand protection. Stay clear of equipment during operation.
3. Use a dual-tube sampler such as a Geoprobe® Macrocore™ to minimize the potential for vertical cross-contamination during probe advancement.
4. The driller will advance and extract the soil sampler and acetate liner. When removed, confirm with the driller which end is the top and which end is the bottom. Record the time of core collection, the soil boring ID, and the depth interval (in feet below ground surface [bgs]) in the field book, boring logs, Collector App, etc. The driller will open the liner on your behalf.
5. Measure the length of recovered soil and record in the field book, boring logs, Collector App, etc.
6. Log soil lithology in half-foot intervals or wherever there is a change in lithology or other observed physical characteristic and record PID readings at each half-foot interval to measure volatile vapors. Soil should be classified using the system specified in the site-specific work plan(s) (modified Burmister Classification System, USCS, or other) and recorded in the field book, boring logs, Collector App, etc.
7. Use fresh, clean nitrile gloves between individual sample collection.
8. Use laboratory-provided sample containers specific to required analytical parameters, and label appropriate sample containers according to the site-specific work plan(s), Langan's sample nomenclature SOPs, etc.
9. Use dedicated, disposable sampling equipment for each sample location. If this is not possible, thorough decontamination of stainless-steel sampling equipment is required prior to use and in between sampling locations. A rinsate blank(s) may be required each day; refer to site-specific work plans.
10. Prior to placing soil in the laboratory bottleware, remove the entire volume of soil from the targeted interval and place it in a decontaminated stainless-steel bowl to homogenize the soil before distributing it among the bottleware provided by the

laboratory for the targeted analyses. Then place the homogenized soil into the appropriate, labeled sample containers using the alternate shoveling method: place a similar volume of soil into each container in sequence and repeat until all containers are full.

11. Collect QA/QC samples in accordance with the site-specific work plan(s). These may include, but are not limited to, duplicates, matrix spike/matrix spike duplicates (MS/MSD), field blanks, temperature blanks, trip blanks, rinsate blanks, etc.
    - Typical QA/QC protocols are 1 duplicate sample per 20 samples, 1 temperature blank per cooler, and 1 equipment blank/rinsate blank per day, per sampling device when sampling tools are decontaminated.
12. Ensure sample container lids are secure and confirm sample label includes:
    - Project name,
    - Sample ID,
    - Sample date,
    - Sample time of collection (each sample receives a unique sample time, there should not be two or more samples with the same sample time),
    - Analysis,
    - Preservative, and
    - Sampler's initials.
13. Document sample information in field book, boring logs, Collector App, etc., as prescribed in the site-specific work plan(s). The sample collection time, sample ID, sample parameters, and sample container used should be legibly marked in the field book and match the information on the sample container label and Chain of Custody (CoC).
14. Document sample information on CoC.
15. Place sample containers into a clean re-sealable plastic bag, then place the bag in a cooler with double-bagged ice to preserve sample quality and maintain a temperature of less than 6°C. Refer to the site-specific work plan(s) or ask the PM for additional information regarding sample preservation, packing, and shipping.

Start of Day, Between DP Soil Sampling Locations, and End of Day:

1. Decontaminate any tools used to collect sample at the start of each day, between each sample location, and at the end of each day in order to mitigate potential cross-contamination of samples.
2. Dispose of disposable tools in trash bag and as specified by site-specific work plan(s).
3. Following sample collection and boring completion, backfill boring with drill cuttings, or as specified in the site-specific work plan.

Decontamination:

1. Establish a decontamination area away from sampling activities.
2. Initially scrape or brush equipment caked with drill cuttings, soil, or other material. The scrapings can be sampled, characterized, and appropriately disposed of.

3. Wash equipment with PFAS-free water, which can be requested from the laboratory.
4. Place decontaminated downhole equipment (e.g. drill pipe, drive casing, bits, tools, bailers) on clean plastic sheeting (PFAS-free) to prevent contact with contaminated soil and allowed to air dry. Minimize airborne contamination by covering or wrapping equipment in PFAS-free plastic sheeting until use.
5. Use a four-stage decontamination process to clean field sampling and other downhole equipment between multiple uses.
    - In a PFAS-free bucket wash the equipment with a mixture of PFAS-free water and PFAS-free soap (bucket #1).
    - In a second PFAS-free bucket (bucket #2), rinse the equipment with PFAS-free water.
    - A second rinse should be done with PFAS-free water using a third bucket (bucket #3).
    - Complete a final triple-rinse with PFAS-free water using a spray bottle (for components coming into direct contact with sample).
6. Replenish decontamination solutions between sampling locations. Spent decontamination fluids should be properly disposed.

6. Resources

DP soil sampling requires that materials and services be provided by outside contractors and suppliers. The drilling subcontractor will provide the appropriate drilling and sampling tools and driller's jars. An environmental rental company may provide a PID to screen the soil for volatile vapors. Laboratory suppliers will provide the sample containers and perform analytical testing of the samples. This section outlines the requirements from each entity.

From the drilling subcontractor:

- Direct-push drill rig with appropriate drilling and sampling tools.
- Sampling method:
    - Thin-walled tub sampler, and
    - Acetate liners.

From the environmental equipment rental company:

- PID: Use a PID with a 10.6 eV lamp (or as appropriate for screening volatile vapors) and a measurement range of 1 ppm to 10,000 ppm with a 1 ppm resolution.
    - PID user manual, and
    - PID calibration gas and equipment (regulator).

From the laboratory contractor:

- High-density polyethylene (HDPE) sampling jars – before ordering, check work plan(s) and confirm the scope with the PM. While not required, it is advisable and good practice to order spare sampling jars as a contingency but there may be incremental costs.

- QA/QC Sampling – QA/QC samples include collection of duplicate, rinsate/equipment blank, and field blank samples in accordance with the site-specific work plan(s). Refer to the site-specific work plan(s) and ask your PM which QA/QC samples will be collected and for what analyses.
- CoC Form – follow standard sample nomenclature when completing the CoC and the sample identification of the soil sample jars. Sample nomenclature is defined in the work plan, Quality Assurance Project Plan (QAPP), or Langan's sample nomenclature SOP.
- PFAS-free deionized water – Used for the final rinse of field sampling equipment and downhole equipment during the decontamination process. Water must be laboratory-verified as PFAS-free prior to use. Decontamination solutions should be replenished between sampling locations as needed.

From Langan personnel:

- Planning Documentation:
    - Health and Safety Plan – inquire about any site-specific safety requirements/policies,
    - Sampling and Analysis Plan/Work plan(s)/proposal,
    - QAPP (if applicable),
    - Printed sample location maps and figures,
    - Printed field sheets/boring logs, and /or
    - Client contact and site contact for coordinating access.

- Equipment:
    - PPE, as specified in the HASP (at minimum, Level D),
    - GPS or survey equipment,
    - Mobile field tablet with GIS maps and Collector App,
    - Steel pin flags, or wooden stakes and spray paint/high-visibility flashing,
    - Measuring tape or field ruler,
    - Stainless steel pocketknife,
    - Stainless steel mixing bowl,
    - Stainless steel or disposal scops,
    - Disposable powderless nitrile gloves,
    - Paper towels,
    - Ball point pens and fine-tipped Sharpie Markers,
    - Re-sealable low-density polyethylene (LDPE) bags (e.g., Ziploc®) (to store sample containers)
    - Appropriate decontamination supplies:
        - Distilled water,
        - Alconox or equivalent (e.g., Simple Green),
        - Decontamination brush,
        - Plastic Sheeting
        - High-density polyethylene (HDPE) 5-gallon buckets

    - Trash bags or container for waste (drum or bucket, 5-gallon), and
    - Labels for waste container,
  - Camera, and/or
  - Thin-wall tube sampler.

See Recommended Environmental PFAS Sampling Procedures (SOP) for additional guidance on the selection of sampling equipment and materials.

8. References:

- Interstate Technology and Regulatory Council (ITRC) PFAS Technical and Regulatory Guidance Document, https://pfas-1.itrcweb.org/.
- USEPA Final Method 1633, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Soil, Biosolids, and Tissue Samples by LC-MS/MS, January 2024.
- USEPA, Region 4 Soil Sampling Operating Procedure, July 2007, Reviewed June 10, 2024.

9. Revision History:

- December 24, 2024 - Version 1.0
- February 12, 2025 – Version 2.0
- March 5, 2025 – Version 3.0

VERSION 2.0
March 5, 2025

STANDARD OPERATING PROCEDURES FOR SURVEY CONTROL POINT GAUGE INSTALLATION AND SURFACE WATER MEASUREMENT

1. Purpose

This Standard Operating Procedure (SOP) provides general guidelines for installing survey control point gauges (SCPGs) and measuring surface water levels. SCPGs help determine whether surface water is gaining or losing relative to groundwater, as well as verify overall hydrologic conditions. Surface water levels and flow paths can be influenced by a variety of operational, historical, or environmental factors, making accurate measurements critical for understanding these conditions.

Areas where this protocol may be especially relevant include:

- Streams, creeks, or ditches (e.g., near outfalls), where data help indicate if the waterbody is receiving groundwater or if it is losing surface water to the subsurface.
- Former dredge spoils or other low-lying areas, which may be perched or hydraulically connected to the local water table.
- Discharge points or regulated outfalls, where ongoing monitoring is essential for assessing hydrologic changes and potential contaminant pathways.

Surface water measurements are typically conducted by installing a durable gauge point (such as rebar or a staff gauge) and using that reference to measure depth to water. The resulting data inform assessments of flow trends, water table fluctuations, and possible transport pathways for per- and polyfluoroalkyl substances (PFAS) or other constituents.

2. Limitations

The procedures described herein should be followed to meet project data quality objectives. Note, however, that regulatory, client-specific, health & safety, or field conditions (“overriding conditions") may necessitate deviations from the procedures in this SOP to address such overriding conditions. Deviations should be documented in the final report for the associated phase of the project.

3. Health & Safety

When working on-site, comply with the project Health and Safety Plan (HASP) and Langan’s Injury and Illness Prevention Program. Proper personal protection clothing and equipment (PPE) are to be worn as specified in the HASP and Job Safety Analysis (JSA). Typically for activities in or near surface water bodies, samplers wear appropriate footwear and life jackets. Surface water should not be entered unless inherent risks such as swift water, entrapment, etc., are identified and appropriately mitigated.

STANDARD OPERATING PROCEDURES FOR SURVEY CONTROL POINT GAUGE INSTALLATION AND SURFACE WATER MEASUREMENT

4. Scope, Application, and Planning

Site-specific conditions may warrant modifying field practices performed in accordance with this SOP. Therefore, guidance provided in this SOP is presented in terms of general steps and strategies that should be applied when approaching installation of survey control point gauges (SCPGs) and surface water level measurement.

The project manager (PM) and field development team are responsible for providing the proposed gauge installation locations. Coordinate site access with the client or site manager and ensure you have access to each gauge installation location.

5. Methods

The general procedure for installing a control point gauge (e.g., rebar, staff gauge, or other fixed reference) and measuring surface water is as follows. Adapt these steps to your Site's specific conditions and equipment availability.

Pre-Sampling Preparation:

1. Review the sampling plan, QAPP, and site-specific instructions and documents.
2. Sign the HASP; have the subcontractor review and sign the HASP if hired by Langan.
3. Before the field work begins, complete the Langan Safe Work Certificate (SWC) which provides a summary of the daily work tasks, identification of potential hazards associated with the work tasks and measures employees should follow to mitigate potential hazards.
4. Verify that personnel are aware of and adhere to protocols to minimize PFAS cross-contamination. See Recommended Environmental PFAS Sampling SOP for expanded guidance.

Identify Installation Location:

1. Consult Project plans and figures to select the appropriate location(s).
2. Consider factors such as accessibility, safety, representativeness of flow, likelihood of turbulence, and presence of bends or obstacles.
3. For streams, locate the gauge in a straight reach to avoid turbulent or rapidly changing flows that can interfere with measurement accuracy.
    - The reach of the stream should be as straight as possible.
    - The installation site should not be on a bend in the stream.
    - Staffs are installed on the upstream side of the control.
4. For dredge spoil pits the rebar should be hammered approximately 2' into the ground.

Prepare for Installation:

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STANDARD OPERATING PROCEDURES FOR SURVEY CONTROL POINT GAUGE INSTALLATION AND SURFACE WATER MEASUREMENT

1. Wash hands and don a new pair of nitrile gloves before handling any equipment or materials to minimize cross-contamination.
2. Gather required equipment, which may include:
   - Water level probe or electronic meter,
   - Sturdy stake/rebar or staff gauge,
   - Mallet or driver for installation,
   - Spray paint, survey flags, or other visible markers,
   - Measuring tape (for offsets and reference measurements).
3. Review the site-specific QAPP to ensure compliance with….

Install the Gauge:

1. From level ground near the water's edge, drive the rebar or staff gauge through the standing water and into the substrate so that the top is firmly seated and will not shift.
2. Document the final location in your field log, note any nearby landmarks, and confirm the gauge is visible and secure.
3. For a driven rebar, spray paint the top and attach a survey flag or similar visible marker to facilitate relocation.

Establish a Reference Elevation:

1. Survey the top of the gauge (or an alternate defined reference point) to obtain a reference elevation. This step ensures accurate correlation of water level depth measurements with site elevations.
2. Record the elevation in the field notebook.

Measure Depth to Water:

1. Using the surveyed top of gauge or other reference point, carefully measure depth to water using an electronic water level meter or probe:
   - Turn on and check the functionality of the depth-to-water probe.
   - Slowly lower the probe until contact with water is indicated (audible tone/light).
   - Read the depth on the probe cable relative to the gauge's reference point.
2. Record the depth to water and the time of measurement in the field log.

Ongoing Measurements:

1. Subsequent field events may only require repeating Step 5 (measuring depth to water).
2. Keep the gauge in place if repeated measurements or continuous monitoring over time are anticipated.

3. If you plan to leave equipment (e.g., a pressure transducer) for longer-term recording:
    - Ensure it is properly secured against site activities or vandalism.
    - Follow manufacturer instructions for calibration, data logging intervals, and barometric compensation (for non-vented transducers).

Post-Measurement Activities:

1. Inspect the gauge installation for stability or damage.
2. Remove any temporary signage or barriers once the activity is complete, unless they are needed for ongoing measurements.
3. Document any issues or unusual observations (e.g., silt buildup, debris, bent rebar) in the field logbook.

See Recommended Environmental PFAS Sampling Procedures (SOP) for additional guidance on the selection of sampling equipment and materials.

6. References:

7. Revision History:

- February 12, 2025 - Version 1.0
- March 5, 2025 – Version 2.0

VERSION 3.0
March 5, 2025

Standard Operating Procedure (SOP) for the Collection of Groundwater Sampling via Low Flow Purging for Per and Polyfluoroalkyl Substances (PFAS) Analysis

1. Purpose

The purpose of this standard operating procedure (SOP) is to describe the low flow purging and sampling technique. The goal of this groundwater sampling procedure is to collect water samples that reflect the total mobile organic and inorganic loads (dissolved and colloidal sized fractions) transported through the subsurface under ambient flow conditions, with minimal physical and chemical alterations from sampling operations. This SOP for collecting groundwater samples will help ensure that the project's data quality objectives (DQOs) are met under certain low-flow conditions.

2. Limitations

The procedures described herein should be followed to meet project data quality objectives. Note, however, that regulatory, client-specific, health & safety, or field conditions ("overriding conditions") may necessitate deviations from the procedures in this SOP to address such overriding conditions. Deviations should be documented in the final report for the associated phase of the project.

3. Health and Safety

When working on-site, comply with the project Health and Safety Plan (HASP) and Langan's Injury and Illness Prevention Program. Proper personal protection clothing and equipment (PPE) are to be worn as specified in the HASP and Job Safety Analysis (JSA).

4. Scope, Application, and Planning

Site-specific conditions may warrant modifying field practices performed in accordance with this SOP. Therefore, guidance provided in this SOP is presented in terms of general steps and strategies that should be applied when approaching an investigation involving low-flow groundwater sampling.

The project manager (PM) and field sampling team are responsible for providing the depths of the proposed groundwater sample and verifying them in the field. Contact the laboratory to confirm the required sample size necessary to obtain the desired reporting limits and request the properly sized sample containers. Coordinate site access with the client or building/property manager.

5. Methods

Field methodology for field instrument calibration, depth to water measurement, pump installation, well purging, water quality monitoring, sampling procedures, and equipment decontamination is provided below.

Pre-Sampling Preparation:

1. Review the sampling plan, QAPP, and site-specific instructions and documents.
2. Sign the HASP; have the subcontractor review and sign the HASP if hired by Langan.
3. Before the field work begins, complete the Langan Safe Work Certificate (SWC) which provides a summary of the daily work tasks, identification of potential hazards associated with the work tasks and measures employees should follow to mitigate potential hazards.
4. Verify that personnel are aware of and adhere to protocols to minimize PFAS cross-contamination. See Recommended Environmental PFAS Sampling SOP for expanded guidance.
5. When multiple samples from one site are collected determine sampling order of monitoring wells, sample up gradient areas first followed by those down gradient of the suspected source.
6. Turn on and calibrate the water quality meter in accordance with manufacturer requirements, and record calibration on field data sheets.

Low-Flow Groundwater Sampling Protocol:

1. Upon arrival, document site conditions (e.g., nearby activities, presence of standing water, ground surface materials), weather, and any potential sources of cross-contamination (including PFAS-related considerations such as site equipment or materials that may contain fluoropolymers).
2. Unlock and open well. Collect depth to water measurement using electronic water level meter. Point of measurement shall be consistent across monitoring events (typically north). Use depth to water measurement and well completion report to calculate length of water column and the volume of standing water in the well. If possible, obtain well depth from well construction data rather than field measurement to avoid resuspension of settled sediments.
3. Use length of water column and well screen interval information to determine pump intake depth in accordance with project requirements. Slowly lower pump, tubing, electrical lines and safety cable to the target pump intake elevation to avoid mixing of the water column. The pump intake depth should be within the screened interval and no less than two feet above the bottom of the well to minimize disturbance of sediments at the bottom.
4. Re-measure depth to water before starting the pump.
5. Begin pumping at a low flow purge rate. Purge rate shall be consistent across sampling events. Purging will be performed at a flow rate of 250 mL per minute of less. Reduce the flow rate if the water is excessively turbid. Stabilized turbidity at the time of sampling should be less than 50 nephelometric turbidity units (NTU), and preferably less than 10 NTU. Methods that can be utilized to minimize turbidity include reducing flow rate and extending the purge time and volume. Discharge water into a graduated cylinder or other container to track total volume purged and to calculate current flow rate. Measure depth to water periodically to monitor drawdown in the well. Adjust rate so there is little (< 4 inches or < 0.1 m) to no water level drawdown. If drawdown does occur it should be minimized.

6. Monitor and record water quality parameters in the field book, low-flow purge field data sheet, Collector App, etc. Water quality parameters include temperature, specific conductance, dissolved oxygen (DO), pH, and oxidation reduction potential (ORP) every five minutes until readings are stable. Stability may be defined as having three consecutive readings within the following limits:
    - 3% for temperature
    - 3% for specific conductance
    - 10% for DO and turbidity
    - ± 0.1 for pH
    - ± 10 millivolts for ORP
7. Sample once water quality indicator parameters stabilize or three volumes of standing water have been purged, whichever comes first.
8. For sampling, disconnect the flow through cell and direct the flow of water into the sample containers and fill each container to the top (but do not overfill).
9. Use fresh, clean nitrile gloves between individual sample collection.
10. Collect groundwater for PFAS analysis using USEPA Method 1633:
    - All samples will be collected at the low flow purge rate by directing the flow down the inside wall of the container with minimal turbulence.
    - When applicable, confirm that samples are collected in bottles with the appropriate preservative.
11. Use laboratory-provided sample containers specific to required analytical parameters, and label appropriate sample containers according to the site-specific work plan(s), Langan’s sample nomenclature SOPs, etc.
12. Collect QA/QC samples in accordance with the site-specific work plan(s). These may include, but are not limited to, duplicates, matrix spike/matrix spike duplicates (MS/MSD), field blanks, temperature blanks, trip blanks, rinsate blanks, etc.
    - Typical QA/QC protocols are 1 duplicate sample per 20 samples, 1 temperature blank per cooler, and 1 equipment blank/rinsate blank per day, per sampling device when sampling tools are decontaminated.
13. Ensure sample container lids are secure and confirm sample label includes:
    - Project name,
    - Sample ID,
    - Sample date,
    - Sample time of collection (each sample receives a unique sample time, there should not be two or more samples with the same sample time),
    - Analysis,
    - Preservative, and
    - Sampler’s initials.
14. Document sample information in field book, low-flow purge logs, Collector App, etc., as prescribed in the site-specific work plan(s). The sample collection time, sample ID, sample parameters, and sample container used should be legibly marked in the field book and match the information on the sample container label and Chain of Custody (CoC).
15. Document sample information on CoC.

16. Place sample containers into a clean re-sealable plastic bag, then place the bag in a cooler with double-bagged ice to preserve sample quality and maintain a temperature of less than 6°C. Refer to the site-specific work plan(s) or ask the PM for additional information regarding sample preservation, packing, and shipping.
17. Remove pump and tubing.
18. Take final depth to water measurement and confirm well depth with electronic water level meter.

Start of Day, Between Low-Flow Groundwater Sampling Locations, and End of Day:

1. Decontaminate pump and other instrumentation at the start of each day, between each monitoring well location, and at the end of each day in order to mitigate potential cross-contamination of samples.
2. Dispose of disposable sampling equipment in trash bag and as specified by site-specific work plan(s).
3. Following sample collection close and lock well.

Decontamination:

1. Establish a decontamination area away from sampling activities.
2. Wash equipment with PFAS-free water, which can be requested from the laboratory.
3. Use a three-stage decontamination process to clean field sampling and other downhole equipment between multiple uses.
    - In a PFAS-free bucket wash the equipment with a mixture of PFAS-free water and PFAS-free soap (bucket #1).
    - In a second PFAS-free bucket (bucket #2), rinse the equipment with PFAS-free water.
    - A second rinse should be done with PFAS-free water using a third bucket (bucket #3).
4. Replenish decontamination solutions between sampling locations. Spent decontamination fluids should be properly disposed.

6. Resources

Low-flow groundwater sampling requires materials and services be provided by outside contractors and supplies. An environmental rental company will provide necessary equipment for well purging. Laboratory suppliers will provide the sample containers and perform analytical testing of the samples. The section outlines the requirements from each entity.

From the environmental rental equipment rental company:

- Water quality meter and flow-through cell
- Water pump and controller (typically a peristaltic pump should be used for PFAS sampling and for this project)

- Appropriate High-density polyethylene (HDPE) (preferred) or Low-density polyethylene (LDPE) tubing depending on pump type
- Battery
- Safety Cable
- Electronic water level meter

From the laboratory contractor:

- High-density polyethylene (HDPE) sampling jars – before ordering, check work plan(s) and confirm the scope with the PM. While not required, it is advisable and good practice to order spare sampling jars as a contingency but there may be incremental costs.
- QA/QC Sampling – QA/QC samples include collection of duplicate, rinsate/equipment blank, and field blank samples in accordance with the site-specific work plan(s). Refer to the site-specific work plan(s) and ask your PM which QA/QC samples will be collected and for what analyses.
- CoC Form – follow standard sample nomenclature when completing the CoC and the sample identification of the soil sample jars. Sample nomenclature is defined in the work plan, Quality Assurance Project Plan (QAPP), or Langan's sample nomenclature SOP.
- PFAS-free deionized water – Used for the final rinse of field sampling equipment and downhole equipment during the decontamination process. Water must be laboratory-verified as PFAS-free prior to use. Decontamination solutions should be replenished between sampling locations as needed.

From Langan personnel:

- Planning Documentation
    - Health and Safety Plan – inquire about any site-specific safety requirements/policies,
    - Sampling and Analysis Plan/Work plan(s)/proposal,
    - Quality Assurance Project Plan (if applicable)
    - Well location map
    - Well construction data
    - Field data from last sampling event (if applicable)
    - Printed field sheets/calibration logs/low-flow purge logs, and/or
    - Client contact and site contact for coordinating access.

- Equipment:
    - PPE, as specified in the HASP (at minimum, Level D),
    - Well keys and tools to open wells
    - Mobile field tablet with GIS maps and Collector App,
    - Disposable powderless nitrile gloves,
    - Paper towels,
    - Ball point pens and fine-tipped Sharpie Markers,

- Re-sealable low-density polyethylene (LDPE) bags (e.g., Ziploc®) (to store sample containers)
- Appropriate decontamination supplies:
    - Distilled water,
    - Alconox or equivalent (e.g., Simple Green),
    - Decontamination brush,
    - High-density polyethylene (HDPE) 5-gallon buckets, and
- Trash bags

See Recommended Environmental PFAS Sampling Procedures (SOP) for additional guidance on the selection of sampling equipment and materials.

7. References:

- Interstate Technology and Regulatory Council (ITRC) PFAS Technical and Regulatory Guidance Document, https://pfas-1.itrcweb.org/.
- Maryland Department of Environment (MDE), Water and Science Administration, Per-and Polyfluoroalkyl Substances (PFAS) Sampling Guidance Document for Wastewater Analysis, September 10, 2024.
- USEPA Final Method 1633, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Soil, Biosolids, and Tissue Samples by LC-MS/MS, January 2024.

9. Revision History:

- October 10, 2024 - Version 1.0
- February 11, 2025 – Version 2.0
- March 5, 2025 – Version 3.0

Standard Operating Procedure (SOP) for the Collection of Soil Samples Using a Hand Auger for Per and Polyfluoroalkyl Substances (PFAS) Analysis

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to describe soil-sampling methods using a manual hand auger. Hand augering is effective for application in unconsolidated formations consisting primarily of sand, silt, and clay with some gravel. This procedure gives descriptions of equipment, field procedures, and quality assurance/quality control (QA/QC) procedures necessary to collect soil samples using a hand auger. The soil sampling techniques described in this SOP are generally suitable for samples analyzed for chemical characterization and physical classification tests. However, because of the open bucket of the hand auger, the resulting soil samples should generally be considered “disturbed” with respect to physical structure and may not be suitable for measuring sensitive physical parameters, such as strength and compressibility. This SOP provides protocols and procedures for initial scoping/planning/preparation, pre-sampling procedures, sampling methods using hand augers, post-sample collection procedures and documentation, other resources and considerations, and select reference materials. These are SOPs (i.e., typically applicable), which can be varied or changed as required, depending on site conditions, equipment limitations, or other procedural limitations, as encountered. In all instances, any deviations from the SOPs should be discussed with the field team leader/project manager before proceeding and the ultimate procedures should be documented.

2. Limitations

The procedures described herein should be followed to meet project data quality objectives. Note, however, that regulatory, client-specific, health & safety, or field conditions (“overriding conditions") may necessitate deviations from the procedures in this SOP to address such overriding conditions. Deviations should be documented in the final report for the associated phase of the project.

3. Health & Safety

When working on-site, comply with the project Health and Safety Plan (HASP) and Langan’s Injury and Illness Prevention Program. Proper personal protection clothing and equipment (PPE) are to be worn as specified in the HASP and Job Safety Analysis (JSA).

4. Scope, Application, and Planning

Site-specific conditions may warrant modifying field practices performed in accordance with this SOP. Therefore, guidance provided in this SOP is presented in terms of general steps and strategies that should be applied when approaching an investigation involving soil sampling utilizing hand augering techniques.

The project manager (PM) and field development team are responsible for providing the proposed soil sample locations. Coordinate site access with the client or site manager and ensure you have access to each soil sample location.

5. Methods

Hand augers are used to advance the sampler bucket into the subsurface, and samples are recovered incrementally as the boring is advanced. Samples are tripped out of the boring through the uncased borehole so formation collapse and cross contamination in non-cohesive and saturated formations may be problematic.

Langan personnel will log the lithology of the boring in the field book, boring log form, Collector App, etc., and screen the soil boring with a photoionization detector (PID) for potential environmental impacts, as prescribed in the site-specific work plan(s). Samples will be collected using clean, stainless steel or disposal spoons from the prescribed sample interval.

Pre-Sampling Preparation:

1. Review the sampling plan, QAPP, and site-specific instructions and documents.
2. Sign the HASP; have the subcontractor review and sign the HASP if hired by Langan.
3. Before the field work begins, complete the Langan Safe Work Certificate (SWC) which provides a summary of the daily work tasks, identification of potential hazards associated with the work tasks and measures employees should follow to mitigate potential hazards.
4. Verify that samplers have reviewed the Langan’s guidelines for soil sampling.
5. Verify that personnel are aware of and adhere to protocols to minimize PFAS cross-contamination. See Recommended Environmental PFAS Sampling SOP for expanded guidance.
6. Check sampling equipment and bottles for accuracy with orders and project requirements.
7. Sampling Personnel should be familiar with the tiered approach to evaluate unplanned conditions. See Recommended Environmental PFAS Sampling SOP for expanded guidance.

Hand Auger Soil Sampling Protocol:

1. Upon arrival, document site conditions (e.g., nearby activities, presence of standing water, ground surface materials), weather, and any potential sources of cross-contamination (including PFAS-related considerations such as site equipment or materials that may contain fluoropolymers).

2. Identify the soil boring location and at what depth it should be advanced based on site-specific work plans and in review of safety, utility clearances, and consultation with driller. Wear proper head (hard hat), eye, hearing, and hand protection.
3. Advance the hand auger six inches into the soil using a clockwise twisting motion to cut through any organic matter or difficult clay layers and pull the auger straight out of the sediment.
4. Continue augering in six-inch increments, through the same hole, to reach the target sample depths.
    - The sampler will utilize two augers, alternating between half-foot intervals to minimize cross contamination. Augers will be decontaminated between each interval. See below for decontamination procedures.
5. Log soil lithology in half-foot intervals or wherever there is a change in lithology or other observed physical characteristics. Soil should be classified using the system specified in the site-specific work plan(s) (modified Burmister Classification System, USCS, or other) and recorded in the field book, boring logs, Collector App, etc. Samples will be collected using laboratory-provided sample containers. Samplers will label sample bottles with the sample identification, date, time, and analysis to be performed.
6. Use fresh, clean nitrile gloves between individual sample collection.
7. Use laboratory-provided sample containers specific to required analytical parameters, and label appropriate sample containers according to the site-specific work plan(s), Langan's sample nomenclature SOPs, etc.
8. Use dedicated, disposable sampling equipment for each sample location. If this is not possible, thorough decontamination of stainless-steel sampling equipment is required prior to use and in between sampling locations. A rinsate blank(s) may be required each day; refer to site-specific work plans.
9. Prior to placing soil in the laboratory bottleware, empty the soil from the bott (cutting edge) of the hand auger into a decontaminated stainless-steel bowl. Do not include/use soil from the top portion (~1 inch) of the auger because this material may include borehole slough from shallower intervals. Homogenize the soil in the stainless steel bowl before distributing it among the bottleware provided by the laboratory for the targeted analyses. Then place the homogenized soil into the appropriate, labeled sample containers using the alternate shoveling method: place a similar volume of soil into each container in sequence and repeat until all containers are full.
10. Collect QA/QC samples in accordance with the site-specific work plan(s). These may include, but are not limited to, duplicates, matrix spike/matrix spike duplicates (MS/MSD), field blanks, temperature blanks, trip blanks, rinsate blanks, etc.
    - Typical QA/QC protocols are 1 duplicate sample per 20 samples, 1 temperature blank per cooler, and 1 equipment blank/rinsate blank per day, per sampling device when sampling tools are decontaminated.
11. Ensure sample container lids are secure and confirm sample label includes:
    - Project name,
    - Sample ID,

  - Sample date,
  - Sample time of collection (each sample receives a unique sample time, there should not be two or more samples with the same sample time),
  - Analysis,
  - Preservative, and
  - Sampler's initials.

12. Document sample information in field book, boring logs, Collector App, etc., as prescribed in the site-specific work plan(s). The sample collection time, sample ID, sample parameters, and sample container used should be legibly marked in the field book and match the information on the sample container label and Chain of Custody (CoC).
13. Document sample information on CoC.
14. Place sample containers into a clean re-sealable plastic bag, then place the bag in a cooler with double-bagged ice to preserve sample quality and maintain a temperature of less than 6°C. Refer to the site-specific work plan(s) or ask the PM for additional information regarding sample preservation, packing, and shipping.

Start of Day, Between DP Soil Sampling Locations, and End of Day:

1. Decontaminate any tools used to collect sample at the start of each day, between each sample location, and at the end of each day in order to mitigate potential cross-contamination of samples.
2. Dispose of disposable tools in trash bag and as specified by site-specific work plan(s).
3. Following sample collection and boring completion, backfill boring with drill cuttings, or as specified in the site-specific work plan.

Decontamination:

1. Establish a decontamination area away from sampling activities.
2. Initially scrape or brush equipment caked with drill cuttings, soil, or other material. The scrapings can be sampled, characterized, and appropriately disposed of.
3. Wash equipment with PFAS-free water, which can be requested from the laboratory.
4. Place decontaminated downhole equipment (e.g. augers) on clean plastic sheeting (PFAS-free) to prevent contact with contaminated soil and allowed to air dry. Minimize airborne contamination by covering or wrapping equipment in PFAS-free plastic sheeting until use.
5. Use a four-stage decontamination process to clean field sampling and other downhole equipment between multiple uses.
    - In a PFAS-free bucket wash the equipment with a mixture of PFAS-free water and PFAS-free soap (bucket #1).
    - In a second PFAS-free bucket (bucket #2), rinse the equipment with PFAS-free water.
    - A second rinse should be done with PFAS-free water using a third bucket (bucket #3).

  - Complete a final triple-rinse with PFAS-free water using a spray bottle (for components coming into direct contact with sample).

6. Replenish decontamination solutions between sampling locations. Spent decontamination fluids should be properly disposed.

6. Resources

Hand auger soil sampling requires that materials and services be provided by outside contractors and suppliers. An environmental rental company may provide a PID to screen the soil for volatile vapors. Laboratory suppliers will provide the sample containers and perform analytical testing of the samples. This section outlines the requirements from each entity.

From the environmental equipment rental company:

- PID: Use a PID with a 10.6 eV lamp (or as appropriate for screening volatile vapors) and a measurement range of 1 ppm to 10,000 ppm with a 1 ppm resolution.
  - PID user manual, and
  - PID calibration gas and equipment (regulator).

From the laboratory contractor:

- High-density polyethylene (HDPE) sampling jars – before ordering, check work plan(s) and confirm the scope with the PM. While not required, it is advisable and good practice to order spare sampling jars as a contingency but there may be incremental costs.
- QA/QC Sampling – QA/QC samples include collection of duplicate, rinsate/equipment blank, and field blank samples in accordance with the site-specific work plan(s). Refer to the site-specific work plan(s) and ask your PM which QA/QC samples will be collected and for what analyses.
- CoC Form – follow standard sample nomenclature when completing the CoC and the sample identification of the soil sample jars. Sample nomenclature is defined in the work plan, Quality Assurance Project Plan (QAPP), or Langan's sample nomenclature SOP.
- PFAS-free deionized water – Used for the final rinse of field sampling equipment and downhole equipment during the decontamination process. Water must be laboratory-verified as PFAS-free prior to use. Decontamination solutions should be replenished between sampling locations as needed.

From Langan personnel:

- Planning Documentation:
  - Health and Safety Plan – inquire about any site-specific safety requirements/policies,
  - Sampling and Analysis Plan/Work plan(s)/proposal,
  - QAPP (if applicable),
  - Printed sample location maps and figures,

  - Printed field sheets/boring logs, and /or
  - Client contact and site contact for coordinating access

- Equipment:
  - PPE, as specified in the HASP (at minimum, Level D),
  - GPS or survey equipment,
  - Mobile field tablet with GIS maps and Collector App,
  - Steel pin flags, or wooden stakes and spray paint/high-visibility flashing,
  - Measuring tape or field ruler,
  - Stainless steel pocketknife,
  - Stainless steel mixing bowl,
  - Stainless steel or disposal scops,
  - Disposable powderless nitrile gloves,
  - Hang auger with 3”x6” bucket
  - Paper towels,
  - Ball point pens and fine-tipped Sharpie Markers,
  - Re-sealable low-density polyethylene (LDPE) bags (e.g., Ziploc®) (to store sample containers)
  - Appropriate decontamination supplies:
    - Distilled water,
    - Alconox or equivalent (e.g., Simple Green),
    - Decontamination brush,
    - Plastic Sheeting
    - High-density polyethylene (HDPE) 5-gallon buckets
    - Trash bags or container for waste (drum or bucket, 5-gallon), and
    - Labels for waste container,
  - Camera, and/or
  - Thin-wall tube sampler.

See Recommended Environmental PFAS Sampling Procedures (SOP) for additional guidance on the selection of sampling equipment and materials.

8. References:

- Interstate Technology and Regulatory Council (ITRC) PFAS Technical and Regulatory Guidance Document, Section 11.1.7.5, https://pfas-1.itrcweb.org/11-sampling-and-analytical-methods/
- USEPA Final Method 1633, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Soil, Biosolids, and Tissue Samples by LC-MS/MS, January 2024.
- USEPA, Region 4 Soil Sampling Operating Procedure, July 2007, Reviewed June 10, 2024.

9. Revision History:

- December 24, 2024 - Version 1.0
- February 11, 2025 – Version 2.0
- March 5, 2025 – Version 3.0

Standard Operating Procedure (SOP) for the Collection of Water Samples from Surface Water for Per and Polyfluoroalkyl Substances (PFAS) Analysis

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to describe surface water sampling techniques. The goal of this surface water sampling procedure is to collect water samples that reflect the PFAS concentrations transported and maintained through surface water under normal flow conditions, with minimal physical and chemical alterations from sampling operations. This SOP for collecting surface water samples will help ensure that the project's data quality objectives (DQOs) are met under normal flow conditions.

This SOP provides protocols and procedures for initial scoping/planning/preparation, pre-sampling procedures, sampling methods for surface water, post sample collection procedures and documentation, other resources and considerations, and select reference materials. These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on-site conditions and limitations with equipment. In all instances, the ultimate procedures employed should be documented.

2. Limitations

The procedures described herein should be followed to meet project data quality objectives. Note, however, that regulatory, client-specific, health & safety, or field conditions (“overriding conditions") may necessitate deviations from the procedures in this SOP to address such overriding conditions. Deviations should be documented in the final report for the associated phase of the project.

3. Health & Safety

When working on-site, comply with the project Health and Safety Plan (HASP) and Langan’s Injury and Illness Prevention Program. Proper personal protection clothing and equipment (PPE) are to be worn as specified in the HASP and Job Safety Analysis (JSA). Typically for surface water sampling, samplers should wear appropriate footwear and life jackets if they will be sampling from a boat or the water’s edge. Surface water should not be entered unless inherent risks such as swift water, entrapment, etc., are identified and appropriately mitigated.

4. Scope, Application, and Planning

Site-specific conditions may warrant modifying field practices performed in accordance with this SOP. Therefore, guidance provided in this SOP is presented in terms of general steps and strategies that should be applied when approaching an investigation involving surface water sampling.

The project manager (PM) and field sampling team are responsible for providing the locations of the proposed surface water sample points and verifying them in the field. Contact the laboratory to confirm the required sample size necessary to obtain the desired reporting limits and request the properly sized sample containers. Coordinate site access with the client or building/property manager.

5. Methods

Field methodology for field instrument calibration, depth to water measurement, pump installation, well purging, water quality monitoring, sampling procedures, and equipment decontamination is provided below.

Pre-Sampling Preparation:

1. Review the sampling plan, QAPP, and site-specific instructions and documents.
2. Sign the HASP; have sub-contractor review/sign the HASP if they are hired by Langan.
3. Before the field work begins, complete the Langan Safe Work Certificate (SWC) which provides a summary of the daily work tasks, identification of potential hazards associated with the work tasks and measures employees should follow to mitigate potential hazards.
4. Verify that personnel are aware of and adhere to protocols to minimize PFAS cross-contamination. See Recommended Environmental PFAS Sampling SOP for expanded guidance.
5. If not already calibrated by the environmental equipment rental company, turn on and calibrate the water quality meter in accordance with the manufacturer’s instructions, record calibration data in the field book. At a minimum, perform a calibration check.
6. Assemble and decontaminate selected sampling device(s)
    - Dip/swing sampler (necessary for points further from the bank)
    - Dedicated unpreserved sample container
    - Bailers
    - Buckets or cups

Sampling Procedure:

1. Upon arrival, document site conditions (e.g., nearby activities, presence of standing water, ground surface materials), weather, and potential sources of cross-contamination (including PFAS-related considerations such as site equipment or materials that may contain fluoropolymers).

2. Identify sampling locations. If sampling in a river or stream, start sampling at the most downstream location and move upstream to avoid disturbing or affecting the areas to be sampled.
3. Slowly submerge the sampling device.
    - If water is to be collected from the water's surface, slowly fill the selected sampling device (telescoping/dip sampler, unpreserved sample container, bailer etc.) with minimal disturbance. If water is flowing, orient the selected sampling device so the opening is facing upstream, allowing water to flow into the sampling device with minimal disturbance. Water will be poured from the sampling device to the sample containers.
    - Proper PPE should be worn to minimize surface disturbance.
    - Care must be taken to minimize disturbance of the surface water bottom, which may cause the re-suspension of deposits. If deposits are re-suspended and the surface water becomes turbid, consider filtering the sample. If field-filtering, filter the water prior to collecting into laboratory-provided sample containers. The analytical laboratory can also filter the sample from an unpreserved sample container; this should be coordinated with the laboratory and PM prior to collecting to ensure quality assurance/quality control objectives can be achieved.
4. Gently collect water into the laboratory-provided sample containers. Continue collecting water under the sample container is almost completely filled – do not overfill container.
5. After you have completed sampling surface water gently lower the multi-parameter water quality meter into the water column and record readings on applicable field documentation.
6. Repeat the surface water sampling protocol described above for each sampling location. Record the sampling information (water quality parameters, sampling time, sampling personnel, etc.) on the appropriate Field Data Sheet, field book, etc.

After Sample Collection:

1. Collect QA/QC samples in accordance with the site-specific work plan(s). These may include, but are not limited to, duplicates, matrix spike/matrix spike duplicates (MS/MSD), field blanks, temperature blanks, trip blanks, rinsate blanks, etc.
    - Typical QA/QC protocols are 1 duplicate sample per 20 samples, 1 temperature blank per cooler, and 1 equipment blank/rinsate blank per day, per sampling device when sampling tools are decontaminated.
2. Ensure sample container lids are secure and confirm sample label includes:
    - Project name,
    - Sample ID,
    - Sample date,
    - Sample time of collection (each sample receives a unique sample time, there should not be two or more samples with the same sample time),
    - Analysis,
    - Preservative, and

  - Sampler’s initials.
3. Document sample information in field book, boring logs, Collector App, etc., as prescribed in the site-specific work plan(s). The sample collection time, sample ID, sample parameters, and sample container used should be legibly marked in the field book and match the information on the sample container label and Chain of Custody (CoC).
4. Document sample information on CoC.
5. Place sample containers into a clean re-sealable plastic bag, then place the bag in a cooler with double-bagged ice to preserve sample quality and maintain a temperature of less than 6°C. Refer to the site-specific work plan(s) or ask the PM for additional information regarding sample preservation, packing, and shipping.

Start of Day, Between Surface Water Sampling Locations, and End of Day:

1. Decontaminate any tools used to collect samples at the start of each day, between each sample location, and at the end of each day in order to mitigate potential cross-contamination of samples.
2. Gloves and assorted disposables should be packaged in a garbage bag and disposed in the nearest sanitary waste receptacle.

Decontamination:

1. Establish a decontamination area away from sampling activities.
2. Use a three-stage decontamination process to clean field sampling and other downhole equipment between multiple uses.
    - In a PFAS-free bucket wash the equipment with a mixture of PFAS-free water and PFAS-free soap (bucket #1).
    - In a second PFAS-free bucket (bucket #2), rinse the equipment with PFAS-free water.
    - A second rinse should be done with PFAS-free water using a third bucket (bucket #3).
3. Replenish decontamination solutions between sampling locations. Spent decontamination fluids should be properly disposed.

6. Resources

Surface water sampling requires that materials and services be provided by outside contractors and suppliers. An environmental equipment rental company may provide the necessary equipment to measure water quality parameters, and a laboratory supplier will provide the sample containers. This section outlines the requirements from each entity.

From the environmental equipment rental company:

- Multi-parameter water quality meter capable of measuring pH, temperature, specific conductance, oxygen reduction potential (ORP), dissolved oxygen (DO), turbidity, and salinity (e.g., YSI 650, Horiba U-52, etc.)
- If a multi-parameter water quality meter is not available, individual meters can be used to measure water quality parameters.
- Flow meter or flow cell (provided as part of the multi-parameter water quality meter).

From the laboratory contractor:

- High-density polyethylene (HDPE) sampling jars – before ordering, check work plan(s) and confirm the scope with the PM. While not required, it is advisable and good practice to order spare sampling jars as a contingency but there may be incremental costs.
- QA/QC Sampling – QA/QC samples include collection of duplicate, rinsate/equipment blank, and field blank samples in accordance with the site-specific work plan(s). Refer to the site-specific work plan(s) and ask your PM which QA/QC samples will be collected and for what analyses.
- CoC Form – follow standard sample nomenclature when completing the CoC and the sample identification of the soil sample jars. Sample nomenclature is defined in the work plan, Quality Assurance Project Plan (QAPP), or Langan’s sample nomenclature SOP.
- PFAS-free deionized water – Used for the final rinse of field sampling equipment and downhole equipment during the decontamination process. Water must be laboratory-verified as PFAS-free prior to use. Decontamination solutions should be replenished between sampling locations as needed.

From Langan personnel:

- Planning Documentation
    - Health and Safety Plan – inquire about any site-specific safety requirements and/or policies
    - Sampling and Analysis Plan
    - Quality Assurance Project Plan (if applicable)
    - Sample location map
    - Field data from last sampling event (if applicable)
    - Client contact and site contact for coordinating access

- Equipment
    - PPE, as specified in the HASP (at minimum, Level D),
    - Mobile field tablet with GIS maps and Collector App,
    - Sampling device:
        - Telescoping/dip sampler
        - Bailer
        - Dedicated unpreserved sample containers/vessels

- Disposable powderless nitrile gloves,
- Paper towels,
- Ball point pens and fine-tipped Sharpie Markers,
- Re-sealable low-density polyethylene (LDPE) bags (e.g., Ziploc®) (to store sample containers)
- Appropriate decontamination supplies:
  - Distilled water,
  - Alconox or equivalent (e.g., Simple Green),
  - Decontamination brush,
  - High-density polyethylene (HDPE) 5-gallon buckets
- Several garbage bags
- Camera

See Recommended Environmental PFAS Sampling Procedures (SOP) for additional guidance on the selection of sampling equipment and materials.

7. Troubleshooting and Considerations

- Insufficient yield or surface water depth not sufficient:
  - If there is insufficient yield or depth to sample, identify if the surface water is blocked upstream. If so, attempt to dislodge and allow flow to reach typical capacity prior to sampling. If the insufficient yield is due to dry conditions, evaluate alternative sampling locations and then discuss approach with PM before abandoning sampling or modifying scope.
- Icy surface:
  - Attempt to break through the icy surface and evaluate if surface water has sufficient depth to sample. If so, sample per the SOP. If not, refer to the first bullet for insufficient yield.
- Tidal Influence:
  - If the surface water to be sampled is tidally influenced, you may be required to sample at both ends of the tidal cycle (i.e., high and low tide). Discuss with PM while planning sampling event.
- Significant water depth:
  - If the surface water is very deep, consider using a specific sampler should you need to collect a representative sample at the sediment and surface water interface. Confirm with PM the appropriate sampling method to employ.

8. References:

- USEPA Final Method 1633, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Soil, Biosolids, and Tissue Samples by LC-MS/MS, January 2024.
- Interstate Technology and Regulatory Council (ITRC) PFAS Technical and Regulatory Guidance Document, Section 11.1.7.5, https://pfas-1.itrcweb.org/11-sampling-and-analytical-methods/

9. Revision History:

- February 12, 2025 - Version 1.0
- March 5, 2025 – Version 2.0
- May 28, 2025 – Version 3.0

Standard Operating Procedure (SOP) for Monitoring Well Installation and Development for Per and Polyfluoroalkyl Substances (PFAS) Analysis

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to outline the proper installation and development of monitoring wells to ensure the collection of accurate and representative groundwater samples, water-level measurements, and other field data.

Monitoring wells must be installed using construction materials that do not introduce contaminants or degrade sample quality. Proper well installation involves selecting materials compatible with site conditions and ensuring secure seals and locking well covers to prevent cross-contamination between aquifers and from surface contaminants. Construction methods should minimize disturbance to the surrounding subsurface and maintain the integrity of the monitoring well for long-term data collection.

Following installation, monitoring wells must be developed to remove drilling fluids, fine-grained particles, and any residual materials that could impact sample quality. Development restores aquifer hydraulic conductivity, establishes an effective filter pack around the well screen, and removes any skin that may form around the screen. This process allows for the collection of water-level data and groundwater samples that are reproducible and chemically and physically representative of the aquifer of interest.

This SOP provides detailed guidance on well installation and development procedures, including appropriate techniques such as bailing, overpumping, surging, and jetting. It also includes protocols for planning, pre-development procedures, post-development verification, and documentation. Site-specific factors, such as recharge rates, well depth, and equipment limitations, may necessitate modifications, which should be discussed with the Project Manager. Proper adherence to these procedures ensures the reliability of monitoring wells for long-term environmental assessments and contaminant migration studies.

2. Limitations

The procedures described herein should be followed to meet project data quality objectives. Note, however, that regulatory, client-specific, health & safety, or field conditions (“overriding conditions") may necessitate deviations from the procedures in this SOP to address such overriding conditions. Deviations should be documented in the final report for the associated phase of the project.

3. Health and Safety

When working on-site, comply with the project Health and Safety Plan (HASP) and Langan’s Injury and Illness Prevention Program. Proper personal protection clothing and equipment (PPE) are to be worn as specified in the HASP and Job Safety Analysis (JSA).

4. Scope, Application and Planning

This Standard Operating Procedure (SOP) provides guidance on the drilling, installation, and development of groundwater monitoring wells to ensure accurate sampling and reliable field data. Monitoring wells serve as critical access points for groundwater sampling, water-level measurements, and other field data collection. They must be constructed using materials that are compatible with contaminants potentially present in soils or groundwater, so as not to contribute or degrade samples. Additionally, properly installed seals and locking well covers are essential to prevent cross-contamination between aquifers and from surface contaminants.

While this SOP outlines general procedures, site-specific conditions may necessitate modifications. During the planning stage, evaluate all known or potential contaminants and consider factors such as recharge rates, anticipated volumes of development water, and best practices for handling, storage, and disposal of development water. Where necessary, contain well development water in steel drums or other suitable containers with adequate headspace for volatile contaminants.

Coordinate with the Project Manager (PM) and onsite personnel to confirm the locations of monitoring wells, arrange site access, and ensure the availability of necessary keys or tools. Ideally, well development should commence 24 hours to no more than 7 days after well completion, grouting, and well-head or surface casing protection. However, for wells with high recharge rates or specific installation methods, discuss with the PM whether development can begin sooner or should be delayed. During development, monitor water quality parameters—pH, specific conductance, temperature, and turbidity—to optimize well performance.

Adherence to the procedures in this SOP and any approved site-specific modifications will ensure that installed monitoring wells provide representative groundwater samples and maintain the long-term integrity of the subsurface environment.

5. Methods

Monitoring Well Installation

Pre-Installation Preparation:

1. Review the sampling plan, QAPP and site-specific instructions and documents.
2. Review the scope of work with the drilling subcontractor to assure that proper equipment is available, and that the field operations and health and safety requirements are understood.
3. Before the field work begins, complete the Langan Safe Work Certificate (SWC) which provides a summary of the daily work tasks, identification of potential hazards

associated with the work tasks and measures employees should follow to mitigate potential hazards.

4. Before the field work begins, complete the Langan Safe Work Certificate (SWC) which provides a summary of the daily work tasks, identification of potential hazards associated with the work tasks and measures employees should follow to mitigate potential hazards.
5. Verify that personnel are aware of and adhere to protocols to minimize PFAS cross-contamination. See Recommended Environmental PFAS Sampling SOP for expanded guidance.
6. Confirm the drilling subcontractor does not use lubricants or decontamination fluids containing PFAS.
7. Underground cable, power lines, and utilities will be determined before drilling activities begin.

Well Installation:

1. Identify the well installation location and at what depth it should be advanced based on site-specific work plans. Wear proper PPE and stay clear of equipment during operation.
2. Clear the first 5-feet of the borehole with soft-digging techniques (i.e. air-knife or other).
3. Advance the borehole to the required depth utilizing a hollow-stem auger or other drilling tool/methods suited to the subsurface and drilling conditions.
4. Make up the screen for installation. The casing and screen should be sampled with an equipment blank (follow water sampling SOP procedures under separate cover, as applicable).
5. Lower the casing string into the drill casing.
6. Install the filter pack. Six inches or more of filter pack material should be spotted at the bottom of the hole, under the screen. Filter pack will be installed to 2 to 3 feet above the top of the screen.
7. Check the depth to the top of the filter pack with a weighted tape.
8. Feed bentonite (PFAS-free) onto the top of the filter pack.
9. Pure bentonite grout will be used as the annular seal, grout will be mechanically mixed with the appropriate amount of water.
10. If wellhead is completed as flush-mounted construction, finish the concrete pad so that it slopes away from the wellhead. If weather conditions warrant, cover the concrete until cured. Lock the well cover.
11. Record the appropriate construction/completion information in the field logbook and on the appropriate monitoring well installation.
12. The well identification should be marked on the protective casing and PVC cap.

Sample Collection:

1. As prescribed in the sampling plan and QAPP, rinsate blank samples from the drill tools will be collected using laboratory-provided sample containers. Samplers will label

sample bottles with the sample identification, date, time, and analysis to be performed.
2. Equipment blanks should taken for both drill tool(s) and PVC screen/casing of well.
3. Fill the sample bottle taking care not to overfill and flush out (or spill) any preservative, if present.
4. Cap the bottle tightly and place it immediately into a cooler with double-bagged ice to maintain a temperature of less than 10°C.

Decontamination:

If required by the project or if field conditions are such that direct collection is not possible, the sampler should discuss the use of tubing or other sampling equipment to support sample collection with the project manager using the tiered approach and equipment guides in the Recommended Environmental PFAS Sampling SOP. Prior to use of any sampling equipment that will contact the sample, an initial decontamination should be completed and an equipment rinsate blank collected.

1. Establish a decontamination area away from sampling activities.
2. Perform a 4-step decontamination of sampling equipment before sample collection and between sampling locations (if equipment is being re-used).
   - Wash with potable water and a detergent.
     - Alconox, Liquinox, and Citrinox are generally acceptable detergents, but it is recommended to verify potential presence/absence of PFAS with manufacturer prior to their use.
   - Initial potable water rinse.
   - Secondary potable water rinse.
   - Complete a final triple-rinse with lab verified PFAS-free water (for components coming into direct contact with sample).

Documentation:

1. Record all well construction details in the field logbook and well construction log, including:
   - Lithology observed
   - Odors, staining, or other discerning observations in soil
   - Top and bottom depth of casing
   - Screen length
   - Length of time for well development
   - Amount of water purged for well development
   - Deviations from the SOP (including documentation of reasons for the deviation and the alternative procedures used)
   - Other observations
2. Record all sampling details in the field logbook, including:
   - Date and time of sample collection
   - Sample location

   - Deviations from the SOP (including documentation of reasons for the deviation and the alternative procedures used)
   - Other observations
3. Ensure the COC form is signed by all parties involved in the sample handling and transportation.

Quality Assurance/Quality Control (QA/QC):

Follow QA/QC procedures as outlined in the sampling plan, including the collection of field duplicates, field blanks, field reagent blanks, equipment rinsate blanks, trip blanks, and source water blanks, as applicable. QA/QC samples shall be identified with unique sample IDs on chains of custody for submission to the laboratory.

1. Field Blanks (FB): If required, collect by pouring laboratory-provided deionized water into a sample bottle at the sampling site.
2. Equipment Rinsate Blanks (ERB): If sampling equipment will contact the sample, the sampler should collect an ERB from that piece of equipment. Collect the ERB following decontamination (steps below). Pour laboratory-provided PFAS-free deionized water through the sampling tube/equipment and into a laboratory-supplied sample container. To the extent practicable, sampling equipment should be dedicated to each sampling location and not utilized at multiple sample sites to avoid cross-contamination.
   - When in Doubt Blank it Out: If field personnel identify a potential cross contamination issue or source or cannot avoid use of a restricted Tier 1 or 2 material, an ERB should be collected. Field personnel should discuss the situation with the project manager prior to submittal for analysis.
3. Trip Blanks (TB): If required, sampler shall collect a trip blank with each sample shipment to the lab. Samplers should verify that trip blanks remain unopened and accompany the samples throughout the sampling and transportation process.
4. Verify that samples are properly labeled, documented, and transported under chain-of-custody procedures.
5. Verify that samplers follow the guidelines outlined in this document, including proper sample handling, documentation, and transportation.

Monitoring Well Development

Monitoring wells are developed to settle and remove fines from the surrounding geologic formation and filter pack. Wells should not be developed for 24 hours after completion when a bentonite grout is used to seal the annular space. Wells are purged immediately before groundwater sampling to remove stagnant water and collect a sample that represents groundwater conditions. Wells should be sampled within 3 hours of purging (optimum) to 24 hours after purging (maximum, for low recharge conditions). Means and methods of developing wells can vary and include:

- Bailing: removing volumes of water with a bailer;

- Over-pumping: pumping the well at a rate higher than recharge;
- Surging: forcing water to flow into and out of the screen by operation of a plunger (surge block) up and down within the well casing, similar to a piston in a cylinder or vi air-lift pumping; and
- Jetting: forcing water into the well at high pressure or flow rate

Means methods and procedures are subject to change based on actual field and subsurface conditions encountered and in discussion and consultation with the driller. This SOP describes protocols and procedures for initial scoping/planning/preparation, pre-development procedures, well development methods, post-development procedures and documentation, other resources and considerations, and select reference materials.

1. Confirm with the project manager and project team before mobilizing to the field the manner in which development water will be handled/managed consistent with project plans and as pre-determined before the on-set of the well development program. Prepare and communicate to the driller and field team.
2. Turn on and calibrate water quality meter(s) in accordance with the manufacturer's instructions, record calibration in the field book.
3. Open and check the condition of the wellhead, noting and recording the condition of the well covers, pressure caps and surveyed reference mark (if present). If a surveyed reference mark is not present, inform the PM. Mark the location of collected measurements on the wellhead using a permanent marker or paint pen on the north side of the top of casing.
4. Measure and record the depth of the static water level (DTW) and depth-to-bottom (DTB) in the monitoring well from the reference mark using an electronic water-level meter, oil/water interface probe or weighted measuring tape and record them in a field form, notebook, or tablet. Compare measurements to previous records of total depth and dimensions obtained from the well installation/completion records, if available.
5. Calculate well volume and record.
   - General equation:
     - For a 2-inch monitoring well:
     - r is radius of well casing in feet (i.e., half of the diameter)
     - H is the difference between the DTW and DTB in feet
6. Setup the selected development method and ensure you can control the flow/discharge of the purged groundwater directed to an appropriate pre-determined location and/or container.
7. Monitor water quality indicator parameters (e.g. pH, specific conductance and turbidity) before beginning development procedures and record during and the end of the development period. During development, visually note any changes/improvements in the observed color and turbidity of discharge water and monitor water quality parameters periodically.
8. Develop the well until produced water is visually clear and free of suspended solids.

9. If the well is depleted of all water during development, temporarily discontinue pumping/bailing and allow groundwater to recharge. Record the recharge rate with periodic water level measurements.
10. Remove the pump assembly from the well and decontaminate. Lock the well cover prior to departure.
11. Manage and properly handle development water generated consistent with project plans and as pre-determined before the on-set of the well development program.

Post Sampling:

1. Complete the sample bottle labels with time of collection and COC form, ensuring information is accurate and matches the sample labels.
2. Store the samples in the cooler with ice (double bagged), not ice packs, to maintain a sample temperature of less than 10°C until they are relinquished to the laboratory or laboratory courier.
3. Transport samples to the laboratory within 48-hours, ideally within 24 hours of collection.

6. Resources

Monitoring well installation and development requires that materials and services be provided by outside contractors and suppliers. The drilling subcontractor will provide the appropriate drilling and sampling tools. Laboratory suppliers will provide the sample containers and perform analytical testing of the samples. This section outlines the requirements from each entity.

From the drilling subcontractor:

- Drilling rig capable of installing wells to the depth in the expected formation material and conditions.
- Drilling or auguring equipment appropriate to site conditions, drilling depth, and other project requirements.
- Drill bits appropriate for the expected soil and rock type(s) to be encountered.
- Sufficient threaded flush-joint riser pipe of an approved material [stainless steel, polyvinyl chloride (PVC), Teflon] in convenient lengths.
- Sufficient threaded flush-joint slotted screen of an approved material (stainless steel, PVC, Teflon) to meet design criteria.
- Properly sized and washed filter pack material (quartz sand) in sufficient volume to meet well design criteria.
- Bentonite or other well PFAS-free well seal material.
- Protective casing with locking cap.
- Weighted measuring tape.

From the environmental equipment rental company:

- Electronic water level meter

From the laboratory contractor:

- High-density polyethylene (HDPE) sampling jars – before ordering, check work plan(s) and confirm the scope with the PM. While not required, it is advisable and good practice to order spare sampling jars as a contingency but there may be incremental costs.
- QA/QC Sampling – QA/QC samples include collection of duplicate, rinsate/equipment blank, and field blank samples in accordance with the site-specific work plan(s). Refer to the site-specific work plan(s) and ask your PM which QA/QC samples will be collected and for what analyses.
- CoC Form – follow standard sample nomenclature when completing the CoC and the sample identification of the soil sample jars. Sample nomenclature is defined in the work plan, Quality Assurance Project Plan (QAPP), or Langan's sample nomenclature SOP.
- PFAS-free deionized water – Used for the final rinse of field sampling equipment and downhole equipment during the decontamination process. Water must be laboratory-verified as PFAS-free prior to use. Decontamination solutions should be replenished between sampling locations as needed.

From Langan personnel:

- Planning Documentation:
    - Health and Safety Plan – inquire about any site-specific safety requirements/policies,
    - Sampling and Analysis Plan/Work plan(s)/proposal,
    - QAPP (if applicable),
    - Printed sample location maps and figures,
    - Printed field sheets/boring logs, well construction logs and /or
    - Client contact and site contact for coordinating access

- Equipment
    - PPE, as specified in the HASP (at minimum, Level D),
    - GPS or survey equipment,
    - Disposable powderless nitrile gloves,
    - Paper towels,
    - Re-sealable low-density polyethylene (LDPE) bags (e.g., Ziploc®) (to store sample containers)
    - Weighted tape measure.
    - Mobile field tablet with GIS maps and Collector App,
    - Steel pin flags, or wooden stakes and spray paint/high-visibility flashing,
    - Appropriate decontamination supplies:
        - Distilled water,
        - Alconox or equivalent (e.g., Simple Green),
        - Decontamination brush,

- Plastic Sheeting
- High-density polyethylene (HDPE) 5-gallon buckets
- Trash bags or container for waste (drum or bucket, 5-gallon), and
- Labels for waste container,

See Recommended Environmental PFAS Sampling Procedures (SOP) for additional guidance on the selection of sampling equipment and materials.

8. References:

- ASTM D5521/D5521M-18 Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers
- Driscoll, F.G., "Groundwater and Wells", 2nd Edition, Johnson Division, St. Paul, Minnesota, 1986.
- Interstate Technology and Regulatory Council (ITRC) PFAS Technical and Regulatory Guidance Document, https://pfas-1.itrcweb.org/.
- USEPA Final Method 1633, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Soil, Biosolids, and Tissue Samples by LC-MS/MS, January 2024.

9. Revision History:

- December 24, 2024 - Version 1.0
- March 6, 2025 – Version 2.0

RECOMMENDED ENVIRONMENTAL PFAS SAMPLING PROCEDURES

1. Statement of Issue

This standard operating procedure (SOP) has been prepared to provide guidelines sampling various media for per- and polyfluoroalkyl substances (PFAS) at Perdue AgriBusiness, LLC (PAB) facility located at 6906 Zion Church Road in Salisbury, Wicomico County, Maryland (the "ZCR Facility" and/or the "Site"). This sampling is being performed at the request of the Maryland Department of the Environment (MDE) Water and Science Administration, Wastewater Pollution Prevention and Reclamation Program (the "Department") in response to their *Request for Action to Address PFAS in Wastewater* letter issued to PAB on November 8, 2024.

This SOP outlines proper equipment, materials, and methods for PFAS sampling at the ZCR Facility and includes procedures and guidance that are intended to limit the potential for PFAS cross-contamination and interference from sources unrelated to the targeted media.

2. Background

On September 12, 2024, MDE issued a letter designating PAB as a responsible person (as defined by Section 7-201 of the Environmental Article) for PFAS detected in groundwater at the western edge of the ZCR Facility and in well and surface water samples collected by MDE to the west of the ZCR Facility.

Langan Engineering and Environmental Services, LLC (Langan) has developed a PFAS Site Investigation Workplan on behalf of PAB to describe the scope and methods for the next phase of a PFAS site/remedial investigation that is being performed for the PAB facility. The Workplan includes proposed soil, groundwater, and/or surface water sampling and other investigation activities that require guidance on limiting cross-contamination of samples in and out of the sample location.

This SOP is informed by EPA Method 1633, approved in January 2024 and ITRC's "Sampling and Analysis" section, revised September 2023.

3. Methodology

3.1 Health and Safety

Langan personnel must abide by Langan's health and safety protocols when performing work-related activities. These protocols should be followed even when they are potentially in conflict with this SOP (including protocols that are intended to limit the potential for PFAS cross-contamination). When there is no appropriate protocol that is consistent both with safe work practices and with this SOP, it is acceptable to deviate from this SOP. Deviations should be documented, and equipment rinsate blanks should be collected and analyzed as appropriate to assess and quantify the potential cross-contamination and other data quality issues arising from the deviation. Refer to the site-specific health and safety plan (HASP) for specific field-related activities and safe work practices.

General safety guidelines are included below:

- Wear safety glasses, protective clothing (i.e., long sleeves and pants; closed-toed, steel-toed shoes; hard hat), and disposable polyethylene or nitrile gloves sampling.
- Avoid contact, inhalation, or ingestion of samples.
- Wash hands thoroughly, along with any other areas that may have contacted or been exposed to the sample, after sampling is complete.
- Post signage to communicate hazards to other facility personnel or isolate work areas, where applicable.

The facility is responsible for following and maintaining on-site awareness of relevant regulations under the Occupational Safety and Health Administration (OSHA), regarding safe sampling handling practices. Safety data sheets for materials used on-site must be made available to facility personnel, and facility personnel must be trained in the proper doffing of contaminated gloves and clothing.

3.2 General Considerations

Industry standard sampling methods for environmental sampling are generally acceptable for use in PFAS sampling, provided that the sampling equipment is evaluated for potential PFAS interference.

3.3 Field Decision Guide

Field staff should follow the tiered approach adopted by Langan in assessing unplanned conditions that could increase the risk of sample cross-contamination by site conditions and/or sampling equipment and procedures. The tiered approach considers possible impact to environmental samples when assessing an unplanned condition. The table below identifies the tiered approach to formulate a solution/response that can be discussed with the PM to confirm conformance with objectives of the sampling program.

Definition		Questions to Consider
Tier 1	Unplanned materials or equipment that will come into direct contact or could reasonably come into direct contact with field samples	Discuss issue and proposed solution with PM Does the material or equipment directly contact field samples? Is there an alternative material or piece of equipment that would be considered acceptable and that is readily available? Is the material necessary for proper sample collection? Can steps be taken to avoid direct contact with field samples? Can a rinsate blank be collected to support an evaluation of cross contamination?
Tier 2	Unplanned materials and equipment that are not expected to come into direct contact with	Issue and solution may warrant discussion with PM.

Definition		Questions to Consider
	field samples, but present the potential for incidental contact and may contain PFAS	Can measures be put in place to further ensure contact with the field samples is avoided? Is additional Quality Assurance/Quality Control (QA/QC) sampling warranted based on project DQO's?
Tier 3	Unplanned materials and equipment that will not come into direct contact with field samples, pose no risk of incidental contact with a sample, and are not known to contain PFAS	Discussion with the PM is not likely necessary and nor is added QA/QC Is this material necessary for the work at hand? Can it be safely and securely removed from the work area?

3.4 Sampling Documentation and Labeling

Follow environmental sampling accepted practices when documenting PFAS sampling. Field books and writing instruments should be evaluated as potential sources of PFAS interference. In addition, evaluate the sampling containers, label paper, adhesive backing and printing ink as potential sources of PFAS interference. As a precaution, labels for PFAS sample containers should be applied after collecting the sample.

3.5 Field Clothing, Personal Protective Equipment and Personal Care Products

Langan field personnel should adhere to standard protective clothing including but not limited to hi-visibility shirts, pants, steel-toed work shoes, and safety glasses. Water resistant, waterproof, stainproof, or stain-treated materials should be avoided when possible, including the standard issued Langan field jacket. Field clothing made of synthetic and natural fibers (preferably cotton) are acceptable. Field clothing should be laundered without the use of fabric softener. Preferably, field gear should be cotton construction and well laundered. New clothing may contain PFAS related treatments.

Additionally, personnel should avoid application of cosmetics, moisturizers, and creams as these may contain PFAS. This includes specific sunscreens and insect repellants. Review **Attachment A - Clothing/ Personal Protective Equipment (PPE) and Personal Care Products** for additional guidance and specific brands of materials and products that are and are not acceptable when PFAS sampling.

3.6 Sampling Equipment

Equipment brought onsite by Langan personnel should be reviewed and confirmed to be PFAS-free prior to sampling event. This includes standard equipment such as:

- Nitrile gloves
- Laboratory provided sample bottles
- Field logbook and writing utensil
- Labels and permanent markers
- Laboratory supplied PFAS-free water

Standard equipment such as Rite in the Rain® field notebooks and fine-tipped Sharpies® have been reviewed by USEPA to not contain PFAS and are acceptable in the field.

Subcontractors and their equipment should be vetted prior to sampling event. Water transported onsite for drilling should be confirmed to be PFAS-free by the subcontractor prior to use. All subcontractors should be made aware of QAPP standards, including Langan

Equipment that comes into contact with samples (i.e. acetate liners, drill bits) should be sampled as an equipment blanks and decontaminated as needed.

3.7 Sampling Procedure

General Procedures

- Wear nitrile gloves and change them frequently. New gloves should be donned prior to sample collection and each time the sampler handles a new tool or contacts a new surface.
- Personal care products should not be applied within the work area. Samplers should thoroughly wash hands and don new gloves after application. Review **Attachment A - Clothing/ Personal Protective Equipment (PPE) and Personal Care Products** for additional guidance.
- Use reputable equipment vendors and laboratories and seek their input on minimizing the potential for introducing PFAS and cross contamination.
- Limit contact with items that are not required for the work at hand; do not eat in the work area.
- Maintain a neat and orderly work area; do not allow sampling equipment to contact the ground (lay out plastic sheeting as necessary).
- Review the project-specific Quality Assurance and Quality Control program with the project team to understand the nuances of PFAS QA/QC as these may be significantly different than standard sampling and have specific procedures and protocols not required for other types of environmental sampling.

Samples should be shipped as soon as practicable, with sufficient ice to maintain a temperature at or below 6°C (approximately 43°F) during transport for a period of at least 48 hours to allow for shipping delays. Upon receipt by the laboratory, samples should be stored at or below -20°C (approximately -4°F, holding time up to 90 days from collection) or between 0 and 6 °C if analyzed within 7 days from time of collection (since analytes of interest include NMeFOSE, NEtFOSE, NMeFOSAA, and NEtFOSAA, and transformation between these PFAS compounds has been observed to occur more quickly than others, which are allotted a 28-day holding time at this storage temperature).

Samples will be analyzed via EPA Method 1633. EPA Method 1633 is titled, "*Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS*." LC-MS/MS refers to liquid chromatography-tandem mass spectrometry, an analytical technique with high sensitivity and specificity for identifying and quantifying compounds in a sample. This method supports NPDES permits and contains all the required quality control procedures for use under the CWA. See Attachment C for a copy of this method.

4. References

Interstate Technology and Regulatory Council (ITRC) PFAS Technical and Regulatory Guidance (https://pfas-1.itrcweb.org/), updated June 2022.

United States Environmental Protection Agency (USEPA). (2024). Method 1633: Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS. Washington, DC: USEPA Office of Water. Retrieved from https://www.epa.gov/cwa-methods/cwa-analytical-methods-and-polyfluorinated-alkyl-substances-pfas

USEPA Final Method 1633, Revision A, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Soil, Biosolids, and Tissue Samples by LC-MS/MS, December 2024.

Appendix E Langan Unified Soil Classification System

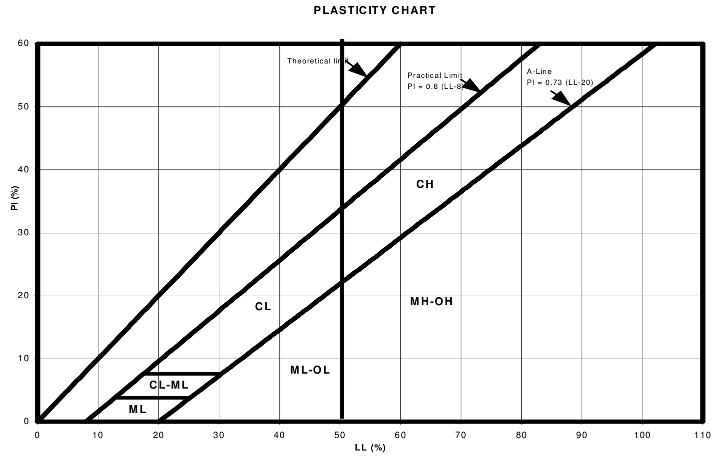
FINE-GRAINED SOIL

More Than Half the Material is Smaller Than the No. 200 Sieve

	GROUP SYMBOLS		GROUP NAMES AND LABORATORY CLASSIFICATION CRITERIA	TYPICAL SOIL IDENTIFICATION FOR INDIVIDUAL GROUPS	FIELD IDENTIFICATION PROCEDURES		
					DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PL)
SILTS and CLAYS with the liquid limit less than 50%	ML		Inorganic, non-plastic and slightly plastic SILTS, and medium plastic clayey SILTS with the limit data plotting below the "A" line and hatched zone on the plasticity chart	v.f. sandy non—plastic SILT medium plastic clayey SILT, trace f. sand	None to slight	Quick to slow	None
	CL		Inorganic, slightly plastic silty CLAYS, and medium plastic to plastic CLAYS with the limit data plotting above the "A" line and hatched zone on the plasticity chart	Slightly plastic to medium plastic silty CLAY Medium plastic silty CLAY, trace f. sand	Medium to high	None to very slow	Medium
	OL		Organic non-plastic to medium plastic SILTS with the limit data plotting below the "A" line and hatched zone on the plasticity chart	f. sandy non-plastic ORGANIC SILT some fibers	Slight to medium	Slow	Slight
SILTS and CLAYS with the liquid limit greater than 50%	MH		Inorganic micaceous or diatomaceous slightly plastic SILTS, and medium plastic to very plastic clayey SILTS with the limit data plotting below the "A" line on the plasticity chart	Medium plastic to plastic clayey SILT Medium plastic clayey SILT, some m.f. sand	Slight to medium	Slow to none	Slight to medium
	CH		Inorganic plastic to very plastic CLAYS with the limit data plotting above the "A" line on the plasticity chart	Plastic to very plastic CLAY f. sandy plastic CLAY	High to very high	None	High
	OH		Organic medium plastic to plastic silty CLAYS, and very plastic CLAYS with the limits data plotting below the "A" line on the plasticity chart	Fibrous plastic ORGANIC silty CLAY	Medium to high	None to very slow	Slight to medium
HIGHLY ORGANIC SOILS	Pt		Organic soils with a distinctive organic texture and containing particles of leaves, grass, branches or other fibrous vegetable matter	Organic silty clayey ROOTMAT Organic silty clayey PEAT, some fibers	Readily identified by color, odor, spongy feel and frequently by fibrous texture		

CONSISTENCY

Descriptive Term	Behavior	Std. Pen. blows/ft	Unconfined Strength, tsf
Very soft	Extruded from between fingers when squeezed	<2	1/4
Soft	Molded by light finger pressure	2 - 4	1/4 - 1/2
Firm	Molded by strong finger pressure	4 - 8	1/2 - 1
Stiff	Indented by thumb	8 - 16	1 - 2
Very stiff	Indented by thumb nail	16 - 32	2 - 4
Hard	Difficult to indent by thumb nail	>32	4


PLASTICITY CHART

Langan

UNIFIED SOIL CLASSIFICATION CHART PLATE A

COARSE GRAINED SOIL

More Than Half the Material is Larger Than the No. 200 Sieve

GROUP DIVISIONS		GROUP SYMBOLS		GROUP NAMES AND LABORATORY CLASSIFICATION CRITERIA	TYPICAL SOIL IDENTIFICATION FOR INDIVIDUAL GROUPS	FIELD IDENTIFICATION PROCEDURES (EXCLUDING PARTICLES LARGER THAN 3 IN. AND BASING FRACTIONS ON ESTIMATED WEIGHTS)
GRAVELS More than half of the coarse fraction is retained on the No. 4 sieve	Gravels with trace or no fines	GW		Well graded GRAVELS with less than 5% fines, Cu greater than 4 and Cc between 1 and 3	Well-graded gravels or gravel-sand mixtures, little or no fines	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.
		GP		Poorly graded GRAVELS with less than 5% fines, and not meeting all gradation requirements for GW	Poorly-graded gravels or gravel-sand mixtures, little or no fines	Predominantly one size or a range of sizes with some intermediate sizes missing.
	Gravels with some or many fines	GM		GRAVELS with greater than 12% ML or MH fines	Silty gravels, gravel-sand-silt mixtures	Nonplastic fines or fines with low plasticity (for identification procedures, see ML other side).
		GC		GRAVELS with greater than 12% CL or CH fines	Clayey gravels, gravel-sand-clay mixtures	Plastic fines (for identification procedures, see CL other side).
		GO		GRAVELS with greater than 12% OL or OH fines		
SANDS More than half of the coarse fraction passes the No. 4 sieve	Sands with trace or no fines	SW		Well-graded SANDS with less than 5% fines, Cu greater than 6 and Cc between 1 and 3	Well-graded sands or gravelly sands, little or no fines	Wide range in grain sizes and substantial amounts of all intermediate particle sizes
		SP		Poorly graded SANDS with less than 5% fines, and not meeting all gradation requirements for SW	Poorly-graded sands or gravelly sands, little or no fines	Predominantly one size or a range of sizes with some intermediate sizes missing
	Sands with some or many fines	SM		SANDS with greater than 12% ML or MH fines	Silty sands, sand-silt mixtures	Nonplastic fines or fines with low plasticity (for identification procedures, see ML other side).
		SC		SANDS with greater than 12% CL or CH fines	Clayey sands, sand-silt mixtures	Plastic fines (for identification procedures, see CL other side).
		SO		SANDS with greater than 12% OL or OH fines		

DESCRIPTION OF CONSTITUENT PERCENTAGES AS USED IN SOIL SAMPLE CLASSIFICATIONS

1%	to	12%	-	"Trace"
13%	to	30%	-	"Some"
31%	to	49%	-	Adjective form of soil group (e.g., sandy)

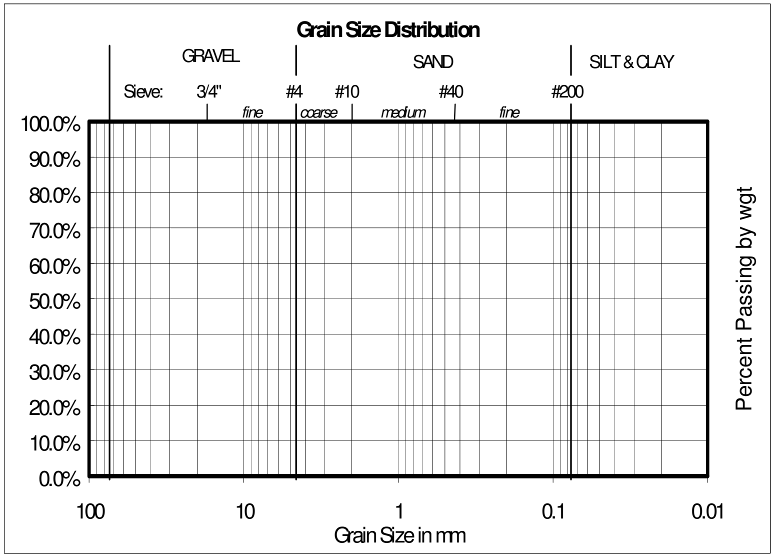
Equal amount of different soil groups - "and"

DESCRIPTION OF WATER CONTENT

Dry	Coarse Grained Soils
Moist	Signs of water and soil is not dusty
Wet	Signs of water and there is some free water when soil densified

COMPACTNESS	BEHAVIOR	STD. PEN. BLOWS/ FT[(1)]	RELATIVE DENSITY, %
Very loose		<4	0 - 15
Loose	Easily penetrated with ½ inch rod pushed by hand	4 - 10	15 - 40
Medium dense	Easily penetrated with ½ inch rod driven with a 5 pound hammer	10 - 30	40 - 70
Dense	Penetrated 1-foot with ½ inch rod driven with a 5 pound hammer	30 - 50	70 - 85
Very dense	Penetrated only a few inches with a ½ inch rod driven with a 5 pound hammer	>50	85 - 100

(1) Should use chart to adjust for overburden



Langan

UNIFIED SOIL CLASSIFICATION CHART PLATE B

Rock Types

Rock Name	Characteristics	Symbol
Shale	Clay sized particles, shale has fissility which is a horizontal sheet-like or laminated feature.	▤
Claystone	Clay sized particles that are consolidated, lacking fissility.	▨
Siltstone	Composed of silt, normally breaks as irregular chunks	X X X X
Sandstone	Primarily sand sized particles modified w/ the descriptor fine, medium, or coarse.	░
Conglomerate	Gravel sized grains and larger held together by finer material, called a breccia if clasts are angular.	▩
Limestone	Effervesses w/ diluted HCl, can be composed of clay up to gravel particles (fossils).	▦
Coal	Black and shiny, can break into cubes or conchoidally.	■

Rock Quality Descriptions

Weathering

Completely Weathered: All rock material is decomposed and/or disintegrated. The original rock structure may still be intact.

Highly Weathered: More than half of the rock material is decomposed. Fresh rock is present only as a discontinuous framework or as corestones.

Moderately Weathered: Less than half of the rock material is decomposed. Fresh rock is present at a discontinuous framework or as corestones.

Slightly Weathered: Discoloration or staining indicates weathering of rock material on discontinuity surfaces. Rock may be discolored and softened.

Fresh: No visible signs of rock material weathering.

RQD

Descriptor	%
Very Poor	<25
Poor	25-50
Fair	50-75
Good	75-90
Excellent	>90

Brokenness

Descriptor	Fracture Spacing (in & ft)
Very Broken	< 1 (<0.08)
Broken	1-3 (0.08-0.25)
Moderately Broken	3-6 (0.25-0.5)
Slightly Broken	>6 (>0.5)

Rock Hardness

Descriptor	Field Criterion	Relative Unconfined Compressive Strength
Very Hard	Difficult to break w/ Hammer	> 30,000 psi
Hard	Hand-held sample breaks w/ Hammer	8,000 to 30,000 psi
Medium Hard	Cannot scrape surface w/ knife	2,000 to 8,000 psi
Soft	Cutting or scraping w/ knife difficult	500 to 2,000 psi
Very Soft	Can be cut w/ knife	< 500 psi

Appendix F Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN; PER AND POLYFLUOROALKYL SUBSTANCES SITE INVESTIGATION

for

Perdue AgriBusiness LLC
6906 Zion Church Road
Salisbury, Maryland

Prepared for:

Perdue AgriBusiness LLC
P.O. Box 1537
Salisbury, MD 21802-1537

Prepared by:

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Philadelphia, Pennsylvania 19103

May 28, 2025

Langan Project No.: 220210101

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FIGURES

Attachments

Attachment A	Laboratory Reporting Limits and Method Detection Limits
Attachment B	Analytical Methods and Quality Assurance Summary Table
Attachment C	Laboratory Quality Manual, Analytical Methods, and Certifications

1.0 PROJECT DESCRIPTION

1.1 Introduction

This Quality Assurance Project Plan (QAPP) was prepared on behalf of Perdue AgriBusiness LLC (Perdue AgriBusiness) to describe the quality assurance/quality control (QA/QC) procedures that will be used during soil, surface water, sediment, process water, and groundwater sampling for certain per- and polyfluoroalkyl substances (PFAS) at the Perdue AgriBusiness facility located at 6906 Zion Church Road, Salisbury, Maryland ("ZCR Facility" or "Site"). Perdue AgriBusiness has retained Langan to perform this soil, sediment and water (surface, process, and groundwater) sampling and analysis.

This QAPP specifies analytical methods to obtain groundwater, process water, surface water, sediment, and soil sampling data that is precise, accurate, representative, comparable, complete, and sensitive of this project's requirements. As specified in Maryland Department of the Environment (MDE)-approved Tier III data requirements, this QAPP has been prepared in general accordance with:

- United States Environmental Protection Agency (EPA) Guidance for Quality Assurance Project Plans (EPA, 2002); and
- Maryland's Assessment Methodologies (MDE, 2024).
- Maryland's Department of the Environment Cleanup Standards for Soil and Groundwater.

1.2 Project Purpose and Scope

The project purpose and scope are described in Langan's *Per and Polyfluoroalkyl Substances (PFAS) Site Investigation Workplan, Perdue AgriBusiness, LLC Zion Church Road Facility* dated May 28, 2025.

2.0 DATA QUALITY OBJECTIVES AND PROCESS

Data Quality Objectives (DQO) are qualitative and quantitative statements to obtain data of known and appropriate quality. DQOs for sampling activities are determined by evaluating five factors:

- Data needs and uses: The types of data required and how the data will be used after it is obtained.
- Parameters of Interest: The types of chemical or physical parameters required for the intended use.
- Level of Concern: Levels of constituents, which may require remedial actions or further investigations.
- Required Analytical Level: The level of data quality, data precision, and QA/QC documentation required for chemical analysis.
- Required Detection Limits: The detection limits necessary based on the above information.

The quality assurance and quality control objectives for measurement data include:

- **Precision** – an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Field sampling precision will be determined by analyzing coded duplicate samples and analytical precision will be determined by analyzing internal quality control (QC) duplicates and/or matrix spike duplicates.
- **Accuracy** – a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern. Accuracy will be determined through the assessment of the analytical results of equipment blanks. Analytical accuracy will be assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), internal standards, laboratory method blanks, instrument calibration, and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks.
- **Representativeness** – expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is dependent upon the adequate design of the sampling program and will be satisfied by ensuring that the scope of work is followed and that specified sampling and analysis techniques are used. Compliance to nationally-recognized analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory's possession aids in obtaining representativeness in the laboratory. This is accomplished by following applicable methods, laboratory-issued standard operating procedures (laboratory-issued

SOPs), the laboratory's Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.

- **Completeness** – the percentage of measurements made which are judged to be valid. Completeness will be assessed through data validation. The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested.
- **Comparability** – expresses the degree of confidence with which one data set can be compared to another. The comparability of data collected for this project will be obtained using several procedures, including standard methods for sampling and analysis as documented in the QAPP, using standard reporting units and reporting formats, and data validation.
- **Sensitivity** – the ability of the instrument or method to detect target analytes at the levels of interest. The project manager will select, with input from the laboratory and quality assurance (QA) personnel, sampling and analytical procedures that achieve the required levels of detection.

The above objectives are discussed in detail in Section 4.0.

3.0 PROJECT ORGANIZATION

Soil and water sampling will be overseen by Langan on behalf of Perdue AgriBusiness. Langan will also arrange data analysis and reporting tasks. The analytical services will be performed by an Environmental Laboratory Accreditation Program (ELAP)-certified laboratory. Data validation services will be performed by Langan. Sampling will be performed by Langan, and the analytical services will be performed by Pace Analytical Services, LLC (Pace) (formerly Alpha Analytical) of Mansfield, Massachusetts (ELAP accreditation number 206224). Data validation services will be performed by Joseph Conboy and Mariana Wissink of Langan.

Key contacts for this project are summarized below.

Personnel	Investigation Role	Contact Information
Jeffrey Smith, P.G. Langan	Project Director/ Senior Associate	Phone – 215-694-7549 Email – jsmith@langan.com
Adam Hackenberg, P.G. Langan	PFAS Subject Matter Expert / Senior Project Manager	Phone – 267-939-3236 Email – ahackenberg@langan.com
Anna Willett, P.E. Langan	Project Manager; Quality Assurance Officer (QAO) / PFAS Subject Matter Expert	Phone – 571-591-5548 Email – awillett@langan.com
To Be Determined	Field Task Manager	To Be Determined
Joseph Conboy Langan	Data Validator / Program Quality Assurance Manager (QAM)	Phone – 609-282-8055 Email – jconboy@langan.com
Mariana Wissink Langan	Data Validator / Program QAM	Phone – 973-560-4885 Email – mwissink@langan.com
Alycia Mogayzel Pace Analytical Services, LLC	Laboratory Representative	Phone – 508-844-4120 Email – Alycia.mogayzel@pacelabs.com

4.0 QUALITY ASSURANCE OBJECTIVES FOR COLLECTION OF DATA

The overall quality assurance and quality control objectives for measurement data include precision, accuracy, representativeness, completeness, comparability, and sensitivity. These objectives are defined in following subsections. Variances from the quality assurance objectives during the investigation will result in the implementation of appropriate corrective measures and an assessment of the impact of corrective measures on the usability of the data.

4.1 Precision

Precision is a measure of the degree to which two or more measurements are in agreement. Field precision is assessed through the collection and measurement of field duplicates. Laboratory precision and sample heterogeneity also contribute to the uncertainty of field duplicate measurements. This uncertainty is taken into account during the data assessment process. The following field duplicate precision criteria will be applied for aqueous samples:

- Results greater than 5 times the laboratory reporting limit (RL) must have a relative percent difference (RPD) $\leq 30\%$.
- Results less than 5 times the RL must have an absolute difference $\leq \pm$RL.

The following field duplicate precision criteria will be applied for soil samples:

- Results greater than 5 times the laboratory reporting limit (RL) must have a relative percent difference (RPD) $\leq 50\%$.
- Results less than 5 times the RL must have an absolute difference $\leq \pm 2$RL.

RLs and method detection limits (MDL) are provided in Attachment A.

Laboratory precision is assessed through the analysis of matrix spike/matrix spike duplicates (MS/MSD), laboratory control sample/laboratory control sample duplicates (LCS/LCSD) and subsequent calculation of RPD. For outliers, if additional sample volume is present, the MS/MSD should be reanalyzed and the RPD recomputed. If additional volume is not present, an evaluation will be performed to determine the extent of potential matrix interference.

4.2 Accuracy

Accuracy is the measurement of the reproducibility of the sampling and analytical methodology. It should be noted that precise data may not be accurate data. For the purpose of this QAPP, bias is defined as the constant or systematic distortion of a measurement process, which manifests itself as a persistent positive or negative deviation from the known or true value. This may be due to (but not limited to) improper sample collection, sample matrix, poorly calibrated analytical or sampling equipment, or limitations or errors in analytical methods and techniques.

Accuracy in the field is assessed through the use of equipment blanks and through compliance to sample handling, preservation, and holding time requirements. Equipment blanks should be non-detect when analyzed by the laboratory. Contaminant detected in an associated equipment blank will be evaluated against laboratory blanks (preparation or method) and evaluated against field samples collected on the same day to determine potential for bias.

Laboratory accuracy is assessed by evaluating the percent recoveries of matrix spike/matrix spike duplicate (MS/MSD) samples, laboratory control samples (LCS), surrogate compound recoveries, and the results of method preparation blanks. MS/MSD, LCS, and surrogate percent recoveries will be compared to either method-specific control limits or laboratory-derived control limits. Sample volume permitting, samples displaying outliers should be reanalyzed. Associated method blanks should be non-detect when analyzed by the laboratory.

4.3 Completeness

Laboratory completeness is the ratio of total number of samples analyzed and verified as acceptable compared to the number of samples submitted to the fixed-base laboratory for analysis, expressed as a percent. Three measures of completeness are defined:

- Sampling completeness, defined as the number of valid samples collected relative to the number of samples planned for collection;
- Analytical completeness, defined as the number of valid sample measurements relative to the number of valid samples collected; and
- Overall completeness, defined as the number of valid sample measurements relative to the number of samples planned for collection.

Data will be subject to a 90% completeness criterion. If the criterion is not met, sample results will be evaluated for trends in rejected and unusable data. The effect of unusable data required for a determination of compliance will also be evaluated. Each individual sample result will be evaluated relative to appropriate screening levels.

4.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. Representativeness is dependent upon the adequate design of the sampling program and will be satisfied by ensuring that the scope of work is followed and that specified sampling and analysis techniques are used. This is performed by following applicable SOPs and this QAPP. Field technicians will be given copies of appropriate documents prior to sampling events and are required to read, understand, and follow each document as it pertains to the tasks at hand.

Representativeness in the laboratory is certified by compliance to nationally-recognized analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory's possession. This is performed by following applicable United States Environmental Protection Agency (USEPA) methods, laboratory-issued SOPs, the laboratory’s Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.

4.5 Comparability

Comparability is an expression of the confidence with which one data set can be compared to another. The comparability of data collected for this project will be checked by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Requiring traceability of analytical standards and/or source materials to the USEPA or National Institute of Standards and Technology (NIST);
- Requiring that calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable);
- Using standard reporting units and reporting formats including the reporting of QC data;
- Performing a complete data validation on a representative fraction of the analytical results, including the use of data qualifiers in cases where appropriate; and
- Requiring that validation qualifiers be used when an analytical result is used.

These steps will enable future users of either the data or the conclusions drawn from them to judge the comparability of these data and conclusions.

4.6 Sensitivity

Sensitivity is the ability of the instrument or method to detect target analytes at the levels of interest. The Project Director (or designee) will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection and QC acceptance limits that meet established performance criteria. Concurrently, the Project Manager (or designee) will select the level of data assessment so that only data meeting the project DQOs are used in decision-making.

Field equipment will be used that can achieve the required levels of detection for analytical measurements in the field. In addition, the field sampling staff should collect and submit full volumes of samples as required by the laboratory for analysis, whenever possible. Full volume aliquots will help achieve the required limits of detection and allow for reanalysis if necessary. The concentration of the lowest level check standard in a multi-point calibration curve will represent the reporting limit.

Analytical methods and quality assurance parameters associated with the sampling program are presented in Attachment B. The frequency of associated field blanks and duplicate samples is described in Section 5.3.

Site-specific MS/MSD samples will be prepared and analyzed by the analytical laboratory by spiking an aliquot of submitted sample volume with analytes of interest. Additional sample volume is not required by the laboratory for this purpose, so long as the full volume required for the sample analysis is collected. An MS/MSD analysis will be analyzed at a rate of 1 out of every 20 samples, or one per analytical batch.

5.0 SAMPLE COLLECTION AND FIELD DATA ACQUISITION PROCEDURES

Personnel performing sampling should follow Langan's project-specific SOPs. The following sections describe procedures to be followed for specific tasks.

5.1 Field Documentation Procedures

Field documentation procedures will include summarizing field observations in field books and/or electronic logs, completing forms for sampling, and proper sample labeling. These procedures are described in the following sections.

5.1.1 Field Data and Notes

Field notebooks, electronic logs, and/or field data sheets will be used to record documentary evidence regarding procedures used and tasks performed by field personnel. Hard cover, bound field notebooks will be used because of their compact size, durability, and secure page binding. Field books with waterproofing should not be used because of the possible presence of PFAS compounds. The pages of the notebook will not be removed. An appropriate electronic system will also be used to record certain field notes and sample logs.

Paper entries will be made in blue or black ink. No erasures will be allowed. If an incorrect entry is made, the information should be crossed out with a single strike mark and the change initialed and dated by the team member making the change. Each entry should be dated. Entries should be legible and contain accurate and thorough documentation of the individual or sampling team's activities or observations made. The level of detail should be sufficient to explain and reconstruct the activity conducted. Each entry should be signed by the person(s) making the entry.

The following types of information should be provided for each sampling task, as appropriate:

- Project name and number.
- Reasons for being onsite or taking the sample.
- Date and time of activity.
- Sample identification numbers.
- Geographical location of sampling points with references to the site, other facilities or a map coordinate system. Sketches will be made in the field logbook when appropriate.
- Physical location of sampling locations.
- Description of the method of sampling including procedures followed, equipment used and departure from the specified procedures.
- Description of the sample including physical characteristics, odor, etc.
- Readings obtained from health and safety equipment.

- Weather conditions at the time of sampling and previous meteorological events that may affect the representative nature of a sample.
- Photographic information including a brief description of what was photographed, the date and time, the compass direction of the picture and the number of the picture on the camera.
- Other pertinent observations such as the presence of other persons on the site, actions by others that may affect performance of site tasks, etc.
- Names of sampling personnel and signature of persons making entries.

Field records may also be collected on field data sheets. Field data sheets should include the project number and stored in the field project files when not in use. At the completion of the field activities, the field data sheets will be maintained in the central project file.

5.1.2 Sample Labeling

Each sample collected will be assigned a unique identification number and placed in an appropriate sample container. Each sample container will have a sample label affixed to the outside with the date and time of sample collection and project name. In addition, the label will contain the sample identification number, analysis, and chemical preservatives added, if any. Samplers will avoid the use of Sharpies and other thick markers because they may contain PFAS compounds. Documentation will be completed in waterproof ink.

Sample nomenclature will be as follows:

SB-#-#-depth_YYYYMMDD for soil samples

MW-#-#_YYYYMMDD for groundwater samples from monitoring wells

WS-#-#_YYYYMMDD for surface water samples

SE-#-#_YYYYMMDD for sediment samples

Where,

- The first "#" is the Area of Interest (AOI) numbers,
- The second "#" is the sequential soil, sediment, monitoring well, or surface water sample number within each AOI (these are predetermined and identified in the accompanying Workplan),
- The depth for soil samples is represented as a depth interval given in decimal feet (e.g., "0.0-0.5"),
- YYYYMMDD is the sample date, four digit year followed by two-digit month and day

QA/QC sample nomenclature will be as follows:

EB-#_YYYYMMDD for Equipment Blank (QA/QC Sampling)

DUP-#_YYYYMMDD for Duplicate (QA/QC Sampling)

Source-Water-#_YYYYMMDD for samples of source water being used for drilling and decontamination purposes

Where,

- The "#" is the numbering sequence for each type QA/QC sample collected on a given day (e.g., the first duplicate on a given day would be "DUP-1," the second would be "DUP-2," etc.)
- YYYYMMDD is the sample date, four-digit year followed by two-digit month and day

Field personnel should record the location, and a detailed description of, QC samples in the field book and/or electronic log including the reason for the QC sample, sampling procedures, and associated parent samples (in the case of duplicates).

5.2 Equipment Calibration and Preventative Maintenance

At a minimum, field calibration and/or field equipment checking should be performed once daily, prior to use. Field calibration will be documented in the field notebook, electronic logs, or on field data sheets. Entries made regarding the status of field equipment should include the following information:

- Date and time of calibration
- Type of equipment serviced and identification number (such as serial number)
- Reference standard used for calibration
- Calibration and/or maintenance procedure used
- Other pertinent information

A water quality meter (Horiba U-52 or or similar) will be used during purging of water to measure field water quality parameters as specified in the applicable SOP. Water-quality meters should be calibrated, and the results documented before use each day using standardized field calibration procedures and calibration checks.

A photoionization detector (PID) will be used during soil logging to measure VOCs and other volatile gases for health and safety monitoring purposes. PIDs should be calibrated, and the results documented before use each day using standardized field calibration procedures and calibration checks.

Equipment that fails calibration or becomes inoperable during use should be removed from service and segregated to prevent inadvertent utilization. The equipment should be properly tagged to indicate that it is out of calibration. Such equipment should be repaired and recalibrated to the manufacturer's specifications by qualified personnel. Equipment that cannot be repaired should be replaced.

Off-site calibration and maintenance of field instruments should be performed as appropriate throughout the duration of project activities. Field instrumentation, sampling equipment and accessories should be maintained in accordance with the manufacturer's recommendations and specifications and established field equipment practice. Off-site calibration and maintenance should be performed by qualified personnel. A logbook, tablet, or field data sheet will be kept to document that established calibration and maintenance procedures have been followed. Documentation should include both scheduled and unscheduled maintenance.

5.3 Sample Collection

5.3.1 Field Samples

Personnel performing sampling should follow Langan's project-specific SOPs.

Samples should be collected directly into pre-cleaned laboratory-supplied bottles. Samples collected for PFAS analysis will be collected into HDPE containers. After collection, sample bottles will be capped and securely tightened, and placed in iced coolers to attempt to maintain a temperature of less than 6°C until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Section 5.4. Analysis and/or extraction and digestion of collected samples should meet the holding times required as specified in Attachment B. In addition, analysis of collected samples should meet quality assurance criteria set forth by this QAPP.

5.3.2 Duplicates and Equipment Blanks

Field blanks should be collected at a rate of 5% of the total number of samples. Duplicate samples will be collected and analyzed for quality assurance purposes. Duplicate samples should be collected at a frequency of a minimum of 5% of the total number of samples and should be submitted to the laboratory as "blind" duplicate samples. If fewer than 20 samples are collected during a particular sampling event, one duplicate sample will be collected.

Equipment blank and source water samples should be collected at the frequency, and using the methods specified in, Langan's project-specific SOPs. The purpose of the equipment blanks is to evaluate potential interference or cross-contamination from sampling equipment or other potential sources. The purpose of the source water samples is to evaluate the PFAS content of water that is to be used for drilling and decontamination purposes (i.e., water that may come into contact with field samples).

5.4 Sample Containers and Handling

Certified, commercially clean sample containers will be obtained from the analytical laboratory. The laboratory will also prepare and supply the required duplicate, equipment blank, and source water sample containers and reagent preservatives. Sample bottle containers will be placed into plastic coolers by the laboratory. Prior to the commencement of field work, Langan field personnel will fill the plastic coolers with ice in Ziploc® bags (or equivalent) to attempt to maintain a temperature at or below 6°C.

Samples collected in the field for laboratory analysis will be placed directly into the laboratory-supplied sample containers. Samples will then be placed and stored on-ice in laboratory provided coolers until shipment to the laboratory. Samples may also be stored in a secured, access-controlled, refrigerator at the Site while awaiting shipment to the laboratory. Blue ice will not be used to cool PFAS samples.

Possession of samples collected in the field will be traceable from the time of collection until they are analyzed by the analytical laboratory or are properly disposed. Chain-of-custody procedures, described in Section 5.10, will be followed to maintain and document sample possession. Samples should be packaged and shipped as described in Section 5.7.

5.5 Special Considerations for PFAS Sample Collection

Special considerations apply to the collection of samples for PFAS analysis to prevent cross-contamination, which are detailed in the PFAS Investigation SOPs, included as an Appendix to the *PFAS Site Investigation Workplan*.

PFAS will be analyzed using USEPA Method 1633.[1] The laboratory will report the 40 compounds listed in the method. A subset of soil samples, to be determined, will also be prepared using the Synthetic Precipitation Leaching Procedure (SPLP) (USEPA Method 1312) and then further analyzed using USEPA Method 1633 for a subset of PFAS analytes, to be determined. A subset of aqueous samples will be additionally analyzed using Total Oxidizable Precursor (TOP) methodology.

The laboratory reporting limits are indicated in Attachment A. The laboratory-issued SOP for PFAS analysis, PFAS compound sampling protocol, and associated laboratory accreditation are provided in Attachment C.

5.6 Sample Preservation

Sample preservation measures will be used in an attempt to prevent sample decomposition by contamination, degradation, biological transformation, chemical interactions and other factors during the time between sample collection and analysis. Preservation will commence at the time of sample collection and will continue until analyses are performed. Should chemical preservation be required, the analytical laboratory will add the preservatives to the appropriate sample containers before shipment to the office or field. Samples will be preserved according to the

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[1] Method 1633 (January 2024) will be used until such time as the laboratory adopts minor method revisions that were published in December 2024 as Method 1633A, at which time the revised method may be used.

requirements of the specific analytical method selected, as summarized in Attachment B, and detailed in Attachment C.

5.7 Sample Shipment

5.7.1 Packaging

Sample containers will be placed in plastic coolers. Ice placed in Ziploc® bags (or similar) will be placed around sample containers. Blue ice will not be used to cool PFAS samples. Cushioning material will be added around the sample containers if necessary. Chains-of-custody and other paperwork will be placed in a Ziploc® bag (or similar) and placed inside the cooler. The cooler will be taped closed and custody seals will be affixed to one side of the cooler at a minimum. Samples may also be stored in a secured, access-controlled, refrigerator at the Site while awaiting shipment to the laboratory. If the samples are being shipped by an express delivery company (e.g. FedEx) then laboratory address labels will be placed on top of the cooler.

5.7.2 Shipping

Standard procedures to be followed for shipping environmental samples to the analytical laboratory are outlined below.

Environmental samples will be transported to the laboratory by a laboratory-provided courier or an express delivery company (e.g., FedEx) under the chain-of-custody protocols described in Section 5.10.

Prior notice should be provided to the laboratory regarding when to expect shipped samples. If the number, type or date of shipment changes due to site constraints or program changes, the laboratory should be informed.

5.8 Decontamination Procedures

Special considerations apply for decontamination procedures to prevent cross-contamination when sampling for PFAS, which are detailed in the applicable SOPs that are attached to the *PFAS Site Investigation Workplan*.

5.9 Residuals Management

Debris (e.g., paper, plastic and disposable personal protective equipment [PPE]) should be collected in plastic garbage bags and disposed of as non-hazardous industrial waste using appropriate receptacles at the Facility. Debris is expected to be transported to a local municipal landfill for disposal.

Investigation derived wastes should be properly managed as indicated in the applicable SOPs that are attached to the *PFAS Site Investigation Workplan*.

5.10 Chain of Custody Procedures

A chain-of-custody protocol has been established for collected samples that will be followed during sample handling activities in both field and laboratory operations. The primary purpose of the chain-of-custody procedures is to document the possession of the samples from collection through shipping, storage and analysis to data reporting and disposal. Chain-of-custody refers to actual possession of the samples. Samples are considered to be in custody if they are within sight of the individual responsible for their security or locked in a secure location. Each person who takes possession of the samples, except the shipping courier, is responsible for sample integrity and safe keeping. Chain-of-custody procedures are provided below:

Chain-of-custody will be initiated by the laboratory supplying the pre-cleaned and prepared sample containers. Chain-of-custody forms will accompany the sample containers.

Following sample collection, the chain-of-custody form will be completed for the sample collected. The sample identification number, date and time of sample collection, analysis requested and other pertinent information (e.g., preservatives) will be recorded on the form. Entries will be made in blue or black ink.

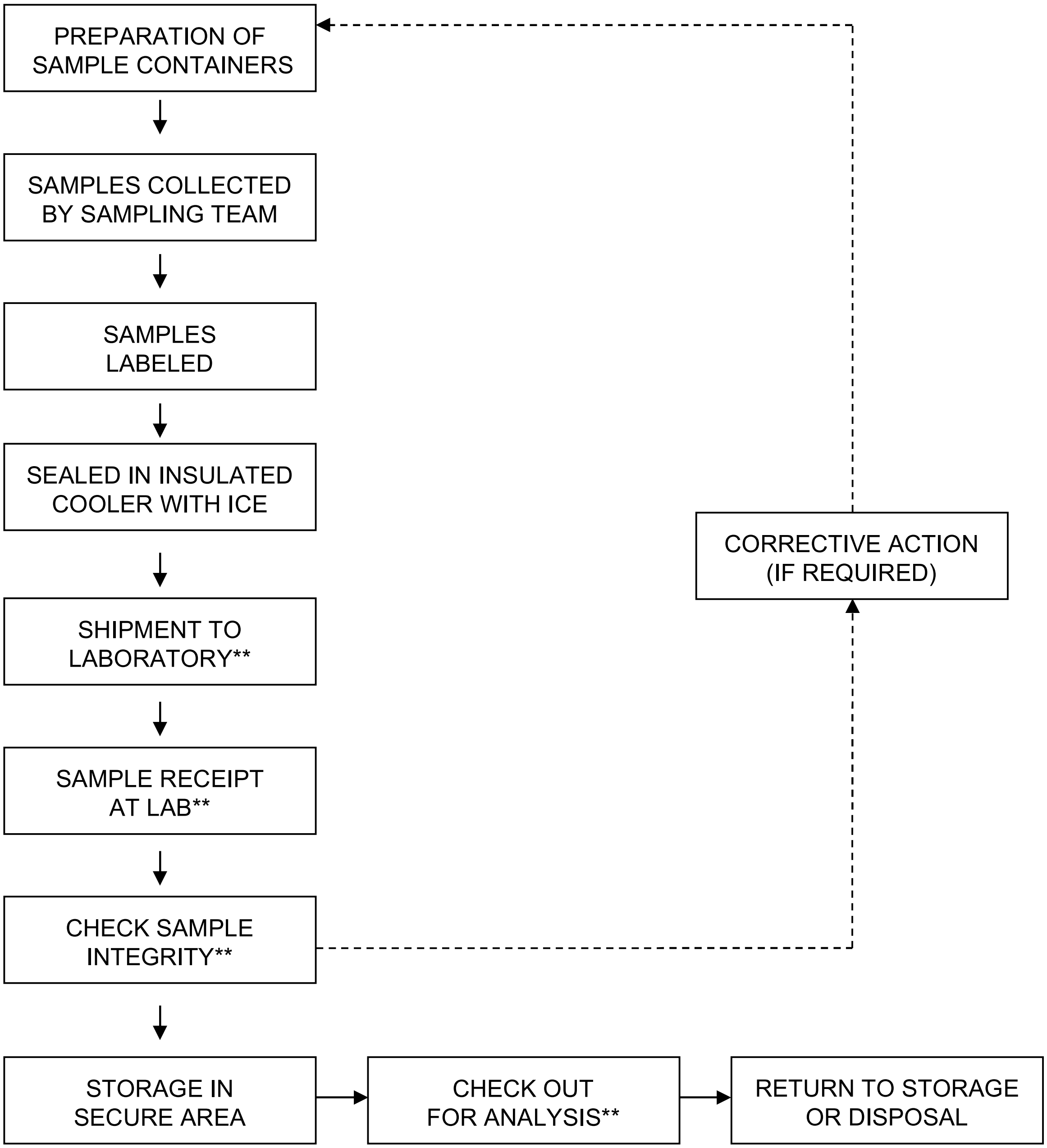
Langan field personnel will be responsible for the care and custody of the samples collected until the samples are transferred to another party, dispatched to the laboratory, or disposed. The sampling team leader will be responsible for enforcing chain-of-custody procedures during field work.

When the form is full or when samples have been collected that will fit in a single cooler, the sampling team leader will check the form for possible errors and sign the chain-of-custody form. Necessary corrections will be made to the record with a single strike mark, dated, and initialed.

Sample coolers will be accompanied by the chain-of-custody form, sealed in a Ziploc®® bag (or similar) and placed on top of the samples or taped to the inside of the cooler lid. If applicable, a shipping bill will be completed for each cooler and the shipping bill number recorded on the chain-of-custody form.

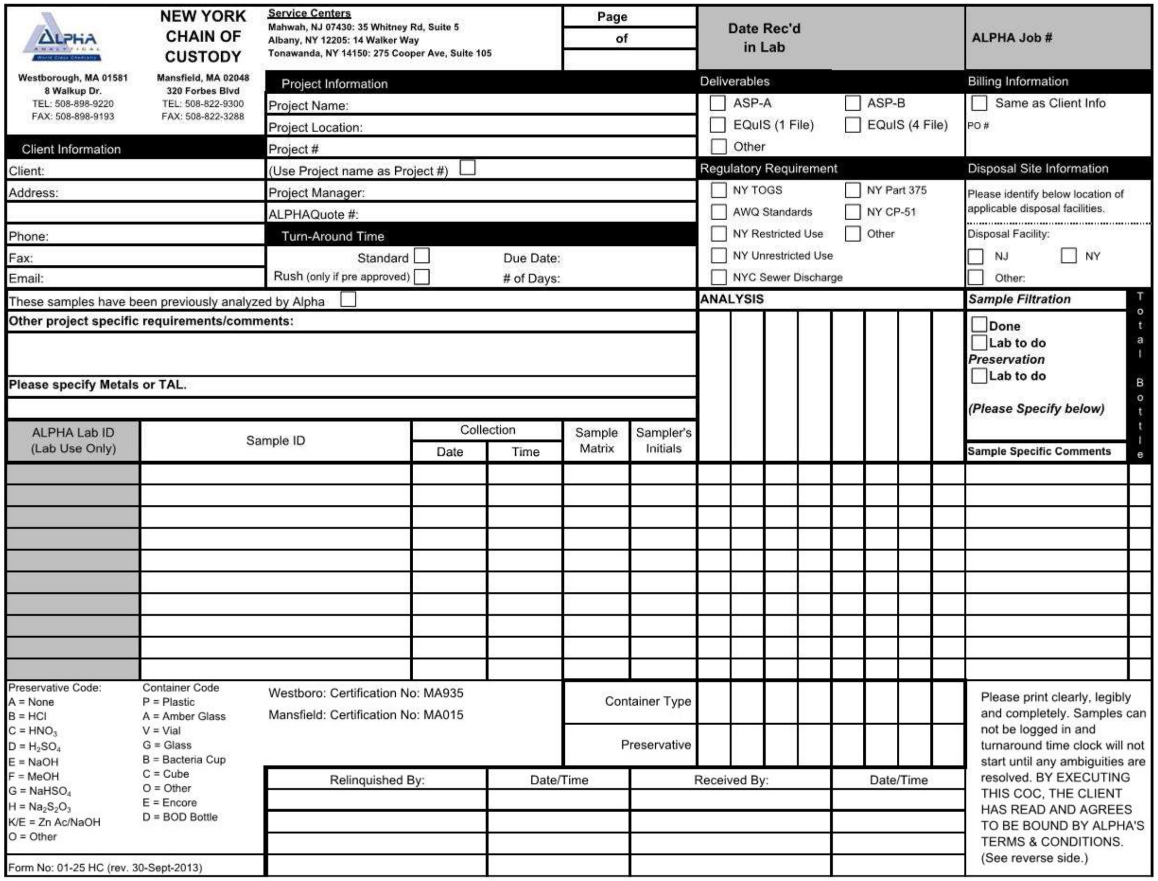
Samples will be packaged for shipment to the laboratory with the appropriate chain-of-custody form. A copy of the form will be retained by the sampling team for the project file and the original will be sent to the laboratory with the samples. Bills of lading will also be retained as part of the documentation for the chain-of-custody records, if applicable. When transferring custody of the samples, the individuals relinquishing and receiving custody of the samples will verify sample numbers and condition and will document the sample acquisition and transfer by signing and dating the chain-of-custody form. This process documents sample custody transfer from the sampler to the analytical laboratory. A flow chart showing a sample custody process is included as Figure 5.1. Blank chain-of-custody forms from Pace are included as Figure 5.2.

Figure 5.1 Sample Custody Process



**REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM

Figure 5.2 Sample Chain-of-Custody Form – Water and Soil



NEW YORK CHAIN OF CUSTODY

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page
of

Date Rec'd in Lab

ALPHA Job #

Westborough, MA 01581
8 Walkup Dr.
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL: 508-822-9300
FAX: 508-822-3288

Project Information
Project Name:
Project Location:
Project #
(Use Project name as Project #) ☐
Project Manager:
ALPHAQuote #:

Client Information
Client:
Address:
Phone:
Fax:
Email:

Turn-Around Time
Standard ☐ Due Date:
Rush (only if pre approved) ☐ # of Days:

Deliverables
☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Billing Information
☐ Same as Client Info
PO #

Regulatory Requirement
☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Disposal Site Information
Please identify below location of applicable disposal facilities.
Disposal Facility:
☐ NJ ☐ NY
☐ Other:

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

ANALYSIS

Sample Filtration
☐ **Done**
☐ **Lab to do**
Preservation
☐ **Lab to do**

(Please Specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection		Sample Matrix	Sampler's Initials									**Sample Specific Comments**	Total Bottle
		Date	Time												

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Container Type								
Preservative								

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

Laboratory chain-of-custody will be maintained throughout the analytical processes as described in the laboratory's QA Manual. The analytical laboratory will provide a copy of the chain-of-custody in the analytical data deliverable package. The chain-of-custody becomes the permanent record of sample handling and shipment.

5.11 Laboratory Sample Storage Procedures

The subcontracted laboratory will use a laboratory information management system (LIMS) to track and schedule samples upon receipt. Sample anomalies identified during sample log-in should be evaluated on individual merit for the impact on the results and the data quality objectives of the project. When irregularities do exist, the environmental consultant must be notified to discuss recommended courses of action and documentation of the issue must be included in the project file.

For samples requiring thermal preservation, the temperature of each cooler will be recorded immediately upon receipt by the laboratory. Each sample and container will be assigned a unique laboratory identification number and secured within the custody room walk-in coolers designated for new samples. Samples will be, as soon as practical, disbursed in a manner that is functional for the operational team. The temperature of coolers and freezers will be monitored and recorded using a certified temperature sensor. Temperature excursions outside of acceptance criteria (i.e., samples must be below 6°C before samples are received by the laboratory; once received by the lab, samples must be held at or below 6°C until extraction or as otherwise specified by the analytical method) will initiate an investigation to determine whether samples may have been affected. Following analysis, the laboratory's specific procedures for retention and disposal will be followed as specified in the laboratory's SOPs and/or QA manual.

6.0 DATA REDUCTION, VALIDATION, AND REPORTING

6.1 Introduction

Data collected during the field investigation will be reduced and reviewed by the laboratory QA personnel, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified as per USEPA 1633. The data package provided by the laboratory will contain items appropriate for the analyses to be performed, and be reported in standard format.

The completed copies of the chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis will be attached to the analytical reports.

6.2 Data Reduction

A CLP-Like Level IV lab report and an electronic data deliverable (EDD) will be provided by the laboratory after receipt of a complete sample delivery group. The Project Manager should arrange for archiving the results and preparation of result tables. These tables will be part of the database for assessment of the site contamination condition.

Each EDD deliverable must be formatted using a Microsoft Windows operating system and the Langan specific EQEDD data deliverable format for EQuIS. To avoid transcription errors, data will be loaded directly into the American Standard Code for Information Interchange (ASCII) format from the LIMS. EDDs must also undergo a QC check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

Data will be compared to appropriate screening levels as indicated in the PFAS Site Investigation Workplan.

The Project Manager or Task Manager should maintain close contact with the QA reviewer to communicate non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA review has been completed, the Project Manager may direct the Team Leaders or others to initiate and finalize the analytical data assessment.

6.3 Data Validation

Data validation will be performed in a manner generally consistent with the USEPA Region 2 SOPs for data validation and USEPA's National Functional Guidelines for Organic. Tier 1 data validation (the equivalent of MDE's Tier III validation and USEPA's Stage 2A validation) will be performed to evaluate data quality. Langan Tier 2 data validation (the equivalent of USEPA's Stage 3 validation) will be performed as needed on select sample analyses based on laboratory case narrative notes and professional judgment.

Langan Tier 1 data validation is based on completeness and compliance checks of sample-related QC results including:

- Holding times;
- Sample preservation;
- Blank results (method, trip, and field blanks);
- Surrogate recovery compounds and extracted internal standards (as applicable);
- PFAS Isotope Dilution Standards;
- LCS and LCSD recoveries and RPDs;
- MS and MSD recoveries and RPDs;
- Laboratory duplicate RPDs; and
- Field duplicate RPDs

In addition to the items outlined in Langan Tier 1 data validation, Langan Tier 2 data validation additionally includes:

- Lab QC samples (serial dilution and post-digestion spikes, as applicable)
- Instrument calibration
- Interference check standards

A Data Usability Assessment (DUA) will be prepared by the data validator and reviewed by the QAM before issuance. The DUA will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain-of-custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.

Based on the results of data validation, the validated analytical results reported by the laboratory will be assigned one of the following usability flags:

- "U" - Not detected. The associated number indicates the approximate sample concentration necessary to be detected significantly greater than the level of the highest associated blank;
- "UJ" - Not detected. Quantitation limit may be inaccurate or imprecise;
- "J" - Analyte is present. Reported value may be associated with a higher level of uncertainty than is normally expected with the analytical method;
- "R" – Unreliable result; data is rejected or unusable. Analyte may or may not be present in the sample; and

- No Flag - Result accepted without qualification.

6.4 Reporting

Upon receipt of validated analytical results, sampling results will be prepared and submitted to MDE.

7.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

7.1 Introduction

Quality assurance audits may be performed by the project quality assurance group under the direction and approval of the QAO. These audits may be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate quality assurance management, the QAO may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

7.2 System Audits

System audits may be performed by the QAO or designated auditors and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Project Manager requests, additional audits may be performed.

7.3 Performance Audits

The laboratory may be required to conduct an analysis of Performance Evaluation samples or provide proof that Performance Evaluation samples submitted by USEPA or a state agency have been analyzed within the past twelve months.

7.4 Formal Audits

Formal audits refer to system or performance audits that are documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating data. Items, activities, and documents determined by lead auditors to be in non-compliance shall be identified at exit interviews conducted with the involved management. Non-compliances will be logged, and documented through audit findings, which are attached to and are a part of the integral audit report. These audit-finding forms are directed to management to satisfactorily resolve the non-compliance in a specified and timely manner.

The Project Manager has overall responsibility to promptly and satisfactorily address corrective actions necessary to resolve audit findings. Audit reports must be submitted to the Project Manager within fifteen days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. Audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAO prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

8.0 CORRECTIVE ACTION

8.1 Introduction

The following procedures have been established so that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

8.2 Procedure Description

When a significant condition adverse to quality is noted at site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, Project Manager, Field Team Leader and involved contractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

Project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;
- As a result of laboratory/field comparison studies; and
- As required by USEPA Method 1633 and USEPA Method 1312.

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the sites, laboratories, or contractor locations. Activities, or documents ascertained to be noncompliant with quality assurance requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.

Personnel assigned to quality assurance functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 8.1 or similar). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify non-compliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that recommended corrective actions are implemented, documented, and approved.

FIGURE 8.1

CORRECTIVE ACTION REQUEST

Number: ___________________________ Date: ____________

TO: ____

You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by _______________

CONDITION:

REFERENCE DOCUMENTS:

RECOMMENDED CORRECTIVE ACTIONS:

__________	______	__________	________	___________	________
Originator	Date	Approval	Date	Approval	Date

RESPONSE

CAUSE OF CONDITION

CORRECTIVE ACTION

(A) RESOLUTION

(B) PREVENTION

(C) AFFECTED DOCUMENTS

C.A. FOLLOW UP:

CORRECTIVE ACTION VERIFIED BY: _____________________________ DATE:_____________

9.0 REFERENCES

1. MDE. Department of the Environment Cleanup Standards for Soil and Groundwater, October 2018.
2. MDE. Information about Submitting Water Quality Data for Maryland's Integrated Report. https://mde.maryland.gov/programs/water/TMDL/Integrated303dReports/Pages/Data-Solicitation.aspx. Accessed October 9, 2024.
3. Taylor, J. K., 1987. Quality Assurance of Chemical Measurements. Lewis Publishers, Inc., Chelsea, Michigan
4. USEPA, 1994. Method 1312 Synthetic Precipitation Leaching Procedure. September 1994.
5. USEPA, 2002. Guidance for Quality Assurance Project Plans. December 2002.
6. USEPA 2017. National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, EPA-540-R-2017-002, January 2017.USEPA 2024. Method 1633, Revision A. Analysis of Per- and Polyfluoroalkyl (PFAS) in Aquesous, Soil, Biosolids, and Tissue Samples by LC-MS/MS, December 2024.

Attachment A
Laboratory Reporting Limits and Method Detection Limits

Date Created: 01/02/25
Created By: Alycia Mogayzel
File: PM18253-1
Page: 1

PFAAs via EPA 1633 (SOIL)

Holding Time: 90 days
Container/Sample Preservation: 1 - Plastic 8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluorobutanoic Acid (PFBA)	375-22-4	0.8	0.2664	ng/g	70-140	30	70-140	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	0.4	0.1336	ng/g	60-150	30	60-150	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	0.2	0.06664	ng/g	65-145	30	65-145	30	30			
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	757124-72-4	0.8	0.2664	ng/g	60-150	30	60-150	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	0.2	0.06664	ng/g	65-140	30	65-140	30	30			
Perfluoropentanesulfonic Acid (PFPeS)	2706-91-4	0.2	0.06664	ng/g	55-160	30	55-160	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	0.2	0.06664	ng/g	65-145	30	65-145	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	0.2	0.06664	ng/g	60-150	30	60-150	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	0.2	0.06664	ng/g	70-150	30	70-150	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	0.8	0.2664	ng/g	55-200	30	55-200	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	0.2	0.06664	ng/g	65-155	30	65-155	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	0.2	0.06664	ng/g	70-155	30	70-155	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	0.2	0.06664	ng/g	65-160	30	65-160	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	0.2	0.06664	ng/g	70-155	30	70-155	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	0.8	0.2664	ng/g	70-150	30	70-150	30	30			
Perfluorononanesulfonic Acid (PFNS)	68259-12-1	0.2	0.06664	ng/g	55-140	30	55-140	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSA	2355-31-9	0.2	0.0856	ng/g	65-155	30	65-155	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	0.2	0.06664	ng/g	70-155	30	70-155	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	0.2	0.06664	ng/g	40-155	30	40-155	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	0.2	0.06664	ng/g	70-140	30	70-140	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	0.2	0.06664	ng/g	65-165	30	65-165	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	0.2	0.06664	ng/g	70-150	30	70-150	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	0.2	0.06664	ng/g	65-150	30	65-150	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	0.2	0.06664	ng/g	65-150	30	65-150	30	30			
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Pr	13252-13-6	0.8	0.2664	ng/g	70-145	30	70-145	30	30			
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	919005-14-4	0.8	0.2664	ng/g	70-160	30	70-160	30	30			
Perfluorododecane Sulfonic Acid (PFDoDS)	79780-39-5	0.2	0.06664	ng/g	25-160	30	25-160	30	30			
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF	756426-58-1	0.8	0.2664	ng/g	70-150	30	70-150	30	30			
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11C	763051-92-9	0.8	0.2664	ng/g	45-160	30	45-160	30	30			
N-Methyl Perfluorooctane Sulfonamide (NMeFOSA)	31506-32-8	0.2	0.06664	ng/g	70-155	30	70-155	30	30			
N-Ethyl Perfluorooctane Sulfonamide (NEtFOSA)	4151-50-2	0.2	0.06664	ng/g	70-140	30	70-140	30	30			
N-Methyl Perfluorooctanesulfonamido Ethanol (NMeFOSE)	24448-09-7	2	0.6664	ng/g	70-140	30	70-140	30	30			
N-Ethyl Perfluorooctanesulfonamido Ethanol (NEtFOSE)	1691-99-2	2	0.6664	ng/g	70-135	30	70-135	30	30			
Perfluoro-3-Methoxypropanoic Acid (PFMPA)	377-73-1	0.4	0.1336	ng/g	30-140	30	30-140	30	30			
Perfluoro-4-Methoxybutanoic Acid (PFMBA)	863090-89-5	0.4	0.1336	ng/g	60-150	30	60-150	30	30			
Perfluoro(2-Ethoxyethane)Sulfonic Acid (PFEESA)	113507-82-7	0.4	0.1336	ng/g	70-140	30	70-140	30	30			
Nonafluoro-3,6-Dioxaheptanoic Acid (NFDHA)	151772-58-6	0.4	0.1336	ng/g	60-155	30	60-155	30	30			
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	356-02-5	1	0.3336	ng/g	45-130	30	45-130	30	30			
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	914637-49-3	5	1.664	ng/g	60-130	30	60-130	30	30			
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	812-70-4	5	1.664	ng/g	60-150	30	60-150	30	30			
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*8-130*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*35-130*		

Please Note that the RL information provided in this table is calculated using a 100% Solids factor. (Soil/Solids only)

Please Note that the information provided in this table is subject to change at anytime at the discretion of Pace Analytical Services.

Date Created: 01/02/25
Created By: Alycia Mogayzel
File: PM18253-1
Page: 2

PFAAs via EPA 1633 (SOIL)

Holding Time: 90 days
Container/Sample Preservation: 1 - Plastic 8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*40-135*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Hexanesulfonic Acid (M2-	*NONE*									*40-165*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*40-130*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*40-130*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*40-130*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*40-130*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*40-215*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*40-130*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*40-130*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*40-130*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*40-275*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*40-135*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*40-130*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*40-130*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*40-150*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*40-130*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*20-130*		
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-1	*NONE*									*40-130*		
N-Methyl-d3-Perfluoro-1-Octanesulfonamide (d3-NMeFOSA	*NONE*									*10-130*		
N-Ethyl-d5-Perfluoro-1-Octanesulfonamide (d5-NEtFOSA)	*NONE*									*10-130*		
2-(N-Methyl-d3-Perfluoro-1-Octanesulfonamido)ethan-d4-o	*1265205-95-5*									*20-130*		
2-(N-Ethyl-d5-Perfluoro-1-Octanesulfonamido)ethan-d4-ol (	*NONE*									*15-130*		

Please Note that the RL information provided in this table is calculated using a 100% Solids factor. (Soil/Solids only)
Please Note that the information provided in this table is subject to change at anytime at the discretion of Pace Analytical Services.

Date Created: 01/02/25
Created By: Alycia Mogayzel
File: PM18252-1
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PFAAs via EPA 1633 (WATER)

Holding Time: 28 days
Container/Sample Preservation: 2 - Plastic 500ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluorobutanoic Acid (PFBA)	375-22-4	6.4	2.136	ng/l	70-140	30	70-140	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	3.2	1.064	ng/l	65-135	30	65-135	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	1.6	0.536	ng/l	60-145	30	60-145	30	30			
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	757124-72-4	6.4	2.136	ng/l	70-145	30	70-145	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	1.6	0.536	ng/l	70-145	30	70-145	30	30			
Perfluoropentanesulfonic Acid (PFPeS)	2706-91-4	1.6	0.536	ng/l	65-140	30	65-140	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	1.6	0.536	ng/l	70-150	30	70-150	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	1.6	0.536	ng/l	65-145	30	65-145	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	1.6	0.536	ng/l	70-150	30	70-150	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	6.4	4.816	ng/l	65-155	30	65-155	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	1.6	0.536	ng/l	70-150	30	70-150	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	1.6	0.536	ng/l	70-150	30	70-150	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	1.6	0.536	ng/l	55-150	30	55-150	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	1.6	0.536	ng/l	70-140	30	70-140	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	6.4	2.136	ng/l	60-150	30	60-150	30	30			
Perfluorononanesulfonic Acid (PFNS)	68259-12-1	1.6	0.536	ng/l	65-145	30	65-145	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSA	2355-31-9	1.6	0.536	ng/l	50-140	30	50-140	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	1.6	0.536	ng/l	70-145	30	70-145	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	1.6	0.536	ng/l	60-145	30	60-145	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	1.6	0.536	ng/l	70-145	30	70-145	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	1.6	0.536	ng/l	70-145	30	70-145	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	1.6	0.536	ng/l	70-140	30	70-140	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	1.6	0.536	ng/l	65-140	30	65-140	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	1.6	0.536	ng/l	60-140	30	60-140	30	30			
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Pr	13252-13-6	6.4	2.136	ng/l	70-140	30	70-140	30	30			
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	919005-14-4	6.4	2.136	ng/l	65-145	30	65-145	30	30			
Perfluorododecane Sulfonic Acid (PFDoDS)	79780-39-5	1.6	0.536	ng/l	50-145	30	50-145	30	30			
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF	756426-58-1	6.4	2.136	ng/l	70-155	30	70-155	30	30			
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11C	763051-92-9	6.4	2.136	ng/l	55-160	30	55-160	30	30			
N-Methyl Perfluorooctane Sulfonamide (NMeFOSA)	31506-32-8	1.6	0.536	ng/l	60-150	30	60-150	30	30			
N-Ethyl Perfluorooctane Sulfonamide (NEtFOSA)	4151-50-2	1.6	0.536	ng/l	65-145	30	65-145	30	30			
N-Methyl Perfluorooctanesulfonamido Ethanol (NMeFOSE)	24448-09-7	16	5.36	ng/l	70-145	30	70-145	30	30			
N-Ethyl Perfluorooctanesulfonamido Ethanol (NEtFOSE)	1691-99-2	16	5.36	ng/l	70-135	30	70-135	30	30			
Perfluoro-3-Methoxypropanoic Acid (PFMPA)	377-73-1	3.2	1.064	ng/l	55-140	30	55-140	30	30			
Perfluoro-4-Methoxybutanoic Acid (PFMBA)	863090-89-5	3.2	1.064	ng/l	60-150	30	60-150	30	30			
Perfluoro(2-Ethoxyethane)Sulfonic Acid (PFEESA)	113507-82-7	3.2	1.064	ng/l	70-140	30	70-140	30	30			
Nonafluoro-3,6-Dioxaheptanoic Acid (NFDHA)	151772-58-6	3.2	1.064	ng/l	50-150	30	50-150	30	30			
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	356-02-5	8	2.664	ng/l	65-130	30	65-130	30	30			
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	914637-49-3	40	13.36	ng/l	70-135	30	70-135	30	30			
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	812-70-4	40	13.36	ng/l	50-145	30	50-145	30	30			
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*5-130*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*40-130*		

Please Note that the RL information provided in this table is calculated using a 100% Solids factor. (Soil/Solids only)

Please Note that the information provided in this table is subject to change at anytime at the discretion of Pace Analytical Services.

Date Created: 01/02/25
Created By: Alycia Mogayzel
File: PM18252-1
Page: 2

PFAAs via EPA 1633 (WATER)

Holding Time: 28 days
Container/Sample Preservation: 2 - Plastic 500ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*40-135*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Hexanesulfonic Acid (M2-	*NONE*									*40-200*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*40-130*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*40-130*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*40-130*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*40-130*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*40-200*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*40-130*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*40-130*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*40-130*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*40-300*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*40-170*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*30-130*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*40-130*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*25-135*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*10-130*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*10-130*		
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-	*NONE*									*40-130*		
N-Methyl-d3-Perfluoro-1-Octanesulfonamide (d3-NMeFOSA	*NONE*									*10-130*		
N-Ethyl-d5-Perfluoro-1-Octanesulfonamide (d5-NEtFOSA)	*NONE*									*10-130*		
2-(N-Methyl-d3-Perfluoro-1-Octanesulfonamido)ethan-d4-o	*1265205-95-5*									*10-130*		
2-(N-Ethyl-d5-Perfluoro-1-Octanesulfonamido)ethan-d4-ol (	*NONE*									*10-130*		

Please Note that the RL information provided in this table is calculated using a 100% Solids factor. (Soil/Solids only)

Please Note that the information provided in this table is subject to change at anytime at the discretion of Pace Analytical Services.

Date Created: 02/10/25
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SPLP PFAAs via EPA 1312/EPA 1633 (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Plastic 8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluorobutanoic Acid (PFBA)	375-22-4	6.4	2.136	ng/l	70-140	30	70-140	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	3.2	1.064	ng/l	65-135	30	65-135	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	1.6	0.536	ng/l	60-145	30	60-145	30	30			
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	757124-72-4	6.4	2.136	ng/l	70-145	30	70-145	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	1.6	0.536	ng/l	70-145	30	70-145	30	30			
Perfluoropentanesulfonic Acid (PFPeS)	2706-91-4	1.6	0.536	ng/l	65-140	30	65-140	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	1.6	0.536	ng/l	70-150	30	70-150	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	1.6	0.536	ng/l	65-145	30	65-145	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	1.6	0.536	ng/l	70-150	30	70-150	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	6.4	4.816	ng/l	65-155	30	65-155	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	1.6	0.536	ng/l	70-150	30	70-150	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	1.6	0.536	ng/l	70-150	30	70-150	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	1.6	0.536	ng/l	55-150	30	55-150	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	1.6	0.536	ng/l	70-140	30	70-140	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	6.4	2.136	ng/l	60-150	30	60-150	30	30			
Perfluorononanesulfonic Acid (PFNS)	68259-12-1	1.6	0.536	ng/l	65-145	30	65-145	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSA	2355-31-9	1.6	0.536	ng/l	50-140	30	50-140	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	1.6	0.536	ng/l	70-145	30	70-145	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	1.6	0.536	ng/l	60-145	30	60-145	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	1.6	0.536	ng/l	70-145	30	70-145	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	1.6	0.536	ng/l	70-145	30	70-145	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	1.6	0.536	ng/l	70-140	30	70-140	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	1.6	0.536	ng/l	65-140	30	65-140	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	1.6	0.536	ng/l	60-140	30	60-140	30	30			
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Pr	13252-13-6	6.4	2.136	ng/l	70-140	30	70-140	30	30			
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	919005-14-4	6.4	2.136	ng/l	65-145	30	65-145	30	30			
Perfluorododecane Sulfonic Acid (PFDoDS)	79780-39-5	1.6	0.536	ng/l	50-145	30	50-145	30	30			
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF	756426-58-1	6.4	2.136	ng/l	70-155	30	70-155	30	30			
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11C	763051-92-9	6.4	2.136	ng/l	55-160	30	55-160	30	30			
N-Methyl Perfluorooctane Sulfonamide (NMeFOSA)	31506-32-8	1.6	0.536	ng/l	60-150	30	60-150	30	30			
N-Ethyl Perfluorooctane Sulfonamide (NEtFOSA)	4151-50-2	1.6	0.536	ng/l	65-145	30	65-145	30	30			
N-Methyl Perfluorooctanesulfonamido Ethanol (NMeFOSE)	24448-09-7	16	5.36	ng/l	70-145	30	70-145	30	30			
N-Ethyl Perfluorooctanesulfonamido Ethanol (NEtFOSE)	1691-99-2	16	5.36	ng/l	70-135	30	70-135	30	30			
Perfluoro-3-Methoxypropanoic Acid (PFMPA)	377-73-1	3.2	1.064	ng/l	55-140	30	55-140	30	30			
Perfluoro-4-Methoxybutanoic Acid (PFMBA)	863090-89-5	3.2	1.064	ng/l	60-150	30	60-150	30	30			
Perfluoro(2-Ethoxyethane)Sulfonic Acid (PFEESA)	113507-82-7	3.2	1.064	ng/l	70-140	30	70-140	30	30			
Nonafluoro-3,6-Dioxaheptanoic Acid (NFDHA)	151772-58-6	3.2	1.064	ng/l	50-150	30	50-150	30	30			
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	356-02-5	8	2.664	ng/l	65-130	30	65-130	30	30			
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	914637-49-3	40	13.36	ng/l	70-135	30	70-135	30	30			
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	812-70-4	40	13.36	ng/l	50-145	30	50-145	30	30			
PFOA/PFOS, Total		1.6	0.536	ng/l				30	30			
PFAS, Total (6)		1.6	0.536	ng/l				30	30			

Please Note that the RL information provided in this table is calculated using a 100% Solids factor. (Soil/Solids only)

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SPLP PFAAs via EPA 1312/EPA 1633 (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Plastic 8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*5-130*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*40-130*		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*40-135*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Hexanesulfonic Acid (M2-	*NONE*									*40-200*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*40-130*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*40-130*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*40-130*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*40-130*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*40-200*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*40-130*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*40-130*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*40-130*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*40-300*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*40-170*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*30-130*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*40-130*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*25-135*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*10-130*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*10-130*		
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-1	*NONE*									*40-130*		
N-Methyl-d3-Perfluoro-1-Octanesulfonamide (d3-NMeFOSA	*NONE*									*10-130*		
N-Ethyl-d5-Perfluoro-1-Octanesulfonamide (d5-NEtFOSA)	*NONE*									*10-130*		
2-(N-Methyl-d3-Perfluoro-1-Octanesulfonamido)ethan-d4-o	*1265205-95-5*									*10-130*		
2-(N-Ethyl-d5-Perfluoro-1-Octanesulfonamido)ethan-d4-ol (	*NONE*									*10-130*		

Please Note that the RL information provided in this table is calculated using a 100% Solids factor. (Soil/Solids only)

Please Note that the information provided in this table is subject to change at anytime at the discretion of Pace Analytical Services.

Attachment B
Analytical Methods and Quality Assurance Summary Table

ATTACHMENT B

ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE

Matrix Type	Field Parameters	Laboratory Parameters	Analytical Methods	Sample Preservation	Sample Container Volume and Type	Sample Hold Time	Field Duplicate Sample Frequency	Equipment Rinsate Blank Samples	MS/MSD Samples
Soil	NA	Listed in Attachment A	USEPA 1633 and/or EPA 1312**	Cool below 6°C No Preservative	Two 8 oz HDPE; no perservative	90 days	1 per 20 samples	As specified in the *PFAS Investigation Workplan*	Conducted by the laboratory 1 per batch (20 samples)
Sediment	NA	Listed in Attachment A	USEPA 1633 and/or EPA 1312**	Cool below 6°C No Preservative	Two 8 oz HDPE; no perservative	90 days	1 per 20 samples	As specified in the *PFAS Investigation Workplan*	Conducted by the laboratory 1 per batch (20 samples)
Groundwater	Temperature, pH, turbidity, conductivity, dissolved oxygen, and oxidation/reduction potential	Listed in Attachment A	USEPA 1633 and Total Oxidizable Precursor (TOP)*	Cool below 6°C No Preservative	Two 500 mL HDPE; no perservative	28 days	1 per 20 samples	As specified in the *PFAS Investigation Workplan*	Conducted by the laboratory 1 per batch (20 samples)
Process Water	Temperature, pH, turbidity, conductivity, dissolved oxygen, and oxidation/reduction potential	Listed in Attachment A	USEPA 1633	Cool below 6°C No Preservative	Two 500 mL HDPE; no perservative	28 days	1 per 20 samples	As specified in the *PFAS Investigation Workplan*	Conducted by the laboratory 1 per batch (20 samples)
Surface Water	Temperature, pH, turbidity, conductivity, dissolved oxygen, and oxidation/reduction potential	Listed in Attachment A	USEPA 1633	Cool below 6°C No Preservative	Two 500 mL HDPE; no perservative	28 days	1 per 20 samples	As specified in the *PFAS Investigation Workplan*	Conducted by the laboratory 1 per batch (20 samples)

Notes:
USEPA - United States Environmental Protection Agency
PFAS - Per-fluoroalkyl substances
HDPE - High-Density Polyethylene
**- SPLP analysis will be dependent on initial soil sample results run under Method 1633
* - A subset of aqueous samples will be additionally analyzed using TOP

Attachment C
Laboratory Quality Manual, Analytical Methods, and Certifications

MARYLAND

FOUNDED 1634

DEPARTMENT OF THE ENVIRONMENT
WATER SUPPLY PROGRAM

Certifies That

Alpha Analytical-Mansfield

320 Forbes Boulevard, Mansfield, MA 02048

Having duly met the requirements of the regulations governing Laboratory Certification and Standards of Performance in accordance with The Annotated Code of Maryland, is hereby approved as a

State Certified Water Quality Laboratory

to perform the analyses indicated on the Annual Certified Parameter List, which must accompany this certificate.

MD Lab ID # 350

Date Issued August 29, 2024

Expiration Date September 30, 2025
(Not Transferable)

Administrator, Water Supply Program

This certification is subject to unannounced laboratory inspections

CONSPICUOUSLY DISPLAY IN THE LABORATORY WITH THE ANNUAL CERTIFIED PARAMETER LIST.

Maryland
Department of the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary

SDWA ANNUAL CERTIFIED PARAMETER LIST - REVISED

Effective Date: October 30, 2024 (*Revision #1*)
Expiration Date: September 30, 2025

Alpha Analytical - Mansfield
320 Forbes Boulevard
Mansfield, MA 02048

John Trimble
MD Lab ID: 350
EPA Lab ID: MA00030

ANALYTE	METHOD	STATUS
Antimony	EPA 200.8, Rev. 5.4	Certified
Arsenic	EPA 200.8, Rev. 5.4	Certified
Barium	EPA 200.7, Rev. 4.4	Certified
Barium	EPA 200.8, Rev. 5.4	Certified
Beryllium	EPA 200.8, Rev. 5.4	Certified
Cadmium	EPA 200.7, Rev. 4.4	Certified
Cadmium	EPA 200.8, Rev. 5.4	Certified
Chromium	EPA 200.7, Rev. 4.4	Certified
Chromium	EPA 200.8, Rev. 5.4	Certified
Copper	EPA 200.7, Rev. 4.4	Certified
Copper	EPA 200.8, Rev. 5.4	Certified
HFPO-DA (GenX)	***EPA 533, December 2019***	***Certified***
HFPO-DA (GenX)	***EPA 537.1, Version 2.0***	***Certified***
Lead	EPA 200.8, Rev. 5.4	Certified
Mercury	EPA 245.1, Rev. 3	Certified
PFBS	***EPA 533, December 2019***	***Certified***
PFBS	***EPA 537.1, Version 2.0***	***Certified***
PFHxS	***EPA 533, December 2019***	***Certified***
PFHxS	***EPA 537.1, Version 2.0***	***Certified***
PFNA	***EPA 533, December 2019***	***Certified***
PFNA	***EPA 537.1, Version 2.0***	***Certified***
PFOA	***EPA 533, December 2019***	***Certified***

SDWA ANNUAL CERTIFIED PARAMETER LIST - REVISED

Effective Date: October 30, 2024 (*Revision #1*)

Expiration Date: September 30, 2025

Alpha Analytical - Mansfield
320 Forbes Boulevard
Mansfield, MA 02048

John Trimble
MD Lab ID: 350
EPA Lab ID: MA00030

ANALYTE	**METHOD**	**STATUS**
PFOA	***EPA 537.1, Version 2.0***	***Certified***
PFOS	***EPA 533, December 2019***	***Certified***
PFOS	***EPA 537.1, Version 2.0***	***Certified***
Selenium	EPA 200.8, Rev. 5.4	Certified
Thallium	EPA 200.8, Rev. 5.4	Certified

State of New Hampshire
Environmental Laboratory Accreditation Program
Awards
PRIMARY NH ELAP ACCREDITATION
to

ALPHA ANALYTICAL (MANSFIELD) [#2062]

of

MANSFIELD, MA

For the matrix, method and analytes listed on the latest Analyte List in accordance with the provisions on the 2016 TNI Standards and Env-C 300.

Certificate Number: 206224
Effective Date: 9/6/2024
Expiration Date: 9/5/2025
Laboratory ID: 2062

Bill Hall
ALPHA AN8/28/2024

Bill Hall
NH ELAP Program Manager

Method accreditation does not imply acceptance for NHDES compliance testing. Laboratory is required to use EPA-approved methods required by regulation. Continuing accreditation status is dependent on successful ongoing participation in the program. Customers may verify the laboratory's current accreditation status by calling (603) 271-2998 or by visiting the NH ELAP website (https://www.des.nh.gov/water/drinking-water/new-hampshire-environmental-laboratory-accreditation-program).

NEW HAMPSHIRE ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

29 Hazen Drive, PO Box 95, Concord, NH 03302 (603) 271-2998

PRIMARY ACCREDITATION ANALYTE LIST

ANALYTE LIST NUMBER: 206224-D

ALPHA ANALYTICAL (MANSFIELD) [#2062]
320 FORBES BLVD

MANSFIELD MA 02048
508-822-9300
Lab ID: 2062

Analyte Code	Analyte Name	Effective Date	Expiration Date	Matrix	Category	Accr. Type
Method Code: 10247708	**Method Ref: EPA METHOD 3C**		**Revision:**		**Date:**	
4926	METHANE	09/10/2020	09/05/2025	AE	VOC	NE
Method Code: 10248405	**Method Ref: EPA TO-13A**		**Revision:**		**Date:**	
5005	NAPHTHALENE	02/21/2017	09/05/2025	AE	VOC	NE
Method Code: 10248449	**Method Ref: EPA TO-13A SIM**		**Revision:**		**Date:**	
5005	NAPHTHALENE	02/21/2017	09/05/2025	AE	VOC	NE
Method Code: 10248803	**Method Ref: EPA TO-15**		**Revision: 2**		**Date: 1999**	
5160	1,1,1-TRICHLOROETHANE	02/21/2017	09/05/2025	AE	VOC	NE
5110	1,1,2,2-TETRACHLOROETHANE	02/21/2017	09/05/2025	AE	VOC	NE
5185	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	02/21/2017	09/05/2025	AE	VOC	NE
5165	1,1,2-TRICHLOROETHANE	02/21/2017	09/05/2025	AE	VOC	NE
4630	1,1-DICHLOROETHANE	02/21/2017	09/05/2025	AE	VOC	NE
4640	1,1-DICHLOROETHYLENE	02/21/2017	09/05/2025	AE	VOC	NE
5155	1,2,4-TRICHLOROBENZENE	02/21/2017	09/05/2025	AE	VOC	NE
5210	1,2,4-TRIMETHYLBENZENE	02/21/2017	09/05/2025	AE	VOC	NE
4570	1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	02/21/2017	09/05/2025	AE	VOC	NE
4585	1,2-DIBROMOETHANE (EDB, ETHYLENE DIBROMIDE)	02/21/2017	09/05/2025	AE	VOC	NE
4695	1,2-DICHLORO-1,1,2,2-TETRAFLUOROETHANE (FREON 114)	02/05/2020	09/05/2025	AE	VOC	NE
4610	1,2-DICHLOROBENZENE (O-DICHLOROBENZENE)	02/21/2017	09/05/2025	AE	VOC	NE
4635	1,2-DICHLOROETHANE (ETHYLENE DICHLORIDE)	02/21/2017	09/05/2025	AE	VOC	NE
4655	1,2-DICHLOROPROPANE	02/21/2017	09/05/2025	AE	VOC	NE
5215	1,3,5-TRIMETHYLBENZENE	02/21/2017	09/05/2025	AE	VOC	NE
4615	1,3-DICHLOROBENZENE (M-DICHLOROBENZNE)	02/21/2017	09/05/2025	AE	VOC	NE
4620	1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	02/21/2017	09/05/2025	AE	VOC	NE
4735	1,4-DIOXANE (1 4-DIETHYLENEOXIDE)	02/21/2017	09/05/2025	AE	VOC	NE
5220	2,2,4-TRIMETHYLPENTANE	02/21/2017	09/05/2025	AE	VOC	NE
4410	2-BUTANONE (METHYL ETHYL KETONE, MEK)	02/21/2017	09/05/2025	AE	VOC	NE
4535	2-CHLOROTOLUENE	02/21/2017	09/05/2025	AE	VOC	NE
4860	2-HEXANONE	02/21/2017	09/05/2025	AE	VOC	NE
4542	4-ETHYLTOLUENE	02/21/2017	09/05/2025	AE	VOC	NE
4995	4-METHYL-2-PENTANONE (MIBK)	02/21/2017	09/05/2025	AE	VOC	NE
4300	ACETALDEHYDE	02/21/2017	09/05/2025	AE	VOC	NE
4315	ACETONE	02/21/2017	09/05/2025	AE	VOC	NE
4320	ACETONITRILE	02/21/2017	09/05/2025	AE	VOC	NE
4325	ACROLEIN (PROPENAL)	02/21/2017	09/05/2025	AE	VOC	NE

This analyte list supersedes all previously issued analyte lists. Method accreditation does not imply acceptance for NHDES compliance testing. Laboratory is required to use EPA-approved methods required by regulation. Continuing accreditation status is dependent on successful ongoing participation in the program. Customers may verify the laboratory's current accreditation status by calling (603) 271-2998 or by visiting the NH ELAP website (https://www.des.nh.gov/water/drinking-water/new-hampshire-environmental-laboratory-accreditation-program).

4340	ACRYLONITRILE	02/21/2017	09/05/2025	AE	VOC	NE
4355	ALLYL CHLORIDE (3-CHLOROPROPENE)	02/21/2017	09/05/2025	AE	VOC	NE
4375	BENZENE	02/21/2017	09/05/2025	AE	VOC	NE
5635	BENZYL CHLORIDE	04/18/2017	09/05/2025	AE	VOC	NE
4395	BROMODICHLOROMETHANE	02/21/2017	09/05/2025	AE	VOC	NE
4400	BROMOFORM	02/21/2017	09/05/2025	AE	VOC	NE
4450	CARBON DISULFIDE	02/21/2017	09/05/2025	AE	VOC	NE
4455	CARBON TETRACHLORIDE	02/21/2017	09/05/2025	AE	VOC	NE
4475	CHLOROBENZENE	02/21/2017	09/05/2025	AE	VOC	NE
4575	CHLORODIBROMOMETHANE	02/21/2017	09/05/2025	AE	VOC	NE
4485	CHLOROETHANE (ETHYL CHLORIDE)	02/21/2017	09/05/2025	AE	VOC	NE
4505	CHLOROFORM	02/21/2017	09/05/2025	AE	VOC	NE
4645	CIS-1,2-DICHLOROETHYLENE	02/21/2017	09/05/2025	AE	VOC	NE
4680	CIS-1,3-DICHLOROPROPENE	02/21/2017	09/05/2025	AE	VOC	NE
4555	CYCLOHEXANE	02/21/2017	09/05/2025	AE	VOC	NE
4625	DICHLORODIFLUOROMETHANE (FREON-12)	02/21/2017	09/05/2025	AE	VOC	NE
4627	DICHLOROFLUOROMETHANE (FREON 21)	02/21/2017	09/05/2025	AE	VOC	NE
4750	ETHANOL	02/21/2017	09/05/2025	AE	VOC	NE
4755	ETHYL ACETATE	02/21/2017	09/05/2025	AE	VOC	NE
4765	ETHYLBENZENE	02/21/2017	09/05/2025	AE	VOC	NE
4835	HEXACHLOROBUTADIENE	02/21/2017	09/05/2025	AE	VOC	NE
4895	ISOPROPYL ALCOHOL (2-PROPANOL, ISOPROPANOL)	02/21/2017	09/05/2025	AE	VOC	NE
4900	ISOPROPYLBENZENE	02/21/2017	09/05/2025	AE	VOC	NE
5240	M+P-XYLENE	02/05/2020	09/05/2025	AE	VOC	NE
4930	METHANOL	02/21/2017	09/05/2025	AE	VOC	NE
4950	METHYL BROMIDE (BROMOMETHANE)	02/21/2017	09/05/2025	AE	VOC	NE
4960	METHYL CHLORIDE (CHLOROMETHANE)	02/21/2017	09/05/2025	AE	VOC	NE
4990	METHYL METHACRYLATE	02/21/2017	09/05/2025	AE	VOC	NE
5000	METHYL TERT-BUTYL ETHER (MTBE)	02/21/2017	09/05/2025	AE	VOC	NE
4975	METHYLENE CHLORIDE (DICHLOROMETHANE)	02/21/2017	09/05/2025	AE	VOC	NE
4435	N-BUTYLBENZENE	02/21/2017	09/05/2025	AE	VOC	NE
4825	N-HEPTANE	02/21/2017	09/05/2025	AE	VOC	NE
4855	N-HEXANE	02/21/2017	09/05/2025	AE	VOC	NE
5090	N-PROPYLBENZENE	02/21/2017	09/05/2025	AE	VOC	NE
5005	NAPHTHALENE	02/21/2017	09/05/2025	AE	VOC	NE
5250	O-XYLENE	02/21/2017	09/05/2025	AE	VOC	NE

4836	PROPENE	02/21/2017	09/05/2025	AE	VOC	NE
4440	SEC-BUTYLBENZENE	02/21/2017	09/05/2025	AE	VOC	NE
5100	STYRENE	02/21/2017	09/05/2025	AE	VOC	NE
4420	TERT-BUTYL ALCOHOL (2-METHYL-2-PROPANOL)	02/21/2017	09/05/2025	AE	VOC	NE
4445	TERT-BUTYLBENZENE	02/21/2017	09/05/2025	AE	VOC	NE
5115	TETRACHLOROETHYLENE (PERCHLOROETHYLENE)	02/21/2017	09/05/2025	AE	VOC	NE
5120	TETRAHYDROFURAN (THF)	02/21/2017	09/05/2025	AE	VOC	NE
5140	TOLUENE	02/21/2017	09/05/2025	AE	VOC	NE
4700	TRANS-1,2-DICHLOROETHYLENE	02/21/2017	09/05/2025	AE	VOC	NE
4685	TRANS-1,3-DICHLOROPROPYLENE	02/21/2017	09/05/2025	AE	VOC	NE
5170	TRICHLOROETHENE (TRICHLOROETHYLENE)	02/21/2017	09/05/2025	AE	VOC	NE
5175	TRICHLOROFLUOROMETHANE (FLUOROTRICHLOROMETHANE, FREON 11)	02/21/2017	09/05/2025	AE	VOC	NE
5225	VINYL ACETATE	02/21/2017	09/05/2025	AE	VOC	NE
5230	VINYL BROMIDE (BROMOETHANE)	02/21/2017	09/05/2025	AE	VOC	NE
5235	VINYL CHLORIDE (CHLOROETHENE)	02/21/2017	09/05/2025	AE	VOC	NE
5260	XYLENE (TOTAL)	09/10/2020	09/05/2025	AE	VOC	NE

Method Code: 10248858 **Method Ref: EPA TO-15 (GC-MS) SIM** **Revision: 2** **Date: 1999**

5160	1,1,1-TRICHLOROETHANE	07/13/2020	09/05/2025	AE	VOC	NE
5110	1,1,2,2-TETRACHLOROETHANE	07/13/2020	09/05/2025	AE	VOC	NE
5185	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	07/13/2020	09/05/2025	AE	VOC	NE
5165	1,1,2-TRICHLOROETHANE	07/13/2020	09/05/2025	AE	VOC	NE
4630	1,1-DICHLOROETHANE	07/13/2020	09/05/2025	AE	VOC	NE
4640	1,1-DICHLOROETHYLENE	07/13/2020	09/05/2025	AE	VOC	NE
5155	1,2,4-TRICHLOROBENZENE	07/13/2020	09/05/2025	AE	VOC	NE
5210	1,2,4-TRIMETHYLBENZENE	07/13/2020	09/05/2025	AE	VOC	NE
4585	1,2-DIBROMOETHANE (EDB, ETHYLENE DIBROMIDE)	07/13/2020	09/05/2025	AE	VOC	NE
4610	1,2-DICHLOROBENZENE (O-DICHLOROBENZENE)	07/13/2020	09/05/2025	AE	VOC	NE
4635	1,2-DICHLOROETHANE (ETHYLENE DICHLORIDE)	07/13/2020	09/05/2025	AE	VOC	NE
4655	1,2-DICHLOROPROPANE	07/13/2020	09/05/2025	AE	VOC	NE
5215	1,3,5-TRIMETHYLBENZENE	07/13/2020	09/05/2025	AE	VOC	NE
4620	1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	07/13/2020	09/05/2025	AE	VOC	NE
4735	1,4-DIOXANE (1 4-DIETHYLENEOXIDE)	07/13/2020	09/05/2025	AE	VOC	NE
4410	2-BUTANONE (METHYL ETHYL KETONE, MEK)	07/13/2020	09/05/2025	AE	VOC	NE
4995	4-METHYL-2-PENTANONE (MIBK)	07/13/2020	09/05/2025	AE	VOC	NE
4315	ACETONE	07/13/2020	09/05/2025	AE	VOC	NE

4340	ACRYLONITRILE	07/13/2020	09/05/2025	AE	VOC	NE
4375	BENZENE	07/13/2020	09/05/2025	AE	VOC	NE
4395	BROMODICHLOROMETHANE	07/13/2020	09/05/2025	AE	VOC	NE
4400	BROMOFORM	07/13/2020	09/05/2025	AE	VOC	NE
4455	CARBON TETRACHLORIDE	07/13/2020	09/05/2025	AE	VOC	NE
4475	CHLOROBENZENE	07/13/2020	09/05/2025	AE	VOC	NE
4575	CHLORODIBROMOMETHANE	07/13/2020	09/05/2025	AE	VOC	NE
4485	CHLOROETHANE (ETHYL CHLORIDE)	07/13/2020	09/05/2025	AE	VOC	NE
4505	CHLOROFORM	07/13/2020	09/05/2025	AE	VOC	NE
4645	CIS-1,2-DICHLOROETHYLENE	07/13/2020	09/05/2025	AE	VOC	NE
4680	CIS-1,3-DICHLOROPROPENE	07/13/2020	09/05/2025	AE	VOC	NE
4625	DICHLORODIFLUOROMETHANE (FREON-12)	07/13/2020	09/05/2025	AE	VOC	NE
4652	DICHLOROTETRAFLUOROETHANE	07/13/2020	09/05/2025	AE	VOC	NE
4765	ETHYLBENZENE	07/13/2020	09/05/2025	AE	VOC	NE
4835	HEXACHLOROBUTADIENE	07/13/2020	09/05/2025	AE	VOC	NE
4900	ISOPROPYLBENZENE	07/13/2020	09/05/2025	AE	VOC	NE
4950	METHYL BROMIDE (BROMOMETHANE)	07/13/2020	09/05/2025	AE	VOC	NE
4960	METHYL CHLORIDE (CHLOROMETHANE)	07/13/2020	09/05/2025	AE	VOC	NE
5000	METHYL TERT-BUTYL ETHER (MTBE)	07/13/2020	09/05/2025	AE	VOC	NE
4975	METHYLENE CHLORIDE (DICHLOROMETHANE)	07/13/2020	09/05/2025	AE	VOC	NE
4435	N-BUTYLBENZENE	07/13/2020	09/05/2025	AE	VOC	NE
5005	NAPHTHALENE	07/13/2020	09/05/2025	AE	VOC	NE
5250	O-XYLENE	07/13/2020	09/05/2025	AE	VOC	NE
5255	P-XYLENE	07/13/2020	09/05/2025	AE	VOC	NE
4440	SEC-BUTYLBENZENE	07/13/2020	09/05/2025	AE	VOC	NE
5100	STYRENE	07/13/2020	09/05/2025	AE	VOC	NE
5115	TETRACHLOROETHYLENE (PERCHLOROETHYLENE)	07/13/2020	09/05/2025	AE	VOC	NE
5140	TOLUENE	07/13/2020	09/05/2025	AE	VOC	NE
4700	TRANS-1,2-DICHLOROETHYLENE	07/13/2020	09/05/2025	AE	VOC	NE
4685	TRANS-1,3-DICHLOROPROPYLENE	07/13/2020	09/05/2025	AE	VOC	NE
5170	TRICHLOROETHENE (TRICHLOROETHYLENE)	07/13/2020	09/05/2025	AE	VOC	NE
5235	VINYL CHLORIDE (CHLOROETHENE)	07/13/2020	09/05/2025	AE	VOC	NE

Method Code: 10248405 **Method Ref: EPA TO-13A** **Revision:** **Date:**

5500	ACENAPHTHENE	02/21/2017	09/05/2025	AE	SBN	NE
5505	ACENAPHTHYLENE	02/21/2017	09/05/2025	AE	SBN	NE
5555	ANTHRACENE	02/21/2017	09/05/2025	AE	SBN	NE

5575	BENZO(A)ANTHRACENE	02/21/2017	09/05/2025	AE	SBN	NE
5580	BENZO(A)PYRENE	02/21/2017	09/05/2025	AE	SBN	NE
5585	BENZO(B)FLUORANTHENE	02/21/2017	09/05/2025	AE	SBN	NE
5605	BENZO(E)PYRENE	02/21/2017	09/05/2025	AE	SBN	NE
5590	BENZO(G,H,I)PERYLENE	02/21/2017	09/05/2025	AE	SBN	NE
5600	BENZO(K)FLUORANTHENE	02/21/2017	09/05/2025	AE	SBN	NE
5855	CHRYSENE	02/21/2017	09/05/2025	AE	SBN	NE
5895	DIBENZO(A,H)ANTHRACENE	02/21/2017	09/05/2025	AE	SBN	NE
6265	FLUORANTHENE	02/21/2017	09/05/2025	AE	SBN	NE
6270	FLUORENE	02/21/2017	09/05/2025	AE	SBN	NE
6315	INDENO(1,2,3-CD)PYRENE	02/21/2017	09/05/2025	AE	SBN	NE
6608	PERYLENE	02/21/2017	09/05/2025	AE	SBN	NE
6615	PHENANTHRENE	02/21/2017	09/05/2025	AE	SBN	NE
6665	PYRENE	02/21/2017	09/05/2025	AE	SBN	NE

Method Code: 10248449 Method Ref: EPA TO-13A SIM Revision: Date:

6380	1-METHYLNAPHTHALENE	02/21/2017	09/05/2025	AE	SBN	NE
6385	2-METHYLNAPHTHALENE	02/21/2017	09/05/2025	AE	SBN	NE
5500	ACENAPHTHENE	02/21/2017	09/05/2025	AE	SBN	NE
5505	ACENAPHTHYLENE	02/21/2017	09/05/2025	AE	SBN	NE
5555	ANTHRACENE	02/21/2017	09/05/2025	AE	SBN	NE
5575	BENZO(A)ANTHRACENE	02/21/2017	09/05/2025	AE	SBN	NE
5580	BENZO(A)PYRENE	02/21/2017	09/05/2025	AE	SBN	NE
5585	BENZO(B)FLUORANTHENE	02/21/2017	09/05/2025	AE	SBN	NE
5605	BENZO(E)PYRENE	02/21/2017	09/05/2025	AE	SBN	NE
5590	BENZO(G,H,I)PERYLENE	02/21/2017	09/05/2025	AE	SBN	NE
5600	BENZO(K)FLUORANTHENE	02/21/2017	09/05/2025	AE	SBN	NE
5855	CHRYSENE	02/21/2017	09/05/2025	AE	SBN	NE
5895	DIBENZO(A,H)ANTHRACENE	02/21/2017	09/05/2025	AE	SBN	NE
6265	FLUORANTHENE	02/21/2017	09/05/2025	AE	SBN	NE
6270	FLUORENE	02/21/2017	09/05/2025	AE	SBN	NE
6315	INDENO(1,2,3-CD)PYRENE	02/21/2017	09/05/2025	AE	SBN	NE
6608	PERYLENE	02/21/2017	09/05/2025	AE	SBN	NE
6615	PHENANTHRENE	02/21/2017	09/05/2025	AE	SBN	NE
6665	PYRENE	02/21/2017	09/05/2025	AE	SBN	NE

Method Code: 10248803 Method Ref: EPA TO-15 Revision: 2 Date: 1999

9318	1,3-BUTADIENE	02/21/2017	09/05/2025	AE	SNO	NE

Method Code: 10248858 **Method Ref: EPA TO-15 (GC-MS) SIM** **Revision: 2** **Date: 1999**

9318	1,3-BUTADIENE	07/13/2020	09/05/2025	AE	SNO	NE

Method Code: 10247504 **Method Ref: EPA TO-10A (GC/ECD)** **Revision:** **Date:**

8880	AROCLOR-1016 (PCB-1016)	02/21/2017	09/05/2025	AE	SPC	NE
8885	AROCLOR-1221 (PCB-1221)	02/21/2017	09/05/2025	AE	SPC	NE
8890	AROCLOR-1232 (PCB-1232)	02/21/2017	09/05/2025	AE	SPC	NE
8895	AROCLOR-1242 (PCB-1242)	02/21/2017	09/05/2025	AE	SPC	NE
8900	AROCLOR-1248 (PCB-1248)	02/21/2017	09/05/2025	AE	SPC	NE
8905	AROCLOR-1254 (PCB-1254)	02/21/2017	09/05/2025	AE	SPC	NE
8910	AROCLOR-1260 (PCB-1260)	02/21/2017	09/05/2025	AE	SPC	NE
8912	AROCLOR-1262 (PCB-1262)	02/21/2017	09/05/2025	AE	SPC	NE
8913	AROCLOR-1268 (PCB-1268)	02/21/2017	09/05/2025	AE	SPC	NE

Method Code: 10249204 **Method Ref: EPA TO-4A** **Revision: 2** **Date: 1999**

8880	AROCLOR-1016 (PCB-1016)	05/13/2019	09/05/2025	AE	SPC	NE
8885	AROCLOR-1221 (PCB-1221)	05/13/2019	09/05/2025	AE	SPC	NE
8890	AROCLOR-1232 (PCB-1232)	05/13/2019	09/05/2025	AE	SPC	NE
8895	AROCLOR-1242 (PCB-1242)	05/13/2019	09/05/2025	AE	SPC	NE
8900	AROCLOR-1248 (PCB-1248)	05/13/2019	09/05/2025	AE	SPC	NE
8905	AROCLOR-1254 (PCB-1254)	05/13/2019	09/05/2025	AE	SPC	NE
8910	AROCLOR-1260 (PCB-1260)	05/13/2019	09/05/2025	AE	SPC	NE
8912	AROCLOR-1262 (PCB-1262)	05/13/2019	09/05/2025	AE	SPC	NE
8913	AROCLOR-1268 (PCB-1268)	05/13/2019	09/05/2025	AE	SPC	NE

Method Code: 10000405 **Method Ref: 40 CFR PART 50 APPENDIX G (LEAD IN SPM)** **Revision:** **Date:**

3907	PARTICULATE LEAD	02/21/2017	09/05/2025	AE	AIR	NE

Method Code: 10247708 **Method Ref: EPA METHOD 3C** **Revision:** **Date:**

3755	CARBON DIOXIDE	09/10/2020	09/05/2025	AE	AIR	NE
1843	NITROGEN	09/10/2020	09/05/2025	AE	AIR	NE
3895	OXYGEN	09/10/2020	09/05/2025	AE	AIR	NE

Method Code: NH0362 **Method Ref: EPA TO-12 MODIFIED** **Revision:** **Date:**

3860	NON-METHANE ORGANICS	05/29/2024	09/05/2025	AE	AIR	NE

Method Code: 10156420 **Method Ref: SW-846 6020B** **Revision: UPDATE V** **Date: 2014**

1000	ALUMINUM	06/29/2018	09/05/2025	BT	MET	NE
1005	ANTIMONY	06/29/2018	09/05/2025	BT	MET	NE
1010	ARSENIC	06/29/2018	09/05/2025	BT	MET	NE
1015	BARIUM	06/29/2018	09/05/2025	BT	MET	NE
1020	BERYLLIUM	06/29/2018	09/05/2025	BT	MET	NE
1030	CADMIUM	06/29/2018	09/05/2025	BT	MET	NE

1035	CALCIUM	06/29/2018	09/05/2025	BT	MET	NE
1040	CHROMIUM	06/29/2018	09/05/2025	BT	MET	NE
1050	COBALT	06/29/2018	09/05/2025	BT	MET	NE
1055	COPPER	06/29/2018	09/05/2025	BT	MET	NE
1070	IRON	06/29/2018	09/05/2025	BT	MET	NE
1075	LEAD	06/29/2018	09/05/2025	BT	MET	NE
1085	MAGNESIUM	06/29/2018	09/05/2025	BT	MET	NE
1090	MANGANESE	06/29/2018	09/05/2025	BT	MET	NE
1100	MOLYBDENUM	06/29/2018	09/05/2025	BT	MET	NE
1105	NICKEL	06/29/2018	09/05/2025	BT	MET	NE
1125	POTASSIUM	06/29/2018	09/05/2025	BT	MET	NE
1140	SELENIUM	06/29/2018	09/05/2025	BT	MET	NE
1150	SILVER	06/29/2018	09/05/2025	BT	MET	NE
1160	STRONTIUM	06/29/2018	09/05/2025	BT	MET	NE
1165	THALLIUM	06/29/2018	09/05/2025	BT	MET	NE
1175	TIN	06/29/2018	09/05/2025	BT	MET	NE
1185	VANADIUM	06/29/2018	09/05/2025	BT	MET	NE
1190	ZINC	06/29/2018	09/05/2025	BT	MET	NE
Method Code: 10166457	**Method Ref: SW-846 7471B**		**Revision: UPDATE IV**		**Date: 2007**	
1095	MERCURY	12/29/2017	09/05/2025	BT	MET	NE
Method Code: 10167007	**Method Ref: SW-846 7474**		**Revision:**		**Date: 2007**	
1095	MERCURY	02/21/2017	09/05/2025	BT	MET	NE
Method Code: 10136002	**Method Ref: SW-846 3051A**		**Revision: UPDATE IV**		**Date: 2007**	
1426	MICROWAVE DIGESTION OF SOLIDS	02/21/2017	09/05/2025	BT	PRE	NE
Method Code: 10138202	**Method Ref: SW-846 3510C**		**Revision: UPDATE III**		**Date: 1996**	
1444	SEPERATORY FUNNEL LIQUID-LIQUID EXTRACTION	02/21/2017	09/05/2025	BT	PRE	NE
Method Code: 10142708	**Method Ref: SW-846 3570**		**Revision:**		**Date: 2002**	
1429	MICROSCALE SOLVENT EXTRACTION	02/21/2017	09/05/2025	BT	PRE	NE
Method Code: 10144602	**Method Ref: SW-846 3610B**		**Revision:**		**Date: 1996**	
1411	ALUMINA CLEANUP	02/21/2017	09/05/2025	BT	PRE	NE
Method Code: 10146802	**Method Ref: SW-846 3630C**		**Revision: UPDATE III**		**Date: 1996**	
1446	SILICA GEL CLEAN-UP	02/21/2017	09/05/2025	BT	PRE	NE
Method Code: 10147203	**Method Ref: SW-846 3640A**		**Revision: UPDATE II**		**Date: 1994**	
1418	GEL-PERMEATION CLEAN-UP	02/21/2017	09/05/2025	BT	PRE	NE
Method Code: 10242543	**Method Ref: SW-846 8270E**		**Revision: UPDATE VI**		**Date: 2018**	
5005	NAPHTHALENE	07/13/2020	09/05/2025	BT	VOC	NE
Method Code: 10242565	**Method Ref: SW-846 8270E SIM**		**Revision: UPDATE VI**		**Date: 2018**	
5005	NAPHTHALENE	07/13/2020	09/05/2025	BT	VOC	NE

Method Code: 10178811 Method Ref: SW-846 8081B Revision: UPDATE IV Date: 2007

6275	HEXACHLOROBENZENE	08/15/2022	09/05/2025	BT	SBN	NE

Method Code: 10242543 Method Ref: SW-846 8270E Revision: UPDATE VI Date: 2018

6703	1,1'-BIPHENYL (BZ-0)	07/13/2020	09/05/2025	BT	SBN	NE
6380	1-METHYLNAPHTHALENE	07/13/2020	09/05/2025	BT	SBN	NE
5795	2-CHLORONAPHTHALENE	07/13/2020	09/05/2025	BT	SBN	NE
6385	2-METHYLNAPHTHALENE	07/13/2020	09/05/2025	BT	SBN	NE
5500	ACENAPHTHENE	07/13/2020	09/05/2025	BT	SBN	NE
5505	ACENAPHTHYLENE	07/13/2020	09/05/2025	BT	SBN	NE
5555	ANTHRACENE	07/13/2020	09/05/2025	BT	SBN	NE
5570	BENZALDEHYDE	07/13/2020	09/05/2025	BT	SBN	NE
5575	BENZO(A)ANTHRACENE	07/13/2020	09/05/2025	BT	SBN	NE
5580	BENZO(A)PYRENE	07/13/2020	09/05/2025	BT	SBN	NE
5585	BENZO(B)FLUORANTHENE	07/13/2020	09/05/2025	BT	SBN	NE
5590	BENZO(G,H,I)PERYLENE	07/13/2020	09/05/2025	BT	SBN	NE
5600	BENZO(K)FLUORANTHENE	07/13/2020	09/05/2025	BT	SBN	NE
5670	BUTYL BENZYL PHTHALATE	07/13/2020	09/05/2025	BT	SBN	NE
5855	CHRYSENE	07/13/2020	09/05/2025	BT	SBN	NE
6065	DI(2-ETHYLHEXYL) PHTHALATE (BIS(2-ETHYLHEXYL)PHTHALATE, DEHP)	07/13/2020	09/05/2025	BT	SBN	NE
5925	DI-N-BUTYL PHTHALATE	07/13/2020	09/05/2025	BT	SBN	NE
6200	DI-N-OCTYL PHTHALATE	07/13/2020	09/05/2025	BT	SBN	NE
5895	DIBENZO(A,H)ANTHRACENE	07/13/2020	09/05/2025	BT	SBN	NE
5905	DIBENZOFURAN	07/13/2020	09/05/2025	BT	SBN	NE
6070	DIETHYL PHTHALATE	07/13/2020	09/05/2025	BT	SBN	NE
6135	DIMETHYL PHTHALATE	07/13/2020	09/05/2025	BT	SBN	NE
6265	FLUORANTHENE	07/13/2020	09/05/2025	BT	SBN	NE
6270	FLUORENE	07/13/2020	09/05/2025	BT	SBN	NE
6315	INDENO(1,2,3-CD)PYRENE	07/13/2020	09/05/2025	BT	SBN	NE
6605	PENTACHLOROPHENOL	07/13/2020	09/05/2025	BT	SBN	NE
6615	PHENANTHRENE	07/13/2020	09/05/2025	BT	SBN	NE
6665	PYRENE	07/13/2020	09/05/2025	BT	SBN	NE

Method Code: 10242565 Method Ref: SW-846 8270E SIM Revision: UPDATE VI Date: 2018

6385	2-METHYLNAPHTHALENE	07/13/2020	09/05/2025	BT	SBN	NE
5500	ACENAPHTHENE	07/13/2020	09/05/2025	BT	SBN	NE
5505	ACENAPHTHYLENE	07/13/2020	09/05/2025	BT	SBN	NE
5555	ANTHRACENE	07/13/2020	09/05/2025	BT	SBN	NE

5575	BENZO(A)ANTHRACENE	07/13/2020	09/05/2025	BT	SBN	NE
5580	BENZO(A)PYRENE	07/13/2020	09/05/2025	BT	SBN	NE
5585	BENZO(B)FLUORANTHENE	07/13/2020	09/05/2025	BT	SBN	NE
5590	BENZO(G,H,I)PERYLENE	07/13/2020	09/05/2025	BT	SBN	NE
5600	BENZO(K)FLUORANTHENE	07/13/2020	09/05/2025	BT	SBN	NE
5895	DIBENZO(A,H)ANTHRACENE	07/13/2020	09/05/2025	BT	SBN	NE
6265	FLUORANTHENE	07/13/2020	09/05/2025	BT	SBN	NE
6270	FLUORENE	07/13/2020	09/05/2025	BT	SBN	NE
6315	INDENO(1,2,3-CD)PYRENE	07/13/2020	09/05/2025	BT	SBN	NE
6605	PENTACHLOROPHENOL	07/13/2020	09/05/2025	BT	SBN	NE
6615	PHENANTHRENE	07/13/2020	09/05/2025	BT	SBN	NE
6665	PYRENE	07/13/2020	09/05/2025	BT	SBN	NE

Method Code: 10179201 Method Ref: SW-846 8082A Revision: Date: 2000

8880	AROCLOR-1016 (PCB-1016)	02/21/2017	09/05/2025	BT	SPC	NE
8885	AROCLOR-1221 (PCB-1221)	02/21/2017	09/05/2025	BT	SPC	NE
8890	AROCLOR-1232 (PCB-1232)	02/21/2017	09/05/2025	BT	SPC	NE
8895	AROCLOR-1242 (PCB-1242)	02/21/2017	09/05/2025	BT	SPC	NE
8900	AROCLOR-1248 (PCB-1248)	02/21/2017	09/05/2025	BT	SPC	NE
8905	AROCLOR-1254 (PCB-1254)	02/21/2017	09/05/2025	BT	SPC	NE
8910	AROCLOR-1260 (PCB-1260)	02/21/2017	09/05/2025	BT	SPC	NE

Method Code: 10178811 Method Ref: SW-846 8081B Revision: UPDATE IV Date: 2007

7355	4,4'-DDD	08/15/2022	09/05/2025	BT	SPE	NE
7360	4,4'-DDE	08/15/2022	09/05/2025	BT	SPE	NE
7365	4,4'-DDT	08/15/2022	09/05/2025	BT	SPE	NE
7025	ALDRIN	08/15/2022	09/05/2025	BT	SPE	NE
7110	ALPHA-BHC (ALPHA-HEXACHLOROCYCLOHEXANE)	08/15/2022	09/05/2025	BT	SPE	NE
7115	BETA-BHC (BETA-HEXACHLOROCYCLOHEXANE)	08/15/2022	09/05/2025	BT	SPE	NE
7250	CHLORDANE (TECH.)	08/15/2022	09/05/2025	BT	SPE	NE
7240	CIS-CHLORDANE (ALPHA-CHLORDANE)	08/15/2022	09/05/2025	BT	SPE	NE
7105	DELTA-BHC	08/15/2022	09/05/2025	BT	SPE	NE
7470	DIELDRIN	08/15/2022	09/05/2025	BT	SPE	NE
7510	ENDOSULFAN I	08/15/2022	09/05/2025	BT	SPE	NE
7515	ENDOSULFAN II	08/15/2022	09/05/2025	BT	SPE	NE
7520	ENDOSULFAN SULFATE	08/15/2022	09/05/2025	BT	SPE	NE
7540	ENDRIN	08/15/2022	09/05/2025	BT	SPE	NE
7530	ENDRIN ALDEHYDE	08/15/2022	09/05/2025	BT	SPE	NE

7535	ENDRIN KETONE	08/15/2022	09/05/2025	BT	SPE	NE
7120	GAMMA-BHC (LINDANE, GAMMA-HEXACHLOROCYCLOHEXANE)	08/15/2022	09/05/2025	BT	SPE	NE
7245	GAMMA-CHLORDANE	08/15/2022	09/05/2025	BT	SPE	NE
7685	HEPTACHLOR	08/15/2022	09/05/2025	BT	SPE	NE
7690	HEPTACHLOR EPOXIDE	08/15/2022	09/05/2025	BT	SPE	NE
7810	METHOXYCHLOR	08/15/2022	09/05/2025	BT	SPE	NE
7870	MIREX	08/15/2022	09/05/2025	BT	SPE	NE
8250	TOXAPHENE (CHLORINATED CAMPHENE)	08/15/2022	09/05/2025	BT	SPE	NE

Method Code: 10123430 Method Ref: EPA 1633 DRAFT 2 Revision: DRAFT 2 Date: 2022

9490	11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF3OUDS)	09/22/2023	09/05/2025	BT	PFC	NE
6948	1H, 1H, 2H, 2H-PERFLUORODECANESULFONIC ACID (8:2 FTS) 39108-34-4	09/22/2023	09/05/2025	BT	PFC	NE
6946	1H, 1H, 2H, 2H-PERFLUOROHEXANESULFONIC ACID (4:2 FTS) 757124-72-4	09/22/2023	09/05/2025	BT	PFC	NE
6947	1H, 1H, 2H, 2H-PERFLUOROOCTANESULFONIC ACID (6:2 FTS) 27619-97-2	09/22/2023	09/05/2025	BT	PFC	NE
9340	2H,2H,3H,3H-PERFLUORODECANOIC ACID (7:3 FTCA) 812-70-4	09/22/2023	09/05/2025	BT	PFC	NE
9338	2H,2H,3H,3H-PERFLUOROOCTANOIC ACID (5:3 FTCA) 914637-49-3	09/22/2023	09/05/2025	BT	PFC	NE
9353	4,4,5,5,6,6-HEPAFLUOROHEXANOIC ACID (3:3 FTCA) 356-02-5	09/22/2023	09/05/2025	BT	PFC	NE
6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (DONA) 919005-14-4	09/22/2023	09/05/2025	BT	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF3ONS)	09/22/2023	09/05/2025	BT	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA) (GENX) 13252-13-6	09/22/2023	09/05/2025	BT	PFC	NE
9395	N-ETHYLPERFLUOROOCTANE SULFONAMIDE (ETFOSAM) 4151-50-2	09/22/2023	09/05/2025	BT	PFC	NE
4846	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	09/22/2023	09/05/2025	BT	PFC	NE
9431	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (ETFOSE) 1691-99-2	09/22/2023	09/05/2025	BT	PFC	NE
9433	N-METHYLPERFLUOROOCTANE SULFONAMIDE (MEFOSA) 31506-32-8	09/22/2023	09/05/2025	BT	PFC	NE
4847	N-METHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA) 2355-31-9	09/22/2023	09/05/2025	BT	PFC	NE
6949	N-METHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (MEFOSE) 24448-09-7	09/22/2023	09/05/2025	BT	PFC	NE

6956	NONFLUORO-3,6-DIOXAHEPTANOIC ACID (NFDHA) 151772-58-6	09/22/2023	09/05/2025	BT	PFC	NE
6957	PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID (PFEESA) 113507-82-7	09/22/2023	09/05/2025	BT	PFC	NE
6965	PERFLUORO-3-METHOXYPROPANOIC ACID (PFMPA) 377-73-1	09/22/2023	09/05/2025	BT	PFC	NE
6966	PERFLUORO-4-METHOXYBUTANOIC ACID (PFMBA) 863090-89-5	09/22/2023	09/05/2025	BT	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	09/22/2023	09/05/2025	BT	PFC	NE
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	09/22/2023	09/05/2025	BT	PFC	NE
6920	PERFLUORODECANE SULFONIC ACID (PFDS) 335-77-3	09/22/2023	09/05/2025	BT	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	09/22/2023	09/05/2025	BT	PFC	NE
6923	PERFLUORODODECANE SULFONIC ACID (PFDOS) 79780-39-5	09/22/2023	09/05/2025	BT	PFC	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	09/22/2023	09/05/2025	BT	PFC	NE
9470	PERFLUOROHEPTANE SULFONIC ACID (PFHPS) 375-92-8	09/22/2023	09/05/2025	BT	PFC	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	09/22/2023	09/05/2025	BT	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	09/22/2023	09/05/2025	BT	PFC	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	09/22/2023	09/05/2025	BT	PFC	NE
6929	PERFLUORONONANE SULFONIC ACID (PFNS) 68259-12-1	09/22/2023	09/05/2025	BT	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	09/22/2023	09/05/2025	BT	PFC	NE
6917	PERFLUOROOCTANE SULFONAMIDE (PFOSAM) 754-91-6	09/22/2023	09/05/2025	BT	PFC	NE
6931	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	09/22/2023	09/05/2025	BT	PFC	NE
6912	PERFLUOROOCTANOIC ACID (PFOA) 335-67-1	09/22/2023	09/05/2025	BT	PFC	NE
6934	PERFLUOROPENTANE SULFONIC ACID (PFPES) 2706-91-4	09/22/2023	09/05/2025	BT	PFC	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	09/22/2023	09/05/2025	BT	PFC	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	09/22/2023	09/05/2025	BT	PFC	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	09/22/2023	09/05/2025	BT	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUNDA) 2058-94-8	09/22/2023	09/05/2025	BT	PFC	NE

Method Code: 10123463 **Method Ref: EPA 1633** **Revision:** **Date: 2024**

9490	11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF3OUDS)	08/30/2024	09/05/2024	BT	PFC	NE
6948	1H, 1H, 2H, 2H-PERFLUORODECANESULFONIC ACID (8:2 FTS) 39108-34-4	08/30/2024	09/05/2024	BT	PFC	NE
9616	1H, 1H, 2H, 2H-PERFLUORODODECANE SULFONIC ACID (10:2 FTS) 120226-60-0	08/30/2024	09/05/2024	BT	PFC	NE
6946	1H, 1H, 2H, 2H-PERFLUOROHEXANESULFONIC ACID (4:2 FTS) 757124-72-4	08/30/2024	09/05/2024	BT	PFC	NE
6947	1H, 1H, 2H, 2H-PERFLUOROOCTANESULFONIC ACID (6:2 FTS) 27619-97-2	08/30/2024	09/05/2024	BT	PFC	NE

9340	2H,2H,3H,3H-PERFLUORODECANOIC ACID (7:3 FTCA) 812-70-4	08/30/2024	09/05/2024	BT	PFC	NE
9338	2H,2H,3H,3H-PERFLUOROOCTANOIC ACID (5:3 FTCA) 914637-49-3	08/30/2024	09/05/2024	BT	PFC	NE
9353	4,4,5,5,6,6-HEPAFLUOROHEXANOIC ACID (3:3 FTCA) 356-02-5	08/30/2024	09/05/2024	BT	PFC	NE
6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (DONA) 919005-14-4	08/30/2024	09/05/2024	BT	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF3ONS)	08/30/2024	09/05/2024	BT	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA) (GENX) 13252-13-6	08/30/2024	09/05/2024	BT	PFC	NE
9395	N-ETHYLPERFLUOROOCTANE SULFONAMIDE (ETFOSAM) 4151-50-2	08/30/2024	09/05/2024	BT	PFC	NE
4846	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	08/30/2024	09/05/2024	BT	PFC	NE
9431	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (ETFOSE) 1691-99-2	08/30/2024	09/05/2024	BT	PFC	NE
9433	N-METHYLPERFLUOROOCTANE SULFONAMIDE (MEFOSA) 31506-32-8	08/30/2024	09/05/2024	BT	PFC	NE
4847	N-METHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA) 2355-31-9	08/30/2024	09/05/2024	BT	PFC	NE
6949	N-METHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (MEFOSE) 24448-09-7	08/30/2024	09/05/2024	BT	PFC	NE
6956	NONFLUORO-3,6-DIOXAHEPTANOIC ACID (NFDHA) 151772-58-6	08/30/2024	09/05/2024	BT	PFC	NE
6957	PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID (PFEESA) 113507-82-7	08/30/2024	09/05/2024	BT	PFC	NE
6965	PERFLUORO-3-METHOXYPROPANOIC ACID (PFMPA) 377-73-1	08/30/2024	09/05/2024	BT	PFC	NE
6966	PERFLUORO-4-METHOXYBUTANOIC ACID (PFMBA) 863090-89-5	08/30/2024	09/05/2024	BT	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	08/30/2024	09/05/2024	BT	PFC	NE
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	08/30/2024	09/05/2024	BT	PFC	NE
6920	PERFLUORODECANE SULFONIC ACID (PFDS) 335-77-3	08/30/2024	09/05/2024	BT	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	08/30/2024	09/05/2024	BT	PFC	NE
6923	PERFLUORODODECANE SULFONIC ACID (PFDOS) 79780-39-5	08/30/2024	09/05/2024	BT	PFC	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	08/30/2024	09/05/2024	BT	PFC	NE
9470	PERFLUOROHEPTANE SULFONIC ACID (PFHPS) 375-92-8	08/30/2024	09/05/2024	BT	PFC	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	08/30/2024	09/05/2024	BT	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	08/30/2024	09/05/2024	BT	PFC	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	08/30/2024	09/05/2024	BT	PFC	NE

6929	PERFLUORONONANE SULFONIC ACID (PFNS) 68259-12-1	08/30/2024	09/05/2024	BT	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	08/30/2024	09/05/2024	BT	PFC	NE
6917	PERFLUOROOCTANE SULFONAMIDE (PFOSAM) 754-91-6	08/30/2024	09/05/2024	BT	PFC	NE
6931	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	08/30/2024	09/05/2024	BT	PFC	NE
6912	PERFLUOROOCTANOIC ACID (PFOA) 335-67-1	08/30/2024	09/05/2024	BT	PFC	NE
6934	PERFLUOROPENTANE SULFONIC ACID (PFPES) 2706-91-4	08/30/2024	09/05/2024	BT	PFC	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	08/30/2024	09/05/2024	BT	PFC	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	08/30/2024	09/05/2024	BT	PFC	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	08/30/2024	09/05/2024	BT	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUNDA) 2058-94-8	08/30/2024	09/05/2024	BT	PFC	NE

Method Code: 10013806 Method Ref: EPA 200.7 Revision: 4.4 Date: 1994

1000	ALUMINUM	02/21/2017	09/05/2025	D	MET	NE
1015	BARIUM	02/21/2017	09/05/2025	D	MET	NE
1025	BORON	02/21/2017	09/05/2025	D	MET	NE
1030	CADMIUM	02/21/2017	09/05/2025	D	MET	NE
1035	CALCIUM	02/21/2017	09/05/2025	D	MET	NE
1040	CHROMIUM	02/21/2017	09/05/2025	D	MET	NE
1050	COBALT	02/21/2017	09/05/2025	D	MET	NE
1055	COPPER	02/21/2017	09/05/2025	D	MET	NE
1070	IRON	02/21/2017	09/05/2025	D	MET	NE
1080	LITHIUM	02/03/2022	09/05/2025	D	MET	NE
1085	MAGNESIUM	02/21/2017	09/05/2025	D	MET	NE
1090	MANGANESE	02/21/2017	09/05/2025	D	MET	NE
1105	NICKEL	02/21/2017	09/05/2025	D	MET	NE
1125	POTASSIUM	02/21/2017	09/05/2025	D	MET	NE
1150	SILVER	02/21/2017	09/05/2025	D	MET	NE
1155	SODIUM	02/21/2017	09/05/2025	D	MET	NE
1160	STRONTIUM	02/21/2017	09/05/2025	D	MET	NE
1175	TIN	02/21/2017	09/05/2025	D	MET	NE
1180	TITANIUM	02/21/2017	09/05/2025	D	MET	NE
1185	VANADIUM	02/21/2017	09/05/2025	D	MET	NE
1190	ZINC	02/21/2017	09/05/2025	D	MET	NE

Method Code: 10014605 Method Ref: EPA 200.8 Revision: 5.4 Date: 1994

1000	ALUMINUM	02/21/2017	09/05/2025	D	MET	NE
1005	ANTIMONY	02/21/2017	09/05/2025	D	MET	NE
1010	ARSENIC	02/21/2017	09/05/2025	D	MET	NE

1015	BARIUM	02/21/2017	09/05/2025	D	MET	NE
1020	BERYLLIUM	02/21/2017	09/05/2025	D	MET	NE
1030	CADMIUM	02/21/2017	09/05/2025	D	MET	NE
1040	CHROMIUM	02/21/2017	09/05/2025	D	MET	NE
1050	COBALT	02/21/2017	09/05/2025	D	MET	NE
1055	COPPER	02/21/2017	09/05/2025	D	MET	NE
1070	IRON	05/10/2018	09/05/2025	D	MET	NE
1075	LEAD	02/21/2017	09/05/2025	D	MET	NE
1090	MANGANESE	02/21/2017	09/05/2025	D	MET	NE
1105	NICKEL	02/21/2017	09/05/2025	D	MET	NE
1125	POTASSIUM	05/10/2018	09/05/2025	D	MET	NE
1140	SELENIUM	02/21/2017	09/05/2025	D	MET	NE
1150	SILVER	02/21/2017	09/05/2025	D	MET	NE
1155	SODIUM	05/10/2018	09/05/2025	D	MET	NE
1165	THALLIUM	02/21/2017	09/05/2025	D	MET	NE
1185	VANADIUM	02/21/2017	09/05/2025	D	MET	NE
1190	ZINC	02/21/2017	09/05/2025	D	MET	NE

Method Code: 10036609 Method Ref: EPA 245.1 Revision: 3 Date: 1994

1095	MERCURY	02/21/2017	09/05/2025	D	MET	NE

Method Code: 10013806 Method Ref: EPA 200.7 Revision: 4.4 Date: 1994

1550	CALCIUM HARDNESS AS CACO3	02/21/2017	09/05/2025	D	NMI	NE
1755	TOTAL HARDNESS AS CACO3	02/21/2017	09/05/2025	D	NMI	NE

Method Code: 10088570 Method Ref: EPA 522 Revision: 1 Date: 2008

4735	1,4-DIOXANE (1 4-DIETHYLENEOXIDE)	12/12/2017	09/05/2025	D	VOC	NE

Method Code: 10091642 Method Ref: EPA 537.1 Revision: 1 Date: 2018

4847	N-METHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA) 2355-31-9	05/10/2019	09/05/2025	D	SNO	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	05/10/2019	09/05/2025	D	SNO	NE

Method Code: 10091595 Method Ref: EPA 537.1 Revision: 2 Date: 2020

9490	11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF3OUDS)	09/12/2024	09/05/2025	D	PFC	NE
6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (DONA) 919005-14-4	09/12/2024	09/05/2025	D	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF3ONS)	09/12/2024	09/05/2025	D	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA) (GENX) 13252-13-6	09/12/2024	09/05/2025	D	PFC	NE
4846	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	09/12/2024	09/05/2025	D	PFC	NE

4847	N-METHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA) 2355-31-9	09/12/2024	09/05/2025	D	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	09/12/2024	09/05/2025	D	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	09/12/2024	09/05/2025	D	PFC	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	09/12/2024	09/05/2025	D	PFC	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	09/12/2024	09/05/2025	D	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	09/12/2024	09/05/2025	D	PFC	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	09/12/2024	09/05/2025	D	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	09/12/2024	09/05/2025	D	PFC	NE
6931	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	09/12/2024	09/05/2025	D	PFC	NE
6912	PERFLUOROOCTANOIC ACID (PFOA) 335-67-1	09/12/2024	09/05/2025	D	PFC	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	09/12/2024	09/05/2025	D	PFC	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	09/12/2024	09/05/2025	D	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUNDA) 2058-94-8	09/12/2024	09/05/2025	D	PFC	NE
Method Code: 10091619	**Method Ref: EPA 533**		**Revision:**		**Date: 2019**	
9490	11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF3OUDS)	03/20/2020	09/05/2025	D	PFC	NE
6948	1H, 1H, 2H, 2H-PERFLUORODECANESULFONIC ACID (8:2 FTS) 39108-34-4	03/20/2020	09/05/2025	D	PFC	NE
6946	1H, 1H, 2H, 2H-PERFLUOROHEXANESULFONIC ACID (4:2 FTS) 757124-72-4	03/20/2020	09/05/2025	D	PFC	NE
6947	1H, 1H, 2H, 2H-PERFLUOROOCTANESULFONIC ACID (6:2 FTS) 27619-97-2	03/20/2020	09/05/2025	D	PFC	NE
6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (DONA) 919005-14-4	03/20/2020	09/05/2025	D	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF3ONS)	03/20/2020	09/05/2025	D	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA) (GENX) 13252-13-6	03/20/2020	09/05/2025	D	PFC	NE
6956	NONFLUORO-3,6-DIOXAHEPTANOIC ACID (NFDHA) 151772-58-6	03/20/2020	09/05/2025	D	PFC	NE
6957	PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID (PFEESA) 113507-82-7	03/20/2020	09/05/2025	D	PFC	NE
6965	PERFLUORO-3-METHOXYPROPANOIC ACID (PFMPA) 377-73-1	03/20/2020	09/05/2025	D	PFC	NE
6966	PERFLUORO-4-METHOXYBUTANOIC ACID (PFMBA) 863090-89-5	03/20/2020	09/05/2025	D	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	03/20/2020	09/05/2025	D	PFC	NE
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	03/20/2020	09/05/2025	D	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	03/20/2020	09/05/2025	D	PFC	NE

6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	03/20/2020	09/05/2025	D	PFC	NE
9470	PERFLUOROHEPTANE SULFONIC ACID (PFHPS) 375-92-8	03/20/2020	09/05/2025	D	PFC	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	03/20/2020	09/05/2025	D	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	03/20/2020	09/05/2025	D	PFC	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	03/20/2020	09/05/2025	D	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	03/20/2020	09/05/2025	D	PFC	NE
6931	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	03/20/2020	09/05/2025	D	PFC	NE
6912	PERFLUOROOCTANOIC ACID (PFOA) 335-67-1	03/20/2020	09/05/2025	D	PFC	NE
6934	PERFLUOROPENTANE SULFONIC ACID (PFPES) 2706-91-4	03/20/2020	09/05/2025	D	PFC	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	03/20/2020	09/05/2025	D	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUNDA) 2058-94-8	03/20/2020	09/05/2025	D	PFC	NE

Method Code: 10091642 Method Ref: EPA 537.1 Revision: 1 Date: 2018

9490	11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF3OUDS)	05/10/2019	09/05/2025	D	PFC	NE
6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (DONA) 919005-14-4	05/10/2019	09/05/2025	D	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF3ONS)	05/10/2019	09/05/2025	D	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA) (GENX) 13252-13-6	05/10/2019	09/05/2025	D	PFC	NE
4846	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	05/10/2019	09/05/2025	D	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	05/10/2019	09/05/2025	D	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	05/10/2019	09/05/2025	D	PFC	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	05/10/2019	09/05/2025	D	PFC	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	05/10/2019	09/05/2025	D	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	05/10/2019	09/05/2025	D	PFC	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	05/10/2019	09/05/2025	D	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	05/10/2019	09/05/2025	D	PFC	NE
6931	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	05/10/2019	09/05/2025	D	PFC	NE
6912	PERFLUOROOCTANOIC ACID (PFOA) 335-67-1	05/10/2019	09/05/2025	D	PFC	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	05/10/2019	09/05/2025	D	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUNDA) 2058-94-8	05/10/2019	09/05/2025	D	PFC	NE

Method Code: 60001174 Method Ref: ALPHA SOP 23528 Revision: 17 Date: 2022

9490	11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF3OUDS)	10/14/2022	09/05/2025	D	PFC	NE
6948	1H, 1H, 2H, 2H-PERFLUORODECANESULFONIC ACID (8:2 FTS) 39108-34-4	10/14/2022	09/05/2025	D	PFC	NE

9616	1H, 1H, 2H, 2H-PERFLUORODODECANE SULFONIC ACID (10:2 FTS) 120226-60-0	10/14/2022	09/05/2025	D	PFC	NE
6946	1H, 1H, 2H, 2H-PERFLUOROHEXANESULFONIC ACID (4:2 FTS) 757124-72-4	10/14/2022	09/05/2025	D	PFC	NE
6947	1H, 1H, 2H, 2H-PERFLUOROOCTANESULFONIC ACID (6:2 FTS) 27619-97-2	10/14/2022	09/05/2025	D	PFC	NE
6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (DONA) 919005-14-4	10/14/2022	09/05/2025	D	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF3ONS)	10/14/2022	09/05/2025	D	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA) (GENX) 13252-13-6	10/14/2022	09/05/2025	D	PFC	NE
9395	N-ETHYLPERFLUOROOCTANE SULFONAMIDE (ETFOSAM) 4151-50-2	10/14/2022	09/05/2025	D	PFC	NE
4846	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	10/14/2022	09/05/2025	D	PFC	NE
9431	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (ETFOSE) 1691-99-2	10/14/2022	09/05/2025	D	PFC	NE
9433	N-METHYLPERFLUOROOCTANE SULFONAMIDE (MEFOSA) 31506-32-8	10/14/2022	09/05/2025	D	PFC	NE
4847	N-METHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA) 2355-31-9	10/14/2022	09/05/2025	D	PFC	NE
6949	N-METHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (MEFOSE) 24448-09-7	10/14/2022	09/05/2025	D	PFC	NE
6956	NONFLUORO-3,6-DIOXAHEPTANOIC ACID (NFDHA) 151772-58-6	10/14/2022	09/05/2025	D	PFC	NE
6957	PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID (PFEESA) 113507-82-7	10/14/2022	09/05/2025	D	PFC	NE
6965	PERFLUORO-3-METHOXYPROPANOIC ACID (PFMPA) 377-73-1	10/14/2022	09/05/2025	D	PFC	NE
6966	PERFLUORO-4-METHOXYBUTANOIC ACID (PFMBA) 863090-89-5	10/14/2022	09/05/2025	D	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	10/14/2022	09/05/2025	D	PFC	NE
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	10/14/2022	09/05/2025	D	PFC	NE
6920	PERFLUORODECANE SULFONIC ACID (PFDS) 335-77-3	10/14/2022	09/05/2025	D	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	10/14/2022	09/05/2025	D	PFC	NE
6923	PERFLUORODODECANE SULFONIC ACID (PFDOS) 79780-39-5	10/14/2022	09/05/2025	D	PFC	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	10/14/2022	09/05/2025	D	PFC	NE
9470	PERFLUOROHEPTANE SULFONIC ACID (PFHPS) 375-92-8	10/14/2022	09/05/2025	D	PFC	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	10/14/2022	09/05/2025	D	PFC	NE
6901	PERFLUOROHEXADECANOIC ACID (PFHXDA) 67905-19-5	10/14/2022	09/05/2025	D	PFC	NE

6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	10/14/2022	09/05/2025	D	PFC	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	10/14/2022	09/05/2025	D	PFC	NE
6929	PERFLUORONONANE SULFONIC ACID (PFNS) 68259-12-1	10/14/2022	09/05/2025	D	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	10/14/2022	09/05/2025	D	PFC	NE
6916	PERFLUOROOCTADECANOIC ACID (PFODA) 16517-11-6	10/14/2022	09/05/2025	D	PFC	NE
6917	PERFLUOROOCTANE SULFONAMIDE (PFOSAM) 754-91-6	10/14/2022	09/05/2025	D	PFC	NE
6931	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	10/14/2022	09/05/2025	D	PFC	NE
6912	PERFLUOROOCTANOIC ACID (PFOA) 335-67-1	10/14/2022	09/05/2025	D	PFC	NE
6934	PERFLUOROPENTANE SULFONIC ACID (PFPES) 2706-91-4	10/14/2022	09/05/2025	D	PFC	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	10/14/2022	09/05/2025	D	PFC	NE
9320	PERFLUOROPROPANESULFONIC ACID (PFPRS) 423-41-6	10/14/2022	09/05/2025	D	PFC	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	10/14/2022	09/05/2025	D	PFC	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	10/14/2022	09/05/2025	D	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUNDA) 2058-94-8	10/14/2022	09/05/2025	D	PFC	NE

Method Code: 10013806 **Method Ref: EPA 200.7** **Revision: 4.4** **Date: 1994**

1000	ALUMINUM	02/21/2017	09/05/2025	N	MET	NE
1005	ANTIMONY	02/21/2017	09/05/2025	N	MET	NE
1010	ARSENIC	02/21/2017	09/05/2025	N	MET	NE
1015	BARIUM	02/21/2017	09/05/2025	N	MET	NE
1020	BERYLLIUM	02/21/2017	09/05/2025	N	MET	NE
1025	BORON	02/21/2017	09/05/2025	N	MET	NE
1030	CADMIUM	02/21/2017	09/05/2025	N	MET	NE
1035	CALCIUM	02/21/2017	09/05/2025	N	MET	NE
1040	CHROMIUM	02/21/2017	09/05/2025	N	MET	NE
1050	COBALT	02/21/2017	09/05/2025	N	MET	NE
1055	COPPER	02/21/2017	09/05/2025	N	MET	NE
1070	IRON	02/21/2017	09/05/2025	N	MET	NE
1075	LEAD	02/21/2017	09/05/2025	N	MET	NE
1085	MAGNESIUM	02/21/2017	09/05/2025	N	MET	NE
1090	MANGANESE	02/21/2017	09/05/2025	N	MET	NE
1100	MOLYBDENUM	02/21/2017	09/05/2025	N	MET	NE
1105	NICKEL	02/21/2017	09/05/2025	N	MET	NE
1125	POTASSIUM	02/21/2017	09/05/2025	N	MET	NE
1140	SELENIUM	02/21/2017	09/05/2025	N	MET	NE
1150	SILVER	02/21/2017	09/05/2025	N	MET	NE
1155	SODIUM	02/21/2017	09/05/2025	N	MET	NE

1160	STRONTIUM	02/21/2017	09/05/2025	N	MET	NE
1165	THALLIUM	02/21/2017	09/05/2025	N	MET	NE
1175	TIN	02/21/2017	09/05/2025	N	MET	NE
1180	TITANIUM	02/21/2017	09/05/2025	N	MET	NE
1185	VANADIUM	02/21/2017	09/05/2025	N	MET	NE
1190	ZINC	02/21/2017	09/05/2025	N	MET	NE

Method Code: 10014605 Method Ref: EPA 200.8 Revision: 5.4 Date: 1994

1000	ALUMINUM	02/21/2017	09/05/2025	N	MET	NE
1005	ANTIMONY	02/21/2017	09/05/2025	N	MET	NE
1010	ARSENIC	02/21/2017	09/05/2025	N	MET	NE
1015	BARIUM	02/21/2017	09/05/2025	N	MET	NE
1020	BERYLLIUM	02/21/2017	09/05/2025	N	MET	NE
1030	CADMIUM	02/21/2017	09/05/2025	N	MET	NE
1035	CALCIUM	09/12/2024	09/05/2025	N	MET	NE
1040	CHROMIUM	02/21/2017	09/05/2025	N	MET	NE
1050	COBALT	02/21/2017	09/05/2025	N	MET	NE
1055	COPPER	02/21/2017	09/05/2025	N	MET	NE
1070	IRON	05/10/2018	09/05/2025	N	MET	NE
1075	LEAD	02/21/2017	09/05/2025	N	MET	NE
1085	MAGNESIUM	09/12/2024	09/05/2025	N	MET	NE
1090	MANGANESE	02/21/2017	09/05/2025	N	MET	NE
1100	MOLYBDENUM	02/21/2017	09/05/2025	N	MET	NE
1105	NICKEL	02/21/2017	09/05/2025	N	MET	NE
1125	POTASSIUM	05/10/2018	09/05/2025	N	MET	NE
1140	SELENIUM	02/21/2017	09/05/2025	N	MET	NE
1150	SILVER	02/21/2017	09/05/2025	N	MET	NE
1155	SODIUM	05/10/2018	09/05/2025	N	MET	NE
1165	THALLIUM	02/21/2017	09/05/2025	N	MET	NE
1185	VANADIUM	02/21/2017	09/05/2025	N	MET	NE
1190	ZINC	02/21/2017	09/05/2025	N	MET	NE

Method Code: 10036609 Method Ref: EPA 245.1 Revision: 3 Date: 1994

1095	MERCURY	02/21/2017	09/05/2025	N	MET	NE

Method Code: 10038105 Method Ref: EPA 245.7 Revision: 2 Date: 2005

1095	MERCURY	08/09/2024	09/05/2025	N	MET	NE

Method Code: 10155916 Method Ref: SW-846 6010D Revision: UPDATE V Date: 2014

1000	ALUMINUM	06/29/2018	09/05/2025	N	MET	NE
1005	ANTIMONY	06/29/2018	09/05/2025	N	MET	NE

1010	ARSENIC	06/29/2018	09/05/2025	N	MET	NE
1015	BARIUM	06/29/2018	09/05/2025	N	MET	NE
1020	BERYLLIUM	06/29/2018	09/05/2025	N	MET	NE
1025	BORON	06/29/2018	09/05/2025	N	MET	NE
1030	CADMIUM	06/29/2018	09/05/2025	N	MET	NE
1035	CALCIUM	06/29/2018	09/05/2025	N	MET	NE
1040	CHROMIUM	06/29/2018	09/05/2025	N	MET	NE
1050	COBALT	06/29/2018	09/05/2025	N	MET	NE
1055	COPPER	06/29/2018	09/05/2025	N	MET	NE
1070	IRON	06/29/2018	09/05/2025	N	MET	NE
1075	LEAD	06/29/2018	09/05/2025	N	MET	NE
1080	LITHIUM	07/18/2023	09/05/2025	N	MET	NE
1085	MAGNESIUM	06/29/2018	09/05/2025	N	MET	NE
1090	MANGANESE	06/29/2018	09/05/2025	N	MET	NE
1100	MOLYBDENUM	06/29/2018	09/05/2025	N	MET	NE
1105	NICKEL	06/29/2018	09/05/2025	N	MET	NE
1125	POTASSIUM	06/29/2018	09/05/2025	N	MET	NE
1140	SELENIUM	06/29/2018	09/05/2025	N	MET	NE
1150	SILVER	06/29/2018	09/05/2025	N	MET	NE
1155	SODIUM	06/29/2018	09/05/2025	N	MET	NE
1160	STRONTIUM	06/29/2018	09/05/2025	N	MET	NE
1165	THALLIUM	06/29/2018	09/05/2025	N	MET	NE
1175	TIN	06/29/2018	09/05/2025	N	MET	NE
1180	TITANIUM	06/29/2018	09/05/2025	N	MET	NE
1185	VANADIUM	06/29/2018	09/05/2025	N	MET	NE
1190	ZINC	06/29/2018	09/05/2025	N	MET	NE

Method Code: 10156420 **Method Ref: SW-846 6020B** **Revision: UPDATE V** **Date: 2014**

1000	ALUMINUM	06/29/2018	09/05/2025	N	MET	NE
1005	ANTIMONY	06/29/2018	09/05/2025	N	MET	NE
1010	ARSENIC	06/29/2018	09/05/2025	N	MET	NE
1015	BARIUM	06/29/2018	09/05/2025	N	MET	NE
1020	BERYLLIUM	06/29/2018	09/05/2025	N	MET	NE
1025	BORON	06/29/2018	09/05/2025	N	MET	NE
1030	CADMIUM	06/29/2018	09/05/2025	N	MET	NE
1035	CALCIUM	06/29/2018	09/05/2025	N	MET	NE
1040	CHROMIUM	06/29/2018	09/05/2025	N	MET	NE

1050	COBALT	06/29/2018	09/05/2025	N	MET	NE
1055	COPPER	06/29/2018	09/05/2025	N	MET	NE
1070	IRON	06/29/2018	09/05/2025	N	MET	NE
1075	LEAD	06/29/2018	09/05/2025	N	MET	NE
1085	MAGNESIUM	06/29/2018	09/05/2025	N	MET	NE
1090	MANGANESE	06/29/2018	09/05/2025	N	MET	NE
1100	MOLYBDENUM	06/29/2018	09/05/2025	N	MET	NE
1105	NICKEL	06/29/2018	09/05/2025	N	MET	NE
1125	POTASSIUM	06/29/2018	09/05/2025	N	MET	NE
1140	SELENIUM	06/29/2018	09/05/2025	N	MET	NE
1150	SILVER	06/29/2018	09/05/2025	N	MET	NE
1155	SODIUM	06/29/2018	09/05/2025	N	MET	NE
1160	STRONTIUM	06/29/2018	09/05/2025	N	MET	NE
1165	THALLIUM	06/29/2018	09/05/2025	N	MET	NE
1175	TIN	06/29/2018	09/05/2025	N	MET	NE
1185	VANADIUM	06/29/2018	09/05/2025	N	MET	NE
1190	ZINC	06/29/2018	09/05/2025	N	MET	NE

Method Code: 10165807 Method Ref: SW-846 7470A Revision: UPDATE II Date: 1994

1095	MERCURY	02/21/2017	09/05/2025	N	MET	NE

Method Code: 10237204 Method Ref: EPA 1631E Revision: Date: 2002

1095	MERCURY	02/21/2017	09/05/2025	N	MET	NE

Method Code: 10013806 Method Ref: EPA 200.7 Revision: 4.4 Date: 1994

1990	SILICA AS SIO2	02/21/2017	09/05/2025	N	NMI	NE
1755	TOTAL HARDNESS AS CACO3	02/21/2017	09/05/2025	N	NMI	NE

Method Code: 10014605 Method Ref: EPA 200.8 Revision: 5.4 Date: 1994

1755	TOTAL HARDNESS AS CACO3	10/07/2024	09/05/2025	N	NMI	NE

Method Code: 10155916 Method Ref: SW-846 6010D Revision: UPDATE V Date: 2014

1990	SILICA AS SIO2	07/07/2022	09/05/2025	N	NMI	NE
2017	SULFUR	06/29/2018	09/05/2025	N	NMI	NE
1755	TOTAL HARDNESS AS CACO3	07/13/2020	09/05/2025	N	NMI	NE

Method Code: 10156420 Method Ref: SW-846 6020B Revision: UPDATE V Date: 2014

1755	TOTAL HARDNESS AS CACO3	07/13/2020	09/05/2025	N	NMI	NE

Method Code: 20046611 Method Ref: SM 2340 B-2011 Revision: Date: 2011

1755	TOTAL HARDNESS AS CACO3	02/21/2017	09/05/2025	N	NMI	NE

Method Code: 10133207 Method Ref: SW-846 3005A Revision: UPDATE I Date: 1992

1438	PRECONCENTRATION UNDER ACID	11/22/2016	09/05/2025	N	PRE	NE

Method Code: 10134006 Method Ref: SW-846 3015A Revision: UPDATE IV Date: 2007

1430	MICROWAVE-ASSISTED ACID DIGESTION OF TCLP EXTRACTS	02/21/2017	09/05/2025	N	PRE	NE

Method Code: 10138202 **Method Ref: SW-846 3510C** **Revision: UPDATE III** **Date: 1996**

1444	SEPERATORY FUNNEL LIQUID-LIQUID EXTRACTION	02/21/2017	09/05/2025	N	PRE	NE

Method Code: 10143007 **Method Ref: SW-846 3580A** **Revision: UPDATE I** **Date: 1992**

1470	WASTE DILUTION	02/21/2017	09/05/2025	N	PRE	NE

Method Code: 10146802 **Method Ref: SW-846 3630C** **Revision: UPDATE III** **Date: 1996**

1446	SILICA GEL CLEAN-UP	02/21/2017	09/05/2025	N	PRE	NE

Method Code: 10147203 **Method Ref: SW-846 3640A** **Revision: UPDATE II** **Date: 1994**

1418	GEL-PERMEATION CLEAN-UP	02/21/2017	09/05/2025	N	PRE	NE

Method Code: 10148400 **Method Ref: SW-846 3660B** **Revision: UPDATE III** **Date: 1996**

1456	SULFUR CLEAN-UP	02/21/2017	09/05/2025	N	PRE	NE

Method Code: 10148808 **Method Ref: SW-846 3665A** **Revision: UPDATE III** **Date: 1996**

1458	SULFURIC ACID / PERMANGANATE CLEAN-UP	02/21/2017	09/05/2025	N	PRE	NE

Method Code: 10088570 **Method Ref: EPA 522** **Revision: 1** **Date: 2008**

4735	1,4-DIOXANE (1 4-DIETHYLENEOXIDE)	02/21/2017	09/05/2025	N	VOC	NE

Method Code: 10242543 **Method Ref: SW-846 8270E** **Revision: UPDATE VI** **Date: 2018**

5155	1,2,4-TRICHLOROBENZENE	07/13/2020	09/05/2025	N	VOC	NE
4610	1,2-DICHLOROBENZENE (O-DICHLOROBENZENE)	07/13/2020	09/05/2025	N	VOC	NE
4615	1,3-DICHLOROBENZENE (M-DICHLOROBENZNE)	07/13/2020	09/05/2025	N	VOC	NE
4620	1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	07/13/2020	09/05/2025	N	VOC	NE
4835	HEXACHLOROBUTADIENE	07/13/2020	09/05/2025	N	VOC	NE
4840	HEXACHLOROETHANE	07/13/2020	09/05/2025	N	VOC	NE
5005	NAPHTHALENE	07/13/2020	09/05/2025	N	VOC	NE
5015	NITROBENZENE	07/13/2020	09/05/2025	N	VOC	NE
5095	PYRIDINE	07/13/2020	09/05/2025	N	VOC	NE

Method Code: 10242565 **Method Ref: SW-846 8270E SIM** **Revision: UPDATE VI** **Date: 2018**

5005	NAPHTHALENE	07/13/2020	09/05/2025	N	VOC	NE

Method Code: 10305609 **Method Ref: SW-846 8015D** **Revision:** **Date: 2003**

4750	ETHANOL	02/21/2017	09/05/2025	N	VOC	NE
4785	ETHYLENE GLYCOL	02/21/2017	09/05/2025	N	VOC	NE
4875	ISOBUTYL ALCOHOL (2-METHYL-1-PROPANOL)	02/21/2017	09/05/2025	N	VOC	NE
4895	ISOPROPYL ALCOHOL (2-PROPANOL, ISOPROPANOL)	02/21/2017	09/05/2025	N	VOC	NE
4930	METHANOL	02/21/2017	09/05/2025	N	VOC	NE
5055	N-PROPANOL	02/21/2017	09/05/2025	N	VOC	NE
4368	TERT-AMYL ALCOHOL (TAA)	02/21/2017	09/05/2025	N	VOC	NE
4420	TERT-BUTYL ALCOHOL (2-METHYL-2-PROPANOL)	02/21/2017	09/05/2025	N	VOC	NE

Method Code: NH0361 **Method Ref: SW-846 8270E SIM ISOTOPE DILUTION** **Revision: UPDATE VI** **Date: 2018**

4735	1,4-DIOXANE (1 4-DIETHYLENEOXIDE)	05/29/2024	09/05/2025	N	VOC	NE

Method Code: 10178811 Method Ref: SW-846 8081B Revision: UPDATE IV Date: 2007

6275	HEXACHLOROBENZENE	08/15/2022	09/05/2025	N	SBN	NE

Method Code: 10242543 Method Ref: SW-846 8270E Revision: UPDATE VI Date: 2018

6703	1,1'-BIPHENYL (BZ-0)	07/13/2020	09/05/2025	N	SBN	NE
6710	1,2,3,5-TETRACHLOROBENZENE	07/13/2020	09/05/2025	N	SBN	NE
6715	1,2,4,5-TETRACHLOROBENZENE	07/13/2020	09/05/2025	N	SBN	NE
6220	1,2-DIPHENYLHYDRAZINE	07/13/2020	09/05/2025	N	SBN	NE
4659	2,2'-OXYBIS(1-CHLOROPROPANE), BIS(2-CHLORO-1-METHYLETHYL)ETHER	07/13/2020	09/05/2025	N	SBN	NE
6735	2,3,4,6-TETRACHLOROPHENOL	07/13/2020	09/05/2025	N	SBN	NE
6835	2,4,5-TRICHLOROPHENOL	07/13/2020	09/05/2025	N	SBN	NE
6840	2,4,6-TRICHLOROPHENOL	07/13/2020	09/05/2025	N	SBN	NE
6000	2,4-DICHLOROPHENOL	07/13/2020	09/05/2025	N	SBN	NE
6130	2,4-DIMETHYLPHENOL	07/13/2020	09/05/2025	N	SBN	NE
6175	2,4-DINITROPHENOL	07/13/2020	09/05/2025	N	SBN	NE
6185	2,4-DINITROTOLUENE (2,4-DNT)	07/13/2020	09/05/2025	N	SBN	NE
6190	2,6-DINITROTOLUENE (2,6-DNT)	07/13/2020	09/05/2025	N	SBN	NE
5795	2-CHLORONAPHTHALENE	07/13/2020	09/05/2025	N	SBN	NE
5800	2-CHLOROPHENOL	07/13/2020	09/05/2025	N	SBN	NE
6360	2-METHYL-4,6-DINITROPHENOL (4,6-DINITRO-2-METHYLPHENOL)	07/13/2020	09/05/2025	N	SBN	NE
6385	2-METHYLNAPHTHALENE	07/13/2020	09/05/2025	N	SBN	NE
6400	2-METHYLPHENOL (O-CRESOL)	07/13/2020	09/05/2025	N	SBN	NE
6460	2-NITROANILINE	07/13/2020	09/05/2025	N	SBN	NE
6490	2-NITROPHENOL	07/13/2020	09/05/2025	N	SBN	NE
5945	3,3'-DICHLOROBENZIDINE	07/13/2020	09/05/2025	N	SBN	NE
6405	3-METHYLPHENOL (M-CRESOL)	07/13/2020	09/05/2025	N	SBN	NE
6465	3-NITROANILINE	07/13/2020	09/05/2025	N	SBN	NE
5660	4-BROMOPHENYL PHENYL ETHER (BDE-3)	07/13/2020	09/05/2025	N	SBN	NE
5700	4-CHLORO-3-METHYLPHENOL	07/13/2020	09/05/2025	N	SBN	NE
5745	4-CHLOROANILINE	07/13/2020	09/05/2025	N	SBN	NE
5825	4-CHLOROPHENYL PHENYLETHER	07/13/2020	09/05/2025	N	SBN	NE
6410	4-METHYLPHENOL (P-CRESOL)	07/13/2020	09/05/2025	N	SBN	NE
6470	4-NITROANILINE	07/13/2020	09/05/2025	N	SBN	NE
6500	4-NITROPHENOL	07/13/2020	09/05/2025	N	SBN	NE
5500	ACENAPHTHENE	07/13/2020	09/05/2025	N	SBN	NE
5505	ACENAPHTHYLENE	07/13/2020	09/05/2025	N	SBN	NE

5510	ACETOPHENONE	07/13/2020	09/05/2025	N	SBN	NE
5545	ANILINE	07/13/2020	09/05/2025	N	SBN	NE
5555	ANTHRACENE	07/13/2020	09/05/2025	N	SBN	NE
5570	BENZALDEHYDE	07/13/2020	09/05/2025	N	SBN	NE
5595	BENZIDINE	07/13/2020	09/05/2025	N	SBN	NE
5575	BENZO(A)ANTHRACENE	07/13/2020	09/05/2025	N	SBN	NE
5580	BENZO(A)PYRENE	07/13/2020	09/05/2025	N	SBN	NE
5585	BENZO(B)FLUORANTHENE	07/13/2020	09/05/2025	N	SBN	NE
5590	BENZO(G,H,I)PERYLENE	07/13/2020	09/05/2025	N	SBN	NE
5600	BENZO(K)FLUORANTHENE	07/13/2020	09/05/2025	N	SBN	NE
5610	BENZOIC ACID	07/13/2020	09/05/2025	N	SBN	NE
5630	BENZYL ALCOHOL	07/13/2020	09/05/2025	N	SBN	NE
5760	BIS(2-CHLOROETHOXY)METHANE	07/13/2020	09/05/2025	N	SBN	NE
5765	BIS(2-CHLOROETHYL) ETHER	07/13/2020	09/05/2025	N	SBN	NE
5670	BUTYL BENZYL PHTHALATE	07/13/2020	09/05/2025	N	SBN	NE
5680	CARBAZOLE	07/13/2020	09/05/2025	N	SBN	NE
5855	CHRYSENE	07/13/2020	09/05/2025	N	SBN	NE
6065	DI(2-ETHYLHEXYL) PHTHALATE (BIS(2-ETHYLHEXYL)PHTHALATE, DEHP)	07/13/2020	09/05/2025	N	SBN	NE
5925	DI-N-BUTYL PHTHALATE	07/13/2020	09/05/2025	N	SBN	NE
6200	DI-N-OCTYL PHTHALATE	07/13/2020	09/05/2025	N	SBN	NE
5895	DIBENZO(A,H)ANTHRACENE	07/13/2020	09/05/2025	N	SBN	NE
5905	DIBENZOFURAN	07/13/2020	09/05/2025	N	SBN	NE
6070	DIETHYL PHTHALATE	07/13/2020	09/05/2025	N	SBN	NE
6135	DIMETHYL PHTHALATE	07/13/2020	09/05/2025	N	SBN	NE
6265	FLUORANTHENE	07/13/2020	09/05/2025	N	SBN	NE
6270	FLUORENE	07/13/2020	09/05/2025	N	SBN	NE
6275	HEXACHLOROBENZENE	07/13/2020	09/05/2025	N	SBN	NE
6315	INDENO(1,2,3-CD)PYRENE	07/13/2020	09/05/2025	N	SBN	NE
6320	ISOPHORONE	07/13/2020	09/05/2025	N	SBN	NE
6545	N-NITROSODI-N-PROPYLAMINE	07/13/2020	09/05/2025	N	SBN	NE
6530	N-NITROSODIMETHYLAMINE	07/13/2020	09/05/2025	N	SBN	NE
6535	N-NITROSODIPHENYLAMINE	07/13/2020	09/05/2025	N	SBN	NE
6600	PENTACHLORONITROBENZENE	07/13/2020	09/05/2025	N	SBN	NE
6605	PENTACHLOROPHENOL	07/13/2020	09/05/2025	N	SBN	NE
6615	PHENANTHRENE	07/13/2020	09/05/2025	N	SBN	NE

6625	PHENOL	07/13/2020	09/05/2025	N	SBN	NE
6665	PYRENE	07/13/2020	09/05/2025	N	SBN	NE

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6380	1-METHYLNAPHTHALENE	07/13/2020	09/05/2025	N	SBN	NE
6385	2-METHYLNAPHTHALENE	07/13/2020	09/05/2025	N	SBN	NE
5500	ACENAPHTHENE	07/13/2020	09/05/2025	N	SBN	NE
5505	ACENAPHTHYLENE	07/13/2020	09/05/2025	N	SBN	NE
9297	ALKALATED PAHS	07/13/2020	09/05/2025	N	SBN	NE
5555	ANTHRACENE	07/13/2020	09/05/2025	N	SBN	NE
5575	BENZO(A)ANTHRACENE	07/13/2020	09/05/2025	N	SBN	NE
5580	BENZO(A)PYRENE	07/13/2020	09/05/2025	N	SBN	NE
5585	BENZO(B)FLUORANTHENE	07/13/2020	09/05/2025	N	SBN	NE
5590	BENZO(G,H,I)PERYLENE	07/13/2020	09/05/2025	N	SBN	NE
5600	BENZO(K)FLUORANTHENE	07/13/2020	09/05/2025	N	SBN	NE
5855	CHRYSENE	07/13/2020	09/05/2025	N	SBN	NE
5895	DIBENZO(A,H)ANTHRACENE	07/13/2020	09/05/2025	N	SBN	NE
6265	FLUORANTHENE	07/13/2020	09/05/2025	N	SBN	NE
6270	FLUORENE	07/13/2020	09/05/2025	N	SBN	NE
6315	INDENO(1,2,3-CD)PYRENE	07/13/2020	09/05/2025	N	SBN	NE
6605	PENTACHLOROPHENOL	07/13/2020	09/05/2025	N	SBN	NE
6615	PHENANTHRENE	07/13/2020	09/05/2025	N	SBN	NE
6665	PYRENE	07/13/2020	09/05/2025	N	SBN	NE

Method Code: 10305609 Method Ref: SW-846 8015D Revision: Date: 2003

6657	PROPYLENE GLYCOL	02/21/2017	09/05/2025	N	SBN	NE

Method Code: 10305609 Method Ref: SW-846 8015D Revision: Date: 2003

9369	DIESEL RANGE ORGANICS (DRO)	02/21/2017	09/05/2025	N	SNO	NE

Method Code: 10179201 Method Ref: SW-846 8082A Revision: Date: 2000

8880	AROCLOR-1016 (PCB-1016)	02/21/2017	09/05/2025	N	SPC	NE
8885	AROCLOR-1221 (PCB-1221)	02/21/2017	09/05/2025	N	SPC	NE
8890	AROCLOR-1232 (PCB-1232)	02/21/2017	09/05/2025	N	SPC	NE
8895	AROCLOR-1242 (PCB-1242)	02/21/2017	09/05/2025	N	SPC	NE
8900	AROCLOR-1248 (PCB-1248)	02/21/2017	09/05/2025	N	SPC	NE
8905	AROCLOR-1254 (PCB-1254)	02/21/2017	09/05/2025	N	SPC	NE
8910	AROCLOR-1260 (PCB-1260)	02/21/2017	09/05/2025	N	SPC	NE
8912	AROCLOR-1262 (PCB-1262)	02/21/2017	09/05/2025	N	SPC	NE
8913	AROCLOR-1268 (PCB-1268)	02/21/2017	09/05/2025	N	SPC	NE

Method Code: 10178811 **Method Ref: SW-846 8081B** **Revision: UPDATE IV** **Date: 2007**

7355	4,4'-DDD	08/15/2022	09/05/2025	N	SPE	NE
7360	4,4'-DDE	08/15/2022	09/05/2025	N	SPE	NE
7365	4,4'-DDT	08/15/2022	09/05/2025	N	SPE	NE
7025	ALDRIN	08/15/2022	09/05/2025	N	SPE	NE
7110	ALPHA-BHC (ALPHA-HEXACHLOROCYCLOHEXANE)	08/15/2022	09/05/2025	N	SPE	NE
7115	BETA-BHC (BETA-HEXACHLOROCYCLOHEXANE)	08/15/2022	09/05/2025	N	SPE	NE
7250	CHLORDANE (TECH.)	08/15/2022	09/05/2025	N	SPE	NE
7240	CIS-CHLORDANE (ALPHA-CHLORDANE)	08/15/2022	09/05/2025	N	SPE	NE
7105	DELTA-BHC	08/15/2022	09/05/2025	N	SPE	NE
7470	DIELDRIN	08/15/2022	09/05/2025	N	SPE	NE
7510	ENDOSULFAN I	08/15/2022	09/05/2025	N	SPE	NE
7515	ENDOSULFAN II	08/15/2022	09/05/2025	N	SPE	NE
7520	ENDOSULFAN SULFATE	08/15/2022	09/05/2025	N	SPE	NE
7540	ENDRIN	08/15/2022	09/05/2025	N	SPE	NE
7530	ENDRIN ALDEHYDE	08/15/2022	09/05/2025	N	SPE	NE
7535	ENDRIN KETONE	08/15/2022	09/05/2025	N	SPE	NE
7120	GAMMA-BHC (LINDANE, GAMMA-HEXACHLOROCYCLOHEXANE)	08/15/2022	09/05/2025	N	SPE	NE
7245	GAMMA-CHLORDANE	08/15/2022	09/05/2025	N	SPE	NE
7685	HEPTACHLOR	08/15/2022	09/05/2025	N	SPE	NE
7690	HEPTACHLOR EPOXIDE	08/15/2022	09/05/2025	N	SPE	NE
7725	ISODRIN	08/15/2022	09/05/2025	N	SPE	NE
7810	METHOXYCHLOR	08/15/2022	09/05/2025	N	SPE	NE
7870	MIREX	08/15/2022	09/05/2025	N	SPE	NE
8250	TOXAPHENE (CHLORINATED CAMPHENE)	08/15/2022	09/05/2025	N	SPE	NE

Method Code: 10242543 **Method Ref: SW-846 8270E** **Revision: UPDATE VI** **Date: 2018**

7065	ATRAZINE	07/13/2020	09/05/2025	N	SPE	NE
7180	CAPROLACTAM	07/13/2020	09/05/2025	N	SPE	NE
6285	HEXACHLOROCYCLOPENTADIENE	07/13/2020	09/05/2025	N	SPE	NE

Method Code: 10123430 **Method Ref: EPA 1633 DRAFT 2** **Revision: DRAFT 2** **Date: 2022**

9490	11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF3OUDS)	09/22/2023	09/05/2025	N	PFC	NE
6948	1H, 1H, 2H, 2H-PERFLUORODECANESULFONIC ACID (8:2 FTS) 39108-34-4	09/22/2023	09/05/2025	N	PFC	NE
9616	1H, 1H, 2H, 2H-PERFLUORODODECANE SULFONIC ACID (10:2 FTS) 120226-60-0	09/22/2023	09/05/2025	N	PFC	NE

6946	1H, 1H, 2H, 2H-PERFLUOROHEXANESULFONIC ACID (4:2 FTS) 757124-72-4	09/22/2023	09/05/2025	N	PFC	NE
6947	1H, 1H, 2H, 2H-PERFLUOROOCTANESULFONIC ACID (6:2 FTS) 27619-97-2	09/22/2023	09/05/2025	N	PFC	NE
9340	2H,2H,3H,3H-PERFLUORODECANOIC ACID (7:3 FTCA) 812-70-4	09/22/2023	09/05/2025	N	PFC	NE
9338	2H,2H,3H,3H-PERFLUOROOCTANOIC ACID (5:3 FTCA) 914637-49-3	09/22/2023	09/05/2025	N	PFC	NE
9353	4,4,5,5,6,6-HEPAFLUOROHEXANOIC ACID (3:3 FTCA) 356-02-5	09/22/2023	09/05/2025	N	PFC	NE
6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (DONA) 919005-14-4	09/22/2023	09/05/2025	N	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF3ONS)	09/22/2023	09/05/2025	N	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA) (GENX) 13252-13-6	09/22/2023	09/05/2025	N	PFC	NE
9395	N-ETHYLPERFLUOROOCTANE SULFONAMIDE (ETFOSAM) 4151-50-2	09/22/2023	09/05/2025	N	PFC	NE
4846	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	09/22/2023	09/05/2025	N	PFC	NE
9431	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (ETFOSE) 1691-99-2	09/22/2023	09/05/2025	N	PFC	NE
9433	N-METHYLPERFLUOROOCTANE SULFONAMIDE (MEFOSA) 31506-32-8	09/22/2023	09/05/2025	N	PFC	NE
4847	N-METHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA) 2355-31-9	09/22/2023	09/05/2025	N	PFC	NE
6949	N-METHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (MEFOSE) 24448-09-7	09/22/2023	09/05/2025	N	PFC	NE
6956	NONFLUORO-3,6-DIOXAHEPTANOIC ACID (NFDHA) 151772-58-6	09/22/2023	09/05/2025	N	PFC	NE
6957	PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID (PFEESA) 113507-82-7	09/22/2023	09/05/2025	N	PFC	NE
6965	PERFLUORO-3-METHOXYPROPANOIC ACID (PFMPA) 377-73-1	09/22/2023	09/05/2025	N	PFC	NE
6966	PERFLUORO-4-METHOXYBUTANOIC ACID (PFMBA) 863090-89-5	09/22/2023	09/05/2025	N	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	09/22/2023	09/05/2025	N	PFC	NE
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	09/22/2023	09/05/2025	N	PFC	NE
6920	PERFLUORODECANE SULFONIC ACID (PFDS) 335-77-3	09/22/2023	09/05/2025	N	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	09/22/2023	09/05/2025	N	PFC	NE
6923	PERFLUORODODECANE SULFONIC ACID (PFDOS) 79780-39-5	09/22/2023	09/05/2025	N	PFC	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	09/22/2023	09/05/2025	N	PFC	NE
9470	PERFLUOROHEPTANE SULFONIC ACID (PFHPS) 375-92-8	09/22/2023	09/05/2025	N	PFC	NE

6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	09/22/2023	09/05/2025	N	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	09/22/2023	09/05/2025	N	PFC	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	09/22/2023	09/05/2025	N	PFC	NE
6929	PERFLUORONONANE SULFONIC ACID (PFNS) 68259-12-1	09/22/2023	09/05/2025	N	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	09/22/2023	09/05/2025	N	PFC	NE
6917	PERFLUOROOCTANE SULFONAMIDE (PFOSAM) 754-91-6	09/22/2023	09/05/2025	N	PFC	NE
6931	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	09/22/2023	09/05/2025	N	PFC	NE
6912	PERFLUOROOCTANOIC ACID (PFOA) 335-67-1	09/22/2023	09/05/2025	N	PFC	NE
6934	PERFLUOROPENTANE SULFONIC ACID (PFPES) 2706-91-4	09/22/2023	09/05/2025	N	PFC	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	09/22/2023	09/05/2025	N	PFC	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	09/22/2023	09/05/2025	N	PFC	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	09/22/2023	09/05/2025	N	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUNDA) 2058-94-8	09/22/2023	09/05/2025	N	PFC	NE

Method Code: 10123463 Method Ref: EPA 1633 Revision: Date: 2024

9490	11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF3OUDS)	08/30/2024	09/05/2024	N	PFC	NE
6948	1H, 1H, 2H, 2H-PERFLUORODECANESULFONIC ACID (8:2 FTS) 39108-34-4	08/30/2024	09/05/2024	N	PFC	NE
9616	1H, 1H, 2H, 2H-PERFLUORODODECANE SULFONIC ACID (10:2 FTS) 120226-60-0	08/30/2024	09/05/2024	N	PFC	NE
6946	1H, 1H, 2H, 2H-PERFLUOROHEXANESULFONIC ACID (4:2 FTS) 757124-72-4	08/30/2024	09/05/2024	N	PFC	NE
6947	1H, 1H, 2H, 2H-PERFLUOROOCTANESULFONIC ACID (6:2 FTS) 27619-97-2	08/30/2024	09/05/2024	N	PFC	NE
9340	2H,2H,3H,3H-PERFLUORODECANOIC ACID (7:3 FTCA) 812-70-4	08/30/2024	09/05/2024	N	PFC	NE
9338	2H,2H,3H,3H-PERFLUOROOCTANOIC ACID (5:3 FTCA) 914637-49-3	08/30/2024	09/05/2024	N	PFC	NE
9353	4,4,5,5,6,6-HEPAFLUOROHEXANOIC ACID (3:3 FTCA) 356-02-5	08/30/2024	09/05/2024	N	PFC	NE
6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (DONA) 919005-14-4	08/30/2024	09/05/2024	N	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF3ONS)	08/30/2024	09/05/2024	N	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA) (GENX) 13252-13-6	08/30/2024	09/05/2024	N	PFC	NE
9395	N-ETHYLPERFLUOROOCTANE SULFONAMIDE (ETFOSAM) 4151-50-2	08/30/2024	09/05/2024	N	PFC	NE
4846	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	08/30/2024	09/05/2024	N	PFC	NE

9431	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (ETFOSE) 1691-99-2	08/30/2024	09/05/2024	N	PFC	NE
9433	N-METHYLPERFLUOROOCTANE SULFONAMIDE (MEFOSA) 31506-32-8	08/30/2024	09/05/2024	N	PFC	NE
4847	N-METHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA) 2355-31-9	08/30/2024	09/05/2024	N	PFC	NE
6949	N-METHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (MEFOSE) 24448-09-7	08/30/2024	09/05/2024	N	PFC	NE
6956	NONFLUORO-3,6-DIOXAHEPTANOIC ACID (NFDHA) 151772-58-6	08/30/2024	09/05/2024	N	PFC	NE
6957	PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID (PFEESA) 113507-82-7	08/30/2024	09/05/2024	N	PFC	NE
6965	PERFLUORO-3-METHOXYPROPANOIC ACID (PFMPA) 377-73-1	08/30/2024	09/05/2024	N	PFC	NE
6966	PERFLUORO-4-METHOXYBUTANOIC ACID (PFMBA) 863090-89-5	08/30/2024	09/05/2024	N	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	08/30/2024	09/05/2024	N	PFC	NE
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	08/30/2024	09/05/2024	N	PFC	NE
6920	PERFLUORODECANE SULFONIC ACID (PFDS) 335-77-3	08/30/2024	09/05/2024	N	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	08/30/2024	09/05/2024	N	PFC	NE
6923	PERFLUORODODECANE SULFONIC ACID (PFDOS) 79780-39-5	08/30/2024	09/05/2024	N	PFC	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	08/30/2024	09/05/2024	N	PFC	NE
9470	PERFLUOROHEPTANE SULFONIC ACID (PFHPS) 375-92-8	08/30/2024	09/05/2024	N	PFC	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	08/30/2024	09/05/2024	N	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	08/30/2024	09/05/2024	N	PFC	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	08/30/2024	09/05/2024	N	PFC	NE
6929	PERFLUORONONANE SULFONIC ACID (PFNS) 68259-12-1	08/30/2024	09/05/2024	N	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	08/30/2024	09/05/2024	N	PFC	NE
6917	PERFLUOROOCTANE SULFONAMIDE (PFOSAM) 754-91-6	08/30/2024	09/05/2024	N	PFC	NE
6931	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	08/30/2024	09/05/2024	N	PFC	NE
6912	PERFLUOROOCTANOIC ACID (PFOA) 335-67-1	08/30/2024	09/05/2024	N	PFC	NE
6934	PERFLUOROPENTANE SULFONIC ACID (PFPES) 2706-91-4	08/30/2024	09/05/2024	N	PFC	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	08/30/2024	09/05/2024	N	PFC	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	08/30/2024	09/05/2024	N	PFC	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	08/30/2024	09/05/2024	N	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUNDA) 2058-94-8	08/30/2024	09/05/2024	N	PFC	NE

Method Code: 60001174 **Method Ref: ALPHA SOP 23528** **Revision: 17** **Date: 2022**

9490	11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF3OUDS)	10/14/2022	09/05/2025	N	PFC	NE

6948	1H, 1H, 2H, 2H-PERFLUORODECANESULFONIC ACID (8:2 FTS) 39108-34-4	10/14/2022	09/05/2025	N	PFC	NE
9616	1H, 1H, 2H, 2H-PERFLUORODODECANE SULFONIC ACID (10:2 FTS) 120226-60-0	10/14/2022	09/05/2025	N	PFC	NE
6946	1H, 1H, 2H, 2H-PERFLUOROHEXANESULFONIC ACID (4:2 FTS) 757124-72-4	10/14/2022	09/05/2025	N	PFC	NE
6947	1H, 1H, 2H, 2H-PERFLUOROOCTANESULFONIC ACID (6:2 FTS) 27619-97-2	10/14/2022	09/05/2025	N	PFC	NE
6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (DONA) 919005-14-4	10/14/2022	09/05/2025	N	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF3ONS)	10/14/2022	09/05/2025	N	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA) (GENX) 13252-13-6	10/14/2022	09/05/2025	N	PFC	NE
9395	N-ETHYLPERFLUOROOCTANE SULFONAMIDE (ETFOSAM) 4151-50-2	10/14/2022	09/05/2025	N	PFC	NE
4846	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	10/14/2022	09/05/2025	N	PFC	NE
9431	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (ETFOSE) 1691-99-2	10/14/2022	09/05/2025	N	PFC	NE
9433	N-METHYLPERFLUOROOCTANE SULFONAMIDE (MEFOSA) 31506-32-8	10/14/2022	09/05/2025	N	PFC	NE
4847	N-METHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA) 2355-31-9	10/14/2022	09/05/2025	N	PFC	NE
6949	N-METHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (MEFOSE) 24448-09-7	10/14/2022	09/05/2025	N	PFC	NE
6956	NONFLUORO-3,6-DIOXAHEPTANOIC ACID (NFDHA) 151772-58-6	10/14/2022	09/05/2025	N	PFC	NE
6957	PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID (PFEESA) 113507-82-7	10/14/2022	09/05/2025	N	PFC	NE
6965	PERFLUORO-3-METHOXYPROPANOIC ACID (PFMPA) 377-73-1	10/14/2022	09/05/2025	N	PFC	NE
6966	PERFLUORO-4-METHOXYBUTANOIC ACID (PFMBA) 863090-89-5	10/14/2022	09/05/2025	N	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	10/14/2022	09/05/2025	N	PFC	NE
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	10/14/2022	09/05/2025	N	PFC	NE
6920	PERFLUORODECANE SULFONIC ACID (PFDS) 335-77-3	10/14/2022	09/05/2025	N	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	10/14/2022	09/05/2025	N	PFC	NE
6923	PERFLUORODODECANE SULFONIC ACID (PFDOS) 79780-39-5	10/14/2022	09/05/2025	N	PFC	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	10/14/2022	09/05/2025	N	PFC	NE
9470	PERFLUOROHEPTANE SULFONIC ACID (PFHPS) 375-92-8	10/14/2022	09/05/2025	N	PFC	NE

6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	10/14/2022	09/05/2025	N	PFC	NE
6901	PERFLUOROHEXADECANOIC ACID (PFHXDA) 67905-19-5	10/14/2022	09/05/2025	N	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	10/14/2022	09/05/2025	N	PFC	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	10/14/2022	09/05/2025	N	PFC	NE
6929	PERFLUORONONANE SULFONIC ACID (PFNS) 68259-12-1	10/14/2022	09/05/2025	N	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	10/14/2022	09/05/2025	N	PFC	NE
6916	PERFLUOROOCTADECANOIC ACID (PFODA) 16517-11-6	10/14/2022	09/05/2025	N	PFC	NE
6917	PERFLUOROOCTANE SULFONAMIDE (PFOSAM) 754-91-6	10/14/2022	09/05/2025	N	PFC	NE
6931	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	10/14/2022	09/05/2025	N	PFC	NE
6912	PERFLUOROOCTANOIC ACID (PFOA) 335-67-1	10/14/2022	09/05/2025	N	PFC	NE
6934	PERFLUOROPENTANE SULFONIC ACID (PFPES) 2706-91-4	10/14/2022	09/05/2025	N	PFC	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	10/14/2022	09/05/2025	N	PFC	NE
9320	PERFLUOROPROPANESULFONIC ACID (PFPRS) 423-41-6	10/14/2022	09/05/2025	N	PFC	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	10/14/2022	09/05/2025	N	PFC	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	10/14/2022	09/05/2025	N	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUNDA) 2058-94-8	10/14/2022	09/05/2025	N	PFC	NE

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1000	ALUMINUM	06/29/2018	09/05/2025	SC	MET	NE
1005	ANTIMONY	06/29/2018	09/05/2025	SC	MET	NE
1010	ARSENIC	06/29/2018	09/05/2025	SC	MET	NE
1015	BARIUM	06/29/2018	09/05/2025	SC	MET	NE
1020	BERYLLIUM	06/29/2018	09/05/2025	SC	MET	NE
1025	BORON	06/29/2018	09/05/2025	SC	MET	NE
1030	CADMIUM	06/29/2018	09/05/2025	SC	MET	NE
1035	CALCIUM	06/29/2018	09/05/2025	SC	MET	NE
1040	CHROMIUM	06/29/2018	09/05/2025	SC	MET	NE
1050	COBALT	06/29/2018	09/05/2025	SC	MET	NE
1055	COPPER	06/29/2018	09/05/2025	SC	MET	NE
1070	IRON	06/29/2018	09/05/2025	SC	MET	NE
1075	LEAD	06/29/2018	09/05/2025	SC	MET	NE
1080	LITHIUM	10/30/2023	09/05/2025	SC	MET	NE
1085	MAGNESIUM	06/29/2018	09/05/2025	SC	MET	NE
1090	MANGANESE	06/29/2018	09/05/2025	SC	MET	NE
1100	MOLYBDENUM	06/29/2018	09/05/2025	SC	MET	NE
1105	NICKEL	06/29/2018	09/05/2025	SC	MET	NE
1125	POTASSIUM	06/29/2018	09/05/2025	SC	MET	NE

1140	SELENIUM	06/29/2018	09/05/2025	SC	MET	NE
1150	SILVER	06/29/2018	09/05/2025	SC	MET	NE
1155	SODIUM	06/29/2018	09/05/2025	SC	MET	NE
1160	STRONTIUM	06/29/2018	09/05/2025	SC	MET	NE
1165	THALLIUM	06/29/2018	09/05/2025	SC	MET	NE
1175	TIN	06/29/2018	09/05/2025	SC	MET	NE
1180	TITANIUM	06/29/2018	09/05/2025	SC	MET	NE
1185	VANADIUM	06/29/2018	09/05/2025	SC	MET	NE
1190	ZINC	06/29/2018	09/05/2025	SC	MET	NE

Method Code: 10156420 Method Ref: SW-846 6020B Revision: UPDATE V Date: 2014

1000	ALUMINUM	06/29/2018	09/05/2025	SC	MET	NE
1005	ANTIMONY	06/29/2018	09/05/2025	SC	MET	NE
1010	ARSENIC	06/29/2018	09/05/2025	SC	MET	NE
1015	BARIUM	06/29/2018	09/05/2025	SC	MET	NE
1020	BERYLLIUM	06/29/2018	09/05/2025	SC	MET	NE
1030	CADMIUM	06/29/2018	09/05/2025	SC	MET	NE
1035	CALCIUM	06/29/2018	09/05/2025	SC	MET	NE
1040	CHROMIUM	06/29/2018	09/05/2025	SC	MET	NE
1050	COBALT	06/29/2018	09/05/2025	SC	MET	NE
1055	COPPER	06/29/2018	09/05/2025	SC	MET	NE
1070	IRON	06/29/2018	09/05/2025	SC	MET	NE
1075	LEAD	06/29/2018	09/05/2025	SC	MET	NE
1085	MAGNESIUM	06/29/2018	09/05/2025	SC	MET	NE
1090	MANGANESE	06/29/2018	09/05/2025	SC	MET	NE
1100	MOLYBDENUM	06/29/2018	09/05/2025	SC	MET	NE
1105	NICKEL	06/29/2018	09/05/2025	SC	MET	NE
1125	POTASSIUM	06/29/2018	09/05/2025	SC	MET	NE
1140	SELENIUM	06/29/2018	09/05/2025	SC	MET	NE
1150	SILVER	06/29/2018	09/05/2025	SC	MET	NE
1155	SODIUM	06/29/2018	09/05/2025	SC	MET	NE
1160	STRONTIUM	06/29/2018	09/05/2025	SC	MET	NE
1165	THALLIUM	06/29/2018	09/05/2025	SC	MET	NE
1175	TIN	06/29/2018	09/05/2025	SC	MET	NE
1185	VANADIUM	06/29/2018	09/05/2025	SC	MET	NE
1190	ZINC	06/29/2018	09/05/2025	SC	MET	NE

Method Code: 10166457	**Method Ref: SW-846 7471B**		**Revision: UPDATE IV**		**Date: 2007**	
1095	MERCURY	12/29/2017	09/05/2025	SC	MET	NE
Method Code: 10167007	**Method Ref: SW-846 7474**		**Revision:**		**Date: 2007**	
1095	MERCURY	02/21/2017	09/05/2025	SC	MET	NE
Method Code: 10155916	**Method Ref: SW-846 6010D**		**Revision: UPDATE V**		**Date: 2014**	
2017	SULFUR	06/29/2018	09/05/2025	SC	NMI	NE
Method Code: 10244823	**Method Ref: SW-846 9060A**		**Revision: UPDATE IIIB**		**Date: 2004**	
2040	TOTAL ORGANIC CARBON (TOC)	02/21/2017	09/05/2025	SC	NMI	NE
Method Code: 20005203	**Method Ref: SM 2540 G**		**Revision: 18th ED**		**Date: 1992**	
1950	RESIDUE-TOTAL (TS)	02/21/2017	09/05/2025	SC	NMI	NE
Method Code: 60041001	**Method Ref: LLOYD KAHN**		**Revision:**		**Date: 1988**	
2040	TOTAL ORGANIC CARBON (TOC)	02/21/2017	09/05/2025	SC	NMI	NE
Method Code: 10135601	**Method Ref: SW-846 3050B**		**Revision: UPDATE III**		**Date: 1996**	
1400	ACID DIGESTION OF SOLIDS	02/21/2017	09/05/2025	SC	PRE	NE
Method Code: 10136002	**Method Ref: SW-846 3051A**		**Revision: UPDATE IV**		**Date: 2007**	
1426	MICROWAVE DIGESTION OF SOLIDS	02/21/2017	09/05/2025	SC	PRE	NE
Method Code: 10142708	**Method Ref: SW-846 3570**		**Revision:**		**Date: 2002**	
1429	MICROSCALE SOLVENT EXTRACTION	02/21/2017	09/05/2025	SC	PRE	NE
Method Code: 10143007	**Method Ref: SW-846 3580A**		**Revision: UPDATE I**		**Date: 1992**	
1470	WASTE DILUTION	02/21/2017	09/05/2025	SC	PRE	NE
Method Code: 10146802	**Method Ref: SW-846 3630C**		**Revision: UPDATE III**		**Date: 1996**	
1446	SILICA GEL CLEAN-UP	02/21/2017	09/05/2025	SC	PRE	NE
Method Code: 10147203	**Method Ref: SW-846 3640A**		**Revision: UPDATE II**		**Date: 1994**	
1418	GEL-PERMEATION CLEAN-UP	02/21/2017	09/05/2025	SC	PRE	NE
Method Code: 10148400	**Method Ref: SW-846 3660B**		**Revision: UPDATE III**		**Date: 1996**	
1456	SULFUR CLEAN-UP	02/21/2017	09/05/2025	SC	PRE	NE
Method Code: 10148808	**Method Ref: SW-846 3665A**		**Revision: UPDATE III**		**Date: 1996**	
1458	SULFURIC ACID / PERMANGANATE CLEAN-UP	02/21/2017	09/05/2025	SC	PRE	NE
Method Code: 10242543	**Method Ref: SW-846 8270E**		**Revision: UPDATE VI**		**Date: 2018**	
5155	1,2,4-TRICHLOROBENZENE	07/07/2022	09/05/2025	SC	VOC	NE
4610	1,2-DICHLOROBENZENE (O-DICHLOROBENZENE)	07/07/2022	09/05/2025	SC	VOC	NE
4615	1,3-DICHLOROBENZENE (M-DICHLOROBENZNE)	07/07/2022	09/05/2025	SC	VOC	NE
4620	1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	07/07/2022	09/05/2025	SC	VOC	NE
4835	HEXACHLOROBUTADIENE	07/07/2022	09/05/2025	SC	VOC	NE
4840	HEXACHLOROETHANE	07/07/2022	09/05/2025	SC	VOC	NE
5005	NAPHTHALENE	07/07/2022	09/05/2025	SC	VOC	NE
5015	NITROBENZENE	07/07/2022	09/05/2025	SC	VOC	NE
5095	PYRIDINE	07/07/2022	09/05/2025	SC	VOC	NE

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5005	NAPHTHALENE	07/13/2020	09/05/2025	SC	VOC	NE

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4750	ETHANOL	02/21/2017	09/05/2025	SC	VOC	NE
4785	ETHYLENE GLYCOL	02/21/2017	09/05/2025	SC	VOC	NE
4875	ISOBUTYL ALCOHOL (2-METHYL-1-PROPANOL)	02/21/2017	09/05/2025	SC	VOC	NE
4895	ISOPROPYL ALCOHOL (2-PROPANOL, ISOPROPANOL)	02/21/2017	09/05/2025	SC	VOC	NE
4930	METHANOL	02/21/2017	09/05/2025	SC	VOC	NE
5055	N-PROPANOL	02/21/2017	09/05/2025	SC	VOC	NE
4368	TERT-AMYL ALCOHOL (TAA)	02/21/2017	09/05/2025	SC	VOC	NE
4420	TERT-BUTYL ALCOHOL (2-METHYL-2-PROPANOL)	02/21/2017	09/05/2025	SC	VOC	NE

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4735	1,4-DIOXANE (1 4-DIETHYLENEOXIDE)	05/29/2024	09/05/2025	SC	VOC	NE

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6275	HEXACHLOROBENZENE	08/15/2022	09/05/2025	SC	SBN	NE

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6703	1,1'-BIPHENYL (BZ-0)	07/07/2022	09/05/2025	SC	SBN	NE
6715	1,2,4,5-TETRACHLOROBENZENE	07/07/2022	09/05/2025	SC	SBN	NE
6220	1,2-DIPHENYLHYDRAZINE	07/07/2022	09/05/2025	SC	SBN	NE
4659	2,2'-OXYBIS(1-CHLOROPROPANE), BIS(2-CHLORO-1-METHYLETHYL)ETHER	07/07/2022	09/05/2025	SC	SBN	NE
6735	2,3,4,6-TETRACHLOROPHENOL	07/07/2022	09/05/2025	SC	SBN	NE
6835	2,4,5-TRICHLOROPHENOL	07/07/2022	09/05/2025	SC	SBN	NE
6840	2,4,6-TRICHLOROPHENOL	07/07/2022	09/05/2025	SC	SBN	NE
6000	2,4-DICHLOROPHENOL	07/07/2022	09/05/2025	SC	SBN	NE
6130	2,4-DIMETHYLPHENOL	07/07/2022	09/05/2025	SC	SBN	NE
6175	2,4-DINITROPHENOL	07/07/2022	09/05/2025	SC	SBN	NE
6185	2,4-DINITROTOLUENE (2,4-DNT)	07/07/2022	09/05/2025	SC	SBN	NE
6190	2,6-DINITROTOLUENE (2,6-DNT)	07/07/2022	09/05/2025	SC	SBN	NE
5795	2-CHLORONAPHTHALENE	07/07/2022	09/05/2025	SC	SBN	NE
5800	2-CHLOROPHENOL	07/07/2022	09/05/2025	SC	SBN	NE
6360	2-METHYL-4,6-DINITROPHENOL (4,6-DINITRO-2-METHYLPHENOL)	07/07/2022	09/05/2025	SC	SBN	NE
6385	2-METHYLNAPHTHALENE	07/07/2022	09/05/2025	SC	SBN	NE
6400	2-METHYLPHENOL (O-CRESOL)	07/07/2022	09/05/2025	SC	SBN	NE
6460	2-NITROANILINE	07/07/2022	09/05/2025	SC	SBN	NE
6490	2-NITROPHENOL	07/07/2022	09/05/2025	SC	SBN	NE

5945	3,3'-DICHLOROBENZIDINE	07/07/2022	09/05/2025	SC	SBN	NE
6405	3-METHYLPHENOL (M-CRESOL)	07/07/2022	09/05/2025	SC	SBN	NE
6465	3-NITROANILINE	07/07/2022	09/05/2025	SC	SBN	NE
5660	4-BROMOPHENYL PHENYL ETHER (BDE-3)	07/07/2022	09/05/2025	SC	SBN	NE
5700	4-CHLORO-3-METHYLPHENOL	07/07/2022	09/05/2025	SC	SBN	NE
5745	4-CHLOROANILINE	07/07/2022	09/05/2025	SC	SBN	NE
5825	4-CHLOROPHENYL PHENYLETHER	07/07/2022	09/05/2025	SC	SBN	NE
6410	4-METHYLPHENOL (P-CRESOL)	07/07/2022	09/05/2025	SC	SBN	NE
6470	4-NITROANILINE	07/07/2022	09/05/2025	SC	SBN	NE
6500	4-NITROPHENOL	07/07/2022	09/05/2025	SC	SBN	NE
5500	ACENAPHTHENE	07/07/2022	09/05/2025	SC	SBN	NE
5505	ACENAPHTHYLENE	07/07/2022	09/05/2025	SC	SBN	NE
5510	ACETOPHENONE	07/07/2022	09/05/2025	SC	SBN	NE
5545	ANILINE	07/07/2022	09/05/2025	SC	SBN	NE
5555	ANTHRACENE	07/07/2022	09/05/2025	SC	SBN	NE
5570	BENZALDEHYDE	07/07/2022	09/05/2025	SC	SBN	NE
5595	BENZIDINE	07/07/2022	09/05/2025	SC	SBN	NE
5575	BENZO(A)ANTHRACENE	07/07/2022	09/05/2025	SC	SBN	NE
5580	BENZO(A)PYRENE	07/07/2022	09/05/2025	SC	SBN	NE
5585	BENZO(B)FLUORANTHENE	07/07/2022	09/05/2025	SC	SBN	NE
5590	BENZO(G,H,I)PERYLENE	07/07/2022	09/05/2025	SC	SBN	NE
5600	BENZO(K)FLUORANTHENE	07/07/2022	09/05/2025	SC	SBN	NE
5610	BENZOIC ACID	07/07/2022	09/05/2025	SC	SBN	NE
5630	BENZYL ALCOHOL	07/07/2022	09/05/2025	SC	SBN	NE
5760	BIS(2-CHLOROETHOXY)METHANE	07/07/2022	09/05/2025	SC	SBN	NE
5765	BIS(2-CHLOROETHYL) ETHER	07/07/2022	09/05/2025	SC	SBN	NE
5670	BUTYL BENZYL PHTHALATE	07/07/2022	09/05/2025	SC	SBN	NE
5680	CARBAZOLE	07/07/2022	09/05/2025	SC	SBN	NE
5855	CHRYSENE	07/07/2022	09/05/2025	SC	SBN	NE
6065	DI(2-ETHYLHEXYL) PHTHALATE (BIS(2-ETHYLHEXYL)PHTHALATE, DEHP)	07/07/2022	09/05/2025	SC	SBN	NE
5925	DI-N-BUTYL PHTHALATE	07/07/2022	09/05/2025	SC	SBN	NE
6200	DI-N-OCTYL PHTHALATE	07/07/2022	09/05/2025	SC	SBN	NE
5895	DIBENZO(A,H)ANTHRACENE	07/07/2022	09/05/2025	SC	SBN	NE
5905	DIBENZOFURAN	07/07/2022	09/05/2025	SC	SBN	NE
6070	DIETHYL PHTHALATE	07/07/2022	09/05/2025	SC	SBN	NE

6135	DIMETHYL PHTHALATE	07/07/2022	09/05/2025	SC	SBN	NE
6265	FLUORANTHENE	07/07/2022	09/05/2025	SC	SBN	NE
6270	FLUORENE	07/07/2022	09/05/2025	SC	SBN	NE
6275	HEXACHLOROBENZENE	07/07/2022	09/05/2025	SC	SBN	NE
6315	INDENO(1,2,3-CD)PYRENE	07/07/2022	09/05/2025	SC	SBN	NE
6320	ISOPHORONE	07/07/2022	09/05/2025	SC	SBN	NE
6545	N-NITROSODI-N-PROPYLAMINE	07/07/2022	09/05/2025	SC	SBN	NE
6530	N-NITROSODIMETHYLAMINE	07/07/2022	09/05/2025	SC	SBN	NE
6535	N-NITROSODIPHENYLAMINE	07/07/2022	09/05/2025	SC	SBN	NE
6600	PENTACHLORONITROBENZENE	07/07/2022	09/05/2025	SC	SBN	NE
6605	PENTACHLOROPHENOL	07/07/2022	09/05/2025	SC	SBN	NE
6615	PHENANTHRENE	07/07/2022	09/05/2025	SC	SBN	NE
6625	PHENOL	07/07/2022	09/05/2025	SC	SBN	NE
6665	PYRENE	07/07/2022	09/05/2025	SC	SBN	NE

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6380	1-METHYLNAPHTHALENE	07/13/2020	09/05/2025	SC	SBN	NE
6385	2-METHYLNAPHTHALENE	07/13/2020	09/05/2025	SC	SBN	NE
5500	ACENAPHTHENE	07/13/2020	09/05/2025	SC	SBN	NE
5505	ACENAPHTHYLENE	07/13/2020	09/05/2025	SC	SBN	NE
9297	ALKALATED PAHS	07/13/2020	09/05/2025	SC	SBN	NE
5555	ANTHRACENE	07/13/2020	09/05/2025	SC	SBN	NE
5575	BENZO(A)ANTHRACENE	07/13/2020	09/05/2025	SC	SBN	NE
5580	BENZO(A)PYRENE	07/13/2020	09/05/2025	SC	SBN	NE
5585	BENZO(B)FLUORANTHENE	07/13/2020	09/05/2025	SC	SBN	NE
5590	BENZO(G,H,I)PERYLENE	07/13/2020	09/05/2025	SC	SBN	NE
5600	BENZO(K)FLUORANTHENE	07/13/2020	09/05/2025	SC	SBN	NE
5855	CHRYSENE	07/13/2020	09/05/2025	SC	SBN	NE
5895	DIBENZO(A,H)ANTHRACENE	07/13/2020	09/05/2025	SC	SBN	NE
6265	FLUORANTHENE	07/13/2020	09/05/2025	SC	SBN	NE
6270	FLUORENE	07/13/2020	09/05/2025	SC	SBN	NE
6315	INDENO(1,2,3-CD)PYRENE	07/13/2020	09/05/2025	SC	SBN	NE
6605	PENTACHLOROPHENOL	07/13/2020	09/05/2025	SC	SBN	NE
6615	PHENANTHRENE	07/13/2020	09/05/2025	SC	SBN	NE
6665	PYRENE	07/13/2020	09/05/2025	SC	SBN	NE

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6657	PROPYLENE GLYCOL	02/21/2017	09/05/2025	SC	SBN	NE

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9369	DIESEL RANGE ORGANICS (DRO)	02/21/2017	09/05/2025	SC	SNO	NE
Method Code: 10179201	**Method Ref: SW-846 8082A**		**Revision:**		**Date: 2000**	
8880	AROCLOR-1016 (PCB-1016)	02/21/2017	09/05/2025	SC	SPC	NE
8885	AROCLOR-1221 (PCB-1221)	02/21/2017	09/05/2025	SC	SPC	NE
8890	AROCLOR-1232 (PCB-1232)	02/21/2017	09/05/2025	SC	SPC	NE
8895	AROCLOR-1242 (PCB-1242)	02/21/2017	09/05/2025	SC	SPC	NE
8900	AROCLOR-1248 (PCB-1248)	02/21/2017	09/05/2025	SC	SPC	NE
8905	AROCLOR-1254 (PCB-1254)	02/21/2017	09/05/2025	SC	SPC	NE
8910	AROCLOR-1260 (PCB-1260)	02/21/2017	09/05/2025	SC	SPC	NE
8912	AROCLOR-1262 (PCB-1262)	02/21/2017	09/05/2025	SC	SPC	NE
8913	AROCLOR-1268 (PCB-1268)	02/21/2017	09/05/2025	SC	SPC	NE
Method Code: 10178811	**Method Ref: SW-846 8081B**		**Revision: UPDATE IV**		**Date: 2007**	
7355	4,4'-DDD	08/15/2022	09/05/2025	SC	SPE	NE
7360	4,4'-DDE	08/15/2022	09/05/2025	SC	SPE	NE
7365	4,4'-DDT	08/15/2022	09/05/2025	SC	SPE	NE
7025	ALDRIN	08/15/2022	09/05/2025	SC	SPE	NE
7110	ALPHA-BHC (ALPHA-HEXACHLOROCYCLOHEXANE)	08/15/2022	09/05/2025	SC	SPE	NE
7115	BETA-BHC (BETA-HEXACHLOROCYCLOHEXANE)	08/15/2022	09/05/2025	SC	SPE	NE
7250	CHLORDANE (TECH.)	08/15/2022	09/05/2025	SC	SPE	NE
7240	CIS-CHLORDANE (ALPHA-CHLORDANE)	08/15/2022	09/05/2025	SC	SPE	NE
7105	DELTA-BHC	08/15/2022	09/05/2025	SC	SPE	NE
7470	DIELDRIN	08/15/2022	09/05/2025	SC	SPE	NE
7510	ENDOSULFAN I	08/15/2022	09/05/2025	SC	SPE	NE
7515	ENDOSULFAN II	08/15/2022	09/05/2025	SC	SPE	NE
7520	ENDOSULFAN SULFATE	08/15/2022	09/05/2025	SC	SPE	NE
7540	ENDRIN	08/15/2022	09/05/2025	SC	SPE	NE
7530	ENDRIN ALDEHYDE	08/15/2022	09/05/2025	SC	SPE	NE
7535	ENDRIN KETONE	08/15/2022	09/05/2025	SC	SPE	NE
7120	GAMMA-BHC (LINDANE, GAMMA-HEXACHLOROCYCLOHEXANE)	08/15/2022	09/05/2025	SC	SPE	NE
7245	GAMMA-CHLORDANE	08/15/2022	09/05/2025	SC	SPE	NE
7685	HEPTACHLOR	08/15/2022	09/05/2025	SC	SPE	NE
7690	HEPTACHLOR EPOXIDE	08/15/2022	09/05/2025	SC	SPE	NE
7810	METHOXYCHLOR	08/15/2022	09/05/2025	SC	SPE	NE
7870	MIREX	08/15/2022	09/05/2025	SC	SPE	NE
8250	TOXAPHENE (CHLORINATED CAMPHENE)	08/15/2022	09/05/2025	SC	SPE	NE

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7180	CAPROLACTAM	07/07/2022	09/05/2025	SC	SPE	NE
6285	HEXACHLOROCYCLOPENTADIENE	07/07/2022	09/05/2025	SC	SPE	NE
Method Code: 10123430	**Method Ref: EPA 1633 DRAFT 2**		**Revision: DRAFT 2**		**Date: 2022**	
9490	11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF3OUDS)	09/22/2023	09/05/2025	SC	PFC	NE
6948	1H, 1H, 2H, 2H-PERFLUORODECANESULFONIC ACID (8:2 FTS) 39108-34-4	09/22/2023	09/05/2025	SC	PFC	NE
9616	1H, 1H, 2H, 2H-PERFLUORODODECANE SULFONIC ACID (10:2 FTS) 120226-60-0	09/22/2023	09/05/2025	SC	PFC	NE
6946	1H, 1H, 2H, 2H-PERFLUOROHEXANESULFONIC ACID (4:2 FTS) 757124-72-4	09/22/2023	09/05/2025	SC	PFC	NE
6947	1H, 1H, 2H, 2H-PERFLUOROOCTANESULFONIC ACID (6:2 FTS) 27619-97-2	09/22/2023	09/05/2025	SC	PFC	NE
9340	2H,2H,3H,3H-PERFLUORODECANOIC ACID (7:3 FTCA) 812-70-4	09/22/2023	09/05/2025	SC	PFC	NE
9338	2H,2H,3H,3H-PERFLUOROOCTANOIC ACID (5:3 FTCA) 914637-49-3	09/22/2023	09/05/2025	SC	PFC	NE
9353	4,4,5,5,6,6-HEPAFLUOROHEXANOIC ACID (3:3 FTCA) 356-02-5	09/22/2023	09/05/2025	SC	PFC	NE
6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (DONA) 919005-14-4	09/22/2023	09/05/2025	SC	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF3ONS)	09/22/2023	09/05/2025	SC	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA) (GENX) 13252-13-6	09/22/2023	09/05/2025	SC	PFC	NE
9395	N-ETHYLPERFLUOROOCTANE SULFONAMIDE (ETFOSAM) 4151-50-2	09/22/2023	09/05/2025	SC	PFC	NE
4846	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	09/22/2023	09/05/2025	SC	PFC	NE
9431	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (ETFOSE) 1691-99-2	09/22/2023	09/05/2025	SC	PFC	NE
9433	N-METHYLPERFLUOROOCTANE SULFONAMIDE (MEFOSA) 31506-32-8	09/22/2023	09/05/2025	SC	PFC	NE
4847	N-METHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA) 2355-31-9	09/22/2023	09/05/2025	SC	PFC	NE
6949	N-METHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (MEFOSE) 24448-09-7	09/22/2023	09/05/2025	SC	PFC	NE
6956	NONFLUORO-3,6-DIOXAHEPTANOIC ACID (NFDHA) 151772-58-6	09/22/2023	09/05/2025	SC	PFC	NE
6957	PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID (PFEESA) 113507-82-7	09/22/2023	09/05/2025	SC	PFC	NE
6965	PERFLUORO-3-METHOXYPROPANOIC ACID (PFMPA) 377-73-1	09/22/2023	09/05/2025	SC	PFC	NE

6966	PERFLUORO-4-METHOXYBUTANOIC ACID (PFMBA) 863090-89-5	09/22/2023	09/05/2025	SC	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	09/22/2023	09/05/2025	SC	PFC	NE
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	09/22/2023	09/05/2025	SC	PFC	NE
6920	PERFLUORODECANE SULFONIC ACID (PFDS) 335-77-3	09/22/2023	09/05/2025	SC	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	09/22/2023	09/05/2025	SC	PFC	NE
6923	PERFLUORODODECANE SULFONIC ACID (PFDOS) 79780-39-5	09/22/2023	09/05/2025	SC	PFC	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	09/22/2023	09/05/2025	SC	PFC	NE
9470	PERFLUOROHEPTANE SULFONIC ACID (PFHPS) 375-92-8	09/22/2023	09/05/2025	SC	PFC	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	09/22/2023	09/05/2025	SC	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	09/22/2023	09/05/2025	SC	PFC	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	09/22/2023	09/05/2025	SC	PFC	NE
6929	PERFLUORONONANE SULFONIC ACID (PFNS) 68259-12-1	09/22/2023	09/05/2025	SC	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	09/22/2023	09/05/2025	SC	PFC	NE
6917	PERFLUOROOCTANE SULFONAMIDE (PFOSAM) 754-91-6	09/22/2023	09/05/2025	SC	PFC	NE
6931	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	09/22/2023	09/05/2025	SC	PFC	NE
6912	PERFLUOROOCTANOIC ACID (PFOA) 335-67-1	09/22/2023	09/05/2025	SC	PFC	NE
6934	PERFLUOROPENTANE SULFONIC ACID (PFPES) 2706-91-4	09/22/2023	09/05/2025	SC	PFC	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	09/22/2023	09/05/2025	SC	PFC	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	09/22/2023	09/05/2025	SC	PFC	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	09/22/2023	09/05/2025	SC	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUNDA) 2058-94-8	09/22/2023	09/05/2025	SC	PFC	NE

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9490	11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF3OUDS)	08/30/2024	09/05/2024	SC	PFC	NE
6948	1H, 1H, 2H, 2H-PERFLUORODECANESULFONIC ACID (8:2 FTS) 39108-34-4	08/30/2024	09/05/2024	SC	PFC	NE
9616	1H, 1H, 2H, 2H-PERFLUORODODECANE SULFONIC ACID (10:2 FTS) 120226-60-0	08/30/2024	09/05/2024	SC	PFC	NE
6946	1H, 1H, 2H, 2H-PERFLUOROHEXANESULFONIC ACID (4:2 FTS) 757124-72-4	08/30/2024	09/05/2024	SC	PFC	NE
6947	1H, 1H, 2H, 2H-PERFLUOROOCTANESULFONIC ACID (6:2 FTS) 27619-97-2	08/30/2024	09/05/2024	SC	PFC	NE
9340	2H,2H,3H,3H-PERFLUORODECANOIC ACID (7:3 FTCA) 812-70-4	08/30/2024	09/05/2024	SC	PFC	NE
9338	2H,2H,3H,3H-PERFLUOROOCTANOIC ACID (5:3 FTCA) 914637-49-3	08/30/2024	09/05/2024	SC	PFC	NE
9353	4,4,5,5,6,6-HEPAFLUOROHEXANOIC ACID (3:3 FTCA) 356-02-5	08/30/2024	09/05/2024	SC	PFC	NE

6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (DONA) 919005-14-4	08/30/2024	09/05/2024	SC	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF3ONS)	08/30/2024	09/05/2024	SC	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA) (GENX) 13252-13-6	08/30/2024	09/05/2024	SC	PFC	NE
9395	N-ETHYLPERFLUOROOCTANE SULFONAMIDE (ETFOSAM) 4151-50-2	08/30/2024	09/05/2024	SC	PFC	NE
4846	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	08/30/2024	09/05/2024	SC	PFC	NE
9431	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (ETFOSE) 1691-99-2	08/30/2024	09/05/2024	SC	PFC	NE
9433	N-METHYLPERFLUOROOCTANE SULFONAMIDE (MEFOSA) 31506-32-8	08/30/2024	09/05/2024	SC	PFC	NE
4847	N-METHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA) 2355-31-9	08/30/2024	09/05/2024	SC	PFC	NE
6949	N-METHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (MEFOSE) 24448-09-7	08/30/2024	09/05/2024	SC	PFC	NE
6956	NONFLUORO-3,6-DIOXAHEPTANOIC ACID (NFDHA) 151772-58-6	08/30/2024	09/05/2024	SC	PFC	NE
6957	PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID (PFEESA) 113507-82-7	08/30/2024	09/05/2024	SC	PFC	NE
6965	PERFLUORO-3-METHOXYPROPANOIC ACID (PFMPA) 377-73-1	08/30/2024	09/05/2024	SC	PFC	NE
6966	PERFLUORO-4-METHOXYBUTANOIC ACID (PFMBA) 863090-89-5	08/30/2024	09/05/2024	SC	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	08/30/2024	09/05/2024	SC	PFC	NE
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	08/30/2024	09/05/2024	SC	PFC	NE
6920	PERFLUORODECANE SULFONIC ACID (PFDS) 335-77-3	08/30/2024	09/05/2024	SC	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	08/30/2024	09/05/2024	SC	PFC	NE
6923	PERFLUORODODECANE SULFONIC ACID (PFDOS) 79780-39-5	08/30/2024	09/05/2024	SC	PFC	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	08/30/2024	09/05/2024	SC	PFC	NE
9470	PERFLUOROHEPTANE SULFONIC ACID (PFHPS) 375-92-8	08/30/2024	09/05/2024	SC	PFC	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	08/30/2024	09/05/2024	SC	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	08/30/2024	09/05/2024	SC	PFC	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	08/30/2024	09/05/2024	SC	PFC	NE
6929	PERFLUORONONANE SULFONIC ACID (PFNS) 68259-12-1	08/30/2024	09/05/2024	SC	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	08/30/2024	09/05/2024	SC	PFC	NE
6917	PERFLUOROOCTANE SULFONAMIDE (PFOSAM) 754-91-6	08/30/2024	09/05/2024	SC	PFC	NE
6931	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	08/30/2024	09/05/2024	SC	PFC	NE

6912	PERFLUOROOCTANOIC ACID (PFOA) 335-67-1	08/30/2024	09/05/2024	SC	PFC	NE
6934	PERFLUOROPENTANE SULFONIC ACID (PFPES) 2706-91-4	08/30/2024	09/05/2024	SC	PFC	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	08/30/2024	09/05/2024	SC	PFC	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	08/30/2024	09/05/2024	SC	PFC	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	08/30/2024	09/05/2024	SC	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUNDA) 2058-94-8	08/30/2024	09/05/2024	SC	PFC	NE

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9490	11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF3OUDS)	10/14/2022	09/05/2025	SC	PFC	NE
6948	1H, 1H, 2H, 2H-PERFLUORODECANESULFONIC ACID (8:2 FTS) 39108-34-4	10/14/2022	09/05/2025	SC	PFC	NE
9616	1H, 1H, 2H, 2H-PERFLUORODODECANE SULFONIC ACID (10:2 FTS) 120226-60-0	10/14/2022	09/05/2025	SC	PFC	NE
6946	1H, 1H, 2H, 2H-PERFLUOROHEXANESULFONIC ACID (4:2 FTS) 757124-72-4	10/14/2022	09/05/2025	SC	PFC	NE
6947	1H, 1H, 2H, 2H-PERFLUOROOCTANESULFONIC ACID (6:2 FTS) 27619-97-2	10/14/2022	09/05/2025	SC	PFC	NE
6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (DONA) 919005-14-4	10/14/2022	09/05/2025	SC	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF3ONS)	10/14/2022	09/05/2025	SC	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA) (GENX) 13252-13-6	10/14/2022	09/05/2025	SC	PFC	NE
9395	N-ETHYLPERFLUOROOCTANE SULFONAMIDE (ETFOSAM) 4151-50-2	10/14/2022	09/05/2025	SC	PFC	NE
4846	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	10/14/2022	09/05/2025	SC	PFC	NE
9431	N-ETHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (ETFOSE) 1691-99-2	10/14/2022	09/05/2025	SC	PFC	NE
9433	N-METHYLPERFLUOROOCTANE SULFONAMIDE (MEFOSA) 31506-32-8	10/14/2022	09/05/2025	SC	PFC	NE
4847	N-METHYLPERFLUOROOCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA) 2355-31-9	10/14/2022	09/05/2025	SC	PFC	NE
6949	N-METHYLPERFLUOROOCTANE SULFONAMIDO ETHANOL (MEFOSE) 24448-09-7	10/14/2022	09/05/2025	SC	PFC	NE
6956	NONFLUORO-3,6-DIOXAHEPTANOIC ACID (NFDHA) 151772-58-6	10/14/2022	09/05/2025	SC	PFC	NE
6957	PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID (PFEESA) 113507-82-7	10/14/2022	09/05/2025	SC	PFC	NE
6965	PERFLUORO-3-METHOXYPROPANOIC ACID (PFMPA) 377-73-1	10/14/2022	09/05/2025	SC	PFC	NE

6966	PERFLUORO-4-METHOXYBUTANOIC ACID (PFMBA) 863090-89-5	10/14/2022	09/05/2025	SC	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	10/14/2022	09/05/2025	SC	PFC	NE
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	10/14/2022	09/05/2025	SC	PFC	NE
6920	PERFLUORODECANE SULFONIC ACID (PFDS) 335-77-3	10/14/2022	09/05/2025	SC	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	10/14/2022	09/05/2025	SC	PFC	NE
6923	PERFLUORODODECANE SULFONIC ACID (PFDOS) 79780-39-5	10/14/2022	09/05/2025	SC	PFC	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	10/14/2022	09/05/2025	SC	PFC	NE
9470	PERFLUOROHEPTANE SULFONIC ACID (PFHPS) 375-92-8	10/14/2022	09/05/2025	SC	PFC	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	10/14/2022	09/05/2025	SC	PFC	NE
6901	PERFLUOROHEXADECANOIC ACID (PFHXDA) 67905-19-5	10/14/2022	09/05/2025	SC	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	10/14/2022	09/05/2025	SC	PFC	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	10/14/2022	09/05/2025	SC	PFC	NE
6929	PERFLUORONONANE SULFONIC ACID (PFNS) 68259-12-1	10/14/2022	09/05/2025	SC	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	10/14/2022	09/05/2025	SC	PFC	NE
6916	PERFLUOROOCTADECANOIC ACID (PFODA) 16517-11-6	10/14/2022	09/05/2025	SC	PFC	NE
6917	PERFLUOROOCTANE SULFONAMIDE (PFOSAM) 754-91-6	10/14/2022	09/05/2025	SC	PFC	NE
6931	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	10/14/2022	09/05/2025	SC	PFC	NE
6912	PERFLUOROOCTANOIC ACID (PFOA) 335-67-1	10/14/2022	09/05/2025	SC	PFC	NE
6934	PERFLUOROPENTANE SULFONIC ACID (PFPES) 2706-91-4	10/14/2022	09/05/2025	SC	PFC	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	10/14/2022	09/05/2025	SC	PFC	NE
9320	PERFLUOROPROPANESULFONIC ACID (PFPRS) 423-41-6	10/14/2022	09/05/2025	SC	PFC	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	10/14/2022	09/05/2025	SC	PFC	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	10/14/2022	09/05/2025	SC	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUNDA) 2058-94-8	10/14/2022	09/05/2025	SC	PFC	NE

Bill Hall

ALPHA ANA 10/7/2024

Bill Hall
NH ELAP Program Manager
Issue Date: 10/07/2024

Matrix Legend: AE=Air; BT=Tissue; D=Drinking Water; N=Non-Potable Water; SC=Solid and Chemical Materials

Category Legend: MIC=Microbiology; MET=Metals; NMI=Non-Metal Inorganics; PRE=Preparation; VOC=Volatile Organic Compounds; SBN=SVOC-BNA; SHE=SVOC-Herbicides; SNO=SVOC-NOS; SPC=SVOC-PCB; SPE=SVOC-Pesticides; RAD=Radiochemistry; WET=Wet, PFC=Perfluorinated compound

Accreditation Legend: NE=NELAP; NH=NH State Certification; CE=State Certification; IN=Interim (NELAP); WI=Withdrawn; AP=Applied; RE=Revoked; SU=Suspended

ENV-SOP-MANS-0111 v01 Preparation and Analysis of PFAS in Aqueous, Solid, and Tissue by EPA Method 1633

Effective Date: 08/07/2024

Management Approval:
John Trimble Approved on 8/7/2024 11:55:41 AM
Laura Vanasse Approved on 8/7/2024 11:32:33 AM
Pete Henriksen Approved on 8/7/2024 10:20:05 AM
Jason Hebert Approved on 8/7/2024 12:02:07 PM

1.0 SCOPE & APPLICATION

This standard operating procedure (SOP) describes the laboratory procedure used by Alpha, a Pace Analytical Laboratory for the determination of the per- and polyfluoroalkyl substances (PFAS) by liquid chromatography/mass spectrometry (LC-MS/MS) following EPA 1633, published January 2024. This SOP is applicable to aqueous (all non-potable water and leachate), solid (soil, biosolids, sediment), and tissue matrices.

The instrumental portion of this method is for use only by analysts experienced with LC-MS/MS or under the close supervision of such qualified persons. The laboratory must demonstrate the ability to generate acceptable results using the procedures in Sections 11.3.1 and 11.3.2.

By their very nature, many components of PFAS present analytical challenges unique to this class of analytes. For example, PFAS analytes readily adhere to the walls of the sample containers and may also stratify in the container.

1.1 Target Analyte List, Limits of Detection & Quantitation (LOD & LOQ)

The target analytes that can be determined by this SOP and the associated LODs and LOQs are provided in Appendix A, Tables 1, 2, and 3.

LOQs are established in accordance with PAS policies and procedures for method validation, determination of detection limits (LOD), and quantitation limits (LOQ). Refer to laboratory SOP ID 1732 (Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ)) for additional information. DL and LOQ are routinely verified and updated when needed. DL and LOQ are always adjusted to account for actual sample amounts used and for dilution.

The reporting limit (RL) is the value to which analytes are reported as detected or non-detect in the final report. When the RL is less than the lower limit of quantitation (LLOQ), all detections and non-detects at the RL are qualitative. The LLOQ is the lowest point of the calibration curve used for each target analyte.

1.2 Reference Methods & Documents

This SOP is based on reference method EPA 1633 (2024). If the laboratory procedure is modified from the reference method, a list of modifications and rationale for the modifications is provided in Section 14.0. Modifications are permitted when allowed by the regulatory program for which test results will be used and when the modification has been validated comparable and equivalent to the reference method.

1.3 Quantitation Range

The quantitation range for each target analyte in this procedure is defined in Appendix A, Table 5: Calibration Standard Concentrations.

1.4 Program Specific Requirements

Not Applicable.

2.0 SUMMARY OF METHOD

Environmental samples are prepared and extracted using method-specific procedures. Sample extracts are subjected to cleanup procedures designed to remove interferences. Analyses of the sample extracts are conducted by LC-MS/MS in the multiple reaction monitoring (MRM) mode. Sample concentrations are determined by isotope dilution or extracted internal standard quantification (see Section 9.2.1) using isotopically labeled compounds added to the samples before extraction.

Individual PFAS analytes are identified through peak analysis of the quantification and confirmation ions, where applicable. Where linear and branched isomers are present in the sample and either qualitative or quantitative standards containing branched and linear isomers are commercially available, the PFAS analyte is reported as a single analyte consisting of the sum of the linear and branched isomer concentrations.

Quantitative determination of target analyte concentrations is made with respect to an isotopically labeled PFAS standard; the concentrations are then used to convert raw peak areas in sample chromatograms to final concentrations.

Results for target analytes are recovery corrected by the method of quantification (i.e., either isotope dilution or extracted internal standard quantification, see Section 9.2.1). Recoveries of isotopically labeled extracted internal standards (EIS) are determined by comparison to the responses of one of seven non-extracted internal standards (NIS) and are used as general indicators of overall analytical quality.

The quality of the analysis is assured through reproducible calibration and testing of the extraction, cleanup, and LC-MS/MS systems.

- Aqueous samples are spiked with isotopically labeled standards (EIS), extracted using solid-phase extraction (SPE) cartridges and undergo cleanup using carbon before analysis.
- Solid samples are spiked with EIS, extracted into basic methanol, and cleaned up by carbon and SPE cartridges before analysis.
- Tissue samples are spiked with EIS, extracted in methanol with potassium hydroxide followed by acetonitrile, and cleaned up by carbon and SPE cartridges before analysis.

3.0 INTERFERENCES

Solvents, reagents, glassware, and other sample processing hardware may yield artifacts and elevated baselines causing misinterpretation of chromatograms. Specific selection of reagents and solvents is required.

Clean all equipment prior to, and after, each use to avoid PFAS cross-contamination. Typical cleaning solvents include water, methanol, and methanolic ammonium hydroxide. The residual PFAS content of disposable plasticware and filters must be verified by batch/lot number and may be used without cleaning if PFAS levels are less than the Method Detection Limit (MDL).

Prior to use, glassware must be solvent rinsed and then air dried. A solvent rinse procedure using methanolic ammonium hydroxide (1%) and methanol is recommended.

Sample manifold ports and transfer tubing should be inspected regularly for signs of wear and/or discoloration. When such observations are made, the associated components should be replaced.

All parts of the SPE manifold must be cleaned between samples by rinsing with methanolic ammonium hydroxide (1%) and air drying prior to use. Smaller parts, like the needles, adapters, reservoirs, transfer lines, and stopcocks associated with the manifold should be rinsed with tap water prior to rinsing with methanolic ammonium hydroxide (1%) and air drying. After loading the samples but prior to elution procedures, the chamber should be rinsed with methanolic ammonium hydroxide (1%).

All materials used in the analysis must be demonstrated to be free from interferences by running method blanks (Section 11.1.1) at the beginning and with each extraction batch (samples started through the extraction process on a given batch to a maximum of 20 field samples).

Reagent water (Section 8.1) can be used to simulate water samples and Ottawa sand and/or reagent-grade sand (Section 7.3) can be used to simulate soils. Fish fillets (tilapia/ cod), chicken breast or other similar animal tissue (see Section 7.3) may be used as the reference matrix for tissue. The laboratory must verify that the source product used does not contain PFAS in detectable amounts.

Interferences co-extracted from samples will vary considerably from source to source, depending on the diversity of the site being sampled. Interfering compounds may be present at concentrations several orders of magnitude higher than the native PFAS. Because low levels of PFAS are measured by this method, elimination of interferences is essential. The cleanup steps given in Section 9.3 can be used to reduce or eliminate these interferences and thereby permit reliable determination of the PFAS at the levels shown in Tables 1, 2 and 3. The most frequently encountered interferences are fluoropolymers; however, bile salts (e.g., Taurodeoxycholic Acid [TDCA]) may be present in various matrices, including fish and wastewaters, and can interfere in the chromatography. For this reason, analysis of a standard containing TDCA is required as part of establishing the initial chromatographic conditions (see Sections 8.3.2 and 8.3.3) and each analytical sequence (see Section 9.4).

4.0 DEFINITIONS

Refer to the Laboratory Quality Manual for a glossary of common lab terms and definitions.

Extracted Internal Standard (EIS) quantification: The response of the target compound is compared to the response of the isotopically labeled analog of another compound with chemical and retention time similarities.

Isotope dilution (ID) quantitation: A means of determining a naturally occurring (native) compound by reference to the same compound in which one or more atoms has been isotopically enriched. The labeled PFAS are spiked into each sample and allow identification and correction of the concentration of the native compounds in the analytical process.

Isotopically labeled compound: An analog of a target analyte in the method which has been synthesized with one or more atoms in the structure replaced by a stable (non-radioactive) isotope of that atom. Common stable isotopes used are 13C (Carbon-13) or Deuterium (D or 2H). These labeled compounds do not occur in nature, so they can be used for isotope dilution quantitation or other method-specific purposes.

Minimum Level of quantitation (ML): The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. The ML represents the lowest concentration at which an analyte can be measured with a known level of confidence. It may be equivalent to the concentration of the lowest calibration standard, assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed.

PAS: Acronym for Pace® Analytical Services, LLC

5.0 HEALTH & SAFETY

The following sections provide general health and safety information about chemicals and materials that may be present in the laboratory.

The toxicity or carcinogenicity of each chemical material used in the laboratory has not been fully established. Each chemical should be regarded as a potential health hazard and exposure to these compounds should be as low as reasonably achievable.

The laboratory maintains documentation of hazard assessments and OSHA regulations regarding the safe handling of the chemicals specified in each method. Safety data sheets for all hazardous chemicals are available to all personnel. Employees must abide by the health, safety and environmental (EHS) policies and procedures specified in this SOP and in the Pace® Chemical Hygiene / Safety Manual (COR-MAN-0001).

Personal protective equipment (PPE) such as safety glasses, gloves, and a laboratory coat must be worn in designated areas and while handling samples and chemical materials to protect against physical contact with samples that contain potentially hazardous chemicals and exposure to chemical materials used in the procedure.

Concentrated corrosives present additional hazards and are damaging to skin and mucus membranes. For procedures that require use of acids, use acids in a fume hood whenever possible with PPE designed for handing these materials. If eye or skin contact occurs, flush with large volumes of water. When working with acids, always add acid to water to prevent violent reactions. For procedures that that emit large volumes of solvents (evaporation/concentration processes), these activities must be performed in a fume hood or apparatus that reduces exposure.

6.0 SAMPLE COLLECTION, PRESERVATION, HOLDING TIME & STORAGE

PAS does not offer sample collection services for this test method. PAS advises customers to collect samples in accordance with a sampling plan and collection procedures appropriate to meet regulatory requirements and data quality objectives for the project. The minimum sample amounts required for the test are provided in this section.

PAS provides containers for the collection of samples upon client request. The routine container type and size is provided in the following table along with requirements for sample size, preservation and holding time. Refer to Bottle Order Preparation (ENV-SOP-WEST-0005), or however named, for procedures related to preparation of bottle kits.

Container Type, Minimum Sample Amount, Preservation, and Holding Time

Matrix	Container Size & Type[1]	Minimum Sample Amount[2]	Preservation	Holding Time
Aqueous (non-potable water)	2 x 500 mL linerless HDPE 1 x 125 mL linerless HDPE[3]	500 mL	Thermal: 0-6°C (or ≤ -20°C)	Collection to Preparation: 28 Days (or 90 Days) Preparation to Analysis: 28 Days
Aqueous (leachate)	2 x 125 mL linerless HDPE	100 mL	Thermal: 0-6°C (or ≤ -20°C)	Collection to Preparation: 28 Days (or 90 Days) Preparation to Analysis: 28 Days
Solid (sediment and soil)	3 oz/ 90 mL linerless polypropylene wide mouth	5 g	Thermal: 0-6°C or ≤ -20°C	Collection to Preparation: 90 Days Preparation to Analysis: 28 Days
Solid (biosolid)	3 oz/ 90 mL linerless polypropylene wide mouth	0.5 g	Thermal: 0-6°C or ≤ -20°C	Collection to Preparation: 90 Days Preparation to Analysis: 28 Days
Tissue[4]	3 oz/ 90 mL linerless polypropylene wide mouth	2 g	Thermal: ≤ -20°C	Collection to Preparation: 90 Days Preparation to Analysis: 28 Days

[1] *Default container type provided in sample kit. To allow room for expansion during freezing (if necessary), aqueous sample containers should not be overfilled. Aqueous sample containers should be filled only to the appropriate gradation marked on the container, or to the shoulder of the container if no gradations are provided.*

[2] *Nominal amount of sample required for each discrete test. Solid and biosolid sample amounts reflect dry weight.*

[3] *Used for pre-screening analyses.*

[4] *Container listed here will be used for tissue homogenate; samples may be received at the laboratory as whole fish or filets wrapped in aluminum foil or food grade polyethylene wrap. Ideally fish should be frozen upon collection and shipped to the laboratory as soon as possible.*

Note: Project-specific requirements dictate which storage condition applies. The storage condition to be used for each project must be formally documented in written form (QAPP or otherwise) before samples are received. Without any prior indication from the client, the lab will store all aqueous and solid/biosolid samples at 0-6°C until extraction, with a 28-day holding time (collection to prep) for aqueous matrices and a 90-day holding time (collection to prep) for solid/biosolid matrices.

Thermal preservation is checked and recorded on receipt in accordance with laboratory SOP (ENV-SOP-WEST-0003, Sample Receipt and Login), or however named.

After receipt, samples are stored as listed above until sample preparation. Prepared sample extracts of all matrices are stored at 0-6°C until sample analysis.

After analysis, samples are retained as stated in the Pace® standard terms and conditions, unless otherwise specified in the analytical services contract. Samples are then disposed of in accordance with Federal, State, and Local regulations.

7.0 EQUIPMENT & SUPPLIES

Use of equivalent instrumentation, support equipment, and supplies from alternative vendors is acceptable so long as they meet the specifications as stated in the reference method.

Due to the possibility of adsorption of analytes onto glass, plastic containers are used for all standard, sample, and extraction preparations. Any time a new lot of SPE cartridges, solvents, cryovials, or autosampler vials are used, it must be demonstrated that a MB is reasonably free of contamination and that the criteria in Section 11.1.1 are met.

7.1 Instrumentation

High-performance liquid chromatograph (HPLC) equipped with tandem quadrupole mass spectrometer – Sciex 5500+ or equivalent

Agilent Zorbax RRHD Eclipse Plus C18, 2.1 x 50 mm (1.8 µm) analytical column (Agilent Part # 959757-902), or equivalent

Guard cartridge/column – Agilent Zorbax Eclipse Plus C18, 2.1 x 5 mm, 1.8 um (Agilent Part# 821725-901), or equivalent

Trap/delay column – InfinityLab PFC Delay Column, 4.6 x 30 mm (Agilent Part# 5062-8100), or equivalent

7.2 Support Equipment

Oven – Capable of maintaining a temperature of 105 ± 5 ºC

Analytical balance – Capable of weighing 0.0001 g

Top loading balance – Capable of weighing 0.01 g

Calibrated mechanical variable volume pipettes with disposable HDPE or polypropylene tips (10 µL to 5 mL) – used for preparation of calibration standards and spiked samples

Point of Use water preparation system – Thermo Scientific Barnstead E-Pure; model 7119 – Used for QC samples to verify the systems are PFAS free

Ultrasonic mixer – Fisherbrand; Model CPX3800 – 5.7L, 40 kHZ, 120V, 2.9 Amp with timer

Analog or digital vortex mixer, single or multi-tube (Fisher Scientific 02-215-452, or equivalent)

Variable speed mixing table (VWR Model 3500 Orbital Shaker, or equivalent)

Centrifuge (Beckman Allegra 6, Hettich Rotanta 460, or equivalent), capable of reaching at least 3000 rpm (~2000 RCF)

Vacuum Pump – Sufficient capacity to maintain a vacuum of approximately 10 to 15 inches of mercury for extraction cartridges. GAST model # DOA-P704-AA, Waters Cat# 725000417, 115V, 60Hz, 4.2A

Vacuum manifold for SPE Cartridges – Waters Cat# WAT200609: SPE Vacuum manifold, or equivalentCat

Vacuum tubing – 1/4” ID, 5/8” OD, 3/16” wall; Fisher Scientific part# 14-176-6B or equivalent

PE Transfer tubing – 1/8” X .062 x 500ft, Freelin Wade part# 1C-109-10 or equivalent.

7.3 Supplies

Solid Phase Extraction (SPE) cartridges – Phenomenex part# CS0-9216, 250 mg WAX/20mL, or equivalent

Carbon Cleanup cartridges – Phenomenex part# 8B-S528-CAJ, 50 mg GCB, or equivalent

SPE reservoirs – 60 mL, Phenomenex part# AH0-7189, or equivalent

SPE adapter caps – Supelco part# 57267 (Adapter cap for 12, 20 & 60 mL SPE tubes)

Disposable liners for Vacuum Manifold – Waters part# 20685 or equivalent

Silanized glass wool (Pyrex 3950 or equivalent)

Reference matrix: Aqueous – reagent water

Reference matrix: Solid – Ottawa sand

Reference matrix: Tissue – fish fillets, chicken breast or similar animal tissue. First preference will be frozen cod fillets.

Bottles – HDPE or PP, with linerless HDPE or polypropylene caps. Various sizes. QEC item # 6212-Q016/BC-150-PACE (500 mL), 6212-Q008BC-P (250 mL), 6213-U004BC-P (125 mL), 6214-003PPGBC-P (90 mL)

Screw top vials, Polypropylene 0.7-mL with polypropylene caps – used in sample analysis and pre-screening (Waters Cat # 186005219 and 186004169 or equivalent)

15- and 50-mL conical polypropylene tubes with polypropylene screw caps for preparing and storing extract solutions and for collection of eluents (Fisher Scientific 05-527-90 and 14-432-22, or equivalent)

500-mL conical polypropylene centrifuge bottles for sample centrifugation (Fisher Scientific 07-200-621 or equivalent)

Extract/Standard storage containers – 15-mL, 8-mL, or 4-mL narrow-mouth HDPE container - Thermo Scientific item# 2002-9050, 2002-9025, 2002-9125; 2.0-mL screw-top polypropylene cryogenic vials – Grainger item# 6EMV1/ Wheaton item# W985872;1.5-mL snap-cap polypropylene microcentrifuge tubes - Fisher item# 05-408-129; or equivalent

pH Paper, range 0-14 - (VWR Cat# BD3539.606 or equivalent), 0.5-unit readability

Disposable glass and plastic pipets

8.0 REAGENTS & STANDARDS

Refer to laboratory SOP (ENV-SOP-MANS-0112, Reagent, Solvent, and Standard Control), or however named, for information regarding standard and reagent tracking and traceability. All reagents and stock standards are commercially prepared, when available. Expiration and storage requirements are defined per manufacturer.

8.1 Reagents

Use of equivalent reagents from alternative vendors is acceptable so long as the substitution meets the performance specifications required by the reference method.

Acetic acid – ACS grade or equivalent, store at room temperature; VWR cat# BDH3098-3.8LP or equivalent

Acetonitrile – UV grade or equivalent, verified before use, store at room temperature; Honeywell Cat# 018-4 or equivalent (for extraction)

Ammonium acetate – ACS or equivalent, store at 2-8° C, replace 2 years after opening date; VWR BDH9204-500G or equivalent.

1M aqueous ammonium acetate (Waters Cat# 186006693-1) used for mobile phase additive; store as indicated by manufacturer.

Ammonium hydroxide – certified ACS+ grade or equivalent, 30% in water, store at room temperature; Fisher A470-500 or equivalent

Formic acid – greater than 96% purity or equivalent, store at room temperature; Acros 147930010 or equivalent

Methanol – HPLC grade or better, 99.9% purity, store at room temperature; Honeywell CAT# 230-4 or equivalent

Mobile Phase A – 2 mM ammonium acetate in 95:5 water/acetonitrile. Aliquot 0.4 mL of aqueous 5M ammonium acetate in 949.6 mL of water and 50 mL of acetonitrile. Alternatively, dissolve 0.154 g of neat ammonium acetate into 950 mL of water and 50 mL of acetonitrile. Store at room temperature; shelf life is 2 months.

Mobile Phase B – Acetonitrile, Ultra HPLC grade or equivalent; OmniSolv AX0142-1 or equivalent

Potassium hydroxide – certified ACS or equivalent, store at room temperature, replace after 2 years; Fisher P250-500 or equivalent.

Reagent water – Laboratory reagent water, test by lot/batch number for residual PFAS content.

8.2 Standards

Use of equivalent standards from alternative vendors is acceptable so long as they are traceable to a national standard, when commercially available. Follow manufacturer's recommended storage conditions and expiration dates.

8.2.1 Primary PFAS Standard

EPA Method 1633 Native PFAS Standard mix from Wellington Laboratories (item# EPA-1633STK) – used to prepare the calibration standards and to spike the reference QC samples prepared/analyzed with every batch of samples. Also used to prepare an intermediate standard for calibration standard preparation and low-level QC sample spiking, as described below.

8.2.2 Secondary PFAS Standard

Method 1633-PFCs-Calibration Standard mix from Absolute Standards (item# 65735) – used to prepare the ICV standard as described below.

8.2.3 Extracted Internal Standard (EIS)

Mass-labelled PFAS Extraction Standard mix from Wellington Laboratories (item# MPFAC-HIF-ES) – used to prepare analytical standards and spike each sample prior to extraction.

8.2.4 Non-extracted Internal Standard (NIS)

Mass-labelled PFAS Injection Standard mix from Wellington Laboratories (item# MPFAC-HIF-IS) – used to prepare analytical standards and spike sample extracts prior to instrumental analysis.

8.2.5 Bile Salt (TDCA) Standard

Neat Taurodeoxycholic acid from Cayman Chemical (item# 15935), or equivalent – used to prepare analytical standards for bile salt interference check.

8.3 Formulations

Prepare standard solutions from materials of known purity and composition or purchase as solutions or mixtures with certification to their purity, concentration, and authenticity. Observe the safety precautions in Section 5.

Purchase of commercial standard solutions or mixtures is highly recommended for this method; however, when these are not available, preparation of stock solutions from neat materials may be necessary. If the chemical purity is 98% or greater, the weight may be used without correction to calculate the concentration of the standard.

When not being used, store standard solutions in the dark at 4 °C, unless the vendor recommends otherwise, in tightly sealed screw-capped vials. Place a mark on the vial at the level of the solution so that solvent loss by evaporation can be detected. Replace the solution if solvent loss has occurred.

Note: 18O-mass labeled perfluoroalkyl sulfonates may undergo isotopic exchange with water under certain conditions, which lowers the isotopic purity of the standards over time.

The laboratory must maintain records of the certificates for all standards for traceability purposes. Copies of the certificates should be provided as part of the data packages in order to check that proper calculations were performed.

8.3.1 Analytical and Preparation Reagents

Analytical and Preparation reagents are stored in plastic or glass containers under ambient conditions. Expiries are listed with each reagent.

Instrument Blank Mix (IBLK Mix) – Methanol with 4% water, 1% ammonium hydroxide and 0.625% acetic acid – add ammonium hydroxide (3.3 mL, 30%), reagent water (1.67 mL) and acetic acid (0.625 mL) to methanol (94.4 mL); store at room temperature, replace after 1 month. This solution is used to prepare the instrument blank (Sections 8.3.3.3 and 9.2.5) and sample extract dilutions.

Mobile Phase A – 2 mM ammonium acetate in 95:5 water: acetonitrile. Aliquot 2.0 mL of aqueous 1M ammonium acetate in 948 mL of water and 50 mL of acetonitrile. Store at room temperature; replace after 2 months or less.

Mobile Phase B – Acetonitrile, HPLC grade or equivalent; Omnisolv AX0142-1 or equivalent

Acetic acid (0.1%) - dissolve acetic acid (1 mL) in reagent water (1 L); store at room temperature, replace after 3 months.

Aqueous ammonium hydroxide (3%) – add ammonium hydroxide (10 mL, 30%) to reagent water (90 mL), store at room temperature, replace after 3 months.

Methanolic ammonium hydroxide (0.3%) – add ammonium hydroxide (1 mL, 30%) to methanol (99 mL), store at room temperature, replace after 1 month.

Methanolic ammonium hydroxide (1%) – add ammonium hydroxide (3.3 mL, 30%) to methanol (97 mL), store at room temperature, replace after 1 month.

Methanolic ammonium hydroxide (2%) – add ammonium hydroxide (6.6 mL, 30%) to methanol (93.4 mL), store at room temperature, replace after 1 month.

Formic acid (aqueous, 0.1 M) – dissolve formic acid (4.6 g / 3.77 mL) in reagent water (1 L), store at room temperature, replace after 2 years.

Formic acid (aqueous, 0.3 M) – dissolve formic acid (13.8 g / 11.31 mL) in reagent water (1 L), store at room temperature, replace after 2 years.

Formic acid (aqueous, 5% v/v) – mix 5 mL formic acid with 95 mL reagent water, store at room temperature, replace after 2 years.

Formic acid (aqueous, 50% v/v) – mix 50 mL formic acid with 50 mL reagent water, store at room temperature, replace after 2 years.

Formic acid (methanolic 1:1, 0.1 M formic acid/methanol) – mix equal volumes of methanol and 0.1 M formic acid, store at room temperature, replace after 2 years.

Methanolic potassium hydroxide (0.05 M KOH) – add 3.3 g of potassium hydroxide to 1 L of methanol, store at room temperature, replace after 3 months.

8.3.2 Intermediate Standards

Intermediate standards are stored in plastic containers as listed below. Expiries are listed with each formulation.

TDCA Stock Solution: Dissolve 10 mg of neat TDCA into 5 mL of MeOH; final concentration equals 2000 µg/mL. Store frozen (<0°C) when not in use; replace after 1 year, or sooner if degradation is observed.

STK-10X Solution: Dilute 200 µL of EPA-1633STK with 1.8 mL of MeOH for a final volume of 2 mL; final concentrations vary by analyte – 25, 50, 100, 125, 250, or 625 ng/mL. Store at 0-6°C when not in use; replace every time a new lot of 1633STK is used, or after 1 month.

8.3.3 Working Solutions

Working solutions are stored in plastic containers under refrigerated conditions at 0-6°C and expire 1 month from the date of preparation.

8.3.3.1 Calibration Standards

A series of calibration solutions containing the target analytes and the EIS and NIS is used to establish the initial calibration of the analytical instrument. The concentration of the method analytes in the solutions varies to encompass the working range of the instrument, while the concentrations of the EIS and NIS (and TDCA) remain constant. The calibration solutions are prepared using the standards and intermediate standards described above. The final solvent composition will match the solvent mix of sample extracts, which contain methanol with 4% water, 1% ammonium hydroxide and 0.625% acetic acid. Calibration standard solutions do not undergo solid phase extraction/cleanup. Prepare the calibration standard solutions according to the table below. Following all formulations listed in this SOP will require 3 ampoules of the 1633STK mix to prepare a full calibration set; other final volumes may be prepared. If the lab follows all formulations in this SOP as written, the remaining volumes of 1633STK and STK-10X solutions after preparing the calibration should be enough to spike approximately 40 sets of aqueous batch QC. The remainder of MPFAC-HIF-ES and MPFAC-HIF-IS mixes should provide enough volume to spike approximately 40-45 samples.

Component[1]	L1	L2 (LOQ)	L3	L4	L5 (CCV)	L6	L7	L8	L9
STK-10X	20	16	40						
EPA-1633STK				20	100	100	200	400	500
MPFAC-HIF-ES	25	10	10	10	25	10	10	10	10
MPFAC-HIF-IS	25	10	10	10	25	10	10	10	10
TDCA Stock	25				25				10
IBLK Mix	4905	1964	1940	1960	4825	1880	1780	1580	1470
Final Volume	5000	2000	2000	2000	5000	2000	2000	2000	2000

[1] *All values listed are µL*

8.3.3.2 Initial Calibration Verification Standard (ICV)

Prepare the ICV standard using the Absolute Standards 1633 PFC Mix, following the table below; expected concentration for all compounds in the ICV will be 10 ng/mL. The ICV is prepared from a separate, second source (or separate manufacturer lot) than that used for the calibration solutions. If a second source or lot is unavailable, a separate preparation using the same stocks is acceptable.

Component	Volume used (µL)
1633 PFC Mix	20
MPFAC-HIF-ES	20
MPFAC-HIF-IS	20
IBLK Mix	3940
ICV Final Volume	4000

8.3.3.3 Instrument Blank

A solvent blank is analyzed at the beginning of each analytical sequence, to demonstrate clean instrumental background, and after samples containing high levels of target compounds (e.g., calibration, CCV) to monitor carryover from the previous injection. The instrument blank consists of clean reagent fortified with the EIS and NIS for quantitation purposes. Prepare the IBLK using the IBLK mix (Section 8.3.1) and an appropriate volume of EIS and NIS; alternatively, prep the IBLK from 1887 µL of 1% Methanolic ammonium hydroxide, 80 µL of reagent water, 12.5 µL of acetic acid, and 10 µL each of EIS and NIS.

9.0 PROCEDURE

9.1 Equipment Preparation

9.1.1 Instrument Setup

9.1.1.1 Routine Instrument Operating Conditions

Example LC Gradient

Step	Total Time (min)	Flow Rate (µL/min)	A: 5% Acetonitrile w/ 10mM Ammonium Acetate (%)	B: Acetonitrile (%)
1	0.00	400	80	20
2	6.00	400	0	100
3	6.50	400	0	100
4	6.51	400	80	20
5	8.50	400	80	20

Example MS Parameters

MS Parameter	Setting or Value
Sample Loop	100 µL
Injection Volume	2 µL
Column Oven Temperature	40° C
MRM Scan Window	60 sec
Curtain Gas (CUR)	30.0
Collision Gas (CAD)	9
Ion Spray Voltage (IS)	-4500 V
Source Temperature (TEM)	450° C
Ion Source Gas 1 (GS1)	30.0
Ion Source Gas 2 (GS2)	50.0

9.1.1.2 Mass Calibration

The mass spectrometer must undergo mass calibration to ensure accurate assignments by the instrument. This mass calibration must be performed at least annually to maintain instrument sensitivity and stability. Mass calibration must be repeated on an as-needed basis (e.g., QC failures, ion masses fall outside of the instrument required mass window, major instrument maintenance, or if the instrument is moved). Mass calibration must be performed using the calibration compounds and procedures prescribed by the manufacturer. The procedures used for mass calibration and mass calibration verification must evaluate an ion range that encompasses the ion range (Q1 and Q2 m/z) of the analytes of interest of this method.

9.1.1.3 Mass Calibration Verification

A mass calibration verification must be performed following mass calibration, prior to standard and sample analyses. Mass verification checks must also be performed after any subsequent mass calibrations. The laboratory must follow the instructions for the individual instrument software to confirm the mass calibration, mass resolution and peak relative response. If the manufacturer's instructions include options for evaluation of mass resolution, the tightest resolution requirements (typically called unit resolution) must be met.

9.1.1.4 Retention Time (RT) calibration

Once RT windows have been confirmed for each target analyte, EIS, and NIS compound, then once per ICAL and at the beginning of the analytical sequence, the position of all target analyte, EIS, and NIS peaks shall be set using the midpoint standard of the ICAL curve when ICAL is performed. When an ICAL is not performed, the initial CCV retention times or the midpoint standard of the ICAL curve can be used to establish the RT window position.

The RTs for the target analytes, EIS, and NIS compounds must fall within 0.4 minutes of the predicted retention times from the midpoint standard of the ICAL or initial daily CCV, whichever was used to establish the RT window position for the analytical batch. All branched isomer peaks identified in either the calibration standard or the qualitative (technical grade) standard also must fall within 0.4 minutes of the predicted retention times from the midpoint standard of the ICAL or initial daily CCV. For all target analytes with exact corresponding isotopically labeled analogs, target analytes must elute within 0.1 minutes of the associated EIS compound.

When establishing the chromatographic conditions, it is important to consider the potential interference of bile salts (i.e. TDCA) during analyses of samples. Analytical conditions must be set to allow a separation of at least 1 minute between TDCA and the retention time window of PFOS. The method requires this evaluation when establishing the chromatographic conditions, regardless of the sample matrices to be analyzed.

9.1.2 Support Equipment

Refer to laboratory SOP (ENV-SOP-WEST-0036 Balance Calibration Verification, ENV-SOP-WEST-0123 Pipette and Bottle Top Verification), or however named, for additional information on calibration requirements for support equipment that may be used in this procedure.

9.2 Calibration

Refer to corporate POL ENV-POL-CORQ-0005, *Acceptable Calibration Practices for Instrument Testing*, for general laboratory calibration policies and procedures.

9.2.1 Calibration Frequency

Prior to the analysis of samples, and after a successful mass calibration check, each LC-MS/MS system must be calibrated at a minimum of 6 standard concentrations (Section 8.3.3.1 and Appendix A, Table 5). This method procedure calibrates and quantifies 40 PFAS target analytes, using the isotopically labeled compounds added to the sample prior to extraction, by one of two approaches (see Appendix A, Table 4 for quantitation associations):

Isotope Dilution quantification (ID), whereby the response of the target compound is compared to the response of its isotopically labeled analog; twenty-four target compounds are quantified in this way.

Extracted Internal Standard quantification (EIS), whereby the response of the target compound is compared to the response of the isotopically labeled analog of another compound with chemical and retention time similarities; sixteen target compounds are quantified in this way.

Each LC-MS/MS system must be calibrated whenever the laboratory takes corrective action that might change or affect the initial calibration criteria, or if either the CCV or ISC acceptance criteria have not been met.

Each time a modification is made to this method, the laboratory is required to repeat the procedure in Sections 11.3.1 and 11.3.2. If calibration will be affected by the change, the instrument must be recalibrated.

9.2.2 Calibration Levels

Calibration standards are stored in plastic containers under refrigerated conditions (0-6°C).

Concentrations for calibration solutions are presented in Appendix A, Table 5. A minimum of six contiguous calibration standards are required for a valid analysis when using a linear calibration model, with at least five of the six calibration standards being within the quantitation range (e.g., from the LOQ to the highest calibration standard). If a second-order calibration model is used, then a minimum of seven calibration standards are required, with at least six of the seven calibration standards within the quantitation range. The lowest level calibration standard must be at a concentration less than or equal to the Limit of Quantitation (LOQ) and must meet a signal-to-noise ratio of 3:1 for the quantitation and confirmation ions that exist and must meet ion ratio requirements described in Section 10.1.1.3. If the analyte has no confirmation ion, then a 10:1 signal to noise ratio is required. All initial calibration requirements listed in Section 9.2.4 and 9.2.5 must be met.

Note: Additional calibration standards, at levels lower than the lowest calibration standard listed in the method, may be added to accommodate a lower limit of quantitation if the instrument sensitivity allows. Calibration standards at the high end of the calibration may be eliminated if the linearity of the instrument is exceeded or at the low end if those calibration standards do not meet the S/N ratio criterion of 3:1 (for quantitation and confirmation ions that exist; 10:1 for analytes with no confirmation ion), so long as the required number of calibration points is met. All analytes with commercially available stable isotope analogues must be quantified using isotope dilution.

9.2.3 Calibration Sequence

Calibration standards must be analyzed in sequence from lowest to highest concentration to minimize the chance that carryover from a higher concentration standard will boost the area of a lower concentration standard. A typical sequence for days when calibration is required is shown below.

Description	Comment
ICAL L1	

Description	Comment
ICAL L2	Also used as ISC (Section 9.2.4.4)
ICAL L3	
ICAL L4	
ICAL L5	Also used as bracketing/closing CCV (Section 9.2.4.5)
ICAL L6	
ICAL L7	
ICAL L8	
ICAL L9	
IBLK	Any detections must be <MDL
ICV	%R must be 70 – 130%
CCV (ISC)	%R must be 70-130%; begins and ends Analytical Sequence

9.2.4 Calibration Evaluation

If the criteria for initial calibration are not met, inspect the system for problems and take corrective actions to achieve the criteria. This may require the preparation and analysis of fresh calibration standards. All initial calibration criteria must be met before any samples or required blanks are analyzed.

9.2.4.1 Curve Fit

One of the following two approaches must be used to evaluate the linearity of the instrument calibration. Weighting (typically 1/x or 1/x2) is allowed for linear and non-linear regressions.

Option 1: Calculate the relative standard deviation (RSD) of the Relative Response (RR) or Response Factor (RF) values of the initial calibration standards for each native compound and isotopically labeled compound. See Section 10.2.1 for calculation of RR and RF. The RSD must be ≤ 20% to establish instrument linearity.

Option 2: Calculate the relative standard error (RSE) for each native compound and EIS compound for all the initial calibration standards that were analyzed. The RSE for all method analytes must be ≤ 20% to establish instrument linearity.

If these criteria cannot be met, corrective action should be taken to restrict the range of calibration, reanalyze and/or reprepare the ICAL standards, or perform instrument maintenance and/or re-optimization.

If more than the minimum number of standards are analyzed and levels are excluded from the calibration, only the lowest or highest standards may be excluded, except as noted here. The removal of calibration levels from the interior of the curve is allowed only when there is sound technical reason for doing so and when the level is removed for all analytes; for example, when it can be proven that the wrong standard was analyzed for the calibration level or there is obvious evidence that the instrument malfunctioned during injection of the standard. The removal of any calibration level from the interior of the curve must be approved by the department supervisor/manager. Management approval and the rationale for the level removal must be documented and kept with the technical record.

9.2.4.2 Relative Error (% RE)

Although not required by the method, it may be useful to compare the actual responses for each standard to the calibration model; percent error of >30% between the calculated and expected concentrations of an analyte in any standard may be cause for concern.

9.2.4.3 Initial Calibration Verification (ICV)

As part of the IDOC and once after each ICAL, analyze an ICV sample prepared from a second source (different from the source of the ICAL standards). If a second vendor is not available, then a different lot of the standard from the same vendor should be used. The ICV should be prepared and analyzed just like a CCV. Acceptance criteria for the ICV are identical to the CCVs: the calculated concentration for each analyte must be within ± 30% of the expected value. If measured analyte concentrations are not of acceptable accuracy, correct the problem and rerun the ICV. If the problem persists, repeat the ICAL. Samples are not to be analyzed until the ICAL has been verified by acceptable ICV accuracy.

9.2.4.4 Instrument Sensitivity Check (ISC)

The lowest calibration standard within the quantitation range must be analyzed at the beginning of the analytical sequence. The signal-to-noise ratio of the ISC must be ≥ 3:1 for the quantification ions and the confirmation ions, or ≥ 10:1 if the analyte only has a quantification ion. Recovery of the native and EIS compounds for the ISC must be within 70-130%. If the requirements cannot be met, the problem should be corrected before analyses can proceed.

The lowest calibration standard within the quantitation range must be analyzed at the beginning of the analytical sequence. The signal-to-noise ratio of the ISC must be ≥ 3:1 for the quantification ions and the confirmation ions, or ≥ 10:1 if the analyte only has a quantification ion. Recovery of the native and EIS compounds for the ISC must be within 70-130%. If the requirements cannot be met, the problem should be corrected before analyses can proceed.

9.2.4.5 Continuing Calibration Verification (CCV)

After a passing MS resolution and a successful initial calibration is achieved and prior to the analysis of any samples, the calibration is verified by injecting an aliquot of the appropriate concentration ICAL standard, analyzed with the same conditions used during the ICAL. CCV is performed at the beginning of each analytical sequence, after every ten samples, and at the end of the analytical sequence. In this context, a “sample” is defined as a field sample: MBs, CCVs, LCSs, MSs, FDs, TBs and MSDs are not counted as samples. All CCV analyses are performed using a mid-level ICAL standard, except for the daily Instrument Sensitivity Check, as noted above.

Calculate concentration for each native and EIS compound in the CCV; the recovery of native and EIS compounds for the CCVs must be within 70 – 130%. If the CCV criteria are not met, take corrective action (possibly including recalibration) and reanalyze any extracts that were analyzed between the last passing CCV and the one that failed. Alternately, the analyst may immediately analyze two CCVs for confirmation. If both confirmation CCV analyses meet the recovery criteria, analysis may proceed; however, the analyst must rerun any samples that were analyzed after the failing CCV and before the 2 passing CCVs. If either of the 2 confirmation CCV analyses fails to meet the acceptance criteria take corrective action and recalibrate the LC-MS/MS.

If an individual target compound recovery in a CCV is above the upper control limit and all associated samples are ND for that compound, the data for those samples may be reported. In such cases, a narrative statement must be included in the report indicating the specific compound result that was biased high in the CCV, and that samples were ND for that compound and thus reportable.

9.2.5 Initial Calibration Blank (ICB) / Continuing Calibration Blank (CCB)

One instrument blank (IBLK) is analyzed immediately following the highest ICAL standard analyzed (ICB), each analysis day prior to sample analysis, and following each bracketing CCV in a sequence (CCB), to check for carryover and instrument contamination. The concentration of each analyte must be ≤ the MDL-equivalent concentration in each IBLK/ICB/CCB. If the IBLK does not pass this requirement after the highest ICAL standard, the acquisition method should be adjusted to reduce the amount of carryover observed. Alternately, the calibration should be performed using a lower concentration for the highest standard until the acceptance criteria is met.

If unacceptable contamination is persistent in blanks, analyze additional instrument blanks until the response of the analyte is no longer detectable, or perform additional troubleshooting steps to identify and minimize other potential sources of PFAS contamination.

9.3 Sample Preparation

This section describes the sample preparation procedures for aqueous samples (Section 9.3.3), solid samples (soil, sediment or biosolid; Section 9.3.6), and tissue samples (Section 9.3.9). For solid samples, percent solids are determined using the procedures in Section 9.3.2. This section also describes the solid phase extraction (SPE) and extract cleanup protocols for all matrices.

Note: The laboratory may choose to pre-screen some samples prior to performing the analysis, following the protocol described in Appendix D. For aqueous samples, use the smaller secondary container to perform the pre-screening. If high levels of PFAS are present in the sample, a lower volume is required for analysis.

Do not use any fluoropolymer articles or task wipes in these extraction procedures. Use only HDPE or polypropylene wash bottles and centrifuge tubes. Reagents and solvents for cleaning may be kept in glass containers.

9.3.1 Homogenization & Subsampling

Refer to laboratory SWI ENV-SWI-WEST-0128, Subsampling of Soil / Solid Samples, or however named, for information regarding the handling, homogenization, and splitting of samples to ensure that a representative aliquot is used for preparation.

The laboratory may subsample the aqueous samples as described in Appendix E; however, subsampling must meet project-specific requirements. The laboratory must notify the client that subsampling has occurred. Subsampling is acceptable for samples which require greater than a 10X dilution for over-range detections (or are known/expected to be highly contaminated), and for samples which fail the acceptance criteria for EIS compounds (see Appendix B, Tables 10-12). Other sample matrix characteristics which may require subsampling are described in Appendix G. When subsampling is required to manage high concentrations, no less than 250 µL of aqueous or leachate samples may be subsampled - if greater dilution is required, serial dilution must be employed. When subsampling is required to manage challenging matrices, no less than 1 mL of samples may be subsampled. For solid and tissue samples, no less than 10% of the target sample mass should be used for reduced-mass extractions, to help ensure the extracted mass is representative of the bulk sample. This means no less than 0.5 g for solids and no less than 0.2 g for tissues may be used for sample preparation.

Tissue sample homogenization will be performed in the Pace Green Bay facility, following SOP ENV-SOP-GBAY-0129 v05 *Sample Homogenization Compositing and Sub-Sampling*.

9.3.2 Determination of Percent Solids

Aqueous samples received with visually observable solids will be handled following the decision tree presented in Appendix G. No TSS pre-test will be performed on aqueous samples prior to preparation.

Percent solids analysis must be performed on all solid samples (excluding tissues) prior to preparation and analysis. All solid samples will be logged in for both 1633 and percent solids analysis. The percent solids analysis will follow the Method SM2540G protocol.

9.3.3 Aqueous Sample Processing

Per the parent method, this protocol is applicable to aqueous samples containing up to 100 mg/L solids per sample, and the procedure requires the preparation of the entire sample where possible. Smaller sample volumes may be analyzed for samples containing solids greater than specified for this method, or when unavoidable due to high levels of PFAS. The typical sample size is 500 mL; however, sample size may vary, depending on project requirements, applicable regulations, and sample characteristics. The sample is to be analyzed in its entirety and should not be filtered.

Leachate samples are analyzed using a 100 mL sample volume. Therefore, they must not be included in the same sample preparation batch as aqueous samples analyzed using 500 mL sample volumes. Otherwise, leachate samples are handled identically to all other aqueous samples.

1) Visually inspect each sample and note any matrix characteristics which may pose challenges during SPE and require additional processing; see Appendix G for more information.

2) Weigh each sample bottle (with the lid) to the nearest 0.1 g. The volume of the aqueous sample analyzed is determined by weighing the full sample bottle and then the empty sample bottle after extraction is complete.

3) Prepare a method blank and two LCSs using PFAS-free water in HDPE bottles. Select a volume of water that is typical of the samples in the batch (i.e., 500 mL; 100 mL for leachate samples). Spike one LCS sample with native standard solution at 2x the LOQ (64 µL of STK-10X mix). This aliquot (LLLCS) will serve to verify the LOQ. Spike the other LCS sample at a concentration near the mid-level calibration point (40 µL of EPA-1633STK). This aliquot will serve as the traditional LCS.

Note: If matrix spikes are required for a specific project, spike the field sample bottles designated for use as MS/MSD samples in the same manner as the LCS.

4) Spike 20 µL of EIS solution (Section 8.2.3) directly into the sample in the original bottle (or subsampled bottle) as well as to the bottles prepared for the QC samples. Mix by capping and inverting the sample containers.

5) Check that the pH is 6.5 ± 0.5. If necessary, adjust pH with 50% formic acid or ammonium hydroxide (or with 5% formic acid and 3% aqueous ammonium hydroxide). The sample is now ready for solid phase extraction (SPE) and cleanup.

9.3.4 Solid Phase Extraction of Aqueous Samples

Note: Carbon cleanup is required. Carbon cleanup may remove analytes if the sample has a very low organic carbon content (this is unusual for non-drinking water environmental samples). This will be apparent if the isotope dilution standard recoveries are significantly higher on the reanalysis.

1) Pack clean silanized glass wool to half the height of a WAX SPE cartridge barrel; repeat for the total number of samples in the batch.

2) For each sample and QC aliquot, set up the vacuum manifold with one WAX SPE cartridge plus a reservoir adaptor and reservoir for each cartridge; label each reservoir with the associated sample ID. If using plastic transfer lines instead of reservoirs, ensure the connecting caps are snug in each cartridge and the transfer lines are placed within the appropriate sample; label each cartridge tube with the associated sample ID.

3) Pre-condition the cartridges by washing them with 15 mL of 1% methanolic ammonium hydroxide followed by 5 mL of 0.3M formic acid. Perform each rinse separately. Do not allow the WAX SPE to go dry. Discard the wash solvents.

4) Pour the sample into the reservoir (do not use a pipette), taking care to avoid splashing while loading; or, if using transfer lines, begin opening the stopcocks on the vacuum manifold. Adjust the vacuum/stopcocks to pass each sample through

the cartridge at approximately 5-10 mL/min; discard the eluate. Retain the empty sample bottle for later rinsing (Section 9.3.5).

Note: In the event the SPE cartridge begins to clog during aqueous sample loading, abandon the loading step and attempt to rinse and dry the clogged cartridge, following the protocol below. The cartridge is then ready for elution. If the clogging prevents the rinse from passing through the cartridge, it will not be possible to collect an extract for the associated sample. See Appendix G for more information.

5) Rinse the walls of the reservoir with 5 mL reagent water twice, followed by 5 mL of 1:1 0.1M formic acid/methanol and pass those rinses through the cartridge using vacuum. If using sample transfer lines for loading, add the 3 rinses to the bottle and load through the transfer lines to the cartridge, one reagent at a time. Dry the cartridge by pulling air through for approximately 5 minutes. Discard the rinse solution.

6) After the WAX cartridges are sufficiently dry, rinse the GCB cartridges with 5 mL of 1% methanolic ammonium hydroxide; discard the rinsate. Do not allow the GCB to go completely dry.

7) Connect the outlet of the WAX cartridges to the inlet of the GCB cartridges to stack them on the manifold and allow for cleanup of the extract as part of elution. Ensure that the WAX cartridges are returned to their original locations on the manifold to avoid cross contamination. Continue to the elution steps in the next section.

9.3.5 Elution of Aqueous Sample Extracts

1) Place clean collection tubes inside the manifold, ensuring that the extract delivery tips do not touch the walls of the tubes. Resume vacuum and ensure a proper seal is achieved. DO NOT add NIS to these collection tubes.

2) Add 5 mL of 1% methanolic ammonium hydroxide to each empty sample bottle. Cap the bottle and rotate to ensure all internal surfaces of each bottle are rinsed; avoid vigorous shaking when rinsing the 500 mL aqueous sample bottles with only 5 mL of methanol – any evaporation/vaporization will contribute to loss of extract here. After rinsing the inside of the sample bottle, pour the rinse from the bottle or use a plastic transfer pipette to transfer the rinse to the SPE reservoir, using it to wash the walls of the reservoir. If using sample transfer lines, simply transfer this rinse from each sample container to its associated cartridge using vacuum. Allow the elution solvent to soak the SPE sorbent for 2 minutes before using vacuum to pull the elution solvent through the cartridge and into the collection tubes in a slow, dropwise manner.

3) Air dry the empty sample bottle after the rinse is transferred. Weigh the empty bottle with the cap on and subtract that from the weight of the bottle with sample, determined in Section 9.3.3, step 2.

4) Add 25 µL of concentrated acetic acid and 20 µL of NIS mix to each sample extract in its collection tube and vortex to mix. Transfer a portion of each extract into an autosampler vial for LC-MS/MS analysis. Cap the collection tubes containing the remaining extracts and store at 0 - 6 °C.

9.3.6 Solid Sample (excluding tissues) Processing

Any solid sample received containing <50% solids (>50% moisture; >10 g target mass for 5 g dry weight) should be re-logged and prepared as a biosolid, using a target dry weight of 0.5 g. Any solid or biosolid sample received containing <5% solids (>95% moisture; >10 g target mass for 0.5 g dry weight) should be re-logged and prepared as a leachate sample, using no more than 100 mL of sample for extraction.

1) Mix the sample in its original jar. If it is impractical to mix the sample within its container, transfer the sample to a larger container. Mix the sample thoroughly, stirring from the bottom to the top and in a circular motion along the sides of the jar, breaking particles up by pressing against the side of the container. The homogenized sample should be even in color and have no separate layers. Store the homogenized material in its original container or in multiple smaller containers.

2) Determine the percent solids as per Section 9.3.2.

Note: The target sample weight for sediment or soil is 5 g dry weight. The target sample weight for biosolids is 0.5 g dry weight. Small amounts of reagent-free water used for method blanks (10% of sample weight or less) can be added to unusually dry samples. This is an option, not a requirement.

3) Check the LIMS system for the percent solids data associated with the samples to be prepared. Using the percent solids data and the calculation below, weigh out an aliquot of each solid sample, not dried, into a 50 mL polypropylene centrifuge tube. Sample mass should be within ±0.2 g of target mass for soil and sediment samples, and within ±0.02 g of target mass for biosolids samples. Sample aliquot should provide 5 g dry weight (Wi_{Dry} below) for soil and sediment or 0.5 g dry weight for biosolids. Because biosolid samples are analyzed with a 0.5 g sample mass, they must not be included in the same sample preparation batch as solid samples analyzed with 5 g sample masses. Any solid sample received containing <50% solids (>50% moisture; >10 g target mass for 5 g dry weight) should be re-logged and prepared as a biosolid, using a target dry weight of 0.5 g. Any solid or biosolid sample received containing <5% solids (>95% moisture; >10 g target mass for 0.5 g dry weight) should be re-logged and prepared as a leachate sample, using no more than 100 mL of sample for extraction.

$$Solid\ Sample\ Target\ Mass\ (g) = \frac{Wi_{Dry}\ (g)}{\%\ solids\ (decimal)}$$

4) Prepare batch QC samples using 5 g of reference solid wetted with 2.5 g of reagent water for the method blank and two LCSs (use 0.5 g of reference solid with 0.25 g of reagent water for biosolid extraction batches). The addition of reagent water to the sand provides a matrix closer in composition to real-world samples. Spike one LCS sample with native standard solution at 2x the LOQ (80 µL of STK-10X mix). This aliquot (LLLCS) will serve to verify the LOQ. Spike the other LCS sample at a concentration near the mid-level calibration point (40 µL of EPA-1633STK). This aliquot will serve as the traditional LCS.

Note: If matrix spikes are required for a specific project, spike the field sample bottles designated for use as MS/MSD samples in the same manner as the LCS.

5) Spike 20 µL of EIS solution (Section 8.2.3) directly into each centrifuge tube containing the aliquoted field and QC samples. Vortex or shake the sample to disperse the standard and allow to equilibrate for approximately 30 minutes.

6) Add 15 mL of 0.3% methanolic ammonium hydroxide to each centrifuge tube. Vortex to disperse, then shake for 30 minutes on a variable speed mixing table. Centrifuge at 3000 rpm (~2000 RCF) for 10 minutes and transfer the supernatant to a clean, labeled 50 mL polypropylene centrifuge tube.

7) Add 15 mL of 0.3% methanolic ammonium hydroxide to the remaining solid sample in each centrifuge tube. Vortex to disperse, then shake for 30 minutes on a variable speed mixing table. Centrifuge at 3000 rpm (~2000 RCF) for 10 minutes and decant the supernatant from the second extraction into the centrifuge tube with the supernatant from the first extraction.

8) Dilute to approximately 40 mL with reagent water. A separate centrifuge tube marked at the 40 mL level may be kept for a visual reference to get the approximate volume. Samples containing excess water may yield extracts that are greater than 40 mL in volume; therefore, do not add water to these.

9) Check that the pH is 6.5 ± 0.5. If necessary, adjust pH with 50% formic acid or ammonium hydroxide (or with 5% formic acid and 3% aqueous ammonium hydroxide). The extract is now ready for solid phase extraction (SPE) and cleanup.

9.3.7 Solid Phase Extraction of Solid Samples

1) Pack clean silanized glass wool to half the height of a WAX SPE cartridge barrel; repeat for the total number of samples in the batch.

2) For each sample and QC aliquot, set up the vacuum manifold with one WAX SPE cartridge plus a reservoir adaptor and reservoir for each cartridge; label each reservoir with the associated sample ID. If using plastic transfer lines instead of reservoirs, ensure the connecting caps are snug in each cartridge and the transfer lines are placed within the appropriate sample; label each cartridge tube with the associated sample ID.

3) Pre-condition the cartridges by washing them with 15 mL of 1% methanolic ammonium hydroxide followed by 5 mL of 0.3M formic acid. Perform each rinse separately. Do not allow the WAX SPE to go dry. Discard the wash solvents.

4) Pour the sample into the reservoir (do not use a pipette), taking care to avoid splashing while loading; or, if using transfer lines, begin opening the stopcocks on the vacuum manifold. Adjust the vacuum/stopcocks to pass each sample through the cartridge at approximately 5-10 mL/min; discard the eluate. Retain the empty sample bottle for later rinsing (Section 9.3.8).

5) Rinse the walls of the reservoir with 5 mL reagent water twice, followed by 5 mL of 1:1 0.1M formic acid/methanol and pass those rinses through the cartridge using

vacuum. If using sample transfer lines for loading, add the 3 rinses to the bottle and load through the transfer lines to the cartridge, one reagent at a time. Dry the cartridge by pulling air through for approximately 5 minutes. Discard the rinse solution.

6) After the WAX cartridges are sufficiently dry, rinse the GCB cartridges with 5 mL of 1% methanolic ammonium hydroxide; discard the rinsate. Do not allow the GCB to go completely dry.

7) Connect the outlet of the WAX cartridges to the inlet of the GCB cartridges to stack them on the manifold and allow for cleanup of the extract as part of elution. Ensure that the WAX cartridges are returned to their original locations on the manifold to avoid cross contamination. Continue to the elution steps in the next section.

9.3.8 Elution of Solid Sample Extracts

1) Place a clean collection tube in the manifold rack for each sample and QC aliquot, ensuring the extract delivery needles are not touching the walls of the tubes. Resume vacuum and ensure a proper seal is achieved. DO NOT add NIS to these collection tubes.

2) Rinse the inside of each sample’s centrifuge tube using 5 mL of 1% methanolic ammonium hydroxide. Then pour the rinse from each bottle (or use a plastic transfer pipette) to transfer the rinse to the associated SPE reservoir, washing the walls of the reservoir. If using sample transfer lines, simply transfer this rinse from each sample container to its associated cartridge using vacuum. Allow the elution solvent to soak the SPE sorbent for 2 minutes, then use vacuum to pull the elution solvent through the cartridge and into the collection tubes in a slow, dropwise manner.

3) Add 25 µL of concentrated acetic acid and 20 µL of NIS mix to each sample extract in its collection tube and vortex to mix. Transfer a portion of each extract into an autosampler vial for LC-MS/MS analysis. Cap the collection tubes containing the remaining extracts and store at 0 - 6 °C.

9.3.9 Tissue Sample Processing

Prior to processing tissue samples, the laboratory must determine the exact tissue to be analyzed. Common requests for analysis of fish tissue include whole fish with the skin on, whole fish with the skin removed, edible fish fillets (filleted in the field or by the laboratory), specific organs, and other portions. Once the appropriate tissue has been determined, the samples must be prepared and homogenized.

Pace utilizes the Green Bay location for tissue homogenization, following ENV-SOP-GBAY-0129 (Sample Homogenization, Compositing, and Subsampling; specifically, Section 9.4).

1) For each sample, weigh a 2 g aliquot of homogenized tissue into a 50 mL polypropylene centrifuge tube. Reseal the container with the remaining homogenized portion of the sample and return it to frozen storage in case it needs to be used for reanalysis. The default sample weight for tissue is 2 g wet weight; however, a 1 g sample may be used. Higher sample weights are not recommended for this method.

2) Prepare the batch QC samples using 2 g of reference tissue matrix for the method blank and two LCSs. Spike one LCS sample with native standard solutions at 2x the LOQ (80 µL of STK-10X mix). This aliquot (LLLCS) will serve to verify the LOQ. Spike the other LCS sample at a concentration near the mid-level calibration point (40 µL of EPA1633-STK). This aliquot will serve as the traditional LCS.

Note: If matrix spikes are required for a specific project, spike the field sample bottles designated for use as MS/MSD samples in the same manner as the LCS.

3) Spike 20 µL of EIS solution (Section 8.2.3) directly into each field and QC sample. Vortex and allow to equilibrate for approximately 30 minutes.

4) Add 15 mL of 0.05M KOH in methanol to each sample. Vortex to disperse the tissue then place tubes on a variable speed mixing table to shake for 1 hour. Centrifuge at 3000 rpm (~2000 RCF) for 10 minutes and collect the supernatant in a 125mL sample bottle.

5) Add 10 mL of acetonitrile to remaining tissue in the centrifuge tube, vortex to mix and disperse the tissue. Sonicate for 30 minutes. Centrifuge at 3000 rpm (~2000 RCF) for 10 minutes and collect the supernatant, adding it to the 125mL bottle containing the initial extract.

6) Dilute to approximately 75 mL with reagent water. A separate bottle marked at the 75 mL level may be used to get the approximate volume.

7) Check that the pH is 6.5 ± 0.5. If necessary, adjust pH with 50% formic acid or ammonium hydroxide (or with 5% formic acid and 3% aqueous ammonium hydroxide). The extract is now ready for solid phase extraction (SPE) and cleanup.

9.3.10 Solid Phase Extraction of Tissue Samples

1) Pack clean silanized glass wool to half the height of a WAX SPE cartridge barrel; repeat for the total number of samples in the batch.

2) For each sample and QC aliquot, set up the vacuum manifold with one WAX SPE cartridge plus a reservoir adaptor and reservoir for each cartridge; label each reservoir with the associated sample ID. If using plastic transfer lines instead of reservoirs, ensure the connecting caps are snug in each cartridge and the transfer lines are placed within the appropriate sample; label each cartridge tube with the associated sample ID.

3) Pre-condition the cartridges by washing them with 15 mL of 1% methanolic ammonium hydroxide followed by 5 mL of 0.3M formic acid. Perform each rinse separately. Do not allow the WAX SPE to go dry. Discard the wash solvents.

4) Pour the sample into the reservoir (do not use a pipette), taking care to avoid splashing while loading; or, if using transfer lines, begin opening the stopcocks on the vacuum manifold. Adjust the vacuum/stopcocks to pass each sample through the cartridge at approximately 5-10 mL/min; discard the eluate. Retain the empty sample bottle for later rinsing (Section 9.3.8).

5) Rinse the walls of the reservoir with 5 mL reagent water twice, followed by 5 mL of 1:1 0.1M formic acid/methanol and pass those rinses through the cartridge using vacuum. If using sample transfer lines for loading, add the 3 rinses to the bottle and load through the transfer lines to the cartridge, one reagent at a time. Dry the cartridge by pulling air through for approximately 5 minutes. Discard the rinse solution.

6) After the WAX cartridges are sufficiently dry, rinse the GCB cartridges with 5 mL of 1% methanolic ammonium hydroxide; discard the rinsate. Do not allow the GCB to go completely dry.

7) Connect the outlet of the WAX cartridges to the inlet of the GCB cartridges to stack them on the manifold and allow for cleanup of the extract as part of elution. Ensure that the WAX cartridges are returned to their original locations on the manifold to avoid cross contamination. Continue to the elution steps in the next section.

9.3.11 Elution of Tissue Sample Extracts

1) Place a clean collection tube in the manifold rack for each sample and QC aliquot, ensuring the extract delivery needles are not touching the walls of the tubes. Resume vacuum and ensure a proper seal is achieved. DO NOT add NIS to these collection tubes.

2) Rinse the inside of each sample's centrifuge tube using 5 mL of 1% methanolic ammonium hydroxide. Then pour the rinse from each bottle (or use a plastic transfer pipette) to transfer the rinse to the associated SPE reservoir, washing the walls of the reservoir. If using sample transfer lines, simply transfer this rinse from each sample container to its associated cartridge using vacuum. Allow the elution solvent to soak the SPE sorbent for 2 minutes, then use vacuum to pull the elution solvent through the cartridge and into the collection tubes in a slow, dropwise manner.

3) Add 25 µL of concentrated acetic acid and 20 µL of NIS mix to each sample extract in its collection tube and vortex to mix. Transfer a portion of each extract into an autosampler vial for LC-MS/MS analysis. Cap the collection tubes containing the remaining extracts and store at 0 - 6 °C.

9.4 Analysis

9.4.1 Sequence Preparation

Analysis of sample extracts for PFAS by LC-MS/MS is performed running manufacturer's data acquisition software. The mass spectrometer is run with unit mass resolution in the multiple reaction monitoring (MRM) mode.

1) Perform mass calibration and mass calibration verification, establish the operating conditions, and perform an initial calibration prior to analyzing samples. Only after all performance criteria are met may blanks, MDLs, IDOC/LCS, and samples be analyzed.

2) Each day of analysis, the column must be thoroughly flushed with 100% Acetonitrile for at least 30 minutes to clear any accumulated impurities and interferences from the sample pathway and equilibrate the system. It is also good practice to open the purge valve(s) on the pumps for the first ~1 minute of flush time and/or use the "purge"

function available as part of the pump functionality. Additionally, it is good practice to purge the autosampler injector flow path daily prior to analysis by using the “purge” function, if available. The column should then be equilibrated to the analysis starting conditions by flushing for approximately 15 mins with 50:50 Mobile Phase A: Mobile Phase B and finally approximately 15 mins with 80:20 Mobile Phase A: Mobile Phase B (acquisition starting conditions). Ensure that system pressure is stable.

3) Following any initial priming injections on days when a calibration is not needed, an ISC and an instrument blank will be analyzed to demonstrate system suitability and the absence of system contamination prior to sample analysis.

4) After acceptable ISC and IBLK results are confirmed, load and submit extracted samples for analysis, typically starting with batch QC with field samples following. A CCV and CCB must be analyzed after every 10 (or fewer) field samples.

9.4.2 Routine Analytical Sequence

After a successful initial calibration has been completed, samples may be analyzed; an example analytical sequence is provided below. The volume injected for samples and QCs must be identical to the volume used for calibration. Standards and sample extracts must be brought to room temperature and vortexed prior to aliquoting into an instrument vial to ensure homogeneity of the extract.

ISC

CCV

Instrument Blank

Method Blank

LLLCS

LCS

Samples (10 or fewer)

CCV

CCB

Samples (10 or fewer)

CCV

If the results are acceptable, the closing CCV analysis may be used as the opening solution for the next analytical sequence.

If the response exceeds the calibration range for any sample, extracts are diluted as per Section 9.4.3 to bring all target responses within the calibration range.

Note: If the analytes that exceed the calibration range in the original analysis are known to not be of concern for the specific project (e.g., are not listed in a discharge permit), then the laboratory may consult with the client regarding the possibility of reporting that sample from the undiluted analysis.

9.4.3 Sample Dilutions

If the measured concentration for any compound exceeds the calibration range of the system, dilute an aliquot of the sample extract with the IBLK mix solution by a factor no greater than 10x, refortify the NIS compounds to initial concentration, and analyze the diluted extract. If the responses for each applicable EIS in the diluted extract meet the S/N and retention time requirements in Section 10.1.1, and the EIS recoveries from the analysis of the diluted extract, corrected for the dilution, are within the limits presented in Table 10, 11 or 12 (according to sample matrix), then the compounds associated with those EISs may be quantified. The EIS recoveries, compound concentrations, detection limits, and LOQs are adjusted to account for the dilution.

If the EIS responses in the diluted extract do not meet the S/N and retention time requirements listed in Section 10.1.1, then the compound cannot be measured reliably in the diluted extract. In such cases, subsample a smaller aliquot of any affected aqueous sample and dilute it to 500 mL with reagent water and re-extract the sample. For solid sample matrices, prepare a smaller aliquot of soil, biosolid, sediment, or tissue and re-extract the sample. The reduced sample volume (or mass) chosen for the re-extraction should reflect the dilution applied to the original extract (i.e., if the original aqueous sample extract was analyzed at a 10X dilution, 50 mL should be subsampled for the re-extraction). See Section 9.3.1 for more guidance. The reported compound concentrations, detection limits, and LOQs are adjusted to account for the reduced sample volume (or mass) that is extracted.

If the recovery of any isotopically labeled compound is outside of the acceptance limits (Appendix B) in the original, undiluted analysis, a diluted aqueous sample or smaller aliquot (for solids and tissue) should be prepared and analyzed.

10.0 DATA ANALYSIS & CALCULATIONS

10.1 Data Analysis

10.1.1 Qualitative Identification

A native, EIS, or NIS compound is positively identified in a standard, blank, sample, or QC sample when all criteria in Sections 10.1.1.1 through 10.1.1.3 are met.

10.1.1.1 Signal-to-Noise Ratio (S/N)

Peak responses of the quantitation and confirmation ions must be at least three times the background noise level (S/N 3:1). The quantitation ion must have a S/N ≥ 10:1 if there is no confirmation ion. If the S/N ratio is not met in a standard or QC sample due to high background noise, the laboratory must correct the issue (e.g., perform instrument troubleshooting). If the S/N ratio is not met in a blank or sample, then the analyte is to be considered a non-detect.

10.1.1.2 RT Criteria

Target analyte, EIS analyte, and NIS analyte RTs must fall within 0.4 minutes of the predicted retention times from the midpoint standard of the ICAL or initial daily CCV, whichever was used to establish the RT window position for the analytical batch. The retention time window used must be of sufficient width to detect earlier-eluting branched isomers. For all method analytes with exact corresponding isotopically labeled analogs, method analytes must elute within 0.1 minutes of the associated EIS.

10.1.1.3 Ion Ratio Criteria

For any reported compound detection, the ratio of the total (branched and linear isomer) quantification ion response to the total (branched and linear isomer) confirmation ion response – referred to as the Ion Ratio – must fall within ± 50% of the ratio observed in the mid-point ICAL standard. The ion ratio requirement does not apply for PFBA, PFPeA, NMeFOSE, NEtFOSE, PFMPA, and PFMBA because suitable secondary transitions are unavailable (not detectable or inadequate S/N).

10.1.2 Manual Integration

Manual integration is sometimes necessary to correct inaccurate automated integrations but must never be used to meet QC criteria or to substitute for proper instrument maintenance and/or method set-up. To assure that all manual integrations are justified and proper all manual integrations must be performed, documented, reviewed, and approved in accordance with corporate SOP ENV-SOP-CORQ-0006, *Manual Integration*. Refer to this SOP for guidance on manual integration techniques and required procedures.

10.1.2.1 Branched Isomer Integration

The response of all isomers in the quantitative standards should be used to define integration parameters and ion ratios. In samples, the total integrated response should include the branched isomer peaks that have been identified in the quantitative standard, if present. For compounds with identified branched and linear isomer peaks, the reported concentration is the sum of all isomers. If standards (either quantitative or qualitative) containing a mix of isomers are not available for purchase for a particular compound, only the linear isomer can be identified and quantitated in samples.

10.1.2.2 Qualification

If the field sample result does not meet all criteria stated in Section 10.1.1, and all sample preparation avenues (e.g., extract cleanup, sample dilution, etc.) have been exhausted, the result may only be reported with a data qualifier alerting the data user that the result could not be confirmed because it did not meet the method-required criteria and therefore should be considered an estimated value. If the criteria listed above are not met for the standards, the laboratory must stop analysis of samples and correct the issue.

10.2 Calculations

Refer to laboratory SOP (ENV-SOP-WEST-0124, Common Laboratory Calculations), or however named, for equations used to perform common calculations.

10.2.1 ICAL Relative Response (RR) and Response Factor (RF)

The response ratio (RR) for each native compound calibrated by isotope dilution is calculated according to the equation below, separately for each of the calibration standards, using the areas of the quantification ions shown in Table 4. RR is used for the 24 compounds measured by true isotope dilution quantification.

$$RR = \frac{Area_t M_{EIS}}{Area_{EIS} M_t}$$

Where:

$Area_t$ = Measured area of the quantitation ion for the target analyte.

$Area_{EIS}$ = Measured area of the quantitation ion for the corresponding labeled PFAS used as the EIS in the calibration standards.

M_{EIS} = Concentration of the isotopically labeled PFAS uses as the EIS in the calibration standards (ng/L)

M_t = Concentration of the target analyte in the calibration standard (ng/L)

Similarly, the response factor (RF) for each native compound calibrated by extracted internal standard is calculated according to the equation below. RF is used for the 16 compounds measured by extracted internal standard quantification.

$$RF = \frac{Area_t M_{EIS}}{Area_{EIS} M_t}$$

Where:

$Area_t$ = Measured area of the quantitation ion for the target analyte.

$Area_{EIS}$ = Measured area of the quantitation ion for the corresponding labeled PFAS used as the EIS in the calibration standards.

M_{EIS} = Concentration of the isotopically labeled PFAS uses as the EIS in the calibration standards (ng/L)

M_t = Concentration of the target analyte in the calibration standard (ng/L)

A response factor (RF_S) is calculated for each EIS compound in the calibration standard using the equation below. RF_S is used for the 24 isotopically labeled compounds measured by non-extracted internal standard quantification.

$$RF_S = \frac{Area_{EIS} M_{NIS}}{Area_{NIS} M_{EIS}}$$

Where:

$Area_{EIS}$ = Measured area of the quantitation ion for the EIS compound added to the sample before extraction.

$Area_{NIS}$ = Measured area of the quantitation ion for the NIS compound in the calibration standard.

M_{NIS} = Concentration of the NIS compound in the calibration standard (ng/L).

M_{EIS} = Concentration of the EIS compound in the calibration standard (ng/L).

10.2.2 Target Analyte Concentration

Concentrations of the target analytes are determined with respect to the extracted internal standard (EIS) which is added to the sample prior to extraction (see Table 4). Other equations may be used if the laboratory demonstrates that those equations produce the same numerical result as produced by the equation below.

$$\boldsymbol{Concentration}\ \left({}^{\boldsymbol{ng}}/_{\boldsymbol{Lor}}{}^{\boldsymbol{ng}}/_{\boldsymbol{g}}\right) = \frac{\boldsymbol{Area_N M_{EIS}}}{\boldsymbol{Area_{EIS}}\left(\overline{\boldsymbol{RR}}\ \boldsymbol{or}\ \overline{\boldsymbol{RF}}\right)}\ \boldsymbol{x\ DF\ x}\ \frac{\boldsymbol{Vf}}{\boldsymbol{Vi}}$$

Where:

$Area_N$ = The measured area of the quantitation ion for the native (unlabeled) PFAS.

$Area_{EIS}$ = The measured area of the quantitation ion for the EIS.

M_{EIS} = The expected concentration of the EIS in the extract (ng/L)

$\overline{\boldsymbol{RR}}$ = Average response ratio used to quantify target compounds by the isotope dilution method.

$\overline{\boldsymbol{RF}}$ = Average response ratio used to quantify target compounds by the extracted internal standard method.

DF = Dilution Factor. If no extract dilution was performed, then DF=1.

Vf = Final extract volume (L)

Vi = Initial sample volume (L) or weight (g)

10.2.3 EIS Concentration

The EIS compounds are quantitated with respect to an NIS, as shown in Table 4, using the response ratios or response factors from the most recent initial calibration. Other equations may be used if the laboratory demonstrates that those equations produce the same numerical result as produced by the equation below.

$$Concentration\ \left({}^{ng}/_{L\ or}{}^{ng}/_{g}\right) = \frac{Area_{EIS} M_{NIS}}{Area_{NIS}\overline{RF}_S}\ x\ DF\ x\ \frac{Vf}{Vi}$$

Where:

$Area_{EIS}$ = The measured area of the quantitation ion for the EIS.

$Area_{NIS}$ = The measured area of the quantitation ion for the associated NIS.

M_{NIS} = The expected concentration of the NIS in the extract (ng/L)

$\overline{\boldsymbol{RF_S}}$ = Average response factor used to quantify the EIS compound by the non-extracted internal standard method**.**

DF = Dilution Factor. If no extract dilution was performed, then DF=1.

Vf = Final extract volume (L)

Vi = Initial sample volume (L) or weight (g)

10.2.4 Relative Error (%RE)

$$\%\ Relative\ Error = \left(\frac{x'i - xi}{xi}\right) x\ 100$$

Where:

xi = True value of the calibration standard

x’i = Measured concentration of the calibration standard

10.2.5 Percent Relative Standard Deviation

$$\%\ Relative\ Standard\ Deviation = \left(\frac{S}{\bar{\bar{x}}}\right) x\ 100$$

Where:

S = Standard Deviation

X = Mean

10.2.6 Standard Deviation

$$S = \left(\frac{\sum (x_i - \bar{x})^2}{(n-1)}\right)$$

Where:

S = standard deviation

n = size of the population

x_i = each value of the population

$\bar{x}$ = population mean

10.2.7 Mean

$$\bar{x} = \frac{\left(\sum_{i=1}^{n} x_i\right)}{n}$$

Where:

$\bar{x}$ = population mean

x_i = each value of the population

n = number of values in the population

10.3 Reporting

All results for aqueous samples will be reported in ng/L. All results for solid samples will be reported in ng/g, on a dry-weight basis, and the percent solids for each sample will be reported separately. All results for tissue samples will be reported in ng/g, on a wet-weight basis. All QC data will be reported with the sample results. See Appendix A for specific reporting limits in all matrices.

Unless specified otherwise by a regulatory authority or in a discharge permit, results for analytes that meet the identification criteria are reported down to the concentration of the LOQ established by the laboratory.

Results for any analyte found in a sample or extract that has been diluted will be reported at the least dilute level for which the measured concentration is within the calibration range (e.g., above the LOQ for the analyte and below the highest calibration standard) and in which isotopically labeled compound recoveries are within their respective QC acceptance criteria. This may require reporting results for some analytes from different analyses.

Recoveries of all associated EIS compounds will be reported for all field samples and QC Quality Control & Method Performance

10.4 Quality Control

Prepare and analyze the following QC samples with each batch of samples. Refer to Appendix B for acceptance criteria and required corrective action(s).

QC Check	Acronym	Frequency
Method Blank	MB	1 per batch of 20 or fewer samples.
Laboratory Control Sample	LCS	1 per batch of 20 or fewer samples.
Low Level Laboratory Control Sample	LLLCS	1 per batch of 20 or fewer samples.
Matrix Spike	MS	1 pair per batch of 20 or fewer samples (if required/requested)
MS Duplicate	MSD	
Sample Duplicate	DUP	1 per AFFF or F3 sample.
Extracted Internal Standard	EIS	All CAL standards, batch QC and field samples.
Non-extracted Internal Standard	NIS	All CAL standards, batch QC and field samples.

The minimum quality control requirements of this method consist of an initial demonstration of laboratory capability, analysis of samples spiked with isotopically labeled compounds to evaluate and document data quality, and analysis of standards and blanks as tests of continued performance. Laboratory performance is compared to established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

If the method is to be applied to a sample matrix other than water (e.g., soils, biosolids, tissue), the appropriate alternative reference matrix is substituted for the reagent water matrix in all performance tests.

The laboratory must make an initial demonstration of the ability to generate acceptable precision and recovery with this method. This demonstration is described in Section 11.3.2.

Analyses of method blanks (MBs) are required on an on-going basis to demonstrate the extent of background contamination in any reagents or equipment used to prepare and analyze field samples. The procedures and criteria for analyses of MBs are described in Section 11.1.1.

The laboratory must spike all samples with isotopically labeled compounds to monitor method performance. These evaluations are described in Sections 11.1.4 and 11.1.5. When results of these spikes indicate atypical method performance for samples, the samples are diluted to evaluate whether the performance issue is caused by the sample matrix. Procedures for dilution are given in Section 9.4.3.

The laboratory must, on an ongoing basis, demonstrate that the analytical system is in control through calibration verification (CCV) and the analysis of blanks and ongoing precision and recovery standards spiked at low (LLLCS) and mid-level concentrations (LCS). These procedures are given in Sections 9.2.4.5, 11.1.1 and 11.1.2.

10.4.1 Method Blank (MB)

A method blank is analyzed with each extraction batch to demonstrate freedom from contamination. The matrix for the method blank must be similar to the sample matrix for the batch (e.g., reagent water blank, solids matrix blank, or tissue blank [Section 7.3]).

Analyze the extract of the method blank aliquot before the analysis of the LCSs.

If any PFAS is found in the MB 1) at a concentration greater than the LOQ for the analyte, 2) at a concentration greater than one-third the regulatory compliance limit, or 3) at a concentration greater than one-tenth the concentration in a sample in the extraction batch, whichever is greatest, analysis of samples must be halted, and the problem corrected. Other project-specific requirements may apply; therefore, the laboratory may adopt more stringent acceptance limits for the method blank at their discretion. If the contamination is traceable to the extraction batch, samples affected by the blank must be re-extracted and analyzed along with a new MB and LCS/LLLCS, provided enough sample volume is available and the samples are still within holding time. Reanalysis or re-extraction is not required if the samples are not impacted. Samples are not impacted when the MB detection is not present in the sample, or the sample concentration is ≥10x the concentration of the detection in the MB.

If the new blank also exhibits contamination and additional volume of the associated sample(s) is not available for re-extraction and analysis, the laboratory must document and report the failures (e.g., as qualifiers on results), unless the failures are not required to be reported as determined by the regulatory/control authority.

10.4.2 Laboratory Control Sample (LCS) / Low-Level LCS (LLLCS)

Analyze the extract of the LCS and LLLCS to ensure the analytical process is under control.

Compute the percent recovery of the native compounds by the appropriate quantification method depending on the compound. Compute the percent recovery of each isotopically labeled compound by the non-extracted internal standard quantitation method.

For the target analytes and EIS compounds, compare the recovery to the LCS and LLLCS limits given in Tables 7 through 10 (or 12). LCS, LLLCS, and EIS results must meet the acceptance criteria in these tables. If all compounds meet the acceptance criteria, system performance is acceptable, and analysis of blanks and aqueous samples may proceed. If, however, any individual concentration falls outside of the given range, the extraction/concentration processes are not being performed properly for that compound. In this event correct the problem, re-extract all affected samples, including any QC samples, and repeat the analysis. Samples are unaffected if the LCS or LLLCS recovery is above the acceptance criteria and the sample is ND for the failing compound.

10.4.3 Matrix Spike (MS)

Matrix spikes generally are not required for methods that employ isotope dilution quantification because deleterious effects of the matrix should be evident in the recoveries of the EIS compounds spiked into every sample. The analysis of matrix spike samples may help diagnose the potential impact of matrix interferences for specific target analytes or sample matrices. See Appendix E for MS/MSD, MS/DUP sample selection guidance.

10.4.4 Extracted Internal Standard (EIS)

To assess method performance on the sample matrix, the laboratory must spike all samples with the EIS solution. Analyze each sample according to the procedures in this SOP. Compute the percent recovery of the EIS compound concentration using the NIS quantitation method and the equation in Section 10.2.3.

The recovery of each EIS compound in an aqueous sample must be within the limits in Table 10, which are the required QC acceptance limits for aqueous samples, including landfill leachates. The recovery of each EIS compound in soil, sediment, or biosolid samples must be within the limits in Table 11. The recovery of each EIS compound in tissue samples must be within the limits in Table 12. The limits presented in Tables 10, 11, and 12 are the required QC acceptance limits for these matrices derived from the multi-laboratory validation study. If the recovery of any EIS falls outside of these limits, method performance is unacceptable for that EIS in that sample. Additional cleanup procedures or limited dilution of the sample extract may be employed to attempt to bring the EIS recovery within the acceptance normal range.

If the recovery cannot be brought within the acceptance limits after extract dilution or additional cleanup procedures have been employed, then the laboratory must take a smaller aliquot of any affected aqueous sample, dilute it to 500 mL with reagent water and prepare and analyze the diluted sample, or must prepare and analyze a smaller aliquot of soil, sediment, biosolid, or tissue sample, per Section 9.4.3.

10.4.5 Non-extracted Internal Standard (NIS)

To assess method performance, the laboratory must spike all sample extracts with the NIS solution. Analyze each sample extract according to the procedures in this SOP. Percent recovery of the NIS compound is calculated by comparing the measured response in each analysis to the average response of the same compound measured in the ICAL.

Calculate the ratio of the NIS peak areas from the QC and field samples relative to the mean area of the corresponding NIS in the most recent initial calibration to check for possible bad injections of NIS solution or loss of instrument sensitivity.

The NIS areas in the field samples and QC samples must be within 50 to 200% of the mean area of the corresponding NIS in the most recent initial calibration (i.e., within a factor of 2). If the areas are low for all the field samples and QC samples in the batch, it suggests a loss of instrument sensitivity, while low areas in only some field or QC samples suggests a possible bad injection.

10.5 Instrument QC

Perform the following checks to verify instrument performance. Refer to Appendix B for acceptance criteria and required corrective action.

Instrument Check	Acronym	Frequency
Mass Calibration		Annually and on as-needed basis
Mass Calibration Verification		After mass calibration

Instrument Check	Acronym	Frequency
Initial Calibration	ICAL	Prior to analysis, and on as-needed basis
Initial Calibration Verification	ICV	Following each ICAL
Instrument Blank	IBLK/ICB	Daily prior to analysis and after high standards
Instrument Sensitivity Check	ISC	Daily prior to analysis
Continuing Calibration Verification	CCV	At the beginning (ISC) and every 10 samples
Continuing Calibration Blank	CCB	After each bracketing CCV
RT Window	RTW	During ICAL and at the beginning of each analytical sequence

10.6 Method Performance

10.6.1 Method Validation

Refer to corporate SOP ENV-SOP-CORQ-0011, *Method Validation and Instrument Verification*, for general requirements and procedures for method validation.

Establish Detection Limit (DL) and limits of quantitation (LOQ) at initial method set up and verify the DL and LOQ on an on-going basis thereafter. Refer to corporate policy and/or SOP for DL and LOQ requirements and procedures.

10.6.2 Demonstration of Capability (DOC)

Refer to laboratory SOP ENV-SOP-WEST-0122 Demonstration of Capability, or however named, for information regarding the laboratory's procedures for initial and ongoing Demonstration of Capability.

Prior to unsupervised (independent) work on any client sample, analysts that prepare or analyze samples must have successful initial demonstration of capability (IDOC) and must successfully demonstrate on-going proficiency on an annual basis (see below for details). Successful means the initial or on-going DOC met criteria, documentation of the DOC is complete, and the DOC record is in the employee’s training file.

Each DOC requires the extraction and analysis of four aliquots of the reference matrix type to be tested, prepared in the same way as the mid-level LCS. At least one method blank, matching the matrix being analyzed, must be prepared with the DOC batch. If more than one MB was prepared and analyzed with the DOC batch, all blank results must be reported. All sample processing steps that are to be used for processing samples, including preparation and extraction, must be included in this test.

Using the results of the four analyses, compute the average percent recovery (%REC) and the relative standard deviation (RSD) of the concentration of each target compound. There are no mean or RSD criteria for EIS compounds in the DOC; %REC of each DOC sample should meet the criteria in Appendix B, Tables 10, 11, or 12, depending on the matrix.

For each target compound, compare RSD and %REC to the corresponding limits for initial precision and recovery in Appendix B, Tables 7, 8, or 9, depending on the matrix.

If RSD and %REC for all compounds meet the acceptance criteria, system performance is acceptable, and analysis of blanks and samples may begin. If, however, any individual RSD exceeds the precision limit or any individual %REC falls outside the range for recovery, system performance is unacceptable for that compound. Correct the problem and repeat the test.

11.0 DATA REVIEW & CORRECTIVE ACTION

11.1 Data Review

The data review process of Pace® Analytical Services includes a series of checks performed at different stages of the process by different people to ensure that SOPs were followed, the analytical record is complete and properly documented, QC criteria were met, proper corrective actions were taken for QC failure and other nonconformance(s), and test results are reported with proper qualification, when necessary.

The review and checks that are performed by the employee performing the task is called primary review.

All data and test results are also peer reviewed. This process, known as secondary review, is performed to verify SOPs were followed, that calibration, instrument performance, and QC criteria were met and/or proper corrective actions were taken, qualitative ID and quantitative measurement is accurate, all manual integrations are justified, documented, and approved in accordance with the Pace® Analytical Services SOP for manual integration, calculations are correct, the analytical record is complete and traceable, and that results are properly qualified.

Lastly, a third-level review, called a completeness check, is performed by reporting or project management staff to verify the test report is complete.

Refer to laboratory SWI ENV-SWI-WEST-0087 SVOA Data Review Work Instructions for specific instructions and requirements for each step of the data review process.

11.2 Corrective Action

Corrective action is required when QC or sample results are not within acceptance criteria.

Refer to Appendix B for a complete summary of QC, acceptance criteria, and recommended corrective actions for QC associated with this test method.

If corrective action is not taken or was not successful, the decision/outcome must be documented in the analytical record. The primary analyst has primary responsibility for taking corrective action when QA/QC criteria are not met. Secondary data reviewers must verify that appropriate action was taken and/or that results reported with QC failure are properly qualified.

Corrective action is also required when carryover is suspected and when results are over range. Samples analyzed after a high concentration sample must be checked for carryover and reanalyzed if carryover is suspected. Carryover is usually indicated by low concentration detects of the analyte in successive samples analyzed after the high concentration sample.

Sample results at concentrations above the upper limit of quantitation must be diluted and reanalyzed. The result in the diluted samples should be within the working concentration range of the instrument calibration. If dilution is not performed, any result reported above the upper range is considered a qualitative measurement and must be qualified as an estimated value.

12.0 POLLUTION PREVENTION & WASTE MANAGEMENT

Refer to laboratory guide ENV-GUI-WEST-0020 Hazardous Waste Management and Disposal, or however named, for waste handling and management practices pertaining to the waste streams created at this facility.

Pace® proactively seeks ways to minimize waste generated during work processes. Some examples of pollution prevention include but are not limited to reduced solvent extraction, solvent capture, use of reusable cycletainers for solvent management, and real-time purchasing.

The EPA requires that laboratory waste management practices comply with all applicable federal and state laws and regulations. Excess reagents, samples, and method process wastes are characterized and disposed of in an acceptable manner in accordance with the Pace® Chemical Hygiene Plan / Safety Manual. Refer to this manual for these procedures.

13.0 MODIFICATIONS

The procedures in this SOP have been modified from the reference test method as follows:

Modification	Section of Reference Method Modified	Justification for Modification	Validation of Modification
Updated EIS quantitation matching for select compounds (PFMPA, 7:3FTCA, ADONA, 9Cl-PF3ONS, 11Cl-PF3OUdS)	Section 20, Table 10	Improved performance, more appropriate correlation	MDL, IDOC, PT
Updated product ion used for measurement of 13C4-PFOA from m/z 172 to m/z 372	Section 20, Table 10	Match ion transition used for EIS 13C8-PFOA and native PFOA	MDL, IDOC, PT
Increased SPE sorbent bed to 250mg, tube size to 20mL	Section 6.7.1	Wider cartridge improves sample loading, reduces chances of clogs	MDL, IDOC, PT
Increased allowable sample loading rate to 5-10 mL/min	Section 12.1.4	Reduced Sample processing time	MDL, IDOC, PT
Omit TSS for aqueous samples	Section 11.1 (11.1.1.5), 11.2.4	Reduced sample processing time	MDL, IDOC, PT
Solid matrix extraction: reduced liquid-solid shake/decant steps to 2; omitted concentration step	Section 11.3 (11.3.4, 11.3.6, 11.3.9)	Improved performance & reduced sample processing time	MDL, IDOC, PT
GCB cartridges: eliminated dGCB + syringe filtration	Section 11.3.7, 11.4.7, 12.1, 12.2.3, 12.2.4, 12.3.3, 12.4.3	Improved performance, reduced sample processing time, & ease of use	MDL, IDOC, PT

Modification	Section of Reference Method Modified	Justification for Modification	Validation of Modification
Tissue matrix extraction: reduced liquid-solid shake/decant steps to 2; reduced shake time; omitted concentration step	Section 11.4.4, 11.4.6, 11.4.8	Improved performance & reduced sample processing time	MDL, IDOC, PT
Clearly defined the characteristics used to distinguish Aqueous vs. Biosolid vs. Solid matrices	n/a	Increased clarity in process decision making, improved first-run performance	MDL, IDOC, PT

When applicable, comparability and/or equivalency studies necessary to validate the modification as required per corporate SOP ENV-SOP-CORQ-0011, *Method Validation and Instrument Verification*, are retained by local quality personnel for historical reference.

14.0 RESPONSIBILITIES

PAS employees that perform any part this procedure in their work activities must have a signed Read and Acknowledgement Statement (R&A) in their training file for the version(s) of the SOP that were in effect during the time the employee performed the activity.

PAS supervisors and managers, however named, are responsible for training employees on the procedures in this SOP, implementing the SOP in the work area, and monitoring on-going adherence to the SOP in the work area(s) they oversee.

PAS employees are responsible for following the procedures in this SOP. Unauthorized deviations or departures from this SOP are not allowed except with documented approval from the local QM and only when those deviations do not violate the Pace® Code of Ethics or Professional Conduct (COR-POL-0004) or associated policy and procedure(s). Hand-edits or manual changes to the SOP are not permitted. If a change is desired or necessary, Pace® employees must follow the procedures for document revision specified in corporate SOPs ENV-SOP-CORQ-0015, *Document Management* and ENV-SOP-CORQ-0016, *SOP for Creation of SOP and SWI.*

15.0 ATTACHMENTS

Appendix A: Routine Analyte Limits (DL, LOQ), Analytical Parameters, and Calibration

Appendix B: QC Summary & Corrective Action; Table: Method Acceptance Criteria

Appendix C: State/Program Specific Requirements

Appendix D: Sample Pre-screening Instructions

Appendix E: Aqueous Sample Subsampling Instructions

Appendix F: MS/MSD, MS/DUP Selection Protocols

Appendix G: Aqueous Sample Management Decision Guide

Appendix H: Aqueous Sample Centrifugation Protocol

Appendix I: Separation and Analysis of Liquid-Solid Biphasic Matrices

Appendix J: TCLP/SPLP by 1633

Appendix K: Wipe Analysis by 1633

Appendix L: Articles of Commerce Analysis via Cryomill Processing

Appendix M: Procedure for Total Oxidizable Precursors (TOP)

16.0 REFERENCES

ENV-POL-CORQ-0005, *Acceptable Calibration Practices*, current version.

ENV-SOP-CORQ-0006, *Manual Integration*, current version.

ENV-SOP-CORQ-0011, *Method Validation and Instrument Verification*, current version.

ENV-SOP-CORQ-0015, *Document Management*, current version.

ENV-SOP-CORQ-0016, *Standard Operating Procedures and Standard Work Instructions,* current version.

COR-POL-0004, *Code of Ethics and Professional Conduct*, current version.

COR-MAN-001, *Pace® Safety Manua*l, current version.

ENV-MAN-WEST-0001, *Quality Manual*, current version.

TNI Standard, “Volume 1 Management and Technical Requirements for Laboratories Performing Environmental Analysis”, current version.

“Working with Carcinogens,” Department of Health, Education, & Welfare, Public Health Service, Centers for Disease Control, NIOSH, Publication 77-206, August 1977, NTIS PB-277256.

“OSHA Safety and Health Standards, General Industry,” OSHA 2206, 29 CFR 1910.

“Safety in Academic Chemistry Laboratories,” ACS Committee on Chemical Safety, 1979.

“Standard Methods for the Examination of Water and Wastewater,” 18th edition and later revisions, American Public Health Association, 1015 15th St, NW, Washington, DC 20005, 1-35: Section 1090 (Safety), 1992.

“Standard Practice for Sampling Water,” ASTM Annual Book of Standards, ASTM, 1916 Race Street, Philadelphia, PA 19103-1187, 1980.

“Handbook of Analytical Quality Control in Water and Wastewater Laboratories,” USEPA EMSL, Cincinnati, OH 45268, EPA 600/4-79-019, April 1979.

“Less is Better: Laboratory Chemical Management for Waste Reduction,” American Chemical Society, 1993. Available from the American Chemical Society's Department of Government Relations and Science Policy, 1155 16th Street NW, Washington, DC 20036.

“Environmental Management Guide for Small Laboratories,” USEPA, Small Business Division, Washington DC, EPA 233-B-00-001, May 2000.

"The Waste Management Manual for Laboratory Personnel," American Chemical Society, 1990. Available from the American Chemical Society's Department of Government Relations and Science Policy, 1155 16th Street NW, Washington, DC 20036.

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Woudneh, Million B., Bharat Chandramouli, Coreen Hamilton, Richard Grace, 2019, "Effects of Sample Storage on the Quantitative Determination of 29 PFAS: Observation of Analyte Interconversions during Storage", Environmental Science and Technology 53(21): 12576-12585.

EPA. Method 1633, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS. January 2024.

Standard Method for the Examination of Water and Wastewater, 23rd Edition, 2017 – Total, Fixed, and Volatile Solids in Solid and Semisolid Samples, Method 2540.

17.0 REVISION HISTORY

Revisions Made from Prior Version

Section	Description of Change
	N/A: new document

Document Succession: This version replaces the following document(s):

Document Number	Version	Document Title	Effective Date:
N/A	N/A	N/A	N/A

Appendix A: Routine Analyte Limits (DL, LOQ), Analytical Parameters, and Calibration

DL and LOQ are always adjusted to account for actual amounts used and for dilution. Values listed are as of effective date of this SOP. DL and LOQ are subject to change. Contact quality personnel for current information. See Table 4 below for more information regarding analyte detection and quantitation.

Table 1: Standard Analyte List – Aqueous and Landfill Leachate Matrices

Analyte Abbreviation	CAS #	Aqueous (ng/L)		Leachate (ng/L)	
		DL	LOQ	DL	LOQ
PFBA	375-73-5	0.527	6.4	2.64	32
PFPeA	2706-91-4	0.359	3.2	1.79	16
PFHxA	355-46-4	0.245	1.6	1.22	8
PFHpA	375-92-8	0.238	1.6	1.19	8
PFOA	1763-23-1	0.263	1.6	1.31	8
PFNA	68259-12-1	0.266	1.6	1.33	8
PFDA	335-77-3	0.210	1.6	1.05	8
PFUnA	79780-39-5	0.178	1.6	0.892	8
PFDoA	375-73-5	0.214	1.6	1.07	8
PFTrDA	2706-91-4	0.187	1.6	0.934	8
PFTeDA	355-46-4	0.160	1.6	0.801	8
PFBS	375-73-5	0.402	1.6	2.01	8
PFPeS	2706-91-4	0.206	1.6	1.03	8
PFHxS	355-46-4	0.133	1.6	0.665	8
PFHpS	375-92-8	0.201	1.6	1.00	8
PFOS	1763-23-1	0.264	1.6	1.32	8
PFNS	68259-12-1	0.203	1.6	1.02	8
PFDS	335-77-3	0.140	1.6	0.699	8
PFDoS	79780-39-5	0.242	1.6	1.21	8
4:2 FTS	757124-72-4	0.910	6.4	4.55	32
6:2 FTS	27619-97-2	4.82	6.4	24.1	32
8:2 FTS	39108-34-4	1.22	6.4	6.11	32
PFOSA	754-91-6	0.097	1.6	.484	8
NMeFOSA	31506-32-8	0.226	1.6	1.13	8
NEtFOSA	4151-50-2	0.351	1.6	1.76	8

Analyte Abbreviation	CAS #	Aqueous (ng/L)		Leachate (ng/L)	
		DL	LOQ	DL	LOQ
NMeFOSAA	2355-31-9	0.483	1.6	2.41	8
NEtFOSAA	2991-50-6	0.478	1.6	2.39	8
NMeFOSE	24448-09-7	1.30	16	6.52	80
NEtFOSE	1691-99-2	1.10	16	5.50	80
HFPO-DA	13252-13-6	1.60	6.4	8.02	32
ADONA	919005-14-4	0.376	6.4	1.88	32
PFMPA	377-73-1	0.244	3.2	1.22	16
PFMBA	863090-89-5	0.360	3.2	1.80	16
NFDHA	151772-58-6	0.541	3.2	2.71	16
9Cl-PF3ONS	756426-58-1	0.442	6.4	2.21	32
11Cl-PF3OUdS	763051-92-9	0.447	6.4	2.23	32
PFEESA	113507-82-7	0.330	3.2	1.65	16
3:3 FTCA	356-02-5	0.535	8	2.68	40
5:3 FTCA	914637-49-3	4.26	40	21.3	200
7:3 FTCA	812-70-4	3.18	40	15.9	200

Table 2: Standard Analyte List – Solid and Biosolid Matrices

Analyte Abbreviation	CAS #	Solid (ng/g)		Biosolid (ng/g)	
		DL	LOQ	DL	LOQ
PFBA	375-73-5	0.028	0.8	0.28	8
PFPeA	2706-91-4	0.038	0.4	0.38	4
PFHxA	355-46-4	0.016	0.2	0.16	2
PFHpA	375-92-8	0.012	0.2	0.12	2
PFOA	1763-23-1	0.026	0.2	0.26	2
PFNA	68259-12-1	0.012	0.2	0.12	2
PFDA	335-77-3	0.035	0.2	0.35	2
PFUnA	79780-39-5	0.013	0.2	0.13	2
PFDoA	375-73-5	0.021	0.2	0.21	2
PFTrDA	2706-91-4	0.016	0.2	0.16	2
PFTeDA	355-46-4	0.024	0.2	0.24	2
PFBS	375-73-5	0.020	0.2	0.20	2

Analyte Abbreviation	CAS #	Solid (ng/g)		Biosolid (ng/g)	
		DL	LOQ	DL	LOQ
PFPeS	2706-91-4	0.027	0.2	0.27	2
PFHxS	355-46-4	0.020	0.2	0.20	2
PFHpS	375-92-8	0.045	0.2	0.45	2
PFOS	1763-23-1	0.031	0.2	0.31	2
PFNS	68259-12-1	0.029	0.2	0.29	2
PFDS	335-77-3	0.015	0.2	0.15	2
PFDoS	79780-39-5	0.022	0.2	0.22	2
4:2 FTS	757124-72-4	0.078	0.8	0.78	8
6:2 FTS	27619-97-2	0.148	0.8	1.48	8
8:2 FTS	39108-34-4	0.259	0.8	2.59	8
PFOSA	754-91-6	0.011	0.2	0.11	2
NMeFOSA	31506-32-8	0.026	0.2	0.26	2
NEtFOSA	4151-50-2	0.022	0.2	0.22	2
NMeFOSAA	2355-31-9	0.086	0.2	0.86	2
NEtFOSAA	2991-50-6	0.044	0.2	0.44	2
NMeFOSE	24448-09-7	0.121	2.0	1.21	20
NEtFOSE	1691-99-2	0.081	2.0	0.81	20
HFPO-DA	13252-13-6	0.039	0.8	0.39	8
ADONA	919005-14-4	0.030	0.8	0.30	8
PFMPA	377-73-1	0.017	0.4	0.17	4
PFMBA	863090-89-5	0.024	0.4	0.24	4
NFDHA	151772-58-6	0.083	0.4	0.83	4
9Cl-PF3ONS	756426-58-1	0.029	0.8	0.29	8
11Cl-PF3OUdS	763051-92-9	0.040	0.8	0.40	8
PFEESA	113507-82-7	0.046	0.4	0.46	4
3:3 FTCA	356-02-5	0.092	1.0	0.92	10
5:3 FTCA	914637-49-3	0.236	5.0	2.36	50
7:3 FTCA	812-70-4	0.365	5.0	3.65	50

Table 3: Standard Analyte List – Tissue Matrices

Analyte Abbreviation	CAS #	DL (ng/g)	LOQ (ng/g)
PFBA	375-73-5	0.215	2.0
PFPeA	2706-91-4	0.088	1.0
PFHxA	355-46-4	0.044	0.5
PFHpA	375-92-8	0.062	0.5
PFOA	1763-23-1	0.070	0.5
PFNA	68259-12-1	0.099	0.5
PFDA	335-77-3	0.102	0.5
PFUnA	79780-39-5	0.093	0.5
PFDoA	375-73-5	0.052	0.5
PFTrDA	2706-91-4	0.067	0.5
PFTeDA	355-46-4	0.039	0.5
PFBS	375-73-5	0.044	0.5
PFPeS	2706-91-4	0.029	0.5
PFHxS	355-46-4	0.075	0.5
PFHpS	375-92-8	0.093	0.5
PFOS	1763-23-1	0.084	0.5
PFNS	68259-12-1	0.065	0.5
PFDS	335-77-3	0.056	0.5
PFDoS	79780-39-5	0.062	0.5
4:2 FTS	757124-72-4	0.222	2.0
6:2 FTS	27619-97-2	0.934	2.0
8:2 FTS	39108-34-4	0.249	2.0
PFOSA	754-91-6	0.051	0.5
NMeFOSA	31506-32-8	0.139	0.5
NEtFOSA	4151-50-2	0.115	0.5
NMeFOSAA	2355-31-9	0.089	0.5
NEtFOSAA	2991-50-6	0.106	0.5
NMeFOSE	24448-09-7	0.598	5.0
NEtFOSE	1691-99-2	0.410	5.0
HFPO-DA	13252-13-6	0.072	2.0

Analyte Abbreviation	CAS #	DL (ng/g)	LOQ (ng/g)
ADONA	919005-14-4	0.139	2.0
PFMPA	377-73-1	0.078	1.0
PFMBA	863090-89-5	0.086	1.0
NFDHA	151772-58-6	0.113	1.0
9Cl-PF3ONS	756426-58-1	0.179	2.0
11Cl-PF3OUdS	763051-92-9	0.228	2.0
PFEESA	113507-82-7	0.069	1.0
3:3 FTCA	356-02-5	0.145	2.5
5:3 FTCA	914637-49-3	1.54	12.5
7:3 FTCA	812-70-4	1.26	12.5

Table 4: Identification and Quantification Information for Target Analytes, Extracted Internal Standards and Non-extracted Internal Standards.

Analyte Name	CAS #	Analyte Abbreviation	Parent Ion Mass	Quantification Ion Mass	Confirmation Ion Mass	Quantification Reference Compound
Perfluorobutanoic acid	375-73-5	PFBA	213	169	NA	13C4-PFBA
Perfluoropentanoic acid	2706-91-4	PFPeA	263	219	69	13C5-PFPeA
Perfluorohexanoic acid	355-46-4	PFHxA	313	269	119	13C5-PFHxA
Perfluoroheptanoic acid	375-92-8	PFHpA	363	319	169	13C4-PFHpA
Perfluorooctanoic acid	1763-23-1	PFOA	413	369	169	13C8-PFOA
Perfluorononanoic acid	68259-12-1	PFNA	463	419	219	13C9-PFNA
Perfluorodecanoic acid	335-77-3	PFDA	513	469	219	13C6-PFDA
Perfluoroundecanoic acid	79780-39-5	PFUnA	563	519	269	13C7-PFUnA
Perfluorododecanoic acid	375-73-5	PFDoA	613	569	319	13C2-PFDoA
Perfluorotridecanoic acid	2706-91-4	PFTrDA	663	619	169	13C2-PFDoA
Perfluorotetradecanoic acid	355-46-4	PFTeDA	713	669	169	13C2-PFTeDA
Perfluorobutanesulfonic acid	375-73-5	PFBS	299	80	99	13C3-PFBS
Perfluoropentansulfonic acid	2706-91-4	PFPeS	349	80	99	13C3-PFHxS
Perfluorohexanesulfonic acid	355-46-4	PFHxS	399	80	99	13C3-PFHxS

Analyte Name	CAS #	Analyte Abbreviation	Parent Ion Mass	Quantification Ion Mass	Confirmation Ion Mass	Quantification Reference Compound
Perfluoroheptanesulfonic acid	375-92-8	PFHpS	449	80	99	13C8-PFOS
Perfluorooctanesulfonic acid	1763-23-1	PFOS	499	80	99	13C8-PFOS
Perfluorononanesulfonic acid	68259-12-1	PFNS	549	80	99	13C8-PFOS
Perfluorodecanesulfonic acid	335-77-3	PFDS	599	80	99	13C8-PFOS
Perfluorododecanesulfonic acid	79780-39-5	PFDoS	699	80	99	13C8-PFOS
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	757124-72-4	4:2 FTS	327	307	81	13C2-4:2FTS
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	6:2 FTS	427	407	81	13C2-6:2FTS
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	39108-34-4	8:2 FTS	527	507	81	13C2-8:2FTS
Perfluorooctanesulfonamide	754-91-6	PFOSA	498	78	478	13C8-PFOSA
N-methyl perfluorooctanesulfonamide	31506-32-8	NMeFOSA	512	219	169	D3-NMeFOSA
N-ethyl perfluorooctanesulfonamide	4151-50-2	NEtFOSA	526	219	169	D5-NEtFOSA
N-methyl perfluorooctanesulfonamidoacetic acid	2355-31-9	NMeFOSAA	570	419	483	D3-NMeFOSAA
N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	NEtFOSAA	584	419	526	D5-NEtFOSAA
N-methyl perfluorooctanesulfonamidoethanol	24448-09-7	NMeFOSE	616	59	NA	D7-NMeFOSE
N-ethyl perfluorooctanesulfonamidoethanol	1691-99-2	NEtFOSE	630	59	NA	D9-NEtFOSE
Hexafluoropropylene oxide dimer acid (GenX)	13252-13-6	HFPO-DA	285	169	185	13C3-HFPODA
4,8-Dioxa-3H-perfluorononanoic acid	919005-14-4	ADONA	377	251	85	13C4-PFHpA
Perfluoro-3-methoxypropanoic acid	377-73-1	PFMPA	229	85	NA	13C4-PFBA
Perfluoro-4-methoxybutanoic acid	863090-89-5	PFMBA	279	85	NA	13C5-PFPeA
Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	NFDHA	295	201	85	13C5-PFHxA

Analyte Name	CAS #	Analyte Abbreviation	Parent Ion Mass	Quantification Ion Mass	Confirmation Ion Mass	Quantification Reference Compound
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	9Cl-PF3ONS	531	351	533→353	13C8-PFOS
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	11Cl-PF3OUdS	631	451	633→453	13C8-PFOS
Perfluoro(2-ethoxyethane)sulfonic acid	113507-82-7	PFEESA	315	135	83	13C5-PFHxA
3-Perfluoropropyl propanoic acid (FPrPA)	356-02-5	3:3FTCA	241	177	117	13C5-PFPeA
2H,2H,3H,3H-Perfluorooctanoic acid (FPePA)	914637-49-3	5:3FTCA	341	237	217	13C5-PFHxA
3-Perfluoroheptyl propanoic acid (FHpPA)	812-70-4	7:3FTCA	441	337	317	13C9-PFNA
Extracted Internal Standard Compounds (EIS)						
Perfluoro-n-[13C4] butanoic acid	NA	13C4-PFBA	217	172	NA	13C3-PFBA
Perfluoro-n-[13C5] pentanoic acid	NA	13C5-PFPeA	268	223	NA	13C2-PFHxA
Perfluoro-n-[1,2,3,4,6-13C5] hexanoic acid	NA	13C5-PFHxA	318	273	NA	13C2-PFHxA
Perfluoro-n-[1,2,3,4-13C4] heptanoic acid	NA	13C4-PFHpA	367	322	NA	13C2-PFHxA
Perfluoro-n-[13C8] octanoic acid	NA	13C8-PFOA	421	376	NA	13C4-PFOA
Perfluoro-n-[13C9] nonanoic acid	NA	13C9-PFNA	472	427	NA	13C5-PFNA
Perfluoro-n-[1,2,3,4,5,6-13C6] decanoic acid	NA	13C6-PFDA	519	474	NA	13C2-PFDA
Perfluoro-n-[1,2,3,4,5,6,7-13C7] undecanoic acid	NA	13C7-PFUnA	570	525	NA	13C2-PFDA
Perfluoro-n-[1,2-13C2] dodecanoic acid	NA	13C2-PFDoA	615	570	NA	13C2-PFDA
Perfluoro-n-[1,2-13C2] tetradecanoic acid	NA	13C2-PFTeDA	715	670	NA	13C2-PFDA
Perfluoro-1-[2,3,4-13C3] butanesulfonic acid	NA	13C3-PFBS	302	80	NA	18O2-PFHxS
Perfluoro-1-[1,2,3-13C3] hexanesulfonic acid	NA	13C3-PFHxS	402	80	NA	18O2-PFHxS

Analyte Name	CAS #	Analyte Abbreviation	Parent Ion Mass	Quantification Ion Mass	Confirmation Ion Mass	Quantification Reference Compound
Perfluoro-1-[13C8] octanesulfonic acid	NA	13C8-PFOS	507	80	NA	13C4-PFOS
1H,1H,2H,2H-Perfluoro-1-[1,2-13C2] hexanesulfonic acid	NA	13C2-4:2FTS	329	81	NA	18O2-PFHxS
1H,1H,2H,2H-Perfluoro-1-[1,2-13C2] octanesulfonic acid	NA	13C2-6:2FTS	429	81	NA	18O2-PFHxS
1H,1H,2H,2H-Perfluoro-1-[1,2-13C2] decanesulfonic acid	NA	13C2-8:2FTS	529	81	NA	18O2-PFHxS
Perfluoro-1-[13C8] octanesulfonamide	NA	13C8-PFOSA	506	78	NA	13C4-PFOS
N-methyl-D3-perfluoro-1-octanesulfonamide	NA	D3-NMeFOSA	515	219	NA	13C4-PFOS
N-ethyl-D5-perfluoro-1-octanesulfonamide	NA	D5-NEtFOSA	531	219	NA	13C4-PFOS
N-methyl-D3-perfluoro-1-octanesulfonamidoacetic acid	NA	D3-NMeFOSAA	573	419	NA	13C4-PFOS
N-ethyl-D5-perfluoro-1-octanesulfonamidoacetic acid	NA	D5-NEtFOSAA	589	419	NA	13C4-PFOS
N-methyl-D7-perfluorooctanesulfonamidoethanol	NA	D7-NMeFOSE	623	59	NA	13C4-PFOS
N-ethyl-D9-perfluorooctanesulfonamidoethanol	NA	D9-NEtFOSE	639	59	NA	13C4-PFOS
Tetrafluoro-2-heptafluoropropoxy-13C3-propanoic acid	NA	13C3-HFPO-DA	287	169	NA	13C2-PFHxA
Non-extracted Internal Standard Compounds (NIS)						
Perfluoro-n-[2,3,4-13C3] butanoic acid	NA	13C3-PFBA	216	172	NA	NA
Perfluoro-n-[1,2-13C2]hexanoic acid	NA	13C2-PFHxA	315	270	NA	NA
Perfluoro-n-[1,2,3,4-13C4]octanoic acid	NA	13C4-PFOA	417	172	NA	NA
Perfluoro-n-[1,2,3,4,5-13C5] nonanoic acid	NA	13C5-PFNA	468	423	NA	NA

Analyte Name	CAS #	Analyte Abbreviation	Parent Ion Mass	Quantification Ion Mass	Confirmation Ion Mass	Quantification Reference Compound
Perfluoro-n-[1,2-13C2]decanoic acid	NA	13C2-PFDA	515	470	NA	NA
Perfluoro-1-hexane[18O2]sulfonic acid	NA	18O2-PFHxS	403	84	NA	NA
Perfluoro-n-[1,2,3,4-13C4] octanesulfonic acid	NA	13C4-PFOS	503	80	NA	NA

Table 5: Calibration Standard Concentrations (ng/mL)

Compound	L1	L2 (ISC)	L3	L4	L5 (CCV)	L6	L7	L8	L9
Perfluoroalkyl carboxylic acids									
PFBA	0.4	0.8	2	10	20	50	100	200	250
PFPeA	0.2	0.4	1	5	10	25	50	100	125
PFHxA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
PFHpA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
PFOA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
PFNA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
PFDA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
PFUnA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
PFDoA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
PFTrDA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
PFTeDA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
Perfluoroalkyl sulfonic acids									
PFBS	0.089	0.178	0.444	2.22	4.44	11.1	22.2	44.4	55.5
PFPeS	0.094	0.188	0.470	2.35	4.70	11.8	23.5	47.0	58.8
PFHxS	0.091	0.182	0.456	2.28	4.56	11.4	22.8	45.6	57.0
PFHpS	0.095	0.190	0.476	2.38	4.76	11.9	23.8	47.6	59.5
PFOS	0.093	0.186	0.464	2.32	4.64	11.6	23.2	46.4	58.0
PFNS	0.096	0.192	0.480	2.40	4.80	12.0	24.0	48.0	60.0
PFDS	0.096	0.193	0.482	2.41	4.82	12.1	24.1	48.2	60.3
PFDoS	0.097	0.194	0.484	2.42	4.84	12.1	24.2	48.4	60.5
Fluorotelomer sulfonic acids									
4:2FTS	0.375	0.750	1.87	9.37	18.7	46.9	93.7	187	234
6:2FTS	0.380	0.761	1.90	9.51	19.0	47.6	95.1	190	238
8:2FTS	0.384	0.768	1.92	9.6	19.2	48	96	192	240
Perfluorooctane sulfonamides									

Compound	L1	L2 (ISC)	L3	L4	L5 (CCV)	L6	L7	L8	L9
PFOSA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
NMeFOSA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
NEtFOSA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
Perfluorooctane sulfonamidoacetic acids									
NMeFOSAA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
NEtFOSAA	0.1	0.2	0.5	2.5	5	12.5	25	50	62.5
Perfluorooctane sulfonamide ethanols									
NMeFOSE	1	2	5	25	50	125	250	500	625
NEtFOSE	1	2	5	25	50	125	250	500	625
Per- and polyfluoroether carboxylic acids									
HFPO-DA	0.4	0.8	2	10	20	50	100	200	250
ADONA	0.378	0.756	1.89	9.45	18.9	47.25	94.5	189	236.25
PFMPA	0.2	0.4	1	5	10	25	50	100	125
PFMBA	0.2	0.4	1	5	10	25	50	100	125
NFDHA	0.2	0.4	1	5	10	25	50	100	125
Ether sulfonic acids									
9Cl-PF3ONS	0.373	0.746	1.87	9.33	18.7	46.7	93.3	187	233
11Cl-PF3OUdS	0.377	0.754	1.89	9.43	18.9	47.2	94.3	189	236
PFEESA	0.178	0.357	0.892	4.46	8.92	22.3	44.6	89.2	112
Fluorotelomer Carboxylic Acids									
3:3FTCA	0.5	1	2.5	12.5	25	62.5	125	250	312.5
5:3FTCA	2.5	5	12.5	62.5	125	312.5	625	1250	1560
7:3FTCA	2.5	5	12.5	62.5	125	312.5	625	1250	1560
Extracted Internal Standards (EIS)									
13C4-PFBA	10	10	10	10	10	10	10	10	10
13C5-PFPeA	5	5	5	5	5	5	5	5	5
13C5-PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
13C4-PFHpA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
13C8-PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
13C9-PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
13C6-PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
13C7-PFUnA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
13C2-PFDoA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
13C2-PFTeDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
13C3-PFBS	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
13C3-PFHxS	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
13C8-PFOS	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
13C2-4:2FTS	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69

Compound	L1	L2 (ISC)	L3	L4	L5 (CCV)	L6	L7	L8	L9
13C2-6:2FTS	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76
13C2-8:2FTS	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
13C8-PFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
D3-NMeFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
D5-NEtFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
D3-NMeFOSAA	5	5	5	5	5	5	5	5	5
D5-NEtFOSAA	5	5	5	5	5	5	5	5	5
D7-NMeFOSE	25	25	25	25	25	25	25	25	25
D9-NEtFOSE	25	25	25	25	25	25	25	25	25
13C3-HFPODA	10	10	10	10	10	10	10	10	10
Non-Extracted Internal Standards (NIS)									
13C3-PFBA	5	5	5	5	5	5	5	5	5
13C2-PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
13C4-PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
13C5-PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
13C2-PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
18O2-PFHxS	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
13C4-PFOS	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40

Appendix B: QC Summary & Corrective Action Table; Method Acceptance Criteria

Table 6: QC Summary & Corrective Action

QC Item	Frequency	Acceptance Criteria	Corrective Action	Qualification
Demonstration of Capability (DOC)	Initially, prior to analyzing field samples and annually thereafter.	See Method Acceptance Criteria for each matrix in the Tables below.	Identify and correct source of problem, repeat.	None. Do not proceed with analysis.
Mass Calibration	Annually and on as-needed basis.	Must meet manufacturer's acceptance criteria.	Identify and correct source of problem, repeat.	None. Do not proceed with analysis.
Mass Calibration Verification	After each Mass Calibration performed.	Must meet manufacturer's acceptance criteria.	Identify and correct source of problem, repeat Mass Calibration.	None. Do not proceed with analysis.
Initial Calibration (ICAL)	At instrument set up, after CCV failure and/or major maintenance.	Must meet one of the curve fit options presented in Section 9.2.4.	Identify and correct source of problem, repeat.	None. Do not proceed with analysis.
Initial Calibration Verification (ICV)	After Each ICAL.	All analytes must be within ± 30% of their true values. (%R)	Identify and correct source of problem, re-analyze. If repeat failure, repeat ICAL. Analysis may proceed if it can be demonstrated that the ICV exceedance has no impact on analytical measurements. For example, the ICV %R is high, CCV is within criteria, and the analyte is not detected in sample(s).	Qualify analytes with ICV out of criteria when results are unaffected; otherwise, correct the problem and repeat ICV.
Initial Calibration Blank (ICB)	After highest concentration ICAL standard.	Must meet criteria specified in Section 9.2.5: all detections ≤MDL concentration.	Identify and correct source of contamination or performance issue. Alternately, calibrate using a lower concentration standard for the highest point.	No samples shall be analyzed until ICB has met acceptance criteria.
RT Window Position	Once per ICAL and at the beginning of the analytical window.	Position is set using the mid-point of the ICAL on the day ICAL is performed; otherwise, opening CCV is used. RT Window is ± 60 secs from RT position.	NA	NA
Instrument Sensitivity Check (ISC)	Daily before sample analysis.	All native and isotopically labelled compounds within ± 30% recovery.	Identify and correct source of problem and reanalyze ISC. If problem persists, repeat ICAL.	No samples shall be analyzed until ISC has met acceptance

QC Item	Frequency	Acceptance Criteria	Corrective Action	Qualification
				criteria. See Section 9.2.4.5 for exceptions.
Bile Salts Check	With each ICAL and daily with each CCV	Bile Salt peak detected >1 min outside RT window for PFOS.	Identify and correct source of problem, then reevaluate Bile Salts separation from PFOS.	No samples shall be analyzed until Bile Salts Check has met acceptance criteria.
Continuing Calibration Verification (CCV)	Daily before sample analysis, after every 10 samples, and at end of analytical sequence.	All native and isotopically labelled compounds within ±30% recovery.	See Section 9.2.4.5 for required corrective actions based on circumstance.	Qualify analytes with CCV out of criteria.
Instrument Blank (IBLK) / Continuing Calibration Blank (CCB)	Daily prior to analysis and after high standards, including CCV.	Must meet criteria specified in Section 9.2.5: all detections ≤MDL concentration.	Identify and correct source of contamination or performance issue. Reanalyze IBLK.	No samples shall be analyzed until IBLK has met acceptance criteria.
Extracted Internal Standards (EIS)	Every field sample, standard and QC sample.	See Method Acceptance Criteria for each matrix in the Tables below.	If batch QC is acceptable, reanalyze to confirm. If confirmed, re-extract and reanalyze samples. If reprep is within acceptance, report reprep data. If failure is confirmed by reprep, qualify as matrix impacted.	Qualify outages and explain in case narrative.
Non-extracted Internal Standards (NIS)	Every field sample, standard and QC sample.	NIS areas in all samples must be within 50 – 200% of the average area of the corresponding NIS in the ICAL.	Troubleshoot instrument performance. Reanalyze samples.	Qualify outages and explain in case narrative.
Method Blank (MB)	1 per batch of 20 or fewer samples.	Must meet criteria specified in Section 10.4.1: all detections ≤MDL concentration.	If IBLK is acceptable, reanalyze MB to confirm. If confirmed, re-extract and reanalyze associated impacted samples (if sufficient sample remains). If insufficient sample remains for reprep, narrate and report data associated with unacceptable MB. See Section 10.4.1 for more details.	Qualify outages and explain in case narrative.

QC Item	Frequency	Acceptance Criteria	Corrective Action	Qualification
LCS/LLLCS	1 pair per batch of 20 or fewer samples.	See Method Acceptance Criteria for each matrix in the Tables below; must meet criteria specified in Section 10.4.2.	If most recent ISC/CCV is acceptable, reanalyze LCS to confirm. If low-failure results are confirmed, re-extract and reanalyze associated samples (if sufficient sample remains). If insufficient sample remains for reprep, narrate and report data associated with low-failure LCS. If high-failure results are confirmed and sample(s) is ND for failing compound, narrate and report sample data.	Qualify outages and explain in case narrative.
MS/MSD	1 pair per batch of 20 or fewer samples. (If requested)	RSD ≤30% between MS/MSD	If possible, reprep to confirm.	Qualify outages and explain in case narrative.
Laboratory Duplicate	1 per AFFF sample; 1 per prep batch for all other matrices (if requested).	RSD ≤30% between parent/DUP	If possible, reprep to confirm.	Qualify outages and explain in case narrative.

Table 7: DOC/LCS/LLLCS Acceptance Limits for Aqueous & Landfill Leachate Matrices

Target Analyte	DOC Mean Recovery (%)	DOC RSD (%)	LCS/LLLCS Recovery (%)
PFBA	70-135	21	70-140
PFPeA	70-135	23	65-135
PFHxA	70-135	24	70-145
PFHpA	70-135	28	70-150
PFOA	65-155	27	70-150
PFNA	70-140	28	70-150
PFDA	65-140	26	70-140
PFUnA	70-135	29	70-145
PFDoA	70-130	21	70-140
PFTrDA	60-145	29	65-140
PFTeDA	70-145	27	60-140
PFBS	70-140	23	60-145
PFPeS	70-135	25	65-140
PFHxS	70-135	27	65-145
PFHpS	70-140	30	70-150
PFOS	70-140	29	55-150
PFNS	70-135	29	65-145
PFDS	70-135	30	60-145

Target Analyte	DOC Mean Recovery (%)	DOC RSD (%)	LCS/LLLCS Recovery (%)
PFDoS	45-135	35	50-145
4:2FTS	70-135	27	70-145
6:2FTS	70-135	32	65-155
8:2FTS	70-140	33	60-150
PFOSA	70-135	22	70-145
NMeFOSA	70-135	30	60-150
NEtFOSA	70-130	26	65-145
NMeFOSAA	65-140	32	50-140
NEtFOSAA	70-135	28	70-145
NMeFOSE	70-135	29	70-145
NEtFOSE	70-130	21	70-135
HFPO-DA	70-135	23	70-140
ADONA	70-135	23	65-145
PFMPA	60-140	23	55-140
PFMBA	65-145	27	60-150
NFDHA	65-140	37	50-150
9Cl-PF3ONS	70-145	30	70-155
11Cl-PF3OUdS	50-150	35	55-160
PFEESA	70-135	25	70-140
3:3FTCA	70-130	23	65-130
5:3FTCA	70-130	24	70-135
7:3FTCA	55-130	34	50-145

Table 8: DOC/LCS/LLLCS Acceptance Limits for Solid & Biosolid Matrices

Target Analyte	DOC Mean Recovery (%)	DOC RSD (%)	LCS/LLLCS Recovery (%)
PFBA	70-140	17	70-140
PFPeA	70-140	26	60-150
PFHxA	70-135	23	65-140
PFHpA	70-140	21	65-145
PFOA	70-140	23	70-150
PFNA	65-145	24	70-155
PFDA	70-145	26	70-155
PFUnA	70-145	26	70-155
PFDoA	70-145	25	70-150
PFTrDA	55-160	26	65-150
PFTeDA	70-145	24	65-150
PFBS	60-145	25	65-145
PFPeS	65-140	29	55-160
PFHxS	65-145	28	60-150
PFHpS	70-140	27	65-155
PFOS	70-135	27	65-160
PFNS	70-140	27	55-140

Target Analyte	DOC Mean Recovery (%)	DOC RSD (%)	LCS/LLLCS Recovery (%)
PFDS	50-150	31	40-155
PFDoS	40-140	40	25-160
4:2FTS	70-135	27	60-150
6:2FTS	60-160	50	55-200
8:2FTS	70-140	27	70-150
PFOSA	70-140	19	70-140
NMeFOSA	65-145	26	70-155
NEtFOSA	70-135	19	70-140
NMeFOSAA	65-145	31	65-155
NEtFOSAA	60-150	31	65-165
NMeFOSE	70-140	19	70-140
NEtFOSE	70-135	17	70-135
HFPO-DA	70-140	25	70-145
ADONA	70-155	26	70-160
PFMPA	70-140	25	30-140
PFMBA	55-145	33	60-150
NFDHA	45-145	27	60-155
9Cl-PF3ONS	65-135	23	70-150
11Cl-PF3OUdS	50-135	31	45-160
PFEESA	70-140	20	70-140
3:3FTCA	45-155	32	45-130
5:3FTCA	70-135	28	60-130
7:3FTCA	70-145	39	60-150

Table 9: DOC/LCS/LLLCS Acceptance Limits for Tissue Matrix

Target Analyte	DOC Mean Recovery (%)	DOC RSD (%)	LCS/LLLCS Recovery (%)
PFBA	70-135	20	60-140
PFPeA	70-130	20	60-145
PFHxA	70-140	20	60-160
PFHpA	70-140	20	60-145
PFOA	70-130	25	60-150
PFNA	70-140	20	60-145
PFDA	70-135	20	60-150
PFUnA	70-135	20	60-155
PFDoA	70-135	20	60-140
PFTrDA	55-160	20	60-150
PFTeDA	70-140	25	60-140
PFBS	70-145	20	60-150
PFPeS	70-150	20	60-145
PFHxS	70-140	25	60-155
PFHpS	70-145	20	60-140
PFOS	70-135	30	60-160

Target Analyte	DOC Mean Recovery (%)	DOC RSD (%)	LCS/LLLCS Recovery (%)
PFNS	60-130	20	45-140
PFDS	55-135	20	50-140
PFDoS	25-145	45	25-140
4:2FTS	65-140	30	55-150
6:2FTS	70-140	25	60-150
8:2FTS	70-150	25	60-170
PFOSA	70-140	20	60-150
NMeFOSA	70-140	30	60-160
NEtFOSA	70-140	40	60-150
NMeFOSAA	70-140	20	60-145
NEtFOSAA	70-140	25	60-145
NMeFOSE	60-150	20	40-180
NEtFOSE	70-145	40	60-205
HFPO-DA	70-140	25	60-145
ADONA	70-145	20	55-165
PFMPA	70-145	40	25-145
PFMBA	70-140	20	60-150
NFDHA	70-155	30	60-180
9Cl-PF3ONS	70-140	20	60-170
11Cl-PF3OUdS	65-140	20	50-170
PFEESA	70-145	25	50-150
3:3FTCA	55-130	25	30-140
5:3FTCA	70-145	20	60-160
7:3FTCA	70-155	20	60-200

Table 10: Acceptance Limits for EIS and NIS Compounds in Aqueous & Landfill Leachate Matrices

Labeled Compound	Aqueous Recovery (%)	Landfill Leachate Recovery (%)
13C4-PFBA	5-130	5-130
13C5-PFPeA	40-130	40-130
13C5-PFHxA	40-130	40-130
13C4-PFHpA	40-130	40-130
13C8-PFOA	40-130	40-130
13C9-PFNA	40-130	40-130
13C6-PFDA	40-130	40-130
13C7-PFUnA	30-130	40-130
13C2-PFDoA	10-130	35-130
13C2-PFTeDA	10-130	25-130
13C3-PFBS	40-135	40-130
13C3-PFHxS	40-130	40-130
13C8-PFOS	40-130	40-130

Labeled Compound	Aqueous Recovery (%)	Landfill Leachate Recovery (%)
13C2-4:2FTS	40-200	40-220
13C2-6:2FTS	40-200	40-170
13C2-8:2FTS	40-300	40-145
13C8-PFOSA	40-130	40-130
D3-NMeFOSA	10-130	40-130
D5-NEtFOSA	10-130	35-130
D3-NMeFOSAA	40-170	35-130
D5-NEtFOSAA	25-135	30-130
D7-NMeFOSE	10-130	20-130
D9-NEtFOSE	10-130	20-130
13C3-HFPODA	40-130	40-130
13C3-PFBA	50-200	50-200
13C2-PFHxA	50-200	50-200
13C4-PFOA	50-200	50-200
13C5-PFNA	50-200	50-200
13C2-PFDA	50-200	50-200
18O2-PFHxS	50-200	50-200
13C4-PFOS	50-200	50-200

Table 11: Acceptance Limits for EIS and NIS Compounds in Solid & Biosolid Matrices

Labeled Compound	Solids Recovery (%)	Biosolids Recovery (%)
13C4-PFBA	8-130	5-130
13C5-PFPeA	35-130	35-130
13C5-PFHxA	40-130	40-130
13C4-PFHpA	40-130	40-130
13C8-PFOA	40-130	40-130
13C9-PFNA	40-130	40-145
13C6-PFDA	40-130	40-130
13C7-PFUnA	40-130	40-130
13C2-PFDoA	40-130	40-130
13C2-PFTeDA	20-130	10-160
13C3-PFBS	40-135	40-150
13C3-PFHxS	40-130	40-140
13C8-PFOS	40-130	40-130
13C2-4:2FTS	40-165	40-300
13C2-6:2FTS	40-215	40-300
13C2-8:2FTS	40-275	40-300

Labeled Compound	Solids Recovery (%)	Biosolids Recovery (%)
13C8-PFOSA	40-130	20-140
D3-NMeFOSA	10-130	20-130
D5-NEtFOSA	10-130	20-130
D3-NMeFOSAA	40-135	30-150
D5-NEtFOSAA	40-150	20-140
D7-NMeFOSE	20-130	25-130
D9-NEtFOSE	15-130	20-130
13C3-HFPODA	40-130	40-130
13C3-PFBA	50-200	50-200
13C2-PFHxA	50-200	50-200
13C4-PFOA	50-200	50-200
13C5-PFNA	50-200	50-200
13C2-PFDA	50-200	50-200
18O2-PFHxS	50-200	50-200
13C4-PFOS	50-200	50-200

Table 12: Acceptance Limits for EIS and NIS Compounds in Tissue Matrices

Labeled Compound	Tissue Recovery (%)
13C4-PFBA	5-130
13C5-PFPeA	10-185
13C5-PFHxA	25-170
13C4-PFHpA	25-150
13C8-PFOA	25-150
13C9-PFNA	35-185
13C6-PFDA	30-150
13C7-PFUnA	30-180
13C2-PFDoA	35-180
13C2-PFTeDA	20-160
13C3-PFBS	25-190
13C3-PFHxS	35-175
13C8-PFOS	40-160
13C2-4:2FTS	30-300
13C2-6:2FTS	35-300
13C2-8:2FTS	40-365
13C8-PFOSA	25-180
D3-NMeFOSA	5-130
D5-NEtFOSA	5-130

Labeled Compound	Tissue Recovery (%)
D3-NMeFOSAA	30-250
D5-NEtFOSAA	30-235
D7-NMeFOSE	5-160
D9-NEtFOSE	5-130
13C3-HFPODA	20-185
13C3-PFBA	50-200
13C2-PFHxA	50-200
13C4-PFOA	50-200
13C5-PFNA	50-200
13C2-PFDA	50-200
18O2-PFHxS	50-200
13C4-PFOS	50-200

Appendix C: State/Program Specific Requirements

This appendix provides program specific requirements that supersede or supplement the main body of the SOP. When analyzing samples under DoD compliance, these requirements are applicable.

QC Item	SOP Section	Requirement
Instrument Blank	9.2.5	No analytes detected > ½ LOQ.
Method Blank	11.1.1	No analytes detected > ½ LOQ.
AFFF Sample Duplicate	Appendix E	All AFFF samples shall be prepared and analyzed in duplicate in the same manner as aqueous samples (e.g., solid phase extraction, extracted internal standards, carbon cleanup, etc.).
Laboratory Duplicate	Appendices B & F	One per preparatory batch. RPD of all analytes should be ≤ 30% between sample and DUP. RPD criterion does not apply if both results are below the LOQ.

Appendix D: Sample Pre-screening Instructions

Samples that are known or suspected to contain high levels of analytes may be pre-screened using the following procedure. These are example procedures using smaller sample aliquots spiked with EIS and NIS and no clean up procedures. Other pre-screening procedures may be used.

Aqueous Samples

1) Weight out 10 (±0.1) g of sample into a 50-mL centrifuge tube.
2) Add 50 µL of EIS to the sample and vortex to mix.
3) Filter 1 mL of the sample through 0.2-µm membrane filter into a microvial. Sample is ready for instrumental analysis.

Solid and Tissue Samples

1) Weigh 1.0 (±0.1) g sample into 50-mL polypropylene centrifuge tubes.
2) Add 20 mL of 0.3% methanolic ammonium hydroxide to the sample. Vortex and mix on a shaker table (or equivalent) for 10 min. Allow to settle and/or centrifuge to produce a clear extract.
3) Filter using a filter vial:
    a. Add 20 µL of EIS to a clean filter vial (chamber).
    b. Add 400 µL of clear extract from step 2 (e.g., by adding extract until it reaches the fill line), carefully vortex to mix.
    c. Use filter/plunger part and filter.
4) Transfer 30 µL of filtrate to a ~300 µL polypropylene microvial and dilute to 300 µL with 0.3% methanolic ammonium hydroxide. Add NIS (1.5 µL) to the resulting solution.
5) The extract is now a 10x dilution.
6) Sample is ready for instrumental screening analysis.
7) Calculate results using the equivalent sample weight computed as follows:

$$Equivalent\ Weight = Sample\ weight\ (g) x \frac{0.4\ mL}{20\ mL}$$

Appendix E: Aqueous Sample Subsampling Instructions

Note: Because some target analytes may be stratified within the sample (e.g., AFFF-contaminated media, surfactants), or adhere to the walls of the sample container, subsampling may only be done on a project-specific basis. Subsampling has been shown to increase uncertainty in PFAS analysis, especially on foaming samples.

If a reduced sample size is required, transfer a weighed subsample using the following subsampling procedure to a 60-mL HDPE bottle and dilute to approximately 60 mL using reagent water. This container is now considered the “sample bottle.”

1) Gently invert sample 3-4 times being careful to avoid foam formation and subsample immediately (do not let stand).
2) If foam forms and more than 5 mL is required – pour sample, avoiding any foam.
3) If foaming forms and a volume less than 5 mL is required – pipette from ½ cm below the foam.
4) If no foam forms – pour or pipette based on volume required.

Required Protocol for AFFF and FFF (F3) Concentrates

Samples composed of AFFF or F3 will be subsampled consistently, with approximately **0.02 g of AFFF/F3 material** aliquoted for each discrete sample preparation/analysis; each AFFF or F3 concentrate sample analyzed under DoD direction **must be prepared in duplicate**. After creating and documenting the subsample aliquot, add approximately 60 mL of reagent water, cap the vessel, and shake vigorously by hand for 20-30 seconds. After adding the reagent water and agitating, allow **at least 3 hours** for the subsample aliquot to fully dissolve in the water. If dissolution is incomplete after 3 hours, agitate again and wait another 3 hours; consider applying continuous agitation (orbital shaker) if full dissolution of the aliquot into water requires extended time. Following the extended dissolution time, prepared AFFF/F3 samples should be prepared and analyzed following the routine protocols for aqueous sample processing. Aqueous reporting limits (MDL/LOD/LOQ) will be used, with values adjusted to account for the actual sample aliquot, assuming 1 g/mL; this constitutes a 25,000X nominal adjustment factor for AFFF/F3 reporting limits, relative to nominal aqueous reporting limits.

Pace **STRONGLY DISCOURAGES** clients from sending AFFF concentrate material for analysis; this protocol is designed for “as-prepared” AFFF materials (i.e. pre-diluted to application concentration) and newer generation ‘Fluorine Free Foam’ (F3) concentrates. If F3 material (concentrate or as-prepared) or as-prepared AFFF material is received, follow the normal routines described in the first paragraph above. If an AFFF concentrate material (usually of a thick gel-like consistency) is received for analysis, the lab shall prepare a 3% (w/w) aqueous solution from the received sample (in the smallest volume feasible) prior to subsampling and diluting 0.02 g for extraction. Handling of AFFF concentrate should ideally be done in an isolated area outside of the PFAS processing area to prevent gross lab contamination. Following the two dilution steps, the nominal adjustment factor for AFFF concentrate material is 833,333X (8.33×10^5) relative to nominal aqueous reporting limits.

Appendix F: MS/MSD, MS/DUP SAMPLE SELECTION PROTOCOL

Project-specific requirements may include that matrix spikes (MS), matrix spike duplicates (MSD), and/or laboratory duplicates (DUP) be prepared and analyzed with project samples. The client/field team should identify those samples which are designated for these additional QC procedures and provide additional sample material for them. In the event that samples are received for such a project without additional containers for MS/MSD/DUP, prep analysts will select samples to be used for this purpose following a hierarchy of preference, as defined below.

Note: Any kind of blank (Field Blank, Trip Blank, Equipment Blank, Rinsate Blank, etc.) will not be used for MS/MSD/DUP analysis.

1) First preference is to use client-designated samples as MS/MSD samples. This designation should show up on the prep worklist, in the comments. It is possible that SR will miss adding this comment to the sample, but this designation will be present in the COC from the client, on the right side of the COC under “Comments/Remarks/Cooler ID.” When a client designates a sample to be used for MS/MSD analysis, they will typically provide us with more than 2 bottles (often 4, sometimes as many as 6).
2) Lacking a client-designated MS/MSD sample, the next preference is to use any sample received with more than 2 bottles provided. If an analyst selects a set of samples for prep in which none of the samples are client-designated for MS/MSD, the analyst should check for any samples in the set that were received with 3 or more bottles. If there is a sample with 3 or more bottles, pull 3 of them and use one for the parent sample and spike the other two for analysis as MS/MSD samples.
3) Lacking any samples received with 3 or more bottles, the prep analyst must use two different parent samples to create an MS/DUP pair. Find two samples out of the set of samples selected for prep which were received with 2 bottles and pull both bottles for each sample. Pick one sample (pair of bottles) to be used for parent/MS prep and the other sample (pair of bottles) to be used for parent/DUP. The sample selected for parent/MS will have one bottle spiked with targets and one prepped as normal, with no added spiking. The bottle which is spiked should be identified in the LIMS as MS. The sample selected for parent/DUP will have both bottles prepared following normal procedures but one of the two should be identified in the LIMS as DUP.
4) If all samples in a particular prep batch were all received in just one bottle, analysis of an MS/MSD or MS/DUP pair will not be possible. This should be an uncommon occurrence, as prep analysts will attempt to adjust batching to ensure that every prep batch contains an MS/MSD or MS/DUP for projects which require the additional QC.

Appendix G: Aqueous Sample Management Decision Guide

NOTE: No TSS pre-test will be performed on aqueous samples received for 1633 analysis.

Per Method 1633, Section 11.1.1.5, "laboratories may utilize other documented strategies for minimizing the disruptions due to SPE clogging and slow extractions." Follow the guide below to evaluate aqueous sample matrices for solid material and determine the appropriate preparation approach; a matching decision tree is included at the end of this appendix.

If potential interferences other than settled solids are observed, take action to mitigate the impacts on data quality. Examples of other sample characteristics that could lead the lab to take precautionary measures with a field sample (i.e., prepare from reduced volume) include: presence of standing foam in the sample after shaking, thick/viscous matrix, collected from a known highly contaminated site/project, client notes indicating potential high concentrations, and knowledge of potential hazards to safety, equipment performance, or process integrity due to sample composition. Consider any visible indications of particulate matter including settled solids collected on the bottom of the container, cloudiness and/or dark color of the sample, suspended solids within the sample, increased viscosity, etc. If uncertain, seek a second opinion from another analyst, supervisor, or operations director; these matrix characteristics may require reduced-volume extraction. The lab will attempt to use the largest volume possible (i.e., the smallest reduction possible) when performing a reduced-volume extraction to manage challenging matrix characteristics, and no less than 1 mL of sample will be used in this case.

1) Allow samples to sit for at least 15 minutes to allow solids in the matrix to settle to the bottom of the container.
2) Visually inspect each sample for settled solids collected in the bottom of the container and follow the appropriate protocol based on observation:
    a. If no solids are observed in the bottom of the container, proceed to step 3.
    b. If solids are observed in the bottom of the container with an approximate depth <1/2 cm (<5 mm), proceed to step 5.
    c. If solids are observed in the bottom of the container with an approximate depth >1/2 cm (>5 mm), proceed to step 7.
    d. If solids observed in the container make up approximately 5% or more of the total sample volume, proceed to step 9.

<u>No Settled Solids Observed:</u>

3) Do not take any additional action to prepare for extraction and follow routine protocols.
4) If the SPE cartridge begins to clog during sample loading (see Identifying Cartridge Clogging section below), abandon loading of the remaining sample volume and proceed to the cartridge rinsing and drying described in step 10 of Section 9.3.4.

a. Document the inability to load the entire sample volume due to cartridge clogging. If the resulting EIS recoveries are below the method acceptance ranges, this documentation provides the rationale for re-extraction from reduced volume.

b. The sample bottle rinse described in step 12 of Section 9.3.5 must be omitted; simply add the 5 mL of 1% methanolic ammonium hydroxide directly to the reservoir/cartridge.

c. If the cartridge clog prevents the cartridge rinses or elution solvent from passing through the cartridge, document that an extract could not be collected for that sample. Submit the sample for re-extraction from reduced volume. Notify the group leader and prep team of this necessity and, based on the total volume loaded in the first extraction attempt, provide a suggested reduction factor (i.e., reduce volume 5X, 10X, 20X, etc.).

Settled Solids Depth <1/2 cm Observed:

5) Do not take any additional action to prepare for extraction and follow routine protocols; however, be aware that there is a higher probability that the SPE cartridge will clog, and care must be taken in sample loading to attempt to pass the entire sample through the sorbent.

6) If the SPE cartridge begins to clog during sample loading (see Identifying Cartridge Clogging section below), abandon loading of the remaining sample volume and proceed to the cartridge rinsing and drying described in step 10 of Section 9.3.4.

    a. The sample bottle rinse described in step 12 of Section 9.3.5 must be omitted; simply add the 5 mL of 1% methanolic ammonium hydroxide directly to the reservoir/cartridge.

    b. Document the inability to load the entire sample volume due to cartridge clogging. If the resulting EIS recoveries are below the method acceptance ranges, this documentation provides the rationale for re-extraction following centrifugation; however,

    c. If the cartridge clog prevents the cartridge rinses or elution solvent from passing through the cartridge, document that an extract could not be collected for that sample. Submit the sample for re-extraction with sample centrifugation (See Aqueous Sample Centrifugation Protocol in Appendix H). Notify the group leader and prep team of this necessity.

        i. If, in the judgment of an experienced analyst, the nature of the solids present in the sample is of a nature that would preclude successful centrifugation and decantation, the decision should be confirmed with the group supervisor and/or another experienced analyst; once confirmed, the sample is submitted for re-extraction from reduced volume. Notify the group of this necessity and, based on the total volume loaded in the first extraction attempt, provide a suggested reduction factor (i.e., reduce volume 5X, 10X, 20X, etc.).
        ii. If the centrifuged sample clogs the cartridge in the second extraction, see step 6 above; if there is sufficient sample remaining for another re-extraction, submit the sample for re-extraction from reduced volume as described in (i) above. If there is not sufficient sample remaining for another re-extraction, narrate any quality exceedances and report data for all runs.

Settled Solids Depth >1/2 cm Observed:

7) The sample will need to be centrifuged before performing SPE. Instead of following the routine sample extraction procedures, refer to Appendix H for the Aqueous Sample Centrifugation Protocol.

8) Document the decision to centrifuge the sample prior to SPE.

    a. If resulting EIS recoveries are below the method acceptance ranges, this documentation provides evidence that the results are impacted by matrix interference.

        i. Report the data with a narrative statement explaining that the results are matrix-impacted.

        ii. Alternately, submit the sample for re-extraction from reduced volume to attempt to provide data with compliant EIS recoveries.

    b. If the decanted sample clogs the SPE and prevents successful collection of the extract, document that detail and submit the sample for re-extraction from reduced volume. Notify the group of this necessity and, based on the total volume loaded in the first extraction attempt, provide a suggested reduction factor (i.e., reduce volume 5X, 10X, 20X, etc.) for the re-extraction.

Settled Solids Observed to be ≥ 5% of Total Volume:

9) Shake the sample to thoroughly homogenize it, then immediately subsample 1 mL into a pre-labeled 50mL centrifuge tube and add reagent water to approximately 40 mL. At 5% solids, a sample contains 50,000 mg/L, so 1 mL contains 50 mg of solid material.

10) Spike the diluted subsample with EIS as normal and proceed with extraction.

11) If the SPE cartridge begins to clog during sample loading (see Identifying Cartridge Clogging section below), abandon loading of the remaining sample volume and proceed to the cartridge rinsing and drying described in step 10 of Section 9.3.4.

    a. Document the inability to load the entire sample volume due to cartridge clogging.

    b. The sample bottle rinse described in step 12 of Section 9.3.5 must be omitted; simply add the 5 mL of 1% methanolic ammonium hydroxide directly to the reservoir/cartridge.

    c. If the cartridge clog prevents the cartridge rinses or elution solvent from passing through the cartridge, document that an extract could not be collected for that sample.

12) If the cartridge clogs during extraction and causes failing results, the lab will contact the client and notify them that sample extraction failed due to the nature of the matrix, and that they must decide between two options for reprocessing the sample:

    a. Apply biosolid matrix protocols, following Sections 9.3.6 through 9.3.8 of this SOP. Use 0.5 g of sample for extraction; do not submit for % solids analysis and report results as ng/g, on a wet weight basis.

b. Attempt to separate and analyze the aqueous and solid phases separately. If the client selects this option, follow the protocol detailed in Appendix I.

Identifying Cartridge Clogging

During the loading phase of the SPE process, some samples may cause their cartridges to clog, preventing the entire sample from being loaded through, and sometimes preventing an extract from being collected. If you have a sample that slows down considerably during the loading process, you may need to abandon loading the remainder of the sample. The goal is to stop the process before the cartridge seizes up completely, so that a sample extract can still be collected from the cartridge.

When Clogs Start

Some of the first visual indications of a cartridge becoming clogged include: discoloration of the cartridge frit and/or sorbent bed, reduced drip rate of the sample through the cartridge, and coloration or sedimentation on the bottom of the reservoir.

When a cartridge starts to clog, it is important to stop the process before the cartridge seizes up completely. Take the actions listed below; an evaluation must be made to decide whether each cartridge can reasonably be used further without seizing up completely.

Do not continue to add any more sample volume to the reservoir of the clogging cartridge.

If there is substantial volume remaining in the reservoir (i.e., > 10 mL) and the cartridge is in apparent imminent danger of seizing completely, close the manifold port to stop sample loading. Carefully remove the cartridge-adaptor-reservoir assembly for the sample in question and pour whatever sample volume remains in the reservoir back into the original sample bottle. This volume will be included in the evaluation of extracted sample volume (initial volume).

If the reservoir on the clogging cartridge empties before the other samples have finished loading, close the manifold port to prevent the cartridge from drying.

If sample volume remains in any of the slowed cartridges after the loading of the other samples is finished, close all the manifold ports and focus pressure on the slowed cartridge in an attempt to load the volume remaining in the reservoir. (Do this one at a time for multiple clogs.) If the cartridge appears to be in imminent danger of seizing up completely, do not attempt to load the volume remaining in the reservoir; follow the steps in the second bullet of this section.

Abandoning Sample Loading

If the decision is made to abandon sample loading, take the following actions. Some of these are partial duplicates of the actions listed in the section above.

If any sample remains in the reservoir, carefully remove the cartridge-adaptor-reservoir assembly for the sample in question and pour whatever sample volume remains in the reservoir back into the original sample bottle. This volume will be included in the evaluation of extracted sample volume (initial volume).

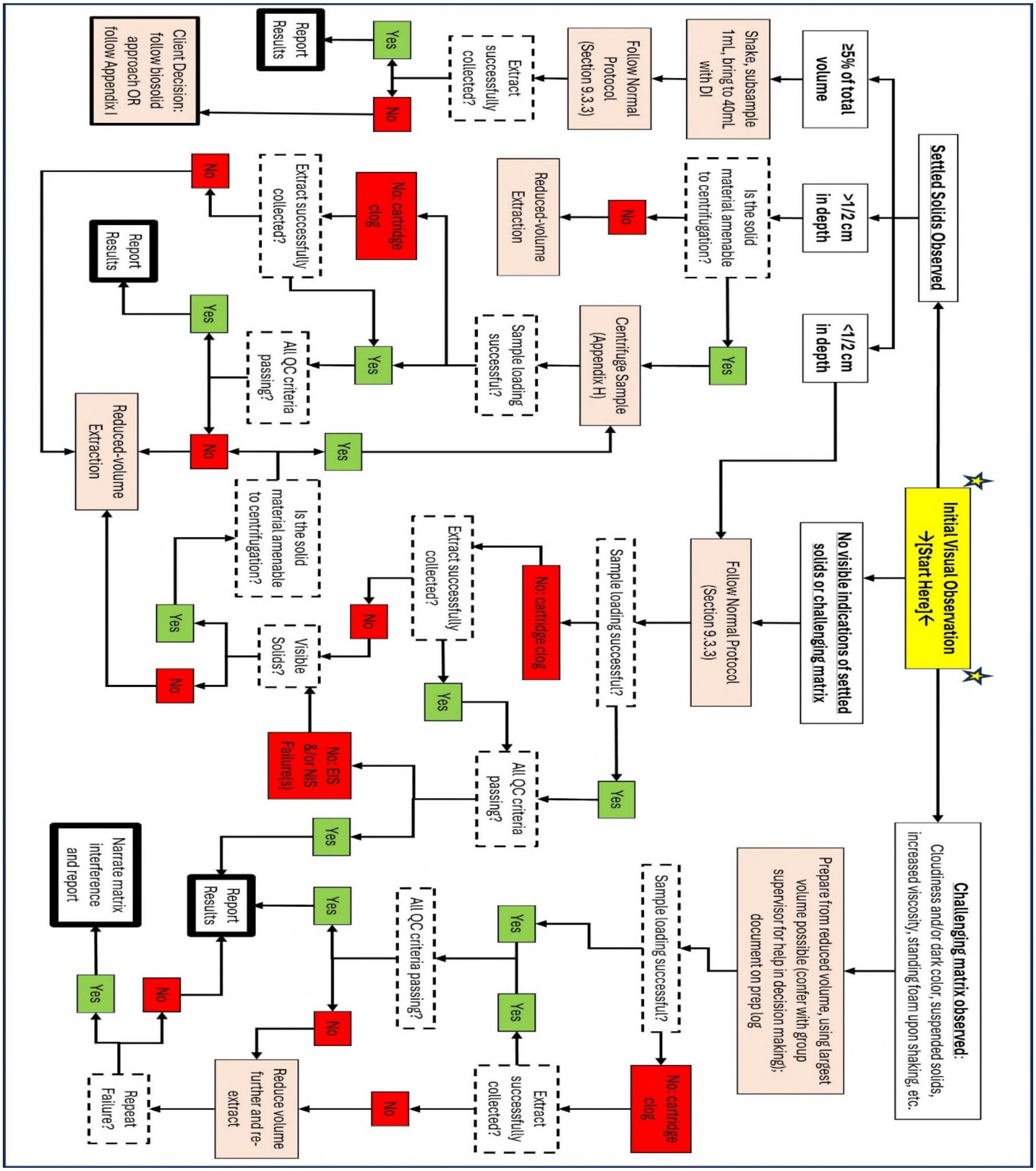
Use the cartridge from the abandoned sample and finish the SPE process to collect what extract is available.

The sample bottle rinse described in step 12 of Section 9.3.5 must be omitted; simply add the 5 mL of 1% methanolic ammonium hydroxide directly to the reservoir/cartridge.

Weigh the sample in its original bottle to establish the “empty bottle” weight (aka post-extraction weight).

Fully Clogged Cartridges

Samples will have to be re-extracted when cartridges clog so fully that the extraction process cannot be taken to completion to collect a sample extract. Based on the total volume loaded in the failed extraction attempt, provide a suggested reduction factor for the re-extraction (i.e., reduce volume 5X, 10X, 20X, etc.) The sample should be shaken up before subsampling for the reduced volume re-extraction. However, for samples containing solids that are very fine and easily suspended, the analyst may consider allowing the sample to settle before subsampling an aliquot for reduced volume re-extraction; this may help prevent cartridge clogging in the re-extraction process.


Initial Visual Observation →[Start Here]←
Settled Solids Observed
≥5% of total volume
Shake, subsample 1mL, bring to 40mL with DI
Follow Normal Protocol (Section 9.3.3)
Extract successfully collected?
Yes
Report Results
No
Client Decision: follow biosolid approach OR follow Appendix I
>1/2 cm in depth
Is the solid material amenable to centrifugation?
No
Reduced-volume Extraction
Yes
Centrifuge Sample (Appendix H)
Sample loading successful?
No: cartridge clog
Extract successfully collected?
No
Yes
All QC criteria passing?
Yes
Report Results
No
Reduced-volume Extraction
Yes
Is the solid material amenable to centrifugation?
<1/2 cm in depth
Follow Normal Protocol (Section 9.3.3)
No visible indications of settled solids or challenging matrix
Sample loading successful?
No: cartridge clog
Extract successfully collected?
No
Visible Solids?
Yes
No
Yes
Yes
All QC criteria passing?
No: EIS &/or NIS Failure(s)
Yes
Report Results
Challenging matrix observed: Cloudiness and/or dark color, suspended solids, increased viscosity, standing foam upon shaking, etc.
Prepare from reduced volume, using largest volume possible (confer with group supervisor for help in decision making); document on prep log
Sample loading successful?
Yes
No: cartridge clog
Extract successfully collected?
Yes
No
Reduce volume further and re-extract
Repeat Failure?
Yes
Narrate matrix interference and report
No
All QC criteria passing?
Yes
No
Report Results

Appendix H: Aqueous Sample Centrifugation Protocol

Method 1633 states “laboratories may utilize other documented strategies for minimizing the disruptions due to SPE clogging and slow extractions,” and “a trained analyst should be able to distinguish samples with very low TSS and focus…on only those samples that might present a risk of clogging.” Therefore, whether an individual sample will require centrifugation for proper preparation will be determined and documented by the preparation analyst, following the guidance in Appendix G. Additionally, the method states “If centrifugation is used to prevent samples with high TSS from clogging the SPE, the EIS compounds must be spiked into the original sample container prior to centrifugation.” This protocol complies with that dictate.

1) Follow Appendix G to evaluate the sample for the presence of solids. Inspect the sample and consider the necessity of centrifuging.
2) If the sample is determined to require centrifugation/decantation, contemporaneously make a note on the prep batch log indicating this fact.
3) Spike samples requiring centrifugation in the same manner and with the same standard volume as samples which will not be centrifuged.
4) Label a 500mL conical centrifuge bottle with the sample ID for each sample that will be centrifuged. Set them in an appropriate rack with the caps removed.
5) Vigorously shake the spiked sample and then quickly pour it into the appropriately labeled centrifuge bottle. Try to ensure that the original sample bottle is devoid of any solid material after the transfer. Be careful to avoid spilling sample during the transfer process. Tightly cap each centrifuge bottle after transfers are complete.
6) Transfer capped centrifuge bottles to the centrifuge rotor, ensuring that the carousel is symmetrically balanced. Close the top and centrifuge at 3000 RPM (~2000 RCF) for 6 minutes.
7) Remove centrifuge bottles and decant the centrifuged liquid from the condensed solids by transferring it back into the original sample bottle. Try to avoid transferring any of the condensed solids from the centrifuge bottle back to the original sample bottle, while maximizing the amount of liquid collected in the sample bottle.
8) Weigh the full, decanted original sample bottle and document in the prep batch log.
9) Extract the decanted sample as normal alongside un-centrifuged samples, through the cartridge rinsing and drying (step 10 of Section 9.3.4).
10) When the SPE cartridges have been dried, rinse the original sample bottle following the protocol in step 12 of Section 9.3.5. Additionally, add 5mL of 1% methanolic ammonium hydroxide (1%-MeOH) to each centrifuge bottle to rinse the inside of them as well as the solids they contain. If the condensed solids become re-suspended while rinsing the bottles, centrifugation may be required. Using a transfer pipet or mechanical pipet, transfer the 1%-MeOH rinse from the centrifuge bottle into the reservoir/SPE cartridge and elute with the original sample bottle rinse into a 15mL conical centrifuge tube.

11) Add 5 mL of additional 1%-MeOH directly to the SPE reservoir of all batch QC samples (MB/LCS/LLLCS) and elute with the normal bottle rinse. This is to match the volume used for elution of centrifuged field samples in the prep batch.

12) After elution, all sample extracts (client and QC) with additional elution volume shall be concentrated to ~3.5 mL and brought to a final volume of ~4 mL with 1%-MeOH. Concentrate each extract at approximately 55 ºC with N2 flow of approximately 1.2 L/min. Use a reference elution tube to reconstitute to the appropriate volume, like the protocol in step 8 of Section 9.3.6 of this SOP. This extract concentration and reconstitution must be done BEFORE adding acetic acid and NIS to the extracts, as directed in step 14 of Section 9.3.5.

13) Weigh the empty bottle with the cap on and subtract that from the weight of the bottle with sample, determined in step 8 of this appendix, to determine initial sample volume.

14) Add 25 µL of concentrated acetic acid and 20 µL of NIS mix to each sample extract in its collection tube and vortex to mix. Transfer a portion of each extract into an autosampler vial for LC-MS/MS analysis. Cap the collection tubes containing the remaining extracts and store at 0 - 6 °C.

15) Generate a narrative statement noting which samples in the prep batch included centrifugation in the extraction process. Include any additional observations and/or deficiencies that were noted during the centrifugation or extraction process, particularly if any issues were encountered during the sample loading step of the SPE process.

Appendix I: Separation & Analysis of Liquid-Solid Biphasic Matrices

Method 1633 states "laboratories may utilize other documented strategies for minimizing the disruptions due to SPE clogging and slow extractions, including centrifuging the sample before adding the EIS and treating the supernatant aqueous phase and the solid phase as separate samples." This will be done only according to client direction or project requirement; see Appendix G for more information regarding management of solids in aqueous samples.

1) If the client has requested to have the sample separated into aqueous and solid phases for analysis, the sample must be logged into the LIMS system separately for both matrices. The resulting solid phase will be reported on a wet weight basis and will not be analyzed for percent solids (aka percent moisture).

NOTE: The LOQ for the resulting solid analysis will depend on the amount of solid material available after decanting – the lab will use ~5 g of material if available, but any reduction in available solids will result in an increase in the reported LOQ.

2) Label a 500mL conical centrifuge bottle with the sample ID for each sample that will be centrifuged. Set them in an appropriate rack with the caps removed.
3) Vigorously shake the sample and then quickly pour it into the appropriately labeled centrifuge bottle. Try to ensure that the original sample bottle is devoid of any solid material after the transfer. Be careful to avoid spilling sample during the transfer process. Tightly cap each centrifuge bottle after transfers are complete.
4) Transfer capped centrifuge bottles to the centrifuge rotor, ensuring that the carousel is symmetrically balanced. Close the top and centrifuge at 3000 RPM (~2000 RCF) for 6 minutes.
5) Remove centrifuge bottles and decant the centrifuged liquid from the condensed solids by transferring it back into the original sample bottle. Try to avoid transferring any of the condensed solids from the centrifuge bottle back to the original sample bottle, while maximizing the amount of liquid collected in the sample bottle.
6) Weigh the full, decanted original sample bottle and document in the prep batch log.
7) Extract the decanted aqueous sample as normal alongside un-centrifuged samples, starting with EIS addition.
8) Label a 50 mL centrifuge tube with the sample ID for each solid phase sample generated from phase separation. Using a wooden tongue depressor or a pre-cleaned metal scoopula, transfer the solid material from the decanted 500 mL centrifuge bottle to the labeled 50 mL tube, targeting 5 g of total sample mass. Record the sample mass transferred to the 50 mL tube – this will be the extracted sample mass used for calculations and reporting. In many cases, re-extraction will not be possible due to limited solid material.
9) Spike the collected solid material with EIS and extract as normal alongside solid samples which were not generated from phase separation.

Appendix J: TCLP/SPLP by 1633

Clients may submit samples (solid or aqueous) for PFAS following TCLP or SPLP procedures. For solid samples, the TCLP and SPLP procedures are used to simulate the leaching of environmental contaminants over extended periods of time from a solid material into the environment. A subsample of the client's sample is weighed out and combined with a leaching solution and mechanically tumbled for a set period. Each leachate prep method (TCLP: Method 1311 or SPLP: Method 1312) employs a unique leaching solution dictated by the parent methods. After the sample has been tumbled/leached by the Organic prep department, the leachate is filtered by the Organic Prep department and delivered to the PFAS sample holding area. The PFAS department is notified by email when the leachate solutions are ready for PFAS prep. The filtered leachate solutions are prepared by the PFAS prep analysts using the 1633 aqueous prep method, at a 1:5 dilution (100 mL of leachate solution).

1) Samples requested for PFAS by SPLP/TCLP analysis will be batched and leached by the normal SPLP/TCLP procedures used by the Westborough Alpha Organic Prep department. Organic Prep will be the initial responsible party for samples analyzed for PFAS by SPLP/TCLP.
2) When the leaching process is complete, Organic Prep will collect approximately 500mL (at minimum 100mL) of the leachate solutions in clean HDPE containers provided by the Emerging Contaminants department.
3) After collecting the leachate solution, an Organic Prep analyst will filter approximately 500 mL (at minimum 100mL) of each leachate solution using a Flipmate apparatus, using normal protocols for Flipmate filtration.
4) After filtering the leachates, the Organic Prep analyst will deliver the filtrates to the Sample management department for transport to the Emerging Contaminants Department (EC) at the Alpha Mansfield Facility. Leachates will be transferred to the EC department's designated sample storage refrigerator.
5) Samples to be analyzed for PFAS following TCLP/SPLP will appear on a separate PFAS prep worklist, the title of which will contain "SPLP" or "TCLP." From these worklists, PFAS analysts will select the samples to be extracted.
6) Pour ~100 mL of filtrate solution into a pre-labeled HDPE PFAS sample bottle, using the gradations marked on the bottle as a guide. Record the actual amount of filtrate by weighing the sample bottle. LOQs for samples prepared in this way will be ~5X higher than normal Aqueous matrix LOQs.
7) Following the instructions in step 7, use the leachate blank solution (typically has sample ID L0000000-01) to prepare three bottles for use as batch QC. Volume for the leachate blank, LLLCS, and LCS will be recorded as 100 mL.
8) Label and fill a clean 125 mL HDPE bottle with ~125 mL of pre-tested reagent water for use as a typical 1633 MB sample. Volume for the 1633 MB sample will be recorded as 100 mL.
9) After preparing the diluted filtrate, filtrate batch QC, and 1633 MB bottles, follow the normal extraction steps for aqueous matrices. Each sample will be spiked with EIS as normal. The filtrate

LLLCS and LCS will be spiked with target analytes according to the routine aqueous protocol for LLLCS and LCS target spiking.

10) Leachate batch QC (MB/LLLCS/MS/MSD) are documented in LIMS as leachate blank (MB), and LLLCS (LCS).

11) Following the SPE process, the instrumental analyst will analyze the extracts by the 1633 method, as normal.

12) After processing, reviewing, generating reports for the data, and importing the data into LIMS, the TCLP/SPLP tumble date must be input into the analytical results from the leachate logs.

Appendix K: Surface Wipe PFAS Analysis by 1633

Clients may submit wipe samples for PFAS analysis by 1633; wipes can be used as a proxy measurement of surface contamination in production facilities, labs, etc. The lab provides sampling kits for users which consist of a 50 mL centrifuge tube paired with a packaged ghost wipe for each surface to be sampled (ghost wipes: Environmental Express Part# SC5000). The wipe is used to swab a defined area of the surface or item of interest and is placed in the accompanying centrifuge tube, which is then capped, labeled, and shipped back to the lab for preparation and analysis.

Used wipe samples are prepared directly in the container in which they are received, following the protocols for solid matrices described in Sections 9.3.6 through 9.3.8; analysis follows normal 1633 routines. No correction will be made for percent solids, and results are reported as ng/wipe.

Appendix L: Articles of Commerce Analysis via Cryomill Processing

Clients may submit samples of various consumer product materials and ‘articles of commerce’ for analysis of PFAS contained in the products. To effectively mobilize any PFAS that may be present within the structure of the material, samples must be milled to a fine powder using a cryogenic mill (or Cryomill).

This appendix provides strategies for processing samples obtained from an article of commerce. Common techniques are covered for mechanical size reduction of articles and their sub-units or portions thereof prior to the determination of PFAS in the article or article components via extraction and quantitative analysis. Polymer powders, nanomaterials, fibers, pastes, fluorinated ionomers etc. may not require size reduction if they are known to be sufficiently homogenous and more than 95% of the material passes a 250 µm sieve. Examples of common articles requiring milling prior to extraction and analysis are compacted cakes, melt extruded pellets and molded articles, elastomers and agglomerates, coated wire, textiles, paper, leather, food, and LDPE and polypropylene.

The user shall elect to apply one or more of the approaches, or compendium of approaches, to create homogenous samples suitable for extraction and analysis. Selection of the appropriate technique(s) depends on the article. Alternative methods of mechanical sample preparation can be used, provided that the required particle size (avg. particle size approx. 100 µm) of the sample is achieved without contaminating or compromising the sample.

Sample Processing Equipment and Materials

The following sample processing equipment and materials are required, subject to the type of material being prepared. Conditions for cryogenic fine milling are provided for the Retsch CryoMill, however, alternative cryomilling equipment like the SPEX ® Freezer/Mill may be used for most products.

1) Scissors, heavy plate shears or RetschTM ZM 200 Grinding Mill (Centrifugal Mill) with 6 or 12 tooth stainless steel (SS) rotor and 1 mm stainless steel bottom sieve.
2) Retsch CryoMill (Ball Mill), with SS grinding cartridge and 25 mm grinding ball (50 mL grinding cartridge, 5 g fill), or equivalent cryogenic mill capable of grinding to approximately 100 µm particles.
3) Cleaning brushes (different sizes) and polishing cloths, or cotton balls/swabs
4) Liquid nitrogen (LN2)
5) High purity methanol and ASTM Type I water for cleaning mill parts
6) Ventilated hood, to minimize exposure to fine particles/dusts/aerosols and chemical vapors
7) Ventilated drying oven capable of > 200°C
8) Precision sieves and accessories, nickel mesh, 50 µm and 150 µm sizes

Manual Cutting

If possible, manual cutting with pre-cleaned shears or scissors is suitable for rough cutting and preparation of samples for further reduction by grinding, etc. Recommended maximum sample size is 10 x 10 mm but will depend on the specification of the equipment used in the subsequent preparation processes.

Fine Grinding by Cryomill

Fine grinding via cryomill is suitable for further mechanical breakdown of samples, grinding material to pieces ~100 µm in diameter. Be careful not to allow the LN2 to come into direct contact with the sample to prevent spattering and sample loss. Thorough cleaning of the mill components between samples is crucial to avoid cross-contamination; see steps 7-11 below for details.

Cryomilling will be performed using a Retsch CryoMill (ball mill) with automatic LN2 feed, as described below:

Sample Type[1]	**Cycles**	**Preset**	**Frequency (Hz)**	**PCT (minutes)**	**MT (minutes)**	**ICT (minutes)**
Elastomers (FKM, FFKM, FEPM, and agglomerates)	1	1	30	Auto	2	NA
Compacted Cake	5	NA	30	Auto	2	2
Melt Extruded Pellets and Molded Articles	7	2	30	Auto	4	2
Coated Wire	3	3	30	Auto	2	2
Textiles, Paper, Leather	3	4	25	10	2.5	0
Food (meat, cheese)	1	5	25	8	2	NA
LDPE and PP	2	6	25	10	2	2

[1] *In most applications, a feed mass of 5 g is used.*

PCT: Precooling time (automatic set)
MT: Milling time
ICT: In-between cooling time

1) In the case of FFKM compounds and articles, care must be taken to avoid excessive energy input as it may lead to cryo-mechanical degradation of the polymer and the creation of mechanoradicals, which can inflate the amount of target substance detected. Filling levels will impact the energy applied in the grinding process and can inflate test results as well.

2) In the case of cured FFKM elastomeric articles, pulverizing the product in a 2-roll mill as commonly used for compounding of elastomers can be an alternate sample preparation method to avoid or reduce the risk of mechanical degradation. Alternative methods for FFKM compounds and articles that do not require cryo-grinding are being investigated.

3) Cryogenically mill the sample powder and sweep out the milled material to collect all the powder. The collected plastic-based sample material should be precision sieved to obtain a sufficiently homogeneous portion of known particle size range of 50 µm to 150 µm, by first sieving material

through the 150 μm sieve, then the 50 μm sieve (keep contents captured on 50 μm sieve). Size range is 100 + 50 μm (i.e. ~ 100 μm).

4) The collected FKM-, FFKM- and FEPM-based samples are visually inspected for homogenous size, verification via light-scattering is beneficial. Sieving of the samples is not recommended due to materials' elastomeric nature and the potential for particles to re-agglomerate into larger segments over time.

NOTE: Freshly cryomilled samples should either be extracted ASAP (same day) OR placed under frozen conditions (-10° C) ASAP and held under frozen conditions until ready to extract.

5) Make sure to follow the User Manual for installing and removing the grinding jar. This includes the two lock rings on the left side of the mechanism.
    a. Make sure outer LOCK RINGS are loosened.
    b. Screw in the grinding jar (from the right side of the mechanism). Tighten with black plastic tightening aid.
    c. TIGHTEN TWO LOCK RINGS: Outside ring tightened first (hand-tighten only); inner ring tightened second (snug), using the tool.
    d. Perform grinding cycle.
    e. LOOSEN THOSE TWO LOCK RINGS: Inside ring loosened first, outer ring loosened second. To loosen either ring, the tool will be needed because of icing.
    f. Unscrew grinding jar.
    g. When cryomill is not in use, make sure to replace the cooling jacket seal.
6) For extraction of cryomilled materials, follow the solid matrix extraction protocol listed in Sections 9.3.6-9.3.8, using 2 g as the target sample mass instead of 5 g. Sample results will be reported as ng/g, with no moisture correction.

Cleaning Procedure for Mill Components

Thorough cleaning of the mill components between samples is crucial to avoid cross-contamination. The following cleaning procedure is recommended.

7) Remove residual polymer thoroughly with DI water and brush.
8) If necessary, wipe away last polymer residue with clean polish cloth or cotton ball/swab.
9) Rinse all parts with methanol, use an ultrasonic bath as needed.
10) Rinse all parts with DI Water, use an ultrasonic bath as needed.
11) Repeat steps 7-10 as needed.

Analysis and Holding Time

Matrix	Routine Container	Minimum Sample Amount	Preservation	Holding Time
Fluoropolymers, molded articles, coated wire, pellets, or other Articles of Commerce[1]	Any container or packaging that does not contain PFAS. Target container is a 125 mL PFAS container; however, clients will often send in Ziploc bags or other packaging.	5 g (target weight for clients to send is 20 g).	Can be shipped at any temperature (being an Article of Commerce). Once received in the lab: <6°C (prior to cryomill) Once cryomilled: Frozen Extract storage: <6°C	Sample receipt (or dated collected)[2] to cryomill: 1 year From cryomilling to extraction: 14 days Once extracted: 30 days

[1] *Almost any “solid” material is applicable to this approach, as long as it can be manually coarse cut to approximately 5-10 mm in size (half a pea). If the matrix is soft (e.g., gummy bear), a larger feed size can be used.*

[2] *Often clients do not include “date collected.” If none provided, “date collected” becomes “date received.”*

Appendix M: Procedure for Total Oxidizable Precursors (TOP)

The following modifications to the referenced SOP are as follows:

Section 7: Water Bath – Capable of monitoring recording to .1 C maintaining 85 C.

Section 8.1: Sodium Hydroxide (NaOH, CAS#: 1310-73-2) – High purity, demonstrated to be free of analytes and interferences.

Potassium Persulfate ($K_2S_2O_8$, CAS#: 7727-21-1) - High purity, demonstrated to be free of analytes and interferences.

Hydrochloric Acid (HCl, CAS#: 7647-01-0) - High purity, demonstrated to be free of analytes and interferences.

Additional table to be added to Section 8

Table 1

Isotope Labeled Standard	Conc. Top Surr Stock (ng/mL)	Vol. of Top Surr Stock (µl)	Final Vol. of Top Surr PDS (mL)	Final Conc. of Top Surr PDS (ng/mL)
$^{13}C_2$-PFOA	50,000	40	4.0	500
$^{13}C_2D_4$-4:2FTS	50,000	80	4.0	1000

For Aqueous samples, prior to Section 10 of SOP 45852, add to each 125 ml sample with Potassium Persulfate until 60 mM (about 2 grams). Add Sodium Hydroxide until the sample is 125 mM (about .625 grams).

Sample should have a pH >12.

Fortify each sample with 20 µl of TOP pre-assay surrogate containing 1 negative control surrogates and 1 positive control surrogates from table 1.

Place sample in a water bath at 85 C for 6 hours.

Remove sample from water bath and adjust pH 6-8 with Hydrochloric Acid.

Following pre-treatment, follow the aqueous extraction protocol from section 10 of SOP 45852 unaltered.

Section 11, An additional calculation is added for the final reporting of the TOP assay results.

TOP Assay = Result of Post TOP assay extraction – Result of analysis from Pre-Top Assay extraction.

Andy Rezendes Approved on 7/15/2024 8:07:59 AM
Chris Ouellette Approved on 7/15/2024 7:20:25 AM
Elena Dayn Approved on 7/3/2024 12:51:13 PM
John Trimble Approved on 7/10/2024 2:26:24 PM
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Pete Henriksen Approved on 7/3/2024 12:43:28 PM
Rusty Vicinie Approved on 7/3/2024 3:15:49 PM
Stephen Witkowski Approved on 7/15/2024 8:26:29 AM
Jason Hebert Approved on 7/15/2024 10:00:40 AM

Management Approval Page
Local Quality Manual
Pace Analytical Services, LLC (PAS)

Signatory Attestation: The employee's electronic signature on this management approval page affirms the approver's obligation, commitment, and responsibility to uphold the requirements of the PAS Quality Management System (QMS) described in this Quality Manual (manual) at each location for which this manual is prepared.

Refer to the page for Quality Manual Signatories to view the job title and physical address for each approver.

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Pace Analytical Services, LLC (PAS)

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Quality Manual Approver Information

The individuals listed below are approvers of this manual and are responsible for implementing the PAS Quality Management System (QMS) and upholding the requirements of this manual at the location(s) for which this manual was prepared, at the time this version of the manual was made effective.

The manual is not revised and released under an updated version when there is a change to personnel. Personnel information is updated during the manual's normal review and revision cycle.

If an approver changes positions, leave the company, or is on extended leave of absence, the responsibility to implement and uphold the PAS QMS automatically transfers to the primary or alternate deputy for the position until the approver is replaced and/or the approver returns to work. The individual replacing the approver automatically accepts the responsibilities associated with the original approver's attestation. Refer to Section 4.1.5.1.1 of this manual to view the deputies assigned to key personnel job titles.

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Table of Contents

1.0 PURPOSE AND SCOPE

1.1 Purpose

This quality manual (manual) outlines the quality management system (QMS) and management structure of Pace® Analytical Services, LLC. Throughout this manual, Pace® Analytical Services, LLC is also referred to by the acronyms PAS or ENV. The acronyms PAS and ENV are interchangeable.

The QMS is also called the quality program throughout this manual and other PAS documents. “Quality Management System” and “Quality Program” are synonymous and inferred by the acronym QMS.

The QMS is the collection of policies and processes established by the senior leaders of PAS (top management) to ensure the services and products provided by PAS consistently meet relevant requirements and achieves the goal of Pace® to provide customers with high quality, cost-effective, analytical measurements, and services.

The QMS is planned to establish conformance[1] and compliance with the current published versions of these international and national quality system Standards:

ISO/IEC 17025: *General requirements for the competence of testing and calibration laboratories*

NELAC/TNI Standard Volume 1: *Management and Technical Requirements for Laboratories Performing Environmental Analysis*

[1] The statement of conformity to these Standards pertains only to testing and sampling activities carried out by the laboratory at its physical address, in temporary or mobile facilities, in-network, or by laboratory personnel at a customer’s facility.

The QMS is also planned to achieve regulatory compliance with the various federal and state programs for which PAS locations provide compliance testing and/or holds certification or accreditation. Federal or state requirements that do not apply to all PAS locations, are provided in addendum to this manual or in other documents that supplement the manual. Customer-specific project and program requirements are not included in the manual in order to maintain client confidentiality.

A list of accreditation and certifications held by each location associated with this manual is provided in Appendix A.

A list of analytical testing capabilities offered by each location associated with this manual is provided in Appendix B.

1.2 Scope and Application

This manual applies to each location listed on the Title Page of this manual:

For purposes of the PAS QMS the term “location” refers to laboratories and/or service centers.

The term “laboratory” refers to any PAS location, however named by Pace® that provides testing, collects samples (sampling), or conducts field measurement services in a fixed building, mobile unit, or in-situ (field).

The phrase “service center” refers to any PAS location, however named by Pace® that does not perform any testing, sampling, or field measurements.

PAS locations are defined by their physical address and other information:

Laboratories are defined by physical address and certification/accreditation ID.

Mobile units are defined by the address of the location to which they are assigned, by VIN (vehicle identification number), or by certification/accreditation ID.

The phrase "satellite laboratory" is used by PAS to refer to a limited-service laboratory affiliated with a larger PAS business unit or location. Some PAS business groups refer to satellite laboratories as service centers for accounting purposes. This designation is not consistent with the definitions specified in this manual or throughout the supporting documents associated with the QMS. Regardless of any internal reference or jargon, any PAS location that generates a test result is a "laboratory" and all laboratories must comply with all requirements specified in this manual for analytical testing services.

1.2.1 Quality Manual Template

This manual was prepared from the PAS Quality Manual Template (template) created by the PAS Corporate Quality Director (CQD).

The template, known as document ID ENV-TMP-CORQ-0007, specifies the minimum requirements that every PAS location must abide by, regardless of scope of services or number of personnel, in order to achieve the objectives of the PAS Quality Policy (See Section 4.2.2).

The template is the mechanism used by top management[1] to communicate their commitment to continuously develop and improve the QMS for effectiveness, to meet customer expectations, and to comply with any statutory and regulatory requirements. Their signature of approval for the template is the mechanism used to document their responsibility.

[1] Top Management is the phrase in the TNI Standard that refers to the leaders of an organization that develop and/or release the PAS Quality Policy Statement and manual under their authority. For PAS, top management includes the Pace® Chief Executive Officer (CEO) and Chief Compliance Officer (CCO) and the PAS President, Corporate Quality Director, Senior Vice President of Operations (Sr. VPO), and the Chief Technical Officer (CTO).

The template and instructions for use of the template are released by corporate quality personnel to the local quality managers responsible for each location (Local QM). The local QM uses the template to prepare the location's manual by following the instructions provided to them. The local QM may not alter the font, structure, or content of the template, except where specified by instruction to do so.

The template is reviewed by corporate quality personnel annually and updated, if needed. More frequent review and revision may occur to manage change, to maintain conformance and compliance to relevant standards or to improve the QMS.

See standard operating procedure (SOP) ENV-SOP-CORQ-00015 *Document Management and Control* for more information.

1.2.2 Quality Manual

The quality manual is created from template ENV-TMP-CORQ-0007 by local quality personnel, who are also responsible for maintenance and management of the local manual.

PAS locations are not permitted to alter content of the template when preparing their manual, except where specified in the template. Control of content in the manual is necessary to ensure consistency of implementation of the PAS quality program across the network.

If additions or changes to the manual are needed to maintain regulatory compliance or conformance to relevant standards and these changes cannot be covered by addendum to the manual, the need for change must be raised to the PAS Corporate Quality Director, who will decide how to resolve the need.

The manual is approved for release by the individuals listed on manual approval page. The person's electronic signature affirms their commitment to implement and uphold the requirements, processes, and procedures of the PAS QMS at each location for which the manual was prepared.

The manual is updated with each release of a new version of the template, and as needed to update appendices and addendum. More frequent review and revision may be necessary when there are significant changes to the capabilities, and resources of the laboratory during the calendar year.

See SOP ENV-SOP-CORQ-00015 *Document Management and Control* for more information.

1.2.3 References to Supporting Documents

The template and the manual include references to other organization documents that support the QMS such as policies and standard operating procedures (SOPs).

These references may include the document's document control number (DC#) and the document title. This information is subject to change at the discretion of PAS. The manual and/or template are updated to reflect the editorial change during the manual's next scheduled review/revision cycle or the next time a version of the manual is released, whichever is sooner.

Each location maintains a current list of documents used by the location to support the QMS. This list, known as the controlled document or master list is readily available to personnel for their use and it provides a cross reference to the legacy document ID, where applicable. Parties external to PAS may contact the location of interest to obtain the most current version of controlled document list if desired.

2.0 REFERENCES

External references used to prepare this manual include:

"Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act." Federal Register, 40 CFR Part 136, most current version.

"Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods." SW-846.

"Methods for Chemical Analysis of Water and Wastes," EPA 600-4-79-020, 1979 Revised 1983, U.S. EPA.

U.S. EPA Contract Laboratory Program Statement of Work for Organic Analysis, current version.

U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, current version.

"Standard Methods for the Examination of Water and Wastewater." Current Edition APHA-AWWA-WPCF.

"Annual Book of ASTM Standards," Section 4: Construction, Volume 04.04: Soil and Rock; Building Stones, American Society of Testing and Materials.

"Annual Book of ASTM Standards," Section 11: Water and Environmental Technology, American Society of Testing and Materials.

"NIOSH Manual of Analytical Methods," U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, most current version.

"Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water," U.S. EPA, Environmental Monitoring and Support Laboratory – Cincinnati (Sep 1986).

Quality Assurance of Chemical Measurements, Taylor, John K.; Lewis Publishers, Inc. 1987.

Methods for Non-conventional Pesticides Chemicals Analysis of Industrial and Municipal Wastewater, Test Methods, EPA-440/1-83/079C.

Environmental Measurements Laboratory (EML) Procedures Manual, HASL-300, US DOE, February 1992.

Requirements for Quality Control of Analytical Data, HAZWRAP, DOE/HWP-65/R1, July 1990.

Quality Assurance Manual for Industrial Hygiene Chemistry, AIHA, most current version.

National Environmental Laboratory Accreditation Conference (NELAC) Standard, most current version.

ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories, 2nd Edition 2005-05-15; 3rd Edition 2017-11

The following are implemented by normative reference to ISO/IEC 17025:

ISO/IEC Guide 99, *International vocabulary of metrology –Basic and general concepts and associated terms*

ISO/IEC 17000, *Conformity assessment – Vocabulary and general principles*

Department of Defense Quality Systems Manual (QSM), most current version.

TNI (The NELAC Institute) Standard, 2009 and 2016 versions.

UCMR Laboratory Approval Requirements and Information Document, most current version.

US EPA Drinking Water Manual, most current version.

3.0 TERMS AND DEFINITIONS

Refer to Appendix C for terms, acronyms, and definitions used in this manual and in other documents used by PAS to support the QMS.

4.0 MANAGEMENT REQUIREMENTS

4.1 Organization

4.1.1 Legal Identity

Pace® Analytical Services, LLC (PAS) is the responsible entity authorized by the State of Minnesota to do business as a limited liability company, under the parent company, PAS Parent, Inc.

4.1.1.1 Change of Ownership

If there is a change of ownership, if a PAS location goes out of business, or if the entire organization ceases to exist, PAS management must notify regulatory authorities of the change within the time required by each state agency for which the location is certified or accredited.

Specifications for retention of records and other business information are addressed in the ownership transfer agreement and in accordance with appropriate regulatory requirements. These details are not included in this manual because each situation is specific to the change event.

4.1.2 Compliance Responsibility

PAS management has the responsibility and authority to establish and implement procedures and to maintain resources necessary to assure its testing activities are carried out in such a way to meet applicable federal and statutory requirements in addition to the requirements specified in this manual and QMS supporting documents.

4.1.3 Scope of the Quality Management System

The QMS applies to work carried out at each location covered by this manual including permanent facilities, at sites away from its permanent facilities, or in associated temporary or mobile facilities.

The permanent and mobile facilities to which this manual applies are listed on the Title Page of this manual.

4.1.4 Organization History and Information

Founded in 1978, Pace® Analytical Services, LLC (PAS) is a privately held scientific services firm operating one of the largest full-service contract laboratory and service center networks in the United States.

The business purpose of PAS is to deliver the highest standard of testing and scientific services in the market. We offer the most advanced solutions in the industry, backed by transparent data, a highly trained team, and the service and support that comes from over four decades of experience.

4.1.4.1 Organization Structure

Each PAS location is led by a management team referred to as local management[1]. Local management is responsible for making day-to-day decisions regarding the operations of the facility and implementing, and sustaining the requirements, policies, and procedures of the PAS quality program.

[1] The term "local management" does not mean "on-site" management. Some of the roles included in the local management team, work off site or from a different PAS location.

For purpose of the QMS, the job titles associated with the local management team include Vice President of Operations (VPO), General Manager (GM), Director of Laboratory Operations (DLO), Quality Program Manager (QPM), and Quality Manager (QM).

The local management team is supported by department supervisors and team leaders, and business groups that support the organization such as HR, IT, Sales & Marketing, Finance, and EHS (Environmental Health & Safety).

Technical oversight for each location is provided by local personnel with support and guidance from the PAS Chief Technical Officer (CTO). Locations that hold TNI accreditation, also have personnel appointed to serve as the "acting technical manager for TNI, however named" to perform the duties and responsibilities of this designation per the TNI Standard. See Section 4.1.5.2.1 for more information on this TNI requirement.

The reporting relationships and responsibilities of quality personnel are independent of operations in order to safeguard impartiality. See Section 4.1.5.2 for more information.

Refer to the organization charts provided in Appendix D to view the organization structure, reporting relationships, and the interrelationships between positions.

4.1.5 Management Requirements

4.1.5.1 Personnel

Each PAS location is staffed with administrative and/or technical personnel who perform and verify work under the supervision of their direct line supervisor.

All personnel are required to perform their duties in accordance with the policies and processes outlined in this manual and in accordance with standard operating procedures (SOPs) and other quality system documents. PAS policies and procedures are designed for impartiality and integrity. When these procedures are fully implemented, personnel remain free from undue pressure and other influences that adversely impact the quality of their work or data.

4.1.5.1.1 Key Personnel

Key personnel are management positions that have the authority and responsibility to plan, direct, and control activities related to the QMS for the entire division (PAS Corporate), or for one or more PAS locations (Local).

PAS job titles classified as key personnel are as follows:

PAS Key Personnel Positions & Deputy Assignments by Role

Job Title	Acronym	Primary / Alternate Deputy
Chief Executive Officer	CEO	President
Chief Compliance Officer	CCO	CQD / As Assigned
President	NA	CEO / Sr. VPO
Corporate Quality Director	CQD	CCO or CTO
Quality Program Manager	QPM	CQD / Peer QPM / As Assigned
Chief Technical Officer	CTO	CQD / As Assigned
Sr. VP of Operations	Sr. VPO	President / VPO
Vice President of Operations	VPO	Sr. VPO / Peer VPO
Director of Lab Operations[1]	DLO	VPO / Peer DLO or Sr. VPO
Health and Safety Director	NA	As Assigned
IT Director	NA	CIO
Quality Manager	QM	QPM /Peer QM / QAA
General Manager[1]	GM	VPO / Sr. VPO or Peer GM
Operations Manager[1]	OM	GM / DL or VPO
Technical Manager[1]	TM	CTO / Peer TM
TNI Approved TM[2]	TNI TM	Another Qualified Employee

[1]:Position is not in place at all locations.

[2]: The TNI TM is not a PAS position. See Section 4.1.5.2.1 for more information.

Some certification and accreditation programs require notification any time there is a change in key personnel. Notification requirements are tracked and upheld by the local QM, when these requirements apply.

4.1.5.2 Roles and Responsibilities

The qualifications, duties, and responsibilities for each position at Pace® are detailed in job descriptions maintained by the Pace® Human Resource personnel (HR).

The following sections provide a general overview of various management and supervisory roles and are presented in no particular order.

Chief Executive Officer (CEO): Provides leadership for overall operations; development of growth strategies; and long-range capital and strategic planning for Pace®.

Chief Compliance Officer (CCO): Provides leadership for compliance related activities.

President: Provides leadership for overall operations; oversight of regulatory and compliance standards; development of growth strategies; and long-range capital and strategic planning for PAS.

Chief Technical Officer (CTO): Provides technical oversight and leadership to all PAS locations. Responsible for innovation and standardization of technical activities.

Corporate Director of Quality (CQD): Responsible for developing the PAS quality program and the policies and procedures that support the QMS. The CQD leads the quality team, establishing functions, responsibilities, duties, and organization structure for PAS.

Corporate Quality Program Manager (QPM): Responsible for helping local management implement, monitor, maintain and improve the PAS quality program for one or more locations in the network and for direct supervision of Quality Manager(s).

Director of Information Technology: Oversees and delivers the systems and processes of information technology used by PAS. These systems include Laboratory Information Management Systems (LIMS); data acquisition, reduction, and reporting software; virus-protection, communication tools, and ensuring the integrity, security of electronic data, and associated policies and procedures.

Sr. Vice President of Operations (Sr VPO): Provides leadership, direction, and insight necessary to achieve strategic initiatives. Develops and improves processes, structure, and allocation of resources for operations for all PAS.

Vice-President of Operations (VPO): Provides leadership, guidance, and resources, including allocation of personnel, necessary to achieve the strategic goals of the organization and the PAS quality program to one or more PAS locations.

Director of Laboratory Operations (DLO): See descriptions for VPO and General Manager. The DLO is an intermediary management position that provides leadership and resources to one or more locations.

General Manager (GM): The GM is responsible for overall administration and operation of one or more PAS locations. Although task duties associated with this responsibility may be delegated, the GM is responsible for ensuring all duties and activities of the locations they oversee comply with the PAS QMS, the PAS EHS program, and with any applicable statutory, regulatory requirements or program requirements. If a GM is not assigned to the location, these responsibilities are transferred to the Operations Manager (OM) or DLO. If no DLO, to the VPO.

Any GM of a TNI Accredited laboratory is also responsible for the designation of technical personnel to serve as acting technical managers for TNI for the fields of accreditation held by the laboratory (See Section 4.1.5.2.1) and for notifying the accreditation body (AB) of any extended absence or reassignment of these designations.

Quality Manager (QM): The QM oversees and monitors the implementation, compliance, and improvement of the QMS and communicates gaps, deviations, and opportunities for improvement to local and corporate laboratory management. The QM is independent of the operation and analytical activities for which they provide oversight and has the authority to carry out the roles and responsibilities of their position without outside influence.

The QM:

- serves as the focal point for QA/QC protocol decisions and oversees review of QC data for trend analysis;
- evaluates data objectively and performs assessments without outside influence;
- has documented training and experience in QA/QC procedures and the PAS quality system;
- has a general knowledge of the analytical methods offered by the laboratory;
- coordinates and conducts internal systems and technical audits;
- notifies laboratory management of deficiencies in the quality system;
- monitors corrective actions;
- provides support to technical personnel and may serve as the primary deputy for the acting TNI Technical Manager(s).

Manager-Client Services (CSM): This position is responsible for the training and supervision of project manager(s) and/or shipping, receiving and courier personnel. The primary responsibility of the CSM is to ensure projects are successfully managed to meet the expectations and needs of PAS customers.

Department Managers/Supervisors/Team Lead): These positions are responsible for administrative and operations management and implementation of the QMS in the work area he/she oversees. These responsibilities include but are not limited to: training and supervision of personnel, monitoring work activity to maintain compliance with this manual, SOPs, policies and other instructional documents that support the QMS; method development, validation and the establishment and implementation of SOPs to assure regulatory compliance and suitability for the intended purpose; monitoring QA/QC performance, proper handling and reporting of nonconforming work; purchasing of supplies and equipment adequate for use; maintaining instrumentation and equipment in proper working order and calibration; and general maintenance of administrative and technical processes and procedures established by the laboratory.

Operations Manager (OM): The OM is responsible for management of production and/or other duties assigned by the GM.

4.1.5.2.1 Approved Technical Manager (TNI Accreditation Only)

The requirements in this subsection apply only to PAS locations that are NELAC/TNI accredited.

The TNI Standard specifies requirements for the qualification and duties of technical personnel. The TNI Standard lists these duties under the reference "technical manager(s), however named."

At PAS, these duties closely correlate with the responsibilities and duties outlined in the PAS job descriptions for managers, supervisors, team leads, and/or scientists. However, these duties do not need to be associated with any specific job title and can be assigned to any one or more PAS employees that meets the qualifications specified in the TNI Standard.

Refer to the applicable version of the TNI Standard to view the required qualifications for each discipline.

PAS locations that are TNI accredited must designate one or more employees to perform these duties and submit these qualifications to the TNI accreditation body (AB) for approval.

Employees approved by the TNI AB, to perform these duties retain their Pace® assigned job title.

When TNI Accreditation Bodies (AB) refer to these employees as 'technical manager' or 'technical director' on the official certificate or the scope of accreditation, this reference is referring to their approval to perform duties of the 'technical manager, however named' as specified in the TNI Standard and not to a PAS job title.

The duties of any approved technical manager for TNI, however named, can be completed in person or remotely. If an employee that is an approved technical manager for TNI is completely absent from work or on a leave of absence for more than 15 calendar days, the duties and responsibilities specified in the TNI Standard are temporarily reassigned to another employee that meets the qualifications for the technology or field of accreditation. If the employee's absence exceeds 35 calendar days, the local QM must formally notify the TNI primary AB of the absence and the details of reassignment of duties in writing.

4.1.5.3 Conflict of Interest

A conflict of interest is a situation where a person has competing interests that may affect impartiality. It is the policy of Pace® to ensure business relationships, decisions and transactions do not place personal interest ahead of the organization, customers, colleagues, job responsibilities or the public we serve. Conflict of interest is avoided by making personnel aware of circumstances that conflict or appear to conflict with impartiality and/or designing process and procedures to include checks and balances to prevent conflict and ensure impartiality.

See the current version of policy COR-POL-0004 *Code of Ethics and Professional Conduct* for more information.

4.1.5.4 Confidentiality

PAS management is committed to preserving the confidentiality of Pace® customers and confidentiality of Pace® business information.

Client information obtained or created during work activities is considered confidential and is protected from intentional release to any person or entity other than the client or the client's authorized representative, except when Pace® is required by law to release confidential information to another party, such as a regulatory agency or for litigation purposes. In which case, Pace® will notify the client of the release of information and the information provided, unless notification is prohibited by law.

When Pace® obtains information about the customer from a source other than the customer, Pace® will keep the source of the information confidential unless disclosure is agreed upon by the source.

The terms of client confidentiality are included in PAS Standard Terms and Conditions (T&C). With the acceptance of the T&C and/or the implicit contract for analytical services that occurs when the client sends samples to PAS for testing, the client authorizes Pace® to release confidential information when required. Other procedures used by PAS to maintain confidentiality include:

A Code of Ethics and Professional Conduct policy that covers this topic (COR-POL-0004);

A Confidentiality Agreement which supervisory and sales personnel and other positions are required to sign at the time of employment and abide by the conditions of throughout employment;

Record retention and disposal procedures that assure confidentiality is maintained; and

Physical access controls and encryption of electronic data.

See policy COR-POL-0004 *Code of Ethics and Professional Conduct* for more information.

4.1.5.5 Communication

Communication is defined as the imparting or exchanging of news and information. Effective (good) communication occurs when the people included in the communication gets the point and understands it.

4.1.5.5.1 Workplace Communication

Effective communication in the workplace is necessary to assure work is performed correctly, efficiently, and in accordance with client specifications.

Instructions for how to conduct testing and other work activities are communicated to personnel via written policies, standard operating procedures, and other work instructions.

Information about PAS performance (positive and negative) and ideas for improvement are communicated to personnel using various communication channels such as face to face meetings, video conferencing, conference calls, email, memoranda, written reports, and posters.

4.1.5.5.2 External Communication

Communication with external parties such as customers, vendors, business partners, and regulatory agencies takes place every day.

PAS management is responsible for training personnel to communicate in professional and respectful ways to build strong relationships and to avoid misunderstanding.

4.2 Quality Management System

4.2.1 Quality Management System Objectives

The objectives of the PAS QMS are to provide clients with consistent, exemplary professional service, and objective work product that is of known and documented quality that meets their requirements for data usability and regulatory compliance.

Objective work products are analytical services, data, test results, and information that is not influenced by personal feeling or opinions. The quality of being objective is also known as 'impartiality.'

4.2.1.1 Impartiality

PAS achieves and maintains impartiality by establishing an organizational structure that safeguards impartiality (See 4.1.4.1) and implementing and adhering to the policies and processes of the QMS outlined in this manual, which are based on industry accepted standards and methodologies.

PAS procedures for handling nonconforming work (See 4.9), corrective and preventive actions (See 4.11, 4.12) and management review (See 4.15) are the primary mechanisms used to identify risk to impartiality and to prompt actions necessary to eliminate or reduce the threat when risk to impartiality is suspected or confirmed.

4.2.1.2 Risk and Opportunity Assessment

Risks are variables that make achieving the goals and objectives of the QMS uncertain.

An opportunity is something that has potential positive consequences for the organization.

PAS personnel manage risks and opportunities on a daily basis by following policies, procedures and processes that support the QMS. Some ways in which the QMS is designed to identify, minimize, or eliminate risk on a daily basis include but are not limited to:

Capability and capacity reviews of each analytical service request to assure the laboratory can meet the customer's requirements;

Maintenance of accreditation and certification for test methods in multiple states and programs to cover a broad range of authority for regulatory compliance;

SOPs and other controlled instructional documents are provided to personnel to eliminate variability in the process. These documents include actions to counter risk factors inherent in the process and are reviewed on a regular basis for on-going suitability and relevancy;

Participation in proficiency testing programs and auditing activities to verify on-going competency and comparability in performance;

Provision of on-the-job training and established protocol for quality control (QC) corrective action for nonconforming events;

An established program for ethics, and data integrity;

Tiered data review process;

Culture of continuous improvement;

Monitoring activities to assess daily and long-term performance; and

Annual critical review of the effectiveness of the QMS.

PAS also promotes a continuous improvement culture based on the principles of lean manufacturing. These principles include 3P (Process, Productivity, Performance) and Kaizen. 3P is a platform used by PAS to share best practices and standardization across the network to achieve operational excellence. Kaizen is a team-based process used to implement tools and philosophies of lean to reduce waste and achieve flow with the purpose of improving both external and internal customer satisfaction. The PAS lean program and activities help to mitigate risk because they generate a collective understanding of vulnerabilities and utilize group-effort to develop and implement solutions at all levels.

Risk and opportunities may also be formally identified using specific risk and opportunity assessment methods such as SWOT Analysis (Strength, Weakness, Opportunity, Threats) and 3-Stage Impact/Probability Grids.

4.2.1.3 Communication of the Quality Management System

This manual is the primary mechanism used by PAS management to communicate the QMS to personnel.

To assure personnel understand and implement the quality program outlined in the manual:

PAS personnel are required to sign a Read and Acknowledgement Statement to confirm the employee has:

1) been informed of the manual by management;

2) has access to the manual;

3) has read the manual;

4) understands the content of the manual; and

5) agrees to abide by the requirements, policies, and procedures therein.

Personnel are informed that the manual provides the “what” of the QMS. The “how to” implementation of the QMS is provided in policy, SOPs, standard work instructions, and other instructional documents.

This manual and supporting policies and procedures are made readily accessible to personnel in the area where the work activity is performed.

4.2.2 Quality Policy Statement

The quality policy of PAS is to provide customers with data of known and documented quality fit for their intended purpose. PAS achieves this policy by implementing the QMS defined in this manual, by following industry accepted protocol for analytical testing and quality assurance and quality control (QA/QC) activities, by conformance with published and industry accepted testing methodologies, and by compliance with international and national standards for the competency and/or accreditation of testing laboratories.

Intrinsic to this policy statement is each of the following principles:

PAS will provide customers with reliable, consistent, and professional service. This is accomplished by making sure each PAS location has the resources necessary to maintain capability and capacity; that staff are trained and competent to perform the tasks they are assigned; that client-facing staff are trained and prepared to find solutions to problems and to assist customers with their needs for analytical services. Customer feedback, both positive and negative, is shared with personnel and used to identify opportunities for improvement.

PAS maintains a quality program that complies with applicable state, federal, and industry standards for analytical testing and competency.

PAS management provides training to personnel so that all personnel are familiar with the QMS outlined in this manual and that they understand that implementation of the QMS is achieved by adherence to the Pace® and PAS policies and procedures.

PAS management continuously evaluates and improves the effectiveness of the QMS by responding to customer feedback, and other measures of performance, such as but not limited to the results of internal/external audits, proficiency testing, metrics, trend reports, and annual and periodic management reviews.

4.2.2.1 Ethics Policy / Data Integrity Program

Pace® has established a comprehensive ethics and data integrity program that is communicated to all Pace® employees so that they understand what is expected of them. The program is designed to promote a mindset of ethical behavior and professional conduct that is applied to all work activities.

The key elements of the Pace® Ethics / Data Integrity Program include:

Ethics Policy (COR-POL-0004);

Standardized data integrity training course taken by all new employees on hire and a yearly refresher data integrity training course for all existing employees;

Policy Acknowledgement Statements that all Pace® personnel, including contract and temporary, are required to sign at the time of employment and again during annual refresher training to document the employee’s commitment and obligation to abide by the company’s standards for ethics, data integrity and confidentiality;

SOPs that provide instructions for how to carry out a test method or process to assure tasks are done correctly and consistently by each employee;

On the Job Training;

Data integrity monitoring activities which include, but are not limited to: primary, secondary and completeness data reviews, internal technical and system audits, data audits, data surveillance, and proficiency testing; and

Confidential reporting process for alleged ethics and data integrity issues.

All PAS managers and supervisors are expected to provide a work environment where personnel feel safe and can report unethical or improper behavior in complete confidence without fear of retaliation. Retaliation against any employee that reports a concern is not tolerated.

Pace® has engaged Lighthouse Services, Inc. to provide personnel with an anonymous reporting process available to them 24 hours a day/7 days per week. The alert line may be used by any employee to report potential violations of the company's ethics and data integrity program. Reports are forwarded to Pace® leadership to investigate and resolve the matter. Investigations concerning data integrity are kept confidential.

See COR-POL-0001 *Compliance Alertline* for more information.

Posters and flyers with the compliance alert line information must be prominently posted in each PAS location for personnel reference.

Compliance Alert Line Information:

English Speaking US & Canada	(844) 940-0003
Spanish Speaking North America	(800) 216-1288
Internet	www/lighthouse-services.com/pacelabs
Email	reports@lighthouse-services.com

4.2.3 Management Commitment: Quality Management System

Evidence of management's commitment for the development, maintenance, and on-going improvement of the QMS is provided by the application of their signature of approval to the template and/or manual. Their signature confirms they understand their responsibility to implement the QMS outlined in this manual, to communicate the quality program to personnel, and to uphold requirements of the program during work activities.

4.2.4 Management Commitment: Customer Service

Management communicates the importance of meeting customer and regulatory requirements to personnel by training personnel on the QMS outlined in this manual, implementing the QMS outlined in this manual, and upholding these requirements for all work activities.

4.2.5 Supporting Procedures

References to processes and procedures that support the QMS are included throughout this manual. The structure of the document management system is outlined in SOP ENV-SOP-CORQ-0015 *Document Management* and summarized in the following subsections.

4.2.5.1 Quality Management System Document Structure

Documents associated with the QMS are classified into document types that identify the purpose of the document and establish how the document is managed and /or controlled.

Examples: Types of PAS Internally Created Documents

Document Type	Purpose
Quality Manual	Outlines the PAS QMS and structure and how it works for a system including policy, goals, objectives and detailed explanation of the system and the requirements for implementation of system. Includes roles and responsibilities, relationships, procedures, systems, and other information necessary to meet the objectives of the system described.
Policy	Provide requirements and rules for a process and is used to set course of actions and to guide and influence decisions. Policy describes the "what," not the "how."
Standard Operating Procedure	Provide written and consistent set of instructions or steps for execution of a routine process, method, or set of tasks performed. Assures that activities are performed properly in accordance with applicable requirements.
Standard Work Instruction	Provide step by step visual and/or written instruction to perform a specific task to improve competency, minimize variability, reduce work injury and strain, or to boost efficiency and quality of work (performance). SWI are associated with an SOP unless the task described is unrelated to generation of or contribution to environmental data or analytical results.
Template	Pre-formatted document that serves as a starting point for a new document.
Guide	Assists users in using a particular product; or a technical interpretation of a method or process by which PAS locations must abide.
Form / Worksheet	Used for a variety of purposes such as to provide a standardized format to record observations, to provide information to supplement an SOP.

Examples: Types of External Documents used by PAS

Certificate	Lists parameters, methods, and matrices for which the location is certified/accredited to perform within the authority of the issuing regulatory agency or accreditation body.
Reference Document	Provide information, protocol, instructions, and/or requirements. Issued by the specifier. Examples include ISO/IEC, TNI, DoD/DOE and published referenced methods such as Standard Methods, ASTM, SW846, EPA, and federal and state regulatory bodies.
Project Document	Provides requirements necessary to meet individual client expectations for intended use of data. Examples include project quality assurance plans (QAPP), client-program technical specifications, contracts, and other agreements.

Project documents are managed as external documents and any requirements for work specified is followed when work for the project is performed. If the project document is less stringent than the PAS QMS, policies, or SOPs, and/or is less stringent than applicable federal or state requirements, PAS locations are still required to meet the minimum requirements of the PAS QMS and any applicable statutory or federal requirements in addition to the requirements specified in the project document. Information and requirements from project documents are not incorporated into PAS policy or SOPs in order to maintain client confidentiality.

Document types are ranked to identify which documents takes precedence when there is an actual or perceived conflict between documents and to establish the hierarchal relationships between documents. The ranking system also provides information to document writers and reviewers to assure downline documents agree with documents of higher rank.

PAS Document Hierarchy

Rank	Document Type
1	External Reference Documents (Standards, Test Methods)
2	Quality Manual Template
3	Corporate & Division Policy
4	Corporate & Division SOP
5	Division SWI, Guides, Forms/Worksheets
6	Local Quality Manual
7	Local SOP
8	Local SWI, Guides, Forms/Worksheets

4.2.6 Roles and Responsibilities

The roles and responsibilities for technical management and the quality manager is provided in section 4.1.5.2.

4.2.7 Change Management

When significant changes to the PAS QMS are planned, these changes are managed by corporate quality personnel to assure that the integrity of the QMS is maintained.

4.3 Document Control

4.3.1 General

PAS uses electronic document management software (eDMS) to control documents that support the PAS QMS. eDMS provides centralized distribution and access to all documents used by PAS. All PAS locations must use the PAS eDMS system unless an exemption to this requirement has been granted by the PAS Corporate Quality Director.

eDMS automates the process for unique document identification, version control, approval, access, and archival and restricts access to archived documents except to authorized users to prevent the use of obsolete documents.

The local QM maintains a master list of controlled documents used at each location. The master list minimally includes the document control number, document title, and current revision status and is made available to personnel for their reference.

See SOP ENV-SOP-CORQ-0015 *Document Management* for more information.

4.3.2 Document Approval and Issue

Documents that support the QMS are reviewed by qualified personnel and approved by management prior to release for use.

Only the approved versions of documents are available to personnel for use unless a draft document is authorized by management.

The managers responsible for authorization of each document is specific to the document type.

See SOP ENV-SOP-CORQ-0015 *Document Management* for more information.

4.3.3 Document Review and Change

Unless a more frequent review is required by regulatory, certification or accreditation program documents are reviewed at least every two years to ensure the documents remain current, appropriate, and relevant.

Documents are also informally reviewed every time the document is used. Personnel are expected to refer to and follow instructions in controlled documents when they conduct their work activities. Consequently, any concerns or problems with the document should be caught and brought to the attention of management on an on-going basis.

Documents are revised whenever necessary to ensure the document remains usable and correct. Older document versions and documents no longer needed are made obsolete and archived for historical purposes.

PAS does not allow hand-edits of documents. If an interim change is needed pending re-issue of the document, the interim change is communicated to those that use the document using a formal communication channel, such as change in progress form, email, or memorandum.

The document review, revision, and archival process is managed by quality personnel at the location from which the document was released using the procedures established in SOP ENV-SOP-CORQ-0015 *Document Management.*

4.4 Analytical Service Request, Tender, and Contract Review

PAS management and/or client service personnel perform thorough reviews of requests and contracts for analytical services to verify the location(s) performing the work has the capability, capacity, and resources necessary to successfully meet the customer's needs. These review procedures are described in SOP ENV-SOP-WES2-0125 Review of Analytical Requests.

The procedures in this SOP(s) are established to ensure:

The PAS location(s) performing the work understand the purpose of data collection in order to ensure the test methods requested are appropriate for the intended use of the data and capable of meeting the client's data quality objectives;

PAS locations and any external subcontractor(s) have the capability, capacity, and resources to meet the project requirements and expectations within the requested time for delivery of work product;

Any concerns that arise from review are discussed and resolved with the client;

Any discrepancies between the PAS QMS, statutory or regulatory requirements and the client request are resolved; and

The results of review and any correspondence with the client related to this process and/or any changes made to the contract are recorded and retained for historical purposes.

Capability review confirms that the PAS locations contracted to perform the work and any internal or external subcontractors hold required certification/accreditation for the test method, matrix, and analyte and verifies the location can achieve the client's target compound list and data quality objectives (DQOs) for analytical sensitivity and reporting limits, QA/QC protocol, and hardcopy test report and electronic data deliverable (EDD) formats.

Capacity review verifies that the in-network locations and any potential subcontractors are able to manage the sample load and deliver work production within the delivery time requested.

Resource review verifies that the location and any potential subcontractors have adequate qualified personnel with the skills and competency to perform the test methods and services requested and sufficient and proper equipment and instrumentation needed to perform the services requested.

Customers must be notified when there is a deviation from the contract after acceptance of the contract by both parties. Instructions for this notification process must be included in the laboratory's SOP for this process.

4.5 Subcontracting (Internal and External)

The terms 'subcontract' and "subcontracting" refers to analytical work done by an organization external to Pace® (External Subcontracting) or by a Pace® location with an address different than the address listed on the cover page of the test report (Internal Subcontracting).

The PAS network offers comprehensive analytical capability and capacity to ensure Pace® can meet a diverse range of client needs for any type of project. If a PAS laboratory receives a request for analytical services and it cannot fulfill the project specifications, the location's client services team will collaborate with the client to place the work within the PAS network.

When it is not possible to place the work within network, the location will, with documented client approval, subcontract the work to a subcontractor that has the capabilities to meet the project specifications and can meet the same commitment agreed on between the location and the client.

Whenever work is subcontracted, the PAS location responsible for management of the project verifies each of these qualifications:

The internal or external subcontractor has the proper accreditation/certifications required for the project and these are current; and

The use of the internal or external subcontractor is approved by the client and/or regulatory agency when such approval is required by the customer. Record of customer approval is retained in the project record.

External subcontractors selected by Pace® must be pre-qualified by quality personnel to verify their QMS is similar to Pace® and complies with all relevant Standards such, as ISO/IEC 17025 and the TNI Standard(s) and/or federal and state regulatory requirements. The list of approved subcontractors for each location is maintained by local quality personnel. Pre-qualification of a subcontractor does not eliminate the requirement for the PAS location placing work to verify the subcontractor has the certifications, capability, capacity, and resources to perform work on behalf of Pace® on a project-specific basis.

For all subcontracted work, the PAS location placing the work internally or externally is responsible to ensure project specifications are always communicated to and understood by the subcontractor.

4.6 Purchasing Services and Supplies

Vendors that provide services and supplies to PAS are qualified to meet the needs of Pace®. These needs include but are not limited to competitive pricing, capacity to fill purchase orders, quality of product, customer service, and business reputation and stability. Evidence of this qualification is the availability to purchase services and supplies from the vendor in the corporate purchasing system.

PAS locations may purchase goods and services from any supplier in the purchasing system.

The specifications (type, class, grade, tolerance, purity, etc.) of supplies, equipment, reagents, standard reference materials and other consumables used in the testing process are specified in SOPs. The SOP specifications are based on the governing requirements of the approved reference methods and any additional program driven regulatory specification, such as drinking water compliance.

All requisitions for materials and consumables are approved by local management who is responsible for ensuring the services and supplies procured and received are fit for intended use.

4.7 Customer Service

Project details and management is managed by PAS client services personnel.

4.7.1 Commitment to Meet Customer Expectations

PAS personnel collaborate closely with our customers to ensure their needs are met and to establish their confidence in the capability of PAS to meet their needs for analytical services and expectations for service.

The project manager (PM) is the customer's primary point of contact for each analytical service request (work order). The PM gathers information from the customer to ensure the details of their request are understood. After samples are received, the PM monitors the progress of the project and alerts the customer of any delays or excursions that may adversely impact data usability. Supervisors are expected to keep the PM informed of project status and any delays or key issues, so that the PM can keep the client informed.

PAS encourages customers to visit our locations to learn more about the capabilities, observe performance and to meet personnel.

PAS customers expect confidentiality. Personnel will not divulge or release information to a third party without proper authorization unless the information is required for litigation purposes. See Section 4.1.5.4 of this manual and policy COR-POL-0004 *Code of Ethics and Professional Conduct* for more information on the policy for client confidentiality.

4.7.2 Customer Feedback

PAS actively seeks positive and negative feedback from customers through surveys and direct communication. Information from the client about their experience working with PAS and their satisfaction with work product is used to enhance processes and practices and to improve decision making. Customer feedback is reviewed to identify risk and opportunity. Corrective, preventive, or continuous improvement actions are taken based on nature of and/or feedback trends.

Also see sections 4.9, 4.10, 4.11, 4.12, 4.14, and 4.15 for more information about how customer feedback is managed by PAS and used to enhance the QMS.

4.8 Complaints

Per ISO/IEC 17025:2017, a complaint is a formal expression of dissatisfaction with the performance of a service or product originating from a party external to the organization. PAS believes complaints provide opportunities to improve processes and/or build stronger working relationships with our clients.

The PAS complaint resolution process is specified in corporate SOP ENV-SOP-CORQ-0020 and all PAS locations are required to use this SOP as their process.

Complaints are thoroughly reviewed to determine if it is valid. If the complaint is valid, action is taken to resolve the situation with the customer. In accordance with ISO/IEC 17025 requirements, the response to the customer is independently reviewed before it is given to ensure the response from PAS is thorough and proper for the situation.

Complaint information is captured in a centralized database and the data is used by PAS management personnel to identify trends and opportunities for improvement during Annual Management Review - See Section 4.15 for more information about annual management review.

4.9 Nonconforming Work

4.9.1 Definition of Nonconforming Work

Nonconforming work is work that does not conform to customer requirements, standard specifications, policies, and procedures, or that does not meet acceptance criteria.

The discovery of non-conforming work comes from various sources which include, but are not limited to:

results of quality control samples and instrument calibrations;

quality checks on consumables and materials;

general observations of personnel;

data review;

proficiency testing;

internal and external audits;

complaints and feedback;

management review and reports; and

regulatory and certification and accreditation actions.

The way in which the laboratory or service center manages nonconforming work depends on the significance and impact (risk) of the issue. Some issues may simply require correction, others may require investigation, corrective action (See 4.11) and/or data recall (See 4.16).

When the location releases data and test results associated with nonconforming QC and acceptance criteria, test results are qualified, or non-conformances are noted in the final analytical report to apprise the data user of the situation. (See 5.10)

Nonconforming work also includes unauthorized departure from policies, procedures, and test methods. Authorized departures are explained in the following subsections. Situations that do not conform to these conditions are considered unauthorized departure(s).

4.9.1.1 Authorized Departure from SOPs

Departures from an SOP may sometimes be necessary to correct an error in an SOP or to resolve a complex problem. For example, to mitigate complex matrix interference.

An authorized departure from a test method SOP is one that has been reviewed and approved by the department leader, however named, of the work area in which the test method is performed. The leader, when authorizing a departure from an SOP, accepts full responsibility to ensure the departure does not conflict with Pace® or PAS policy or procedure, does not affect statutory, regulatory or program compliance and does not adversely affect data integrity or usability.

Departure from administrative or process-oriented SOPs must be approved by the local QM.

Documentation of the reason for the SOP departures must be retained with management approval. Approved departures from test method SOPs should be noted in the final test report to advise the data user.

See SOP ENV-SOP-CORQ-0016 *SOP for SOPs and SWI*, for more information.

4.9.1.2 Authorized Departure from Test Methods (Method Modifications)

When test results are associated to a published reference test method, the location's test method SOP must be consistent with the test method. If the test method is mandated for use by a specific regulatory program such as drinking water, wastewater or a certification or accreditation program, such as TNI/NELAC, the SOP must comply with or include these requirements, or the resulting data and test results cannot be used for regulatory compliance purposes.

If the procedures in the SOP are modified from the test method, these modifications must be clearly identified in the SOP. The conditions under which the location may establish an SOP that is modified from these reference methods or regulatory program and what is considered a modification are specified in ENV-SOP-CORQ-0011 *Method Validation and Instrument Verification.*

Client requests to deviate from the test method are managed as client requests to depart from the test method SOP since it is the SOP that the location follows when performing work.

4.9.1.3 Stop Work Authority

Stop Work Authority provides PAS personnel with capability to temporarily stop work when there is a perceived unsafe condition or situation that may affect data integrity or the safety of personnel.

All personnel have the authority to initiate and request a stop work order when necessary to preserve data integrity or safety of workers.

The need for the stop work order and resolution of the problem must be confirmed by subject matter experts and resumption of work must be approved as follows:

> For stop work orders related to environmental health and safety (EHS) and/or waste management, the decision to stop work may be made in real time to protect the safety of the worker. Actions taken to correct the problem and lift the stop work order are made by the EHS Director, or the deputies assigned to these positions.
>
> Any employee may request a temporary stop work order for concerns related to data integrity. However, the request must be reviewed and the need to stop work affirmed by the Quality Manager to confirm the concern is valid. The decision to uphold the stop work order must be made jointly by the local QM, the QPM, the GM or DLO, and the VPO. The Corporate Quality Director and Chief Technical Officer, and other members of PAS management are consulted as needed. The actions taken to correct the problem and authorization to lift the stop work order are made by the same management team.

4.10 Continuous Improvement

The PAS QMS is designed to achieve continuous improvement through the implementation of the quality policy and objectives outlined in this manual. Information about laboratory and service center activities and performance is gained from sources such as customer feedback, audits, QC, trend analysis, business analytics, management reports, proficiency testing, and management systems review. This information is subsequently used during the corrective action (see section 4.11) and preventive action (see section 4.12) processes and during annual review of the management system (see section 4.15) to establish goals and objectives for improvement.

PAS also promotes a continuous improvement culture based on the principles of lean manufacturing. These principles include 3P (Process, Productivity, Performance) and Kaizen. 3P is a platform used by Pace to share best practices and standardization across the network to achieve operational excellence. Kaizen is a team-based process used to implement tools and philosophies of lean to reduce waste and achieve flow with the purpose of improving both external and internal customer satisfaction. All activities of 3P and Lean must conform with the requirements of this quality manual and supporting policies and procedures.

4.11 Corrective Action

Corrective action is a process used to eliminate the cause of a detected nonconformity. It is different from a correction. A correction is an action taken to fix an immediate problem but that does not resolve the underlying cause of why the problem occurred. The objective of corrective action is to find the underlying cause(s) of the problem and to put in place fixes to prevent the problem from happening again. The corrective action process, referred to as CAPA, is one of the most effective tools used by PAS to prevent nonconforming work, identify risk and opportunity, and improve service to our customers.

PAS has two general processes for corrective action, the application of which process is used depends on the type of nonconformity.

Quality control (QC) exceptions (nonconformance) that occur during routine testing is investigated through troubleshooting and required actions for correction is specified in policies and SOPs. When action is not taken, cannot be taken, or is not successful, test results associated with the nonconforming work are qualified in the final test report. Documentation of the nonconformance and corrective action taken is documented in the analytical record.

A 7-stage corrective action process is used when there is a recurring problem. These problems are identified through various activities such as but not limited to quality control trends, internal and external audits, management review, customer feedback, and general observation.

The 7 Stage CAPA Process for PAS includes:

1) Identification and Containment
2) Evaluation
3) Investigation
4) Cause Analysis
5) Action Plan
6) Implementation
7) Follow Up and Effectiveness Review

PAS procedures for corrective action are specified in corporate SOP ENV-SOP-CORQ-0018, *Procedure for Corrective and Preventive Action*. Some key concepts and activities related to the PAS corrective action process is provided in the next three subsections.

4.11.1 Cause Analysis (AKA Root Cause Analysis)

Cause analysis is the process of investigation used to identify the underlying cause(s) of the problem. After causal factors are identified, ways to mitigate the causal factors are identified and action(s) most likely to eliminate these factors are taken.

PAS uses different methods to conduct cause analysis. The most common approach is 5-Why, 4M, Fishbone Diagrams, or brainstorming may be appropriate depending on the situation. The method used is case specific and is documented in the CAPA record.

4.11.2 Effectiveness Review

Monitoring corrective actions for effectiveness is an essential part of the corrective action process. Effectiveness means the actions taken were appropriate and sustainable. Appropriate means the action(s) taken prevented recurrence of the problem since the time corrective action was taken and sustainable means the actions taken are still in place.

The data from CAPA records are used by PAS to identify opportunities for preventive action or to gain lessons learned when actions taken were not adequate to solve the problem. See Section 4.12 (Preventive Action) and 4.15 (Management Review) for more information.

4.11.3 Additional Audits

When cause analysis and investigation of a problem casts doubt on compliance with PAS policies, procedures, or to regulatory requirements; a special audit of the area of activity may be performed as part of the corrective action process. These special audits are used to determine the scope of the problem and to provide information for the CAPA process. Additional full-scale audits are done when a grave issue or risk to the business is identified.

4.12 Preventive Action

Preventive action(s) are actions taken to eliminate the cause of a potential nonconformity before it happens.

Some examples of preventive action include, but are not limited to:

Routine instrument maintenance (Preventive maintenance)

Addition of Staff and Equipment

Professional Development Activities

Implementation of New Technology

PAS looks for opportunities for preventive action from a variety of sources including employee idea's, customer feedback, business partners input, trend analysis, business analytics, management reviews, proficiency testing results, and risk-benefit analysis.

PAS management evaluates the success of preventive actions taken in any given year during annual management review. See Section 4.15 for more information.

4.12.1 Change Management

Preventive actions may sometimes result in significant changes to processes and procedures used by PAS locations. PAS management evaluates the risks and benefits of change and includes in its implementation of change process, actions to minimize or eliminate any risk. The types of changes for which risk are considered and managed include infrastructure change, change in analytical service offerings, certification or accreditation status, instrumentation, LIMS changes, and changes in key personnel.

4.13 Control of Records

PAS records document activities and provide evidence of conformity to the requirements established in the QMS. These records may be hardcopy or electronic on any form of media.

4.13.1 General Requirements

4.13.1.1 Procedure

PAS requirements for control of records are specified in corporate policy ENV-POL-CORQ-0013 *Record Management*.

The policy was established to assure quality and technical records are identified, retained, indexed, and filed to allow for retrieval during the entire retention time. During storage, records are kept secure and protected from deterioration. At the end of the retention time, the records are disposed of properly in order to maintain client confidentiality and to protect the interests of the company.

In general, PAS records fall into three categories: quality, technical, and administrative.

Examples of each are provided in the following table:

Record Type	Includes Records of:
Quality	Audits: Internal and External Certificates and Scopes of Accreditation Corrective & Preventive Action Management Review Data Investigations Method Validation Instrument Verification Training Records
Technical	Raw Data Logbooks Certificates of Traceability Analytical Record Test Reports & Project Information Technical Training Records & Demonstration of Capability
Administrative	Personnel Records Finance/Business

4.13.1.2 Record Legibility and Storage

Records are designed to clearly identify the information recorded. Manual entries are made in indelible ink; automated entries are in a typeface and of sufficient resolution to be read. The records identify personnel that performed the activity or entered the information. Records are archived and stored in a way that they are retrievable. Access to archived records is controlled and managed.

For records stored electronically, the capability to restore or retrieve the electronic record is maintained for the entire retention period. Hardcopy records are filed and stored in a suitable environment to protect from damage, deterioration, or loss. Hardcopy records may be scanned to PDF for retention. Scanned records must be checked against the hardcopy to verify the scan is complete and legible.

Administrative records are kept for a minimum of 5 years and technical and quality records are kept for 10 years unless otherwise specified by the client or regulatory program.

The date from which retention time is calculated depends on the record. In general, the retention time of technical records of original observation and measurement is calculated from the date the record is created. If the technical record is kept in a chronological logbook, the date of retention may be calculated from the date the logbook is archived. The retention time of test reports and project records, which are considered technical records, is calculated from the date the test report was issued.

The retention time of quality records is usually calculated from the date the record is archived.

Refer to the record management policy and the location specific SOP for more information.

4.13.1.3 Security

PAS locations are secure facilities and access to records is restricted to authorized personnel.

4.13.1.4 Electronic Records

The data systems used to store electronic records is backed up in accordance with SOP ENV-SOP-WES2-0115, *Computer System Backup Control.* Access to archived records stored electronically is maintained by personnel responsible for management of the electronic system.

4.13.1.5 Electronic Signature Policy

Work done by PAS locations include activities that require the application of a signature. Some work products are in electronic format and signatures are applied electronically.

The Electronic Signatures in Global and National Commerce Act (E-Sign Act) clarifies that electronic signatures are legally valid and enforceable under United States law.

See guide ENV-GUI-CORQ-0007 *Electronic Signatures* for more information.

4.13.2 Technical Records

In addition to the requirements specified in subsections 4.13.1.1 through 4.13.1.5, the requirements in the following subsections also apply to technical records.

4.13.2.1 Description

Technical records are the accumulation of data and information generated from the analytical process. These records may include forms, worksheets, workbooks, checklists, notes, raw data, calibration records, final test reports, and project records. The accumulated record needs to provide adequate detail to historically reconstruct the process and identify the personnel that performed the tasks associated with a test result.

4.13.2.2 Real Time Recordkeeping

Personnel are instructed and expected to always record observations, data, and calculations at the time they are made. PAS managers are responsible for ensuring that data entries, whether made electronically or on hardcopy, are identifiable to the task.

4.13.2.3 Error Correction

Errors in records must never be erased, deleted, or made illegible. Use of correction fluid, such as white-out is prohibited. In hardcopy records, the error is corrected by a single strike through the original entry and the new entry recorded alongside or footnoted to allow for readability. Corrections are initialed and dated by the person making the correction. If the correction is not self-explanatory, a reason for the correction is recorded. Maintenance of proper practices for error correction is monitored through the tiered data review process described in Section 5.9.3.

For electronic records, equivalent measures of error correction or traceability of changes made is kept. For example, audit trails provide records of change.

4.14 Audits

Quality personnel, or their designees, perform internal systems and technical audits to assess implementation of the QMS and compliance to this manual, policy, and procedures that make up the QMS.

PAS locations are also audited by external parties such as regulatory agencies, customers, consultants, and non-government assessment bodies (NGAB).

Information from internal and external audits is used by local and corporate PAS management to address deficiencies and to identify opportunities to improve customer service and quality of work, including reliability and usability of data and test results.

Deficiencies, observations, and recommendations from audits are managed by the local QM using the CAPA process. See Section 4.11 for more information.

4.14.1 Internal Audit

Internal audits are conducted to ensure laboratory and business practices match what we say we do and what we say we do is compliant with the PAS QMS and relevant standards and requirements.

The internal audit program is managed by the local QM who prepares an audit plan at the beginning of each calendar year. The schedule is prepared to assure that all work areas are reviewed over the course of the year and test methods are audited every two years, unless a more frequent test method audit is required by program. Conformance to the schedule is monitored on a monthly basis.

PAS management is responsible for ensuring the audit schedule is maintained. PAS supervisors are expected to cooperate with the quality personnel to provide them with complete access to the work area, personnel, and records needed to conduct the audit.

Internal audits may be performed by non-quality personnel when the auditor is approved by the local QM. Non-quality personnel may not audit their own work activities unless it can be demonstrated that an effective and objective audit will be conducted. The person conducting the audit must be trained, qualified, and familiar enough with the objectives and policies of the PAS QMS and knowledgeable with process and test method SOPs related to the activities audited. The auditor should be trained in auditing practices in order to perform a thorough and effective evaluation.

Test method audits include reviews of test reports to verify the product is consistent with customer/project requirements, the work was conducted in accordance with policy and SOPs, the SOP complies with the cited reference method, test results are accurate, and of known and documented quality and properly qualified, when necessary.

Special audits are performed as needed to follow up on a specific issue such as a client complaint, negative feedback, concerns of data integrity or ethics, or a problem identified through other audits. Special audits may be scheduled or unscheduled. Unscheduled internal audits are conducted whenever doubts are cast on compliance with regulatory requirements or its own policies and procedures. These unscheduled internal audits may be conducted at any time and may be performed without an announcement to the location or work area audited.

When observations and findings from any audit (internal or external) cast doubt on the validity of testing results, the location takes immediate action to investigate the problem and take corrective action. (Also see 4.11 and 4.16)

4.14.1.1 Corporate Compliance Audit

PAS locations may also be audited by Pace® corporate personnel at discretion. The purpose of the corporate compliance audit is to assess whether the location's practices, processes and procedures conform with the PAS QMS and to identify risk and opportunity.

4.15 Management Review

Local management conducts an annual business review of each location under their purview to assess performance and to establish goals, objectives, and action plans for the upcoming year.

The procedure used to conduct this review is specified in corporate SOP ENV-SOP-CORQ-0005 *Management Review*.

At a minimum, the following topics are reviewed and discussed during annual management review:

Changes in internal and external issues relevant to the location;

Fulfillment of objectives and initiatives;

suitability of policies and procedures, including EHS and waste management;

status of actions from previous performance reviews;

The outcome of recent internal audits;

Corrective and preventive actions;

Assessments by external bodies;

The results of interlaboratory comparisons or proficiency tests;

Changes in the volume and type of the work;

Customer and personnel feedback, including complaints;

Effectiveness of improvements / preventive actions made since last review;

Adequacy of resources;

results of risk identification;

Proficiency testing performance and other measures related to the assurance of validity of test results; other relevant factors, such as QC trends and training status.

The discussion and results of this review are documented in a report prepared by local management. This report includes a determination of the effectiveness of the management system and its processes, goals, and objectives for improvements in the coming year with timelines and responsibilities, and any other need for change.

Goals and action items from annual management systems review are shared with local employees and with corporate management to highlight focus areas for improvement in addition to areas in which the location has excelled.

4.16 Data Integrity

PAS procedures for the investigation and response to events that may affect data integrity are described in the PAS corporate SOP ENV-SOP-CORQ-0017 *Data Impact Assessment*s.

Customers whose data are affected by the problem are notified in a timely manner, usually within 30 days after the impact of the problem is understood. Some accreditation programs also require notification to the accreditation body (AB) within a certain timeframe from date of discovery. PAS locations must follow any program or project specific requirements for notification, when applicable.

5.0 TECHNICAL REQUIREMENTS

5.1 General

Multiple factors contribute to the correctness and reliability of the technical work performed by PAS.

These factors fall under these broad categories:

Human Performance

Facility and Environmental Conditions

Test Method Performance and Validation

Measurement Traceability

Handling of Samples

The impact of each of these factors varies based on the type of work performed. To minimize negative effects from each of these factors, PAS accounts for the contribution from each of these categories when developing test method and process (administrative) SOPs, evaluating personnel qualifications and competence, and in the selection of equipment and supplies used.

5.2 Personnel

5.2.1 Personnel Qualifications

PAS personnel are qualified and competent to perform the roles and responsibilities of their position based on education, experience, and training.

Qualifications, duties, responsibilities, and authorities of each position are specified in job descriptions maintained by corporate HR (See Section 5.2.4). These job descriptions provide the general basis for the selection of personnel for hire and are used by the location to communicate to personnel the duties, responsibilities, and authorities of their position. Qualification records may include but are not limited to diploma, transcripts, and curriculum vitae (CV).

The term "personnel" refers to individuals employed by PAS or a PAS subsidiary directly as full-time, part-time, or temporary, and individuals employed by PAS by contract, such as through an employment agency. The term "personnel" is used interchangeably with the term "employee" throughout this manual. For the purposes of this manual, these terms are equivalent.

5.2.1.1 Competence

Competence is the ability to apply a skill or series of skills to complete a task or series of tasks correctly within defined expectations.

PAS requirements for competence of personnel (education, qualification, work experience, technical skills, and responsibilities) are specified in job descriptions created by management and kept by human resources (HR). The job description provides the basis for the selection of personnel for each position.

An employee is considered competent when they have completed the required training specified in Section 5.2.2.

5.2.2 Required Training

Training requirements are outlined in Pace® policies COR-POL-0023 *Mandatory Training Policy,* COR-POL-0004 *Code of Ethics and Professional Conduct* and this Quality Manual.

5.2.2.1 Training Program

The PAS training program includes these elements:

Scheduling
Execution
Documentation

Evaluation of Effectiveness

Training is scheduled by corporate personnel, local quality personnel, and the employee's direct supervisor.

Training is delivered using various methods that incorporate techniques that appeal to the four main learning styles: visual, aural, linguistic, and kinesthetic. Delivery methods include, on-the-job (OJT), instructor-led, self-study, eLearning, and blended.

Training must be documented with a training record to prove training occurred. Required training (Section 5.2.2.1.1-5.2.2.1.5) must be complete before the employee is authorized to work independently on client samples. Complete means the employee has successfully completed training and evidence of training is filed in the employees training record maintained by the corporate training group, the corporate group that assigned training, such as IT, HR, or EHS, and/or and the local quality department.

The employee's direct supervisor is responsible for monitoring completion of the employee's required training program and for providing adequate time to the employee to complete training assignments. The supervisor and employee are jointly responsible to ensure the employee's training status and training records for all required training is current, complete, documented and the training records are accessible.

Until the required training is complete, the employee's direct supervisor is responsible and accountable for all work produced by the employee under their supervision.

Training status is tracked by local quality personnel and made readily available to all employees so they can access and monitor their status in real time.

The following subsections specify the required PAS training for new hires and requirements for on-going training.

5.2.2.1.1 New Hire Required Training

New hire training requirements apply to personnel new to Pace® and to existing employees starting in a new position or different work area.

Required new hire training includes each of the following topics:

Ethics and Data Integrity (5.2.2.1.3)

Quality Management System Policy and Procedure (5.2.2.1.4)

Environmental Health and Safety (EHS)

Demonstration of Capability (DOC) (5.2.2.1.5): Employees that prepare and test samples may also be required to successfully complete a DOC for the test method they are assigned before working independently on customer samples and to verify capability on a routine basis thereafter. Independent means without direct supervision of the work activity by the supervisor or a qualified trainer.

5.2.2.1.2 On-Going Required Training

All personnel receive on-going training on each of the following topics:

Ethics and Data Integrity

Quality Management System Policy and Procedure

EHS

5.2.2.1.3 Ethics and Data Integrity

Ethics and data integrity training is provided to all new personnel upon hire and refresher training is provided to all employees minimally on an annual basis and more frequently as needed.

The training materials emphasize expectations, what to do, what not to do and the potential consequences that result from scientific misconduct and improper practices. Employees are informed that Pace® has a Zero Tolerance Policy for scientific misconduct, improper practices, and fraud. The employment of any employee found to have conducted, sanctioned, or instructed an employee to engage in these infractions will be terminated and the employee may be subject to debarment, and civil/criminal prosecution.

The following topics are covered:

Pace® Policy for honest, transparent, and objective reporting of test results and data;

Practices that are considered scientific misconduct, fraudulent and improper;

How and when to report data integrity concerns or ethical violations;

Record Keeping. The training emphasizes the importance of accurate, complete, and legible documentation of work activities;

Procedures used by Pace® to prevent and monitor for infractions;

Specific examples of breaches of ethical behavior such as improper data manipulations, adjustments of instrument time clocks, and inappropriate changes in concentrations of standards.

See COR-POL-0004 for more information.

5.2.2.1.4 Management System Documents Training

The primary documents that support the PAS QMS include the Quality Manual, policies, and SOPs.

These documents specify what we do, how, and why and are the documents all employees must abide. The employee's commitment to abide by these documents is acknowledged with a Read and Acknowledgement Attestation (R&A). PAS employees must have a R&A on record for the local Quality Manual, and the policies and SOPs relevant to their job responsibilities. The R&A acknowledges the employee has received, read, and understands the content of the management system document, the employee agrees to follow any instructions and requirements specified in the document when carrying out their work tasks; and the employee understands that unauthorized changes or departure from procedures and requirements specified in the documents not allowed unless authorized, documented and disclosed.

Other documents that support the management system include forms and worksheets that record original observations and/or calculate test results, guides, project-specific documents, or other reference materials. Employees are not required to have a R&A for these types of documents – how to use the document is learned on the job.

Employee understanding, application, and adherence to the content specified in management system documents is continuously reinforced by on-the-job (OJT) training and routine checks and balances, such as secondary data review and internal audits.

5.2.2.1.5 Demonstration of Capability (DOC) Requirements

A DOC is a procedure that establishes the ability of the analyst to perform a test procedure and obtain test results with acceptable accuracy and/or precision.

Newly hired employees that prepare or test samples are required to successfully complete an initial demonstration of capability (IDOC) for the test method before they are permitted to work independently on real world samples.

On-going demonstration of capability (ODOC) must be demonstrated on an annual basis thereafter.

The procedure for IDOC and ODOC can differ based on technology, analyte group and/or the regulatory or accreditation/certification program requirements that apply. In general, the options for ODOC are more flexible than for an IDOC on the premise that the analyst has routinely analyzed samples by the test method during the calendar year.

When more than 365 days (1 Year) has passed since the employee last analyzed real world samples by the test method; the employee must successfully redemonstrate capability with an IDOC to remain authorized to independently test real world samples.

A successfully complete DOC (IDOC or ODOC) is one where:

1) The DOC study data has been compiled, reviewed, and verified to meet acceptance criteria;
2) The DOC record has been approved by the department supervisor;
3) The DOC record has been verified complete by local quality personnel; and
4) The DOC record has been archived in the employee's training file for accessibility and reference.

If any of the above conditions is not met, the DOC is not complete.

Until the required training is complete, the employee's direct supervisor is responsible and accountable for all work produced by the employee under their supervision.

DOC procedures and acceptance criteria vary by program, technology, analyte group - therefore all options are not specified in this manual.

PAS locations must put in place a local DOC program appropriate for the testing services offered and that complies with relevant regulatory and/or accreditation/certification program requirements.

For example – an acceptable DOC program for laboratories accredited to the TNI Standard might look like this:

A DOC for chemistry test methods where spiking is an option is based on the employee's capability to achieve acceptable precision and accuracy for each analyte accredited from a series (usually 4) of replicates that were spiked at a specific concentration, and prepared and analyzed using the laboratory's test method SOPs.

A DOC for a test method where spiking is not an option is based on an employee's capability to achieve comparable results to a peer.

Specific instructions and acceptance criteria for DOCs for each test method may be specified in the test method SOP or a stand-alone SOP for DOC.

5.2.2.2 Effectiveness of Training

Training effectiveness is measured by the employee's demonstrated ability to comprehend the training material and apply knowledge and skills gained to their job task. These evaluations include but are not limited to:

Testing of the employee's knowledge of the QMS, policies, and technical and administrative procedures through various mechanisms, such as quizzes, and interviews.

Demonstrated ability to convey information correctly and factually in written and verbal communication.

Demonstrated ability to follow instructions and adhere to policy and procedure.

Demonstrated ability to make sound decisions based on guidance and information available and to defend decisions made.

Demonstrated initiative to seek help or guidance when the employee is unsure of how to proceed.

5.2.2.3 Supplemental Learning

Supplemental learning objectives may be established for newly hired personnel to aid in their development of administrative and technical skills. These learning objectives and materials, referred to as Learning Plans (LP), are managed by the employee's direct supervisor.

Pace® also offers a wide variety of supplemental learning courses that are made available to all employees for professional development. The learning may be self-initiated based on an employee's interest or may be assigned to the employee at the discretion of management as professional development as part of an employee's annual goals.

Supplemental learning assignments are not prerequisites for competency (Section 5.2.1.1) and are not included in the required training program.

5.2.3 Personnel Supervision

Every employee is assigned a direct supervisor, however named, who is responsible for their supervision.

General supervisory responsibilities may include but are not limited to:

Hiring Employees

Training Employees

Performance Management

Development, oversight, and execution of personnel training plans

Monitoring personnel work product to assure the work is conducted in accordance with this quality manual, policies, SOPs, and other documents that support the QMS.

5.2.4 Job Descriptions

Job Descriptions that define the required education, qualifications, experience, skills, roles and responsibilities, and reporting relationships for each Pace® position are established by top management and kept by corporate HR. The job descriptions apply to employees who are directly employed by Pace®, part-time, temporary, technical, and administrative and by those that are under contract with Pace® through other means.

The job descriptions include the education, expertise, and experience required for the position and the responsibilities and duties, including any supervisory or managerial duties assigned to the position.

5.2.5 Authorization of Technical Personnel

Technical personnel are authorized to perform the technical aspects of their position after laboratory management has verified that the employee meets the qualifications for the position, and has successfully completed required training (Section 5.2.2.1). After initial authorization, technical personnel are expected to maintain a current and complete training record, demonstrate on-going capability at least annually for each test method performed, and produce reliable results through accurate analysis of certified reference materials, proficiency testing samples, and/or routine quality control samples in order to remain authorized to continue to perform their duties.

Records used to support authorization which may include but are not limited to, transcripts, resumes, training records, experience, training, and certificates are kept by the PAS location or business function to which the employee is assigned, if the employee is in a role that support more than one location or business unit.

5.3 Accommodations and Facilities

5.3.1 Facilities

PAS facilities are designed to support the activity performed. Access to PAS facilities is controlled by various measures, such as card access, locked doors, and staffed main entry.

5.3.2 Environmental Conditions

Each location is equipped with energy sources, lighting, heating, and ventilation necessary to facilitate proper and safe performance of calibrations and tests. Local management ensures that housekeeping, electromagnetic interference, humidity, line voltage, temperature, sound, and vibration levels are appropriately controlled to ensure the integrity of specific measurement results and to prevent adverse effects on accuracy or increases in the uncertainty of each measurement.

Environmental conditions are monitored, controlled, and recorded as required by the relevant specifications, methods, and procedures. Operations are stopped if it is discovered that the environmental conditions would jeopardize the integrity of analytical results or other work products.

5.3.3 Separation of Incompatible Activities

The layout and infrastructure of each work area including air handling systems, power supplies, and gas supplies of each work area are designed for the type of analytical activity performed. Effective separation between incompatible work activities is maintained. For example, sample storage, preparation, and chemical handling for volatile organic analysis (VOA) is kept separate from semi-volatile organic analysis (SVOA).

Samples known or suspected to contain high concentration of analytes are separated from other samples to avoid the possibility for cross-contamination. If contamination is found, the source of contamination is investigated and resolved.

5.3.4 Security

Security is maintained by controlled access to the building and by surveillance of work areas by authorized personnel. Access to each area may be controlled depending on the required personnel, the sensitivity of the operations performed, and potential safety concerns.

5.3.5 Good Housekeeping

Local management must maintain good housekeeping practices in their facilities and maintain a standard of cleanliness necessary for analytical integrity and personnel health and safety.

5.4 Test Methods

5.4.1 General Requirements

PAS locations must use test methods and procedures that are appropriate for the scope of analytical test services the laboratory offers.

Instructions on the use and operation of equipment and sample handling, preparation, and analysis of samples must be specified in SOPs. The instructions in SOPs may be supplemented with other documents including, but not limited to, standard work instructions (SWI), manuals, guides, project documents, and other reference materials.

5.4.2 Method Selection

The test methods offered by PAS are primarily industry accepted published reference test methods. Each PAS laboratory bases its test method SOP on the latest version of the reference method unless regulatory requirements specify an earlier version must be used.

The laboratory confirms that it can perform the test method and achieve desired outcome before analyzing samples following method validation protocols specified in Section 5.4.5.

The test methods used by the laboratory to test real world samples must meet the needs of the customer, be appropriate for the intended use of the data, and must conform with applicable federal, statutory, or program requirements.

When a customer does not specify the test method(s) to be used, the laboratory may suggest test methods that are appropriate for the intended use of the data and the type of samples to be tested. The laboratory will also inform customers when test methods requested are considered inappropriate for their purpose and/or out of date. This discourse takes place during review of analytical service requests (See Section 4.4).

5.4.3 Laboratory Developed Methods

A laboratory developed method is a test method developed wholly by PAS or a modification to a published method that is substantially modified from the specifications and procedures of a published test method.

Laboratory developed methods must be validated prior to use (see section 5.4.5) and the procedure documented in a test method SOP.

The requirements for non-standard methods (Section 5.4.4) also apply to PAS developed methods.

5.4.4 Non-standard Methods

A non-standard method is a testing protocol that is not published or approved for use by conventional industry standards.

Use of a non-standard method for testing must be agreed upon with the customer. The agreement, which is retained by the laboratory in the project record, must include the specifications of the client's requirements, the purpose of testing, and their authorization for use of the non-standard method.

5.4.5 Method Validation

The laboratory confirms that it can successfully perform the test method before analyzing samples through a process called method validation. Method validation is partially or fully repeated when there is a change in the published reference method or a change in the way the laboratory performs the test method that may affect selectivity, sensitivity, accuracy, precision, or general performance of the method.

5.4.5.1 Validation Description

Validation is the process of confirmation and the provision of objective evidence that the stated requirements for a specific method/procedure are fulfilled.

The laboratory's requirements and procedures for method validation are outlined in SOP ENV-SOP-CORQ-0011 *Method Validation and Instrument Verification.*

5.4.5.2 Validation Summary

All test methods offered by the laboratory are validated before use to confirm the procedure works as expected and the data and test results are accurate and precise.

The record of validation is retained and kept in accordance with method validation SOP and PAS corporate policy ENV-CORQ-POL-0013 *Record Management*.

5.4.5.3 Validation of Customer Need

The laboratory's validation process includes measures to assess accuracy, precision, sensitivity, selectivity, linearity, repeatability, reproducibility, robustness, and cross-sensitivity of the laboratory's procedure against general customer expectations for data usability.

The following subsections describe some of these concepts in relation to organic and inorganic chemistry (chemical testing). These descriptions and the requirements specified are pertinent to chemical testing and may not apply in the same context to other testing services offered by PAS such as radiochemistry, whole effluent toxicity (WET), asbestos, and microbiology. For more information about validation measures for these testing services, refer to the laboratory's test method SOPs.

5.4.5.3.1 Accuracy

Accuracy is the degree to which the result of a measurement, calculation, or specification conforms to the correct value or a standard. When the result is within a range from the known value (control limit); the result is considered accurate.

5.4.5.3.2 Precision

Precision refers to the closeness of two or more measurements to each other. It is measured by calculating the relative percent difference (RPD) or relative standard deviation (RSD) of results from separate analysis of the same sample. Precision provides information about repeatability, reproducibility, and robustness of the laboratory's procedure.

5.4.5.3.3 Sensitivity

Sensitivity refers to the smallest amount of substance in a sample that can accurately be measured.

In chemical testing, this threshold is commonly known as the detection limit (DL) or method detection limit (MDL).

The DL is defined as the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results.

The DL is either a statistically derived value obtained by multiplying the standard deviation from a series of spiked replicates by the student-T value that correlates to the number of replicates analyzed or it is set to the concentration greater than found in a population of method blanks.

Detections of target analytes below the DL are not reported – unless specified by regulatory program protocol, because presence of target analytes at this level cannot be differentiated from noise.

Limits of Quantitation represent the threshold of the laboratory's procedure for quantitative sensitivity.

> The LOQ is the minimum level, concentration, or quantity of a target analyte that can be reported with a specified degree of confidence.
>
> The LLOQ is simply the concentration of the lowest calibration standard included in the calibration curve.

Although the LOQ and LLOQ may be and often are the same value; the definitions are not the same.

The LOQ is static – it is set when the DL is determined. The LOQ value must be routinely verified to confirm the laboratory can detect the concentration within a range of accuracy.

The LLOQ fluctuates based on the series of standards included in each calibration curve – the LLOQ is always the concentration of the lowest calibration standard included in the curve fit and for which samples are quantitated against. The LLOQ is not the concentration of the lowest standard analyzed, if the lowest concentration standard is not included in the curve, it is not relevant to sample quantitation. Unless otherwise specified by test method, regulatory program or project-specific protocol, accuracy at the LLOQ does not need to be verified independent of the evaluation of relative error or relative standard error.

Target analytes detected at concentrations between the DL and LOQ are known as estimated values – they are within the range of qualitative identification and outside the range of quantitative accuracy. If reported, the results must be qualified to indicate the test result is estimated.

The meaning of Limit of Detection (LOD) varies based on the context by which the term is used. Outside of the DoD program, LOD is another term used to refer to the DL or MDL.

PAS laboratories that are accredited for DoD, must also establish an LOD. The DoD defines the LOD as the smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. This definition is different from the definition of DL - the DL represents the theoretical value at which a detection is distinguishable from a blank.

For DoD, the LOD is a value between the DL and the LOQ. Specifically, it must be 2-4X greater than the DL but less than the LLOQ or LOQ. The value of the LOD set by the laboratory must meet all criteria for qualitative identification and quantitative accuracy based on the signal to noise ratio.

For DoD/DOE project work, target analytes that are not detected at the DL are reported as undetected at the LOD and results between the DL and the LOQ are reported as estimated values.

The reporting limit (RL) is the value to which test results are reported as detected or not detected. The RL may be project-defined based on project data quality objectives (DQO) and it may be above or below the LOQ or LLOQ. In the absence of project specific requirements, the RL is usually the same value as the LLOQ. The RL is also called the practical quantitation limit (PQL) – but this can be misleading if the RL is less than the LLOQ or LOQ.

In general, the RL should always be greater than or equal to the value that establishes the threshold for quantitative sensitivity, but it is common for clients to request laboratories to report undetected target analytes at the DL value. This instruction has evolved as an acceptable reporting practice; however, data users should understand the DL is a statistically derived value that does not represent the limit of quantitation.

Unless otherwise specified by regulatory program or test method, detection, quantitation, and reporting limits are adjusted for the amount of sample used (preparation factor) and the dilution factor and are adjusted for percent moisture when samples are reported on a dry weight basis.

To ensure detection and quantitation limits are sound and defensible, the procedures that PAS laboratories use to establish detection, quantitation and reporting limits for chemical testing must comply with the current version of each of the following documents:

EPA document EPA-821-R-16-006 Definition and Procedure for the Determination of the Method Detection Limit;

2016 TNI Standard V1M4; and

TNI GUID-3-109-Rev. 0, V1M4 2016 Standard Update Guidance on Detection and Quantitation.

5.4.5.3.4 Selectivity

Selectivity refers to the ability of a method to correctly determine an analyte without interference from other compounds.

5.4.5.3.5 Linearity

Linearity is a mathematical concept applied to calibration models that employ multiple points to establish a calibration range used for quantitative analysis. Linearity is measured differently based on the calibration model. In general, if linearity is demonstrated then the slope of the response of standards are sufficiently close to one another. The accuracy of the linear regression and non-linear curves is verified by checking percent error or relative standard error (RSE), which is the process of refitting calibration data back to the model to determine if the results are accurate. For linear curves that use average calibration or response factor, error is measured by relative standard difference (RSD).

Linearity also establishes the range of quantitation for the test method used which directly impacts the sensitivity of the test method and uncertainty in measurement results. As previously noted, the LLOQ establishes the lower limit of quantitation. The upper range of linearity establishes the upper limit of quantitation. For most technologies, results outside of this range are considered qualitative values. However, some inorganic test methods allow the linear range to be extended above the upper limit of quantitation when accuracy at this level is verified.

Linearity can also be used to establish repeatability, reproducibility, and robustness of the laboratory's test method. When linearity is demonstrated using a specific calibration model during method validation, then use of this same calibration model to achieve linearity on a day-to-day basis confirms the laboratory's method is repeatable, reproducible, and robust.

5.4.6 Measurement Uncertainty

PAS provides an estimate of uncertainty with analytical results on request, or when required. For example, for radiochemistry testing, uncertainty is always reported with the test result.

For chemistry the uncertainty of the test method is embedded in the control limits used to assess performance of quality control (QC) samples. Language in ISO/IEC 17025 clarifies that measurement uncertainty is satisfied when a well-recognized test method specifies limits that account for source of bias, the laboratory has satisfied the requirements on analytical uncertainty by following the test method and reporting instructions. See Section 5.9.1.1.9 for more information.

5.4.7 Control of Data

PAS has policies and processes in place to assure that reported data is free from calculation and transcription errors, manual changes to data are thoroughly reviewed for need and correctness, and software systems used to generate or store data is secure.

5.4.7.1 Calculations, Data Transfer, Reduction and Review

Data reduction is performed using commercially available data processing/reduction software, the LIMS (Laboratory Information Management System) and/or programs and worksheets created by PAS.

PAS does not permit manual calculation of results – that is the calculation of a test result by pen and paper or calculator. When there is no commercial software or LIMS option, PAS laboratories must create a worksheet from a spreadsheet program, such as Excel, to calculate results based on raw inputs and original observations. Spreadsheets for these purposes must be validated and controlled in accordance with policy ENV-CORQ-POL-0015 *Spreadsheet Validation.*

5.4.7.1.1 Manual Integration

The PAS policy and procedures for manual integration are specified in PAS SOP ENV-SOP-CORQ-0006 *Manual Integration.*

This SOP includes the conditions under which manual integration is allowed and the requirements for documentation.

Required documentation of manual integration minimally includes:

- complete audit trail to permit reconstruction of before and after results;
- identification of the analyst that performed the integration and the reason the integration was performed; and
- identification of the individual(s) that reviewed the integration and verified the integration was done and documented in compliance with the SOP.

5.4.7.2 Use of Computers and Automated Acquisition

Whenever possible, PAS uses software and automation for the acquisition, processing, recording, reporting, storage, and/or retrieval of data.

In-house developed software is validated by Pace® corporate IT for adequacy before release for routine use. Commercial off the shelf software is considered sufficiently validated when the location follows the manufacturer or vendor’s manual for set-up and use. Records of validation are kept by the corporate information technology (IT) group or by the group that performed the validation.

The PAS process for the protection of data stored in electronic systems includes:

- Individual usernames and passwords for Laboratory Information Management Systems (LIMS) and auxiliary systems used to store or process data.
- Employee Training in Computer Security Awareness
- Validation of spreadsheets used for calculations to verify formulas and logic yield correct results and protection of these cells to prevent unauthorized change.
- Operating system and file access safeguards
- Protection from Computer Viruses
- Regular system backup; and testing of retrieved data
- Verification the software application works as expected and is adequate for use and fulfills compliance requirements, such as the need to record date/time of data generation.
- Change control to assure requests for changes are reviewed and approved by management before the change is made.
- Communication channels to assure all staff are aware of changes made.
- Version Control and maintenance of historical records.

5.5 Calibration Requirements

5.5.1 Availability of Equipment

Local management ensures the laboratory is furnished with all equipment and instrumentation necessary to correctly perform the tests offered in compliance with the specifications of the test method and to achieve the accuracy and sensitivity required.

5.5.2 Calibration

Equipment and instrumentation are checked prior to use to verify it performs within tolerance for its intended application.

5.5.2.1 Support Equipment

Support equipment is verified to be in proper working order, and to meet the tolerance specifications for the purpose(s) for which it will be used prior to placement in service. Thereafter, periodic checks are performed to verify on-going performance per a schedule maintained by local quality personnel. Support equipment that does not meet specifications is removed from service and either repaired or replaced. Records of repair and maintenance activities are maintained.

Procedures used to conduct and record these checks are outlined in SOP ENV-SOP-WES2-0036, *Balance Calibration Verification*, ENV-SOP-WES2-0039 *Thermometer Calibration*, ENV-SOP-WES2-0123 *Autopipet and Wet Chem Titrator Calibration Verification*.

5.5.2.2 Analytical Instruments

Analytical instruments are checked prior to placement in service in accordance with SOP ENV-SOP-CORQ-0011 *Method Validation and Instrument Verification*. After the initial service date, the calibration of instruments and verification of calibration is performed in accordance with local test method SOPs.

The calibration procedures in the test method SOPs must comply with the requirements for acceptable calibration practices outlined in corporate policy ENV-POL-CORQ-0005 *Acceptable Calibration Practices*, the reference methods, and any applicable regulatory or program requirements.

5.5.3 Equipment Use and Operation

Up-to-date instructions and procedures for the use and maintenance of analytical equipment are included in SOPs and/or supplemental documents such as standard work instructions (SWI) or instrument manuals which are made readily accessible in the work area to all laboratory personnel.

5.5.4 Equipment Identification

Each piece of equipment is uniquely identified by serial number or any other unique ID system. The identifier is included in the equipment list maintained by the quality department and may not be reused or used interchangeably. New equipment and replacement equipment are assigned a new unique ID.

5.5.5 Equipment Lists and Records

5.5.5.1 Equipment List

Each PAS location maintains a list of equipment that includes information about the equipment including a description, manufacturer, serial number, date placed in service, condition when received, identity, and the work area where the equipment is used. The equipment list(s) for each location covered by this manual is provided in Appendix E.

5.5.5.2 Equipment Records

In addition to the equipment list, other equipment records maintained by PAS include:

Verification that equipment conforms with specifications.

Calibration records including dates, results, acceptance criteria, and next calibration dates.

Maintenance plan and records.

Records of damage, malfunction, or repair.

The laboratory follows an equipment maintenance program designed to optimize performance and to prevent instrument failure which is described in the analytical method SOPs.

The maintenance program includes routine maintenance activities which are performed as recommended by the manufacturer at the frequency recommended and non-routine maintenance, which is performed to resolve a specific problem such as degradation of peak resolution, shift in calibration relationship, loss of sensitivity, or repeat failure of instrument performance checks and quality control samples.

Maintenance is performed by PAS personnel or by outside service providers.

All maintenance activities performed by PAS personnel are recorded by the individual(s) that performed the activity at the time the maintenance was performed in an instrument maintenance log.

The maintenance record minimally includes the date of maintenance, the initials of the person(s) performing maintenance, a description of the activity performed, why (when the maintenance is non-routine), and the return to analytical control. When maintenance is performed by an external vendor, the service record must be maintained and accessible for easy retrieval. The location must provide personnel with unrestricted access to instrument maintenance logs in order to promote good instrument maintenance and recordkeeping practices.

If an instrument must be moved, the location will use safe practices for handling and transport to minimize damage and contamination.

5.5.6 Out of Service Protocol

Equipment that has been subjected to overloading, mishandling, gives suspect results, has been shown to be defective, or is performing outside of specified limits is taken out of service and either removed from the work area or labeled to prevent accidental use until it has been repaired and verified to perform correctly.

When analytical equipment is taken out of service because it no longer meets tolerance specifications, the potential effect the nonconformity may have had on previously reported analytical results is evaluated.

5.5.7 Calibration Status

Support equipment is labeled to identify its calibration status.

The calibration status of analytical instruments is identified in the instrument run log, in the data processing software or other systems the laboratory may use for processing of data. Analysts verify on-going acceptability of calibration status prior to use and with instrument performance check standards. These procedures are described in test method SOPs.

5.5.8 Returned Equipment Checks

When equipment or an instrument is sent out for service, the function and calibration status of the equipment must be rechecked and shown to be satisfactory before the equipment is returned to service. This requirement must be included in the laboratory's protocols for servicing equipment.

5.5.9 Intermediate Equipment Checks

PAS performs intermediate checks on equipment to verify the on-going calibration status. For example, most test methods require some form of continuing calibration verification check, and these procedures are included in the test method SOP. Periodic checks of support equipment are also performed; see SOP ENV-SOP-WES2-0036 *Balance Calibration Verification*, ENV-SOP-WES2-0039 *Thermometer Calibration*, ENV-SOP-WES2-0039 Autopipet and *Wet Chem Titrator Calibration Verification* for more information.

5.5.10 Safeguarding Equipment Integrity

Equipment integrity in maintained by:

Following manufacturer's specification for instrument use so that settings do not exceed manufacturer's recommendation or stress the performance of the equipment;

Established maintenance programs;

Transparent maintenance records and unrestricted access to maintenance logs;

Validation and approval of software before use;

Audits to confirm instrument settings are consistent with SOPs; and

On-the-job training for safe and proper use of laboratory equipment.

5.6 Measurement Traceability

5.6.1 General

Measurement traceability is best described as the way to ensure measurements take into consideration all uncertainties and are representative of the most accurate measurement captured. Traceability is accomplished with the recording of the lot numbers of materials and equipment used in the testing process and by purchasing materials traceable to the international standards of units (SI), International Bureau of Weights and Measures (BIPM) and/or National Measures Institute NMI).

When traceability to SI units, BIPM, or NMI cannot be achieved, traceability is accomplished with the use of reference standards and equipment obtained from competent suppliers that provide calibration certificates and/or certificates of analysis (COA).

5.6.2 Equipment Correction Factors

Measurements are adjusted by the correction factor when the equipment used for the measurement has a correction factor.

5.6.2.1 Requirements for Calibration Laboratories

PAS does not offer calibration services, therefore, the ISO/IEC 17025 for calibration laboratories do not apply.

5.6.2.2 Requirements for Testing Laboratories

Requirements to verify equipment is calibrated prior to being put into service and to maintain measurement traceability are described in sections 5.5.2 and 5.6, respectively.

5.6.3 Reference Standards and Reference Materials

5.6.3.1 Reference Standards

The laboratory uses measurement reference standards to verify adequacy of working weights and thermometers. The working weights are the weight(s) used for daily balance calibration checks and the working thermometers are used for daily temperature measurements.

Working weights and thermometers are periodically checked to verify on-going adequacy for use between the calibrations performed by an external calibration laboratory using reference standards traceable to SI or a national standard and that are used solely for verification purposes.

For example:

> An acceptable reference standard to verify working thermometers is a NIST Certified thermometer or a NIST Traceable thermometer that is not used for any other purpose other than to check the adequacy of the working thermometer.
>
> An acceptable reference standard for the working weights is a set of Class S weights that is not used for any other purpose than to verify the weights used daily.

The working weights are checked against the reference standard annually and recertified by an ISO accredited calibration body every 5 years. “Annually” means within thirteen (13) months from the date of the last check.

Working thermometers are checked against the reference thermometer prior to placement in service to establish a correction factor (CF) and then re-checked annually (± 13 months from date of last check) or if electronic, every three (3) months (± 100 days from date of last check).

Exceptions to the 3-month recheck for battery operated sensors are allowed when the sensor is embedded in a unit and the manufacturer/vendor has evidence to show that the accuracy of the sensor is not affected by battery life.

Liquid in Glass NIST Certified reference thermometers must be recertified by an ISO/IEC accredited calibration laboratory every 5 years. If the reference thermometer is NIST Traceable or is a digital NIST Certified thermometer, the reference thermometer must be recertified annually by an ISO/IEC 17025 accredited calibration laboratory or service provider that provides traceability to a national standard.

5.6.3.2 Reference Materials

PAS purchases chemical reference materials (also known as stock standards) from vendors that are accredited to ISO 17034 or Guide 34. Purchased reference materials must be received with a Certificate of Analysis (COA) where available. If a reference material cannot be purchased with a COA, it must be verified by analysis and comparison to a certified reference material and/or there must be a demonstration of capability for characterization. COA are reviewed for adequacy and retained by the laboratory for future reference.

All prepared standards, reference materials, and reagents are verified to meet the requirements of the test method through routine analyses of quality control samples.

The laboratory procedure for traceability and use of these materials is provided in SOP ENV-SOP-WES2-0038 *Reagent Solvent and Standard Control.*

This SOP must minimally include each of the following requirements:

Procedures for receipt and tracking of reference and working standards to ensure the record includes material name, name of the material, lot number, receipt date, and manufacturer’s expiration date.

Storage conditions and the requirement that reference standards are stored separately from samples, extracts, and digestates.

Requirements to assure that preparation of intermediate or working solutions are recorded and assigned a unique identification number for tracking. Records of preparation include the lot number of the stock standard(s) used, the type and lot number of the solvent, the formulation, date, new expiration date, and the preparer’s initials. The lot number of working standards is recorded in the analytical record to provide traceability to the standard preparation record. The preparation record provides traceability to the COA, which is traceable to SI or the national measurement standard.

A requirement that the expiration dates of prepared standards may not exceed the expiration date of the parent standard. Standards, reference materials, and reagents are not used after their expiration dates unless it is not possible to procure a new standard and the reliability of the expired material is verified and documented by the location using a procedure approved by corporate quality personnel. Otherwise, the expired material is promptly removed from the work area or clearly labeled as acceptable for qualitative/troubleshooting purposes only.

The second source materials used for verification of instrument calibration are obtained from a different manufacturer or may be a different lot from the same manufacturer, when only one vendor or manufacturer provides the standard.

Procedures to check reference materials for degradation and replacement of material if degradation or evaporation is suspected.

Procedures for labeling. At a minimum, the container must identify the material, the ID of the material and the expiration date. Original containers should also be labeled with date opened.

5.6.3.3 Intermediate Checks

Checks to confirm the acceptability of reference standards and materials is specified in test method SOPs and are appropriate for the purpose for which the standard is used. For example, a second source standard analyzed after an initial calibration may help the analyst identify if degradation of the standards used for calibration has occurred.

5.6.3.4 Transport and Storage

PAS handles, transports and stores reference standards in a manner that protects the integrity of the materials. The integrity of the reference standard is protected by segregation from incompatible materials and/or minimizing exposure to degrading environments or materials. As previously stated, standards and reference materials are stored separately from samples, extracts, and digestates to prevent contamination. All standards are stored according to the manufacturer’s recommended conditions. Temperatures colder than the manufacturer’s recommendation are acceptable if it does not compromise the integrity of the material (e.g., remains in liquid state and does not freeze solid).

Specific requirements are provided in test method SOPs.

5.7 Sampling

Sampling refers to both the field collection of samples and to subsamples taken by the laboratory for analysis.

Subsampling procedures are included in each test method SOP or a stand-alone SOP to assure the aliquot used for testing is representative of the field collected sample.

The requirements in the following subsections apply when sampling is performed by PAS.

5.7.1 Sampling Plans and SOPs

When PAS performs field collection of samples, the sampling is conducted in accordance with a project sampling plan and sampling SOPs to ensure representative samples are collected.

5.7.2 Customer Requested Deviations

When the customer requests deviations, additions, or exclusions from the project sampling plan and/or the SOP, the laboratory records the client's change request in detail with the sampling record, communicates the change to sampling personnel, and includes this information in the final test report.

5.7.3 Recordkeeping

PAS assures the sampling record includes the sampling procedure used, any deviations from the procedure, the date and time of sampling, the identification of the sampler, environmental conditions (if relevant), and the sampling location.

5.8 Sample Management & Handling

5.8.1 Procedures

The procedures for sample management and handling are outlined in SOP ENV-SOP-WES2-0003 *Sample Receipt and Login* and SOP ENV-SOP-WES2-0002 *Sample Custody and Tracking*. The procedures in the local SOP must meet the requirements specified in this quality manual to guarantee the integrity of the sample from receipt to disposal.

5.8.1.1 Chain of Custody

All samples received by PAS must be accompanied with a Chain of Custody (COC). The COC is the legal record that documents the collection of samples and the transfer of samples to the laboratory. The COC provides PAS with information about the samples collected and tests requested.

The COC is completed by the sample collector and must minimally include the following information:

Client name, address, phone number;

Project Reference;

Client Sample Identification (Client ID);

Date, Time, and Location of Sampling;

Sampler's Name or Initials;

Matrix;

Type of container, and total number collected;

Preservative;

Analyses Requested;

Mode of collection;

Any special instructions; and

The date and time and signature of sample transfer from collection to PAS. When samples are shipped to the laboratory by a 3rd party such as UPS or Fed EX, the COC is placed inside the sealed shipping container at time of collection and the container is not opened until it is received by PAS. Thus, the intermediate courier does not sign the COC. The shipping manifest and/or air bill is the record of possession of samples during transport to the laboratory. The shipping manifest and/or air bill is part of the COC record and must be retained and provided in the test report with the COC record, when required. (See Section 5.10.3).

A complete and legible COC is required. When the COC is incomplete, illegible, or cannot be understood, the client is contacted for resolution.

Hand entries on the COC must be made in indelible ink and errors corrected by drawing a single line through the original entry, so the original entry is not obscured and entering the correct information with the date the change was made and the initials of the person making the change.

5.8.1.2 Legal Chain of Custody

Legal chain of custody (Legal COC) is an industry defined protocol that is sometimes used for evidentiary or legal purposes that establishes an intact, continuous record of the physical possession, storage, and disposal of samples, including sample aliquots and prepared samples.

The legal COC record accounts for all time periods associated with the samples and identifies all individuals who physically handled them from the point established by legal authority, which is usually at the time the sample containers are provided for sample collection or at the time of sample collection.

A sample is in someone's legal custody if:

It is in one's physical possession;

It is in one's view after being in one's physical possession;

It has been in one's physical possession and then locked or sealed so that no one can tamper with it; and/or

It is kept in a secure area, restricted to authorized personnel only.

Legal COC is not a common request, but if it is requested and the laboratory agrees to the project specification; the laboratory must maintain a procedure or process to guarantee all aspects of the protocol are met.

5.8.2 Unique Identification

Each sample received by PAS is assigned a unique identification number (Lab ID) after the sample has been accepted by PAS in accordance with the PAS sample acceptance policy (See 5.8.3). The Lab ID is affixed to the sample container using a durable label.

The lab ID is linked to the field ID (client ID) in the sample receipt and log-in record so that both IDs are traceable to testing activities performed.

5.8.3 Sample Receipt Checks and Sample Acceptance Policy

The condition and integrity of samples is checked on receipt and the samples received are verified to match the COC. Any problem with the samples or discrepancy between the COC is recorded. If the problem impacts the suitability of the sample for analysis or if the CoC is incomplete, the client is notified for resolution and decisions and instructions from the client regarding the samples are maintained in the project record.

5.8.3.1 Sample Receipt Checks

The following checks are performed:

The COC is complete and legible;

Sample container labels include the client sample ID, the date and time of collection, and the preservative used;

The container type and preservative are appropriate for the test requested;

The required volume is received for each test requested;

There is no evidence of damage or tampering;

There is no headspace in VOA vials greater than 5-6 mm (the size of a pea);

Thermal Preservation, when required. When thermal preservation is required, temperature on receipt is typically considered acceptable if the temperature is within 0-6°C and the samples are not frozen solid unless otherwise specified by federal, statutory, program or test method. If samples are received on the same day of collection, there must be evidence that the chilling process has begun, such as arrival of the samples on ice.

Chemical Preservation, as required.

Holding Time. When the holding time for the test method is longer than 15 minutes from time of collection and samples are received out of hold, the client is notified of the situation so they can make a decision to proceed or cancel analysis. Tests with a holding time of 15 minutes or less from time of collection are those where the method specifies the holding time as “immediate” are excluded from the notification requirement because the customer is aware that the holding time cannot be met unless the test is performed in the field (in situ).

5.8.3.2 Sample Acceptance Policy

PAS maintains a sample acceptance policy to clearly establish the circumstances in which samples are accepted.

When these conditions are not met, the exception must be documented, and the client notified. Decisions to accept or reject the samples are documented and when required, test results are qualified in the test report.

Criteria for Sample Acceptance:

All samples received must be listed on the COC and information provided must include the client ID of the sample, date and time of collection, collector's name, preservation type and type of sample;

The sample containers must be properly labeled to uniquely identify the sample; and the label must be both durable and legible;

The sample container must be appropriate for the tests requested;

Samples must be received within holding time. Exceptions are made for samples where the test method specifies a holding time of "immediate or immediately" – which is translated to within 15 minutes from sample collection. For these test methods, samples are always received out of hold and/or there is no expectation that the laboratory perform the test within the 15-minute holding time.

Sufficient sample volume must be provided to perform the test method per the laboratory's SOP. If the test is performed for regulatory compliance and the method requested is mandated; the volume provided must be adequate for the laboratory to perform the test per the test method without modification.

Be received within appropriate temperature ranges unless program requirements or customer contractual obligations mandate otherwise.

Be free of evidence of tampering or signs of contamination; and

Meet applicable requirements for thermal and chemical preservation.

Additional conditions may also apply depending on the services offered. For example, some PAS locations will not accept samples known to be radioactive.

5.8.4 Sample Control and Tracking

Samples received by PAS are tracked using the laboratory's Laboratory Information Management System (LIMS).

After the sample receipt process is complete, samples are logged into the LIMS and a Lab ID is assigned and affixed to each container with a durable label. The Lab ID is used to track the samples through the testing process through test report generation and sample disposal.

Minimally, the following information is included in the log-in for each sample:

Client Name and Contact Information;

The laboratory ID linked to the client ID;

Date and time of sample collection;

Date and time of sample receipt;

Matrix; and

Tests Requested.

After log-in is complete, the log-in record must be independently reviewed by the PAS Project Manager (PM) responsible for the work order to verify the log-in is complete and correct per the testing agreement with the customer and the chain-of-custody so that any log-in errors or questions about the samples received are corrected and resolved before work begins.

Documentation of the log-in record, called a Sample Acknowledgement Form (SRF) is provided to customers per their request. The SRF provides information necessary for the customer to verify that there are no errors with the information provided to PAS with the sample shipment.

As previously stated in this manual, the customer must be notified of any problems or discrepancies between the information expected and information received and/or nonconformances observed during the sample receipt and log-in process. Authorization to proceed with testing and/or instructions to correct the problem must be retained for historical recordkeeping purposes. How the notification requirement is achieved must be included in a laboratory SOP.

5.8.5 Sample Storage, Handling, and Disposal

5.8.5.1 Sample Storage

The samples are stored according to the specification in the test method and any appliable program and regulatory requirements. Samples are stored separately from standards, reagents, or other potential sources of contamination and in a manner that prevents cross contamination. All sample fractions, extracts, leachates, and other sample preparation products are stored in the same manner as actual samples or as specified by the analytical method.

Refrigerated storage areas are maintained at 4°C ±2 (but not frozen) and freezer storage areas are maintained at <-10°C, unless otherwise required per method or regulatory program. The temperature of each storage area is checked and documented at least once for each day of use. If the temperature falls outside the acceptable limits, corrective actions are taken and documented.

Samples are placed in the storage location immediately after sample receipt and log-in procedures are completed. All sample storage areas have limited access. Samples are removed from storage areas by designated personnel and returned to the storage areas as soon as possible after the required sample quantity has been taken.

5.8.5.2 Sample Retention and Disposal

The procedures used by the location for sample retention and disposal are detailed in SOP ENV-SOP-WES2-0002 *Sample Custody and Tracking* and ENV-SOP-MANS-0077 *Hazardous Waste Management and Sample Disposal*.

In general, PAS retains unused sample volume and prepared samples such as extracts, digestates, distillates and leachates (samples) per Pace® Terms & Conditions.

After analysis, samples may be stored at ambient temperature until time of sample disposal, unless otherwise specified by regulation or agreed upon contract specifications.

After the retention time has expired non-hazardous samples are properly disposed. Hazardous samples are returned to the customer, unless other arrangements for disposal have been made with the laboratory.

5.9 Assuring the Quality of Test Results

5.9.1 Quality Control (QC) Procedures

PAS monitors the validity and reliability of test results using quality control (QC) samples that are prepared and analyzed concurrently with and in the same manner as field samples. QC results are always associated to and reported with the field samples they were prepared and analyzed with.

When the results are not within acceptance criteria correction and corrective action(s) are taken. These actions may include retesting or qualification of test results and/or disclosure of the situation in the test report to alert the data user of the situation.

Other control measures to maintain quality of test results include the use of certified reference materials (see 5.6.3), participation in interlaboratory proficiency testing (see 5.9.1.2), verification that formulae used for reduction of data and calculation of results is accurate (see 5.9.3), on-going monitoring of environmental conditions that could impact test results (see 5.3.2), and evaluation and verification of method selectivity and sensitivity (see 5.4.5).

QC results are also used for trend analysis and to establish acceptance criteria when no method or regulatory criteria exist. (See 5.9.1.1.9).

5.9.1.1 Essential QC

QC protocol is technology and test method specific and is specified in test method SOPs. The SOP includes the type of QC required, frequency for analysis, acceptance criteria, recommended corrective actions, and procedures for reporting test results associated with QC exceptions.

PAS ensures the QC requirements in the SOP conform to the reference method and applicable regulations for which results of the test are used and to any program requirements for the process required by the certification/accreditation program required for testing.

> When a project requires more stringent QC protocol than specified in PAS policy or the test method SOP, the project specification is followed.
>
> When the project requires less stringent QC protocol than PAS policy or the SOP, the project specification may be followed as an authorized departure if the project specification still meet the requirements in the test method and any applicable regulatory and certification/accreditation requirements.

The following sections describe essential QC for chemistry. These QC types may not apply to other technologies and disciplines such as microbiology, radiochemistry, whole effluent toxicity, and/or asbestos. For essential QC for these test offerings, refer to test method SOPs.

5.9.1.1.1 Calibration Verification (Second Source)

A second source standard is a standard from a different vendor or from a different lot than the standards used for initial calibration. A different lot from the same vendor is permissible, when the standard is only available from a single vendor.

It is a positive control used to verify the accuracy of instrument calibration relative to the purity of the standards used for calibration. This check may be referred to in published test methods and quality system standards as the initial calibration verification (ICV) or a quality control sample (QCS). For most test methods, it is analyzed immediately after the calibration and before analysis of any samples. When the ICV is not within acceptance criteria, a problem with the purity or preparation of the standards may be indicated. The source of the problem should be investigated and corrected prior to use of the calibration/instrument for sample analysis.

5.9.1.1.2 Calibration Verification (CCV)

The CCV is used to determine if the analytical response has significantly changed since calibration. The CCV is usually made from the same standards used for initial calibration, but a second source standard may be used.

When the response of the CCV is within criteria, the calibration is considered valid. If not, there may be a problem that requires further investigation and correction. The actions taken are technology and method specific.

It is sometimes acceptable to report test results associated with a CCV that does not meet criteria.

For example, when a CCV exceeds criteria above the limit; high bias is suspected in the measurement system. If the analyte is not detected in the sample; then the high bias has no impact on the validity of the test result. If the analyte is detected in sample, then corrective action to bring the CCV within criteria is expected to eliminate the possibility that the detection is biased.

5.9.1.1.3 Blanks

Blanks are negative controls used to assess for contamination.

The method blank (MB) is a clean matrix similar to the associated samples that is known to be free of analytes of interest. The MB, unless otherwise specified by the test method, is processed with, and carried through all preparation and analytical steps as the associated samples.

The criteria used to assess for contamination depends on the intended use of data. In general, detections in the MB above the RL or ½ the RL indicate contamination. When contamination is indicated, the source is investigated, and corrections are taken to reduce or eliminate it. Analytical results associated with MB that do not meet criteria are qualified in the final test report.

Other types of blanks that serve as negative controls in the process may include:

Trip Blanks (VOA)

Storage Blanks

Equipment Blanks

Field Blanks

Calibration Blanks

Cleanup Blanks

Instrument Blanks

5.9.1.1.4 Laboratory Control Sample (LCS)

The LCS is a positive control used to measure the accuracy. The LCS is a blank matrix spiked with standard solution that includes target analytes or it may be a pre-made certified reference standard. Like the MB, unless otherwise specified in the test method, the LCS is processed with and carried through all preparation and analytical steps as the associated samples.

When the percent recovery (%R) of the LCS is within the established control limit, the test is within control. If not, the cause of the problem is investigated and corrected, and the procedure may be repeated. Analytical results associated with LCS that does not meet criteria are qualified in the final test report.

5.9.1.1.5 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

The MS and MSD are replicates of a client sample that is spiked with known amount of target analyte. When there is not a client-designated matrix spike on any sample in the batch, the MS/MSD may be performed on a randomly selected sample and these MS/MSD are called "batch" MS/MSD.

MS/MSD results provide information about the effects the sample matrix has on recovery and reproducibility of target analytes on site samples. MS/MSD results are not used to control performance of the preparation or analytical batch because the way in which the matrix impacts efficiency and robustness of the test cannot be mitigated or controlled by the laboratory.

The heterogeneity of the sample submatrix influences accuracy and precision. For example, MS/MSD results for a sample that is mostly sand will not be the same for a sediment sample even though both matrices are "soil" and both samples subjected to the same test procedure in the same batch. For this reason, batch MS/MSD results may not be representative of the effect the matrix has on accuracy and precision on test results for all samples in the batch – except when all samples in the batch are from the same collection site and are identical in composition.

5.9.1.1.6 Sample Duplicate (SD)

A sample duplicate is a second replicate of sample taken through the testing process used to measure precision and/or homogeneity of samples collected.

The relative percent difference (RPD) between replicates are evaluated against the established acceptance criteria and if the RPD is not met, associated test results are reported with qualification.

5.9.1.1.7 Surrogates

Surrogates are compounds not normally found in the environment but that have similar physical and chemical properties of target analytes that are added to environmental samples, QC, and calibration standards prior to preparation and analysis. They are used to evaluate extraction efficiency and matrix interference on a sample specific basis.

The percent recovery of surrogates is evaluated against method-specified limits or statistically derived in-house limits. Project-specific limits and/or program-specific limits are used when required. Results with surrogate recovery out of limits in samples are reported with qualification. Samples with surrogate failures can also be re-extracted and/or re-analyzed to confirm that the out-of-control value was caused by the matrix of the sample and not by some other systematic error.

5.9.1.1.8 Internal Standards

Internal Standards are compounds not expected to occur naturally in field samples. They are added to every standard and sample at a known concentration prior to analysis for the purpose of adjusting the response factor used in quantifying target analytes. The location follows specific guidelines for the treatment of internal standard recoveries and further information can be found in the applicable test method SOP.

5.9.1.1.9 QC Acceptance Criteria and Control Limits

QC acceptance criteria are specified in test method SOPs. The criteria in the SOP are based on the requirements in the published test method or regulatory program. When there are no established acceptance criteria, the location develops acceptance criteria in accordance with recognized industry standards.

Some methods and programs require the laboratory to establish control limits for LCS, MS/MSD, and surrogate evaluation using historical data. PAS developed limits are referred to as “in-house” control limits. In-house control limits represent ± 3 Standard Deviations (99% confidence level) from the average recovery of at least 20 data points generated using the same preparation and analytical procedure in a similar matrix.

See SOP ENV-SOP-WES2-0119 *Control Limit Generation* for more information about the procedures used to establish in-house control limits.

5.9.1.2 Proficiency Testing (PT)

PAS participates in interlaboratory proficiency testing (PT) studies to measure our performance of the test method.

PT participation is based on the certification and accreditation requirements held by the laboratory. The PT samples are obtained from accredited proficiency testing providers (PTP) and treated as field samples which means they are incorporated into our normal analytical processes and do not receive extraordinary attention due to their nature.

PAS locations do not share PT samples with other PAS locations, does not communicate with other PAS locations regarding current PT sample results during the duration of the study, and does not attempt to obtain the assigned value of any PT sample from the PT provider.

PT results scored unacceptable are investigated and correction action taken, when necessary.

Refer to corporate policy ENV-POL-CORQ-0002, *PT Policy* for more information.

5.9.2 QC Corrective Action

When the results of QC are not within acceptance criteria or expectations for method performance, correction and corrective action(s) are taken per the specifications in the test method SOP. These actions may include retesting or reporting of data with qualification to alert the end user of the situation.

5.9.3 Data Review

PAS uses a tiered system for data review. The tiered process includes as series of sequential checks to verify data transfer is complete; manual calculations, if performed, are correct, manual integrations are appropriate and documented, calibration and QC requirements are met, appropriate corrective action was taken when required, test results are properly qualified, process and test method SOPs were followed, project specific requirements were met, when applicable, and the test report is complete.

The sequential process includes three tiers referred to as primary review, secondary review, and administrative/completeness review.

Detailed procedures for the data review process are described in SOP ENV-SOP-WES2-0124 *Data Review*. General expectations for the tiered data review process are specified in the following sections:

5.9.3.1 Primary Review

Primary review is performed by the individual that performed the task. All PAS personnel are responsible for the review of their own work to assure it is complete, accurate, documented, and consistent with PAS policy and SOPs.

Checks performed during primary review include but are not limited to:

Verification that data transfer and acquisition is complete;

Manual calculations, if performed, are documented and accurate;

Manual integrations, if performed, are documented, and comply with SOP ENV-SOP-CORQ-006 *Manual Integration;*

Calibration and QC criteria were met, instrument calibration conforms with policy ENV-POL-CORQ-005 *Acceptable Calibration Practices*, and/or proper correction and corrective actions were taken, and data and test results associated with QC and criteria exceptions are properly qualified;

Work is consistent with SOPs and any other relevant instructional document such as SWI, program requirements, or project quality assurance plans (QAPP).

5.9.3.2 Secondary Review

Secondary review is an independent review of the data set performed by a qualified peer or supervisor. Secondary review includes a repeat of the checks performed during primary review in addition to chromatography review to verify the accuracy of quantitative analyte identification.

5.9.3.3 Completeness Review

Completeness review is an administrative review that is performed prior to release of the test report to the customer to verify the final test report is complete and meets project specifications. This review also assures that information necessary for the client's interpretation of results are explained in the case narrative or footnoted in the test report.

5.9.3.4 Data Audits

Test reports are randomly audited by local quality personnel to verify compliance with SOPs and to check for data integrity, technical accuracy, and compliance with the PAS QMS and any applicable federal, statutory, and program requirements. These audits are not part of the tertiary data review process that is performed prior to release of the test report. These audits are performed on test reports that have been previously released to the customer to avoid potential risks to impartiality and other factors that may influence thoroughness of review.

If any problems with the data or test results are found during the data audit, the impact of the nonconforming work is evaluated using the process described in Section 4.9.

Also see Section 4.14 for internal audits.

5.9.4 Calibration Certificates

PAS does not perform calibration activities for its customers and calibration certificates are not offered or issued.

5.9.5 Opinions and Interpretations

PAS provides objective data and information to its customers of sufficient detail for their interpretation and decision making. Objective data and information are based solely on fact and PAS does not attempt to explain the meaning (interpret) or offer a view or judgement (opinion) on usability of data.

PAS personnel are not permitted to provide opinion on how a nonconformance impacts the usability of results or how test results and information should be used, or suggestions or guidance to the customer for improvement..

5.9.6 Subcontractor Reports

When analytical work is subcontracted to an organization external to PAS or its subsidiaries, PAS includes the test report from the subcontractor in its entirety as an amendment to the final test report.

Test results performed by multiple locations within the PAS network (internal subcontracting) may be merged into a single test report so long as the test report issued clearly identifies the location and address of each network location that performed testing, and which tests each PAS location performed. (See 5.10.2)

5.9.7 Electronic Transmission of Results

When test results and/or reports are submitted to the customer through electronic transmission, the procedures established in this manual for confidentiality and protection of data apply.

5.9.8 Format of Test Reports

The test formats offered by PAS are designed to accommodate each type of analytical test method performed and to minimize the possibility of misunderstanding or misuse of analytical results. The format of electronic data deliverables (EDD) follows the specifications for the EDD.

5.9.9 Amendments to Test Reports

Test reports that are revised or amended by the location after date of release of the original final test report to the customer are issued as a new test report that is clearly identified as an amendment or revision and that includes a reference to the originally issued final test report.

The customer is the organization doing business with PAS external to PAS.

Changes made to test results and data before the final test report is issued to the customer are not amendments or revisions and do not need to be tracked or marked as such, these changes are simply corrections to errors found during data review.

The procedure for report amendments and revision are outlined in SOP ENV-SOP-WES2-0120 *Report Generation and Approval.*

5.10 Reporting

5.10.1 General Requirements

PAS offers a wide variety of test report formats to meet project needs of Pace® customers and federal and state regulatory program requirements

The type and level of deliverable, including the electronic data deliverable (EDD) format are established between PAS and the customer during the contracting process. The report specifications include the test report format, protocol for the reporting limit (RL), conventions for the reporting of results less than the limit of quantitation (LOQ), and specification for the use of project or program specific data qualifiers. Information about review of analytical service requests is provided in Section 4.4.

5.10.2 Test Reports: Required Items

Regardless of deliverable or report requested, every test report issued by PAS and its subsidiaries includes each of the following items:

a) A Title;

b) The name and address of the location issuing the test report and for each location where testing was performed if different than address of the location issuing the report. When testing is done at multiple PAS locations, the report must also clearly identify which PAS location performed each test method;

c) Unique identification of the test report and on each page an identification number to link each page to the test report, and clear identification of the end of the report;

d) The name and address of the customer;

e) Identification of test methods used. When testing is done at multiple PAS locations, the report must also clearly identify which PAS location performed each test method;

f) Cross reference between client sample identification number (Sample ID) and the identification number for the sample (Lab ID) to provide unambiguous identification of samples;

g) The date of receipt of samples, condition of samples on receipt, and identification of any instance where receipt of the samples did not meet sample acceptance criteria;

h) Date and times of sample collection, receipt, preparation, and analysis;

i) Test results and units of measurement, and qualification of results associated with QC criteria exceptions, and identification of reported results outside of the calibration range;

j) All chains of custody (COC) including records of internal transfer between locations within PAS;

k) Name, title, signature of the person(s) authorizing release of the test report and date of release;

l) A statement that the results in the test report relate only to the items tested; and

m) Statement that the test report may not be reproduced except in full without written approval from PAS.

5.10.3 Test Reports: Supplemental Items

5.10.3.1 Supplemental Requirements

The following items are included in the test report when required or relevant:

a) Shipping manifests/bill of ladings as applicable when common couriers are utilized for shipment of samples,

b) Explanation of departure from test method SOPs including, what the departure was and why it was necessary.

c) Statistical methods used. (Required for Whole Effluent Toxicity)

d) For solid samples, specification that results are reported on a dry weight or wet weight basis.

e) Signed Affidavit, when required by client or regulatory agency.

f) A statement of compliance/non-compliance with requirements or specifications (client, program, or standard) that includes identification of test results that did not meet acceptance criteria.

g) When requested by the client, statement of estimated measurement uncertainty. In general, for environmental testing, estimated uncertainty of measurement is extrapolated from LCS control limits. Control limits incorporate the expected variation of the data derived from the laboratory's procedure. When the control limits are specified by the test method or regulatory program, the control limits represent the expected variation of the test method and/or matrices for which the test method was designed.

h) If a claim of accreditation/certification is included in the test report, identification of any test methods or analytes for which accreditation/certification is not held by the location if the accrediting body offers accreditation/certification for the test method/analyte. The fields of accreditation/certification vary between agencies, and it cannot be presumed that because accreditation/certification is not held that it is offered or required.

i) Certification Information, including certificate number and issuing body.

For PAS locations accredited to ISO/IEC 17025:2017:

Data included in the test report provided by a customer should be clearly identified.

A statement that the test results apply only to the samples as received.

PAS does not provide opinion or interpretations about usability of data or test results in order to maintain impartiality with the testing services provided.

5.10.3.2 Test Reports: Sampling Information

The following items are included in the test report when samples are collected by PAS or when this information is necessary for the interpretation of test results:

a) Date of Sampling.

b) Unambiguous identification of material samples.

c) Location of sampling including diagrams, sketches, or photographs.

d) Reference to the sampling plan and procedures used.

e) Details of environmental conditions at time of sample that may impact test results.

f) Any standard or other specification for the sampling method or procedure, and deviations, additions to or exclusions from the specification concerned.

6.0 REVISION HISTORY

This Version (Version 3):

SECTION	DESCRIPTION OF CHANGE
Management Approval Page	Created a new cover page for management approval date / time stamps to allow room for signatories. This information was previously on the Title Page.
Header	Updated Copyright
Title Page	Simplified options for laboratory name based on legal entity.
Approval Page	Revised language for clarity, added spot for TNI accredited laboratories to list the AB approved "TNI Technical Manager, however named" – this description is not a job title, it refers to the individual designated by the laboratory and approved by the AB to provide technical oversight for a specific discipline.
All Sections	Updated format where needed.
4.1.5.1.1	Updated deputies for key personnel.
4.4	Added TNI requirement to notify customers when PAS is proposing or has made a deviation to a contract previously approved by both parties.
4.8	Added reference to the PAS Corporate SOP for Client Complaints
4.9.1.3	Added "Temporary" to "Stop Work Order" to clarify that a stop work is temporary and distinct from permanent discontinuation of a testing service, which is called a reduction in capabilities. Updated content to clearly identify the roles authorized to lift the stop work order.
4.13.15	Deleted the reference to an obsolete policy and inserted a reference to the technical guide that replaced the policy.
4.13.2.3	Replaced last paragraph with a reference to another section to eliminate redundancy.
4.14	Rewrote entire section to refine language; no change in requirements made.
4.16	Added reference to PAS Corporate SOP for Data Impact Assessments
5.2.1	Updated definition for competency. Added roles authorized to provide opinion or consult on usability of test results.
5.2.2	Rewrote entire section to refine language; no change in requirements made.
5.4	Rewrote entire section to refine language; no change in requirements made.
5.5	Rewrote entire section to refine language; no change in requirements made.
5.6	Rewrote entire section to refine language; no change in requirements made.
5.8	Rewrote entire section to refine language; no change in requirements made.
5.8.1.1 -1.2	Clarified that a CoC is a legal record for sample collection and "legal COC" is an industry-defined protocol for tracking possession of samples.
5.9	Rewrote section and re-organized content to be more concise.
Glossary	Updated Definition List and Definitions
Section 8.0	Added Suggested Addendum for AIHA and NVLAP

This document supersedes the following documents:

Document Number	Title	Version
ENV-TMP-CORQ-0007	Quality Manual Template	02
ENV-TMP-CORQ-0007	Quality Manual Template	01
ENV-MAN-CORQ-0001	Quality Manual	00

7.0 APPENDICES

7.1 Appendix A: Certification / Accreditation Listing

Disclaimer: The certifications / accreditation lists provided in this Appendix are those that were held by the PAS location on the effective date of this manual. This information is subject to change without notice and must not be considered valid proof of certification or accreditation status. This manual is not updated with each change made. Current certificates are accessible via the eDMS Portal for PAS employees. External parties should contact the location for the most current information.

7.1.1 PAS-WES2 8 Walkup Drive, Westborough, MA

Authority	ID	Authority	ID
Connecticut	PH-0826	North Carolina (DW)	25700
Illinois	200077	North Carolina (NPW/SCM)	666
Indiana	C-MA-03	Ohio - VAP	Based on NH
Kentucky	KY98045	Oregon	MA-1316
Maine	MA00086	Pennsylvania	68-03671
Maryland	348	Rhode Island	LAO00065
Massachusetts	M-MA086	Texas	T104704476-17-14
New Hampshire Primary	2064	Vermont	VT-0935
New Jersey	MA935	Virginia	460195
New York	11148		

7.1.2 PAS-MANS 320 Forbes Blvd. Mansfield, MA

Authority	ID	Authority	ID
Connecticut	PH-0825	New Jersey	MA015
ANAB/DoD	L2474	New York	11627
Illinois	200081	North Carolina	685
Indiana	C-MA-04	Ohio-VAP	Based on NH
Kentucky	KY98046	Oregon	MA-0262
Louisiana	3090	Pennsylvania	68-02089
Maine	MA00030	Rhode Island	LAO00299
Maryland	350	Texas	T104704419
Massachusetts	M-MA030	Vermont	VT-0015
Michigan	9110	Virginia	460194
Minnesota	025-999-495	Washington	C954
New Hampshire Primary	2062		

7.1.3 PAS-MANS 120 Forbes Blvd. Mansfield, MA

Authority	ID	Authority	ID

7.2 Appendix B: Capability Listing

The capabilities listed in this Appendix were held by the location referenced on the effective date of this manual. This information is subject to change without notice. External parties should contact the location for the most current information.

Table Legend:

Air = Air
DW = Drinking Water
NPW = Non-Potable Water
SCM = Solid and Chemical Materials
Waste = Non-Aqueous Phase Liquid (NAPL), Oil
Tissue = Biota and Tissue

7.2.1 PAS-WES2 8 Walkup Drive, Westborough, MA

Parameter	Method	Matrices			
		DW	NPW	SCM	Waste
1,1,1,2-Tetrachloroethane	EPA 524.2	X			
1,1,1,2-Tetrachloroethane	EPA 8260D		X	X	
1,1,1-Trichloroethane	EPA 524.2	X			
1,1,1-Trichloroethane	EPA 624.1		X		
1,1,1-Trichloroethane	EPA 8260D		X	X	
1,1,2,2-Tetrachloroethane	EPA 524.2	X			
1,1,2,2-Tetrachloroethane	EPA 624.1		X		
1,1,2,2-Tetrachloroethane	EPA 8260D		X	X	
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	EPA 624.1		X		
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	EPA 8260D		X	X	
1,1,2-Trichloroethane	EPA 524.2	X			
1,1,2-Trichloroethane	EPA 624.1		X		
1,1,2-Trichloroethane	EPA 8260D		X	X	
1,1'-Biphenyl	EPA 8270E		X	X	
1,1-Dichloroethane	EPA 524.2	X			
1,1-Dichloroethane	EPA 624.1		X		

1,1-Dichloroethane	EPA 8260D		X	X	
1,1-Dichloroethene	EPA 524.2	X			
1,1-Dichloroethene	EPA 624.1		X		
1,1-Dichloroethene	EPA 8260D		X	X	
1,1-Dichloropropene	EPA 524.2	X			
1,1-Dichloropropene	EPA 8260D		X	X	
1,2,3-Trichlorobenzene	EPA 524.2	X			
1,2,3-Trichlorobenzene	EPA 624.1		X		
1,2,3-Trichlorobenzene	EPA 8260D		X	X	
1,2,3-Trichloropropane	EPA 504.1	X			
1,2,3-Trichloropropane	EPA 524.2	X			
1,2,3-Trichloropropane	EPA 8011		X		
1,2,3-Trichloropropane	EPA 8260D		X	X	
1,2,4,5-Tetrachlorobenzene	EPA 8270E		X	X	
1,2,4-Trichlorobenzene	EPA 524.2	X			
1,2,4-Trichlorobenzene	EPA 624.1		X		
1,2,4-Trichlorobenzene	EPA 625.1		X		
1,2,4-Trichlorobenzene	EPA 8260D		X	X	
1,2,4-Trichlorobenzene	EPA 8270E		X	X	
1,2,4-Trimethylbenzene	EPA 524.2	X			
1,2,4-Trimethylbenzene	EPA 8260D		X	X	
1,2-Dibromo-3-Chloropropane (DBCP)	EPA 504.1	X			
1,2-Dibromo-3-Chloropropane (DBCP)	EPA 524.2	X			
1,2-Dibromo-3-Chloropropane (DBCP)	EPA 624.1		X		
1,2-Dibromo-3-Chloropropane (DBCP)	EPA 8011		X		
1,2-Dibromo-3-Chloropropane (DBCP)	EPA 8260D		X	X	
1,2-Dibromoethane (EDB)	EPA 504.1	X			
1,2-Dibromoethane (EDB)	EPA 524.2	X			
1,2-Dibromoethane (EDB)	EPA 8011		X		
1,2-Dibromoethane (EDB)	EPA 8260D		X	X	
1,2-Dichlorobenzene	EPA 524.2	X			
1,2-Dichlorobenzene	EPA 624.1		X		
1,2-Dichlorobenzene	EPA 8260D		X	X	

1,2-Dichlorobenzene	EPA 8270E		X	X	
1,2-Dichloroethane	EPA 524.2	X			
1,2-Dichloroethane	EPA 624.1		X		
1,2-Dichloroethane	EPA 8260D		X	X	
1,2-Dichloropropane	EPA 524.2	X			
1,2-Dichloropropane	EPA 624.1		X		
1,2-Dichloropropane	EPA 8260D		X	X	
1,2-Diphenylhydrazine	EPA 625.1		X		
1,2-Diphenylhydrazine	EPA 8270E		X	X	
1,3,5-Trichlorobenzene	EPA 524.2	X			
1,3,5-Trichlorobenzene	EPA 8260D		X	X	
1,3,5-Trimethylbenzene	EPA 524.2	X			
1,3,5-Trimethylbenzene	EPA 8260D		X	X	
1,3-Dichlorobenzene	EPA 524.2	X			
1,3-Dichlorobenzene	EPA 624.1		X		
1,3-Dichlorobenzene	EPA 8260D		X	X	
1,3-Dichlorobenzene	EPA 8270E		X	X	
1,3-Dichloropropane	EPA 524.2	X			
1,3-Dichloropropane	EPA 624.1		X		
1,3-Dichloropropane	EPA 8260D		X	X	
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270E		X		
1,4-Dichlorobenzene	EPA 524.2	X			
1,4-Dichlorobenzene	EPA 624.1		X		
1,4-Dichlorobenzene	EPA 8260D		X	X	
1,4-Dichlorobenzene	EPA 8270E		X	X	
1,4-Dioxane	EPA 624.1		X		
1,4-Dioxane	EPA 8260D		X	X	
1,4-Dioxane	EPA 8260D-SIM		X		
1,4-Dioxane	EPA 8270E			X	
1-Methylnaphthalene	EPA 8270E		X	X	
1-Methylnaphthalene	EPA 8270E-SIM			X	
2,2-Dichloropropane	EPA 524.2	X			
2,2-Dichloropropane	EPA 8260D		X	X	

2,3,4,6-Tetrachlorophenol	EPA 625.1		X		
2,3,4,6-Tetrachlorophenol	EPA 8270E		X	X	
2,3-Dimethylaniline	EPA 8270E		X		
2,4,5-T	EPA 8151A		X	X	
2,4,5-TP (Silvex)	EPA 8151A		X	X	
2,4,5-Trichlorophenol	EPA 625.1		X		
2,4,5-Trichlorophenol	EPA 8270E		X	X	
2,4,5-Trimethylaniline	EPA 8270E		X		
2,4,6-Trichlorophenol	EPA 625.1		X		
2,4,6-Trichlorophenol	EPA 8270E		X	X	
2,4-D	EPA 8151A		X	X	
2,4-DB	EPA 8151A		X	X	
2,4-Dichlorophenol	EPA 625.1		X		
2,4-Dichlorophenol	EPA 8270E		X	X	
2,4-Dimethylaniline	EPA 8270E		X		
2,4-Dimethylphenol	EPA 625.1		X		
2,4-Dimethylphenol	EPA 8270E		X	X	
2,4-Dinitrophenol	EPA 625.1		X		
2,4-Dinitrophenol	EPA 8270E		X	X	
2,4-Dinitrotoluene (2,4-DNT)	EPA 625.1		X		
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270E		X	X	
2,6-Dinitrotoluene (2,6-DNT)	EPA 625.1		X		
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270E		X	X	
2-Butanone (Methyl ethyl ketone, MEK)	EPA 524.2	X			
2-Butanone (Methyl ethyl ketone, MEK)	EPA 624.1		X		
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260D		X	X	
2-Chloroethyl Vinyl ether	EPA 624.1		X		
2-Chloroethyl Vinyl ether	EPA 8260D		X	X	
2-Chloronaphthalene	EPA 625.1		X		
2-Chloronaphthalene	EPA 8270E		X	X	
2-Chlorophenol	EPA 625.1		X		
2-Chlorophenol	EPA 8270E		X	X	
2-Chlorotoluene	EPA 524.2	X			

2-Chlorotoluene	EPA 8260D		X	X	
2-Ethylaniline	EPA 8270E		X		
2-Hexanone	EPA 524.2	X			
2-Hexanone	EPA 624.1		X		
2-Hexanone	EPA 8260D		X	X	
2-Methyl-4,6-dinitrophenol	EPA 625.1		X		
2-Methyl-4,6-dinitrophenol	EPA 8270E		X	X	
2-Methyl-4,6-dinitrophenol	EPA 8270E-SIM		X	X	
2-Methylnaphthalene	EPA 625.1		X		
2-Methylnaphthalene	EPA 8270E		X	X	
2-Methylnaphthalene	EPA 8270E-SIM		X	X	
2-Methylphenol	EPA 625.1		X		
2-Methylphenol	EPA 8270E		X	X	
2-Naphthylamine	EPA 8270E		X		
2-Nitroaniline	EPA 625.1		X		
2-Nitroaniline	EPA 8270E		X	X	
2-Nitrophenol	EPA 625.1		X		
2-Nitrophenol	EPA 8270E		X	X	
2-Nitropropane	EPA 8260D			X	
3,3'-Dichlorobenzidine	EPA 625.1		X		
3,3'-Dichlorobenzidine	EPA 8270E		X	X	
3,4-Dimethylaniline	EPA 8270E		X		
3-Methylphenol	EPA 625.1		X		
3-Methylphenol	EPA 8270E		X	X	
3-Nitroaniline	EPA 625.1		X		
3-Nitroaniline	EPA 8270E		X	X	
4,4'-DDD	EPA 608.3		X		
4,4'-DDD	EPA 8081B		X	X	
4,4'-DDE	EPA 608.3		X		
4,4'-DDE	EPA 8081B		X	X	
4,4'-DDT	EPA 608.3		X		
4,4'-DDT	EPA 8081B		X	X	
4-Bromophenyl phenyl ether	EPA 625.1		X		

4-Bromophenyl phenyl ether	EPA 8270E		X	X	
4-Chloro-3-methylphenol	EPA 625.1		X		
4-Chloro-3-methylphenol	EPA 8270E		X	X	
4-Chloroaniline	EPA 625.1		X		
4-Chloroaniline	EPA 8270E		X	X	
4-Chloro-o-Toluidine	EPA 8270E		X		
4-Chlorophenyl phenyl ether	EPA 625.1		X		
4-Chlorophenyl phenyl ether	EPA 8270E		X	X	
4-Chlorotoluene	EPA 524.2	X			
4-Chlorotoluene	EPA 8260D		X	X	
4-Methyl-2-pentanone (MIBK)	EPA 524.2	X			
4-Methyl-2-pentanone (MIBK)	EPA 624.1		X		
4-Methyl-2-pentanone (MIBK)	EPA 8260D		X	X	
4-Methylphenol	EPA 625.1		X		
4-Methylphenol	EPA 8270E		X	X	
4-Nitroaniline	EPA 625.1		X		
4-Nitroaniline	EPA 8270E		X	X	
4-Nitrophenol	EPA 625.1		X		
4-Nitrophenol	EPA 8270E		X	X	
Acenaphthene	EPA 625.1		X		
Acenaphthene	EPA 8270E		X	X	
Acenaphthene	EPA 8270E-SIM		X	X	
Acenaphthylene	EPA 625.1		X		
Acenaphthylene	EPA 8270E		X	X	
Acenaphthylene	EPA 8270E-SIM		X		
Acenaphthylene	EPA 8270E-SIM		X		
Acetone	EPA 524.2	X			
Acetone	EPA 624.1		X		
Acetone	EPA 8260D		X	X	
Acetophenone	EPA 625.1		X		
Acetophenone	EPA 8270E		X	X	
Acid Digestion of Waters	EPA 3005A			X	
Acidity	SM 2310B		X		

Acrolein	EPA 624.1		X		
Acrolein	EPA 8260D		X	X	
Acrylonitrile	EPA 624.1		X		
Acrylonitrile	EPA 8260D		X	X	
Alachlor	EPA 8081B		X	X	
Aldrin	EPA 608.3		X		
Aldrin	EPA 8081B		X	X	
Alkalinity	SM 2320B	X	X		
Allyl Chloride	EPA 8260D			X	
Alpha-BHC	EPA 608.3		X		
alpha-BHC	EPA 8081B		X	X	
alpha-Chlordane	EPA 608.3		X		
alpha-Chlordane	EPA 8081B		X	X	
Ammonia	EPA 350.1		X		
Ammonia	SM 4500NH3-B		X		
Ammonia	SM 4500NH3-H		X		
Aniline	EPA 625.1		X		
Aniline	EPA 8270E		X	X	
Anthracene	EPA 625.1		X		
Anthracene	EPA 8270E		X	X	
Anthracene	EPA 8270E-SIM		X	X	
Atrazine	EPA 625.1		X		
Atrazine	EPA 8270E		X	X	
Azobenzene	EPA 625.1		X		
Benzaldehyde	EPA 8270E		X	X	
Benzene	EPA 524.2	X			
Benzene	EPA 624.1		X		
Benzene	EPA 8260D		X	X	
Benzidine	EPA 625.1		X		
Benzidine	EPA 8270E		X	X	
Benzo(a)anthracene	EPA 625.1		X		
Benzo(a)anthracene	EPA 8270E		X	X	
Benzo(a)anthracene	EPA 8270E-SIM		X	X	

Benzo(a)pyrene	EPA 625.1		X		
Benzo(a)pyrene	EPA 8270E		X	X	
Benzo(a)pyrene	EPA 8270E-SIM		X	X	
Benzo(b)fluoranthene	EPA 625.1		X		
Benzo(b)fluoranthene	EPA 8270E		X	X	
Benzo(b)fluoranthene	EPA 8270E-SIM		X	X	
Benzo(g,h,i)perylene	EPA 625.1		X		
Benzo(g,h,i)perylene	EPA 8270E		X	X	
Benzo(g,h,i)perylene	EPA 8270E-SIM		X	X	
Benzo(k)fluoranthene	EPA 625.1		X		
Benzo(k)fluoranthene	EPA 8270E		X	X	
Benzo(k)fluoranthene	EPA 8270E-SIM		X	X	
Benzoic acid	EPA 625.1		X		
Benzoic acid	EPA 8270E		X	X	
Benzyl alcohol	EPA 625.1		X		
Benzyl alcohol	EPA 8270E		X	X	
Beta-BHC	EPA 608.3		X		
beta-BHC	EPA 8081B		X	X	
Biochemical Oxygen Demand	SM 5210B		X		
Biochemical Oxygen Demand - Carbonaceous	SM 5210B		X		
bis(2-Chloroethoxy)methane	EPA 625.1		X		
bis(2-Chloroethoxy)methane	EPA 8270E		X	X	
bis(2-Chloroethyl)ether	EPA 625.1		X		
bis(2-Chloroethyl)ether	EPA 8270E		X	X	
bis(2-Chloroethyl)ether	EPA 8270E-SIM		X		
bis(2-Chloroisopropyl)ether	EPA 625.1		X		
bis(2-Chloroisopropyl)ether	EPA 8270E		X	X	
bis(2-Ethylhexyl)phthalate	EPA 625.1		X		
bis(2-Ethylhexyl)phthalate	EPA 8270E		X	X	
Bromide	EPA 300.0		X		
Bromobenzene	EPA 524.2	X			
Bromobenzene	EPA 8260D		X	X	
Bromochloromethane	EPA 524.2	X			

Bromochloromethane	EPA 8260D		X	X	
Bromodichloromethane	EPA 524.2	X			
Bromodichloromethane	EPA 624.1		X		
Bromodichloromethane	EPA 8260D		X	X	
Bromoform	EPA 524.2	X			
Bromoform	EPA 624.1		X		
Bromoform	EPA 8260D		X	X	
Bromomethane	EPA 524.2	X			
Bromomethane	EPA 624.1		X		
Bromomethane	EPA 8260D		X	X	
Butylbenzyl phthalate	EPA 625.1		X		
Butylbenzyl phthalate	EPA 8270E		X	X	
Caprolactam	EPA 8270E		X	X	
Carbazole	EPA 625.1		X		
Carbazole	EPA 8270E		X	X	
Carbon Dioxide	SM 4500 CO2-D [1]		X		
Carbon disulfide	EPA 524.2	X			
Carbon disulfide	EPA 624.1		X		
Carbon disulfide	EPA 8260D		X	X	
Carbon Tetrachloride	EPA 524.2	X			
Carbon Tetrachloride	EPA 624.1		X		
Carbon Tetrachloride	EPA 8260D		X	X	
Chemical Oxygen Demand	EPA 410.4		X		
Chemical Oxygen Demand	SM 5220D		X		
Chemical Oxygen Demand, Flocculated	SM 5220D(m) [1]		X		
Chlordane	EPA 608.3		X		
Chlordane	EPA 8081B		X	X	
Chloride	EPA 300.0	X			
Chloride	EPA 300.0		X		
Chloride	EPA 9056A		X		
Chloride	EPA 9251		X	X	
Chloride	SM 4500CL-E		X		
Chlorine Demand	SM 2350B [1]	X	X		

Chlorobenzene	EPA 524.2	X			
Chlorobenzene	EPA 624.1		X		
Chlorobenzene	EPA 8260D		X	X	
Chlorodifluoromethane	EPA 8260D			X	
Chloroethane (Ethyl chloride)	EPA 524.2	X			
Chloroethane (Ethyl chloride)	EPA 624.1		X		
Chloroethane (Ethyl chloride)	EPA 8260D		X	X	
Chloroform	EPA 524.2	X			
Chloroform	EPA 624.1		X		
Chloroform	EPA 8260D		X	X	
Chloromethane	EPA 524.2	X			
Chloromethane	EPA 624.1		X		
Chloromethane	EPA 8260D		X	X	
Chlorophyll A	SM 10200H [1]	X	X		
Chlorophyll A	EPA 446.0(m) [1]	X	X		
Chromium VI	EPA 7196A		X	X	
Chromium VI	SM 3500Cr-B		X		
Chromium VI Digestion	EPA 3060A		X	X	
Chrysene	EPA 625.1		X		
Chrysene	EPA 8270E		X	X	
Chrysene	EPA 8270E-SIM		X	X	
cis-1,2-Dichloroethene	EPA 524.2	X			
cis-1,2-Dichloroethene	EPA 624.1		X		
cis-1,2-Dichloroethene	EPA 8260D		X	X	
cis-1,3-Dichloropropene	EPA 524.2	X			
cis-1,3-Dichloropropene	EPA 624.1		X		
cis-1,3-Dichloropropene	EPA 8260D		X	X	
Coliform, Fecal (Enumeration QuantiTray)	SM 9223B		X		
Coliform, Total (Colilert P/A)	SM 9223B	X			
Coliform, Total (Enumeration QuantiTray)	SM 9223B	X			
Color	SM 2120B	X	X		
Cyanide, Amenable	EPA 9012B		X	X	
Cyanide, Free	EPA 9016 [1]		X	X	

Cyanide, Free	SM 4500 CN-E (m) [1]		X	X	
Cyanide, Reactive	SW-846 Ch 7.3 [1]		X	X	
Cyanide, Total	EPA 9010C		X	X	
Cyanide, Total	EPA 9012B		X	X	
Cyanide, Total	EPA 9014		X	X	
Cyanide, Total	Lachat 10-204-00-1-A		X		
Cyanide, Total	SM 4500CN-CE	X	X		
Cyclohexane	EPA 8260D		X	X	
Cyclohexanone	EPA 8260D		X	X	
Dalapon	EPA 8151A		X	X	
Delta-BHC	EPA 608.3		X		
delta-BHC	EPA 8081B		X	X	
Density	ASTM D1475 [1]		X	X	X
Dibenzo(a,h)anthracene	EPA 625.1		X		
Dibenzo(a,h)anthracene	EPA 8270E		X	X	
Dibenzo(a,h)anthracene	EPA 8270E-SIM		X	X	
Dibenzofuran	EPA 625.1		X		
Dibenzofuran	EPA 8270E		X	X	
Dibromochloromethane	EPA 524.2	X			
Dibromochloromethane	EPA 624.1		X		
Dibromochloromethane	EPA 8260D		X	X	
Dibromomethane	EPA 524.2	X			
Dibromomethane	EPA 624.1		X		
Dibromomethane	EPA 8260D		X	X	
Dicamba	EPA 8151A		X	X	
Dichlorodifluoromethane (Freon-12)	EPA 524.2	X			
Dichlorodifluoromethane (Freon-12)	EPA 624.1		X		
Dichlorodifluoromethane (Freon-12)	EPA 8260D		X	X	
Dichloroprop	EPA 8151A		X	X	
Dieldrin	EPA 608.3		X		
Dieldrin	EPA 8081B		X	X	
Diesel Range Organics	EPA 8015D		X	X	
Diethyl ether	EPA 524.2	X			

Diethyl ether	EPA 8260D		X	X	
Diethyl phthalate	EPA 625.1		X		
Diethyl phthalate	EPA 8270E		X	X	
Di-isopropylether (DIPE)	EPA 524.2	X			
Di-isopropylether (DIPE)	EPA 8260D		X	X	
Dimethyl phthalate	EPA 625.1		X		
Dimethyl phthalate	EPA 8270E		X	X	
Di-n-butyl phthalate	EPA 625.1		X		
Di-n-butyl phthalate	EPA 8270E		X	X	
Di-n-octyl phthalate	EPA 625.1		X		
Di-n-octyl phthalate	EPA 8270E		X	X	
Dinoseb	EPA 8151A		X		
Diphenylamine	EPA 8270E		X	X	
Dissolved Organic Carbon (DOC)	SM 5310C	X			
Dissolved Oxygen	SM 4500O-C		X		
E. Coli (Colilert P/A)	SM 9223B	X			
E. Coli (Enumeration QuantiTray)	SM 9223B	X			
E. Coli (Enumeration QuantiTray)	SM 9223B		X		
Endosulfan I	EPA 608.3		X		
Endosulfan I	EPA 8081B		X	X	
Endosulfan II	EPA 608.3		X		
Endosulfan II	EPA 8081B		X	X	
Endosulfan Sulfate	EPA 608.3		X		
Endosulfan Sulfate	EPA 8081B		X	X	
Endrin	EPA 608.3		X		
Endrin	EPA 8081B		X	X	
Endrin Aldehyde	EPA 608.3		X		
Endrin Aldehyde	EPA 8081B		X	X	
Endrin Ketone	EPA 608.3		X		
Endrin Ketone	EPA 8081B		X	X	
EPH	MA EPH v. 2.1		X	X	
Ethanol	EPA 624.1		X		
Ethanol	EPA 8260D		X	X	

Ethyl Acetate	EPA 8260D		X	X	
Ethyl Methacrylate	EPA 8260D		X	X	
Ethylbenzene	EPA 524.2	X			
Ethylbenzene	EPA 624.1		X		
Ethylbenzene	EPA 8260D		X	X	
Ethyl-Tert-Butyl-Ether	EPA 524.2	X			
Ethyl-Tert-Butyl-Ether	EPA 8260D		X	X	
ETPH	CT ETPH		X	X	X
Ferrous Iron	SM 3500Fe-B		X		
Flashpoint	EPA 1010A		X	X	
Florisil Cleanup	EPA 3620C			X	
Fluoranthene	EPA 625.1		X		
Fluoranthene	EPA 8270E		X	X	
Fluoranthene	EPA 8270E-SIM		X	X	
Fluorene	EPA 625.1		X		
Fluorene	EPA 8270E		X	X	
Fluorene	EPA 8270E-SIM		X	X	
Fluoride	EPA 300.0	X	X		
Fluoride	EPA 9056A		X		
Fluoride	SM 4500F-C	X	X		
Fluoride Preliminary Distillation	SM 4500F-B		X		
Formaldehyde	EPA 8315A		X		
gamma-Chlordane	EPA 608.3		X		
gamma-Chlordane	EPA 8081B		X	X	
Gasoline Range Organics	EPA 8015D		X	X	
Heptachlor	EPA 608.3		X		
Heptachlor	EPA 8081B		X	X	
Heptachlor Epoxide	EPA 608.3		X		
Heptachlor Epoxide	EPA 8081B		X	X	
Heterotrophic Plate Count	SM 9215B	X	X		
Hexachlorobenzene	EPA 625.1		X		
Hexachlorobenzene	EPA 8270E		X	X	
Hexachlorobenzene	EPA 8270E-SIM		X	X	

Hexachlorobutadiene	EPA 524.2	X			
Hexachlorobutadiene	EPA 625.1		X		
Hexachlorobutadiene	EPA 8260D		X	X	
Hexachlorobutadiene	EPA 8270E		X	X	
Hexachlorobutadiene	EPA 8270E-SIM		X	X	
Hexachlorocyclopentadiene	EPA 625.1		X		
Hexachlorocyclopentadiene	EPA 8270E		X	X	
Hexachloroethane	EPA 625.1		X		
Hexachloroethane	EPA 8260D			X	
Hexachloroethane	EPA 8270E		X	X	
Ignitability	EPA 1030			X	
Indeno(1,2,3-cd)pyrene	EPA 625.1		X		
Indeno(1,2,3-cd)pyrene	EPA 8270E		X	X	
Indeno(1,2,3-cd)pyrene	EPA 8270E-SIM		X	X	
Iodomethane (Methyl Iodide)	EPA 8260D		X	X	
Isophorone	EPA 625.1		X		
Isophorone	EPA 8270E		X	X	
Isopropyl Alcohol	EPA 8260D		X		
Isopropylbenzene	EPA 524.2	X			
Isopropylbenzene	EPA 624.1		X		
Isopropylbenzene	EPA 8260D		X	X	
Langelier Index Calculation	SM 2330B [1]	X	X		
Limestone Equivalent	1.1.04 B			X	
Lindane (gamma-BHC)	EPA 608.3		X		
Lindane (gamma-BHC)	EPA 8081B		X	X	
m+p-Xylene	EPA 624.1	X			
m+p-Xylene	EPA 524.2	X			
MCPA	EPA 8151A		X	X	
MCPP	EPA 8151A		X	X	
Methoxychlor	EPA 608.3		X		
Methoxychlor	EPA 8081B		X	X	
Methyl Acetate	EPA 8260D		X	X	
Methyl Cyclohexane	EPA 624.1		X		

Methyl Cyclohexane	EPA 8260D		X	X	
Methyl Methacrylate	EPA 8260D		X	X	
Methyl tert-butyl ether (MTBE)	EPA 524.2	X			
Methyl tert-butyl ether (MTBE)	EPA 624.1		X		
Methyl tert-butyl ether (MTBE)	EPA 8260D		X	X	
Methylene Chloride	EPA 524.2	X			
Methylene Chloride	EPA 624.1		X		
Methylene Chloride	EPA 8260D		X	X	
Microwave Acid Digestion	EPA 3015A			X	
Microwave Extraction	EPA 3546			X	
Mirex	EPA 608.3		X		
M-Xylene	EPA 8260D		X	X	
Naphthalene	EPA 524.2	X			
Naphthalene	EPA 625.1		X		
Naphthalene	EPA 8260D		X	X	
Naphthalene	EPA 8270E		X	X	
Naphthalene	EPA 8270E-SIM		X	X	
n-Butyl Alcohol	EPA 8260D		X	X	
n-Butylbenzene	EPA 524.2	X			
n-Butylbenzene	EPA 8260D		X	X	
n-Decane	EPA 625.1		X		
n-Hexane	EPA 624.1		X		
n-Hexane	EPA 8260D		X	X	
Nitrate-N	EPA 300.0	X	X		
Nitrate-N	EPA 353.2	X	X		
Nitrate-N	EPA 9056A		X		
Nitrate-N	SM 4500NO3-F	X	X		
Nitrate-Nitrite	EPA 353.2		X		
Nitrate-Nitrite	SM 4500NO3-F	X	X		
Nitrite-N	EPA 353.2	X	X		
Nitrite-N	SM 4500NO2-B		X		
Nitrite-N	SM 4500NO3-F	X	X		
Nitrobenzene	EPA 625.1		X		

Nitrobenzene	EPA 8260D			X	
Nitrobenzene	EPA 8270E		X	X	
Nitrogen, Total Kjeldahl	EPA 351.1		X		
Nitrogen, Total Kjeldahl	Lachat 10-107-06-2-D		X		
Nitrogen, Total Kjeldahl	SM 4500NH3-H		X		
Nitrogen, Total Kjeldahl (Distillation)	SM 4500Norg-C		X		
N-Nitrosodiethylamine	EPA 625.1		X		
n-Nitrosodimethylamine	EPA 625.1		X		
n-Nitrosodimethylamine	EPA 8270E		X	X	
n-Nitroso-di-n-propylamine	EPA 625.1		X		
n-Nitroso-di-n-propylamine	EPA 8270E		X	X	
N-Nitrosodiphenylamine	EPA 625.1		X		
N-Nitrosodiphenylamine	EPA 8270E		X	X	
N-Nitrosopyrrolidine	EPA 625.1		X		
N-Octadecane	EPA 625.1		X		
n-Propylbenzene	EPA 524.2	X			
n-Propylbenzene	EPA 8260D		X	X	
Odor	SM 2150B	X			
Oil & Grease	EPA 1664B		X		
Oil & Grease	EPA 9071B			X	
Oil & Grease (TPH)	EPA 1664B		X		
Oil Range Organics	EPA 8015D		X	X	
Organic Matter, Total	ASTM D2974		X	X	
Orthophosphate	SM 4500P-E	X			
Orthophosphate	SM 4500P-E		X		
Oxygen Reduction Potential	EPA 1498 [1]			X	
o-Toluidine	EPA 8270E		X		
O-Xylene	EPA 524.2	X			
O-Xylene	EPA 8260D		X	X	
Paint Filter (Free Liquid)	EPA 9095B			X	
Parathion	EPA 8270E		X	X	
PCB-1016	EPA 608.3		X		
PCB-1016	EPA 8082A		X	X	X

PCB-1221	EPA 608.3		X		
PCB-1221	EPA 8082A		X	X	X
PCB-1232	EPA 608.3		X		
PCB-1232	EPA 8082A		X	X	X
PCB-1242	EPA 608.3		X		
PCB-1242	EPA 8082A		X	X	X
PCB-1248	EPA 608.3		X		
PCB-1248	EPA 8082A		X	X	X
PCB-1254	EPA 608.3		X		
PCB-1254	EPA 8082A		X	X	X
PCB-1260	EPA 608.3		X		
PCB-1260	EPA 8082A		X	X	X
PCB-1262	EPA 8082A		X	X	X
PCB-1268	EPA 8082A		X	X	X
Pentachloroethane	EPA 8260D		X		
Pentachloronitrobenzene	EPA 8270E		X	X	
Pentachlorophenol	EPA 625.1		X		
Pentachlorophenol	EPA 8270E		X	X	
Pentachlorophenol	EPA 8270E-SIM		X	X	
pH	EPA 9040C		X	X	
pH	EPA 9045D			X	
pH	SM 4500H+-B	X	X		
Phenanthrene	EPA 625.1		X		
Phenanthrene	EPA 8270E		X	X	
Phenanthrene	EPA 8270E-SIM		X	X	
Phenol	EPA 625.1		X		
Phenol	EPA 8270E		X	X	
p-Isopropyltoluene	EPA 524.2	X			
p-Isopropyltoluene	EPA 8260D		X	X	
Purge & Trap Aqueous	EPA 5030C		X	X	
Purge & Trap Soil Low/High	EPA 5035A			X	
P-Xylene	EPA 8260D		X	X	
Pyrene	EPA 625.1		X		

Pyrene	EPA 8270E		X	X	
Pyrene	EPA 8270E-SIM		X	X	
Pyridine	EPA 625.1		X		
Pyridine	EPA 8270E		X	X	
Salinity	SM 2520B		X		
sec-Butylbenzene	EPA 524.2	X			
Sec-Butylbenzene	EPA 8260D		X	X	
Separatory Funnel Extraction	EPA 3510C		X		
Settleable Solids	SM 2540F		X		
Shake Extraction of Solid Waste With Water	ASTM D3987-12			X	
Silica Gel Cleanup	EPA 3630C		X	X	
Soxhlet Extraction	EPA 3540C			X	
Specific Conductance	EPA 120.1		X		
Specific Conductance	EPA 9050A		X	X	
Specific Conductance	SM 2510B	X	X		
SPLP	EPA 1312			X	
Styrene	EPA 524.2	X			
Styrene	EPA 624.1		X		
Styrene	EPA 8260D		X	X	
Sulfate	EPA 300.0	X	X		
Sulfate	EPA 9038		X	X	
Sulfate	EPA 9056A		X		
Sulfate	SM 4500SO4-E		X		
Sulfide	SM 4500S2-D		X		
Sulfide, Reactive	SW-846 Ch 7.3 [1]		X	X	
Sulfide Distillation	EPA 9030B		X		
Sulfite	SM 4500SO3-B		X		
Sulfur Cleanup	EPA 3660B			X	
Sulfuric Acid Cleanup	EPA 3665A		X	X	
Surfactants (MBAS)	SM 5540C		X		
Tannin & Lignin	SM 5550B		X		
TCLP	EPA 1311			X	
tert-Amyl methyl ether (TAME)	EPA 524.2	X			

tert-Amyl methyl ether (TAME)	EPA 624.1		X		
tert-Amyl methyl ether (TAME)	EPA 8260D		X	X	
Tert-Butyl Alcohol	EPA 524.2	X			
Tert-Butyl Alcohol	EPA 624.1		X		
Tert-Butyl Alcohol	EPA 8260D		X	X	
Tert-Butylbenzene	EPA 524.2	X			
Tert-Butylbenzene	EPA 8260D		X	X	
Tetrachloroethene	EPA 524.2	X			
Tetrachloroethene	EPA 624.1		X		
Tetrachloroethene	EPA 8260D		X	X	
Tetrahydrofuran	EPA 524.2	X			
Tetrahydrofuran	EPA 8260D		X	X	
Thionazin	EPA 8270E		X		
Toluene	EPA 524.2	X			
Toluene	EPA 624.1		X		
Toluene	EPA 8260D		X	X	
Total Dissolved Solids	SM 2540C	X			
Total Dissolved Solids	SM 2540C		X		
Total EPH	NJDEP EPH		X	X	
Total Organic Carbon	EPA 9060A		X		
Total Organic Carbon	SM 5310C	X	X		
Total Petroleum Hydrocarbons	EPA 8015D		X		
Total Phenolics	EPA 420.1		X		
Total Phenolics	EPA 9065		X	X	
Total Phosphorus	SM 4500P-E		X		
Total Phosphorus (Digestion)	SM 4500P-B		X		
Total Residue	SM 2540B		X		
Total Residue (% Total Solids)	SM 2540G			X	
Total Suspended Solids	SM 2540D		X		
Total Volatile Solids	SM 2540E		X		
Total Volatile Solids	SM 2540G			X	
Toxaphene	EPA 608.3		X		
Toxaphene	EPA 8081B		X	X	

Trans-1,2-Dichloroethene	EPA 524.2	X			
Trans-1,2-Dichloroethene	EPA 624.1		X		
Trans-1,2-Dichloroethene	EPA 8260D		X	X	
Trans-1,3-Dichloropropene	EPA 524.2	X			
Trans-1,3-Dichloropropene	EPA 624.1		X		
Trans-1,3-Dichloropropene	EPA 8260D		X	X	
Trans-1,4-Dichloro-2-butene	EPA 8260D		X	X	
Trichloroethene	EPA 524.2	X			
Trichloroethene	EPA 624.1		X		
Trichloroethene	EPA 8260D		X	X	
Trichlorofluoromethane	EPA 524.2	X			
Trichlorofluoromethane	EPA 624.1		X		
Trichlorofluoromethane	EPA 8260D		X	X	
Turbidity	EPA 180.1	X			
Turbidity	EPA 180.1		X		
Turbidity	SM 2130B	X	X		
Ultrasonic Extraction	EPA 3550C			X	
Ultraviolet Absorbance	EPA 5910B [1]	X	X		
Vinyl Acetate	EPA 624.1		X		
Vinyl Acetate	EPA 8260D		X	X	
Vinyl chloride	EPA 524.2	X			
Vinyl Chloride	EPA 624.1		X		
Vinyl Chloride	EPA 8260D		X	X	
VPH	MA VPH v. 2.1		X	X	
Waste Dilution	EPA 3580A			X	X
Xylenes, Total	EPA 524.2	X			
Xylenes, Total	EPA 624.1		X		
Xylenes, Total	EPA 8260D		X	X	

[1] = Laboratory does not hold TNI Accreditation for this test method.

7.2.2 PAS-MANS 320 Forbes Blvd. Mansfield, MA

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
1,1,1-Trichloroethane	EPA TO-15	X					
1,1,1-Trichloroethane	EPA TO-15 SIM	X					
1,1,2,2-Tetrachloroethane	EPA TO-15	X					
1,1,2,2-Tetrachloroethane	EPA TO-15 SIM	X					
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	EPA TO-15	X					
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	EPA TO-15 SIM	X					
1,1,2-Trichloroethane	EPA TO-15	X					
1,1,2-Trichloroethane	EPA TO-15 SIM	X					
1,1'-Biphenyl	EPA 8270E			X	X		X
1,1-Dichloroethane	EPA TO-15	X					
1,1-Dichloroethane	EPA TO-15 SIM	X					
1,1-Dichloroethene	EPA TO-15	X					
1,1-Dichloroethene	EPA TO-15 SIM	X					
1,2,3,5-Tetrachlorobenzene	EPA 8270E			X			
1,2,4,5-Tetrachlorobenzene	EPA 8270E			X	X		
1,2,4-Trichlorobenzene	EPA 8270E			X	X		
1,2,4-Trichlorobenzene	EPA TO-15	X					
1,2,4-Trichlorobenzene	EPA TO-15 SIM	X					
1,2,4-Trimethylbenzene	EPA TO-15	X					
1,2,4-Trimethylbenzene	EPA TO-15 SIM	X					
1,2-Dibromo-3-Chloropropane (DBCP)	EPA TO-15	X					
1,2-Dibromo-3-Chloropropane (DBCP)	EPA TO-15 SIM	X					
1,2-Dibromoethane (EDB)	EPA TO-15	X					
1,2-Dibromoethane (EDB)	EPA TO-15 SIM	X					
1,2-Dichlorobenzene	EPA 8270E			X	X		
1,2-Dichlorobenzene	EPA TO-15	X					
1,2-Dichlorobenzene	EPA TO-15 SIM	X					
1,2-Dichloroethane	EPA TO-15	X					
1,2-Dichloroethane	EPA TO-15 SIM	X					
1,2-Dichloropropane	EPA TO-15	X					

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
1,2-Dichloropropane	EPA TO-15 SIM	X					
1,2-Dichlorotetrafluoroethane	EPA TO-15	X					
1,2-Dichlorotetrafluoroethane	EPA TO-15 SIM	X					
1,2-Diphenylhydrazine	EPA 8270E			X	X		
1,3,5-Trimethylbenzene	EPA TO-15	X					
1,3,5-Trimethylbenzene	EPA TO-15 SIM	X					
1,3-Butadiene	EPA TO-15	X					
1,3-Butadiene	EPA TO-15 SIM	X					
1,3-Dichlorobenzene	EPA 8270E			X	X		
1,3-Dichlorobenzene	EPA TO-15	X					
1,3-Dichlorobenzene	EPA TO-15 SIM	X					
1,4-Dichlorobenzene	EPA 8270E			X	X		
1,4-Dichlorobenzene	EPA TO-15	X					
1,4-Dichlorobenzene	EPA TO-15 SIM	X					
1,4-Dioxane	EPA 522		X	X			
1,4-Dioxane	EPA 8270E-SIM			X	X		
1,4-Dioxane	EPA TO-15	X					
1,4-Dioxane	EPA TO-15 SIM	X					
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11-Cl-PF3OUdS) 763051-92-9	EPA 1633 DRAFT 2			X	X		X
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11-Cl-PF3OUdS) 763051-92-9	EPA 533		X				
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11-Cl-PF3OUdS) 763051-92-9	EPA 537.1		X				
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11-Cl-PF3OUdS) 763051-92-9	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
1H, 1H, 2H, 2H-Perfluorodecanesulfonic acid (8:2 FTS)	EPA 1633 DRAFT 2			X	X		X
1H, 1H, 2H, 2H-Perfluorohexanesulfonic acid (4:2 FTS)	EPA 1633 DRAFT 2						X
1H, 1H, 2H, 2H-Perfluorooctanesulfonic acid (6:2 FTS)	EPA 1633 DRAFT 2						X
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2FTS)	EPA 533		X				
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2FTS)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2FTS)	EPA 1633 DRAFT 2			X	X		
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2FTS)	EPA 533		X				
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2FTS)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2FTS)	EPA 1633 DRAFT 2			X	X		
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2FTS)	EPA 533		X				

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2FTS)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2FTS)	EPA 1633 DRAFT 2			X	X		
1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2FTS)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
1-Methylnaphthalene	EPA 8270E						X
1-Methylnaphthalene	EPA 8270E-SIM			X	X		
1-Methylnaphthalene	EPA TO-13A SIM	X					
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol (NEtFOSE)	EPA 1633 DRAFT 2			X	X		
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol (NEtFOSE)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol (NMeFOSE)	EPA 1633 DRAFT 2			X	X		
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol (NMeFOSE)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
2,2,4-Trimethylpentane	EPA TO-15	X					
2,2,4-Trimethylpentane	EPA TO-15 SIM	X					
2,3,4,6-Tetrachlorophenol	EPA 8270E			X	X		
2,4,5-Trichlorophenol	EPA 8270E			X	X		
2,4,6-Trichlorophenol	EPA 8270E			X	X		
2,4-Dichlorophenol	EPA 8270E			X	X		
2,4-Dimethylphenol	EPA 8270E			X	X		
2,4-Dinitrophenol	EPA 8270E			X	X		
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270E			X	X		
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270E			X	X		
2-Butanone (Methyl ethyl ketone, MEK)	EPA TO-15	X					
2-Butanone (Methyl ethyl ketone, MEK)	EPA TO-15 SIM	X					
2-Chloronaphthalene	EPA 8270E			X	X		X
2-Chlorophenol	EPA 8270E			X	X		
2-Chlorotoluene	EPA TO-15	X					
2-Chlorotoluene	EPA TO-15 SIM	X					
2H,2H,3H,3H-Perfluorodecanoic acid (7:3 FTCA) 812-70-4	EPA 1633 DRAFT 2						X
2H,2H,3H,3H-Perfluorooctanoic acid (5:3 FTCA) 914637-49-3	EPA 1633 DRAFT 2			X	X		X
2-Hexanone	EPA TO-15	X					
2-Hexanone	EPA TO-15 SIM	X					
2-Methyl-4,6-dinitrophenol	EPA 8270E			X	X		
2-Methylnaphthalene	EPA 8270E			X	X		X

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
2-Methylnaphthalene	EPA 8270E-SIM			X	X		X
2-Methylnaphthalene	EPA TO-13A SIM	X					
2-Methylphenol	EPA 8270E			X	X		
2-Nitroaniline	EPA 8270E			X	X		
2-Nitrophenol	EPA 8270E			X	X		
3,3'-Dichlorobenzidine	EPA 8270E			X	X		
3-Methylphenol	EPA 8270E			X	X		
3-Nitroaniline	EPA 8270E			X	X		
3-Perfluoropropyl propanoic acid 3:3FTCA	EPA 1633 DRAFT 2			X	X		
4,4,5,5,6,6,6-Heptafluorohexanoic acid (3:3 FTCA) 356-02-5	EPA 1633 DRAFT 2						X
4,4'-DDD	EPA 8081B			X	X		X
4,4'-DDE	EPA 8081B			X	X		X
4,4'-DDT	EPA 8081B			X	X		X
4,8-Dioxa-3H-perfluorononanoic acid (ADONA) 919005-14-4	EPA 1633 DRAFT 2			X	X		
4,8-Dioxa-3H-perfluorononanoic acid (ADONA) 919005-14-4	EPA 533		X				
4,8-Dioxa-3H-perfluorononanoic acid (ADONA) 919005-14-4	EPA 537.1		X				
4,8-Dioxa-3H-perfluorononanoic acid (ADONA) 919005-14-4	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
4,8-Dioxa-3H-perfluorononanoic acid (DONA) 919005-14-4	EPA 1633 DRAFT 2						X
4-Bromophenyl phenyl ether	EPA 8270E			X	X		
4-Chloro-3-methylphenol	EPA 8270E			X	X		
4-Chloroaniline	EPA 8270E			X	X		
4-Chlorophenyl phenyl ether	EPA 8270E			X	X		
4-Ethyltoluene	EPA TO-15	X					
4-Ethyltoluene	EPA TO-15 SIM	X					
4-Methyl-2-pentanone (MIBK)	EPA TO-15	X					
4-Methyl-2-pentanone (MIBK)	EPA TO-15 SIM	X					
4-Methylphenol	EPA 8270E			X	X		
4-Nitroaniline	EPA 8270E			X	X		
4-Nitrophenol	EPA 8270E			X	X		
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9-Cl-PF3ONS) 756426-58-1	EPA 1633 DRAFT 2			X	X		X
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9-Cl-PF3ONS) 756426-58-1	EPA 533		X				
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9-Cl-PF3ONS) 756426-58-1	EPA 537.1		X				

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9-Cl-PF3ONS) 756426-58-1	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Acenaphthene	EPA 8270E			X	X		X
Acenaphthene	EPA 8270E-SIM			X	X		X
Acenaphthene	EPA TO-13A Full Scan	X					
Acenaphthene	EPA TO-13A SIM	X					
Acenaphthylene	EPA 8270E			X	X		X
Acenaphthylene	EPA 8270E-SIM			X	X		X
Acenaphthylene	EPA TO-13A Full Scan	X					
Acenaphthylene	EPA TO-13A SIM	X					
Acetaldehyde	EPA TO-15	X					
Acetaldehyde	EPA TO-15 SIM	X					
Acetone	EPA TO-15	X					
Acetone	EPA TO-15 SIM	X					
Acetonitrile	EPA TO-15	X					
Acetonitrile	EPA TO-15 SIM	X					
Acetophenone	EPA 8270E			X	X		
Acetylene	RSK-175 [1]			X			
Acid Digestion of Waters	EPA 3015A			X			
Acrolein	EPA TO-15	X					
Acrolein	EPA TO-15 SIM	X					
Acrylonitrile	EPA TO-15	X					
Acrylonitrile	EPA TO-15 SIM	X					
Aldrin	EPA 8081B			X	X		X
Alkalinity	SM 2320B			X			
Alkylated PAHs	EPA 8270E-SIM			X	X		
Allyl chloride	EPA TO-15	X					
Allyl chloride	EPA TO-15 SIM	X					
alpha-BHC	EPA 8081B			X	X		X
alpha-Chlordane	EPA 8081B			X	X		X
Alumina Cleanup	EPA 3610B						X
Aluminum	EPA 200.7		X	X			
Aluminum	EPA 200.8		X	X			

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Aluminum	EPA 6010D			X	X		
Aluminum	EPA 6020B			X	X		X
Aniline	EPA 8270E			X	X		
Anthracene	EPA 8270E			X	X		X
Anthracene	EPA 8270E-SIM			X	X		X
Anthracene	EPA TO-13A Full Scan	X					
Anthracene	EPA TO-13A SIM	X					
Antimony	EPA 200.7			X			
Antimony	EPA 200.8		X	X			
Antimony	EPA 6010D			X	X		
Antimony	EPA 6020B			X	X		X
Arsenic	EPA 200.7			X			
Arsenic	EPA 200.8		X	X			
Arsenic	EPA 6010D			X	X		
Arsenic	EPA 6020B			X	X		X
Arsenic	EPA 1632A(m) [1]			X	X		
Ash Solids	ASTM D2974 [1]						X
Atrazine	EPA 8270E			X			
Barium	EPA 200.7		X	X			
Barium	EPA 200.8		X	X			
Barium	EPA 6010D			X	X		
Barium	EPA 6020B			X	X		X
Benzaldehyde	EPA 8270E			X	X		X
Benzene	EPA TO-15	X					
Benzene	EPA TO-15 SIM	X					
Benzidine	EPA 8270E			X	X		
Benzo(a)anthracene	EPA 8270E			X	X		X
Benzo(a)anthracene	EPA 8270E-SIM			X	X		X
Benzo(a)anthracene	EPA TO-13A Full Scan	X					
Benzo(a)anthracene	EPA TO-13A SIM	X					
Benzo(a)pyrene	EPA 8270E			X	X		X
Benzo(a)pyrene	EPA 8270E-SIM			X	X		X

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Benzo(a)pyrene	EPA TO-13A Full Scan	X					
Benzo(a)pyrene	EPA TO-13A SIM	X					
Benzo(b)fluoranthene	EPA 8270E			X	X		X
Benzo(b)fluoranthene	EPA 8270E-SIM			X	X		X
Benzo(b)fluoranthene	EPA TO-13A Full Scan	X					
Benzo(b)fluoranthene	EPA TO-13A SIM	X					
Benzo(e)pyrene	EPA TO-13A Full Scan	X					
Benzo(e)pyrene	EPA TO-13A SIM	**X**					
Benzo(g,h,i)perylene	EPA 8270E			X	X		X
Benzo(g,h,i)perylene	EPA 8270E-SIM			X	X		X
Benzo(g,h,i)perylene	EPA TO-13A Full Scan	X					
Benzo(g,h,i)perylene	EPA TO-13A SIM	X					
Benzo(k)fluoranthene	EPA 8270E			X	X		X
Benzo(k)fluoranthene	EPA 8270E-SIM			X	X		X
Benzo(k)fluoranthene	EPA TO-13A Full Scan	X					
Benzo(k)fluoranthene	EPA TO-13A SIM	X					
Benzoic acid	EPA 8270E			X	X		
Benzyl alcohol	EPA 8270E			X	X		
Benzyl Chloride	EPA TO-15	X					
Benzyl Chloride	EPA TO-15 SIM	X					
Beryllium	EPA 200.7			X			
Beryllium	EPA 200.8		X	X			
Beryllium	EPA 6010D			X	X		
Beryllium	EPA 6020B			X	X		X
beta-BHC	EPA 8081B			X	X		X
bis(2-Chloroethoxy)methane	EPA 8270E			X	X		
bis(2-Chloroethyl)ether	EPA 8270E			X	X		
bis(2-Chloroisopropyl)ether	EPA 8270E			X	X		
bis(2-Ethylhexyl)phthalate	EPA 8270E			X	X		X
Boron	EPA 200.7		X	X			
Boron	EPA 6010D			X	X		
Boron	EPA 6020B			X			

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Bromodichloromethane	EPA TO-15	X					
Bromodichloromethane	EPA TO-15 SIM	X					
Bromoform	EPA TO-15	X					
Bromoform	EPA TO-15 SIM	X					
Bromomethane	EPA TO-15	X					
Bromomethane	EPA TO-15 SIM	X					
Butane	RSK-175 [1]			X			
Butylbenzyl phthalate	EPA 8270E			X	X		X
Cadmium	EPA 200.7		X	X			
Cadmium	EPA 200.8		X	X			
Cadmium	EPA 6010D			X	X		
Cadmium	EPA 6020B			X	X		X
Cadmium	AVS-SEM [1]				X		
Calcium	EPA 200.7		X	X			
Calcium	EPA 6010D			X	X		
Calcium	EPA 6020B			X	X		X
Calcium Hardness	EPA 200.7		X				
Caprolactam	EPA 8270E			X	X		
Carbazole	EPA 8270E			X	X		
Carbon Dioxide	RSK-175 [1]			X			
Carbon disulfide	EPA 3C	X					
Carbon disulfide	EPA TO-15	X					
Carbon disulfide	EPA TO-15 SIM	X					
Carbon Tetrachloride	EPA TO-15	X					
Carbon Tetrachloride	EPA TO-15 SIM	X					
Chlordane	EPA 8081B			X	X		X
Chlorobenzene	EPA TO-15	X					
Chlorobenzene	EPA TO-15 SIM	X					
Chloroethane (Ethyl chloride)	EPA TO-15	X					
Chloroethane (Ethyl chloride)	EPA TO-15 SIM	X					
Chloroform	EPA TO-15	X					
Chloroform	EPA TO-15 SIM	X					

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Chloromethane	EPA TO-15	X					
Chloromethane	EPA TO-15 SIM	X					
Chromium	EPA 200.7		X	X			
Chromium	EPA 200.8		X	X			
Chromium	EPA 6010D			X	X		
Chromium	EPA 6020B			X	X		X
Chromium	AVS-SEM [1]				X		
Chrysene	EPA 8270E			X	X		X
Chrysene	EPA 8270E-SIM			X	X		
Chrysene	EPA TO-13A Full Scan	X					
Chrysene	EPA TO-13A SIM	X					
cis-1,2-Dichloroethene	EPA TO-15	X					
cis-1,2-Dichloroethene	EPA TO-15 SIM	X					
cis-1,3-Dichloropropene	EPA TO-15	X					
cis-1,3-Dichloropropene	EPA TO-15 SIM	X					
Cobalt	EPA 200.7		X	X			
Cobalt	EPA 200.8		X	X			
Cobalt	EPA 6010D			X	X		
Cobalt	EPA 6020B			X	X		X
Copper	EPA 200.7		X	X			
Copper	EPA 200.8		X	X			
Copper	EPA 6010D			X	X		
Copper	EPA 6020B			X	X		X
Copper	AVS-SEM [1]				X		
Cyclohexane	EPA TO-15	X					
Cyclohexane	EPA TO-15 SIM	X					
Delta-BHC	EPA 8081B			X	X		X
Density	SM 2520C [1]					X	X
Density	ASTM D7263 [1]				X		
Dibenzo(a,h)anthracene	EPA 8270E			X	X		X
Dibenzo(a,h)anthracene	EPA 8270E-SIM			X	X		X
Dibenzo(a,h)anthracene	EPA TO-13A Full Scan	X					

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Dibenzo(a,h)anthracene	EPA TO-13A SIM	X					
Dibenzofuran	EPA 8270E			X	X		X
Dibromochloromethane	EPA TO-15	X					
Dibromochloromethane	EPA TO-15 SIM	X					
Dichlorodifluoromethane (Freon-12)	EPA TO-15	X					
Dichlorodifluoromethane (Freon-12)	EPA TO-15 SIM	X					
Dichlorofluoromethane	EPA TO-15	X					
Dichlorofluoromethane	EPA TO-15 SIM	X					
Dieldrin	EPA 8081B			X	X		X
Diesel Range Organics	EPA 8015D			X	X		
Diethyl phthalate	EPA 8270E			X	X		X
Dimethyl phthalate	EPA 8270E			X	X		X
Di-n-butyl phthalate	EPA 8270E			X	X		X
Di-n-octyl phthalate	EPA 8270E			X	X		X
Endosulfan I	EPA 8081B			X	X		X
Endosulfan II	EPA 8081B			X	X		X
Endosulfan Sulfate	EPA 8081B			X	X		X
Endrin	EPA 8081B			X	X		X
Endrin Aldehyde	EPA 8081B			X	X		X
Endrin ketone	EPA 8081B			X	X		X
Ethane	RSK-175 [1]			X			
Ethene	RSK-175 [1]			X			
Ethanol	EPA 8015D			X	X		
Ethanol	EPA 8270E-SIM(m) 1					**6**	
Ethanol	EPA TO-15	X					
Ethanol	EPA TO-15 SIM	X					
Ethyl acetate	EPA TO-15	X					
Ethyl acetate	EPA TO-15 SIM	X					
Ethylbenzene	EPA TO-15	X					
Ethylbenzene	EPA TO-15 SIM	X					
Ethylene Glycol	EPA 8015D			X	X		
Fluoranthene	EPA 8270E			X	X		X

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Fluoranthene	EPA 8270E-SIM			X	X		X
Fluoranthene	EPA TO-13A Full Scan	X					
Fluoranthene	EPA TO-13A SIM	X					
Fluorene	EPA 8270E			X	X		X
Fluorene	EPA 8270E-SIM			X	X		X
Fluorene	EPA TO-13A Full Scan	X					
Fluorene	EPA TO-13A SIM	X					
Fractional Organic Carbon	ASTM D2974 [1]				X		
gamma-Chlordane	EPA 8081B			X	X		X
Gel-Permeation Clean-up	EPA 3640A			X	X		X
Grain Size	ASTM D6913 [1]				X		
Grain Size	ASTM D7928 [1]				X		
Heptachlor	EPA 8081B			X	X		X
Heptachlor Epoxide	EPA 8081B			X	X		X
Hexachlorobenzene	EPA 8081B			X	X		
Hexachlorobenzene	EPA 8270E			X	X		
Hexachlorobutadiene	EPA 8270E			X	X		
Hexachlorobutadiene	EPA TO-15	X					
Hexachlorobutadiene	EPA TO-15 SIM	X					
Hexachlorocyclopentadiene	EPA 8270E			X	X		
Hexachloroethane	EPA 8270E			X	X		
Hexafluoropropylene oxide dimer acid (HFPO-DA) 13252-13-6	EPA 533		X				
Hexafluoropropylene oxide dimer acid (HFPO-DA) 13252-13-6	EPA 537.1		X				
Hexafluoropropyleneoxide dimer acid (HFPO-DA) (GenX) 13252-13-6	EPA 1633 DRAFT 2						X
Indeno(1,2,3-cd)pyrene	EPA 8270E			X	X		X
Indeno(1,2,3-cd)pyrene	EPA 8270E-SIM			X	X		X
Indeno(1,2,3-cd)pyrene	EPA TO-13A Full Scan	X					
Indeno(1,2,3-cd)pyrene	EPA TO-13A SIM	X					
Iron	EPA 200.7		X	X			
Iron	EPA 200.8		X	X			
Iron	EPA 6010D			X	X		
Iron	EPA 6020B			X	X		X

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Iron	AVS-SEM [1]				X		
Iso-butyl Alcohol	EPA 8015D			X	X		
Isophorone	EPA 8270E			X	X		
Isopropyl Alcohol	EPA 8015D			X	X		
Isopropyl Alcohol	EPA TO-15	X					
Isopropyl Alcohol	EPA TO-15 SIM	X					
Isopropylbenzene	EPA TO-15	X					
Isopropylbenzene	EPA TO-15 SIM	X					
Lead	EPA 200.7			X			
Lead	EPA 200.8		X	X			
Lead	EPA 6010D			X	X		
Lead	EPA 6020B			X	X		X
Lead	AVS-SEM [1]				X		
Lead, Tetraethyl	EPA 8270E-SIM(m) [1]			X	X	X	
Lead, Tetramethyl	EPA 8270E-SIM(m) [1]			X	X	X	
Lead, Trimethyl Ethyl	EPA 8270E-SIM(m) [1]			X	X	X	
Lead, Diethyl Dimethyl	EPA 8270E-SIM(m) [1]			X	X	X	
Lead, Methyl Triethyl	EPA 8270E-SIM(m) [1]			X	X	X	
Lead on Air Filter	EPA 40 CFR Part 50 App. G	X					
Lindane (gamma-BHC)	EPA 8081B			X	X		X
Lipids, Percent	NOS ORCA 130 [1]						X
Lithium	EPA 200.7		X				
Lithium	EPA 6010D			X			
Magnesium	EPA 200.7		X	X			
Magnesium	EPA 6010D			X	X		
Magnesium	EPA 6020B			X	X		X
Manganese	EPA 200.7		X	X			
Manganese	EPA 200.8		X	X			
Manganese	EPA 6010D			X	X		
Manganese	EPA 6020B			X	X		X
Manganese	AVS-SEM [1]				X		
Mercury	EPA 1631E			X			

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Mercury	EPA 245.1		X	X			
Mercury	EPA 7470A			X			
Mercury	EPA 7471B				X		
Mercury	EPA 7474				X		
Mercury	NIOSH 6009 [1]	X					
Methane	EPA 3C	X					
Methane	RSK-175 [1]			X			
Methoxychlor	EPA 8081B			X	X		X
Methyl Alcohol (methanol)	EPA 8015D			X	X		
Methyl Alcohol (methanol)	EPA TO-15	X					
Methyl Alcohol (methanol)	EPA TO-15 SIM	X					
Methyl methacrylate	EPA TO-15	X					
Methyl methacrylate	EPA TO-15 SIM	X					
Methyl tert-butyl ether (MTBE)	EPA TO-15	X					
Methyl tert-butyl ether (MTBE)	EPA TO-15 SIM	X					
Methylene Chloride	EPA TO-15	X					
Methylene Chloride	EPA TO-15 SIM	X					
Microscale Solvent Extraction (MSE)	EPA 3570				X		X
Microwave Acid Digestion	EPA 3050B				X		X
Microwave Acid Digestion	EPA 3051A				X		X
Mirex	EPA 8081B			X	X		
Molybdenum	EPA 200.7			X			
Molybdenum	EPA 200.8			X			
Molybdenum	EPA 6010D			X	X		
Molybdenum	EPA 6020B			X	X		X
m-Xylene	EPA TO-15	X					
m-Xylene	EPA TO-15 SIM	X					
Naphthalene	EPA 8270E			X	X		X
Naphthalene	EPA 8270E-SIM			X	X		X
Naphthalene	EPA TO-13A Full Scan	X					
Naphthalene	EPA TO-13A SIM	X					
Naphthalene	EPA TO-15	X					

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Naphthalene	EPA TO-15 SIM	X					
n-Butylbenzene	EPA TO-15	X					
n-Butylbenzene	EPA TO-15 SIM	X					
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	EPA 1633 DRAFT 2			X	X		
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	EPA 537.1		X				
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
N-ethylperfluoro-1-octanesulfonamide (NEtFOSA)	EPA 1633 DRAFT 2			X	X		
N-ethylperfluoro-1-octanesulfonamide (NEtFOSA)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
N-Ethylperfluorooctane sulfonamide (EtFOSAm) 4151-50-2	EPA 1633 DRAFT 2						X
N-Ethylperfluorooctane sulfonamido acetic acid (NEtFOSAA) 2991-50-6	EPA 1633 DRAFT 2						X
N-Ethylperfluorooctane sulfonamido ethanol (EtFOSE) 1691-99-2	EPA 1633 DRAFT 2						X
n-Heptane	EPA TO-15	X					
n-Heptane	EPA TO-15 SIM	X					
n-Hexane	EPA TO-15	X					
n-Hexane	EPA TO-15 SIM	X					
Nickel	EPA 200.7		X	X			
Nickel	EPA 200.8		X	X			
Nickel	EPA 6010D			X	X		
Nickel	EPA 6020B			X	X		X
Nickel	AVS-SEM [1]				X		
Nitrobenzene	EPA 8270E			X	X		
Nitrogen	EPA 3C	X					
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	EPA 1633 DRAFT 2			X	X		
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	EPA 537.1		X				
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
N-methylperfluoro-1-octanesulfonamide (NMeFOSA)	EPA 1633 DRAFT 2			X	X		
N-methylperfluoro-1-octanesulfonamide (NMeFOSA)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
N-Methylperfluorooctane sulfonamide (MeFOSA) 31506-32-8	EPA 1633 DRAFT 2						X
N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA) 2355-31-9	EPA 1633 DRAFT 2						X
N-Methylperfluorooctane sulfonamido ethanol (MeFOSE) 24448-09-7	EPA 1633 DRAFT 2						X
n-Nitrosodimethylamine	EPA 8270E			X	X		
n-Nitroso-di-n-propylamine	EPA 8270E			X	X		

Parameter	**Method**	**Matrices**					
		Air	**DW**	**NPW**	**SCM**	**Waste**	**Tissue**
N-Nitrosodiphenylamine	EPA 8270E			X	X		
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) 151772-58-6	EPA 1633 DRAFT 2			X	X		X
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) 151772-58-6	EPA 533		X				
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) 151772-58-6	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Non-Methane Organic Compounds	EPA TO-12	X					
n-Propanol	EPA 8015D			X	X		
n-Propylbenzene	EPA TO-15	X					
n-Propylbenzene	EPA TO-15 SIM	X					
Organic Matter, Total	ASTM D2974 [1]				X		
Oxygen	EPA 3C	X					
o-Xylene	EPA TO-15	X					
o-Xylene	EPA TO-15 SIM	X					
Particulate Matter (PM-10)	IO-3.1 [1]	X					
Particulate Matter (TSP)	IO-3.1 [1]	X					
PCB-1016	EPA 8082A			X	X		X
PCB-1016	EPA TO-10A	X					
PCB-1016	EPA TO-4A	X					
PCB-1221	EPA 8082A			X	X		X
PCB-1221	EPA TO-10A	X					
PCB-1221	EPA TO-4A	X					
PCB-1232	EPA 8082A			X	X		X
PCB-1232	EPA TO-10A	X					
PCB-1232	EPA TO-4A	X					
PCB-1242	EPA 8082A			X	X		X
PCB-1242	EPA TO-10A	X					
PCB-1242	EPA TO-4A	X					
PCB-1248	EPA 8082A			X	X		X
PCB-1248	EPA TO-10A	X					
PCB-1248	EPA TO-4A	X					
PCB-1254	EPA 8082A			X	X		X
PCB-1254	EPA TO-10A	X					
PCB-1254	EPA TO-4A	X					

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
PCB-1260	EPA 8082A			X	X		X
PCB-1260	EPA TO-10A	X					
PCB-1260	EPA TO-4A	X					
PCB-1262	EPA 8082A			X	X		
PCB-1262	EPA TO-10A	X					
PCB-1262	EPA TO-4A	X					
PCB-1268	EPA 8082A			X	X		
PCB-1268	EPA TO-10A	X					
PCB-1268	EPA TO-4A	X					
PCB Congeners and Homologs	EPA 680(m) [1]			X	X		X
PCB Congeners and Homologs	EPA 8270E-SIM(m) [1]			X	X		X
Pentachloronitrobenzene	EPA 8270E			X	X		
Pentachlorophenol	EPA 8270E			X	X		X
Pentachlorophenol	EPA 8270E-SIM			X	X		
Perfluoro(2-ethoxyethane) sulfonic acid (PFEESA) 113507-82-7	EPA 1633 DRAFT 2			X	X		X
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) 113507-82-7	EPA 533		X				
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) 113507-82-7	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluoro-3-methoxypropannoic acid (PFMPA) 377-73-1	EPA 1633 DRAFT 2			X	X		
Perfluoro-3-methoxypropannoic acid (PFMPA) 377-73-1	EPA 533		X				
Perfluoro-3-methoxypropannoic acid (PFMPA) 377-73-1	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluoro-3-methoxypropanoic acid (PFMPA) 377-73-1	EPA 1633 DRAFT 2						X
Perfluoro-4-methoxybutanoic acid (PFMBA) 863090-89-5	EPA 1633 DRAFT 2			X	X		X
Perfluoro-4-methoxybutanoic acid (PFMBA) 863090-89-5	EPA 533		X				
Perfluoro-4-methoxybutanoic acid (PFMBA) 863090-89-5	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorobutane sulfonic acid (PFBS) 375-73-5	EPA 1633 DRAFT 2			X	X		X
Perfluorobutane sulfonic acid (PFBS) 375-73-5	EPA 533		X				
Perfluorobutane sulfonic acid (PFBS) 375-73-5	EPA 537.1		X				
Perfluorobutane sulfonic acid (PFBS) 375-73-5	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorobutanoic acid (PFBA) 375-22-4	EPA 1633 DRAFT 2			X	X		X
Perfluorobutanoic acid (PFBA) 375-22-4	EPA 533		X				
Perfluorobutanoic acid (PFBA) 375-22-4	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorodecane sulfonic acid (PFDS) 335-77-3	EPA 1633 DRAFT 2			X	X		X

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Perfluorodecanesulfonic acid (PFDS)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorodecanoic acid (PFDA) 335-76-2	EPA 1633 DRAFT 2			X	X		X
Perfluorodecanoic acid (PFDA) 335-76-2	EPA 533		X				
Perfluorodecanoic acid (PFDA) 335-76-2	EPA 537.1		X				
Perfluorodecanoic acid (PFDA) 335-76-2	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorododecane sulfonic acid (PFDoS) 79780-39-5	EPA 1633 DRAFT 2			X	X		X
Perfluorododecanesulfonic acid (PFDoS)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorododecanoic acid (PFDOA) 307-55-1	EPA 1633 DRAFT 2			X	X		X
Perfluorododecanoic acid (PFDoA) 307-55-1	EPA 533		X				
Perfluorododecanoic acid (PFDoA) 307-55-1	EPA 537.1		X				
Perfluorododecanoic acid (PFDoA) 307-55-1	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluoroheptane sulfonic acid (PFHpS) 375-92-8	EPA 1633 DRAFT 2			X	X		X
Perfluoroheptanesulfonic Acid (PFHPS) 375-92-8	EPA 533		X				
Perfluoroheptanesulfonic Acid (PFHPS) 375-92-8	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluoroheptanoic acid (PFHpA) 375-85-9	EPA 1633 DRAFT 2			X	X		X
Perfluoroheptanoic acid (PFHpA) 375-85-9	EPA 533		X				
Perfluoroheptanoic acid (PFHpA) 375-85-9	EPA 537.1		X				
Perfluoroheptanoic acid (PFHpA) 375-85-9	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluoroheptyl propanoic acid 7:3FTCA	EPA 1633 DRAFT 2			X	X		
Perfluorohexadecanoic acid (PFHxDA)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorohexane sulfonic acid (PFHxS) 355-46-4	EPA 1633 DRAFT 2			X	X		X
Perfluorohexane sulfonic acid (PFHxS) 355-46-4	EPA 533		X				
Perfluorohexane sulfonic acid (PFHxS) 355-46-4	EPA 537.1		X				
Perfluorohexane sulfonic acid (PFHxS) 355-46-4	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorohexanoic acid (PFHxA) 307-24-4	EPA 1633 DRAFT 2			X	X		X
Perfluorohexanoic acid (PFHXA) 307-24-4	EPA 533		X				
Perfluorohexanoic acid (PFHXA) 307-24-4	EPA 537.1		X				
Perfluorohexanoic acid (PFHXA) 307-24-4	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorononane sulfonic acid (PFNS) 68259-12-1	EPA 1633 DRAFT 2			X	X		X
Perfluorononanesulfonic acid (PFNS)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorononanoic acid (PFNA) 375-95-1	EPA 1633 DRAFT 2			X	X		X
Perfluorononanoic acid (PFNA) 375-95-1	EPA 533		X				

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Perfluorononanoic acid (PFNA) 375-95-1	EPA 537.1		X				
Perfluorononanoic acid (PFNA) 375-95-1	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorooctadecanoic acid (PFODA)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorooctane Sulfonamide (PFOSA)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorooctane sulfonamide (PFOSAm) 754-91-6	EPA 1633 DRAFT 2						X
Perfluorooctane sulfonic acid (PFOS) 1763-23-1	EPA 1633 DRAFT 2						X
Perfluorooctane sulfonic acid (PFOS) 1763-23-1	EPA 533		X				
Perfluorooctanesulfonamide (PFOSA)	EPA 1633 DRAFT 2			X	X		
Perfluorooctanesulfonic acid (PFOS)	EPA 1633 DRAFT 2			X	X		
Perfluorooctanesulfonic acid (PFOS)	EPA 537.1		X				
Perfluorooctanesulfonic acid (PFOS)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X				
Perfluorooctanesulfonic acid (PFOS)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17			X	X		
Perfluorooctanoic acid (PFOA) 335-67-1	EPA 1633 DRAFT 2			X	X		X
Perfluorooctanoic acid (PFOA) 335-67-1	EPA 533		X				
Perfluorooctanoic acid (PFOA) 335-67-1	EPA 537.1		X				
Perfluorooctanoic acid (PFOA) 335-67-1	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluoropentane sulfonic acid (PFPeS) 2706-91-4	EPA 1633 DRAFT 2			X	X		X
Perfluoropentane sulfonic acid (PFPES) 2706-91-4	EPA 533		X				
Perfluoropentane sulfonic acid (PFPES) 2706-91-4	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluoropentanoic acid (PFPeA) 2706-90-3	EPA 1633 DRAFT 2			X	X		X
Perfluoropentanoic acid (PFPEA) 2706-90-3	EPA 533		X				
Perfluoropentanoic acid (PFPEA) 2706-90-3	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluoropropanesulfonic acid (PFPrS)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorotetradecanoic acid (PFTA)	EPA 1633 DRAFT 2			X	X		
Perfluorotetradecanoic acid (PFTA)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorotetradecanoic acid (PFTDA) 376-06-7	EPA 1633 DRAFT 2						X
Perfluorotridecanoic acid (PFTrDA)	EPA 1633 DRAFT 2			X	X		
Perfluorotridecanoic acid (PFTrDA)	EPA 537.1		X				
Perfluorotridecanoic acid (PFTrDA)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluorotridecanoic acid (PFTrDA) 72629-94-8	EPA 1633 DRAFT 2			X	X		X
Perfluoroundecanoic acid (PFUnA) 2058-94-8	EPA 533		X				
Perfluoroundecanoic acid (PFUnA) 2058-94-8	EPA 537.1		X				

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Perfluoroundecanoic acid (PFUnA) 2058-94-8	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Perfluoroundecanoic acid (PFUnDA) 2058-94-8	EPA 1633 DRAFT 2						X
Perylene	EPA TO-13A Full Scan	X					
Perylene	EPA TO-13A SIM	X					
Phenanthrene	EPA 8270E			X	X		X
Phenanthrene	EPA 8270E-SIM			X	X		X
Phenanthrene	EPA TO-13A Full Scan	X					
Phenanthrene	EPA TO-13A SIM	X					
Phenol	EPA 8270E			X	X		
P.I.A.N.O.	EPA 8260D(m) [1]	X		X	X	X	
Potassium	EPA 200.7		X	X			
Potassium	EPA 200.8		X	X			
Potassium	EPA 6010D			X	X		
Potassium	EPA 6020B			X	X		X
Preconcentration Under Acid	EPA 3005A			X			
Propane	RSK-175 [1]			X			
Propene	RSK-175 [1]			X			
Propylene	EPA TO-15	X					
Propylene	EPA TO-15 SIM	X					
Propylene Glycol	EPA 8015D			X	X		
p-Xylene	EPA TO-15	X					
p-Xylene	EPA TO-15 SIM	X					
Pyrene	EPA 8270E			X	X		X
Pyrene	EPA 8270E-SIM			X	X		X
Pyrene	EPA TO-13A Full Scan	X					
Pyrene	EPA TO-13A SIM	X					
Pyridine	EPA 8270E			X	X		
sec-Butylbenzene	EPA TO-15	X					
sec-Butylbenzene	EPA TO-15 SIM	X					
Selenium	EPA 200.7			X			
Selenium	EPA 200.8		X	X			
Selenium	EPA 6010D			X	X		

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Selenium	EPA 6020B			X	X		X
Selenium	EPA 1632A(m) [1]			X	X		
Separatory Funnel Extraction	EPA 3510C			X			X
Silica Gel Cleanup	EPA 3630C			X	X		X
Silica, Dissolved	EPA 200.7			X			
Silica, Dissolved	EPA 6010D			X			
Silver	EPA 200.7		X	X			
Silver	EPA 200.8		X	X			
Silver	EPA 6010D			X	X		
Silver	EPA 6020B			X	X		X
Silver	AVS-SEM [1]				X		
Sodium	EPA 200.7		X	X			
Sodium	EPA 200.8		X	X			
Sodium	EPA 6010D			X	X		
Sodium	EPA 6020B			X	X		
Solid Phase Micro Extraction	ASTM D7363-13A [1]				X		
Specific Gravity	ASTM D854 [1]				X		
Strontium	EPA 200.7		X	X			
Strontium	EPA 6010D			X	X		
Strontium	EPA 6020B			X	X		X
Styrene	EPA TO-15	X					
Styrene	EPA TO-15 SIM	X					
Sulfide, Acid Volatile	AVS-SEM [1]				X		
Sulfur	EPA 6010D			X	X		
Sulfur Cleanup	EPA 3660B			X	X		
Sulfuric Acid Cleanup	EPA 3665A			X	X		
t-Amyl Alcohol	EPA 8015D			X	X		
Tert-Butyl Alcohol	EPA 8015D			X	X		
Tert-Butyl Alcohol	EPA TO-15	X					
Tert-Butyl Alcohol	EPA TO-15 SIM	X					
Tert-Butylbenzene	EPA TO-15	X					
Tert-Butylbenzene	EPA TO-15 SIM	X					

Parameter	**Method**	**Matrices**					
		Air	**DW**	**NPW**	**SCM**	**Waste**	**Tissue**
Tetrachloroethene	EPA TO-15	X					
Tetrachloroethene	EPA TO-15 SIM	X					
Tetrafluoro-2(heptafluoropropoxy)propanoic acid (HFPO-DA)	EPA 1633 DRAFT 2			X	X		
Tetrafluoro-2(heptafluoropropoxy)propanoic acid (HFPO-DA)	PFAS Isotope Dilution Alpha SOP 23528 Rev 17		X	X	X		
Tetrahydrofuran	EPA TO-15	X					
Tetrahydrofuran	EPA TO-15 SIM	X					
Thallium	EPA 200.7			X			
Thallium	EPA 200.8		X	X			
Thallium	EPA 6010D		X	X			
Thallium	EPA 6020B			X	X		X
Tin	EPA 200.7		X	X			
Tin	EPA 6010D			X	X		
Tin	EPA 6020B			X	X		X
Titanium	EPA 200.7		X	X			
Titanium	EPA 6010D			X	X		
Toluene	EPA TO-15	X					
Toluene	EPA TO-15 SIM	X					
Total Hardness (CaCO3)	EPA 200.7		X	X			
Total Hardness (CaCO3)	EPA 6010D			X			
Total Hardness (CaCO3)	EPA 6020B			X			
Total Hardness (CaCO3)	SM 2340B			X			
Total Organic Carbon	EPA 9060A				X		
Total Organic Carbon	Lloyd Kahn				X		
Total Residue (% Total Solids)	SM 2540G				X		
Toxaphene	EPA 8081B			X	X		X
Trans-1,2-Dichloroethene	EPA TO-15	X					
Trans-1,2-Dichloroethene	EPA TO-15 SIM	X					
Trans-1,3-Dichloropropene	EPA TO-15	X					
Trans-1,3-Dichloropropene	EPA TO-15 SIM	X					
Trichloroethene	EPA TO-15	X					
Trichloroethene	EPA TO-15 SIM	X					
Trichlorofluoromethane	EPA TO-15	X					

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Trichlorofluoromethane	EPA TO-15 SIM	X					
Vanadium	EPA 200.7		X	X			
Vanadium	EPA 200.8		X	X			
Vanadium	EPA 6010D			X	X		
Vanadium	EPA 6020B			X	X		X
Vinyl acetate	EPA TO-15	X					
Vinyl acetate	EPA TO-15 SIM	X					
Vinyl Bromide	EPA TO-15	X					
Vinyl Bromide	EPA TO-15 SIM	X					
Vinyl Chloride	EPA TO-15	X					
Vinyl Chloride	EPA TO-15 SIM	X					
Waste Dilution	EPA 3580A			X	X	X	
Water Content	ASTM D2216-98 [1]				X	X	
Xylenes, Total	EPA TO-15 SIM	X					
Zinc	EPA 200.7		X	X			
Zinc	EPA 200.8		X	X			
Zinc	EPA 6010D			X	X		
Zinc	EPA 6020B			X	X		X
Zinc	AVS-SEM [1]				X		

[1] = Laboratory does not hold TNI Accreditation for this test method.

7.2.3 PAS-MANS 120 Forbes Blvd. Mansfield, MA

Parameter	Method	Matrices	
		Air	NPW
1,1,1-Trichloroethane	EPA TO-15	X	
1,1,1-Trichloroethane	EPA TO-15 SIM	X	
1,1,2,2-Tetrachloroethane	EPA TO-15	X	
1,1,2,2-Tetrachloroethane	EPA TO-15 SIM	X	
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	EPA TO-15	X	
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	EPA TO-15 SIM	X	
1,1,2-Trichloroethane	EPA TO-15	X	
1,1,2-Trichloroethane	EPA TO-15 SIM	X	
1,1-Dichloroethane	EPA TO-15	X	
1,1-Dichloroethane	EPA TO-15 SIM	X	

Parameter	Method	Matrices	
		Air	NPW
1,1-Dichloroethene	EPA TO-15	X	
1,1-Dichloroethene	EPA TO-15 SIM	X	
1,2,4-Trichlorobenzene	EPA TO-15	X	
1,2,4-Trichlorobenzene	EPA TO-15 SIM	X	
1,2,4-Trimethylbenzene	EPA TO-15	X	
1,2,4-Trimethylbenzene	EPA TO-15 SIM	X	
1,2-Dibromo-3-Chloropropane (DBCP)	EPA TO-15	X	
1,2-Dibromo-3-Chloropropane (DBCP)	EPA TO-15 SIM	X	
1,2-Dibromoethane (EDB)	EPA TO-15	X	
1,2-Dibromoethane (EDB)	EPA TO-15 SIM	X	
1,2-Dichlorobenzene	EPA TO-15	X	
1,2-Dichlorobenzene	EPA TO-15 SIM	X	
1,2-Dichloroethane	EPA TO-15	X	
1,2-Dichloroethane	EPA TO-15 SIM	X	
1,2-Dichloropropane	EPA TO-15	X	
1,2-Dichloropropane	EPA TO-15 SIM	X	
1,2-Dichlorotetrafluoroethane	EPA TO-15	X	
1,2-Dichlorotetrafluoroethane	EPA TO-15 SIM	X	
1,3,5-Trimethylbenzene	EPA TO-15	X	
1,3,5-Trimethylbenzene	EPA TO-15 SIM	X	
1,3-Butadiene	EPA TO-15	X	
1,3-Butadiene	EPA TO-15 SIM	X	
1,3-Dichlorobenzene	EPA TO-15	X	
1,3-Dichlorobenzene	EPA TO-15 SIM	X	
1,4-Dichlorobenzene	EPA TO-15	X	
1,4-Dichlorobenzene	EPA TO-15 SIM	X	
1,4-Dioxane	EPA TO-15	X	
1,4-Dioxane	EPA TO-15 SIM	X	
2,2,4-Trimethylpentane	EPA TO-15	X	
2,2,4-Trimethylpentane	EPA TO-15 SIM	X	
2-Butanone (Methyl ethyl ketone, MEK)	EPA TO-15	X	
2-Butanone (Methyl ethyl ketone, MEK)	EPA TO-15 SIM	X	

Parameter	**Method**	**Matrices**	
		Air	**NPW**
2-Chlorotoluene	EPA TO-15	X	
2-Chlorotoluene	EPA TO-15 SIM	X	
2-Hexanone	EPA TO-15	X	
2-Hexanone	EPA TO-15 SIM	X	
4-Ethyltoluene	EPA TO-15	X	
4-Ethyltoluene	EPA TO-15 SIM	X	
4-Methyl-2-pentanone (MIBK)	EPA TO-15	X	
4-Methyl-2-pentanone (MIBK)	EPA TO-15 SIM	X	
Acetaldehyde	EPA TO-15	X	
Acetaldehyde	EPA TO-15 SIM	X	
Acetone	EPA TO-15	X	
Acetone	EPA TO-15 SIM	X	
Acetonitrile	EPA TO-15	X	
Acetonitrile	EPA TO-15 SIM	X	
Acrolein	EPA TO-15	X	
Acrolein	EPA TO-15 SIM	X	
Acrylonitrile	EPA TO-15	X	
Acrylonitrile	EPA TO-15 SIM	X	
Allyl chloride	EPA TO-15	X	
Allyl chloride	EPA TO-15 SIM	X	
Benzene	EPA TO-15	X	
Benzene	EPA TO-15 SIM	X	
Benzyl Chloride	EPA TO-15	X	
Benzyl Chloride	EPA TO-15 SIM	X	
Bromodichloromethane	EPA TO-15	X	
Bromodichloromethane	EPA TO-15 SIM	X	
Bromoform	EPA TO-15	X	
Bromoform	EPA TO-15 SIM	X	
Bromomethane	EPA TO-15	X	
Bromomethane	EPA TO-15 SIM	X	
Carbon disulfide	EPA 3C	X	
Carbon disulfide	EPA TO-15	X	

Parameter	**Method**	**Matrices**	
		Air	**NPW**
Carbon disulfide	EPA TO-15 SIM	X	
Carbon Tetrachloride	EPA TO-15	X	
Carbon Tetrachloride	EPA TO-15 SIM	X	
Chlorobenzene	EPA TO-15	X	
Chlorobenzene	EPA TO-15 SIM	X	
Chloroethane (Ethyl chloride)	EPA TO-15	X	
Chloroethane (Ethyl chloride)	EPA TO-15 SIM	X	
Chloroform	EPA TO-15	X	
Chloroform	EPA TO-15 SIM	X	
Chloromethane	EPA TO-15	X	
Chloromethane	EPA TO-15 SIM	X	
cis-1,2-Dichloroethene	EPA TO-15	X	
cis-1,2-Dichloroethene	EPA TO-15 SIM	X	
cis-1,3-Dichloropropene	EPA TO-15	X	
cis-1,3-Dichloropropene	EPA TO-15 SIM	X	
Cyclohexane	EPA TO-15	X	
Cyclohexane	EPA TO-15 SIM	X	
Dibromochloromethane	EPA TO-15	X	
Dibromochloromethane	EPA TO-15 SIM	X	
Dichlorodifluoromethane (Freon-12)	EPA TO-15	X	
Dichlorodifluoromethane (Freon-12)	EPA TO-15 SIM	X	
Dichlorofluoromethane	EPA TO-15	X	
Dichlorofluoromethane	EPA TO-15 SIM	X	
Ethanol	EPA TO-15	X	
Ethanol	EPA TO-15 SIM	X	
Ethyl acetate	EPA TO-15	X	
Ethyl acetate	EPA TO-15 SIM	X	
Ethylbenzene	EPA TO-15	X	
Ethylbenzene	EPA TO-15 SIM	X	
Hexachlorobutadiene	EPA TO-15	X	
Hexachlorobutadiene	EPA TO-15 SIM	X	
Isopropyl Alcohol	EPA TO-15	X	

Parameter	**Method**	**Matrices**	
		Air	**NPW**
Isopropyl Alcohol	EPA TO-15 SIM	X	
Isopropylbenzene	EPA TO-15	X	
Isopropylbenzene	EPA TO-15 SIM	X	
Methane	EPA 3C	X	
Methyl Alcohol (methanol)	EPA TO-15	X	
Methyl Alcohol (methanol)	EPA TO-15 SIM	X	
Methyl methacrylate	EPA TO-15	X	
Methyl methacrylate	EPA TO-15 SIM	X	
Methyl tert-butyl ether (MTBE)	EPA TO-15	X	
Methyl tert-butyl ether (MTBE)	EPA TO-15 SIM	X	
Methylene Chloride	EPA TO-15	X	
Methylene Chloride	EPA TO-15 SIM	X	
m-Xylene	EPA TO-15	X	
m-Xylene	EPA TO-15 SIM	X	
Naphthalene	EPA TO-15	X	
Naphthalene	EPA TO-15 SIM	X	
n-Butylbenzene	EPA TO-15	X	
n-Butylbenzene	EPA TO-15 SIM	X	
n-Heptane	EPA TO-15	X	
n-Heptane	EPA TO-15 SIM	X	
n-Hexane	EPA TO-15	X	
n-Hexane	EPA TO-15 SIM	X	
Nitrogen	EPA 3C	X	
Non-Methane Organic Compounds	EPA TO-12	X	
n-Propylbenzene	EPA TO-15	X	
n-Propylbenzene	EPA TO-15 SIM	X	
Oxygen	EPA 3C	X	
o-Xylene	EPA TO-15	X	
o-Xylene	EPA TO-15 SIM	X	
Propylene	EPA TO-15	X	
Propylene	EPA TO-15 SIM	X	
p-Xylene	EPA TO-15	X	

Parameter	**Method**	**Matrices**	
		Air	**NPW**
p-Xylene	EPA TO-15 SIM	X	
sec-Butylbenzene	EPA TO-15	X	
sec-Butylbenzene	EPA TO-15 SIM	X	
Styrene	EPA TO-15	X	
Styrene	EPA TO-15 SIM	X	
Tert-Butyl Alcohol	EPA TO-15	X	
Tert-Butyl Alcohol	EPA TO-15 SIM	X	
Tert-Butylbenzene	EPA TO-15	X	
Tert-Butylbenzene	EPA TO-15 SIM	X	
Tetrachloroethene	EPA TO-15	X	
Tetrachloroethene	EPA TO-15 SIM	X	
Tetrahydrofuran	EPA TO-15	X	
Tetrahydrofuran	EPA TO-15 SIM	X	
Toluene	EPA TO-15	X	
Toluene	EPA TO-15 SIM	X	
Trans-1,2-Dichloroethene	EPA TO-15	X	
Trans-1,2-Dichloroethene	EPA TO-15 SIM	X	
Trans-1,3-Dichloropropene	EPA TO-15	X	
Trans-1,3-Dichloropropene	EPA TO-15 SIM	X	
Trichloroethene	EPA TO-15	X	
Trichloroethene	EPA TO-15 SIM	X	
Trichlorofluoromethane	EPA TO-15	X	
Trichlorofluoromethane	EPA TO-15 SIM	X	
Vinyl acetate	EPA TO-15	X	
Vinyl acetate	EPA TO-15 SIM	X	
Vinyl Bromide	EPA TO-15	X	
Vinyl Bromide	EPA TO-15 SIM	X	
Vinyl Chloride	EPA TO-15	X	
Vinyl Chloride	EPA TO-15 SIM	X	
Xylenes, Total	EPA TO-15 SIM	X	

[1] = Laboratory does not hold TNI Accreditation for this test method.

7.3 Appendix C: Glossary

This glossary provides common terms and definitions used in environmental testing; it is not intended to be a complete list of all terms and definitions used; some terms are defined in the context of the document or application. The definitions have been compiled mostly from the TNI Standard and DoD QSM. Although this information has been reproduced with care, errors cannot be entirely excluded.

Term	Definition
Acceptance Criteria	Specified limits placed on characteristics of an item, process, or service defined in requirement documents.
Accreditation	The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.
Accreditation Body	The organization having responsibility and accountability for environmental laboratory accreditation, and which grants accreditation.
Accuracy	The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.
Aliquot	A discrete, measured, representative portion of a sample taken for analysis.
Analysis	A combination of sample preparation and instrument determination.
Analysis Sequence	A compilation of all samples, standards and quality control samples run during a specific amount of time on a particular instrument in the order they are analyzed.
Analyte	A substance, organism, physical parameter, property, or chemical constituent(s) for which an environmental sample is being analyzed.
Analytical Method	A formal process that identifies and quantifies the chemical components of interest in a sample.
Analytical Uncertainty	A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.
Annual (or annually)	Defined by PAS as every 12 months ± 30 days.
Assessment	The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its system to defined criteria (to the standards and requirements of laboratory accreditation).
Atomic Absorption Spectrometer	Instrument used to measure concentration in metals samples.
Audit	A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives.
Batch	Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same quality systems matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours or the time specified by the regulatory program. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed 20 samples.
Bias	The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).
Blank	A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage, or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results (See Method Blank).

Blind Sample	A sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.
Calibration	A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards.
Calibration Curve	The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.
Calibration Method	A defined technical procedure for performing a calibration.
Calibration Range	The range of values (concentrations) between the lowest and highest calibration standards of a multi-level calibration curve.
Calibration Standard	A substance or reference material used for calibration.
Certified Reference Material	Reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute.
Chain of Custody	An unbroken trail of accountability that verifies the physical security of samples, data, and records.
Client /Customer	Any individual or organization external to Pace for whom items or services are furnished or work performed in response to defined requirements and expectations.
Code of Federal Regulations (CFR)	A codification of the general and permanent rules published in the Federal Register by agencies of the federal government.
Comparability	An assessment of the confidence with which one data set can be compared to another.
Completeness	The percentage of valid data obtained from a measurement system compared to the amount of valid data expected under normal conditions. This attribute is always calculated by the end data user, not by the laboratory.
Confirmation	Verification of the identity of a component through the use of an approach with a different scientific principle from the original method.
Continuing Calibration Blank (CCB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method.
Continuing Calibration Check Compounds (CCC)	Compounds listed in mass spectrometry methods are used to evaluate an instrument calibration from the standpoint of the integrity of the system.
Continuing Calibration Verification (CCV) Standard	A standard used to verify the initial calibration of compounds in an analytical method. May be referred to as a CCC in some programs, such as UCMR.
Control Limit	A range within which specified measurement results must fall to verify that the analytical system is in control.
Correction	Action taken to eliminate a detected non-conformity.
Corrective Action	The action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation in order to prevent recurrence.
Data Integrity	The condition that exists when data are sound, correct, and complete, and accurately reflect activities and requirements.
Data Quality Objective (DQO)	Strategic planning tool that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use or end user.
Data Reduction	The process of transforming the number of data items by arithmetic or statistical calculation, standard curves, and concentration factors, and collating them into a more usable form.
Demonstration of Capability (DOC)	A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision.
Detection Limit (DL)	The minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from the method blank results.
Dry Weight	The percent of sample that is not water, which may be used to adjust the reported results.

Electronic Data Deliverable (EDD)	A summary of environmental data which clients request for ease of data review and comparison to historical results.
Environmental Protection Agency (EPA)	An agency of the federal government of the United States which was created for the purpose of protecting human health and the environment by writing and enforcing regulations based on laws passed by Congress.
Equipment Blank	A sample of analyte-free media used to rinse common sampling equipment to check effectiveness of decontamination procedures.
Extracted Internal Standard Analyte	Isotopically labeled analogs of analytes of interest added to all standards, blanks and samples analyzed. Added to samples and batch QC samples prior to the first step of sample extraction and to standards and instrument blanks prior to analysis. Used for isotope dilution methods.
False Negative	A result that fails to identify (detect) an analyte to be present.
False Positive	A result that erroneously identifies (detects) an analyte to be present.
Field Blank	A blank sample prepared in the field by filling a clean container with reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken.
Field Measurement	Testing performed in the field outside of a fixed-laboratory or outside of an enclosed structure that meets the requirements of a mobile laboratory.
Flame Atomic Absorption Spectrometer (FAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the fact that ground state metals absorb light at different wavelengths. Metals in a solution are converted to the atomic state by use of a flame.
Flame Ionization Detector (FID)	A type of gas detector used in GC analysis where samples are passed through a flame which ionizes the sample so that various ions can be measured.
Gas Chromatography (GC)	Instrumentation which utilizes a mobile carrier gas to deliver an environmental sample across a stationary phase with the intent to separate compounds out and measure their retention times.
Gas Chromatograph/ Mass Spectrometry (GC/MS)	In conjunction with a GC, this instrumentation utilizes a mass spectrometer which measures fragments of compounds and determines their identity by their fragmentation patterns (mass spectra).
Gasoline Range Organics (GRO)	A range of compounds that denote all the characteristic compounds that make up gasoline (range can be state or program specific).
Graphite Furnace Atomic Absorption Spectrometry (GFAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the absorption of light at different wavelengths that are characteristic of different analytes.
High Pressure Liquid Chromatography (HPLC)	Instrumentation used to separate, identify, and quantitate compounds based on retention times which are dependent on interactions between a mobile phase and a stationary phase.
Holding Time	The maximum time specified in a reference method that can elapse between analytical activities.
Homogeneity	The degree to which a property or substance is uniformly distributed throughout a sample.
Incremental Sampling Method (ISM)	A sampling method designed to provide an accurate characterization of contamination in soils at a site through collection of numerous portions of soil that are combined, processed, and subsampled in order to reduce the effects of soil heterogeneity.
Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)	Analytical technique used for the detection of trace metals which uses plasma to produce excited atoms that emit radiation of characteristic wavelengths.
Inductively Coupled Plasma- Mass Spectrometry (ICP/MS)	An ICP that is used in conjunction with a mass spectrometer so that the instrument is not only capable of detecting trace amounts of metals and non-metals but is also capable of monitoring isotopic speciation for the ions of choice.
Infrared Spectrometer (IR)	An instrument that uses infrared light to identify compounds of interest.

Initial Calibration (ICAL)	The process of analyzing standards, prepared at specified concentrations, to define the quantitative response relationship of the instrument to the analytes of interest.
Initial Calibration Blank (ICB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method.
Initial Calibration Verification (ICV)	A standard obtained or prepared from a source independent of the source of the initial calibration standards to verify the initial calibration.
Instrument Blank	An analyte free matrix processed through the instrumental steps of the measurement process; use to determine instrument contamination.
Interference	The suppression or elevation of result of an analyte of interest due to the presence of other compounds.
Internal Standard	A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.
International Organization for Standardization (ISO)	An international standard-setting body composed of representatives from various national standards organizations.
Intermediate Standard Solution	Reference solutions prepared by dilution of the stock solutions with an appropriate solvent.
International System of Units (SI)	The coherent system of units adopted and recommended by the General Conference on Weights and Measures.
Ion Chromatography (IC)	Instrumentation or process that allows the separation of ions and molecules based on the charge properties of the molecules.
Isomer	One of two or more compounds, radicals, or ions that contain the same number of atoms of the same element but differ in structural arrangement and properties. For example, hexane (C_6H_{14}) could be n-hexane, 2-methylpentane, 3-methylpentane, 2,3-dimethylbutane, 2,2-dimethylbutane.
Laboratory	A facility that performs testing, whether in-house or in the field.
Laboratory Control Sample (LCS)	Also known as laboratory fortified blank (LFB): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, which is taken through all sample preparation and analytical steps of the procedure.
Laboratory Information Management System (LIMS)	The entirety of an electronic data system (including hardware and software) that collects, analyzes, stores, and archives electronic records and documents.
Legal Chain-of-Custody Protocols	Industry defined protocol that is sometimes used for evidentiary or legal purposes that establishes an intact, continuous record of the physical possession, storage, and disposal of samples, including sample aliquots and prepared samples.
Limit(s) of Detection (LOD)	The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence.
Limit(s) of Quantitation (LOQ)	The minimum level, concentration, or quantity of a target analyte that can be reported with a specified degree of confidence.
Lower Limit of Quantitation (LLOQ)	The concentration of the lowest calibration standard included in the calibration curve.
Linear Dynamic Range	Concentration range where the instrument provides a linear response.
Liquid chromatography/ tandem mass spectrometry (LC/MS/MS)	Instrumentation that combines the physical separation techniques of liquid chromatography with the mass analysis capabilities of mass spectrometry.
Lot	A definite amount of material produced during a single manufacturing cycle and intended to have uniform character and quality.
Matrix	The substrate of a test sample.

Matrix Duplicate	A replicate matrix prepared in the laboratory and analyzed to obtain a measure of precision.
Matrix Spike (MS)	A sample prepared, taken through all sample preparation and analytical steps of the procedure, to which a known amount of target analyte is added to a specified amount of sample for which an independent test result of target analyte concentration is available.
Matrix Spike Duplicate (MSD)	A replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.
Measurement System	A method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s).
Measurement Uncertainty	An estimate of the error in a measurement often stated as a range of values that contain the true value within a certain confidence level.
Method	A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification).
Method Blank	A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures.
Method Detection Limit (MDL)	The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.
Method of Standard Additions	A set of procedures adding one or more increments of a standard solution to sample aliquots of the same size in order to overcome inherent matrix effects.
Minimum Detectable Activity (MDA)	Estimate of the smallest true activity that ensures a specified high confidence, $1 - \beta$, of detection above the Critical Value, and a low probability β of false negatives below the Critical Value. For radiometric methods, β is often set at 0.05.
Negative Control	A sample included in the method that is treated the same as all others but is expected to have a detection of analytes of interest.
Nonconformance	An indication or judgment that a product or service has not met the requirement of the relevant specifications, contract, or regulation; also, the state of failing to meet the requirements.
Positive Control	A sample included in the method that is treated the same as all others and is expected to have a detection of the analytes of interest.
Practical Quantitation Limit (PQL)	Another term for a method reporting limit.
Precision	The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves.
Preservation	Any conditions under which a sample must be kept in order to maintain chemical, physical, and/or biological integrity prior to analysis.
Primary Accreditation Body (Primary AB)	The TNI-approved state agency responsible for assessing a laboratory's total quality system, on-site assessment, and PT performance tracking for fields of accreditation.
Procedure	Written instructions detailing the performance of a task, process, or other laboratory activity.
Proficiency Testing (PT)	A means to evaluate a laboratory's performance under controlled conditions relative to a given set of criteria, through analysis of unknown samples provided by an external source.
Proficiency Testing Reporting Limit (PTRL)	A statistically derived value that represents the lowest acceptable concentration for an analyte in a PT sample, if the analyte is spiked into the PT sample. The PTRLs are specified in the TNI FoPT tables.
Qualitative Analysis	Analysis designed to identify the components of a substance or mixture.
Quality Assurance (QA)	An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.
Quality Assurance Project Plan (QAPP)	A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.

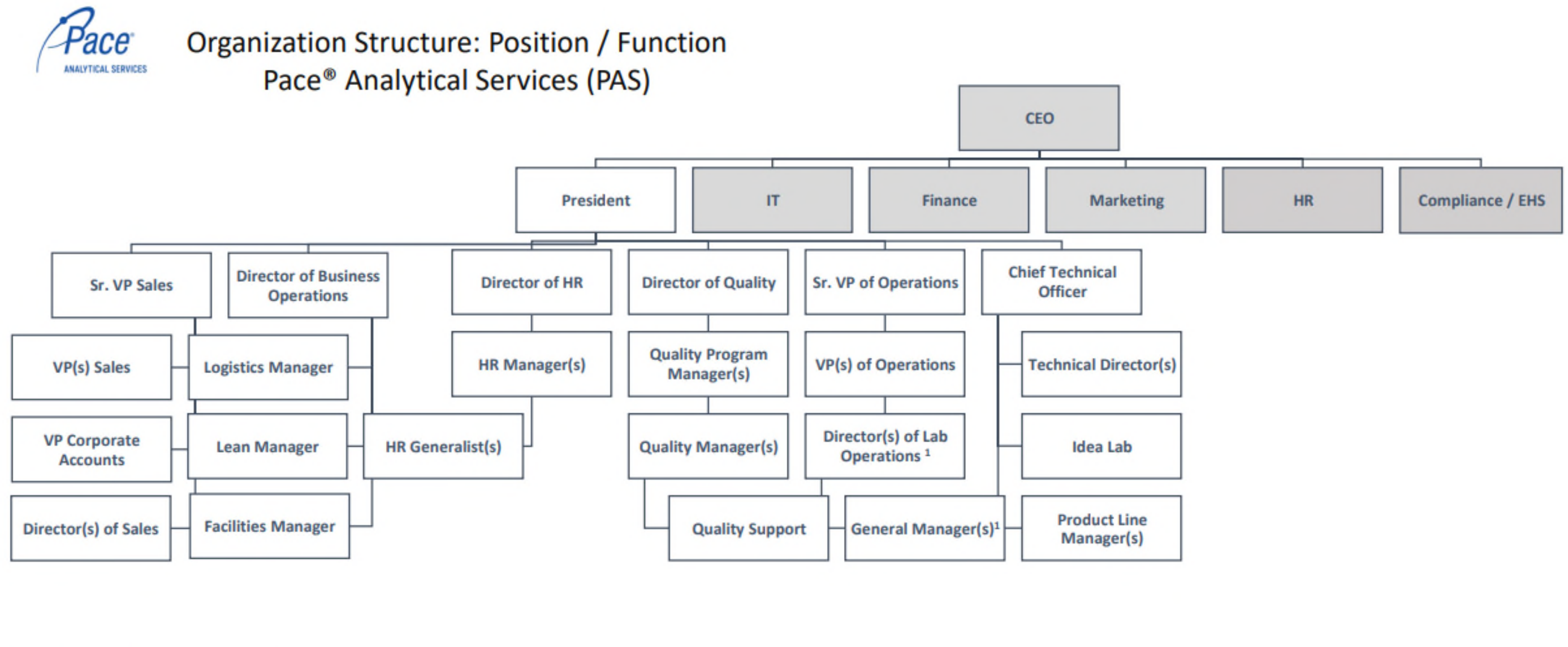
Quality Control (QC)	The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality.
Quality Control Sample (QCS)	A sample used to assess the performance the measurement system.
Quality Manual	A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality Management System	A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance and quality control activities.
Quantitation Range	The upper and lower limit to which values can be reported without being qualified as estimated.
Quantitative Analysis	Analysis designed to determine the amounts or proportions of the components of a substance.
Raw Data	The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records.
Record	Documentation, data, or other records constituting a piece of evidence about the past, especially an account of an act or occurrence kept in writing or some other permanent form. Records may be in electronic or hardcopy media. Unless otherwise specified, the term "record" refers to both electronic and hardcopy media.
Reference Material	Material or substance one or more of whose property values are sufficiently homogenized and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.
Reference Method	A published method issued by an organization recognized as competent to do so. (When the ISO language refers to a "standard method," that term is equivalent to "reference method").
Reference Standard	Standard used for the calibration of working measurement standards in a given organization or at a given location.
Relative Percent Difference (RPD)	A measure of precision defined as the difference between two measurements divided by the average concentration of the two measurements.
Reporting Limit (RL)	The value to which test results are reported as detected or not detected.
Representativeness	A quality element related to the ability to collect a sample reflecting the characteristics of the part of the environment to be assessed.
Retention Time	The time between sample injection and the appearance of a solute peak at the detector.
Sample	The item submitted for testing.
Sampling	Activity related to obtaining a representative sample for analysis.
Selected Ion Monitoring (SIM)	A mode of analysis in mass spectrometry where the detector is set to scan over a very small mass range, typically one mass unit.
Selectivity	The ability of a method to correctly determine an analyte without interference from other compounds.
Sensitivity	The smallest amount of substance in a sample that can accurately be measured.
Serial Dilution	The stepwise dilution of a substance in a solution.
Standard Operating Procedure (SOP)	A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps.
Standard Reference Material (SRM)	A certified reference material produced by the US NIST or other equivalent organization and characterized for absolute content, independent of analytical method.

Stock Standard	A concentrated reference solution containing one or more analytes prepared in the laboratory using an assayed reference compound or purchased from a reputable commercial source.
Storage Blank	A sample of analyte-free media prepared by the laboratory and retained in the sample storage area.
Suitability	The quality of being appropriate for a particular purpose.
Surrogate	A substance with properties that mimic the analyte of interest, and unlikely to be found in environmental samples.
Systems Audit	An on-site inspection or assessment of a laboratory's quality system.
Target Analytes	Analytes or chemicals of primary concern identified by the customer on a project-specific basis.
Technology	A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.
Traceability	The ability to trace the history of measuring equipment to national or international standards, primary standards, basic physical conditions or properties, or reference materials.
Trip Blank	A cleaned sample container filled with laboratory reagent water that is stored, shipped, and analyzed with its associated samples to detect sample contamination during transport and storage of the sample.
Tuning	A check and/or adjustment of instrument performance for mass spectrometry as required by the method.
Validation	The confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.
Verification	Confirmation by examination and objective evidence that specified requirements have been met. In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation, or specification peculiar to the management of the measuring equipment.
Working Standard	Dilution made of a stock or intermediate standard used in the analytical process.

7.4 Appendix D: Organization Chart(s)

7.4.1 PAS Corporate Organization Chart(s)

The information in this organization chart is subject to change. Please contact PAS for the most up-to-date version.

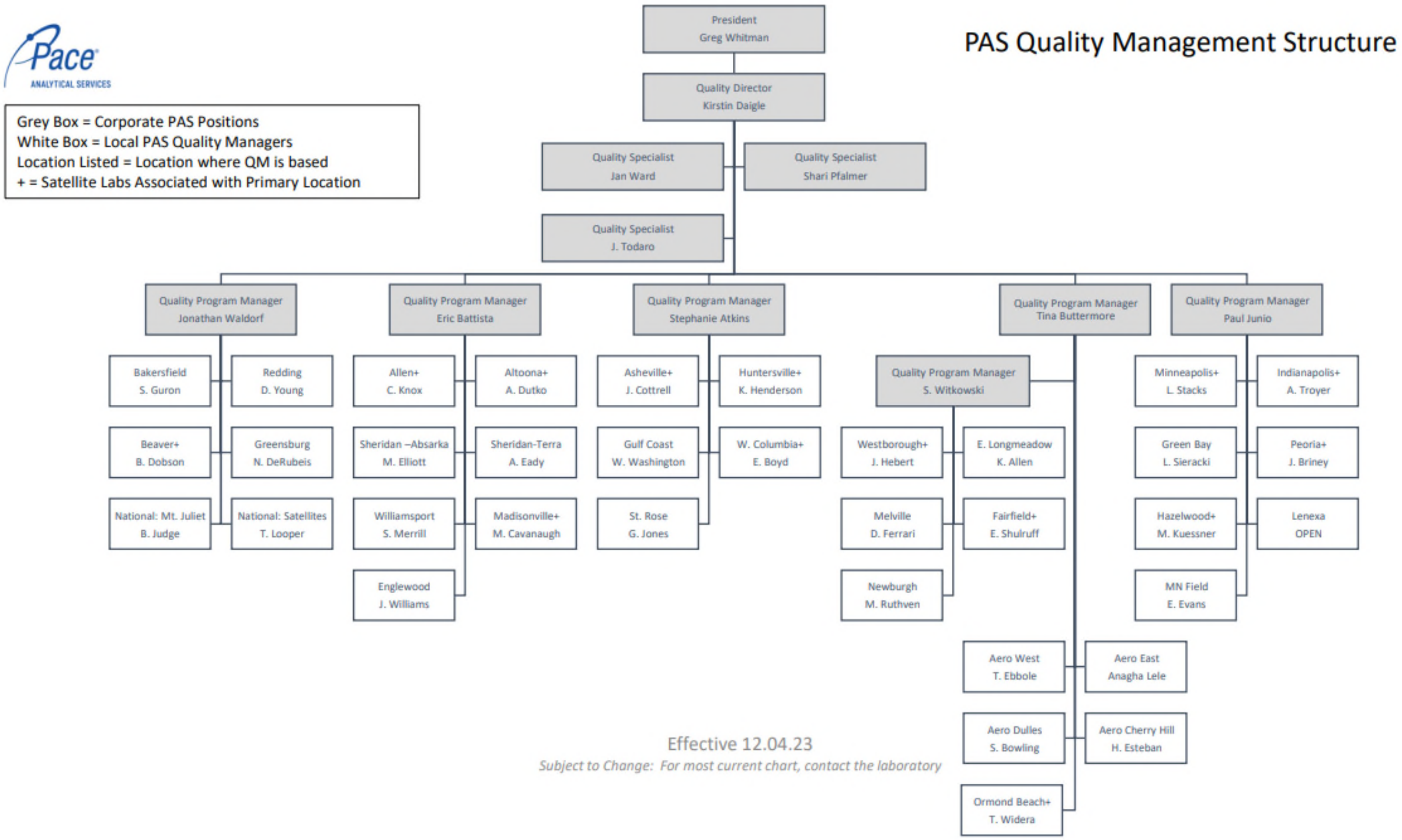


White Box = PAS Positions / Functions
Grey Box = Pace®Corporate Positions / Functions
1= Positions not Assigned to all Locations – see location specific organization charts

Effective 12.18.23
Information is subject to change, please contact PAS for most up-to-date version.

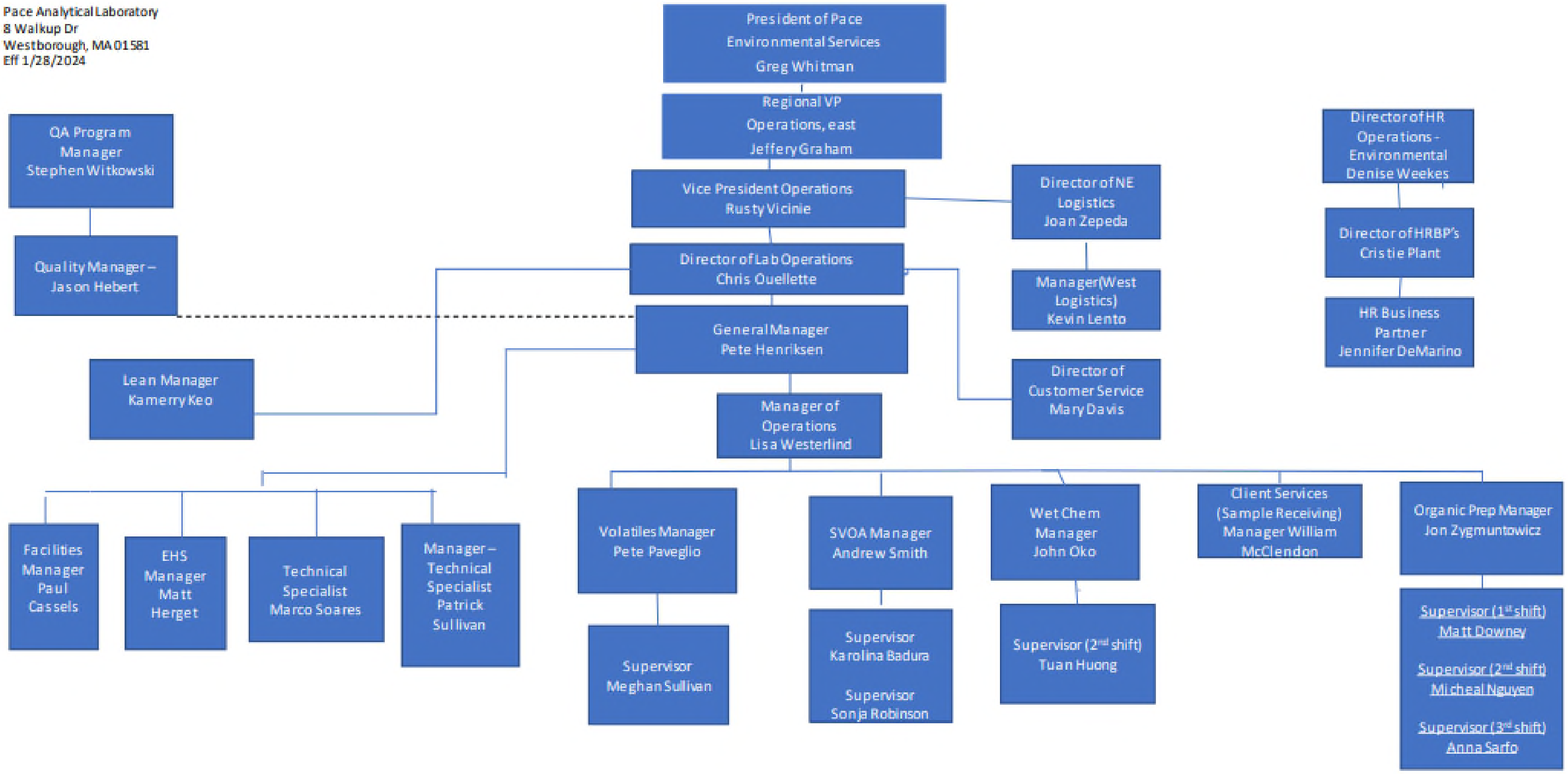
7.4.2 PAS Quality Systems Management Organization Chart

The information in this organization chart is subject to change. Please contact PAS for the most up-to-date version.



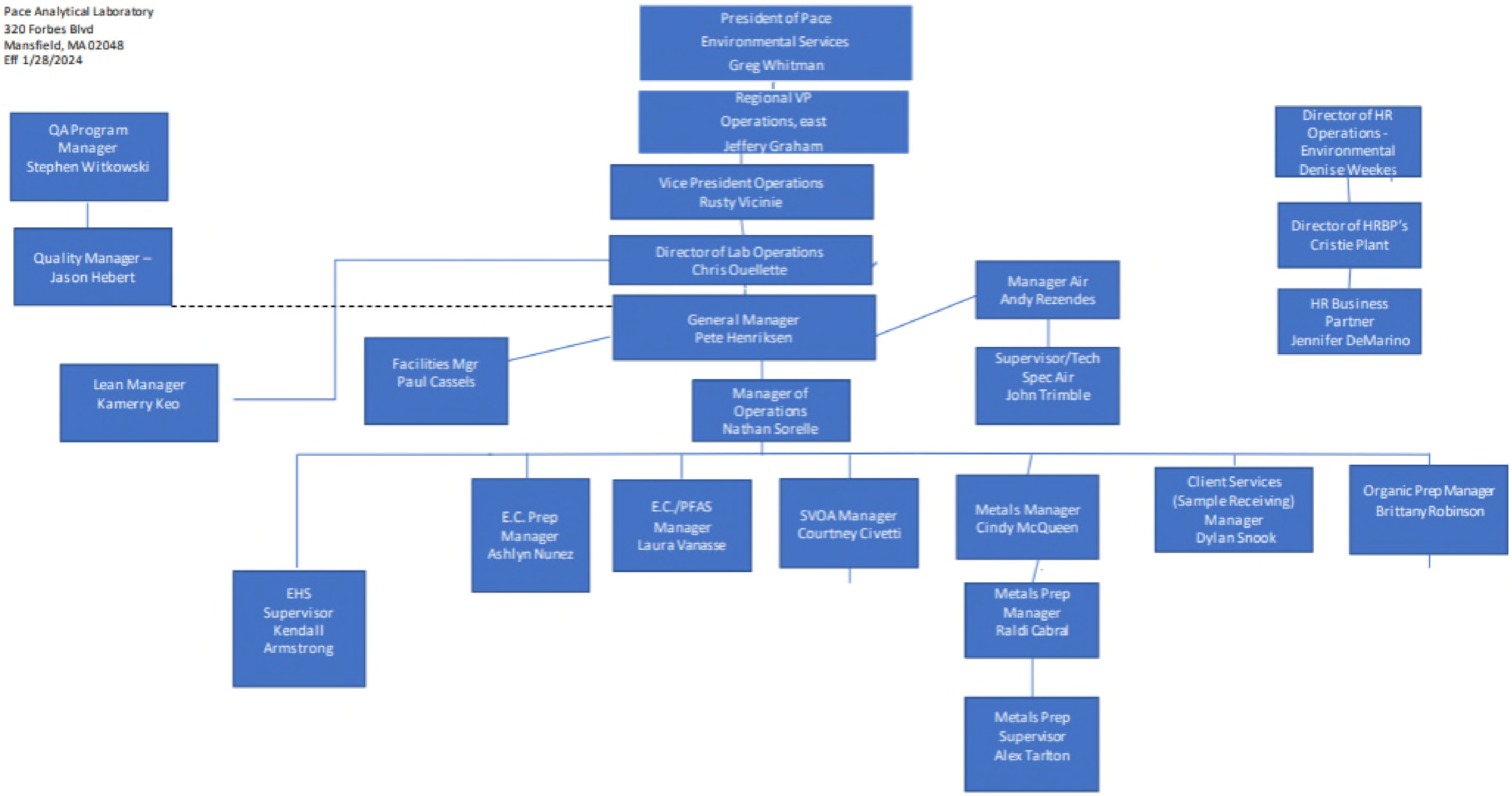
7.4.3 PAS-WES2 – Organization Chart

The information in this organization chart is subject to change. Please contact PAS for the most up-to-date version.

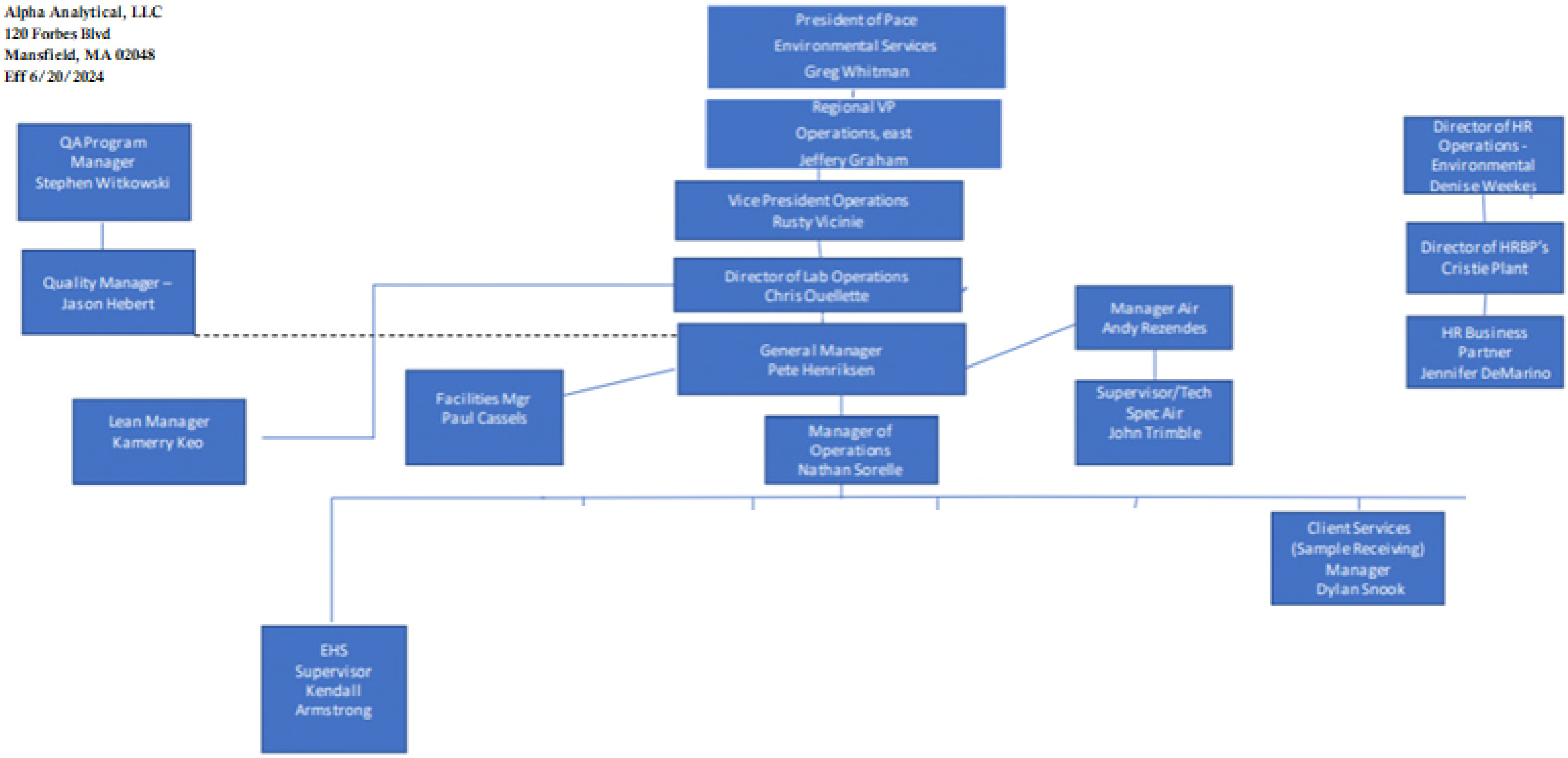


7.4.4 PAS-MANS 320 Forbes Blvd, Mansfield, MA – Organization Chart

The information in this organization chart is subject to change. Please contact PAS for the most up-to-date version



7.4.5 PAS-MANS 120 Forbes Blvd. Mansfield, MA – Organization Chart



7.5 Appendix E: Equipment Listing

The equipment listed represents equipment were held by each location on the effective date of this manual. This information is subject to change without notice. External parties should contact the location for the most current information.

7.5.1 PAS-WES2

Equipment List: PAS-WES2 8 Walkup Drive, Westborough, MA

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Adsorption Module	Mitsubishi Chemical Analytech	TXA-04	D9D00104	5/1/2015	New	WB Wet Chemistry	2281	QA Backup/Team
Ammonia Distillation Unit	Buchi	K-355	10000323097	12/19/2018	New	WB Wet Chemistry	3496	QA Backup/Team
Anemometer	Control Company	33500-096	130078984	8/9/2013	New	WB Wet Chemistry	2004	QA Backup/Team
Auto Boat Controller	Mitsubishi Chemical Analytech	ABC-201	D8CA0054	3/1/2015	New	WB Wet Chemistry	2280	QA Backup/Team
Auto Sampler	EST Analytical	Centurion	CENT371060314	9/1/2015	UNK	WestVOA	2308	QA Backup/Team
Autoclave	Harvey	ST75925	1.28E+12	6/25/1905	UNK	WB Microbiology	734	QA Backup/Team
Autoclave	Tuttnauer	2340E	9612771	1/1/2001	UNK	WB Microbiology	2011	QA Backup/Team
Autoclave	Tuttnauer	3870EA	1202281	3/28/2016	Used	WB Wet Chemistry	2391	QA Backup/Team
Automated IS Dispener	Pace Ideas Lab	Viper	1	6/1/2023	New	WB SVOA	4846	QA Backup/Team
Autosampler	Agilent	7693	CN17020085	UNK	UNK	WB SVOA	3070	QA Backup/Team
Autosampler	Agilent	7693A	CN19340010	8/27/2019	New	WB SVOA	3714	QA Backup/Team
Autosampler	Agilent	G2614A	CN85252207	UNK	UNK	WB SVOA	1082	QA Backup/Team
Autosampler	Agilent	G2614A	US83301526	UNK	UNK	WB SVOA	1071	QA Backup/Team
Autosampler	Agilent	G2614A	US90403246	UNK	UNK	WB SVOA	1080	QA Backup/Team
Autosampler	Agilent	G2614A	CN20920296	UNK	UNK	WB SVOA	1351	QA Backup/Team
Autosampler	Agilent	G2614A	CN34927347	UNK	UNK	WB SVOA	1355	QA Backup/Team
Autosampler	Agilent	G2614A	US12211768	UNK	UNK	WB SVOA	1060	QA Backup/Team
Autosampler	Agilent	G2614A	US12712062	UNK	UNK	WB SVOA	1101	QA Backup/Team
Autosampler	Agilent	G2614A	CN85352302	UNK	UNK	WB SVOA	1107	QA Backup/Team
Autosampler	Agilent	G2614A	CN42229080	UNK	UNK	WB SVOA	1089	QA Backup/Team
Autosampler	Agilent	G2614A	CN72244178	UNK	UNK	WB SVOA	2034	QA Backup/Team
Autosampler	Agilent	G2614A	CN71543674	UNK	UNK	WB SVOA	1086	QA Backup/Team
Autosampler	Agilent	G2614A	US92605580	UNK	UNK	WB SVOA	1509	QA Backup/Team
Autosampler	Agilent	G2614A	US14213136	UNK	UNK	WB SVOA	1111	QA Backup/Team
Autosampler	Agilent	G2614A	CN51132503	UNK	UNK	WB SVOA	1114	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Autosampler	Agilent	G2614A	CN71743823	UNK	UNK	WB SVOA	839	QA Backup/Team
Autosampler	Agilent	G2614A	CN22020701	UNK	UNK	WB SVOA	1369	QA Backup/Team
Autosampler	Agilent	G2614A	CN80146891	UNK	UNK	WB SVOA	1137	QA Backup/Team
Autosampler	Agilent	G2614A	CN34626993	UNK	UNK	WB SVOA	3781	QA Backup/Team
Autosampler	Agilent	G4514A	CN12420010	UNK	UNK	WB SVOA	3780	QA Backup/Team
Autosampler	Agilent	G4514A	CN10130029	UNK	UNK	WB SVOA	1405	QA Backup/Team
Autosampler	Agilent	G4514A	CN15060082	UNK	UNK	WB SVOA	2313	QA Backup/Team
Autosampler	Agilent	G4514A	CN13150014	UNK	UNK	WB SVOA	2132	QA Backup/Team
Autosampler	Agilent	G4514A	CN15320105	UNK	UNK	WB SVOA	3073	QA Backup/Team
Autosampler	Agilent	G4514A	CN17020081	UNK	UNK	WB SVOA	3216	QA Backup/Team
Autosampler	Agilent	G4514A	CN18170257	UNK	New	WB SVOA	3416	QA Backup/Team
Autosampler	Agilent	G4514A	CN17020085	UNK	UNK	WB SVOA	3212	QA Backup/Team
Autosampler	Agilent	G4514A	CN10210007	UNK	UNK	WB SVOA	1136	QA Backup/Team
Autosampler	Agilent	G4514A	CN10130053	UNK	UNK	WB SVOA	1359	QA Backup/Team
Autosampler	Agilent	G4514A	CN10340019	UNK	UNK	WB SVOA	1143	QA Backup/Team
Autosampler	Agilent	G4514A	CN10130053	UNK	UNK	WB SVOA	1410	QA Backup/Team
Autosampler	Agilent	G4514A	CN10230053	UNK	UNK	WB SVOA	1124	QA Backup/Team
Autosampler	Agilent	G4514A	CN13440032	UNK	UNK	WB SVOA	2089	QA Backup/Team
Autosampler	Agilent	G4514A	CN18430060	UNK	UNK	WB SVOA	3782	QA Backup/Team
Autosampler	Agilent	G4514A	cn15490113	UNK	New	WB SVOA	3102	QA Backup/Team
Autosampler	Agilent	G4514A	cn16150057	UNK	New	WB SVOA	3111	QA Backup/Team
Autosampler	Agilent	G4514A	CN10470031	UNK	UNK	WB SVOA	1075	QA Backup/Team
Autosampler	Agilent	G4514A	CN10260029	UNK	UNK	WB SVOA	1378	QA Backup/Team
Autosampler	Agilent	G4514A	CN10200045	UNK	UNK	WB SVOA	1447	QA Backup/Team
Autosampler	Agilent	G4514A	CN10210005	UNK	UNK	WB SVOA	1419	QA Backup/Team
Autosampler	Agilent	G4514A	CN13430014	UNK	UNK	WB SVOA	2086	QA Backup/Team
Autosampler	Agilent	G4514A	CN13430061	UNK	UNK	WB SVOA	2104	QA Backup/Team
Autosampler	Agilent	G4514A	CN16150002	UNK	UNK	WB SVOA	3106	QA Backup/Team
Autosampler	Agilent	G4514A	CN10380042	UNK	UNK	WB SVOA	1123	QA Backup/Team
Autosampler	Agilent	G4514A	cn16150002	UNK	New	WB SVOA	3106	QA Backup/Team
Autosampler	Agilent	G4567A	CN18520009	UNK	UNK	WB SVOA	3700	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Autosampler	EST Analytical	CENT w/s	cents417070915	UNK	New	WestVOA	3065	QA Backup/Team
AutoSampler	EST Analytical	CENT w/s	CENTS556041018	4/1/2018	New	WestVOA	3378	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS144031610	UNK	UNK	WestVOA	1029	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS270060112	UNK	New	WestVOA	3757	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS140531810	UNK	UNK	WestVOA	1020	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS237071411	UNK	UNK	WestVOA	1036	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS246100411	UNK	New	WestVOA	3753	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS505051217	UNK	New	WestVOA	3755	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS156051410	UNK	UNK	WestVOA	1007	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS370060314	UNK	New	WestVOA	3771	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS359031014	UNK	New	WestVOA	3758	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS330101713	UNK	New	WestVOA	3754	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS3490122140	UNK	UNK	WestVOA	2047	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS605020419	UNK	New	WestVOA	3770	QA Backup/Team
Autosampler	EST Analytical	Cent WS	CENTS276071712	UNK	New	WestVOA	3772	QA Backup/Team
Autosampler	EST Analytical	Centurion	CENT219110606	UNK	New	WestVOA	3756	QA Backup/Team
Autosampler	EST Analytical	Centurion	4.16E+11	UNK	New	WestVOA	3359	QA Backup/Team
Autosampler	EST Analytical	Centurion	CENT239072409	UNK	UNK	WestVOA	845	QA Backup/Team
Autosampler	EST Analytical	Centurion	CENTS220113006	UNK	UNK	WestVOA	821	QA Backup/Team
Autosampler	EST Analytical	Centurion WS	CENTS367050514	6/1/2014	UNK	WestVOA	2093	QA Backup/Team
AutoSampler	EST Analytical	EST Centurion	CENT480010317	1/1/2017	New	WestVOA	3079	QA Backup/Team
Autosampler	HP	18596B	3215A2800	UNK	UNK	WB SVOA	1442	QA Backup/Team
Autosampler	HP	G2614A	US81900879	UNK	UNK	WB SVOA	1128	QA Backup/Team
Autosampler	Tekmar	ASX-7200HR	121951A7200HR	12/1/2019	New	WestVOA	3802	QA Backup/Team
Autosampler	Teledyne Tekmar	Aquatek LVA	US21208005	9/1/2021	New	WestVOA	4273	QA Backup/Team
AutoSampler	THERMO	AS-DV PN#068888	170512365	UNK	New	WB Wet Chemistry	3353	QA Backup/Team
Autosampler (Lachat)	Hach	ASX-560	101952A560	12/27/2019	New	WB Wet Chemistry	3775	QA Backup/Team
Autosampler Controller	Agilent	7673	US71801886	UNK	UNK	WB SVOA	1065	QA Backup/Team
AutoSampler Pump	Mantech	PC-1000-75	MT-1H3-267	10/22/2013	New	WB Wet Chemistry	2257	QA Backup/Team
Autosampler Tray	Agilent	G4514A	CN14100106	8/18/2014	New	WB SVOA	2123	QA Backup/Team
Autosampler/Purge&Trap	Tekmar	Atomx XYZ	US20014001	12/1/2019	New	WestVOA	3794	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Autosampler/Purge&Trap	Teledyne Tekmar	Atomx XYZ	US18065019	5/8/2018	New	WestVOA	3773	QA Backup/Team
Autosampler/Purge&Trap	Teledyne Tekmar	Atomx XYZ	US21222017	9/1/2021	New	WestVOA	4277	QA Backup/Team
Auto-shaker	Glas-Col	099A VS5504T	407598	N/A	New	WB Organic Prep	986	QA Backup/Team
Auto-shaker	Glas-Col	099A VS5504T	407597	N/A	New	WB Organic Prep	3408	QA Backup/Team
Auto-shaker	Glas-Col	099A VS5504T	407596	N/A	New	WB Organic Prep	3407	QA Backup/Team
Auto-shaker	Glas-Col	099A VS5504T	11347043	N/A	New	WB Organic Prep	3386	QA Backup/Team
Balance	A&D	HR120	12330253	8/12/2011	New	WB Microbiology	1001	QA Backup/Team
Balance	AND	GF-2000	UNK	UNK	New	WB Organic Prep	3061	QA Backup/Team
Balance	AnD	GF2002A	T2105461	1/7/2021	New	WB Login	4040	QA Backup/Team
Balance	AND	GF-2002A	UNK	UNK	New	WB Organic Prep	4289	QA Backup/Team
Balance	AND	GF-2002A	UNK	UNK	New	WB Organic Prep	4851	QA Backup/Team
Balance	AND	GF-2002A	UNK	UNK	New	WB Organic Prep	4857	QA Backup/Team
Balance	AND	GF-2002AN	UNK	UNK	New	WB Organic Prep	4856	QA Backup/Team
Balance	Mettler Toledo	30133522	C130219766	9/3/2021	New	WB Wet Chemistry	4267	QA Backup/Team
Balance	Mettler Toledo	30133522	C130219767	9/3/2021	New	WB Wet Chemistry	4268	QA Backup/Team
Balance	Mettler Toledo	AE 200	H23588	UNK	UNK	WB SVOA	242	QA Backup/Team
Balance	Mettler Toledo	AX205	1125430398	11/2/2004	UNK	WB Wet Chemistry	732	QA Backup/Team
Balance	Mettler Toledo	ML104	B145441300	2/28/2012	New	WB Login	1798	QA Backup/Team
Balance	Mettler Toledo	MS104TS/00	1100496882	UNK	New	WB Wet Chemistry	3707	QA Backup/Team
Balance	Mettler Toledo	MS104TS/00	b923778218	UNK	New	WB Wet Chemistry	3708	QA Backup/Team
Balance	Mettler Toledo	UNK	UNK	UNK	Used	WB Organic Prep	4637	QA Backup/Team
Balance	Ohaus	EP214	J2621126341952	9/19/2005	Used	WB Microbiology	2003	QA Backup/Team
Balance	Ohaus	EX223	BO33261336	7/1/2012	UNK	WestVOA	1871	QA Backup/Team
Balance	Ohaus	SP-202	B424698330	10/23/2014	UNK	WestVOA	2392	QA Backup/Team
Balance	VWR	1002E	12132021032	12/1/2022	New	WB Wet Chemistry	4833	QA Backup/Team
Balance	VWR	VWR-123P	6232017223	UNK	New	WB Wet Chemistry	3383	QA Backup/Team
Balance	VWR	VWR-500P	12252015398	6/2/2016	New	WB Wet Chemistry	3094	QA Backup/Team
Balance	VWR	VWR-500P	6152015336	3/20/2018	New	WestVOA	3363	QA Backup/Team
Balance	VWR	VWR-500P Balance	7282022110	6/15/2023	New	WB Login	4423	QA Backup/Team
Barometer	Control Company	15551-024	130739731	UNK	UNK	WB Wet Chemistry	2266	QA Backup/Team
Barometer	VWR	10510-922	170391456	UNK	UNK	WB Wet Chemistry	3286	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
BOD Analyzer	SEAL	ML1200	8694	8/22/2024	New	WB Microbiology	4714	QA Backup/Team
BOD Auto Sampler	Mantech	automax122	261H3N227	10/22/2013	New	WB Wet Chemistry	2255	QA Backup/Team
BOD Incubator	Fisher	ISO-Temp	94167062	UNK	UNK	WB Microbiology	481	QA Backup/Team
BOD Incubator	Sheldon	SRI20P	8046419	9/11/2019	New	WB Microbiology	3716	QA Backup/Team
BOD Incubator	VWR	2020	300795	4/24/1995	UNK	WB Microbiology	80	QA Backup/Team
BOD Incubator	VWR	414004-632	0411302125M008	4/1/2013	New	WB Microbiology	1933	QA Backup/Team
BOD Pump	ManSci	PC-1000-443	MT-1K6-220	UNK	UNK	WB Microbiology	QA Backup/Team	
BOD Pump	ManSci	PC-1000-443	MT-1K6-220	4/17/2015	New	WB Microbiology	3185	QA Backup/Team
BOD Pump	ManSci	PC-1000-443	MT-1H3-177	7/28/2014	New	WB Microbiology	3186	QA Backup/Team
Chiller	Buchi	F-108	997813	10/6/2013	New	WB Organic Prep	2026	QA Backup/Team
Chiller	Buchi	F-108	997613	10/10/2013	New	WB Organic Prep	3736	QA Backup/Team
Chiller	Buchi	F-108	10006176655	8/13/2014	New	WB Organic Prep	2127	QA Backup/Team
Chiller	Buchi	F-108	1000172485	8/13/2014	New	WB Organic Prep	3737	QA Backup/Team
Chiller	Buchi	F-108	1000200054	6/19/2015	New	WB Organic Prep	2293	QA Backup/Team
Chiller	Buchi	F-308	1636816	1/1/2019	New	WB Organic Prep	3690	QA Backup/Team
Chiller	Neslab	M-33	103357029	UNK	UNK	WB Wet Chemistry	1185	QA Backup/Team
Chiller	Neslab	M75	102128080	UNK	UNK	WB Wet Chemistry	1225	QA Backup/Team
Chiller	VWR	1172	614617	UNK	UNK	WB Wet Chemistry	1211	QA Backup/Team
Chiller	VWR	1177MD	107700434	UNK	UNK	WB Wet Chemistry	1230	QA Backup/Team
Chiller	VWR	1177PD	5L12A0727	10/19/2012	New	WB Organic Prep	3735	QA Backup/Team
Chiller	WKL	1000	LWG47304-0012	UNK	UNK	WB Wet Chemistry	1193	QA Backup/Team
Chiller	Buchi	F-108	UNK	UNK	UNK	WB Organic Prep	4713	QA Backup/Team
Chiller	Buchi	F-108	UNK	UNK	UNK	WB Organic Prep	4718	QA Backup/Team
Chiller	Buchi	F-108	UNK	UNK	UNK	WB Organic Prep	4427	QA Backup/Team
Chiller	VWR	1177PD	UNK	UNK	UNK	WB Organic Prep	3733	QA Backup/Team
Chiller	VWR	1177PD	6U1551245	UNK	UNK	WB Organic Prep	QA Backup/Team	
Chromatography Oven	Dionex	LC30	4120631	2/2/2005	UNK	WestVOA	747	QA Backup/Team
Cl Titrimeter-Amperometric	HACH	19299	9.81E+12	6/20/1905	UNK	WB Wet Chemistry	579	QA Backup/Team
COD Reactor	Environmental Express	B3000	2018CODW127	12/10/2018	New	WB Wet Chemistry	3491	QA Backup/Team
COD Reactor	HACH	45600	910404502	UNK	UNK	WB Microbiology	1227	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
COD Reactor	HACH	DRB-200	115261	Fall, 2006	UNK	WB Microbiology	807	QA Backup/Team
COD Reactor	HACH	LTG082	14100C0075	6/17/2015	New	WB Wet Chemistry	2298	QA Backup/Team
Colony Counter	Quebec	3330	UNK	UNK	UNK	WB Microbiology	1261	QA Backup/Team
Concentrator	Buchi	Q-101	1000176503	6/19/2015	New	WB Organic Prep	3388	QA Backup/Team
Concentrator	Buchi	Q-101	100170193	7/6/1905	New	WB Organic Prep	2002	QA Backup/Team
Concentrator	Buchi	Q-101	1000176504	7/6/1905	New	WB Organic Prep	3785	QA Backup/Team
Concentrator	Buchi	Q-101	1000149181	10/1/2013	New	WB Organic Prep	3387	QA Backup/Team
Concentrator	Buchi	Q-101	1000151471	10/9/2013	New	WB Organic Prep	2029	QA Backup/Team
Concentrator	Buchi	Q-101	1000153955	10/5/2013	New	WB Organic Prep	2025	QA Backup/Team
Concentrator	Buchi	Q-101	1000176507	8/13/2014	New	WB Organic Prep	3409	QA Backup/Team
Concentrator	Buchi	Q-101	1000176500	8/13/2014	New	WB Organic Prep	2128	QA Backup/Team
Concentrator	Buchi	Q-101	1000180892	1/1/2019	New	WB Organic Prep	3498	QA Backup/Team
Concentrator	EST Analytical	Encon	529112106	UNK	New	WestVOA	3764	QA Backup/Team
Concentrator	EST Analytical	Encon	559091207E	9/1/2007	UNK	WestVOA	846	QA Backup/Team
Concentrator	EST Analytical	Encon	560091207E	9/1/2007	UNK	WestVOA	847	QA Backup/Team
Concentrator	EST Analytical	ENCON	581013108	UNK	UNK	WestVOA	1035	QA Backup/Team
Concentrator	EST Analytical	Encon Evolution	EV24032410	UNK	UNK	WestVOA	1028	QA Backup/Team
Concentrator	EST Analytical	Encon Evolution	EV701092115	UNK	New	WestVOA	3778	QA Backup/Team
Concentrator	EST Analytical	Encon Evolution	EV375082911	UNK	UNK	WestVOA	3798	QA Backup/Team
Concentrator	EST Analytical	Encon Evolution	EV584060314	UNK	New	WestVOA	3765	QA Backup/Team
Concentrator	EST Analytical	Encon Evolution	EV218082009	UNK	UNK	WestVOA	1048	QA Backup/Team
Concentrator	EST Analytical	Encon Evolution	EV373080211	UNK	New	WestVOA	3761	QA Backup/Team
Concentrator	EST Analytical	Encon Evolution	EV250251410	UNK	UNK	WestVOA	1008	QA Backup/Team
Concentrator	EST Analytical	Encon Evolution	EV245040910	UNK	UNK	WestVOA	1021	QA Backup/Team
Concentrator	EST Analytical	Encon Evolution	EV429073112	UNK	New	WestVOA	3766	QA Backup/Team
Concentrator	EST Analytical	ENCON Evolution	EV516101713	10/1/2013	UNK	WestVOA	2035	QA Backup/Team
Concentrator	EST Analytical	Encon Evolution	EV737032416	UNK	New	WestVOA	3762	QA Backup/Team
Concentrator	EST Analytical	Encon Evolution	EV736032416	UNK	New	WestVOA	3763	QA Backup/Team
Concentrator	EST Analytical	Encon Evolution	EVX1038020419	UNK	UNK	WestVOA	3774	QA Backup/Team
Concentrator	EST Analytical	EV	EV952041018	4/1/2018	New	WestVOA	3377	QA Backup/Team
Conductivity Cell	Dionex	CD20	4120779	2/2/2005	UNK	WB SVOA	744	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Conductivity Meter	Corning	441	1262	11/1/1998	UNK	WB Wet Chemistry	471	QA Backup/Team
Conductivity Meter	Hanna Instruments	HI 9033	UNK	6/1/1996	UNK	WB Wet Chemistry	340	QA Backup/Team
Conductivity Meter		HI 99300	H0028302	UNK	New	WB Wet Chemistry	3084	QA Backup/Team
Controller	Buchi	V-855	1000129622	10/3/2013	New	WB Organic Prep	2023	QA Backup/Team
Controller	Buchi	V-855	1000144338	10/7/2013	New	WB Organic Prep	2027	QA Backup/Team
Controller	Buchi	V-855	1000144331	10/11/2013	New	WB Organic Prep	2031	QA Backup/Team
Controller	Buchi	V-855	1000171223	8/13/2014	New	WB Organic Prep	2125	QA Backup/Team
Controller	Buchi	V-855	1000174547	8/13/2014	New	WB Organic Prep	2129	QA Backup/Team
Controller	Buchi	V-855	1000202566	6/19/2015	New	WB Organic Prep	2292	QA Backup/Team
Controller	Horizon	3000	71403	UNK	UNK	WB Wet Chemistry	1209	QA Backup/Team
Controller	Horizon	1000/3000XL	1002	UNK	UNK	WB Wet Chemistry	1210	QA Backup/Team
Controller	Horizon	SPE-DEX 3000	71398	UNK	UNK	WB Wet Chemistry	1323	QA Backup/Team
Controller	V&P Scientific Inc	KBMB	710332	8/14/2012	New	WB Wet Chemistry	1926	QA Backup/Team
Controller (PID)	OI Analytical	4430	C142530284	UNK	UNK	WestVOA	3768	QA Backup/Team
Controller (PID)	OI Analytical	4430	UNK	UNK	UNK	WestVOA	1037	QA Backup/Team
Controller (PID)	OI Analytical	4430	C234530245	UNK	UNK	WestVOA	3769	QA Backup/Team
Controller (PID)	OI Analytical	4430	UNK	UNK	UNK	WestVOA	1034	QA Backup/Team
Datalogger	Dickson	DWE	16462703	3/20/2022	New	WB Login	4581	QA Backup/Team
Datalogger	Dickson	DWE	16456788	3/20/2022	New	WB Login	4582	QA Backup/Team
Datalogger	Dickson	DWE	16456796	3/20/2022	New	WB Login	4583	QA Backup/Team
Datalogger	Dickson	DWE	16461534	3/20/2022	New	WB Organic Prep	4584	QA Backup/Team
Datalogger	Dickson	DWE	16461470	3/20/2022	New	WB Organic Prep	4585	QA Backup/Team
Datalogger	Dickson	DWE	16456784	3/20/2022	New	WB Organic Prep	4586	QA Backup/Team
Datalogger	Dickson	DWE	16461447	3/20/2022	New	WB Organic Prep	4587	QA Backup/Team
Datalogger	Dickson	DWE	16461383	3/20/2022	New	WB Organic Prep	4588	QA Backup/Team
Datalogger	Dickson	DWE	16462549	3/20/2022	New	WB Organic Prep	4589	QA Backup/Team
Datalogger	Dickson	DWE	16461446	3/20/2022	New	WB Wet Chemistry	4611	QA Backup/Team
Datalogger	Dickson	DWE	16461405	3/20/2022	New	WB Wet Chemistry	4612	QA Backup/Team
Datalogger	Dickson	DWE	16462516	3/20/2022	New	WB Wet Chemistry	4613	QA Backup/Team
Datalogger	Dickson	DWE	16461546	3/20/2022	New	WB Wet Chemistry	4614	QA Backup/Team
Datalogger	Dickson	DWE	16456759	3/20/2022	New	WB Wet Chemistry	4615	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Datalogger	Dickson	DWE	16462550	3/20/2022	New	WB Wet Chemistry	4616	QA Backup/Team
Datalogger	Dickson	DWE	16462443	3/20/2022	New	WB Wet Chemistry	4617	QA Backup/Team
Datalogger	Dickson	DWE	16456792	3/20/2022	New	WB Wet Chemistry	4618	QA Backup/Team
Datalogger	Dickson	DWE	16462437	3/20/2022	New	WB Wet Chemistry	4619	QA Backup/Team
Datalogger	Dickson	DWE	16462558	3/20/2022	New	WB Wet Chemistry	4620	QA Backup/Team
Datalogger	Dickson	DWE	16462767	3/20/2022	New	WB Wet Chemistry	4621	QA Backup/Team
Datalogger	Dickson	DWE	16462770	3/20/2022	New	WB Wet Chemistry	4607	QA Backup/Team
Datalogger	Dickson	DWE	16462494	3/20/2022	New	WB Wet Chemistry	4622	QA Backup/Team
Datalogger	Dickson	DWE	16462440	3/20/2022	New	WB Wet Chemistry	4623	QA Backup/Team
Datalogger	Dickson	DWE	16462455	3/20/2022	New	WB Wet Chemistry	4624	QA Backup/Team
Datalogger	Dickson	DWE	16462612	3/20/2022	New	WB Wet Chemistry	4625	QA Backup/Team
Datalogger	Dickson	DWE	16462585	3/20/2022	New	WB Wet Chemistry	4631	QA Backup/Team
Datalogger	Dickson	DWE	16461388	3/20/2022	New	WB Wet Chemistry	4610	QA Backup/Team
Datalogger	Dickson	DWE	16456797	3/20/2022	New	WB Wet Chemistry	4609	QA Backup/Team
Datalogger	Dickson	DWE	16461541	3/20/2022	New	WB Wet Chemistry	4608	QA Backup/Team
Datalogger	Dickson	DWE	16456784	3/20/2022	New	WB Wet Chemistry	4627	QA Backup/Team
Datalogger	Dickson	DWE	16462602	3/20/2022	New	WB Wet Chemistry	4634	QA Backup/Team
Datalogger	Dickson	DWE	16461398	3/20/2022	New	WB Wet Chemistry	4633	QA Backup/Team
Datalogger	Dickson	DWE	16462541	3/20/2022	New	WB Wet Chemistry	4632	QA Backup/Team
Datalogger	Dickson	DWE	16461522	3/20/2022	New	WB Wet Chemistry	4626	QA Backup/Team
Datalogger	Dickson	DWE	16461424	3/20/2022	New	WB SVOA	4591	QA Backup/Team
Datalogger	Dickson	DWE	16461464	3/20/2022	New	WB SVOA	4592	QA Backup/Team
Datalogger	Dickson	DWE	16462534	3/20/2022	New	WB SVOA	4593	QA Backup/Team
Datalogger	Dickson	DWE	16461483	3/20/2022	New	WB SVOA	4594	QA Backup/Team
Datalogger	Dickson	DWE	16461509	3/20/2022	New	WestVOA	4595	QA Backup/Team
Datalogger	Dickson	DWE	16461497	3/20/2022	New	WestVOA	4596	QA Backup/Team
Datalogger	Dickson	DWE	16462595	3/20/2022	New	WestVOA	4597	QA Backup/Team
Datalogger	Dickson	DWE	16462717	3/20/2022	New	WestVOA	4598	QA Backup/Team
Datalogger	Dickson	DWE	16461495	3/20/2022	New	WestVOA	4599	QA Backup/Team
Datalogger	Dickson	TWE	16374979	3/20/2022	New	WB Login	4601	QA Backup/Team
Datalogger	Dickson	TWE	16374958	3/20/2022	New	WB Login	4602	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Datalogger	Dickson	TWE	16375067	3/20/2022	New	WB Organic Prep	4603	QA Backup/Team
Datalogger	Dickson	TWE	16374353	3/20/2022	New	WB Organic Prep	4590	QA Backup/Team
Datalogger	Dickson	TWE	16375259	3/20/2022	New	WestVOA	4604	QA Backup/Team
Datalogger	Dickson	TWE	16375268	3/20/2022	New	WestVOA	4606	QA Backup/Team
Datalogger	Dickson	TWE	16374897	3/20/2022	New	WestVOA	4605	QA Backup/Team
Dessicator	Boekel	Sm Stainless	None	UNK	UNK	WB Wet Chemistry	1215	QA Backup/Team
Dessicator	Boekel	Sm Stainless	None	UNK	UNK	WB Wet Chemistry	1215	QA Backup/Team
Dessicator	Fisher	Old Stainless	None	UNK	UNK	WB Wet Chemistry	1164	QA Backup/Team
Dessicator	Fisher	Old Stainless	None	UNK	UNK	WB Wet Chemistry	1165	QA Backup/Team
Dessicator	Fisher	Sm Stainless	None	N/A	N/A	WB Organic Prep	1246	QA Backup/Team
Dessicator	Sanplatec	DryKeeper	None	N/A	N/A	WB Organic Prep	1248	QA Backup/Team
Dessicator	Sanplatec	DryKeeper	None	UNK	UNK	WB Wet Chemistry	1206	QA Backup/Team
Dessicator	Terra Universal	1911-26A	1911-26A11885811	UNK	UNK	WB Wet Chemistry	1161	QA Backup/Team
Digestion Block	Environmental Express	SC151	UNK	1/1/2019	New	WB Wet Chemistry	3724	QA Backup/Team
Diluter	Lachat	2900-000	2000-361	2/1/1997	UNK	WB Wet Chemistry	401	QA Backup/Team
Discrete Analyzer	Seal	AQ2	90856	2/19/2013	New	WB Wet Chemistry	1932	QA Backup/Team
Discrete Analyzer	SEAL	AQ400	341247	UNK	New	WB Wet Chemistry	4290	QA Backup/Team
Dishwasher	Labconco	4420431	191084550G	12/30/2019	New	WB Organic Prep	3747	QA Backup/Team
Dishwasher	Labconco	4420431	191287365G	2/5/2020	New	WB Organic Prep	3814	QA Backup/Team
Dishwasher	Miele	G7783	12/53084579	UNK	UNK	WB Wet Chemistry	1194	QA Backup/Team
Dishwasher	Miele	G7783	44/074359852	7/2/2012	UNK	WB Wet Chemistry	1927	QA Backup/Team
Dishwasher	UNK	UNK	UNK	UNK	UNK	WB Wet Chemistry	1200	QA Backup/Team
Distillation Block	Environmental Express	EMD1920-106	2245	12/21/2024	New	WB Wet Chemistry	3948	QA Backup/Team
Distillation Block	Environmental Express	EMD1920-107	2244	12/21/2024	New	WB Wet Chemistry	3949	QA Backup/Team
Distillation System MIDI	Andrews	110-10-R	A1V10062	UNK	UNK	WB Wet Chemistry	1185	QA Backup/Team
Distillation System MIDI	Andrews	110-10-R	A6R0209	10/6/1996	UNK	WB Wet Chemistry	1187	QA Backup/Team
Distillation System MIDI	Andrews	110-10-R	Unknown	UNK	UNK	WB Wet Chemistry	1195	QA Backup/Team
Distillation System MIDI	Andrews	110-10-R	Unknown	UNK	UNK	WB Wet Chemistry	1196	QA Backup/Team
Distillation System MIDI	UNK	Unknown	Unknown	1996	UNK	WB Wet Chemistry	1188	QA Backup/Team
Distillation Unit	Environmental Express	7100-1320-107	2033	6/23/1905	UNK	WB Wet Chemistry	694	QA Backup/Team
Distillation Unit	Environmental Express	emd1920-106	2395	1/3/2020	New	WB Wet Chemistry	3730	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Distillation Unit	Environmental Express	EMD-1920-106	2308	2/4/2013	New	WB Wet Chemistry	1925	QA Backup/Team
Distillation Unit	Environmental Express	EMD-1920-106	2309	2/4/2013	New	WB Wet Chemistry	1924	QA Backup/Team
Distillation Unit	Environmental Express	UNK	9378	1/1/2019	New	WB Wet Chemistry	3726	QA Backup/Team
Distillation Unit	Environmental Express	UNK	2384	1/1/2109	New	WB Wet Chemistry	3727	QA Backup/Team
Distillation Unit	Foss	2100	520026801	UNK	UNK	WB Wet Chemistry	1179	QA Backup/Team
Distillation Unit	Glastron	emd1920-106	2331	6/1/2014	UNK	WB Wet Chemistry	2143	QA Backup/Team
Distillation Unit	Kjeltec	8100	91712470	10/11/2011	UNK	WB Wet Chemistry	1922	QA Backup/Team
Distillation Unit	Kjeltec	2200	44021	12/1/1997	UNK	WB Wet Chemistry	399	QA Backup/Team
DO Meter	YSI	5000	97F0722AC	UNK	UNK	WB Microbiology	669	QA Backup/Team
DO Meter	YSI	5100-115	13D100734	10/22/2013	New	WB Wet Chemistry	2256	QA Backup/Team
Eluent Generator	Dionex	EG50	5010177	2/2/2005	UNK	WB SVOA	746	QA Backup/Team
Flash Tester	Koehler	K16200	R07002918B	1/27/2011	UNK	WB Wet Chemistry	1930	QA Backup/Team
Florisil System	Supelco	None	None	N/A	N/A	WB Organic Prep	999	QA Backup/Team
Florisil System	Supelco	None	None	N/A	N/A	WB Organic Prep	996	QA Backup/Team
Fluke Thermometer	Fluke	52 II	57130039MV	10/25/2022	New	West QA	4834	WEST QA
Fluoride Meter	Hanna	HI5222	F0022641	3/27/2017	New	WB Wet Chemistry	3128	QA Backup/Team
Freezer	Beverage Air	HF2-1S	11803668	9/29/2017	UNK	WB Login	3294	QA Backup/Team
Freezer	Beverage Air	HF2-1S	13005852	7/16/2019	New	WB Login	3710	QA Backup/Team
Freezer	Beverage Air	HF2-1S	11803668	UNK	New	WestVOA	3294	QA Backup/Team
Freezer	Electrolux Home Products Inc	FGCH25M8L W1	WB32046880	UNK	Used	WB Login	4262	QA Backup/Team
Freezer	Horizon	AFV-20	VWR-WB83460777-1810	10/23/2018	New	WB Login	3083	QA Backup/Team
Freezer	Kenmore	235.2104241	WB3758093	UNK	New	WB Login	3731	QA Backup/Team
Freezer	Kenmore	253.2104241	WB62354772	7/18/2016	New	WestVOA	3099	QA Backup/Team
Freezer	Kenmore	Unknown	Unknown	UNK	Used	WestVOA	2069	QA Backup/Team
Freezer	NorthLAke Scientific	LF141WWW/0HC	NLS-8A10336552-2105	5/26/221	New	WestVOA	4049	QA Backup/Team
Freezer	Sears	253.2104241	WB61755744	61/16	New	WestVOA	3096	QA Backup/Team
Freezer	ThermoScientific	ULT430A	1.12E+15	10/31/2019	New	WestVOA	3722	QA Backup/Team
Freezer	VWR	AFV-14	VWR-WB85059039-1901	1/8/2019	New	WestVOA	3495	QA Backup/Team
Freezer	VWR	AFV-17	VWR-WB72553667-1710	New	WB SVOA	3296	QA Backup/Team	

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Freezer	VWR	HCUCFS-0420	VWR-041905161153-1908	11/15/2019	New	WB Login	3721	QA Backup/Team
Freezer	TRUE	T-23F	1-3454087	UNK	UNK	WestVOA	1058	QA Backup/Team
Gas Chromatograph	Agilent	8890	US2125A063	9/1/2021	New	WestVOA	4271	QA Backup/Team
Gas Chromatograph	Agilent	8890	US2125A060	9/1/2021	New	WestVOA	4275	QA Backup/Team
Gas Chromatograph	Agilent	8890	US2150A036	12/21/2024	New	WestVOA	4286	QA Backup/Team
GC	Agilent	6890	US10203098	8/1/2004	UNK	WB SVOA	1488	QA Backup/Team
GC	Agilent	6890	CN10439073	11/1/2004	UNK	WestVOA	716	QA Backup/Team
GC	Agilent	6890	US00029138	UNK	UNK	WestVOA	1102	QA Backup/Team
GC	Agilent	6890	US000034651	6/1/2003	UNK	WestVOA	710	QA Backup/Team
GC	Agilent	7890	CN11351196	9/1/2011	UnUsed	WestVOA	2015	QA Backup/Team
GC	Agilent	5977B	US18523035	UNK	New	WB SVOA	3701	QA Backup/Team
GC	Agilent	5977B	US1715R024	4/1/2017	New	WestVOA	3268	QA Backup/Team
GC	Agilent	6890N	US10203095	2-Mar	UNK	WB SVOA	677	QA Backup/Team
GC	Agilent	6890N	CN10525090	5-Sep	UNK	WB SVOA	837	QA Backup/Team
GC	Agilent	6890N	US10128056	1-Jul	UNK	WB SVOA	663	QA Backup/Team
GC	Agilent	6890N	US10137101	UNK	UNK	WB SVOA	1068	QA Backup/Team
GC	Agilent	6890N	CN10625123	UNK	UNK	WB SVOA	1084	QA Backup/Team
GC	Agilent	6890N	US 10641076	4/1/2007	UNK	WB SVOA	824	QA Backup/Team
GC	Agilent	6890N	CN10413083	4-May	UNK	WB SVOA	718	QA Backup/Team
GC	Agilent	6890N	CN10444076	3/15/2005	UNK	WestVOA	737	QA Backup/Team
GC	Agilent	6890N	CN10433067	11/1/2004	UNK	WestVOA	714	QA Backup/Team
GC	Agilent	6890N	CN10733012	9/1/2007	UNK	WestVOA	844	QA Backup/Team
GC	Agilent	6890N	US10143049	1/1/2003	UNK	WestVOA	693	QA Backup/Team
GC	Agilent	6890N (G1530N)	CN10413009	4-Feb	UNK	WB SVOA	750	QA Backup/Team
GC	Agilent	7890A	CN10842068	UNK	UNK	WB SVOA	1121	QA Backup/Team
GC	Agilent	7890A	CN10715071	8/1/2013	Used	WB SVOA	2006	QA Backup/Team
GC	Agilent	7890A	CN13411007	10/2/2013	New	WB SVOA	2033	QA Backup/Team
GC	Agilent	7890A	CN12471113	2014	UNK	WB SVOA	2334	QA Backup/Team
GC	Agilent	7890A	CN10021057	8/2/2010	New	WB SVOA	1133	QA Backup/Team
GC	Agilent	7890A	CN10261101	UNK	UNK	WB SVOA	1127	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
GC	Agilent	7890A	CN10803048	8-May	UNK	WB SVOA	852	QA Backup/Team
GC	Agilent	7890A	US10828037	UNK	UNK	WB SVOA	1140	QA Backup/Team
GC	Agilent	7890A	CN10181023	UNK	UNK	WB SVOA	1352	QA Backup/Team
GC	Agilent	7890A	CN10847125	6/5/2010	Used	WB SVOA	1407	QA Backup/Team
GC	Agilent	7890A	CN10511068	UNK	UNK	WB SVOA	1073	QA Backup/Team
GC	Agilent	7890A	CN10341144	10/1/2012	UNK	WB SVOA	1375	QA Backup/Team
GC	Agilent	7890A	CN10221049	UNK	UNK	WB SVOA	1444	QA Backup/Team
GC	Agilent	7890A	CN10031123	UNK	UNK	WB SVOA	1416	QA Backup/Team
GC	Agilent	7890A	CB10804039	4/1/2008	UNK	WestVOA	834	QA Backup/Team
GC	Agilent	7890A	CN10031129	UNK	UNK	WestVOA	1026	QA Backup/Team
GC	Agilent	7890A	CN11311129	UNK	UNK	WestVOA	1033	QA Backup/Team
GC	Agilent	7890A	CN10181119	1/1/2011	Used	WestVOA	1047	QA Backup/Team
GC	Agilent	7890A	CN10051030	Spring 2010	UNK	WestVOA	1006	QA Backup/Team
GC	Agilent	7890A	CN10843110	UNK	UNK	WestVOA	1018	QA Backup/Team
GC	Agilent	7890A	CN10521070	UNK	Used	WestVOA	1390	QA Backup/Team
GC	Agilent	7890A	CN10391176	UNK	UNK	WestVOA	1356	QA Backup/Team
GC	Agilent	7890A	CN10141099	5/1/2010	New	WestVOA	1402	QA Backup/Team
GC	Agilent	7890B	CN13443026	5/14/2014	UNK	WB SVOA	2088	QA Backup/Team
GC	Agilent	7890B	CN15483113	UNK	New	WB SVOA	3071	QA Backup/Team
GC	Agilent	7890B	CN17123159	UNK	New	WB SVOA	3218	QA Backup/Team
GC	Agilent	7890B	CN18233173	UNK	New	WB SVOA	3418	QA Backup/Team
GC	Agilent	7890B	US19363002	8/27/2019	New	WB SVOA	3713	QA Backup/Team
GC	Agilent	7890B	CN15283138	UNK	UNK	WB SVOA	2312	QA Backup/Team
GC	Agilent	7890B	CN15443075	UNK	UNK	WB SVOA	3068	QA Backup/Team
GC	Agilent	7890B	CN15483138	UNK	New	WB SVOA	3702	QA Backup/Team
GC	Agilent	7890B	CN13523172	5/1/2014	UNK	WB SVOA	2084	QA Backup/Team
GC	Agilent	7890B	CN13503187	7/1/2014	UNK	WB SVOA	2102	QA Backup/Team
GC	Agilent	7890B	CN18023166	UNK	UNK	WB SVOA	3698	QA Backup/Team
GC	Agilent	7890B	US19523001	19-Dec	New	WB SVOA	3789	QA Backup/Team
GC	Agilent	7890B	us16453037	11/1/2016	UNK	WB SVOA	3116	QA Backup/Team
GC	Agilent	7890B	CN17123083	UNK	UNK	WB SVOA	3215	QA Backup/Team

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GC	Agilent	7890B	CN13463132	1/1/2014	UNK	WestVOA	2045	QA Backup/Team
GC	Agilent	7890B	CN14703033	6/1/2014	UNK	WestVOA	2095	QA Backup/Team
GC	Agilent	7890B	CN15143068	9/1/2015	UNK	WestVOA	2310	QA Backup/Team
GC	Agilent	7890B	CN16503164	1/1/2017	New	WestVOA	3184	QA Backup/Team
GC	Agilent	7890b	CN17493168	12/1/2018	New	WestVOA	3695	QA Backup/Team
GC	Agilent	7890B	CN19513025	12/1/2019	New	WestVOA	3792	QA Backup/Team
GC	Agilent	7890B (G3442B)	CN16123112	UNK	New	WB SVOA	3100	QA Backup/Team
GC	Agilent	7890B (G3442B)	cn16293097	UNK	New	WB SVOA	3108	QA Backup/Team
GC	Agilent	7890B (G3442B)	cn16293093	UNK	New	WB SVOA	3104	QA Backup/Team
GC	Agilent	7890B/G3442 B	CN15483138	UNK	New	WestVOA	3063	QA Backup/Team
GC	Agilent	7890B/G3442 B	CN17513094	4/1/2018	New	WestVOA	3375	QA Backup/Team
GC	Agilent	G1530N	CN10528088	10/10/2005	UNK	WB SVOA	766	QA Backup/Team
GC	Agilent	G1530N	CN10528089	10/10/2005	UNK	WB SVOA	765	QA Backup/Team
GC	Agilent	G3442B	CN16293093	UNK	UNK	WB SVOA	3104	QA Backup/Team
GC	HP	6890	US00029050	11/1/1999	UNK	WestVOA	3795	QA Backup/Team
GC	HP	6890N	US10151112	2-Jun	UNK	WB SVOA	692	QA Backup/Team
GC	HP	6890N	US10225135	5/1/2003	UNK	WestVOA	689	QA Backup/Team
GC	HP	G1530A	US00008152	6/5/1997	UNK	WB SVOA	366	QA Backup/Team
GC	HP	HP 6890 series	US00020499	May-98	UNK	WB SVOA	423	QA Backup/Team
GC	HP	HP6890 series	US00021266	Jun-98	UNK	WB SVOA	452	QA Backup/Team
GC	HP	HP6890 Series	US00032120	4/1/2000	UNK	WestVOA	3797	QA Backup/Team
GC	Agilent	7890B	CN14173019	8/18/2014	New	WB SVOA	3717	QA Backup/Team
GC	Agilent	7890A	CN10371137	UNK	UNK	WB SVOA	1115	QA Backup/Team
GC Fan	Zip Scientific	GC Chaser	UNK	7-Feb	UNK	WB SVOA	814	QA Backup/Team
GC Fan	Zip Scientific	GC Chaser	1215545	UNK	UNK	WB SVOA	1063	QA Backup/Team
GC Fan	Zip Scientific	GC Chaser	UNK	7-Jan	UNK	WB SVOA	812	QA Backup/Team
GC Fan	Zip Scientific	GC Chaser	1215526	UNK	UNK	WB SVOA	1147	QA Backup/Team
GC Fan	Zip Scientific	GC Chaser	1215525	4/1/2008	UNK	WestVOA	835	QA Backup/Team
GC Fan	Zip Scientific	GC Chaser	1215524	4/1/2008	UNK	WestVOA	836	QA Backup/Team
GC Fan	Zip Scientific	GC Chaser	1215576	UNK	UNK	WestVOA	1057	QA Backup/Team
Gilson Frac Unit	Gilson	GX274	261M8N261	12/19/2018	New	WB Organic Prep	3691	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Gilson Frac Unit	Gilson	GX274 Aspec	261A6N021	12/1/2016	New	WB Organic Prep	3273	QA Backup/Team
Gilson Pump	Gilson	Verity 4260	641B6Q013	N/A	N/A	WB Organic Prep	3275	QA Backup/Team
Gilson Pump	Gilson	Verity 4260	641B6Q012	N/A	N/A	WB Organic Prep	3274	QA Backup/Team
Gilson Pump	Gilson	Verity 4260	641L8Q098	12/19/2018	New	WB Organic Prep	3692	QA Backup/Team
Gilson Pump	Gilson	Verity 4260	641L8Q099	12/19/2018	New	WB Organic Prep	3693	QA Backup/Team
Grinding Mill	IKA Works	T25BS1	3026403	UNK	UNK	WB Wet Chemistry	157	QA Backup/Team
Headspace Concentrator/sampler	Teledyne tekmar	HT3	US15016001	UNK	New	WestVOA	3751	QA Backup/Team
Headspace Concentrator/sampler	Teledyne tekmar	HT3	US1512004	UNK	New	WestVOA	3751	QA Backup/Team
Headspace Concentrator/sampler	Teledyne tekmar	HT3	US16074007	UNK	New	WestVOA	3748	QA Backup/Team
Headspace Concentrator/sampler	Teledyne tekmar	HT3	US16074007	UNK	New	WestVOA	3749	QA Backup/Team
Headspace Concentrator/sampler	Teledyne tekmar	HT3	US18096003	4/1/2018	New	WestVOA	3799	QA Backup/Team
Headspace Concentrator/sampler	Teledyne tekmar	HT3	US19114002	UNK	New	WestVOA	3750	QA Backup/Team
Heat Block, Digital	VWR	UNK	None	UNK	UNK	WestVOA	1012	QA Backup/Team
Helium Manifold	Concoa	5267-133-57-590	05301LAT	2005	UNK	WB SVOA	779	QA Backup/Team
Hood-Benchtop	Captairflex	M481	Enc1008731	3/8/2016	New	WB Login	2340	QA Backup/Team
Hood-Benchtop HEPA	Labconco	398032	080383851C	UNK	UNK	WB Login	1212	QA Backup/Team
Hot Block	Environmental Express	SC154	8462CECW3635	UNK	UNK	WB Wet Chemistry	3264	QA Backup/Team
Hot Block Controller	V&P Scientific	VP 710 Series	710806	1/1/2019	New	WB Wet Chemistry	3723	QA Backup/Team
Hot Block/Stir Plate	Environmental Express	SC 151	7021CECW3334	8/14/2012	UNK	WB Wet Chemistry	1928	QA Backup/Team
Hot Plate	Barnstead	HP46225	2.37E+11	N/A	N/A	WB Organic Prep	3840	QA Backup/Team
Hot Plate	Barnstead	HP46225	2878307	UNK	UNK	WB Wet Chemistry	1171	QA Backup/Team
Hot Plate	Barnstead	HP47135	6.12E+11	UNK	UNK	WB Wet Chemistry	1172	QA Backup/Team
Hot Plate	Thermo Scientific	HPA2240MQ	C1707150619208	N/A	New	WB Organic Prep	3399	QA Backup/Team
Hot Plate	Thermo Scientific	HPA2240MQ	C1707150411634	N/A	New	WB Organic Prep	3397	QA Backup/Team
Hot Plate	Thermo Scientific	HPA2240MQ	C1707150411637	N/A	New	WB Organic Prep	2301	QA Backup/Team
Hot Plate	Thermo Scientific	HPA2240MQ	C1707150619205	N/A	New	WB Organic Prep	2302	QA Backup/Team
Hot Plate	Thermo Scientific	HPA4440M	C1707140203963	4/2/2014	New	WB Organic Prep	2078	QA Backup/Team
Hot Plate	Thermolyne	Cinarec2	UNK	UNK	UNK	WB Wet Chemistry	1175	QA Backup/Team

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HotPlate/Stir	Barnstead	Multi-magnastir 1268				WB Wet Chemistry	1174	QA Backup/Team
HotPlate/Stir	Barnstead	Multi-magnastir 1288R	0902-1079	UNK	UNK	WB Wet Chemistry	1173	QA Backup/Team
HotPlate/Stir	Corning	PC-320	unknown	UNK	UNK	WB Wet Chemistry	1184	QA Backup/Team
HotPlate/Stir	Corning	PC-520	3010478	UNK	UNK	WB Wet Chemistry	1183	QA Backup/Team
HotPlate/Stir	Lab-Line	Pyro Multi-magnastir	1.66E+12	UNK	UNK	WB Wet Chemistry	1170	QA Backup/Team
HotPlate/Stir	VWR	12620-986	70206006	UNK	UNK	WB Wet Chemistry	1176	QA Backup/Team
HotPlate/Stir	VWR	12620-986	70206002	UNK	UNK	WB Wet Chemistry	1177	QA Backup/Team
HotPlate/Stir	VWR	12620-986	70206005	UNK	UNK	WB Wet Chemistry	1178	QA Backup/Team
HPLC	Shimadzu	LC-2030C-3D	L21455300850	5/12/2014	New	WB Wet Chemistry	3124	QA Backup/Team
Hydrogen Generator	PARKER	H2PEMD-1300-100	15PLD5036	4/1/2015	New	WB SVOA	2276	QA Backup/Team
Hydrogen Generator	Parker	H2PEMPD-1300-100	15PLD5035	4/1/2015	New	WB SVOA	2277	QA Backup/Team
Ice Machine	Scotsman	CME806AS-32F	6.02E+12	8/20/2006	UNK	WB Login	790	QA Backup/Team
Incubator	Barnstead	120	1.46E+12	UNK	UNK	WB Wet Chemistry	1221	QA Backup/Team
Incubator	Fisher	650D	412N0382	5/2/2005	UNK	WB Wet Chemistry	742	QA Backup/Team
Incubator	ShelLab	SRI20P	5010117	5/5/2017	New	WB Wet Chemistry	3265	QA Backup/Team
Incubator	ShelLab	SRI20P	1003218	UNK	New	WB Microbiology	3299	QA Backup/Team
Incubator	Thermo Electron Corp.	6LM	102711	4/1/2006	UNK	WB Microbiology	789	QA Backup/Team
Incubator	VWR	2005	9003704	11/2/2004	UNK	WB Wet Chemistry	731	QA Backup/Team
Incubator	VWR Sheldon	1545	1011505	5/2/2005	UNK	WB Microbiology	741	QA Backup/Team
Interface Module	Mantech	Automax 122	MT-1H3-205	10/22/2013	New	WB Wet Chemistry	2258	QA Backup/Team
Ion Chromatograph	Thermo	22153-60315 Dionex HPLC	17070793	UNK	New	WB Wet Chemistry	3352	QA Backup/Team
Ionization Gauge Controller	Agilent	59864B	US6010073	UNK	UNK	WB SVOA	1062	QA Backup/Team
Ionization Gauge Controller	Agilent	59864B	US60101846	UNK	UNK	WB SVOA	1067	QA Backup/Team
Ionization Gauge Controller	HP	59864A	UNK	UNK	UNK	WestVOA	534	QA Backup/Team
IR Gun	Omega	OS542	141008955	UNK	UNK	WB Login	3088	QA Backup/Team
Kiln	Paragon DTC 100	TNF823	283662	UNK	UNK	WB Wet Chemistry	276	QA Backup/Team
Kiln	Select Fire	ex 270sf	7385	6/1/2019	N/A	WB Organic Prep	3123	QA Backup/Team
Lachat	HACH	Quickchem QC8500 Series 2	1.91E+11	12/27/2019	New	WB Wet Chemistry	3777	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Lachat Analyzer	Lachat	Quick Chem 8500 Series 2	90300001086	4/30/2009	UNK	WB Wet Chemistry	865	QA Backup/Team
Lachat Analyzer	Lachat	Quickchem QC8500 Series 2	1.40E+11	5/28/2014	New	WB Wet Chemistry	2114	QA Backup/Team
Lachat Autosampler	Lachat	ASX-520	031445A520	5/28/2014	New	WB Wet Chemistry	2113	QA Backup/Team
Lachat Autosampler	Lachat	ASX-520 series	90300001856	4/30/2009	UNK	WB Wet Chemistry	864	QA Backup/Team
Lachat Diluter	Lachat	PDS 200	90300000509	4/30/2009	UNK	WB Wet Chemistry	867	QA Backup/Team
Lachat Diluter	Lachat	PDS 200	1.41E+11	5/28/2014	New	WB Wet Chemistry	2115	QA Backup/Team
Lachat Pump	Lachat	ISM1135	A82000-3058	5/28/2014	New	WB Wet Chemistry	2112	QA Backup/Team
LC/MS/MS	ABI/Sciex	API-2000	B7590411	2/2/2005	UNK	WB SVOA	743	QA Backup/Team
Line Voltage Transformer	SCIEX	14179	117255104	UNK	UNK	WB SVOA	1095	QA Backup/Team
Mass Spectrometer	Agilent	5977B	US2131R033	9/1/2021	New	WestVOA	4272	QA Backup/Team
Mass Spectrometer	Agilent	5977B	US2131R022	9/1/2021	New	WestVOA	4276	QA Backup/Team
Mass Spectrometer	Agilent	5977b	US2144R051	12/21/2024	New	WestVOA	4285	QA Backup/Team
Microscope	Fisher	Stereomaster Z 5	1891	UNK	UNK	WB Microbiology	137	QA Backup/Team
Microwave	CEM	91900	1891421	10/1/2012	New	WB Organic Prep	1887	QA Backup/Team
Microwave	CEM	910900	MJ2060	N/A	N/A	WB Organic Prep	3611	QA Backup/Team
Microwave	CEM	910900	MJ6008	4/15/2015	New	WB Organic Prep	4041	QA Backup/Team
Microwave	CEM	Mars 6	MJ 9687	12/26/2018	New	WB Organic Prep	3085	QA Backup/Team
Microwave	CEM	Mars 6	AC1020	8/29/2019	New	WB Organic Prep	3711	QA Backup/Team
Microwave	CEM	R907501	MD4731	10/28/2016	N/A	WB Organic Prep	3115	QA Backup/Team
MS	Agilent	5973	US10461505	UNK	UNK	WB SVOA	1069	QA Backup/Team
MS	Agilent	5973	US43110455	3/15/2005	UNK	WestVOA	738	QA Backup/Team
MS	Agilent	5973	US43110414	11/1/2004	UNK	WestVOA	715	QA Backup/Team
MS	Agilent	5973	US90160009	6/1/2003	UNK	WestVOA	711	QA Backup/Team
MS	Agilent	5975	US52420453	5-Sep	UNK	WB SVOA	838	QA Backup/Team
MS	Agilent	5973 Network	BN30464483	2-Mar	UNK	WB SVOA	679	QA Backup/Team
MS	Agilent	5973N	US10451041	1-Jul	UNK	WB SVOA	664	QA Backup/Team
MS	Agilent	5975C	US11023714	UNK	UNK	WB SVOA	1074	QA Backup/Team
MS	Agilent	5975C	US10373606	9/14/2010	UNK	WB SVOA	1376	QA Backup/Team
MS	Agilent	5975C	US10213435	UNK	UNK	WB SVOA	1445	QA Backup/Team
MS	Agilent	5975C	US10223405	UNK	UNK	WB SVOA	1417	QA Backup/Team

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MS	Agilent	5975C	US11093732	UNK	UNK	WB SVOA	1371	QA Backup/Team
MS	Agilent	5975C	US80818631	4/1/2008	UNK	WestVOA	833	QA Backup/Team
MS	Agilent	5975C	US10033003	UNK	UNK	WestVOA	1027	QA Backup/Team
MS	Agilent	5975C	US71215997	9/1/2007	UNK	WestVOA	843	QA Backup/Team
MS	Agilent	5975C	US10113007	6/7/2010	UNK	WestVOA	1046	QA Backup/Team
MS	Agilent	5975C	US10133009	Spring 2010	New	WestVOA	1005	QA Backup/Team
MS	Agilent	5975C	US83110164	UNK	UNK	WestVOA	1019	QA Backup/Team
MS	Agilent	5975C	US11093709	UNK	Used	WestVOA	1391	QA Backup/Team
MS	Agilent	5975C	US10393819	UNK	UNK	WestVOA	1357	QA Backup/Team
MS	Agilent	5975C	US10163303	5/10/2024	New	WestVOA	1403	QA Backup/Team
MS	Agilent	5977A	US1410L222	5/1/2014	UNK	WB SVOA	2085	QA Backup/Team
MS	Agilent	5977A	US1419L202	7/1/2014	UNK	WB SVOA	2101	QA Backup/Team
MS	Agilent	5977A	US139L217	1/1/2014	UNK	WestVOA	2046	QA Backup/Team
MS	Agilent	5977A	US14118L211	6/1/2014	UNK	WestVOA	2096	QA Backup/Team
MS	Agilent	5977B	US1850R041	UNK	UNK	WB SVOA	3699	QA Backup/Team
MS	Agilent	5977B	US1850R037	12/1/2018	New	WestVOA	3696	QA Backup/Team
MS	Agilent	5977B/G7081B	US1952R015	19-Dec	New	WB SVOA	3790	QA Backup/Team
MS	Agilent	5977B/G7081B	US1609R019	UNK	New	WestVOA	3062	QA Backup/Team
MS	Agilent	5977B/G7081B	US1814R010	4/1/2018	New	WestVOA	3376	QA Backup/Team
MS	Agilent	5977B/G7081B	US1952R008	12/1/2019	New	WestVOA	3793	QA Backup/Team
MS	Agilent	G3170A	US65115053	UNK	UNK	WB SVOA	825	QA Backup/Team
MS	Agilent	G7077B	CN2+25M013	UNK	New	WB SVOA	3105	QA Backup/Team
MS	Agilent	G7077B	us1630r005	UNK	New	WB SVOA	3109	QA Backup/Team
MS	Agilent	G7077B	us1630r007	UNK	New	WB SVOA	3105	QA Backup/Team
MS	HP	5973	US80221319	May-98	UNK	WB SVOA	424	QA Backup/Team
MS	HP	5973	US92522665	11/1/1999	UNK	WestVOA	3796	QA Backup/Team
MS	HP	G1098A	US71410498	6/5/1997	UNK	WB SVOA	367	QA Backup/Team
MS	Agilent	5977A	US1426l317	8/18/2012	New	WB SVOA	2120	QA Backup/Team
MS	Agilent	5977A	US1513423	9/1/2015	UNK	WestVOA	2311	QA Backup/Team
MS	Agilent	7890B	CN17083153	4/1/2017	New	WestVOA	3269	QA Backup/Team
MS	Agilent	Agilent MS 5977B	US1701R001	1/1/2017	New	WestVOA	3077	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Muffle Furnace	Thermolyne	Type 6000	1.06E+12	12/1/1999	UNK	WB Wet Chemistry	621	QA Backup/Team
Orbital Shaker	Lab-Line	3627	0402-6479	5/1/2003	UNK	WB Wet Chemistry	769	QA Backup/Team
Oven	Fisher	6925	610666-291	UNK	UNK	WB Wet Chemistry	1888	QA Backup/Team
Oven	Fisher	3510FS	1.88E+12	UNK	UNK	WB Login	1213	QA Backup/Team
Oven	Fisher	655G	109982 or 11000174	UNK	UNK	WB Wet Chemistry	1162	QA Backup/Team
Oven	Fisher	Iso-Temp 655G	UNK	UNK	UNK	WestVOA	541	QA Backup/Team
Oven	Fisher	655F	90400206	UNK	UNK	WB Wet Chemistry	1166	QA Backup/Team
Oven	ShelLab	SMO28-2	5014617	6/8/2017	New	WB Wet Chemistry	3266	QA Backup/Team
Oven	VWR	1690	3015012	11/16/2015	New	WB Login	2332	QA Backup/Team
Oven	VWR	1350GM	3059606	5/1/2006	UNK	WB Wet Chemistry	811	QA Backup/Team
Oven	VWR	1370F	700698	UNK	UNK	WB Wet Chemistry	1163	QA Backup/Team
Oven	VWR	89511-404	41854416	3/8/2016	New	WB Organic Prep	2336	QA Backup/Team
Oven	VWR Sheldon	1680	7064804	11/1/2004	UNK	WB Wet Chemistry	728	QA Backup/Team
pH Meter	Hanna	HI 5521	F0022641	UNK	New	WB Wet Chemistry	3128	QA Backup/Team
pH Meter	Hanna	HI5521-01	3130023991	11/26/2018	New	WB Organic Prep	3086	QA Backup/Team
pH Meter	Hanna Instruments	HI 5521	F0011343	10/30/2015	New	WB Wet Chemistry	2329	QA Backup/Team
pH Meter	Hanna Instruments	HI2002-01	C0322019	UNK	New	WB Wet Chemistry	3267	QA Backup/Team
pH Meter	Hanna Instruments	HI2002-01	CO813071	12/21/2024	New	WB Wet Chemistry	3947	QA Backup/Team
pH Meter	Hanna Instruments	HI2020-01	C051079	UNK	New	WB Wet Chemistry	3705	QA Backup/Team
pH Meter	Hanna Instruments	Hl2002-01	CO3261C3	5/2/2017	New	WestVOA	3219	QA Backup/Team
pH Meter	Hanna Insturments	H198128	7390442121	UNK	New	WB Wet Chemistry	4288	QA Backup/Team
pH Meter	Orion	940	RT89A	UNK	UNK	WB Wet Chemistry	675	QA Backup/Team
pH Meter	Orion	210A+	21847	9/1/2005	UNK	WB Wet Chemistry	761	QA Backup/Team
pH Meter	Orion	555A	17857	4/1/2005	UNK	WB Wet Chemistry	810	QA Backup/Team
pH/Conductivity Meter	Oakton	35413-00	2918627	1/8/2020	New	WB Wet Chemistry	3746	QA Backup/Team
Pump	Buchi	V-700	1000143237	10/4/2013	New	WB Organic Prep	2024	QA Backup/Team
Pump	Buchi	V-700	1000153942	10/8/2013	New	WB Organic Prep	2028	QA Backup/Team
Pump	Buchi	V-700	1000153941	10/12/2013	New	WB Organic Prep	2032	QA Backup/Team
Pump	Buchi	V-700	1000175456	8/13/2014	New	WB Organic Prep	2126	QA Backup/Team
Pump	Buchi	V-700	1000176883	8/13/2014	New	WB Organic Prep	2130	QA Backup/Team
Pump	Buchi	V-700	1000204369	6/19/2015	New	WB Organic Prep	2294	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Pump	Cole-Palmer	07522-20	F17005271	UNK	New	WestVOA	3760	QA Backup/Team
Pump	Pfeiffer	DUO 2.5, PDK41062G	22033282	4/1/2017	New	WestVOA	3271	QA Backup/Team
Pump (Lachat)	HACH	12Ch PVD-115V	W19005570	12/27/2019	New	WB Wet Chemistry	3776	QA Backup/Team
Purge & Trap Concentrator	EST Analytical	Centurion	CENTS496033117	4/1/2017	New	WestVOA	3272	QA Backup/Team
Purge & Trap Concentrator	EST Analytical	Encon Evolution	EV550012214	1/1/2014	UNK	WestVOA	2048	QA Backup/Team
Purge & Trap Concentrator	EST Analytical	Encon Evolution	EV574050514	6/1/2014	UNK	WestVOA	2094	QA Backup/Team
Purge & Trap Concentrator	EST Analytical	Encon Evolution	EV585060314	9/1/2015	UNK	WestVOA	2309	QA Backup/Team
Purge & Trap Concentrator	EST Analytical	Encon Evolution	EV829033117	4/1/2017	New	WestVOA	3270	QA Backup/Team
Purge & Trap Concentrator	EST Analytical	EST Evolution	EV804010317	1/1/2017	New	WestVOA	3078	QA Backup/Team
Purge & Trap Concentrator	EST/PTS Analytical, Inc.	Encon Evolution	EV376091911	9/1/2011	UnUsed	WestVOA	2014	QA Backup/Team
Purge & Trap Concentrator	Tekmar	Lumin	US19361008	12/1/2019	New	WestVOA	3801	QA Backup/Team
Purge and trap concentrator	EST Analytical	Evolution	4.16E+11	UNK	New	WestVOA	3358	QA Backup/Team
Purge and trap concentrator	Teledyne Tekmar	Lumin	US21222005	9/1/2021	New	WestVOA	4274	QA Backup/Team
QA Reference weight set	Rice Lake		2305	3/14/2024	New	West QA	2305	WEST QA
QuantiTray Sealer	IDEXX	89-20894-04	05267-08-023	4/10/2013	New	WB Wet Chemistry	2261	QA Backup/Team
Refrigerator	Asber	ARMD 49	8101980025	6/3/2021	New	WB Login	4261	QA Backup/Team
Refrigerator	Asber	AWRR-23F	8102136498	4/16/2021	New	WB Wet Chemistry	4046	QA Backup/Team
Refrigerator	Avanti	ARBC17T2PG	A58101911781862800068	3/4/2019	New	WB Organic Prep	3697	QA Backup/Team
Refrigerator	Avanti	ARBC17T2PG	A58101911781852900050	N/A	New	WB Organic Prep	3706	QA Backup/Team
Refrigerator	Beverage Air	LV45-1-B	9503809	UNK	UNK	WB Login	1252	QA Backup/Team
Refrigerator	Beverage Air	LV45-1-B	9702500	UNK	Used	WB Login	1597	QA Backup/Team
Refrigerator	Beverage Air	LV45-1-B-LED		4/24/2024	New	WB Login	2271	QA Backup/Team
Refrigerator	Beverage Air	LV45-1-B-LED	11602214	8/20/2015	New	WB Login	2303	QA Backup/Team
Refrigerator	Beverage Air	LV45-1-W	9705029	5/6/2011	New	WB Login	1256	QA Backup/Team
Refrigerator	Beverage Air	LV45-1-W	9803502	6/22/2011	New	WB Login	1052	QA Backup/Team
Refrigerator	Beverage Air	LV45-1-W	9410518	UNK	Used	WB Login	1596	QA Backup/Team
Refrigerator	Beverage Air	LV45-1-W	9803502	UNK	UNK	WestVOA	1052	QA Backup/Team
Refrigerator	Beverage Air	LV45-1-W-LED	12104441	5/15/2017	New	WB Login	3732	QA Backup/Team
Refrigerator	Beverage Air	LV45HC-1-Wq	12402812	9/18/2017	New	WB Login	3292	QA Backup/Team
Refrigerator	Blue Air	BKGM49-HC	KGM49-HC-V11-0548	6/3/2021	New	WB Login	4260	QA Backup/Team
Refrigerator	Della	048-GM-48313	1805000096	7/27/2018	New	WB Wet Chemistry	3419	QA Backup/Team

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Refrigerator	Frigidaire	EFMIS9000	A2203420230001879	9/22/2024	New	WB Organic Prep	4716	QA Backup/Team
Refrigerator	Frigidaire	EFMIS9000	A2202412030000042	9/22/2024	New	WB Organic Prep	4717	QA Backup/Team
Refrigerator	Frigidaire	FRU17B2JW20	WA01002558	UNK	UNK	WB Microbiology	1222	QA Backup/Team
Refrigerator	Haier	HRC2736BWB	HH647591	UNK	UNK	WB Wet Chemistry	3412	QA Backup/Team
Refrigerator	Haier	HRC2736BWB	HH647657	UNK	UNK	WB Wet Chemistry	3413	QA Backup/Team
Refrigerator	Haier	HRC2736BWB	FH638434	UNK	UNK	WB Wet Chemistry	3414	QA Backup/Team
Refrigerator	Kenmore	106.762494	ET2516230	11/6/2024	UNK	WestVOA	1595	QA Backup/Team
Refrigerator	Kenmore	253-60722007	WA93700459	1/7/2010	New	WB Microbiology	1224	QA Backup/Team
Refrigerator	Kenmore	795-73259300	305MR00109	UNK	UNK	WB SVOA	1145	QA Backup/Team
Refrigerator	Kenmore	unknown	unknown	UNK	UNK	WB Wet Chemistry	1167	QA Backup/Team
Refrigerator	Kenmore	unknown	unknown	1/1/2001	UNK	WB Microbiology	1223	QA Backup/Team
Refrigerator	Powers	BS103GD	B033878	N/A	N/A	WB Organic Prep	1235	QA Backup/Team
Refrigerator	Powers	BS103GD4	B050961	4/1/2005	N/A	WB Organic Prep	735	QA Backup/Team
Refrigerator	Powers	BS33SD	D947046	UNK	UNK	WestVOA	297	QA Backup/Team
Refrigerator	Powers	BS33SD	C946508	UNK	UNK	WestVOA	299	QA Backup/Team
Refrigerator	Sears	253-67189504	4A63621623	UNK	UNK	WB Wet Chemistry	1167	QA Backup/Team
Refrigerator	True Refrigeration	GDM-45	6880875	UNK	Used	WB Login	1595	QA Backup/Team
Refrigerator/Freezer	Frigidaire	FFTR1814QW9B	A7121956	4/24/2017	New	WestVOA	3211	QA Backup/Team
Refrigerator/Freezer	VWR	scrf-20a	vwr-4a74903508-1805	New	WB SVOA	3374	QA Backup/Team	
RO Generator	Evoqua	MFXR21003A	1615580	3/1/2017	New	WB Wet Chemistry	3260	QA Backup/Team
RPM Meter	Monarch	TACH-4A	1133816	UNK	New	West QA	751	WEST QA
Sensor and Stir Control	ManTech	Automax122	MT-1H3-161	UNK	New	WB Wet Chemistry	2260	QA Backup/Team
Shaker/Incubator	Lab-Line	3627	0402-6479	UNK	UNK	WB Wet Chemistry	769	QA Backup/Team
Solid Phase Extractor	Horizon	3000XL	72088	UNK	UNK	WB Wet Chemistry	1208	QA Backup/Team
Solid Phase Extractor	Horizon	3000XL	72087	UNK	UNK	WB Wet Chemistry	1207	QA Backup/Team
Solid Phase Extractor	Horizon	SPE-DEX 3000XL	13-1926	6/3/2013	New	WB Wet Chemistry	2010	QA Backup/Team
Solid Phase Extractor Controller	Horizon	Oil & Grease Controller	13-1340	6/3/2013	New	WB Wet Chemistry	2009	QA Backup/Team
Solvent Evaporation System	Horizon	SpeedVap II 9000	99-167	6/1/2024	UNK	WB Wet Chemistry	668	QA Backup/Team
Solvent Evaporation System	Horizon	SpeedVapIII	456002	UNK	UNK	WB Wet Chemistry	1173	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Solvent Evaporator	Organimation	406	57409	N/A	N/A	WB Organic Prep	3080	QA Backup/Team
Solvent Evaporator	Organimation	406	57968	N/A	N/A	WB Organic Prep	3081	QA Backup/Team
Solvent Evaporator	Organimation	16169	62481	N/A	N/A	WB Organic Prep	3415	QA Backup/Team
Solvent Evaporator	Organimation	OA-Sys	61619	N/A	N/A	WB Organic Prep	3279	QA Backup/Team
Solvent Evaporator	Organomation	13165	63969	7/16/2021	New	WB Organic Prep	4266	QA Backup/Team
Solvent Evaporator	Organomation	14169	58990	5/1/2013	New	WB Organic Prep	3369	QA Backup/Team
Solvent Evaporator	Organomation	14169	58371	5/2/2013	New	WB Organic Prep	3372	QA Backup/Team
Solvent Evaporator	Organomation	14169	58376	5/1/2013	New	WB Organic Prep	3368	QA Backup/Team
Solvent Evaporator	Organomation	14169	58374	5/1/2013	New	WB Organic Prep	3743	QA Backup/Team
Solvent Evaporator	Organomation	14169	58372	5/1/2013	New	WB Organic Prep	3373	QA Backup/Team
Solvent Evaporator	Organomation	16165	64428	3/1/2022	New	WB Organic Prep	4291	QA Backup/Team
Solvent Evaporator	Organomation	N/A	57183	N/A	N/A	WB Organic Prep	3739	QA Backup/Team
Solvent Evaporator	Organomation	N-EVAP 112	57409	4/15/2012	New	WB Organic Prep	1913	QA Backup/Team
Solvent Evaporator	Organomation	N-EVAP 116	57318	11/1/1997	N/A	WB Organic Prep	3361	QA Backup/Team
Solvent Evaporator	Organomation	N-EVAP 116	54344	N/A	N/A	WB Organic Prep	1912	QA Backup/Team
Sonicator	Qsonica	Q500	71932AD+11-12	11/30/2012	New	WB Organic Prep	3393	QA Backup/Team
Sonicator	BRANSON	M1800	BGA081823140B	10/19/2018	New	WB SVOA	3497	QA Backup/Team
Spectrophotometer	HACH	DR/2000	900409085	2/19/2016	Used	WB Wet Chemistry	2338	QA Backup/Team
Spectrophotometer	HACH	DR/2000 Direct Read	9.61E+11	UNK	UNK	WB Wet Chemistry	482	QA Backup/Team
Spectrophotometer	Spectronic	Genesys 5	3Volatiles141004	12/18/1998	UNK	WB Wet Chemistry	472	QA Backup/Team
Spectrophotometer	Thermo Scientific	G10S UV-VIS	2L6S254202	11/17/2014	New	WB Wet Chemistry	3350	QA Backup/Team
Spectrophotometer	Thermo Scientific	Genesys 50	9A3Y2500056	12/16/2020	New	WB Wet Chemistry	4265	QA Backup/Team
Spectrophotometer	Thermofisher Scientific	G10s UV-VIS	2L5T315224	11/19/2015	New	WB Wet Chemistry	2328	QA Backup/Team
Speed Vap	Horizon	Speed Vap 3	07-0651	7/7/2007		WB Wet Chemistry	1929	QA Backup/Team
Stir Plate	VWR	MultiStir 9	160421001	4/28/2016	New	WB Organic Prep	2339	QA Backup/Team
Stirbase for Hotblock	Environmental Express	SC100	2016Stir100	1/1/2019	New	WB Wet Chemistry	3725	QA Backup/Team
TCLP Tumbler	Analytical Testing Corp.	DC-20B Rotary Agitator	N/A	9/8/2011	New	WB Wet Chemistry	1004	QA Backup/Team
TCLP Tumbler	Associated Design	3740-12-BRE	None	UNK	UNK	WestVOA	1014	QA Backup/Team
TCLP Tumbler	Dayton	None	None	UNK	UNK	WestVOA	1016	QA Backup/Team
TCLP/SPLP Tumbler	Environmental Express	LE1002	39564698003	2/19/2014	New	WB Organic Prep	2074	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
TCLP/SPLP Tumbler	Environmental Express	LE1002	39564698010	2/19/2014	New	WB Organic Prep	2073	QA Backup/Team
TCLP/SPLP Tumbler	Environmental Express	LE1002	39564698007	2/19/2014	New	WB Organic Prep	2072	QA Backup/Team
TCLP/SPLP Tumbler	Environmental Express	LE1002	39564698001	2/19/2014	New	WB Organic Prep	2071	QA Backup/Team
TCLP/SPLP Tumbler	N/A	N/A	N/A	N/A	N/A	WB Organic Prep	2049	QA Backup/Team
TCLP/SPLP Tumbler	N/A	N/A	N/A	N/A	N/A	WB Organic Prep	2058	QA Backup/Team
TCLP/SPLP Tumbler	N/A	N/A	N/A	N/A	N/A	WB Organic Prep	2059	QA Backup/Team
TCLP/SPLP Tumbler	N/A	N/A	N/A	N/A	N/A	WB Organic Prep	2060	QA Backup/Team
TCLP/SPLP Tumbler	N/A	N/A	N/A	N/A	N/A	WB Organic Prep	2050	QA Backup/Team
TCLP/SPLP Tumbler	N/A	N/A	N/A	N/A	N/A	WB Organic Prep	2051	QA Backup/Team
TCLP/SPLP Tumbler	N/A	N/A	N/A	N/A	N/A	WB Organic Prep	2052	QA Backup/Team
TCLP/SPLP Tumbler	N/A	N/A	N/A	N/A	N/A	WB Organic Prep	2053	QA Backup/Team
TCLP/SPLP Tumbler	N/A	N/A	N/A	N/A	N/A	WB Organic Prep	2054	QA Backup/Team
TCLP/SPLP Tumbler	N/A	N/A	N/A	N/A	N/A	WB Organic Prep	2055	QA Backup/Team
TCLP/SPLP Tumbler	N/A	N/A	N/A	N/A	N/A	WB Organic Prep	2056	QA Backup/Team
TCLP/SPLP Tumbler	N/A	N/A	N/A	N/A	N/A	WB Organic Prep	2057	QA Backup/Team
TCN Distillation Unit Blue	Galstron	Midi-Dist	2357	?	?	WB Wet Chemistry	3229	QA Backup/Team
Teactor	Gerhardt	Vapodest 20S	1/7370 13 0004	12/11/2015	New	WB Wet Chemistry	3187	QA Backup/Team
Thermocouple Reader	Control Company	127U00	36313	6/4/2015	New	WB Wet Chemistry	2286	QA Backup/Team
Thermometer	Klein Tools	unknown	N/A	unknown	New	WB Login	4913	QA Backup/Team
Thermometer	Klein Tools	unknown	N/A	unknown	New	WB Login	4914	QA Backup/Team
Thermometer	Omega	OS542	141008955	5/15/2015	New	WB Login	3088	QA Backup/Team
Thermometer	Omega	OS542	140409823		New	WB Login	3492	QA Backup/Team
Thermometer	Omega	OS542	121205819	8/29/2013	New	WB Wet Chemistry	2109	QA Backup/Team
Titration Rinse Pump	Mantech	TitraRinse/ A Module Automax 122	MT-1H3-504	10/22/2013	New	WB Wet Chemistry	2259	QA Backup/Team
Titrator	HACH		9.90E+11			WB Wet Chemistry	1203	QA Backup/Team
Titrator	Mettler Toledo	T70	B526103250	8/1/2015	New	WB Wet Chemistry	2316	QA Backup/Team
Titrator Control	Mettler Toledo	N/A	B526103250	8/1/2015	New	WB Wet Chemistry	2318	QA Backup/Team
Titrator Dosing Unit	Mettler Toledo	Dosing Unit	B522989237	8/1/2015	New	WB Wet Chemistry	2317	QA Backup/Team
Titrator Dosing Unit	Mettler Toledo	N/A	B522989237	8/1/2015	New	WB Wet Chemistry	2317	QA Backup/Team
TOC Analyzer	Shimadzu	TOC-V WP	638-91116-42	5/1/2016	New	WB Wet Chemistry	3093	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
TOC Analyzer	Shimadzu	TOC-VWP	H51714700045NK			WB Wet Chemistry	1219	QA Backup/Team
TOC Analyzer	Shimadzu	TOC-VWP	H51725700382	3/1/2020	New	WB Wet Chemistry	3816	QA Backup/Team
TOC Analyzer	Shimadzu	TOC-VWP	H51725900648 NK	2/17/2022	New	WB Wet Chemistry	4292	QA Backup/Team
TOC Autosampler	Shimadzu	ASI-V	H52125200085 SA	9/22/2015	UNK	WB Wet Chemistry	3126	QA Backup/Team
TOC Autosampler	Shimadzu	ASI-V	H52104804040125A	UNK	UNK	WB Wet Chemistry	1220	QA Backup/Team
TOC Autosampler	Shimadzu	ASI-V	H52125700445	3/1/2020	New	WB Wet Chemistry	3817	QA Backup/Team
Tower	Agilent	7683B	UNK	UNK	UNK	WB SVOA	3779	QA Backup/Team
Tower	Agilent	7683B	CN70238232	UNK	UNK	WB SVOA	1131	QA Backup/Team
Tower	Agilent	7683B	CN82450119	UNK	UNK	WB SVOA	2007	QA Backup/Team
Tower	Agilent	7683B	CN53427173	UNK	UNK	WB SVOA	1116	QA Backup/Team
Tower	Agilent	7683B	CN84653785	UNK	UNK	WB SVOA	1354	QA Backup/Team
Tower	Agilent	7683B	CN71940440	UNK	UNK	WB SVOA	1507	QA Backup/Team
Tower	Agilent	7693A	CN19310024	8/27/2019	New	WB SVOA	3715	QA Backup/Team
Tower	Agilent	CAN'T SEE	CAN'T SEE	UNK	UNK	WB SVOA	1130	QA Backup/Team
Tower	Agilent	G2613A	US12419330	UNK	UNK	WB SVOA	1129	QA Backup/Team
Tower	Agilent	G2613A	CN42437240	UNK	UNK	WB SVOA	1490	QA Backup/Team
Tower	Agilent	G2613A	CN54128256	UNK	UNK	WB SVOA	1119	QA Backup/Team
Tower	Agilent	G2613A	US11618650	UNK	UNK	WB SVOA	1081	QA Backup/Team
Tower	Agilent	G2613A	US41121685	UNK	UNK	WB SVOA	1059	QA Backup/Team
Tower	Agilent	G2613A	CN23326700	UNK	UNK	WB SVOA	3357	QA Backup/Team
Tower	Agilent	G2613A	CN42537313	UNK	UNK	WB SVOA	1472	QA Backup/Team
Tower	Agilent	G2613A	CN14222765	UNK	UNK	WB SVOA	1108	QA Backup/Team
Tower	Agilent	G2613A	CN22125486	UNK	UNK	WB SVOA	1109	QA Backup/Team
Tower	Agilent	G2613A	CN41536146	UNK	UNK	WB SVOA	1112	QA Backup/Team
Tower	Agilent	G2613A	CN14122490	UNK	UNK	WB SVOA	1367	QA Backup/Team
Tower	Agilent	G2613A	US12419337	UNK	UNK	WB SVOA	1117	QA Backup/Team
Tower	Agilent	G2913A	CN54128256	UNK	UNK	WB SVOA	1070	QA Backup/Team
Tower	Agilent	G2913A	CN85255133	UNK	UNK	WB SVOA	1139	QA Backup/Team
Tower	Agilent	G2913A	CN43920908	UNK	UNK	WB SVOA	1079	QA Backup/Team
Tower	Agilent	G2913A	CN84854097	UNK	UNK	WB SVOA	1100	QA Backup/Team
Tower	Agilent	G4513A	CN13040010	UNK	UNK	WB SVOA	1122	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Tower	Agilent	G4513A	CN10150101	UNK	UNK	WB SVOA	1404	QA Backup/Team
Tower	Agilent	G4513A	CN13470207	UNK	UNK	WB SVOA	2090	QA Backup/Team
Tower	Agilent	G4513A	CN12420101	UNK	UNK	WB SVOA	2133	QA Backup/Team
Tower	Agilent	G4513A	CN15420129	UNK	UNK	WB SVOA	3072	QA Backup/Team
Tower	Agilent	G4513A	CN17120046	UNK	UNK	WB SVOA	3217	QA Backup/Team
Tower	Agilent	G4513A	CN18120050	UNK	New	WB SVOA	3417	QA Backup/Team
Tower	Agilent	G4513A	CN17120043	UNK	New	WB SVOA	3214	QA Backup/Team
Tower	Agilent	G4513A	CN10240069	UNK	UNK	WB SVOA	1134	QA Backup/Team
Tower	Agilent	G4513A	CN10150014	UNK	UNK	WB SVOA	1408	QA Backup/Team
Tower	Agilent	G4513A	cn10240058	UNK	New	WB SVOA	3356	QA Backup/Team
Tower	Agilent	G4513A	CN10240056	UNK	UNK	WB SVOA	1125	QA Backup/Team
Tower	Agilent	G4513A	CN10240058	UNK	UNK	WB SVOA	1126	QA Backup/Team
Tower	Agilent	G4513A	CN10520150	UNK	UNK	WB SVOA	1392	QA Backup/Team
Tower	Agilent	G4513A	CN10020007	UNK	UNK	WB SVOA	1142	QA Backup/Team
Tower	Agilent	G4513A	cn10020011	UNK	New	WB SVOA	3345	QA Backup/Team
Tower	Agilent	G4513A	cn1015024	UNK	New	WB SVOA	3355	QA Backup/Team
Tower	Agilent	G4513A	CN10020014	UNK	UNK	WB SVOA	1141	QA Backup/Team
Tower	Agilent	G4513A	CN15110128	UNK	UNK	WB SVOA	2315	QA Backup/Team
Tower	Agilent	G4513A	CN15450269	UNK	UNK	WB SVOA	3069	QA Backup/Team
Tower	Agilent	G4513A	CN15450270	UNK	UNK	WB SVOA	3067	QA Backup/Team
Tower	Agilent	G4513A	CN18510067	UNK	New	WB SVOA	3703	QA Backup/Team
Tower	Agilent	G4513A	CN18510076	UNK	New	WB SVOA	3704	QA Backup/Team
Tower	Agilent	G4513A	CN15110120	6/30/2018	New	WB SVOA	2314	QA Backup/Team
Tower	Agilent	G4513A	cn16010036	UNK	New	WB SVOA	3103	QA Backup/Team
Tower	Agilent	G4513A	cn16230177	UNK	New	WB SVOA	3110	QA Backup/Team
Tower	Agilent	G4513A	CN16230177	UNK	UNK	WB SVOA	3110	QA Backup/Team
Tower	Agilent	G4513A	CN10310057	UNK	UNK	WB SVOA	1377	QA Backup/Team
Tower	Agilent	G4513A	CN10510119	UNK	UNK	WB SVOA	1372	QA Backup/Team
Tower	Agilent	G4513A	CN14290139	UNK	UNK	WB SVOA	3784	QA Backup/Team
Tower	Agilent	G4513A	CN16290215	UNK	UNK	WB SVOA	3119	QA Backup/Team
Tower	Agilent	G4513A	CN10020006	UNK	UNK	WB SVOA	1358	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Tower	Agilent	G4513A	CN14240243	8/18/2014	New	WB SVOA	2122	QA Backup/Team
Tower	Agilent	G4513A	CN10170067	UNK	New	WB SVOA	1446	QA Backup/Team
Tower	Agilent	G4513A	CN10170034	UNK	UNK	WB SVOA	1418	QA Backup/Team
Tower	Agilent	G4513A	CN14030252	UNK	UNK	WB SVOA	3783	QA Backup/Team
Tower	Agilent	G4513A	CN16290213	UNK	UNK	WB SVOA	3118	QA Backup/Team
Tower	Agilent	G4513A	CN17120044	UNK	UNK	WB SVOA	3213	QA Backup/Team
Tower	Agilent	G4513A	cn16320183	UNK	New	WB SVOA	3107	QA Backup/Team
Tower	Agilent	G4567A	CN19500018	19-Dec	New	WB SVOA	3791	QA Backup/Team
Tower	HP	7683	NA	UNK	UNK	WB SVOA	1113	QA Backup/Team
TOX-300 Analyzer	Mitsubishi Chemical Analytech	TOX-300	H0AA0064	3/1/2015	New	WB Wet Chemistry	2279	QA Backup/Team
Turbidimeter	HACH	2100AN	9.41E+11	UNK	UNK	WB Wet Chemistry	304	QA Backup/Team
Turbidimeter	HACH	at1122	00-0E-1C-04-8C-4C	2/5/2016	New	WB Wet Chemistry	3125	QA Backup/Team
Turbidimeter	HACH	HI83414	E0039034	11/26/2014	New	WB Wet Chemistry	3114	QA Backup/Team
Turbo Vap	Biotage	TurboVap II	TV1634N21603	N/A	N/A	WB Organic Prep	3113	QA Backup/Team
Turbo Vap	Biotage	TurboVap II	TV163421605	N/A	N/A	WB Organic Prep	3112	QA Backup/Team
UF GC Analyzer	Electronic Sensor Tech	7100	UNK	UNK	UNK	WestVOA	1011	QA Backup/Team
UV-lamp	Spectroline	Q-22S	281009	UNK	UNK	WB Microbiology	1262	QA Backup/Team
Vaccum Pump	Pfeiffer	pk d41 062 G	22046576	4/1/2018	New	WestVOA	3379	QA Backup/Team
Vacuum Pump	Buchi	V-300	10028595988	1/1/2019	New	WB Organic Prep	3499	QA Backup/Team
Vortexer	VWR	10153-838	151112045	4/14/2016	New	WestVOA	3067	QA Backup/Team
Vortexer	VWR	58816-121	110307051	N/A	N/A	WB Organic Prep	1268	QA Backup/Team
Vortexer	VWR	89399-880	151007001	UNK	New	WestVOA	2331	QA Backup/Team
Vortexer	VWR	89399-880	151007002	UNK	New	WestVOA	2330	QA Backup/Team
Vortexer	VWR	9453VWALUS	C206510378	1/1/2022	New	WB Organic Prep	4628	QA Backup/Team
Vortexer	VWR	9453VWALUS	C210803066	1/1/2022	New	WB Organic Prep	4629	QA Backup/Team
Vortexer	VWR	97043-564	N/A	10/1/2020	New	WB SVOA	3944	QA Backup/Team
Vortexer	VWR	G-560	2-128130	UNK	UNK	WB SVOA	1094	QA Backup/Team
Water Bath	Fisher	2335	117204-263	N/A	N/A	WB Organic Prep	3410	QA Backup/Team
Water Bath	Fisher	Iso Temp 205	411N 0901	8/1/2005	UNK	WB Wet Chemistry	756	QA Backup/Team
Water Bath	Precision	51221036	604021381	3/1/2004	UNK	WB Microbiology	696	QA Backup/Team
Water Bath	Precision	808	202176-109	UNK	UNK	WB Microbiology	2868	QA Backup/Team

Description	Manufacturer	Model	Serial Number	Date in Service	Condition	Location	Alpha Asset Tag	Location of Manual
Water Deionization System	Barnstead	Nanopure 2	8806030	UNK	UNK	WB Wet Chemistry	152	QA Backup/Team
Water Deionization System	Millipore	Milli-Q Direct-8	F2CIA76293B	4/27/2015	New	WestVOA	2272	QA Backup/Team
Water Treatment Controller	Walchem	W600Series WCN610PSNNN-NN	1501080475	1/19/2015	UNK	WB Wet Chemistry	2254	QA Backup/Team
WebAlert WA500 Series	Walchem	WA500-PNN	1501080523	1/19/2015	UNK	WB Wet Chemistry	2253	QA Backup/Team
ZHE Tumbler	Analytical Testing Corp	DC-20B/DC	N/A	UNK	New	WestVOA	3284	QA Backup/Team
ZHE Tumbler	Analytical Testing Corp	DC-20B/DC	N/A	UNK	New	WestVOA	3285	QA Backup/Team
ZHE Tumbler	Analytical Testing Corp	DC-20B/DC	N/A	UNK	New	WestVOA	3282	QA Backup/Team
ZHE Tumbler	Analytical Testing Corp	DC-20B/DC	N/A	UNK	New	WestVOA	3281	QA Backup/Team
ZHE Tumbler	Analytical Testing Corp	DC-20B/DC	N/A	UNK	New	WestVOA	3280	QA Backup/Team
ZHE Tumbler	Analytical Testing Corp	DC-20B/DC	N/A	UNK	New	WestVOA	3283	QA Backup/Team

7.5.2 PAS-MANS

Equipment List: PAS-MANS 320 Forbes Blvd. Mansfield, MA

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Location of Manual
Arsenic analyzer	PS Analytical	Millenium Excalibur 10.055	201	2/7/2007	New	MF Metals	1342	WB Tech
Autosampler	Agilent	7693	CN17040056	UNK	New	MF Forensics	3576	WB Tech
Autosampler	Agilent	G1530N	CN10652042	UNK	New	MF Forensics	1432	WB Tech
Autosampler	Agilent	G2614A	CN82549202	UNK	New	MF Forensics	3572	WB Tech
Autosampler	Agilent	G2614A	US82201034	UNK	New	MF Forensics	3573	WB Tech
Autosampler	Agilent	G2614A	CN92453237	UNK	New	MF Forensics	3577	WB Tech
Autosampler	Agilent	G4514A	R019500089	12/17/2019	New	MF Forensics	3788	WB Tech
Autosampler	Cetac	ASX-520	017566A520	UNK	New	MF Metals	3582	WB Tech
Autosampler	Cetac	ASX-520	031527A520	UNK	New	MF Metals	3583	WB Tech
Autosampler	Cetac	ASX-520	071276A520	UNK	New	MF Metals	3584	WB Tech
Autosampler	Cetac	ASX-520	120759A520	UNK	New	MF Metals	3585	WB Tech
Autosampler	Cetac	ASX-560	071736A560	UNK	New	MF Metals	3578	WB Tech
Autosampler	Cetac	ASX-560	121564A560	UNK	New	MF Metals	3579	WB Tech
Autosampler	Cetac	ASX-560	061917A560	UNK	New	MF Metals	3580	WB Tech
Autosampler	CETAC Technologies	ASX-520	1011121A120	UNK	New	MF Metals	4283	WB Tech
Autosampler	CETAC Technologies	ASX-520	041503A520	UNK	New	MF Metals	4284	WB Tech
Autosampler	PS Analytical	20.4	4703A11585	UNK	New	MF Metals	1340	WB Tech
Autosampler	SCIEX	ExionLC 2.0 Autosampler	FZC212510014	9/22/2024	New	MF EC	3870	WB Tech
Autosampler	Sciex	ExionLC 2.0 Autosampler	FZC213810002	22-Oct	New	MF EC	4642	WB Tech
Autosampler	SCIEX	ExionLC 2.0 Autosampler	FZC212510014	9/22/2024	New	MF EC	3870	WB Tech
Autosampler	Sciex	ExionLC 2.0 Autosampler	FZC213810002	22-Oct	New	MF EC	4642	WB Tech
Autosampler	SCIEX	ExionLC AD Autosampler	AB3AC5771320	12/5/2019	New	MF EC	3592	WB Tech
Autosampler	SCIEX	ExionLC AD Autosampler	AB3AC5771319	12/5/2019	New	MF EC	3598	WB Tech
Autosampler	SCIEX	ExionLC AD Autosampler	AB3AC5972606	12/21/2024	New	MF EC	4215	WB Tech
Autosampler	SCIEX	ExionLC AD Autosampler	AB3AC5972604	12/21/2024	New	MF EC	4210	WB Tech
Autosampler	SCIEX	ExionLC AD Autosampler	AB3AC5771320	12/5/2019	New	MF EC	3592	WB Tech
Autosampler	SCIEX	ExionLC AD Autosampler	AB3AC5771319	12/5/2019	New	MF EC	3598	WB Tech
Autosampler	SCIEX	ExionLC AD Autosampler	AB3AC5972606	12/21/2024	New	MF EC	4215	WB Tech
Autosampler	SCIEX	ExionLC AD Autosampler	AB3AC5972604	12/21/2024	New	MF EC	4210	WB Tech
Autosampler (LEAP)	CTC Analytics	GC PAL	1211847	5/1/1997	New	MF Forensics	1346	WB Tech

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Location of Manual
Autosampler Controller	Agilent	7673	US71301482	UNK	New	MF Forensics	1439	WB Tech
Autosampler Controller	Agilent	7673	A000064524	UNK	New	MF Forensics	1443	WB Tech
Autosampler Tower	Agilent	G4513A	CN14240243	8/18/2014	New	MF Forensics	2122	WB Tech
Autosampler Tray	Agilent	G4514A	CN14100106	8/18/2014	New	MF Forensics	2123	WB Tech
Balance	A&D	GF2000	T0337841	4/5/2013	New	MF Metals	1934	WB Tech
Balance	AND	GF1202A	T2108383	6/28/2021	New	MF EC	4017	WB Tech
Balance	AND	GF1202A	T2108383	6/28/2021	New	MF EC	4017	WB Tech
Balance	Mettler-Toledo	PB 302	1116383231	6/10/2011	New	MF EC	1907	WB Tech
Balance	Mettler-Toledo	PB 302	1116383231	6/10/2011	New	MF EC	1907	WB Tech
Balance	Ohaus	AX523	B748064593	3/7/2018	New	MF Metals	3173	WB Tech
Balance	Ohaus	AX523	B902049357	4/19/2024	New	MF Metals	3514	WB Tech
Balance	Ohaus	AX525	C101869817	4/19/2021	New	MF Metals	4013	WB Tech
Balance	Ohaus	SJX1502N/E	CO51719854	11/15/2021	New	MF Metals	4258	WB Tech
Balance	Ohaus	V11P3	20931060	5/7/2014	New	MF Metals	2079	WB Tech
Binary Pump	Sciex	ExionLC 2.0 Binary Pump	FBT215010002	10/1/2022	New	MF EC	4641	WB Tech
Binary Pump	Sciex	ExionLC 2.0 Binary Pump	FBT215010002	10/1/2022	New	MF EC	4641	WB Tech
Chiller	Neslab	Thermo 2500	1.27E+14	9/10/2014	New	MF Metals	2139	WB Tech
Chiller	Thermo Fisher Scientific	ThermoFlex 2500	111056013	UNK	New	MF Metals	1152	WB Tech
Chiller	Thermo Fisher Scientific	ThermoFlex 900	UNK	UNK	New	MF Metals	1157	WB Tech
Chiller	Thermo Scientific	1.01E+14	1.11E+14	UNK	New	MF EC	3486	WB Tech
Chiller	Thermo Scientific	1.01E+14	1.11E+14	UNK	New	MF EC	3486	WB Tech
Chiller	Thermo Scientific	Thermoflex 9000	1.17E+15	UNK	New	MF Metals	4298	WB Tech
Chiller	Thermo Scientific	Thermoflex 9000	1.17E+15	UNK	New	MF Metals	4299	WB Tech
Chiller	Thermo Scientific	Thermoflex 9000	1.21E+14	UNK	New	MF Metals	3860	WB Tech
Chiller	Thermo Scientific	Thermoflex 9000	1.28E+15	UNK	New	MF Metals	3861	WB Tech
Chiller	Thermo Scientific	Thermoflex 9000	1.12E+15	UNK	New	MF Metals	3862	WB Tech
Chiller	Thermo Scientific	Thermoflex 9000	1.17E+15	UNK	New	MF Metals	3863	WB Tech
Chiller	Thermo Scientific	Thermoflex 9000	1.11E+15	UNK	New	MF Metals	3864	WB Tech
Chiller	Thermo Scientific	Thermoflex 9000	1.17E+15	UNK	New	MF Metals	3865	WB Tech
CHNS/O Analyzer	Perkin Elmer	2400 Series II	241N8102003	6/1/2002	New	MF Metals	1328	WB Tech
Circulator	VWR	1177PD	108601065	UNK	New	MF Metals	1156	WB Tech
Clean Benches, Class 100	Atmos Tech Industries	EL222	4132	1/1/1993	New	MF Metals	1611	WB Tech

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Location of Manual
Clean Benches, Class 100	Laminire	LP-24	Unknown	1/1/1999	New	MF Metals	1613	WB Tech
Clean Benches, Class 100	Unknown	Unknown	Unknown	UNK	New	MF Metals	1612	WB Tech
Cleanup System	Miura	GO-6EHT	JP83260105-4	UNK	New	MF EC	3549	WB Tech
Cleanup System	Miura	GO-6EHT	JP83260105-4	UNK	New	MF EC	3549	WB Tech
Column Oven	SCIEX	ExionLC 2.0 column oven	FCC214510004	9/22/2024	New	MF EC	3871	WB Tech
Column Oven	Sciex	ExionLC 2.0 column oven	FCC214710010	10/1/2022	New	MF EC	3879	WB Tech
Column Oven	SCIEX	ExionLC 2.0 column oven	FCC214510004	9/22/2024	New	MF EC	3871	WB Tech
Column Oven	Sciex	ExionLC 2.0 column oven	FCC214710010	10/1/2022	New	MF EC	3879	WB Tech
Column Oven	SCIEX	ExionLC AD column oven	AB3C15770954	12/5/2019	New	MF EC	3589	WB Tech
Column Oven	SCIEX	ExionLC AD column oven	AB3C15770953	12/5/2019	New	MF EC	3595	WB Tech
Column Oven	SCIEX	ExionLC AD column oven	AB3CT5971355	12/21/2024	New	MF EC	4217	WB Tech
Column Oven	SCIEX	ExionLC AD column oven	ABC3CT5971363	12/21/2024	New	MF EC	4212	WB Tech
Column Oven	SCIEX	ExionLC AD column oven	AB3C15770954	12/5/2019	New	MF EC	3589	WB Tech
Column Oven	SCIEX	ExionLC AD column oven	AB3C15770953	12/5/2019	New	MF EC	3595	WB Tech
Column Oven	SCIEX	ExionLC AD column oven	AB3CT5971355	12/21/2024	New	MF EC	4217	WB Tech
Column Oven	SCIEX	ExionLC AD column oven	ABC3CT5971363	12/21/2024	New	MF EC	4212	WB Tech
Concentrator	Biotage	103187/07	TV1719N21931	UNK	New	MF EC	3502	WB Tech
Concentrator	Biotage	103187/07	TV1719N21931	UNK	New	MF EC	3502	WB Tech
Concentrator	Labanco	7810014	181268080	UNK	New	MF EC	3489	WB Tech
Concentrator	Labanco	7810014	181268080	UNK	New	MF EC	3489	WB Tech
Conditioner	Ametek	ABC15.0-20D41Y	7401564R-1720004	UNK	New	MF EC	3487	WB Tech
Conditioner	Ametek	ABC15.0-20D41Y	7401564R-1720004	UNK	New	MF EC	3487	WB Tech
Controller	SCIEX	ExionLC AD Pump	ABCBM5974510	12/21/2024	New	MF EC	4216	WB Tech
Controller	SCIEX	ExionLC AD Pump	ABCBM5974511	12/21/2024	New	MF EC	4211	WB Tech
Controller	SCIEX	ExionLC AD Pump	ABCBM5974510	12/21/2024	New	MF EC	4216	WB Tech
Controller	SCIEX	ExionLC AD Pump	ABCBM5974511	12/21/2024	New	MF EC	4211	WB Tech
Controller	SCIEX	ExionLC Controller	ASCBM5772286	12/5/2019	New	MF EC	3588	WB Tech
Controller	SCIEX	ExionLC Controller	ASCBM5772285	12/5/2019	New	MF EC	3594	WB Tech
Controller	SCIEX	ExionLC Controller	ASCBM5772286	12/5/2019	New	MF EC	3588	WB Tech
Controller	SCIEX	ExionLC Controller	ASCBM5772285	12/5/2019	New	MF EC	3594	WB Tech
Data Logger	Honeywell	Miniitrend QX	1029Y086	40724	New	MF QA	1905	

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Location of Manual
Dishwasher	Miele	G7783	Inaccessable	UNK	New	MF Metals	1269	WB Tech
Dishwasher	Miele	G7783	Inaccessable	UNK	New	MF Metals	1270	WB Tech
Freezer	Kenmore	253.2826281	WB24838847	12/10/2012	New	MF Forensics	1910	WB Tech
GC	Agilent	5890	2950A26298	UNK	New	MF Forensics	1440	WB Tech
GC	Agilent	6890	US10218066	8/1/2002	New	MF Forensics	701	WB Tech
GC	Agilent	6890	CN10426030	8/1/2004	New	MF Forensics	1469	WB Tech
GC	Agilent	6890	CN10517033	6/1/2005	New	MF Forensics	1494	WB Tech
GC	Agilent	7890	CN17093098,	UNK	New	MF Forensics	3170	WB Tech
GC	Agilent	7890	CN10937017	10/1/2009	New	MF Forensics	1426	WB Tech
GC	Agilent	7890	US19523008	12/17/2019	New	MF Forensics	3786	WB Tech
GC	Agilent	6890N	CN10731003	8/1/2009	New	MF Forensics	1506	WB Tech
GC	Agilent	6890N	US10350004	5/1/1997	New	MF Forensics	1459	WB Tech
GC	Agilent	6890N	CN10517034	UNK	New	MF Forensics	1510	WB Tech
GC	Agilent	6890N	CN10547119	10/1/2005	New	MF Forensics	1449	WB Tech
GC	Agilent	6890N	CN10652042	2/1/2007	New	MF Forensics	815	WB Tech
GC	Agilent	6890N	US10123018	1-Jul	New	MF Forensics	666	WB Tech
GC	Agilent	6890N	US10344015	UNK	New	MF Forensics	1366	WB Tech
GC	Agilent	6890N	US10350110	UNK	New	MF Forensics	1348	WB Tech
GC	Agilent	6890N	CN10425029	UNK	New	MF Forensics	1476	WB Tech
GC	Agilent	6890N	CN10606012	3/1/2006	New	MF Forensics	1500	WB Tech
GC	Agilent	6890N	US00008300	5/1/2004	New	MF Forensics	1311	WB Tech
GC	Agilent	6890N	US10218066	UNK	New	MF Forensics	4282	WB Tech
GC	Agilent	7890A	CN11211149	UNK	New	MF Forensics	1344	WB Tech
GC	Agilent	7890A	CN12471036	5/8/2013	New	MF Forensics	1935	WB Tech
GC	Agilent	7890A	CN10850068	4/1/2009	New	MF Forensics	1429	WB Tech
GC	Agilent	7890A	CN10221048	6/10/2024	New	MF Forensics	1421	WB Tech
GC	Agilent	7890A	CN10211018	UNK	New	MF Forensics	1464	WB Tech
GC	Agilent	7890A	CN10341126	UNK	New	MF Forensics	1380	WB Tech
GC	Agilent	7890A	CN10141040	8/18/2014	New	MF Forensics	2117	WB Tech
GC	Agilent	7890A	CN12471113	7/6/1905	New	MF Forensics	2334	WB Tech
GC	Agilent	7890A	CN10929193	8/1/2009	New	MF Forensics	1483	WB Tech

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Location of Manual
GC	Agilent	7890A	CN10141040	5/1/2010	New	MF Forensics	1411	WB Tech
GC	Agilent	7890A	CN11261020	UNK	New	MF Forensics	1361	WB Tech
GC	Agilent	7890B	US18143006	4/1/2018	New	MF Forensics	3380	WB Tech
GC	Agilent	7890B	CN13483104	1/30/2014	New	MF Forensics	2043	WB Tech
GC	Agilent	6890	US00021356	4/1/1998	New	MF Forensics	1436	WB Tech
GC	Agilent	7890	CN10341125	9/14/2010	New	MF Forensics	1385	WB Tech
GC	Agilent	7890A	CN14173019	8/18/2014	New	MF Forensics	2121	WB Tech
Heated Coil	PS Analytical	S570U100	10	UNK	New	MF Metals	1343	WB Tech
Hg System	PS Analytical	Millenium Merlin 10.036	11	2/16/2007	New	MF Metals	1339	WB Tech
Hot Block	Environmental Express	Hotblock 150	OW5516	6/7/2021	New	MF Metals	4016	WB Tech
Hot Block	Environmental Express	SC154	2019CECW5098	6/12/2019	New	MF Metals	3525	WB Tech
Hot Block	Environmental Express	SC154	2002CEC1249	1-Jul	New	MF Metals	725	WB Tech
Hot Block	Environmental Express	SC154	4298CEC5056	3/21/2007	New	MF Metals	3174	WB Tech
Hot Block	Environmental Express	SC154	8462CE CW3635	5/28/2013	New	MF Metals	2001	WB Tech
Hot Block	Environmental Express	SC154	8462CE CW3625	5/28/2013	New	MF Metals	2002	WB Tech
Hot Block	Environmental Express	SC154	7021CECW3303	4/1/2014	New	MF Metals	3176	WB Tech
Hot Block	Environmental Express	SC154	UNK	UNK	New	MF Metals	3521	WB Tech
Hot Block	SCP Science	LS	LSX1014130215	5/1/2014	New	MF Metals	2082	WB Tech
Hot Plate	VWR	986974	130726001	UNK	New	MF Metals	3142	WB Tech
Hydrogen Generator	Parker Balston	HP2EMPD-100-100	15PLD5041	4/15/2015	New	MF Forensics	3148	WB Tech
ICP	Thermo Fisher Scientific	iCAP 6000 DUO	ICP-20081510	8-Apr	New	MF Metals	851	WB Tech
ICP	Thermo Scientific	ICAP 6500 DUO	IC5D20122909	9/1/2015	New	MF Metals	2335	WB Tech
ICP	Thermo Scientific	iCAP 6500 DUO	IC65DU131201	5/13/2013	New	MF Metals	1994	WB Tech
ICP-MS	Thermo Fisher Scientific	ICP-MSQ	03031R	9/10/2014	New	MF Metals	2140	WB Tech
ICP-MS	Thermo Fisher Scientific	ICP-MSQ	ICAP01717	UNK	New	MF Metals	3581	WB Tech
ICP-MS	Thermo Fisher Scientific	Xseries2	01925C	UNK	New	MF Metals	1150	WB Tech
ICP-MS	Thermo Scientific	iCap RQ	iCapRQ01904	UNK	New	MF Metals	3570	WB Tech
ICP-OES	Thermo Scientific	BRE731404	iCAPPRO60606	22-Nov	New	MF Metals	3876	WB Tech
Injector	Agilent	7683B	CN84459462	UNK	New	MF Forensics	3574	WB Tech
Injector	Agilent	G4513A	CN17280100	UNK	New	MF Forensics	3575	WB Tech
Ion Gauge	Agilent	59864A	1218	UNK	New	MF Forensics	1461	WB Tech

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Location of Manual
Ion Gauge	Agilent	59864B	Unknown	UNK	New	MF Forensics	1514	WB Tech
Ion Gauge	Agilent	59864B	US60111985	UNK	New	MF Forensics	1471	WB Tech
Ion Gauge	Agilent	59864B	US60101708	UNK	New	MF Forensics	1503	WB Tech
LCMS	SCIEX	Triple Quad 4500	EB253951909	12/5/2019	New	MF EC	3587	WB Tech
LCMS	SCIEX	Triple Quad 4500	EB253891909	12/5/2019	New	MF EC	3593	WB Tech
LCMS	SCIEX	Triple Quad 4500	EB253951909	12/5/2019	New	MF EC	3587	WB Tech
LCMS	SCIEX	Triple Quad 4500	EB253891909	12/5/2019	New	MF EC	3593	WB Tech
LCMS	SCIEX	Triple Quad 5500+	EX232132111	12/21/2024	New	MF EC	4183	MF QA
LCMS	SCIEX	Triple Quad 5500+	EX232182111	12/21/2024	New	MF EC	4182	WB Tech
LCMS	SCIEX	Triple Quad 5500+	EX232132111	12/21/2024	New	MF EC	4183	MF QA
LCMS	SCIEX	Triple Quad 5500+	EX232182111	12/21/2024	New	MF EC	4182	WB Tech
LCMS	SCIEX	Triple Quad 5500+	EX234802207	9/22/2024	New	MF EC	3872	WB Tech
LCMS	SCIEX	Triple Quad 5500+	EX234802207	9/22/2024	New	MF EC	3872	WB Tech
LCMSMS	Waters	Column Manager	E16CMP407G	11/1/2016	New	MF EC	3181	WB Tech
LCMSMS	Waters	Column Manager	G18CMP447G	9/18/2018	New	MF EC	3152	WB Tech
LCMSMS	Waters	Column Manager Aux	H16CMX8446	11/1/2016	New	MF EC	3180	WB Tech
LCMSMS	Waters	Column Manager Aux	E18CMX435G	9/18/2018	New	MF EC	3153	WB Tech
LCMSMS	waters	Quaternary Solvent Manager	G16QSM637A	11/1/2016	New	MF EC	3183	WB Tech
LCMSMS	Waters	Quaternary Solvent Manager	G18QSP719A	9/18/2018	New	MF EC	3150	WB Tech
LCMSMS	Waters	sample manager FTN	g16sdi3096	11/1/2016	New	MF EC	3182	WB Tech
LCMSMS	Waters	sample manager FTN	F18FPT673G	9/18/2018	New	MF EC	3151	WB Tech
LCMSMS	Waters	TQ-S Micro	QEA0276	11/1/2016	New	MF EC	3139	WB Tech
LCMSMS	Waters	TQ-S Micro	QEB0050	9/18/2018	New	MF EC	3154	WB Tech
Liquid Limit Set	Humboldt	H-4226	2104226	8/1/2003	New	MF Metals	3523	WB Tech
Mass Spectrometer	Sciex	5500+	EX235302209	22-Oct	New	MF EC	3878	WB Tech
Mass Spectrometer	Sciex	5500+	EX235302209	22-Oct	New	MF EC	3878	WB Tech
Mercury Analyzer	CETAC Technologies	M-8000 CVAF	071201QM8	12/3/2012	New	MF Metals	1895	WB Tech
Mercury Analyzer	NIC	RA-4300A	18830145	8/7/2019	New	MF Metals	3543	WB Tech
Mercury Analyzer	Nippon Instruments Corp	RA-4300A	20830193	7/26/2021	New	MF Metals	4019	WB Tech
Mercury Analyzer	Teledyne Insturments	QuickTrace M-8000	US21193004	9/17/2021	New	MF Metals	4256	WB Tech

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Location of Manual
Microwave	CEM	910900	MJ7964	UNK	New	MF EC	3488	WB Tech
Microwave	CEM	910900	MJ7964	UNK	New	MF EC	3488	WB Tech
Microwave	CEM	910900	MY1048	UNK	New	MF Metals	3544	WB Tech
Microwave	CEM	MARS Xpress	MD8680	7-Jan	New	MF Metals	861	WB Tech
Microwave	CEM	Mars6	MJ1475	3/1/2013	New	MF Metals	2039	WB Tech
MS	Agilent	5973	US52020185	UNK	New	MF Forensics	1511	WB Tech
MS	Agilent	5973	US80221425	6/22/2005	New	MF Forensics	772	WB Tech
MS	Agilent	5973N	US10442382	8/1/2002	New	MF Forensics	1495	WB Tech
MS	Agilent	5973N	US60542296	UNK	New	MF Forensics	1501	WB Tech
MS	Agilent	5975B	US62714677	2/1/2007	New	MF Forensics	816	WB Tech
MS	Agilent	5975C	US83111241	4/1/2009	New	MF Forensics	1430	WB Tech
MS	Agilent	5975C	US10223404	UNKJ	New	MF Forensics	1465	WB Tech
MS	Agilent	5975C	US11333920	UNK	New	MF Forensics	1386	WB Tech
MS	Agilent	5975C	US10363617	UNK	New	MF Forensics	1381	WB Tech
MS	Agilent	5975C	US92012831	8/1/2009	New	MF Forensics	1484	WB Tech
MS	Agilent	5975C	US10163301	5/1/2010	New	MF Forensics	1412	WB Tech
MS	Agilent	5975C	?US11283937	UNK	New	MF Forensics	1362	WB Tech
MS	Agilent	5977A	US1350L211	1/30/2014	New	MF Forensics	2044	WB Tech
MS	Agilent	5973	US35130153	UNK	New	MF Forensics	1455	WB Tech
MS	Agilent	5975C	US10203305	10-Jun	New	MF Forensics	1422	WB Tech
MS	Agilent	3171	US1723R002	UNK	New	MF Forensics	3171	WB Tech
MS	Agilent	5973	US33220217	5/1/1997	New	MF Forensics	1460	WB Tech
MS	Agilent	5973	US52020194	6/1/2005	New	MF Forensics	1398	WB Tech
MS	Agilent	5973 FID	US40646577	8/1/2004	New	MF Forensics	1470	WB Tech
MS	Agilent	5973N	US41746584	8/1/2004	New	MF Forensics	1477	WB Tech
MS	Agilent	5977A	US10163301	8/18/2012	New	MF Forensics	2116	WB Tech
MS	Agilent	5973	US52421036	10/1/2005	New	MF Forensics	1450	WB Tech
N-Evap	Organomation	N-EVAP 116	N3435264	UNK	New	MF EC	3547	WB Tech
N-Evap	Organomation	N-EVAP 116	N3435264	UNK	New	MF EC	3547	WB Tech
N-Evap	Organomation	N-Evap 116 (13165)	63648	12/1/2020	New	MF EC	3619	WB Tech
N-Evap	Organomation	N-Evap 116 (13165)	63648	12/1/2020	New	MF EC	3619	WB Tech
N-Evap	Organomation	N-EVAP 116, 13165	62798	UNK	New	MF EC	3537	WB Tech

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Location of Manual
N-Evap	Organomation	N-EVAP 116, 13165	62798	UNK	New	MF EC	3537	WB Tech
N-Evap	Organomation	OA-SYS	Unknown	UNK	New	MF EC	3177	WB Tech
N-Evap	Organomation	OA-SYS	Unknown	UNK	New	MF EC	3177	WB Tech
Non touch Data Logger	Dickson	DWE	16462806	4/5/2022	New	MF EC	4339	WB Tech
Non touch Data Logger	Dickson	DWE	16462707	4/5/2022	New	MF EC	4340	WB Tech
Non touch Data Logger	Dickson	DWE	16462545	4/5/2022	New	MF EC	4351	WB Tech
Non touch Data Logger	Dickson	DWE	16461525	4/5/2022	New	MF EC	4295	WB Tech
Non touch Data Logger	Dickson	DWE	16462806	4/5/2022	New	MF EC	4339	WB Tech
Non touch Data Logger	Dickson	DWE	16462707	4/5/2022	New	MF EC	4340	WB Tech
Non touch Data Logger	Dickson	DWE	16462545	4/5/2022	New	MF EC	4351	WB Tech
Non touch Data Logger	Dickson	DWE	16461525	4/5/2022	New	MF EC	4295	WB Tech
Non touch Data Logger	Dickson	DWE	16462583	4/5/2022	New	MF Forensics	4354	WB Tech
Non touch Data Logger	Dickson	DWE	16461526	4/5/2022	New	MF Forensics	4355	WB Tech
Non touch Data Logger	Dickson	DWE	16462779	4/5/2022	New	MF Metals	4338	WB Tech
pH Meter	Hanna Instruments	HI 2210-01	8491385	10/14/2011	New	MF Metals	1793	WB Tech
pH Meter	Orion	920	TX79A	UNK	New	MF Metals	1237	WB Tech
pH/MV/Temperature meter	Hach	H260G	150514062	UNK	New	MF Metals	2320	WB Tech
Plastic Limit tester	Humboldt	H-4226	N/A	5/3/2019	New	MF Metals	3522	WB Tech
Power Conditioner	Powervar	95208-74R	95208-74R1420012	9/10/2014	New	MF Metals	2137	WB Tech
PSA Millenium Analyzer	PSA Millenium	10.055	669	11/1/2021	New	MF Metals	4257	WB Tech
Pump	SCIEX	ExionLC 2.0 Binary Pump	FBT213510007	22-Sep	New	MF EC	4359	WB Tech
Pump	SCIEX	ExionLC 2.0 Binary Pump	FBT213510007	22-Sep	New	MF EC	4359	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5773193	12/5/2019	New	MF EC	3590	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5773194	12/5/2019	New	MF EC	3591	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5773191	12/5/2019	New	MF EC	3596	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5773192	12/5/2019	New	MF EC	3597	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5976629	21-Dec	New	MF EC	4218	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5976622	21-Dec	New	MF EC	4219	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5976630	21-Dec	New	MF EC	4213	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5676631	21-Dec	New	MF EC	4214	WB Tech

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Pump	SCIEX	ExionLC AD Pump	AB3AD5773193	12/5/2019	New	MF EC	3590	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5773194	12/5/2019	New	MF EC	3591	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5773191	12/5/2019	New	MF EC	3596	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5773192	12/5/2019	New	MF EC	3597	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5976629	21-Dec	New	MF EC	4218	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5976622	21-Dec	New	MF EC	4219	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5976630	21-Dec	New	MF EC	4213	WB Tech
Pump	SCIEX	ExionLC AD Pump	AB3AD5676631	21-Dec	New	MF EC	4214	WB Tech
Refrigerator	Frigidaire	FFRU17B2Q WD	WA94302118	1/8/2020	New	MF EC	3586	WB Tech
Refrigerator	Frigidaire	FFRU17B2Q WD	WA94302118	1/8/2020	New	MF EC	3586	WB Tech
Refrigerator	Frigidaire	FRC03L2DB1	RA62430491	10/1/2013	New	MF Forensics	2020	WB Tech
Refrigerator	Frigidaire	FRC252GB	KA90601040	10/1/2013	New	MF Forensics	2019	WB Tech
Refrigerator	Haier	BC76B	BA0142E0400BD5 5G3848	10/1/2013	New	MF Forensics	2018	WB Tech
Refrigerator	Haier	BC76B	BA0142E0400BD5 5G3848	10/1/2013	New	MF Forensics	2018	WB Tech
Refrigerator	Haier	HUM013EA	J2010600544	7/1/2002	New	MF Forensics	1518	WB Tech
Refrigerator	Kenmore	253.6041261E	BA91302482	4/15/2019	New	MF Forensics	3513	WB Tech
Refrigerator	Magic Chef	HMR440WE	YOW2004HMR44 0WE0907	9/2/2021	New	MF EC	4251	WB Tech
Refrigerator	Magic Chef	HMR440WE	YOW2004HMR44 0WE0907	9/2/2021	New	MF EC	4251	WB Tech
Refrigerator	Magic Chef	MCBR445B1	YOW1205MCBR4 45B10195	11/28/2012	New	MF Forensics	1918	WB Tech
Refrigerator	Magic Chef	MCBR445W1	0906MCBR445W1 1923	UNK	New	MF Forensics	1517	WB Tech
Refrigerator	Sears	253.6041261E	BA84826476	4/22/2019	New	MF Forensics	3515	WB Tech
Refrigerator	True Refrigeration	GDM-47-HC-LD	9506312	UNK	New	MF EC	3512	WB Tech
Refrigerator	True Refrigeration	GDM-47-HC-LD	9506312	UNK	New	MF EC	3512	WB Tech
Refrigerator	Welbilt	BC-110	UNK	UNK	New	MF Metals	1271	WB Tech
Refrigerator	Whirlpool	WRR56X18F W03	UA4405645	22-Oct	New	MF EC	3873	WB Tech
Refrigerator	Whirlpool	WRR56X18F W03	UA4405645	22-Oct	New	MF EC	3873	WB Tech
Sonicator	Fisher	Solidstate/Ultrasonic FS-28	195737	UNK	New	MF Metals	1622	WB Tech
SPE	Prochrom	SPE-03	202007002	9/1/2021	New	MF EC	4252	WB Tech
SPE	Prochrom	SPE-03	202108011	9/1/2021	New	MF EC	4253	WB Tech
SPE	Prochrom	SPE-03	202108010	9/1/2021	New	MF EC	4254	WB Tech
SPE	Prochrom	SPE-03	202007002	9/1/2021	New	MF EC	4252	WB Tech
SPE	Prochrom	SPE-03	202108011	9/1/2021	New	MF EC	4253	WB Tech

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SPE	Prochrom	SPE-03	202108010	9/1/2021	New	MF EC	4254	WB Tech
Thermocouple	Fluke	51 II	497439393MV	(spare)	New	MF QA	4012	
Thermometer - Digital	SPER SCIENTIFIC	800005	80408354		New	MF Metals	1619	WB Tech
Touchscreen Data Logger	Dickson	TWE	16374983	4/5/2022	New	MF Forensics	4335	WB Tech
Touchscreen Data Logger	Dickson	TWE	16345157	4/5/2022	New	MF Metals	4336	WB Tech
Tower	Agilent	G4513A	CN19390160	12/17/2019	New	MF Forensics	3787	WB Tech
Turbidity meter	Hanna Instruments	HI88703	F0000845	6/25/2019	New	MF Metals	3529	WB Tech
Turbovap	Biotage	415001	192301123		New	MF EC	3548	WB Tech
Turbovap	Biotage	415001	192301123		New	MF EC	3548	WB Tech
Vacuum Pump	Oerlikon Leybold	Sogevac SV40BI	31000983667	9/10/2014	New	MF Metals	2141	WB Tech
Water Deionization System	Barnstead	D4641	1.09E+12	2002	New	MF Metals	868	WB Tech
Water Deionization System	Thermo Scientific	7119	383274-262	9/1/2014	New	MF Metals	2252	WB Tech

7.5.3 PAS-MANS

Equipment List: PAS-MANS 120 Forbes Blvd. Mansfield, MA

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Location of Manual
Canister Autosampler	EnTech	7650	0080	5/1/2024	Used	120-MANS	N/A	Electronic
Canister Autosampler	EnTech	7016D	N/A	5/1/2024	Used	120-MANS	Airlab23	Electronic
Preconcentrator	EnTech	7200A	00101	5/1/2024	Used	120-MANS	Airlab23	Electronic
MS	Agilent	5977B	CABZG7081B	5/1/2024	Used	120-MANS	Airlab23	Electronic
GC	Agilent	7890B	CN18253111	5/1/2024	Used	120-MANS	Airlab23	Electronic

8.0 ADDENDUM: PROGRAM REQUIREMENTS

Section 8.0 provides additional requirements the locations covered by this manual are required to follow when performing work under the program. Only requirements that are not covered by the main body of the manual are listed in the addendum.

8.1 DoD/DOE

PAS-MANS maintains accreditation for DoD/DoE Environmental Laboratory Approval Program (ELAP).

This addendum outlines additional policies and processes established by this laboratory to maintain compliance with DoD/DOE program specific requirements as outlined in the DoD/DOE Consolidated Quality Systems Manual (QSM) for Environmental Laboratories. The QSM incorporates ISO/IEC 17025 and the TNI Standard and includes additional program-specific requirements for laboratories that perform analytical testing services for DoD and DOE, and which must be followed for DoD / DOE projects.

Section 4.2.5: Supporting Documents

In addition to the requirements specified in Section 4.2.5, technical SOPs used for DoD/DOE testing must also include instructions for equipment and instrument maintenance, computer software/hardware, and troubleshooting.

The review frequency for technical SOPs used for DoD/DOE testing is annual, instead of every 2 years.

Section 4.4: Review of Analytical Service Requests

If the DoD/DOE customer requests a statement of conformity, the standard used for the decision rule must be communicated to and agreed on with the customer and identified in the final test report.

Laboratory requests to deviate from the requirements specified in the DoD/DOE QSM must be requested on a project-basis and include technical justifications for the deviation. These requests are submitted to and approved by the DoD/DOE project chemist or contractor, however name, in addition to the PAS client.

For DoD / DOE projects, will also seek clarification from the customer when the customer has requested an incorrect, obsolete, or improper method for the intended use of data; the laboratory needs to depart from its test method SOP in order to meet project-specific data quality objectives; information in project planning documents is missing or is unclear,

Section 4.5: Subcontracting

In addition to written client approval of any subcontractor for testing, the customer is notified of the laboratory's intent to use a subcontractor for any management system element (such as data review, data processing, project management or IT support) and consent for subcontracting is obtained approved in writing by the DoD/DOE customer and record of consent kept in the project record.

Section 4.6: Purchasing and Supplies

The laboratory procedure for records of receipt of materials and supplies used in testing also include a specification to record the date opened (DOE only).

Section 4.9.3: Nonconforming Work

The laboratory's procedure for client notification includes the 15-business day DoD /DOE time for notification of the problem and the 30-business day timeframe for submission of the corrective action plan or corrective actions taken. This procedure also includes the DoD/DOE requirement for AB notification of discovery.

Section 4.13: Control of Records

Technical Records: The laboratory's procedure for logbooks includes measures to prevent the removal of or addition of pages to the logbook (applies to both hardcopy and electronic). Hardcopy logbooks are version controlled, pre-numbered and bound. Initials and entries are signed or initialed and dated by the person making the entry and the entry is made at the time the activity is performed and in chronological order. Each page of the logbook must be closed by the last person making the entry on the page. Closure is recorded by the initial and date of the person making the last entry.

Section 5.4.5.3.3: Limit of Detection

For DoD/DOE the LOD is an estimate of the minimum amount of an analyte that can be reliably detected by an analytical process. For clarification, the LOD is the analyte concentration necessary to distinguish its presence from its absence. The LOD may be used as the lowest concentration for reliably reporting a non-detect (ND). The LOD is specific to each suite of analyte, matrix, and method including sample preparation.

After each DL determination, the laboratory establishes the LOD by spiking a quality system matrix at a concentration of least 2X but no greater than 4X the DL (i.e., 2X DL ≤ LOD Spike ≤ 4X DL). The spike concentration establishes the LOD and the concentration at which the LOD is verified.

The LOD is established during method validation and after major changes to the analytical system or procedure that affects sensitivity of analysis or how the procedure is performed.

An LOD study is not required for any component for which spiking solutions or quality control samples are not available. Additionally, an LOD study is not required if the laboratory does not report data below the LOQ.

The LOD must be verified on a quarterly basis. Each preparation method listed on the scope of accreditation must have quarterly LOD verifications; however, verification of all combinations of preparation and clean-up techniques is not required. Where LOD verifications are not performed on all combinations, the LOD verification is based on the worst-case combination (preparation method with all applicable cleanup steps).

The laboratory's procedure for LOD determination and verification is detailed in SOP ENV-SOP-WES2-0112 Method Detection Limit & Limit of Quantitation.

Section 5.4.5.3.4: Limit of Quantitation

For DoD/DOE, the LOQ is established for each analyte-matrix-method combination, including surrogates. When an LOD is determined or verified by the laboratory, the LOQ must be above the LOD [DL<LOD<LOQ].

At a minimum, the LOQ must be verified quarterly; however, verification of all combinations of preparation and clean-up techniques is not required. Where LOQ verifications are not performed on all combinations, the LOQ verification on the worst-case combination (preparation method with all applicable cleanup steps).

The laboratory's procedure for LOQ determination and verification is detailed in laboratory SOP ENV-SOP-WES2-0112 *Method Detection Limit & Limit of Quantitation*.

Section 5.4.7: Control of Data

The laboratory will ensure LIMS passwords are changed at least once per year.

An audit of the LIMS will be incorporated into the laboratory's annual internal audit schedule.

The laboratory will have procedures in place to notify DoD/DOE customers of changes to LIMS software or hardware configurations that may impact the customer's integrity of electronic data

Section 5.9.1: Quality Control

For DoD/DOE, storage blanks are essential QC to monitor the storage of samples for volatile organic analysis (VOA). The SOP for storage of VOA samples must include a contamination monitoring program based on the performance of storage blanks. (See QSM 5.3.3)

Section 5.8.5: Sample Disposal

For DOE projects, the record of disposal must also include how the sample was disposed and the name of the person that performed the task.

Appendix E: Support Equipment Calibration

Mechanical Volumetric Pipette: In addition to the quarterly verification check, pipettes used for DoD/DOE projects are checked daily before use using the same procedure and criteria specified for the quarterly check.

Water Purification System: The performance of the water purification system is checked daily prior to use in accordance with SOP ENV-SOP-WES2-0127 *DI Water System*.

Additional: (DOE): Section 6.0 of the QSM outlines additional management system requirements for the management of hazardous and radioactive materials management and health and safety practices. The laboratory, if approved for DOE, will consult with the PAS Health and Safety Director to establish plans, policies and procedures that conform to these comprehensive specifications and incorporate these documents into the QMS.

8.2 Unregulated Contaminant Monitoring Rule 5 (UCMR5)

PAS-MANS maintains EPA approval to report data for the Unregulated Contaminant Monitoring Rule 5. This addendum outlines additional policies and processes established by this laboratory to maintain compliance with UCMR 5 program specific requirements. These requirements are outlined in the UCMR 5 Laboratory Approval Requirements and Information Document. Data may not be uploaded to the Safe Drinking Water Accession and Review System (SDWARS) if it does not comply with these requirements.

Section 5.8.3: Sample Receipt Checks and Sample Acceptance Policy

Samples cannot be reported to SDWARS for UCMR5 Compliance if any of the following receipt issues are encountered: received in an insecure manner, inappropriate containers, outside the required temperature range, outside the recognized holding time, inadequate identification on sample containers and/or COC, improper preservation.

Section 5.8.3.1: Sample Receipt Checks - Thermal Preservation

Samples must be received at the laboratory within 48 hours of collection and must be ≤ 10˚C. After arrival or within 48 hours of collection, whichever is sooner, the samples must be refrigerated at ≤ 6°C. Samples received more than 48 hours after collection are valid only if they are received at ≤ 6°C and the laboratory can obtain documentation from the client to verify that they were refrigerated between collection and shipment. Temperature requirements apply to all UCMR5 samples with the exception of Lithium by EPA 200.7.

Section 5.9.1.1.3: Method Blank

The method blank will be considered contaminated if the concentration of any target analyte in the method blank is greater than 1/3 the MRL for that analyte. If samples cannot be re-processed, then samples must be re-collected. Data with a failing method blank cannot be reported to SDWARS.

Section 5.9.1.1.4: Laboratory Control Sample (LCS)

If the LCS recovery fails, then all data for the problem analyte are considered invalid for all samples in the Extraction or Digestion Batch. Data associated with a failing LCS must not be reported to SDWARS. If the LCS surrogate or internal standard fails QC criteria, all data for the Extraction or Digestion Batch must not be reported to SDWARS.

Section 5.9.1.1.5: Matrix Spikes (MS/MSD)

A UCMR5 sample must be used as the parent sample for the MS/MSD in batches containing UCMR5 samples. The spike concentration of the MS/MSD must be alternated between a low- and mid-level concentration.

There are no method analyte recovery acceptance criteria specific for MS/MSD results. Data should not be rejected based on the recovery of the fortified target analytes or on the precision between the MS and MSD, provided internal standard and surrogate standard recoveries and all other QC results are valid. If surrogate or internal standard recovery fails criteria in the MS and MSD, do not report results. If one of the fortified samples fails QC, the results of the passing fortified sample should be reported as the MS. The entire analysis batch does not need to be reanalyzed because of a failure of a surrogate or internal standard in MS or MSD. Recollection of the field sample is not required with a surrogate or internal standard fails criteria in the MS/MSD.

Section 5.9.1.1.7: Surrogates

A sample that fails QC criteria for surrogate recovery should be rerun in case a mis-injection occurred. If the sample continues to fail surrogate QC criteria, the laboratory should process a new aliquot of the sample. Typically, data for samples with failed surrogate recovery must not be reported to SDWARS.

If the surrogate recovery fails the acceptance criteria in a MB or LCS, the MB or LCS may be reanalyzed later in the Analysis Batch. If surrogate recovery fails again, all field sample results for the associated Extraction Batch are invalid and must not be reported. If the surrogate recovery fails in an MB that is needed to pass an Analysis Batch, all data for that Analysis Batch are invalid and must not be reported. If possible, the laboratory should process new aliquots of the affected samples; if this is not possible, the affected field samples must be recollected. One LCS must pass surrogate recovery within a 24-h period of analysis. If not, the samples in the Analysis Batches that correspond to that required LCS, cannot be reported.

Section 5.9.1.1.8: Internal Standards

If the internal standard recovery in a sample fails the acceptance criteria, then the results for the analytes that are associated with the internal standard in that sample are invalid. Data that fail internal standard criteria must not be reported to SDWARS. If possible, the laboratory should process a new aliquot of the sample; if this is not possible, the field sample must be recollected.

For an Extraction Batch or Digestion Batch, if the internal standard recoveries in a MB or LCS fail the acceptance criteria, all data for the analytes that are associated with that internal standard in that Extraction Batch or Digestion Batch are invalid and must not be reported. If the internal standard recoveries in a MB or LCS fail the acceptance criteria in an Analysis Batch, all data for the analytes that are associated with that internal standard in the Analysis Batch are invalid and must not be reported. If possible, the laboratory should process new aliquots of the affected samples.

SPLP Extraction

Inorganics and Semivolatile Organics

Reference Method: **EPA 1312**

Reference: **SW-846**, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Update III, September 1994

State of Connecticut, DEP, SPLP by SW-846 Method 1312, Version 2.0, December 2006.

1. Scope and Application

Matrices: Liquid, solid, and multiphasic wastes.

Definitions: Refer to Alpha Analytical Quality Manual.

The SPLP is designed to determine the mobility of both organic and inorganic analytes present in liquid, solid, and multiphasic wastes.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of trained analysts. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

For liquid wastes, (i.e., those containing less than 0.5% dry solid material), the waste, after filtration through a 0.6 to 0.8 µm glass fiber filter, is defined as the SPLP extract.

For wastes containing greater than or equal to 0.5% solids, the liquid, if any, is separated from the solid phase and stored for later analysis; the particle size of the solid phase is reduced, if necessary. The solid phase is extracted with an amount of extraction fluid equal to 20 times the weight of the solid phase. The extraction fluid employed is SPLP Fluid. Following extraction, the liquid extract is separated from the solid phase by filtration through a 0.6 to 0.8 µm glass fiber filter.

If compatible (i.e., multiple phases will not form on combination), the initial liquid phase of the waste is added to the liquid extract, and these are analyzed together. If incompatible, the liquids are analyzed separately and the results are mathematically combined to yield a volume-weighted average concentration.

For additional detailed instruction, see TCLP and SPLP Work Instruction (ID# 17618).

2.1 Method Modifications from Reference

None.

3. Reporting Limits

Refer to analytical SOPs for method reporting limits.

4. Interferences

4.1 The most common cause of contamination is from improperly cleaned glassware and lab supplies. All glassware and re-useable extraction equipment must be scrupulously cleaned, following the Organic Extraction Glassware Cleaning and Handling SOP/1953 and Work Instruction 10995, Solvent rinsing guide.

4.2 Impurities in solvents and reagents may also yield artifacts and/or interferences that may compromise the results of sample analysis. All of these materials must be demonstrated to be free from interferences under the conditions of extract preparation and analysis by preparing method blanks with each extraction batch. The same solvents and reagents are used for the method blank and the associated samples.

4.3 Phthalate esters contaminate many types of products used in the laboratory. Plastic materials must not contact the samples or extracts, as phthalates could be easily leached from the plastic. The exception is in the use of various pre-packed reagent cartridges (Florisil, Silica gel) used in the extract cleanup steps. Each new lot of cartridges is checked for contamination, and is monitored on an on-going basis through the analysis of method blanks.

4.4 Additional specific interference or contamination concerns are addressed in the various analytical SOPs.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents. This includes wearing personal protective equipment such as a lab coat, safety glasses, gloves and respirator (as necessary).

5.1 Lab coats, safety glasses, and gloves must be worn when handling samples, extracts, standards or solvents and when washing glassware.

5.2 All extract concentration steps must be performed in the extraction hoods. All solvent and extract transfers must also be handled in the hood.

5.3 All expired stock standards, working standards, and spent sample extracts must be placed into the waste bucket in the lab, for future disposal by the Hazardous Waste Manager. The container must be properly labeled with hazard warning labels indicating the container contents.

5.4 Bottles containing flammable solvents must be stored in the flammables cabinet or in the vented cabinets found under the hoods.

5.5 All waste solvents must be transferred to the satellite waste storage containers located in the extraction lab. Separate containers are provided for chlorinated and non-chlorinated solvents and must be used accordingly. Under no circumstances are solvents to be poured down the sink drains.

5.6 Inspect all glassware prior to use. Do not use any glassware that is chipped, cracked or etched if it could present a safety hazard. Damaged glassware is put aside for repair, otherwise discard the piece.

5.7 All Field Samples must be opened and handled in a hood.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Soil/solid samples are collected in 250 - 500mL glass amber jars with Teflon-lined caps. Water/liquid samples are collected in1000mL glass amber jars with Teflon-lined caps.

6.2 Sample Preservation

Preservatives shall not be added to samples before extraction.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

Samples may be refrigerated unless refrigeration results in irreversible physical change to the waste. If precipitation occurs, the entire sample (including precipitate) should be extracted.

Samples must undergo SPLP extraction within the time periods listed in Table 1.

7. Equipment and Supplies

7.1 Agitation Apparatus: End-over-end 30 ± 2 rpm. Calibrated quarterly.

7.2 Vacuum Filtration Unit

7.3 0.6 to 0.8 µm Glass Fiber Filter Paper: For organics extraction, use the standard TCLP filters-90mm, 7um, or the SPE thick glass fiber pre-filters, 90mm**.** For Metal extraction, use pre-cleaned filters, acid washed TCLP filters, 47mm, and 07um.

7.4 2L Glass/Plastic-coated Bottles

7.5 pH Meter: +/- 0.01 units resolution

7.6 Laboratory Balance: +/- 0.1g tolerance

7.7 2L Graduated Cylinder: Class A

7.8 250mL Graduated Cylinder: Class A

7.9 1L Amber Bottle: Thermo Scientific, Item # 341-0950, Jar Tall Amber WM.

7.10 250mL Plastic Bottle: Greenwood, Product # 07-250OB45F22603, Natural HDPE WM Oblong Bottle Assembled w/45-400 F-217 Lined Cap.

8. Reagents and Standards

Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

8.1 Reagent Water (ASTM Type II): All references to water within this SOP refer to reagent water unless otherwise specified. Reagent water is interference-free.

8.2 Trace Nitric Acid (1:1 HNO3): 500mL cHNO3 diluted to 1 liter with DI water. Store at room temperature in hood. Expires 3 months from date of prep.

8.3 Sulfuric Acid / Nitric Acid (60/40 weight percent mixture) H_2SO_4 / HNO_3: Cautiously mix 60g of concentrated sulfuric acid with 40g of concentrated nitric acid. See section 8.5 for diluted mixture, making it easier to adjust the pH of the extractions fluids. Expires 1 year from date of prep.

8.4 Extraction Fluid

The extraction fluid should be monitored frequently for impurities. The pH should be checked prior to use to ensure that the fluid is made up accurately. If impurities are found or the pH is not within the specifications, the fluid shall be discarded and fresh extraction fluid prepared.

8.4.1 Extraction Fluid #1: This fluid is made by adding the 60/40 weight percent mixture of sulfuric and nitric acids to (or a suitable dilution) to reagent water until the pH is 4.20 ± 0.05. The fluid is used to determine the leachability of soil from a site that is east of the Mississippi River, and the leachability of wastes and wastewaters. Note: Solutions are un-buffered and exact pH may not be attained.

8.4.2 Extraction Fluid #2: This fluid is made by adding the 60/40 weight percent mixture of sulfuric and nitric acids to reagent water until the pH is 5.00 ±0.05. This fluid is used to determine the leachability of soil from a site that is west of the Mississippi River.

8.4.3 Extraction Fluid #3: This fluid is reagent water (section 8.1) and is used to determine leachability of volatiles and cyanide. Reagent water may also be used for wet chemistry methods that are not suitable for leachability with extraction fluids containing sulfuric and nitric acids (i.e. reactive sulfide, hexavalent chromium, etc.).

8.5 100X Sulfuric Acid/Nitric Acid (100X H2SO4/HNO3 - 60/40 weight percent mixture): 100x dilution of Sulfuric Acid / Nitric Acid (60/40 weight percent mixture) H2SO4 / HNO3. Dilute 10mL of 60/40 weight percent mixture with DI water up to 1L. Expires 1 year from date of prep.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

A minimum of one blank (using the same extraction fluid as used for the samples) must be analyzed for every batch of 20 samples or less.

9.2 Laboratory Control Sample (LCS)

Not applicable.

9.3 Initial Calibration Verification (ICV)

Not applicable.

9.4 Continuing Calibration Verification (CCV)

Not applicable.

9.5 Matrix Spike

Not applicable.

9.6 Laboratory Duplicate

Not applicable.

9.7 Method-specific Quality Control Samples

Not applicable.

9.8 Method Sequence

Determine analysis to be performed (Metals, ABN, Pest/PCB/Herbicides/Wet Chemistry)

Check sample; ensure there is enough sample for the analysis

Determine the %solids of the waste

Extract the sample for SPLP

Filter the sample after extraction

Aliquot sample to proper preparation departments; preserve samples for testing

Prepare samples according to total protocols

10. Procedure

10.1 Equipment Set-up

10.1.1 Tumble Vessel and Filtration Equipment Preparation

Prior to use, tumble vessels and filtration equipment require cleaning with the appropriate reagents in order to reduce the risk of contamination. Depending on the intended analysis, tumble vessels and filtration equipment require different cleaning methods.

10.1.2 Organics

10.1.2.1 Organics only or samples being analyzed for organics and metals are tumbled in glass amber vessels rinsed with 50% hydrochloric acid and 10% nitric acid followed by DI water.

10.1.2.2 Samples being analyzed for organics use glass filtration setups rinsed with 50% hydrochloric acid, then 10% nitric acid, then DI through the fritted top, and a final set of three rinses with DI water.

10.1.3 Metals

10.1.3.1 Metals only samples are tumbled in plastic tumble vessels rinsed with 50% hydrochloric acid and 10% nitric acid followed by DI water.

10.1.3.2 Samples being analyzed for metals use plastic filtration cups soaked in 10% nitric acid for 10 minutes, and then thoroughly rinsed with DI water. The tubes that attach to the bottom of the filters are rinsed with 50% hydrochloric acid, then 10% nitric acid, and then thoroughly rinsed with DI water.

10.1.4 Wet Chemistry

10.1.4.1 Wet chemistry samples are tumbled in glass amber vessels rinsed with 10% hydrochloric acid and thoroughly rinsed with DI water three times.

10.1.4.2 Samples being analyzed for wet chemistry products use glass filtration setups rinsed with 10% hydrochloric acid, then DI through the fritted glass base. The entire setup is rinsed three more times with DI water.

10.1.5 PFAS

10.1.5.1 Reference: PFAS by SPE and LC/MS/MS Isotope Dilution (ID# 23528).

10.1.5.2 PFAS samples require new (never used) HDPE plastic vessels. These vessels are not rinsed before use.

10.1.5.3 Samples being analyzed for PFAS use glass filtration setups rinsed with DCM and DI water prior to use.

10.2 Initial Calibration

Not applicable.

10.3 Equipment Operation and Sample Processing

10.3.1 Preliminary Evaluation

Perform preliminary SPLP evaluations on a minimum of 100g aliquot of waste. If there is limited sample volume, the chemist must contact the project manager. This aliquot may not actually undergo SPLP extraction. These preliminary evaluations include: (1) determination of the percent solids (Section 10.3.1.1); (2) determination of whether the waste contains insignificant solids and is, therefore, its own extract after filtration (Section 10.3.2.3); (3) determination of whether the solid portion of the waste requires particle size reduction (Section 10.3.1.2); and (4) determination of which of the two extraction fluids are to be used for the nonvolatile SPLP extraction of the waste (Section10.3.1.3).

10.3.1.1 Determine % Solids :

10.3.1.1.1 If waste contains no free liquid, proceed to Section 10.3.1.2 where the waste is the solid portion.

10.3.1.1.2 If the waste contains less than 0.5% solids, proceed to Section 10.3.2.3.

10.3.1.1.3 Multiphasic waste - separate liquid and solid portion

10.3.1.1.3.1 Pre-weigh the filter and the container to receive the initial filtrate.

10.3.1.1.3.2 Assemble the pressure filter or vacuum filter apparatus according to the manufacturer's directions.

10.3.1.1.3.3 Weigh a subsample of the waste (100 gram minimum) and record the weight.

10.3.1.1.3.4 Transfer the waste sample to the filter holder spreading evenly over the filter.

10.3.1.1.3.5 Gradually apply a gentle pressure of 1-50psi until the pressurizing gas moves through the filter or turn on the vacuum filter apparatus and allow the liquid to go through.

10.3.1.1.3.6 The material in the filter holder is defined as the SOLID PHASE of waste and the filtrate is defined as the LIQUID PHASE.

Note: the SOLID PHASE may appear liquid in some samples. Do Not replace original filter. Use only one filter.

10.3.1.1.3.7 Weigh the filtrate filled container and calculate the weight of the LIQUID PHASE as follows:

$$W_{LP} = W_F - W_C$$

Where:

W_{LP} = Weight of the LIQUID PHASE
W_F = Weight of the filtrate filled container
W_C = Weight of container

10.3.1.1.3.8 Calculate the weight of the SOLID PHASE using the following formula:

$$W_{SP} = W_W - W_{LP}$$

Where:

W_{SP} = Weight of the SOLID PHASE
W_W = Weight of the waste sample
W_{LP} = Weight of the LIQUID PHASE

10.3.1.1.3.9 Calculate the percent solids using the following formula:

$$\%\,\text{Solids} \quad \frac{W_{SP}}{W_W \times 100}$$

Where:

W_{SP} = Weight of the SOLID PHASE
W_W = Weight of the waste sample

10.3.1.1.3.10 If the % Solids determined above, Section 10.3.1.1.3.9, is less than 0.5%, then the filtrate is the SPLP extract. Filter sample until enough filtrate is obtained for analysis and proceed to Section 10.3.2.3.211.

10.3.1.1.3.11 Remove the solid phase and filter from the filtration apparatus, dry at 100 ± 2 C, cool and weigh.

10.3.1.1.3.12 Calculate the percent dry solids using the following formula:

$$\% \text{ dry solids} \quad \frac{W_{DW} \quad W_F}{W_W \times 100}$$

Where:

W_{DW} = Weight of dried waste + filter
W_F = Weight of the filter
W_W = Weight of waste sample

10.3.1.1.3.13 If the % dry solids determine above, 10.3.1.1.3.12, is less than 0.5%, then the filtrate is the SPLP extract. Filter sample until enough filtrate is obtained for analysis and proceed to Section 10.3.2.3.21.

10.3.1.2 Determine whether waste requires particle size reduction

10.3.1.2.1 Using fresh portion of the waste, obtain another solid phase of the waste sample Section 10.3.1.1, above (.1-.5). Evaluate the solid phase for particle size. Particle size reduction is required unless the solid has a surface area greater to 3.1 cm^2 per gram, or is smaller than 1 cm in its narrowest dimension.

If the surface area is smaller or the particle size is larger than described above, prepare the solid portion of the waste for extraction by crushing, cutting or grinding the waste to a surface area or particle size as described above.

10.3.2 Extraction of SOLID PHASE

10.3.2.1 After selecting another aliquot of the waste sample, 100 gram minimum, of SOLID PHASE is extracted to produce the SPLP extract. In some cases, a larger sample size may be required in order to produce enough liquid for the required analysis. If the amount of extract generated by a single SPLP extraction will not be sufficient to perform all of the analysis, more than one extraction may be performed and the extracts combined for analysis. If there is limited sample volume, the chemist must contact the project manager.

10.3.2.2 100% Solid Waste

10.3.2.2.1 If the waste is 100% solid, Section 10.3.1.1, homogenize the sample and weigh out an aliquot (100 gram min.) and proceed to 10.3.2.3.13.

10.3.2.3 Liquid or Multiphasic Waste

10.3.2.3.1 Pre-weigh the container that will receive the filtrate.

10.3.2.3.2 For organics extraction, use the standard TCLP filters-90mm, 7uL, or the SPE thick glass fiber pre-fitters, 90mm**.** For Metal extraction, use pre-cleaned filters, acid washed TCLP filters, 47 mm, and 07um.

10.3.2.3.3 Assemble the filter apparatus according to manufacturer's instructions.

10.3.2.3.4 Weigh an aliquot of the waste (100 gram min.) and record the weight. Weight of aliquot selected should produce sufficient volume of SPLP extract to perform the requested analysis.

10.3.2.3.5 Allow slurries to stand so the solid phase can settle to ease filtration.

10.3.2.3.6 Quantitatively transfer the waste sample to the pressure filter or vacuum filter apparatus.

10.3.2.3.7 Turn on the vacuum and allow the liquid to go through.

10.3.2.3.8 The material in the filter holder is defined as the SOLID PHASE of waste and the filtrate is defined as the LIQUID PHASE.

10.3.2.3.9 Weigh the filtrate (LIQUID PHASE) and store at 4 C until time of analysis, either directly or after combining with solid extract solution.

NOTE: Some waste samples will produce a SOLID PHASE that appears to be liquid but are to be treated as a solid and extracted as a solid. Do not replace the original filter - Use only one filter.

10.3.2.3.10 If the waste contains less than 0.5% dry solids, section 10.3.1.1.3.9, the filtrate is the SPLP extract, proceed to 10.3.2.3.19.

10.3.2.3.11 If the particle size reduction is not needed, Section 10.3.1.2, proceed to 10.3.2.3.13.

10.3.2.3.12 Prepare the solid portion of the waste for extraction by crushing, cutting, or grinding the waste to a surface area or particle size as described in Section 10.3.1.2.

10.3.2.3.13 Quantitatively transfer the solid material, along with the filter, into a glass extractor bottle (plastic may be used if only metals are being analyzed).

10.3.2.3.14 Determine the amount of extraction fluid to add to the extractor vessel as follows:

$$\mathbf{V_{EF}}\ \frac{20\ \mathrm{X}\%\ \mathbf{Solids}\ \mathrm{X}\ \mathbf{W_W}}{100}$$

Where:

V_{EF} = Volume of extraction fluid required.
W_W = Weight of waste filtered
%Solids = percent solids (determined in Section 10.3.1.1.3.9)

10.3.2.3.15 Add the weight (from Section 10.3.2.3.14) of the appropriate extraction fluid (determined in Section 10.3.1.3) to the extraction vessel.

10.3.2.3.16 Close the extractor bottle tightly, secure in rotary agitation device, and rotate at 30 ± 2 rpm for 18 ± 2 hours while maintaining room temperature at 23 ± 2 C.

10.3.2.3.16.1 The room temperature (°C) is recorded in the extraction logbook at both the beginning and the end of extraction.

10.3.2.3.16.2 To verify that the proper room temperature is maintained during extraction, a Maximum/Minimum thermometer is reset at the beginning of the extraction period. This thermometer is reviewed at the end of the extraction period and the Maximum and Minimum temperatures are noted in the extraction logbook.

10.3.2.3.16.3 If proper room temperature is not maintained during the extraction period, it is considered a variation from the method and must be written into a laboratory note and submitted with the reported data. The Department Supervisor is immediately notified to determine the proper corrective action to be taken.

10.3.2.3.16.4 If determination is made that a MAX/MIN thermometer reading is outside of the acceptance range (21C-25C), it must be confirmed by comparison to the average temperature of the room during the extraction period recorded in the data logger records. Any MAX/MIN temperature reading that exceeds acceptance criteria must be reviewed by the department manager or team leader and QA.

10.3.2.3.17 Following extraction, separate extraction mixture into its component liquid and solid phases outlined in Section 10.3.2.3.7 for this final filtration, the glass fiber filter may be changed to facilitate filtration.

10.3.2.3.18 Prepare the SPLP extract as follows:

10.3.2.3.18.1 If the waste contained no initial liquid phase, the filtered liquid material obtained from Section 10.3.2.3.17 is defined as the SPLP extract. Proceed to 10.3.2.3.19.

10.3.2.3.18.2 Determine compatibility of liquids

10.3.2.3.18.2.1 If a LIQUID PHASE was filtered in Section 10.3.1.1.3.7, check its compatibility with the extraction fluid determined in Section 10.3.1.3. If the liquids are compatible, then only one SPLP extract needs be analyzed. If the liquids are not compatible, then the two liquids will have to be analyzed separately.

10.3.2.3.18.3 If the initial liquid phase of the waste obtained in Section 10.3.2.3.9, is not compatible with the liquid phase obtained in Section 10.3.2.3.17, do not combine the liquids. Analyze these liquids, collectively defined as the SPLP extract, separately and mathematically combine the results, as described in Section 10.3.2.3.22.

10.3.2.3.19 Record the pH of the SPLP extract in the SPLP Extraction Logbook prior to any preservation.

10.3.2.3.20 For metals analyses, immediately aliquot and preserve the extract with 5mL of 1:1 HNO3 for analysis according to the analytical method. If preservation alters the physical properties of the extract, do not preserve and analyze as soon as possible. For non-volatile organic analyses, no preservation is required.

10.3.2.3.20.1 Check the pH of the preserved samples to ensure that the sample is properly preserved at a pH of less than 2.

10.3.2.3.21 Follow the appropriate analytical procedure.

10.3.2.3.22 If the individual liquid phases (i.e. non-compatible liquids) are analyzed separately, determine the volume of the individual phases, conduct the appropriate analyses, and combine the results mathematically by using a simple volume-weighted average:

$$\text{Final Analyte Concentration} \quad \frac{(V_1)(C_1) \quad (V_2)(C_2)}{V_1 \quad V_2}$$

Where:

V_1 = Volume of the first phase (L)
C_1 = Analyte concentration first phase (mg/L)
V_2 = Volume of the second phase (L)
C_2 = Analyte concentration second phase (mg/L)

10.4 Continuing Calibration

Not applicable.

10.5 Preventive Maintenance

None.

11. Data Evaluation, Calculations and Reporting

None.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

12.1 All Holding time exceedences, improper preservation and Extraction Anomalies are to be reported to a Supervisor or Manager. Non Conformance Reports may need to be issues through the Qualtrax System.

12.2 Refer to determinative method SOPs for additional Corrective Action information.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

Not applicable for this method.

13.2.2 Continuing (DOC)

Not applicable for this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

SOP 2121 Chemical Hygiene Plan

SOP 1732 MDL/LOD/LOQ Generation

SOP 1739 IDC/DOC Generation

SOP 1728 Waste Management and Disposal SOP

WI 17618 TCLP and SPLP Work Instruction

16. Attachments

Table 1: Maximum Holding Times

Table 1

MAXIMUM HOLDING TIMES

Sample Maximum Holding Times (Days)

	From: Field Collection **To:** SPLP Extraction	**From:** SPLP extraction **To:** Preparative extraction	**From:** Preparative extraction **To:** Determinative analysis	**Total Elapsed Time**
Semi-volatiles	14	7	40	61
Mercury	28	-----	28	56
Metals, except mercury	180	-----	180	360
Wet Chemistry parameters	N/A	24 hours	Refer to the Analytical SOPs	N/A

Appendix G Health and Safety Plan

HEALTH AND SAFETY PLAN;
FOR PER AND POLYFLUOROALKYL SUBSTANCES (PFAS) SITE INVESTIGATION

for

Perdue AgriBusiness LLC
6906 Zion Church Road
Salisbury, Maryland

Prepared for:

Perdue AgriBusiness LLC
P.O. Box 1537
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Prepared by:

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1818 Market Street, Suite 3300
Philadelphia, Pennsylvania 19103

March 5, 2025

Langan Project No.: 220210101

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* Items to be posted prominently on site or made readily available to personnel

1.0 INTRODUCTION

Langan Engineering and Environmental Services, LLC (Langan) is committed to providing a safe and healthful work environment. Langan’s goal is to be SAFE (Stay Accident Free Everyday), meaning that we strive to complete every project without injury, illness, property damage, or environmental damage. Safety must always take precedence over expediency. No phase of the planned operation is more important than accident prevention. As such, high standards have been followed in developing the safety program for this project. Through adherence to the safety program, careful planning, and a positive safety attitude by workers; Langan asserts that the safety of people and property is of the utmost importance.

This Health and Safety Plan (HASP) has been developed by Langan to comply with Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.120(b)(4), *Hazardous Waste Operations and Emergency Response*, Langan policies/procedures, and Perdue AgriBusiness (PAB) requirements and considerations as currently understood and as appropriate. In addition, Langan will comply with federal, state, and local regulations as applicable to the project. Compliance with this HASP is required of Langan personnel and subcontractors who are engaged in the tasks covered by this HASP at, and involving, the PAB facility located at 6906 Zion Church Road in Salisbury, Wicomico County, Maryland (the “Site” or “Zion Church Road [ZCR] Facility”).

The management of the day-to-day site activities and implementation of this HASP in the field is the responsibility of the Site Safety Officer (SSO). Assistance in the implementation of this HASP can also be obtained from the Langan Health and Safety Manager (HSM). The content of this HASP may change or undergo revision based upon additional information made available to health and safety personnel, monitoring results, or changes in the scope of work.

2.0 EMERGENCY RESPONSE PLAN

2.1 General

This Emergency Response Plan has been developed as part of the HASP to address management of emergency situations such as injury or chemical exposure to personnel; fire or explosion; environmental release; security threat, or serious weather conditions. Reference Table 1 for the emergency notification master contact list.

2.2 Responsibilities

2.2.1 Site Emergency Coordinator - The SSO, or their designated alternate, will serve as the Site Emergency Coordinator and shall implement emergency procedures whenever conditions warrant such action. The Site Emergency Coordinator will be responsible for coordinating with PAB regarding the evacuation, emergency treatment, emergency transport of site personnel, and notification of emergency units and the appropriate management staff. Emergency response instructions will be provided by PAB and the SSO as part of every employee's training prior to the start of work.

2.2.2 Employees - Langan employees at the Site will be familiar with emergency response procedures for this work location.

2.3 Emergency Medical Treatment

Personnel Injury - In case of injury to Langan personnel, the SSO will or their designee will administer emergency first aid as soon as possible. The ambulance/rescue squad will also be contacted as necessary. Some situations may require transport of the injured parties to the closest emergency medical facility. Therefore, maps/directions to the nearest hospital are provided as Figure 1. Figure 1 will either be posted at the site or will be made readily available to personnel.

Personnel Exposure – If there is exposure to a chemical, follow procedures on the corresponding Safety Data Sheet (SDS) attached to Appendix E and seek emergency medical attention/poison control if warranted based on the severity of the exposure. The following provides general emergency first aid procedures for chemical exposure.

Skin Contact:	Use ample amounts of soap and water. Wash/rinse affected areas thoroughly, then provide appropriate medical attention. Rinse eyes with water for at least 15 minutes.

Inhalation:	Move to fresh air and/or, if necessary, decontaminate and transport to emergency medical facility or request the assistance of emergency medical professionals.
Ingestion:	Decontaminate and transport to emergency medical facility or request assistance of medical professionals.
Puncture/Laceration:	Decontaminate, if possible, and transport to emergency medical facility or request the assistance of emergency medical professionals.

2.4 Non-Emergency Medical Treatment

In case of injury to personnel, which is not a medical emergency the employee will contact WorkCare at (1-888-449-7787). WorkCare provides access 24 hours / 7 days a week to experienced occupational health nurses and physicians who confer with employees at the onset of a work-related injury or illness. WorkCare will provide over the phone injury treatment or direct employees to medical treatment by third party provider, if appropriate.

2.5 Nearest Medical Assistance

The address and telephone number of the nearest hospital/emergency care facility:

TidalHealth Peninsula Regional
100 E. Carroll Street
Salisbury, Maryland 21801
410-546-6400

A map with directions to the hospital/emergency care facility is provided as Figure 1. Be advised that the specific directions to the hospital listed above will vary depending on the location where injury, exposure, or other health event occurred. From most sampling locations, the individual should head south and turn right onto Old Ocean City Road. From there, the individual can follow the instructions included on Figure 1. This information will either be posted prominently at the Site or be otherwise readily available to Langan personnel. Further, field personnel, including the SSO, will know the directions to the hospital.

2.6 Emergency Contacts/Notification System

Emergency telephone numbers are summarized in Table 1. This list is to be included with the site first aid kit and readily available to Langan personnel. Langan requires that property damage, environmental releases, injuries of personnel (Langan employees, subcontractors, property owner, site visitors, etc.), and near misses associated with the field activities be reported on the Incident Injury Report located in Appendix C and to Langan’s Incident/Injury Hotline at (973-560-4699) as soon as possible following the incident.

2.7 Evacuation

In the event of an emergency situation on-Site, Langan personnel should follow procedures prescribed by Perdue AgriBusiness, which will be communicated to Langan Site personnel upon initial arrival at the Site.

Otherwise, in the event of an off-Site emergency situation, an air horn or vehicle horn should be sounded three times indicating the initiation of evacuation procedures. Loud voice command, if appropriate, can be used. Personnel should evacuate and assemble at the Site entrance or pre-designated muster point. No one, except the emergency responders, will be allowed to proceed into the area once the emergency signal has been given. The Site Safety Officer will facilitate access for emergency equipment and direct the shutdown of sources of combustion (e.g., operating machinery, etc.) once the alarm has been sounded. Wind direction should be taken into consideration for evacuation plans. Evacuation plans will be discussed at the initial Site-Specific Training and as needed at the regular safety briefings.

When an on-site emergency results in an evacuation, personnel shall not re-enter until:

- The conditions resulting in the emergency have been corrected,
- The hazards have been reassessed,
- This HASP has been reviewed, and
- Site personnel have been briefed on changes to this HASP.

2.8 The Buddy System

When working in teams of two or more, workers will use the "buddy system" for work activities so that rapid assistance can be provided in the event of an emergency. Work groups will be organized so workers can remain close together and maintain visual contact with one another. Workers using the "buddy system" have the following responsibilities:

- Provide his/her partner with assistance.
- Observe his/her partner for signs of chemical or heat exposure.
- Periodically check the integrity of his/her partner's PPE.
- Notify the SSO or other site personnel if emergency service is needed.

2.9 Fire or Explosion

Appropriate fire extinguishers should be made available at the site for trained personnel to use on fires in their initial stage without endangering the safety and health of those nearby. If the use of fire extinguishers will not extinguish the fire, immediately notify the fire department or call 911, sound the evacuation signal, and then evacuate the area, assembling at the site entrance to be accounted for and to receive further instruction.

2.10 Explosive Atmospheres

Areas deemed to be an explosive atmosphere are to be classified as a confined space/permit required confined space and shall not be entered. Confined space/permit required confined space entry procedures must be followed per Langan’s Corporate HASP prior to entering an explosive atmosphere. Langan employees are prohibited from entering or conducting work in a confined space where IDLH conditions are present.

Areas where an explosive atmosphere exist should not be entered until appropriate testing has deemed the area safe for entry and confined space entry procedures have been followed. For explosive atmospheres such as excavation operations, a multi-gas meter equipped for monitoring of VOCs, H_2S, LEL, O_2, and CO with a remote sensing head should be used.

For LEL readings between 0% to <10%; continue to work and continue to monitor atmosphere. For reading $\geq$10% of the LEL; evacuate the area.

2.11 Oxygen Deficient Atmospheres

Areas deemed oxygen deficient are to be considered a confined space/permit required confined space and shall not be entered. Confined space/permit required confined space entry procedures must be followed per Langan's Corporate HASP prior to entering an oxygen deficient atmosphere. Langan employees are prohibited from entering or conducting work in a confined space where IDLH conditions are present.

Areas where oxygen deficient atmospheres exist should not be entered until appropriate testing has deemed the area safe for entry and confined space entry procedures have been followed. Prior to entering spaces where an oxygen deficiency may exist, an oxygen meter will be used to test for adequate oxygen levels. Decisions will be based on oxygen concentrations as follows:

Oxygen Concentration	**Decision**
20.8%	Continue Operations
< 20.8%	Continuous Monitoring
< 19.5%	Stop Work/Do not Enter, withdraw from work area; notify HSM & PM
> 22%	Stop Work/Do not Enter, withdraw from work area; notify HSM & PM

2.12 Spills/Leaks

In the event of accidental spillage, the following spill response protocol will be implemented as follows:

- Immediately stop work and move up-wind of the spill.
- Administer first aid to injured personnel and call 911 if necessary.
- Notify the Langan SSO immediately of the spill. The SSO will notify the Project Manager who will notify the client and appropriate outside agencies.
- If possible and safe to do, gather data regarding material spilled, location, quantity spilled, injuries and environmental impacts.
- An exclusion zone will be set up, informing and warning site personnel of the hazard(s).
- Complete an Incident Injury Report and notify Langan's Incident/Injury Hotline at (973-560-4699) as soon as possible following the incident.

2.13 Adverse Weather Conditions

In the event of severe weather (rain, snow, sleet, heat, etc.), conditions will be assessed on site to determine if the work can proceed safely. If it is determined that the weather poses a significant hazard, site operations will be stopped and rescheduled. Some of the items to be considered prior to determining if work should continue include:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related working conditions.
- Limited visibility.

2.14 Underground Utilities Strike

In the event a utility is encountered or disturbed during subsurface work, follow these procedures:

- Immediately stop work;
- Leave the work area and retreat to a safe area;
- Call 911, if necessary;
- Contact the client representative and owner and operator of the property; and
- Immediately notify the Langan PM, SSO and Langan Incident/Injury Hotline.

2.15 Documentation

Employees are required to contact WorkCare at (1-888-449-7787) to document incidents/injuries which are not medical emergencies. Following an incident or near miss, unless emergency medical treatment is required, either the employee, coworker or supervisor must contact the Langan Incident/Injury Hotline at (973-560-4699) and the client representative to report the incident or near miss. For emergencies involving personnel injury and/or exposure, the SSO and affected employee will complete an Incident Injury Report located in Appendix C and submit to Langan's H&S Department as soon as possible following the incident.

3.0 SITE LOCATION AND BACKGROUND

3.1 Location

The ZCR Facility includes approximately 294-acres situated in a predominantly rural area to the east of Salisbury, Maryland at 6906 Zion Church Road. It is bounded to the west by the Salisbury Bypass (US Route 50) with residential properties beyond; to the north by Morris Leonard Road with residential, farm, and wooded/undeveloped properties beyond; to the east by Zion Church Road with residential, farm, mixed-use, and wooded/undeveloped properties beyond; and to the south by the Delmarva Central Railroad with residential and mixed-used properties beyond. The Site currently consists of a soybean processing plant, a feed mill, a boiler house, grain receiving and storage facilities, an edible soybean oil refinery, two hatcheries, a truck fleet garage, and related support facilities and operations. A Site plan depicting the Site boundaries and features is included as Figure 2.

The 2019 United States Geological Survey (USGS) 7.5-minute quadrangle topographic map for Salisbury depicts the Site at elevations varying from approximately 40 to 60 feet above mean sea level (amsl). The regional topography is relatively flat, with ground surface elevation varying from approximately 15 to 60 feet amsl, and topography sloping downward to the west toward the Wicomico River, which is located approximately 3 miles west of the Site at its nearest point.

This HASP includes activities necessary to identify, report, and sample soil, groundwater, and surface water points on the ZCR Facility.

3.2 Background

According to Perdue Agribusiness, in August 2023, the MDE contacted Perdue AgriBusiness as part of a state-wide sampling project to assess PFAS levels in wastewater, drinking water, and groundwater across the state. In these initial tests, MDE detected elevated levels of certain PFAS, specifically, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), in wastewater at the ZCR Facility. As a result, in December 2023, Perdue AgriBusiness, in collaboration with MDE and the Maryland Department of Health, provided additional information and facilitated MDE conducting additional PFAS sampling and testing. The subsequent testing results showed lower levels of the detected PFAS, complicating determination of a source. Perdue completed additional follow-up sampling and testing on-Site at the request of MDE in February and March 2024. In cooperation with MDE, additional monitoring wells were installed, and another round of testing was conducted in July 2024. Results for this sampling event were submitted to MDE in August 2024. On September 12, 2024, MDE sent Perdue AgriBusiness a letter designating the company as the responsible person for elevated PFAS concentrations in groundwater at the Site.

3.3 Summary of Work Tasks by AOI

The scope of sampling and testing covered by this HASP is described in Langan's *PFAS Site Investigation Workplan* for the ZCR Facility dated March 5, 2025. Film Forming Foam (AFFF) – Fire Suppression System

4.0 IDENTIFICATION OF KEY PERSONNEL/HEALTH AND SAFETY PERSONNEL

The following sections briefly describe the health and safety (H&S) designations and general responsibilities that may be employed for this site. The personnel titles have been established to accommodate the project needs and requirements and promote the safe conduct of Site activities. The H&S personnel requirements for a given work location are based on the proposed site activities.

4.1 Langan Project Manager (PM)

The Langan Project Manager (PM) is **Anna Willett**. Responsibilities include:

- Arranging for an appropriate HASP to be developed and approved prior to on-Site activities.
- Seeing that the project tasks are performed in a manner consistent with Langan's Corporate Health and Safety Program and this HASP.
- Verifying that subcontractors being utilized have been approved for usage in Langan's Subcontractor Safety Screening Program.

4.2 Langan Corporate Health and Safety Manager (HSM)

The Langan Corporate Health and Safety Manager (HSM) is Tony Moffa. Responsibilities include:

- Updating the Health and Safety Program.
- Assisting the Site Safety Officer (SSO) with development and revisions of the HASP.
- Assisting the SSO in the implementation of this HASP and conducting Jobsite Safety Inspections and assisting with communication of results and correction of shortcomings found.
- Maintaining records on personnel including medical evaluation results, training, certifications, and Incident/Injury reports

4.3 Langan Site Safety Officer (SSO)

The Langan Site Safety Officers (SSO) is to be determined; alternate SSOs may be designed throughout the project, and those alternates will be notified of their responsibilities and clearly identified to the Langan project team. The SSO responsibilities include:

- Participating in the development and implementation of this HASP.
- The management of the day-to-day site activities and implementation of this HASP in the field.
- Complete the Safe Work Certificate (in cooperation with the PM) and conducting the daily Tailgate Safety and Close-Out Meetings.
- Conduct Jobsite Safety Inspections and correct shortcomings in a timely manner.
- Making proper PPE available and worn by Langan employees as appropriate and properly stored and maintained.
- Controlling entry into and exit from the site contaminated areas or zones.
- Monitoring employees for signs of stress, such as heat stress, fatigue, and cold exposure.
- Monitoring site hazards and conditions.
- Knowing (and confirming that site personnel also know) emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
- Resolving conflicts that may arise concerning safety requirements and working conditions.
- Reporting incidents, injuries and near misses to the Langan Incident/Injury Hotline immediately and the client representative.

4.4 Subcontractor Responsibilities

Each subcontractor shall develop and implement their own HASP, which identifies a lead individual responsible for H&S compliance for each of their employees, lower-tier subcontractors, and consultants. The subcontractor's HASP will be at least as stringent as this Langan HASP. The subcontractor must be familiar with and abide by the requirements outlined in their own HASP. A subcontractor may elect to adopt Langan's HASP as its own provided that it has given written notification to Langan, but where Langan's HASP excludes provisions pertinent to the subcontractor’s work (i.e., confined space entry); the subcontractor must provide written addendums to this HASP. Additionally, the subcontractor must:

- Confirm their employees are trained in the use of appropriate PPE for the tasks involved;
- Notify Langan of hazardous material brought onto the job site or site related area, the hazards associated with the material, and must provide a SDS for the material;
- Have knowledge of, understand, and abide by current federal, state, and local health and safety regulations pertinent to the work;
- Confirm their employees have received current training in the appropriate levels of 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response* (HAZWOPER) and other training required for site work;
- Confirm their employees have been medically cleared to work and to wear a respirator, if necessary;
- Confirm their employees have been fit-tested within the year on the type of respirator they will wear.

5.0 GENERAL HAZARD MANAGEMENT

This section provides an assessment of the general hazards that may be encountered during field work activities at the site through a task-by-task risk analysis. Potential hazards are addressed below.

5.1 Chemical Exposure Hazards

Known and suspected chemical contaminant hazards that could be encountered during site operations are detailed in Table 2, Part A. An inventory of safety data sheets (SDS) for chemical products that may be encountered can be found in Appendix E.

5.2 Physical Hazards

Physical hazards, which may be encountered during site operations for this project, are detailed in Table 2 Part B.

5.3 Biological Hazards

Biological hazards, which may be encountered during site operations for this project, are detailed in Table 2 Part B.

5.4 Task-By-Task Risk Analysis

Through information gathering, inspection, and monitoring; hazards that are potentially present have been determined for each specific task described in Table 2. This table provides a summary of chemical, physical and biological hazards that could potentially be encountered by personnel during each task effort.

5.5 Job Safety Analysis

A Job Safety Analysis (JSA) is a process to identify existing and potential hazards associated with each job or task so these hazards can be eliminated, controlled or minimized. JSAs should be reviewed at the beginning of each workday, when a Langan employee begins a new task or moves to a new location. JSAs should be developed and reviewed by parties involved. A blank JSA form and documentation of completed JSAs are in Appendix G.

5.6 Tailgate Safety Briefings

Before starting work each day or as needed, the Langan SSO will conduct a brief tailgate safety briefing meeting to assist site personnel in conducting their activities safely. Briefings will include the following:

- Scope of work for the day.

- Review of safety information relevant to planned tasks and environmental conditions.
- New activities/task being conducted.
- Results of Jobsite Safety Inspection Checklist.
- Changes in work practices.
- Safe work practices; and
- Discussion and remedies for noted or observed deficiencies.

5.7 Safe Work Certificate

A Safe Work Certificate (SWC) must be developed, documented and adhered to by Langan employees daily while conducting fieldwork. A SWC and associated Tailgate Safety Meeting must be completed prior to the start of fieldwork each day. The SWC must be submitted during the Close-Out Meeting at the end of each workday or after completion of site fieldwork, whichever occurs first. The Site Safety Officer (SSO) is responsible for completing the Safe Work Certificate Process. Copies of SWC are saved to the project folder.

6.0 TRAINING & MEDICAL CLEARANCE REQUIREMENTS

The general training and medical clearance requirements for Langan personnel are discussed in the following sections.

6.1 Project Training

Completion of an initial 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training program as detailed in OSHA's 29 CFR 1910.120(e) is required for employees who will perform work in areas where the potential for a toxic exposure exists. Annual eight-hour refresher training is also required to maintain competencies. Training records are maintained by Langan’s H&S Department.

6.2 Site Specific Training

Training will be provided to specifically address the activities, procedures, monitoring, and equipment for site operations at the beginning of each field mobilization and the beginning of each discrete phase of work. The training will include the site and facility layout, hazards, and emergency services at the site, and will detail the provisions contained within this HASP.

6.3 Medical Surveillance/Fitness for Duty

Personnel who will be performing field work involving potential exposure to toxic and hazardous substances will be required to have passed an initial baseline medical examination, with follow-up medical exams thereafter, consistent with 29 CFR 1910.120(f). Medical evaluations will be performed by, or under the direction of, a physician board-certified in occupational medicine. Personnel who may be required to perform work while wearing a respirator must receive medical clearance as required under CFR 1910.134(e), *Respiratory Protection*. Results of medical evaluations are maintained by Langan's H&S Department.

7.0 AIR MONITORING

7.1 General

In certain instances, it will be necessary to monitor the atmospheric conditions during on-site work activities to identify and quantify airborne contaminants; to assist in defining work zones; and, to determine the level of work protection needed. Air monitoring will be performed on an as needed basis, when and where the possibility of worker exposure to hazardous substances exists. If determined to be needed, air monitoring will be performed at the worker's breathing zone. Upgrades/downgrades to personal protective equipment (PPE) will be made based on air monitoring results in the breathing zone. If needed, the air monitoring device will be calibrated daily, and readings will be recorded in the field log or in Appendix D.

7.2 Action Levels

A PID will be used to evaluate action levels during investigation activities. Table 3 provides a summary explanation of available monitoring equipment.

Breathing zone readings should be taken at the start of work in each areas each day, as well as during the field activities, and frequently whenever strong odors are detected. Before any field activities commence, the background levels of the site will be monitored and recorded away from the areas of potential contamination to representative conditions. Continuous monitoring is required during intrusive work. Instrumentation Action levels for general monitored gases based on PID readings are provided in Table 4.

Work will be stopped immediately, and crews will remove themselves to fresh air if workers are experiencing potential acute physical symptoms of exposure such as irritation, nausea, drowsiness or headache. Work will not recommence in the area until reasoning for exposure is determined, and appropriate control measures have been taken.

8.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

8.1 Levels of Protection

Langan will provide PPE to workers to protect them from the specific hazards they are likely to encounter on-site. Selection of the appropriate PPE must take into consideration: (1) identification of the hazards or suspected hazards; (2) potential exposure routes; and (3) the performance of the PPE construction (materials and seams) in providing a barrier to these hazards.

Activities to be performed within certain areas of the Site designated by PAB will be performed using Level D protection as described below.

The upgrading/downgrading of the level of protection will be based on continuous air monitoring results as described in Section 7 or based on the potential exposure to chemicals. The decision to modify standard PPE will be made by the SSO after conferring with the site project manager. The levels of protection are described below.

Level D Protection

Level D is used when no respiratory protection is required, and minimal skin protection is needed (used for nuisance contamination only). The following conditions suggest a need for Level D protection:

The atmosphere contains no known hazard; and Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of chemicals.

The following constitutes Level D equipment; to be used as appropriate:

- Long pants
- Nitrile gloves (during sampling activities)
- Boots/shoes, chemical-resistant steel toe and shank
- Short-or long sleeve t-shirt
- Safety glasses or chemical splash goggles (during sampling activities)
- Safety vest or high-visibility clothing (optional – as applicable)
- Boots, outer, chemical-resistant (disposable) (optional – as applicable).
- Hard hat (required on-Site)
- Escape mask (optional – as applicable)
- Face shield (optional – as applicable).

Level D Modified

Level D Modified is the same as Level D for respiratory protection, but the skin protection is increased to that of level C.

Level C Protection (as needed)

Level C is used when the concentrations and types of airborne substances are known and the criteria for using air purifying respirators are met. The following conditions suggest a need for Level C protection:

- The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through exposed skin;

- The types of air contaminants have been identified, concentrations measured, and an air-purifying respirator is available that can remove the contaminants; and

The following constitutes Level C equipment; it may be used as appropriate.

- Full-face or half-mask, air purifying respirators (NIOSH approved).
- Hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls)
- Coveralls (optional – as applicable).
- Gloves, outer, chemical-resistant.
- Gloves, inner, chemical-resistant.
- Boots (outer), chemical-resistant steel toe and shank (optional – as applicable).
- Boot-covers, outer, chemical-resistant (disposable) (optional – as applicable).
- Hard hat (optional – as applicable).
- Face shield (optional – as applicable).
- Escape mask (optional – as applicable).

8.2 Respirator Fit-Test

Langan employees who may be exposed to hazardous volatile or airborne substances at the work site are in possession of a full or half face-piece air-purifying respirator, appropriate cartridges and have been successfully fit-tested within the past year. Fit-test records are maintained by Langan's H&S Department.

9.0 SITE CONTROL

9.1 Site Communications Plan

Verbal communications will be the primary method of communication used at the work site. Cell phones shall be used to the extent practical if allowed to be used on-Site. In the instances where verbal communication cannot be used, such as when working in respiratory protective equipment, hand signals will be used. Hand signals will be covered prior to the start of jobsite work or during tailgate safety meetings.

Hand Signal	Meaning
Hand gripping throat	Out of air; cannot breathe
Grip partners wrists or place both hands around waist	Leave immediately without debate
Hands on top of head	Need assistance
Thumbs up	OK; I'm alright; I understand
Thumbs down	No; negative
Simulated "stick" break with fists	Take a break; stop work

9.2 Work Zones

The need to formally establish specific work zones (Support, Contamination Reduction, and Exclusion Zones) during site activities will be determined by the SSO. A general description of these work zones is provided in Figure 2. It is important for the safety of concerned that appropriate barriers (cones, wooden horses, plastic fencing etc.) are in place to keep vehicles and pedestrians away from the Work Zone.

9.3 Standing Orders/Safe Work Practices

The standing orders, which consist of a description of safe work practices that must always be followed by Langan employees and subcontractors while on-Site, are shown in Appendix A. The SSO has the responsibility for enforcing these practices. The standing orders will be posted prominently at the site or are made available to personnel. Those who do not abide by these safe work practices will be removed from the site.

9.4 Site Security

No unauthorized personnel shall be permitted access to the work areas.

9.5 Underground Utility Clearance

Langan's Underground Utility Clearance Policy should be adhered to when ground disturbance is being conducted by Langan or its subcontractors. The following procedures must be completed and documented prior to ground disturbance:

- One-Call System Notification (or equivalent)
- Private Utility Mark-Out
- Site Utility Plans Reviewed
- Site Visit Conducted
- Soft Digging Requirements Followed

9.6 Site Safety Inspection

The Langan SSO or designated alternate will conduct daily checks of the work area at the beginning and end of each work shift at a minimum. More frequent checks may be required to confirm safe work conditions. The SSO or designated alternate must complete the Jobsite Safety Inspection Checklist, found in Appendix F, at least weekly or before completion of work, whichever is shorter. Deficiencies shall be discussed during the daily tailgate meeting and shared with the PM and HSM, if needed.

9.7 Hand and Power Tools

Hand and electric-power tools, and similar equipment shall be maintained in a safe operating condition. Electric-power tools must be inspected initially and prior to each use. Damaged tools shall be tagged and removed immediately from service or repaired. Tools shall be used only for the purpose for which they were designed. Users must be properly trained in their safe operation.

9.8 Stop Work Authority

Langan employees have the authority to stop work of Langan employees and subcontractors when they believe an unsafe condition exists. Project staff are encouraged to exercise "stop work authority" as part of Langan's safety culture.

The following steps shall be taken by Langan employees when performing work with Langan co-workers and Langan subcontractors within a work zone at a site and an unsafe condition is observed.

- When an employee observes an unsafe condition, a Stop Work Intervention shall be immediately initiated with the person(s) potentially. at risk.
- The Stop Work Intervention shall be coordinated through the Langan SSO on-site.
- All affected personnel in the work zone shall immediately be notified of the Stop Work Intervention. If necessary, associated work activities should be stopped and persons should be removed from the area.
- All affected personnel shall discuss and gain agreement on the cause of the Stop Work Intervention.
- Every attempt shall be made to resolve the cause of the Stop Work Intervention prior to the resumption of work.
- If the cause of the Stop Work Intervention cannot be resolved immediately, then work shall be suspended until proper resolution is achieved.
- All Stop Work Interventions and associated details shall be documented and reported to the PM and HSM, if needed.

9.9 Subcontractor Safety Screening Program

Subcontractors utilized by Langan are required to be screened through Langan's Subcontractor Safety Screening program. This Program is intended to confirm that subcontractors utilized by Langan have safety programs, training, policies and statistical data of safety performance that are in accordance with Langan and project requirements and policies. A Langan subcontractor is a firm or person who has been contracted by Langan to perform services for Langan and is not a permanent employee of Langan. A list of Langan's subcontractors currently in the Subcontractor Safety Screening Program and their assigned "grades" can be found on Langan’s intranet.

10.0 DECONTAMINATION PLAN

10.1 General

In the event that equipment is contaminated, personnel, equipment, and samples leaving the contaminated area of the site must be decontaminated. Decontamination for this operation is achieved through physical removal and chemical detoxification/ disinfection/sterilization. The first step in decontamination, however, is prevention and standard operating procedures have been established meant to minimize contact with wastes:

- Work habits that minimize contact with wastes are stressed.
- Disposable equipment, where appropriate, will be used.

In addition to the above, precautions shall be taken by the sampler to avoid- the initial introduction of PFAS into the sampling area to avoid cross-contamination. Precautionary actions include the following:

- Avoid wearing or carrying items that may contain PFAS, such as certain water-resistant clothing, cosmetics, sunscreen, and insect repellant.
- Use PFAS-free materials for sampling (e.g. no Teflon tape, no waterproof notebooks). Consult Attachment A of Appendix I for more information.
- Change gloves frequently, especially if they come into contact with surfaces that might be contaminated.

The sampler should consult Langan's *Recommended Environmental PFAS Sampling Procedures* attached Langan's *PFAS Site Investigation Workplan* for the ZCR Facility.

10.2 Decontamination Procedures

The Standard decontamination procedures are described in Appendix B. In accordance with the Langan *PFAS Investigation Standard Operating Procedures (SOPs)* included as Appendix B of the *PFAS Site Investigation Workplan*, standard decontamination procedures have been altered to reflect PFAS sensitivity. The following procedures should be employed for decontamination if warranted:

- Establish a decontamination area aware from sampling activities
- Perform a four-step decontamination of sampling equipment before sample collection and between sampling location (if equipment is being reused).
  - Wash with potable water and a detergent.
    - Alconox and Citrinox are generally acceptable detergents, but it is recommended to verify potential presence/absence of PFAS with manufacturer prior to use.
  - Initial potable water rinse.
  - Secondary potable water rinse
  - Complete final triple-rinse with lab verified PFAS-free water (for components coming into direct contact with the sample).

10.3 Disposal of Wastes

Debris (e.g., paper, plastic and disposable personal protective equipment [PPE]) will be collected in plastic garbage bags and disposed of as non-hazardous industrial waste using appropriate receptacles at the Site. Debris is expected to be transported to a local municipal landfill for disposal.

Investigation derived wastes should be properly managed as indicated in the applicable SOPs that are attached to the *PFAS Site Investigation Workplan*.

11.0 CONFINED SPACE ENTRY

A confined space has limited or restricted means for entry or exit and is not designed for continuous occupancy. Confined spaces include, but are not limited to, tanks, vessels, silos, storage bins, hoppers, vaults, pits, manholes, tunnels, equipment housings, ductwork, pipelines, etc. Confined spaces **will not** be entered by Langan personnel.

12.0 HASP ACKNOWLEDGEMENT FORM

Langan field personnel and subcontractors will sign this HASP Compliance Agreement indicating that they have become familiar with this HASP and that they understand it and agree to abide by it.

LANGAN PERSONNEL

Anna Willett, Senior Project Manager Date

Site Safety Officer (SSO) Date

Printed Name	Signature	Company	Date

TABLES

TABLE 1
EMERGENCY NOTIFICATION MASTER CONTACT LIST

ORGANIZATION	CONTACT	TELEPHONE
Local Police Department		911 or 410-548-3165
Local Fire Department		911 or 410-548-3122
Ambulance/Rescue Squad		911 or 860-435-0058
Hospital		911 or 410-546-6400
(Work related Injuries/Illnesses)		
WorkCare		1-888-449-7787
Langan Incident / Injury Hotline		973-560-4699
Langan Senior Project Manager	Anna Willett	571-591-5548 (cell)
Langan Project Leader	Jeff Smith	215-694-7549 (cell)
Langan Health and Safety Manager (HSM)	Tony Moffa	215-491-6545 (office) 215-756-2523 (cell)
Langan Site Health & Safety Officer (SSO)	To be Determined	To be Determined
Perdue	G. Andrew (Drew) Getty	443-397-8023
Perdue	Jaclyn Mays	443-397-0255
National Response Center (NRC)		800-424-8802
Chemical Transportation Emergency Center (Chemtrec)		800-424-9300
Center for Disease Control (CDC)		404-639-3534
EPA (RCRA Superfund Hotline)		800-424-9346
TSCA Hotline		202-554-1404
Poison Control Center		800-222-1222

TABLE 2
TASK RISK ANALYSES

A. CONTAMINANT HAZARDS OF CONCERN

Task	Contaminant	Monitoring Device	PEL/IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1	Per- and polyfluoroalkyl substances (PFAS)			Water, Soil	Abs, Con		Eyes and Skin: Wash and irrigate as appropriate using PFAS-free, laboratory supplied water.

EXPLANATION OF ABBREVIATIONS

PID = Photoionization Detector
Inh = Inhalation
Abs = Skin absorption
Ing = Ingestion
Con = Skin and/or eye contact
PEL = Permissible Exposure Limit (8-hour Time Weighted Average
IDLH = Immediately Dangerous to Life and Health
LEL = Lower Explosive Limit
ppm = part per million
TLV = Threshold Limit Value
abdom = abdominal
anor = anorexia
arrhy = arrhythmia
card = cardiac
Ca = Considered by NIOSH to be potential occupational carcinogen
[carc] = potential occupational carcinogen
CNS = central nervous system
depres = depressant/depression
derm= dermititis
dizz = dizziness
drow = drowsiness
tg = fatigue
gidd = giddiness
inco = incoordination
inj = injury
lass = lassitude (weakness, exhaustion)
muc memb = mucous membrane
nau = nausea
pares = paresthesia
som = somnolence (sleepiness, unnatural drowsiness)
verti = vertigo
vis dist = visual disturbance

B. PHYSICAL & BIOLOGICAL HAZARDS OF CONCERN

Task	Hazard	Description	Control Measures	First Aid
1	Skin contact	Sample water or sample preservative spills on skin; splashes in eyes. Contact with contaminated water during sampling.	Wear proper PPE; follow safe practices; TAKE 5	See "A" above
1	Lacerations, abrasions, punctures	Cutting tubing, twine, etc. with knife. Using tools in tight spaces, etc.	Wear proper PPE; follow safe practices; TAKE 5; Cut resistant gloves; No open blade knifes	Utilize first aid kit. Depending on severity of injury, seek medical attention if needed.
1	Lifting	Improper lifting/carrying of equipment and materials causing strains	Follow safe lifting techniques; TAKE 5	Follow the Rest, Ice, Compression, and Elevation (RICE) procedures
1	Slips, trips, and falls	A number of injuries could occur from slips, trips, and falls in carrying out these tasks	Good housekeeping at site, constant awareness and focus on the task; TAKE 5; Plan your route	
1	Traveling To/From Jobsite	Other Vehicles, Wildlife, Weather Conditions, Fatigue	Adjust safety features of vehicle prior to driving; Obey posted signage, do not use cellphones while driving, Situational awareness, Take breaks frequently, do not drive if fatigued, watch for wildlife while driving or other objects that may enter your lane of travel; adjust driving according to the weather and time of day; TAKE 5	

Task	Hazard	Description	Control Measures	First Aid
1	Pinch points	Incidental pinch points created during sampling and movement of equipment and lifting of well lids.	Recognize pinch points prior to starting activity. Use other tools (i.e. crowbar) for leverage.	Assess severity. Seek immediate medical attention if needed.
1	Unknown conditions	Sampling will be conducted in private residences. Conditions within private residences are not known.	Wear proper PPE; Also utilize the Buddy System when entering into an unknown residence. TAKE 5 and perform JSA for unexpected hazardous conditions	
1	Biological hazards	Wild animals, or spiders/insects	One Buddy keep watch while sampling is occurring. Wear gloves when reaching into infrequently-used spaces.	

TABLE 3
Summary of Monitoring Equipment

Instrument	Operation Parameters
Photoionization Detector (PID)	**Hazard Monitored:** Many organic and some inorganic gases and vapors. **Application:** Detects total concentration of many organic and some inorganic gases and vapors. Some identification of compounds is possible if more than one probe is measured. **Detection Method:** Ionizes molecules using UV radiation; produces a current that is proportional to the number of ions. **General Care/Maintenance:** Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories. **Typical Operating Time:** 10 hours. 5 hours with strip chart recorder.
Oxygen Meter	**Hazard Monitored:** Oxygen (O_2). **Application:** Measures the percentage of O_2 in the air. **Detection Method:** Uses an electrochemical sensor to measure the partial pressure of O_2 in the air and converts the reading to O_2 concentration. **General Care/Maintenance:** Replace detector cell according to manufacturer's recommendations. Recharge or replace batteries prior to explanation of the specified interval. If the ambient air is less than 0.5% C $O_{2,}$ replace the detector cell frequently. **Typical Operating Time:** 8 – 12 hours.
Additional equipment (if needed, based on site conditions)	
Combustible Gas Indicator (CGI)	**Hazard Monitored:** Combustible gases and vapors. **Application:** Measures the concentration of combustible gas or vapor. **Detection Method:** A filament, usually made of platinum, is heated by burning the combustible gas or vapor. The increase in heat is measured. Gases and vapors are ionized in a flame. A current is produced in proportion to the number of carbon atoms present. **General Care/Maintenance:** Recharge or replace battery. Calibrate immediately before use. **Typical Operating Time:** Can be used for as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.

Instrument	Operation Parameters
Flame Ionization Detector (FID) with Gas Chromatography Option *(i.e., Foxboro Organic Vapor Analyzer (OVA))*	**Hazard Monitored:** Many organic gases and vapors (approved areas only). **Application:** In survey mode, detects the concentration of many organic gases and vapors. In gas chromatography (GC) mode, identifies and measures specific compounds. In survey mode, all the organic compounds are ionized and detected at the same time. In GC mode, volatile species are separated. **General Care/Maintenance:** Recharge or replace battery. Monitor fuel and/or combustion air supply gauges. Perform routine maintenance as described in the manual. Check for leaks. **Typical Operating Time:** 8 hours; 3 hours with strip chart recorder.
Potable Infrared (IR) Spectrophotometer	**Hazard Monitored:** Many gases and vapors. **Application:** Measures concentration of many gases and vapors in air. Designed to quantify one or two component mixtures. **Detection Method:** Passes different frequencies of IR through the sample. The frequencies absorbed are specific for each compound. **General Care/Maintenance:** As specified by the manufacturer.
Direct Reading Colorimetric Indicator Tube	**Hazard Monitored:** Specific gas and vapors. **Application:** Measures concentration of specific gases and vapors. **Detection Method:** The compound reacts with the indicator chemical in the tube, producing a stain whose length or color change is proportional to the compound's concentration. **General Care/Maintenance:** Do not use a previously opened tube even if the indicator chemical is not stained. Check pump for leaks before and after use. Refrigerate before use to maintain a shelf life of about 2 years. Check expiration dates of tubes. Calibrate pump volume at least quarterly. Avoid rough handling which may cause channeling.
Aerosol Monitor	**Hazard Monitored:** Airborne particulate (dust, mist, fume) concentrations. **Application:** Measures total concentration of semi-volatile organic compounds, PCBs, and metals. **Detection Method:** Based on light-scattering properties of particulate matter. Using an internal pump, air sample is drawn into the sensing volume where near infrared light scattering is used to detect particles. **General Care/Maintenance:** As specified by the mfr. Also, the instrument must be calibrated with particulates of a size and refractive index similar to those to be measured in the ambient air.
Monitox	**Hazard Monitored:** Gases and vapors.

Instrument	Operation Parameters
	Application: Measures specific gases and vapors. **Detection Method:** Electrochemical sensor relatively specific for the chemical species in question. **General Care/Maintenance:** Moisten sponge before use; check the function switch; change the battery when needed.
Gamma Radiation Survey Instrument	**Hazard Monitored:** Gamma Radiation. **Application:** Environmental radiation monitor. **Detection Method:** Scintillation detector. **General Care/Maintenance:** Must be calibrated annually at a specialized facility. **Typical Operating Time:** Can be used for as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.

TABLE 4

INSTRUMENTATION ACTION LEVELS

Below levels are based using Benzene as the COC and use of a Full-Face or Half-Face Air Purifying Respirator.

Photoionization Detector Action Levels	Action Required
Background to 1 ppm	No respirator; no further action required.
> 1 ppm but < 5 ppm for < 5 minutes	1. Temporarily discontinue all activities and evaluate potential causes of the excessive readings. If these levels persist and cannot be mitigated (i.e., by slowing drilling or excavation activities), contact SSO to review conditions and determine source and appropriate response action. 2. If PID readings remain above 1 ppm, temporarily discontinue work and upgrade to Level C protection (Half-Face or Full-Face Respirator Required). 3. If sustained PID readings fall below 1 ppm, downgrading to Level D protection may be permitted.
> 5 ppm but < 10 ppm for > 5 minutes	1. Discontinue all work; all workers shall move to an area upwind of the jobsite. 2. Evaluate potential causes of the excessive readings and allow work area to vent until VOC concentrations fall below 5 ppm. 3. Level C protection (Half-face or Full-Face Respirator Required) will continue to be used until PID readings fall below 1 ppm.
>10 ppm but < 50 ppm for > 5 minutes	1. Discontinue all work; all workers shall move to an area upwind of the jobsite. 2. Re-evaluate potential causes of the excessive readings and allow work area to vent until VOC concentrations fall below 10 ppm. Follow Level C Protection ((Half-face or Full-Face Respirator Required) 3. Level C protection (Full-Face Respirator Required – see note #4) will continue to be used until PID readings fall below 10 ppm.
> 50 ppm	Evacuate the work area.

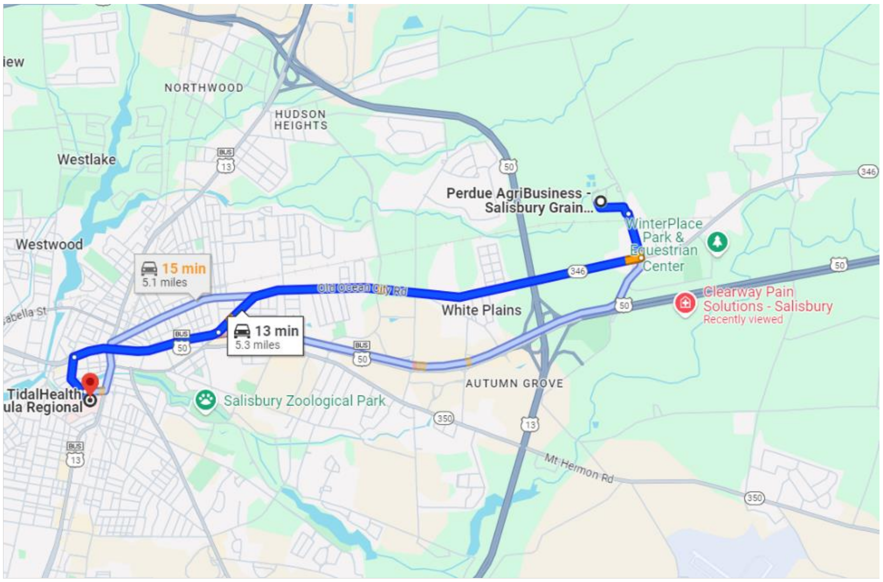
Notes:

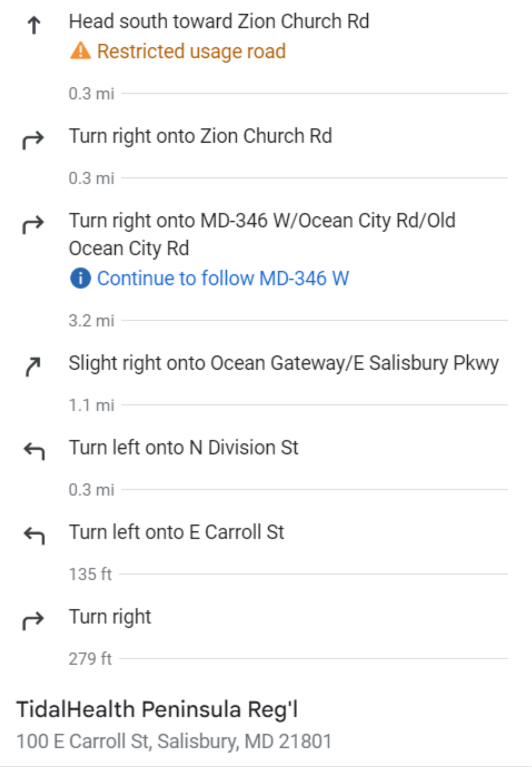
1. 1 ppm level based on OSHA Permissible Exposure Limit (PEL) for benzene.
2. 5 ppm level based on OSHA Short Term Exposure Limit (STEL) maximum exposure for benzene for any 15-minute period.
3. 50 ppm level based on the Maximum Use Concertation (MUC) for a full-face respirator or NIOSH Immediately Dangerous to Life and Health (IDLH) for benzene. (The lower value will be used).
4. Full-Face air purifying respirator must have been fit tested using Quantitative fit testing procedures.

FIGURES

FIGURE 1

HOSPITAL MAP & DIRECTIONS





↑ Head south toward Zion Church Rd

⚠ Restricted usage road

0.3 mi

↱ Turn right onto Zion Church Rd

0.3 mi

↱ Turn right onto MD-346 W/Ocean City Rd/Old Ocean City Rd

ⓘ Continue to follow MD-346 W

3.2 mi

↗ Slight right onto Ocean Gateway/E Salisbury Pkwy

1.1 mi

↰ Turn left onto N Division St

0.3 mi

↰ Turn left onto E Carroll St

135 ft

↱ Turn right

279 ft

TidalHealth Peninsula Reg'l

100 E Carroll St, Salisbury, MD 21801

APPENDIX A

STANDING ORDERS

STANDING ORDERS

GENERAL

- Utilize Stop Work Authority when warranted.
- No smoking, eating, or drinking in this work zone.
- Use PFA-s free water.
- Be sensitive as to not wear PFAS containing materials or products such as deodorants, waterproof clothing, perfumes, sunblock and insect repellants, etc.
- Upon leaving the work zone, personnel will thoroughly wash their hands and face.
- Minimize contact with contaminated materials through proper planning of work areas and decontamination areas, and by following proper procedures. Do not place equipment on the ground. Do not sit on contaminated materials.
- No open flames in the work zone.
- Only properly trained and equipped personnel are permitted to work in potentially contaminated areas.
- Use the appropriate level of personal protective equipment (PPE).
- Maintain close contact with your buddy in the work zone.
- Contaminated material will be contained in the Exclusion Zone (EZ) and will need to be transported between properties.
- Report unusual conditions.
- Work areas will be kept clear and uncluttered. Debris and other slip, trip, and fall hazards will be removed as frequently as possible.
- The number of personnel and equipment in the work zone will be kept to an essential minimum.
- Be alert to the symptoms of fatigue and heat/cold stress, and their effects on the normal caution and judgment of personnel.
- Conflicting situations which may arise concerning safety requirements and working conditions must be addressed and resolved quickly by the site SSO.

TOOLS AND HEAVY EQUIPMENT

- Do not enter or ride in or on a backhoe bucket, materials hoist, or other device not specifically designed to carrying passengers.
- Loose-fitting clothing or loose long hair is prohibited around moving machinery.
- See that heavy equipment operators and other personnel in the work zone are using the same hand signals to communicate.
- Drilling/excavating within 10 feet of overhead power lines is prohibited.
- The locations of underground utilities must be identified and marked out prior to initiating subsurface activities.
- Check to verify that the equipment operator has lowered blades and buckets to the ground before shutting off the vehicle.
- If the equipment has an emergency stop device, have the operator show personnel its location and how to activate it.
- Help the operator verify adequate clearances when the equipment must negotiate in tight quarters; serve as a signalman to direct backing as necessary.
- Direct that heavy equipment that is used in the Exclusion Zone is kept in that zone until the job is done, and that such equipment is appropriately decontaminated before moving it into the clean area of the work zone.

- Samplers must not reach into or get near rotating equipment such as the drill rig. If personnel must work near tools that could rotate, the equipment operator must completely shut down the rig prior to initiating such work. It may be necessary to use a remote sampling device.

APPENDIX B

DECONTAMINATION PROCEDURES

PERSONNEL DECONTAMINATION

LEVEL C DECONTAMINATION

Station 1:	Equipment Drop	1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	2. Scrub outer boots, outer gloves and chemical-resistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Canister or Mask Change	4. If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5:	Boot, Gloves and Outer Garment Removal	5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 6:	Facepiece Removal	6. Facepiece is removed (avoid touching face with fingers). Facepiece deposited on plastic sheets.
Station 7:	Field Wash	7. Hands and face are thoroughly washed. Shower as soon as possible.

LEVEL D DECONTAMINATION

Station 1:	Equipment Drop	1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	2. Scrub outer boots, outer gloves and chemical resistant splash suit with PFAS-free decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Boot, Gloves and Outer Garment Removal	4. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 5:	Field Wash	5. Hands and face are thoroughly washed. Shower as soon as possible.

EQUIPMENT DECONTAMINATION

GENERAL:

Equipment to be decontaminated during the project may include tools, monitoring equipment, respirators, sampling containers, laboratory equipment and drilling equipment.

All decontamination will be done by personnel in protective gear, appropriate for the level of decontamination, as determined by the site SSO. The decontamination work tasks will be split or rotated among support and work crews. Decontamination of equipment shall be conducted in accordance with the Langan *PFAS Investigation Standard Operating Procedures (SOPs)* included with Langan's *PFAS Site Investigation Workplan for the ZCR Facility* using a direct push methods and a hand auger (Appendix I). PFAS-free water, equipment and detergent shall be used during the decontamination process.

Depending on site conditions, pumps may be decontaminated over a portable decontamination pad to contain wash water; or, wash water may be allowed to run off into a storm sewer system. Equipment needed may include a steam generator with high-pressure water, empty drums, screens, screen support structures, and shovels. Drums will be used to hold contaminated wash water pumped from the lined pit. These drums will be labeled as such.

Miscellaneous tools and equipment will be dropped into a plastic pail, tub, or other container. They will be brushed off and rinsed with a PFAS-free detergent solution, and finally rinsed with PFAS-free water.

MONITORING EQUIPMENT:

The contaminated equipment will be taken from the drop area and the protective coverings removed and disposed in the appropriate containers. Dirt or obvious contamination will be brushed or wiped with a disposable paper wipe.

RESPIRATORS:

Respirators will be cleaned and disinfected after every use. Taken from the drop area, the masks (with the cartridges removed and disposed of with other used disposable gear) will be immersed in a cleaning solution and scrubbed gently with a soft brush, followed by a rinse in plain warm water, and then allowed to air dry. In the morning, new cartridges will be installed. Personnel will inspect their own masks for serviceability prior to donning them. And, once the mask is on, the wearer will check the respirator for leakage using the negative and positive pressure fit check techniques.

APPENDIX C

INCIDENT/ INJURY REPORT

INCIDENT/ INJURY REPORT
LANGAN ENGINEERING & ENVIRONMENTAL SERVICES

(Complete and return to Tony Moffa in the Doylestown Office)

Affected Employee Name: ______________________ Date: ______________________

Incident type: ☐ Injury ☐ Report Only/No Injury

☐ Near Miss ☐ Other: ______________________

EMPLOYEE INFORMATION (Person completing Form)

Employee Name: ______________________ Employee No: ______________________

Title: ______________________ Office Location: ______________________

Length of time employed or date of hire: ______________________

Mailing address: ______________________

____

Sex: M ☐ F ☐ Birth date: ______________________

Business phone & extension: ______________________ Residence/cell phone: ______________________

ACCIDENT INFORMATION

Project: ______________________ Project #: ______________________

Date & time of incident: ______________________ Time work started & ended: ______________________

Site location: ______________________

Incident Type: Possible Exposure ☐ Exposure ☐ Physical Injury ☐

Names of person(s) who witnessed the incident: ______________________

____

Exact location incident occurred: ______________________

____

LANGAN

Describe work being done:____

Describe what affected employee was doing prior to the incident occurring: ____________________

Describe in detail how the incident occurred:__________________________________

Nature of the incident (List the parts of the body affected):____________________________

Person(s) to whom incident was reported (Time and Date): ____________________________

List the names of other persons affected during this incident: ____________________________

Possible causes of the incident (equipment, unsafe work practices, lack of PPE, etc): ______________

Weather conditions during incident:____

MEDICAL CARE INFORMATION

Did affected employee receive medical care? Yes ☐ No ☐

If Yes, when and where was medical care received:____________________________

Provide name of facility (hospital, clinic, etc): ____________________________

Length of stay at the facility? ______________________________

Did the employee miss work time? Yes ☐ No ☐ Undetermined ☐

Date employee last worked: ________________ Date employee returned to work:__________

Has the employee returned to work? Yes ☐ No ☐

Does the employee have work limitations or restrictions from the injury?: Yes ☐ No ☐

If Yes, please describe: ______________________________

____

Did the exposure/injury result in permanent disability? Yes ☐ No ☐ Unknown ☐

If Yes, please describe: ______________________________

HEALTH & SAFETY INFORMATION

Was the operation being conducted under an established site-specific Health and Safety Plan?
Yes ☐ No ☐ Not Applicable: ☐

Describe protective equipment and clothing used by the employee:

____

____

____

Did limitations in safety equipment or protective clothing contribute to or affect exposure / injury? If so, explain:

____

____

____

______________________________ ________________

Employee Signature Date

______________________________ ________________

Langan Representative Date

APPENDIX D

CALIBRATION LOG

DATE: ________________

PROJECT: ____________________

CALIBRATION LOG

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calib Reading	Performed By:

APPENDIX E

SAFETY DATA SHEETS (SDSs)

AccuStandard®, Inc.
125 Market St., New Haven, CT 06513 USA
Tel: 203-786-5290 Fax: 203-786-5287

SAFETY DATA SHEET

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

1.1 - Product Identifiers

Catalog Name: PFOA-026S

Description: 3-Perfluoropropyl Propanoic acid (3:3 FTCA) in Methanol

1.2 - Relevant Identified Uses of the Substance or Mixture

Laboratory Chemical Reference Material

1.3 - Supplier Details

Company: AccuStandard, Inc.
125 Market St.
New Haven, CT 06513 USA

Telephone Number: 203-786-5290

Fax: 203-786-5287

Email: edocs@accustandard.com

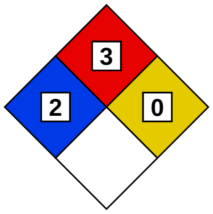
1.4 - Emergency Telephone Number

Emergency Phone #: AccuStandard, Inc.
1-203-502-7070 (USA)
+001-203-502-7070 (International)

24 hours / 7 days a week

SECTION 2 - HAZARDS IDENTIFICATION

2.1 - GHS Label Elements



*	2	HEALTH
	3	FLAMMABILITY
	0	PHYSICAL HAZARD

Signal Word: Danger

Hazard Codes:

H225 - Highly Flammable (Flammable liquids, category 2)

H301 - Toxic if swallowed. (Acute toxicity, oral, category 3)

H311 - Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

H315 - Irritating to skin. (Skin corrosion/irritation, category 2)

H320 - Irritating to eyes. (Eye damage/irritation, category 2B)

H332 - Harmful if inhaled. (Acute toxicity, inhalation, category 4)

H336 - Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

H360 - California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

H370 - Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

Precautionary Codes:

SECTION 2 - HAZARDS IDENTIFICATION *- continued*

2.1 - GHS Label Elements *- continued*

P202 - This product should only by used by persons trained in the safe handling of hazardous chemicals.

P233 - Store in a tightly closed container. (P404)

P262 - Do not get in eyes, on skin or clothing.

P264 - Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

P280 - Protective gloves must be worn to prevent skin contact.

P284 - Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

P331 - Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person.

P338 - Eye contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

P360 - Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

2.2 - Other Hazards

2.2.1 - Symptom of Exposure Health/Environment

Highly Flammable (Flammable liquids, category 2)

Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

After ingestion or inhalation, initial symptoms may be only that of mild intoxication, but may become severe after 12 or 18 hours.

POISON: May be fatal or cause blindness if swallowed.

Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

2.2.2 - Potential Health Effects

Irritating to eyes. (Eye damage/irritation, category 2B)

Irritating to skin. (Skin corrosion/irritation, category 2)

Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

Irritating to mucous membrane and upper respiratory system.

Harmful if inhaled. (Acute toxicity, inhalation, category 4)

Toxic if swallowed. (Acute toxicity, oral, category 3)

2.2.3 - Routes of Entry

Inhalation, ingestion or skin contact.

2.2.4 - Carcinogenicity

California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

SECTION 3 - COMPOSITION / ANALYTES DATA

Description: 3-Perfluoropropyl Propanoic acid (3:3 FTCA) in Methanol

SECTION 3 - COMPOSITION / ANALYTES DATA *- continued*

			ACGIH -TLV (mg/m³)			OSHA -PEL (mg/m³)		
Analyte	CAS #	% Concentration	TWA	STEL	Skin	TWA	STEL	Skin
3-Perfluoropropyl propanoic acid	356-02-5	0.010						
PT Methanol	67-56-1	99.990				260		

SECTION 4 - FIRST AID MEASURES

4.1 - First Aid Procedures - General

Get medical assistance for all cases of overexposure.

4.2 - Eye Contact

Eye contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. (P338)

4.3 - Skin Contact

Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse. (P360)

4.4 - Inhalation

Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

4.5 - Ingestion

Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person. (P331)

SECTION 5 - FIRE FIGHTING MEASURES

5.1 - Flammable Properties

Dangerous fire and explosive hazard.

Containers can build up pressure if exposed to heat.

Vapors can travel to a source of ignition and flash back.

During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

5.2 - Extinguishing Media

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.

5.3 - Protection of Firefighters

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

6.1 - Spill Response

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

SECTION 7 - HANDLING AND STORAGE

Store in a tightly closed container. (P404)

Store in a cool place below 14 °F (-10 °C).

Avoid breathing vapors or mists.

Use with adequate ventilation.

Do not get in eyes, on skin or clothing. (P262)

Avoid prolonged or repeated exposure.

This product should only by used by persons trained in the safe handling of hazardous chemicals. (P202)

SECTION 8 - EXPOSURE CONTROLS

8.1 - Engineering Controls/PPE

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available. (P264)

8.2 - General Hygene Considerations

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact. (P280)

(Chloroprene, natural rubber, nitrile, or equivalent)

Use eye protection tested and approved under the appropriate government standards such as NIOSH (US) or EN 166 (EU).

All recommendations are advisory only and must be evaluated by an industrial hygienist and/or safety officer familiar with the specific situation of anticipated use, such as concentration and amount of the substance in the workplace. Any recommendation should not be construed as offering an approval for any specific use of the product.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Clear liquid

Odor: N/A

Odor Threshold: N/A

pH: N/A

Melting Point: -93.9 °C

Boiling Point: 65 °C

Flash Point: 52 °F (11 °C) (tcc)

Evaporation Rate (Butyl Acetate=1): 5.9

Flammability Class: N/A

Lower Flammability Level: 6.7

Upper Flammability Level: 36.5

Vapor Pressure: 97 mmHg (20 °C)

Vapor Density (Air = 1): 1.1 g/L

Specific Gravity: 0.791 g/cm3

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES *- continued*

Solubility in Water: Very soluble

Partition Coefficient: log Pow: -0.77

Autoignition Temperature: 385 °C

Decomposition Temperature: N/A

Viscosity: N/A

VOC Content: N/A

Percent Volatile: 99.9+

SECTION 10 - STABILITY AND REACTIVITY

Stability: Stable

Materials to Avoid: Acids
Oxidizers

Hazardous Decomposition: Oxides of carbon; Formaldehyde

Hazardous Polymerization: Will not occur

Condition to Avoid: Heat; Contact with ignition sources

SECTION 11 - TOXICOLOGICAL INFORMATION

Human Health Toxicity

See section 2 for specific toxicological information for the ingredients of this product.

LD50 (Oral): Human - 143 mg/kg; Rat - 1500 mg/kg

LD50 (Dermal) : Rabbit - >2000 mg/kg

LC50 (Inhalation): Rat - >20 mg/L

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

No other information related to the toxicological properties of this product is available at this time.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Toxicity

By complying with sections 6 and 7 there should be no release to the environment.

LC50 (Fish): >1000 mg/L 96H

EC50 (Aquatic Invertebrate): >1000 mg/L 48H

BCF: 1.0

Hydrolyzes readily on contact with water. Readily biodegradable.

No other information related to the ecological properties of this product is available at this time.

SECTION 13 - DISPOSAL CONSIDERATIONS

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

SECTION 14 - TRANSPORT INFORMATION

Transportation Information (DOT/IATA)

SECTION 14 - TRANSPORT INFORMATION *- continued*

UN Number: UN1230

Class: 3

Packing Group: II

Proper Shipping Name: Methanol

Poison by Inhalation: No

Marine Pollutant: No

SECTION 15 - REGULATORY INFORMATION

Not all components are listed on the TSCA Inventory.

This product contains a compound or compounds subject to EU Regulation (EC) No 1907/2006 (REACH) on Annex XIV, Annex XVII, and/or Article 59. Refer to the below table for details.

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

This product is subject to SARA section 313 reporting requirements.

For laboratory, research and development use only. Not for manufacturing or commercial purposes.

In addition to federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

			REACH (1907/2006)		
Analyte	CAS #	% Concentration	Annex XIV	Annex XVII	Article 59
PT Methanol	67-56-1	99.990		X	

SECTION 16 - OTHER INFORMATION

This document has been designed to meet the requirements of OSHA, ANSI, GHS and CHIPs regulations. Chemicals are classified using the Globally Harmonized System for Classification and Labeling of Chemicals and CLP Regulation (EC) No. 1272/2008.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. The manufacturer will not assume any liability for the accuracy and completeness of this information. Final determination of the suitability of the material is the responsibility of the user. Although certain hazards are described herein, the user should not presume that these are the only hazards that exist. Since conditions and manner of use are outside of the manufacturers control, we make

NO WARRANTY OF MERCHANTABILITY, EXPRESSED OR IMPLIED, AND ASSUME NO LIABILITY RESULTING FROM ITS USE.

Legend : N/A = Not Available ND = Not Determined NR = Not Regulated

Alteration of any information contained herein without written permission from the manufacturer is strictly prohibited.

HMIS/NFPA HAZARD INDEX

0 - Minimal
1 - Slight
2 - Moderate
3 - Serious
4 - Severe

* - Additional Hazard

GHS HAZARD INDEX

Category 1 - Most Severe
Category 5 - Least Severe

**** End of Document ****

Safety Data Sheet
acc. to OSHA HCS

Printing date 08/18/2023 Revision date 08/18/2023

1 Identification

· **Product identifier**

· **Trade name: 1H,1H,2H,2H-Perfluorohexanesulfonic Acid**
· **Synonym** 3,3,4,4,5,5,6,6,6-nonafluoro-1-hexanesulfonic acid

· **Article number:** 37261
· **CAS Number:**
757124-72-4
· **EC number:**
816-391-3
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS05 Corrosion

Skin Corrosion 1B	H314 Causes severe skin burns and eye damage.
Eye Damage 1	H318 Causes serious eye damage.


GHS07

Acute Toxicity - Oral 4	H302 Harmful if swallowed.
Acute Toxicity - Dermal 4	H312 Harmful in contact with skin.
Acute Toxicity - Inhalation 4	H332 Harmful if inhaled.
Specific Target Organ Toxicity - Single Exposure 3	H335 May cause respiratory irritation.

(Contd. on page 2)

(Contd. from page 1)

· **Label elements**

· **GHS label elements**

The substance is classified and labeled according to the Globally Harmonized System (GHS).

· **Hazard pictograms**

GHS05

GHS07

· **Signal word** Danger

· **Hazard statements**

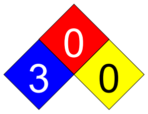
H302+H312+H332	Harmful if swallowed, in contact with skin or if inhaled.
H314	Causes severe skin burns and eye damage.
H335	May cause respiratory irritation.

· **Precautionary statements**

P260	Do not breathe dusts or mists.
P264	Wash 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/doctor if you feel unwell.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P321	Specific treatment (see on this label).
P362+P364	Take off contaminated clothing and wash it before reuse.
P363	Wash contaminated clothing before reuse.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*3
FIRE	0
REACTIVITY	0

Health = *3
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

(Contd. on page 3)

(Contd. from page 2)

3 Composition/information on ingredients

- **Chemical characterization: Substances**
- **CAS No. Description**
  757124-72-4 1H,1H,2H,2H-Perfluorohexanesulfonic Acid
- **Identification number(s)**
- **EC number:** 816-391-3

4 First-aid measures

- **Description of first aid measures**
- **General information:**
  Immediately remove any clothing soiled by the product.
  Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
- **After inhalation:**
  Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
  In case of unconsciousness place patient stably in side position for transportation.
- **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
- **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
- **After swallowing:**
  Immediately call a doctor.
  Drink copious amounts of water and provide fresh air. Immediately call a doctor.
- **Information for doctor:**
- **Most important symptoms and effects, both acute and delayed**
  No further relevant information available.
- **Indication of any immediate medical attention and special treatment needed**
  No further relevant information available.

5 Fire-fighting measures

- **Extinguishing media**
- **Suitable extinguishing agents:**
  Use fire fighting measures that suit the environment.
  A solid water stream may be inefficient.
- **Special hazards arising from the substance or mixture** No further relevant information available.
- **Advice for firefighters**
- **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures**
  Wear protective equipment. Keep unprotected persons away.
- **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:**
  Use neutralizing agent.
  Dispose contaminated material as waste according to section 13.
  Ensure adequate ventilation.
- **Reference to other sections**
  See Section 7 for information on safe handling.

(Contd. on page 4)

(Contd. from page 3)

See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

- **Protective Action Criteria for Chemicals**
- **PAC-1:** Substance is not listed.
- **PAC-2:** Substance is not listed.
- **PAC-3:** Substance is not listed.

7 Handling and storage

- **Handling:**
- **Precautions for safe handling**

  Thorough dedusting.
  Ensure good ventilation/exhaustion at the workplace.
- **Information about protection against explosions and fires:** No special measures required.

- **Conditions for safe storage, including any incompatibilities**
- **Storage:** Store in accordance with information listed on the product insert.
- **Requirements to be met by storerooms and receptacles:** No special requirements.
- **Information about storage in one common storage facility:** Not required.
- **Further information about storage conditions:** Keep receptacle tightly sealed.
- **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

- **Additional information about design of technical systems:** No further data; see section 7.

- **Control parameters**
- **Components with limit values that require monitoring at the workplace:** Not required.
- **Additional information:** The lists that were valid during the creation were used as basis.

- **Exposure controls**
- **Personal protective equipment:**
- **General protective and hygienic measures:**

  Keep away from foodstuffs, beverages and feed.
  Immediately remove all soiled and contaminated clothing.
  Wash hands before breaks and at the end of work.
  Avoid contact with the eyes.
  Avoid contact with the eyes and skin.
- **Breathing equipment:**

  In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
- **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

(Contd. on page 5)

(Contd. from page 4)

· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C6H5F9O3S
· **Molecular Weight**	328.2 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.

(Contd. on page 6)

Safety Data Sheet
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(Contd. from page 5)

Kinematic:	Not applicable.
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Caustic effect on skin and mucous membranes.
· **on the eye:**
Strong caustic effect.
Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (Self-assessment): slightly hazardous for water
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

(Contd. on page 7)

(Contd. from page 6)

· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is not listed.
· **TSCA (Toxic Substances Control Act):** Substance is not listed.
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.

(Contd. on page 8)

(Contd. from page 7)

- **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
- **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 08/18/2023
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 4: Acute toxicity – Category 4
Skin Corrosion 1B: Skin corrosion/irritation – Category 1B
Eye Damage 1: Serious eye damage/eye irritation – Category 1
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3

Safety Data Sheet
acc. to OSHA HCS

Printing date 01/31/2023 Revision date 01/31/2023

1 Identification

· **Product identifier**

· **Trade name: 2H,2H,3H,3H-Perfluorooctanoic Acid**

· **Article number:** 37270
· **CAS Number:**
914637-49-3
· **EC number:**
811-572-3
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS05 Corrosion

Skin Corrosion 1B H314 Causes severe skin burns and eye damage.


GHS07

Specific Target Organ Toxicity - Single Exposure 3 H335 May cause respiratory irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).

(Contd. on page 2)

(Contd. from page 1)

· **Hazard pictograms**


GHS05


GHS07

· **Signal word** Danger

· **Hazard statements**

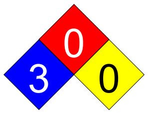
H314 Causes severe skin burns and eye damage.
H335 May cause respiratory irritation.

· **Precautionary statements**

P260	Do not breathe dusts or mists.
P264	Wash thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P321	Specific treatment (see on this label).
P363	Wash contaminated clothing before reuse.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	3
FIRE	0
REACTIVITY	0

Health = 3
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**

· **CAS No. Description**

914637-49-3 2H,2H,3H,3H-Perfluorooctanoic Acid

(Contd. on page 3)

Safety Data Sheet
acc. to OSHA HCS

(Contd. from page 2)

· **Identification number(s)**
· **EC number:** 811-572-3

4 First-aid measures

· **Description of first aid measures**
· **General information:** Immediately remove any clothing soiled by the product.
· **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:** Drink copious amounts of water and provide fresh air. Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** No special measures required.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Use neutralizing agent.
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**
· **PAC-1:** Substance is not listed.
· **PAC-2:** Substance is not listed.
· **PAC-3:** Substance is not listed.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling** Thorough dedusting.
· **Information about protection against explosions and fires:** No special measures required.

(Contd. on page 4)

(Contd. from page 3)

· **Conditions for safe storage, including any incompatibilities**

· **Storage:** Store in accordance with information listed on the product insert.

· **Requirements to be met by storerooms and receptacles:** No special requirements.

· **Information about storage in one common storage facility:** Not required.

· **Further information about storage conditions:** Keep receptacle tightly sealed.

· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

· **Control parameters**

· **Components with limit values that require monitoring at the workplace:** Not required.

· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**

· **Personal protective equipment:**

· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.

· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.

· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**

Tightly sealed goggles

(Contd. on page 5)

(Contd. from page 4)

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C8H5F11O2
· **Molecular Weight**	342.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
SOLUBILITY	DMF: 5 mg/ml; DMSO: 2 mg/ml; Ethanol: insol; PBS (pH 7.2): insol
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.

(Contd. on page 6)

(Contd. from page 5)

- **Conditions to avoid** No further relevant information available.
- **Incompatible materials:** No further relevant information available.
- **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

- **Information on toxicological effects**
- **Acute toxicity:**
- **Primary irritant effect:**
- **on the skin:** Caustic effect on skin and mucous membranes.
- **on the eye:** Strong caustic effect.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**
  Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

- **Carcinogenic categories**
- **IARC (International Agency for Research on Cancer)** Substance is not listed.
- **NTP (National Toxicology Program)** Substance is not listed.
- **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

- **Toxicity**
- **Aquatic toxicity:** No further relevant information available.
- **Persistence and degradability** No further relevant information available.
- **Behavior in environmental systems:**
- **Bioaccumulative potential** No further relevant information available.
- **Mobility in soil** No further relevant information available.
- **Additional ecological information:**
- **General notes:**
  Water hazard class 1 (Self-assessment): slightly hazardous for water
  Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
  Must not reach bodies of water or drainage ditch undiluted or unneutralized.
- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **Other adverse effects** No further relevant information available.

13 Disposal considerations

- **Waste treatment methods**
- **Recommendation:**
  Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

- **Uncleaned packagings:**
- **Recommendation:** Disposal must be made according to official regulations.

(Contd. on page 7)

Safety Data Sheet
acc. to OSHA HCS

(Contd. from page 6)

14 Transport information

· **UN-Number**	
· **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name**	
· **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)**	
· **DOT, ADN, IMDG, IATA**	
· **Class**	not regulated
· **Packing group**	
· **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is not listed.
· **TSCA (Toxic Substances Control Act):** Substance is not listed.
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

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(Contd. on page 8)

(Contd. from page 7)

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 01/31/2023
- **Abbreviations and acronyms:**

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REL: Recommended Exposure Limit
Skin Corrosion 1B: Skin corrosion/irritation – Category 1B
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3

AccuStandard® Inc.
125 Market St., New Haven, CT 06513 USA
Tel: 203-786-5290 Fax: 203-786-5287

SAFETY DATA SHEET

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

1.1 - Product Identifiers

Catalog Name: PFOS-028S

Description: 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS) in Methanol

1.2 - Relevant Identified Uses of the Substance or Mixture

Laboratory Chemical Reference Material

1.3 - Supplier Details

Company: AccuStandard, Inc.
125 Market St.
New Haven, CT 06513 USA

Telephone Number: 203-786-5290

Fax: 203-786-5287

Email: edocs@accustandard.com

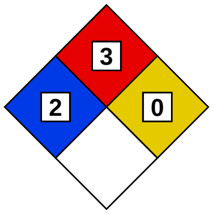
1.4 - Emergency Telephone Number

Emergency Phone #: AccuStandard, Inc.
1-203-502-7070 (USA)
+001-203-502-7070 (International)

24 hours / 7 days a week

SECTION 2 - HAZARDS IDENTIFICATION

2.1 - GHS Label Elements



*	2	HEALTH
	3	FLAMMABILITY
	0	PHYSICAL HAZARD

Signal Word: Danger

Hazard Codes:

H225 - Highly Flammable (Flammable liquids, category 2)

H301 - Toxic if swallowed. (Acute toxicity, oral, category 3)

H311 - Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

H315 - Irritating to skin. (Skin corrosion/irritation, category 2)

H320 - Irritating to eyes. (Eye damage/irritation, category 2B)

H332 - Harmful if inhaled. (Acute toxicity, inhalation, category 4)

H336 - Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

H360 - California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

H370 - Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

Precautionary Codes:

SECTION 2 - HAZARDS IDENTIFICATION *- continued*

2.1 - GHS Label Elements *- continued*

P202 - This product should only by used by persons trained in the safe handling of hazardous chemicals.

P233 - Store in a tightly closed container. (P404)

P262 - Do not get in eyes, on skin or clothing.

P264 - Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

P280 - Protective gloves must be worn to prevent skin contact.

P284 - Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

P331 - Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person.

P338 - Eye contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

P360 - Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

2.2 - Other Hazards

2.2.1 - Symptom of Exposure Health/Environment

Highly Flammable (Flammable liquids, category 2)

Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

After ingestion or inhalation, initial symptoms may be only that of mild intoxication, but may become severe after 12 or 18 hours.

POISON: May be fatal or cause blindness if swallowed.

Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

2.2.2 - Potential Health Effects

Irritating to eyes. (Eye damage/irritation, category 2B)

Irritating to skin. (Skin corrosion/irritation, category 2)

Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

Irritating to mucous membrane and upper respiratory system.

Harmful if inhaled. (Acute toxicity, inhalation, category 4)

Toxic if swallowed. (Acute toxicity, oral, category 3)

2.2.3 - Routes of Entry

Inhalation, ingestion or skin contact.

2.2.4 - Carcinogenicity

California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

SECTION 3 - COMPOSITION / ANALYTES DATA

Description: 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS) in Methanol

SECTION 3 - COMPOSITION / ANALYTES DATA *- continued*

			ACGIH -TLV (mg/m³)			OSHA -PEL (mg/m³)		
Analyte	CAS #	% Concentration	TWA	STEL	Skin	TWA	STEL	Skin
1H,1H,2H,2H-Perfluorooctane sulfonic acid	27619-97-2	0.010						
Methanol	67-56-1	99.990				260		

SECTION 4 - FIRST AID MEASURES

4.1 - First Aid Procedures - General

Get medical assistance for all cases of overexposure.

4.2 - Eye Contact

Eye contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. (P338)

4.3 - Skin Contact

Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse. (P360)

4.4 - Inhalation

Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

4.5 - Ingestion

Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person. (P331)

SECTION 5 - FIRE FIGHTING MEASURES

5.1 - Flammable Properties

Dangerous fire and explosive hazard.

Containers can build up pressure if exposed to heat.

Vapors can travel to a source of ignition and flash back.

During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

5.2 - Extinguishing Media

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.

5.3 - Protection of Firefighters

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

6.1 - Spill Response

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

SECTION 7 - HANDLING AND STORAGE

Store in a tightly closed container. (P404)

Store in a cool area away from ignition sources and oxidizers.

Avoid breathing vapors or mists.

Use with adequate ventilation.

Do not get in eyes, on skin or clothing. (P262)

Avoid prolonged or repeated exposure.

This product should only by used by persons trained in the safe handling of hazardous chemicals. (P202)

SECTION 8 - EXPOSURE CONTROLS

8.1 - Engineering Controls/PPE

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available. (P264)

8.2 - General Hygene Considerations

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact. (P280)

(Chloroprene, natural rubber, nitrile, or equivalent)

Use eye protection tested and approved under the appropriate government standards such as NIOSH (US) or EN 166 (EU).

All recommendations are advisory only and must be evaluated by an industrial hygienist and/or safety officer familiar with the specific situation of anticipated use, such as concentration and amount of the substance in the workplace. Any recommendation should not be construed as offering an approval for any specific use of the product.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Clear liquid

Odor: N/A

Odor Threshold: N/A

pH: N/A

Melting Point: -93.9 °C

Boiling Point: 65 °C

Flash Point: 52 °F (11 °C) (tcc)

Evaporation Rate (Butyl Acetate=1): 5.9

Flammability Class: N/A

Lower Flammability Level: 6.7

Upper Flammability Level: 36.5

Vapor Pressure: 97 mmHg (20 °C)

Vapor Density (Air = 1): 1.1 g/L

Specific Gravity: 0.791 g/cm3

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES *- continued*

Solubility in Water: Very soluble

Partition Coefficient: log Pow: -0.77

Autoignition Temperature: 385 °C

Decomposition Temperature: N/A

Viscosity: N/A

VOC Content: N/A

Percent Volatile: 99.9+

SECTION 10 - STABILITY AND REACTIVITY

Stability: Stable

Materials to Avoid: Acids
Oxidizers

Hazardous Decomposition: Oxides of carbon; Formaldehyde

Hazardous Polymerization: Will not occur

Condition to Avoid: Heat; Contact with ignition sources

SECTION 11 - TOXICOLOGICAL INFORMATION

Human Health Toxicity

See section 2 for specific toxicological information for the ingredients of this product.

LD50 (Oral): Human - 143 mg/kg; Rat - 1500 mg/kg

LD50 (Dermal) : Rabbit - >2000 mg/kg

LC50 (Inhalation): Rat - >20 mg/L

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

No other information related to the toxicological properties of this product is available at this time.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Toxicity

By complying with sections 6 and 7 there should be no release to the environment.

LC50 (Fish): >1000 mg/L 96H

EC50 (Aquatic Invertebrate): >1000 mg/L 48H

BCF: 1.0

Hydrolyzes readily on contact with water. Readily biodegradable.

No other information related to the ecological properties of this product is available at this time.

SECTION 13 - DISPOSAL CONSIDERATIONS

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

SECTION 14 - TRANSPORT INFORMATION

Transportation Information (DOT/IATA)

SECTION 14 - TRANSPORT INFORMATION *- continued*

UN Number: UN1230

Class: 3

Packing Group: II

Proper Shipping Name: Methanol

Poison by Inhalation: No

Marine Pollutant: No

SECTION 15 - REGULATORY INFORMATION

This product contains a compound or compounds subject to EU Regulation (EC) No 1907/2006 (REACH) on Annex XIV, Annex XVII, and/or Article 59. Refer to the below table for details.

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

This product is subject to SARA section 313 reporting requirements.

All components are listed on the TSCA Inventory.

For laboratory, research and development use only. Not for manufacturing or commercial purposes.

In addition to federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

			REACH (1907/2006)		
Analyte	CAS #	% Concentration	Annex XIV	Annex XVII	Article 59
Methanol	67-56-1	99.990		X	

SECTION 16 - OTHER INFORMATION

This document has been designed to meet the requirements of OSHA, ANSI, GHS and CHIPs regulations. Chemicals are classified using the Globally Harmonized System for Classification and Labeling of Chemicals and CLP Regulation (EC) No. 1272/2008.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. The manufacturer will not assume any liability for the accuracy and completeness of this information. Final determination of the suitability of the material is the responsibility of the user. Although certain hazards are described herein, the user should not presume that these are the only hazards that exist. Since conditions and manner of use are outside of the manufacturers control, we make

NO WARRANTY OF MERCHANTABILITY, EXPRESSED OR IMPLIED, AND ASSUME NO LIABILITY RESULTING FROM ITS USE.

Legend : N/A = Not Available ND = Not Determined NR = Not Regulated

Alteration of any information contained herein without written permission from the manufacturer is strictly prohibited.

HMIS/NFPA HAZARD INDEX

0 - Minimal
1 - Slight
2 - Moderate
3 - Serious
4 - Severe

* - Additional Hazard

GHS HAZARD INDEX

Category 1 - Most Severe
Category 5 - Least Severe

**** End of Document ****

Safety Data Sheet
acc. to OSHA HCS

1 Identification

· **Product identifier**

· **Trade name: 2H,2H,3H,3H-Perfluorodecanoic Acid**
· **Synonym** 4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-pentadecafluoro-decanoic acid

· **Article number:** 37271
· **CAS Number:**
812-70-4
· **EC number:**
696-430-7
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS05 Corrosion

Skin Corrosion 1B	H314 Causes severe skin burns and eye damage.
Eye Damage 1	H318 Causes serious eye damage.


GHS07

Specific Target Organ Toxicity - Single Exposure 3	H335 May cause respiratory irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).

(Contd. on page 2)

(Contd. from page 1)

· **Hazard pictograms**

GHS05

GHS07

· **Signal word** Danger

· **Hazard statements**

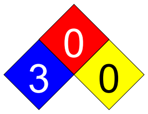
H314 Causes severe skin burns and eye damage.
H335 May cause respiratory irritation.

· **Precautionary statements**

P260	Do not breathe dusts or mists.
P264	Wash thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P321	Specific treatment (see on this label).
P363	Wash contaminated clothing before reuse.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*3
FIRE	0
REACTIVITY	0

Health = *3
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**

· **CAS No. Description**

812-70-4 2H,2H,3H,3H-Perfluorodecanoic Acid

(Contd. on page 3)

(Contd. from page 2)

- **Identification number(s)**
- **EC number:** 696-430-7

4 First-aid measures

- **Description of first aid measures**
- **General information:** Immediately remove any clothing soiled by the product.
- **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
- **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
- **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
- **After swallowing:** Drink copious amounts of water and provide fresh air. Immediately call a doctor.
- **Information for doctor:**
- **Most important symptoms and effects, both acute and delayed**
  No further relevant information available.
- **Indication of any immediate medical attention and special treatment needed**
  No further relevant information available.

5 Fire-fighting measures

- **Extinguishing media**
- **Suitable extinguishing agents:**
  Use fire fighting measures that suit the environment.
  A solid water stream may be inefficient.
- **Special hazards arising from the substance or mixture** No further relevant information available.
- **Advice for firefighters**
- **Protective equipment:** No special measures required.

6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures**
  Wear protective equipment. Keep unprotected persons away.
- **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:**
  Use neutralizing agent.
  Dispose contaminated material as waste according to section 13.
  Ensure adequate ventilation.
- **Reference to other sections**
  See Section 7 for information on safe handling.
  See Section 8 for information on personal protection equipment.
  See Section 13 for disposal information.
- **Protective Action Criteria for Chemicals**
- **PAC-1:** Substance is not listed.
- **PAC-2:** Substance is not listed.
- **PAC-3:** Substance is not listed.

7 Handling and storage

- **Handling:**
- **Precautions for safe handling** Thorough dedusting.
- **Information about protection against explosions and fires:** No special measures required.

(Contd. on page 4)

(Contd. from page 3)

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see section 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:**

Tightly sealed goggles

(Contd. on page 5)

(Contd. from page 4)

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C10H5F15O2
· **Molecular Weight**	442.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.

(Contd. on page 6)

(Contd. from page 5)

- **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

- **Information on toxicological effects**
- **Acute toxicity:**
- **Primary irritant effect:**
- **on the skin:** Caustic effect on skin and mucous membranes.
- **on the eye:**
  Strong caustic effect.
  Strong irritant with the danger of severe eye injury.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**
  Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

- **Carcinogenic categories**
- **IARC (International Agency for Research on Cancer)** Substance is not listed.
- **NTP (National Toxicology Program)** Substance is not listed.
- **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

- **Toxicity**
- **Aquatic toxicity:** No further relevant information available.
- **Persistence and degradability** No further relevant information available.
- **Behavior in environmental systems:**
- **Bioaccumulative potential** No further relevant information available.
- **Mobility in soil** No further relevant information available.
- **Additional ecological information:**
- **General notes:**
  Water hazard class 1 (Self-assessment): slightly hazardous for water
  Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
  Must not reach bodies of water or drainage ditch undiluted or unneutralized.
- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **Other adverse effects** No further relevant information available.

13 Disposal considerations

- **Waste treatment methods**
- **Recommendation:**
  Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

- **Uncleaned packagings:**
- **Recommendation:** Disposal must be made according to official regulations.

(Contd. on page 7)

(Contd. from page 6)

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is not listed.
· **TSCA (Toxic Substances Control Act):** Substance is not listed.
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

(Contd. on page 8)

(Contd. from page 7)

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 08/18/2023
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Skin Corrosion 1B: Skin corrosion/irritation – Category 1B
Eye Damage 1: Serious eye damage/eye irritation – Category 1
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3

Safety Data Sheet
acc. to OSHA HCS

Printing date 08/18/2023 Revision date 08/18/2023

1 Identification

- **Product identifier**
- **Trade name: 1H,1H,2H,2H-Perfluorodecanesulfonic Acid**
- **Synonym** 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluoro-1-decanesulfonic acid
- **Article number:** 37259
- **CAS Number:**
  39108-34-4
- **EC number:**
  254-295-8
- **Application of the substance / the mixture**
  This product is for research use - Not for human or veterinary diagnostic or therapeutic use.
- **Details of the supplier of the safety data sheet**
- **Manufacturer/Supplier:**

Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

- **Information department:** Product safety department
- **Emergency telephone number:**

During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

- **Classification of the substance or mixture**

GHS08 Health hazard

Specific Target Organ Toxicity - Repeated Exposure 2	H373	May cause damage to organs through prolonged or repeated exposure.

GHS05 Corrosion

Skin Corrosion 1A	H314	Causes severe skin burns and eye damage.
Eye Damage 1	H318	Causes serious eye damage.

(Contd. on page 2)

(Contd. from page 1)

GHS07

Acute Toxicity - Oral 4	H302 Harmful if swallowed.
Specific Target Organ Toxicity - Single Exposure 3	H335 May cause respiratory irritation.

· **Label elements**

· **GHS label elements**

The substance is classified and labeled according to the Globally Harmonized System (GHS).

· **Hazard pictograms**

GHS05 GHS07 GHS08

· **Signal word** Danger

· **Hazard statements**

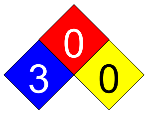
H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.
H335 May cause respiratory irritation.
H373 May cause damage to organs through prolonged or repeated exposure.

· **Precautionary statements**

P260	Do not breathe dusts or mists.
P264	Wash 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/doctor if you feel unwell.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P321	Specific treatment (see on this label).
P314	Get medical advice/attention if you feel unwell.
P363	Wash contaminated clothing before reuse.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*3
FIRE	0
REACTIVITY	0

Health = *3
Fire = 0
Reactivity = 0

(Contd. on page 3)

(Contd. from page 2)

· **Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
39108-34-4 1H,1H,2H,2H-Perfluorodecanesulfonic Acid
· **Identification number(s)**
· **EC number:** 254-295-8

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Immediately remove any clothing soiled by the product.
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:**
Immediately call a doctor.
Drink copious amounts of water and provide fresh air. Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** No special measures required.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Use neutralizing agent.
Dispose contaminated material as waste according to section 13.

(Contd. on page 4)

(Contd. from page 3)

Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**
· **PAC-1:** Substance is not listed.
· **PAC-2:** Substance is not listed.
· **PAC-3:** Substance is not listed.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling** Thorough dedusting.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see section 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

(Contd. on page 5)

(Contd. from page 4)

- **Material of gloves**
  The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
- **Penetration time of glove material**
  The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
- **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

- **Information on basic physical and chemical properties**
- **General Information**

· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C10H5F17O3S
· **Molecular Weight**	528.2 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.

(Contd. on page 6)

(Contd. from page 5)

Kinematic:	Not applicable.
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Strong caustic effect on skin and mucous membranes.
· **on the eye:**
Strong caustic effect.
Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (Self-assessment): slightly hazardous for water
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

(Contd. on page 7)

(Contd. from page 6)

· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is not listed.
· **TSCA (Toxic Substances Control Act):** Substance is not listed.
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.

(Contd. on page 8)

(Contd. from page 7)

· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

· **Department issuing SDS:** Environment protection department.
· **Contact:** -
· **Date of preparation / last revision** 08/18/2023
· **Abbreviations and acronyms:**
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 4: Acute toxicity – Category 4
Skin Corrosion 1A: Skin corrosion/irritation – Category 1A
Eye Damage 1: Serious eye damage/eye irritation – Category 1
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3
Specific Target Organ Toxicity - Repeated Exposure 2: Specific target organ toxicity (repeated exposure) – Category 2

LGC | DR EHRENSTORFER™

REFERENCE MATERIAL CERTIFICATE

Reference Material

This certificate is designed in accordance with ISO Guide 31. This reference material (RM) was designed, produced and verified in accordance with a registered quality management system ISO 9001. All measurements were performed according to ISO/IEC 17025 by a DAkkS accredited laboratory (D-PL-19883-01-00).

Product Name
11-Chloroeicosafluoro-3-oxaundecane-1-
sulfonic acid potassium

Product Code
DRE-CA11407100

CAS No.
83329-89-9

Mol. Weight
670.69

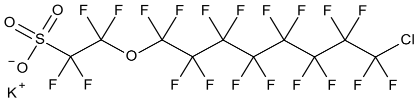
Mol. Formula
$C_{10}ClF_{20}O_4S \cdot K$

Lot Number
1480096

Format
Neat

Expiry Date
05 Sep 2027

Storage Temp
20°C ± 4°C



CERTIFIED	CERTIFIED
Purity 97.7% (g/g)	Expanded Uncertainty (U) 5.0% (g/g)

Uncertainty
The certified value(s) and uncertainty(ies) are determined in accordance with EURACHEM/CITAC Guide for "Quantifying Uncertainty in Analytical Measurement, 3rd edition", with an 95% confidence level (k=2). Uncertainty is based on the Total Combined Uncertainty, including uncertainties of characterisation and stability testing. Stability values are based on real evidence opposed to simulation.

The producer certifies that this reference material meets the specification stated in this certificate until the expiry date, provided it is stored unopened at the recommended temperature herein. Product warranties for this reference material are set out in the terms and conditions of purchase.

CERTIFIED BY	CERTIFIED ON		
N. Müller	05 Sep 2024		RM Release

REFERENCE MATERIAL CERTIFICATE

CHROMATOGRAM

No chromatogram available.

Instrument
HPLC/DAD+MS

Detection
DAD+MS

Column
Synergi Polar-RP 4 µm 250 x 4.6 mm

Method Details
see Batch Information

Inj.-Vol.
10 µL

Flow
0.5 mL/min

Method of Characterisation
Purity was determined by quantitative 19F-NMR

Method of Identification
NMR, RT, IR, MS

Batch Information
Substance is hygroscopic.
Method Details
Eluent A: 100% Acetonitrile
Eluent B: Water + Formic Acid

Time [min]	Eluent A [%]	Eluent B [%]
0	10	90
1	10	90
21	98	2
25	98	2

Intended Use
This RM is intended for use in a laboratory as a calibration and quality control standard or in method development for analytical techniques.

Safety
Proper precautions should be observed while handling. See Safety Data Sheet.

Traceability
The balances used for gravimetric measurements are calibrated with weights traceable to the national standards (DKD). The calibration of the balances is verified daily internally and annually by an external accredited calibration service. Chromatographic methods are traceable to the International System of Units (SI).

Storage
The RM should be stored in the original sealed container at the indicated temperature.

Instructions for use
It is recommended to use 1 mg as the minimum sample size and if less material is used, to increase the certified uncertainty by a factor of two for half sample and four for a quarter of sample. If storage after opening is necessary, the RM should be tightly closed and kept from light and moisture. If the RM was in a sealed ampoule, it should be transferred to a vial with minimum head space. Visit the support section of our website lgcstandards.com for a series of Dr. Ehrenstorfer Tech Tip videos and frequently asked questions.

1 Identification

· **Product identifier**

· **Product Name: Stock Organic Standard**

· **Part Name:** PFAS-ADONA
· **Application of the substance / the mixture** Certified Reference Material

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Spex CertiPrep, LLC.
203 Norcross Ave, Metuchen,
NJ 08840 USA
732-549-7144
USMet-CRMSales@antylia.com

· **Information department:** product safety department
· **Emergency telephone number:**
Emergency Phone Number (24 hours)
CHEMTREC (800-424-9300)
Outside US: 703-527-3887

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS02 Flame

Flammable Liquids 2 H225 Highly flammable liquid and vapor.


GHS06 Skull and crossbones

Acute Toxicity - Inhalation 3 H331 Toxic if inhaled.


GHS08 Health hazard

Specific Target Organ Toxicity - Single Exposure 1 H370 Causes damage to the central nervous system and the visual organs.

· **Label elements**
· **GHS label elements** The product is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**


GHS02


GHS06


GHS08

· **Signal word** Danger

· **Hazard-determining components of labeling:**
methanol
· **Hazard statements**
H225 Highly flammable liquid and vapor.
H331 Toxic if inhaled.
H370 Causes damage to the central nervous system and the visual organs.
· **Precautionary statements**

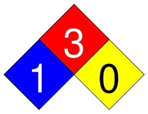
P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P260	Do not breathe dust/fume/gas/mist/vapors/spray.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P307+P311	IF exposed: Call a POISON CENTER or doctor/physician.
P321	Specific treatment (see on this label).
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P403+P235	Store in a well-ventilated place. Keep cool.

(Contd. on page 2)

(Contd. of page 1)

P405 Store locked up.
P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

· ***Classification system:***
· ***NFPA ratings (scale 0 - 4)***



Health = 1
Fire = 3
Reactivity = 0

· ***HMIS-ratings (scale 0 - 4)***

HEALTH	*1
FIRE	3
REACTIVITY	0

*Health = *1*
Fire = 3
Reactivity = 0

· ***Other hazards***
· ***Results of PBT and vPvB assessment***
· ***PBT:*** *Not applicable.*
· ***vPvB:*** *Not applicable.*

3 Composition/information on ingredients

· ***Chemical characterization: Mixtures***
· ***Description:*** *Mixture of the substances listed below with nonhazardous additions.*

· ***Dangerous components:***		
67-56-1	methanol	94.5%

· ***Chemical identification of the substance/preparation***		
7732-18-5	water, distilled, conductivity or of similar purity	4.99%
1310-73-2	sodium hydroxide	<0.5%
919005-14-4	4,8-Dioxa-3H-perfluorononanoic Acid	0.01%

4 First-aid measures

· ***Description of first aid measures***
· ***General information:***
Immediately remove any clothing soiled by the product.
Remove breathing apparatus only after contaminated clothing have been completely removed.
In case of irregular breathing or respiratory arrest provide artificial respiration.
· ***After inhalation:***
Supply fresh air or oxygen; call for doctor.
In case of unconsciousness place patient stably in side position for transportation.
· ***After skin contact:*** *Immediately wash with water and soap and rinse thoroughly.*
· ***After eye contact:*** *Rinse opened eye for several minutes under running water. Then consult a doctor.*
· ***After swallowing:*** *Do not give anything to eat or drink - Do not induce vomitting*
· ***Information for Doctor:***
· ***Most important symptoms and effects, both acute and delayed*** *No further relevant information available.*
· ***Indication of any immediate medical attention and special treatment needed*** *No further relevant information available.*

5 Fire-fighting measures

· ***Extinguishing media***
· ***Suitable extinguishing agents:*** *CO2, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.*
· ***Special hazards arising from the substance or mixture*** *During heating or in case of fire poisonous gases are produced.*
· ***Advice for firefighters***
· ***Protective equipment:*** *Mouth respiratory protective device.*

6 Accidental release measures

· ***Personal precautions, protective equipment and emergency procedures***
Mount respiratory protective device.
Wear protective equipment. Keep unprotected persons away.
· ***Environmental precautions:***
Dilute with plenty of water.
Do not allow to enter sewers/ surface or ground water.
· ***Methods and material for containment and cleaning up:***
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Dispose contaminated material as waste according to item 13.

(Contd. on page 3)

(Contd. of page 2)

Ensure adequate ventilation.

· ***Reference to other sections***
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

· ***Protective Action Criteria for Chemicals***

· ***PAC-1:***		
67-56-1	*methanol*	*530 ppm*
1310-73-2	*sodium hydroxide*	*0.5 mg/m³*

· ***PAC-2:***		
67-56-1	*methanol*	*2,100 ppm*
1310-73-2	*sodium hydroxide*	*5 mg/m³*

· ***PAC-3:***		
67-56-1	*methanol*	*7200* ppm*
1310-73-2	*sodium hydroxide*	*50 mg/m³*

7 Handling and storage

· ***Handling:***
· ***Precautions for safe handling***
Ensure good ventilation/exhaustion at the workplace.
Open and handle receptacle with care.
Prevent formation of aerosols.
· ***Information about protection against explosions and fires:***
Keep ignition sources away - Do not smoke.
Protect against electrostatic charges.
Keep respiratory protective device available.

· ***Conditions for safe storage, including any incompatibilities***
· ***Storage:***
· ***Requirements to be met by storerooms and receptacles:*** *Store in a cool location.*
· ***Information about storage in one common storage facility:*** *Not required.*
· ***Further information about storage conditions:***
Keep receptacle tightly sealed.
Store in cool, dry conditions in well sealed receptacles.
· ***Specific end use(s)*** *No further relevant information available.*

8 Exposure controls/personal protection

· ***Additional information about design of technical systems:*** *No further data; see item 7.*

· ***Control parameters***

· ***Components with limit values that require monitoring at the workplace:***	
67-56-1 methanol	
PEL	*Long-term value: 260 mg/m³, 200 ppm*
REL	*Short-term value: 325 mg/m³, 250 ppm* *Long-term value: 260 mg/m³, 200 ppm* *Skin*
TLV	*Short-term value: 250 ppm* *Long-term value: 200 ppm* *Skin; BEI*

· ***Ingredients with biological limit values:***	
67-56-1 methanol	
BEI	*15 mg/L* *Medium: urine* *Time: end of shift* *Parameter: Methanol (background, nonspecific)*

· ***Additional information:*** *The lists that were valid during the creation were used as basis.*

· ***Exposure controls***
· ***Personal protective equipment:***
· ***General protective and hygienic measures:***
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.

(Contd. on page 4)

(Contd. of page 3)

· **Respiratory protection:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.

· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

· **Penetration time of glove material** *The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.*

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	*Liquid*
Color:	*According to product specification*
· **Odor:**	*Characteristic*
· **Odour Threshold:**	*Not applicable.*
· **pH-value:**	*Not applicable.*
· **Change in condition**	
Melting point/Melting range:	*Undetermined.*
Boiling point/Boiling range:	*64.7 °C (148.5 °F)*
· **Flash point:**	*< 23 °C (< 73.4 °F)*
· **Flammability (solid, gaseous):**	*Highly flammable.*
· **Ignition temperature:**	*455 °C (851 °F)*
· **Decomposition temperature:**	*Not applicable.*
· **Auto igniting:**	*Product is not selfigniting.*
· **Danger of explosion:**	*Product is not explosive. However, formation of explosive air/vapor mixtures are possible.*
· **Explosion limits:**	
Lower:	*5.5 Vol %*
Upper:	*44 Vol %*
· **Vapor pressure at 20 °C (68 °F):**	*128 hPa (96 mm Hg)*
· **Density at 20 °C (68 °F)**	*0.80048 g/cm³ (6.68001 lbs/gal)*
· **Relative density**	*Not applicable.*
· **Vapor density**	*Not applicable.*
· **Evaporation rate**	*Not applicable.*
· **Solubility in / Miscibility with**	
Water:	*Fully miscible.*
· **Partition coefficient (n-octanol/water):**	*Not applicable.*
· **Viscosity:**	
Dynamic:	*Not applicable.*
Kinematic:	*Not applicable.*
· **Solvent content:**	
Organic solvents:	*94.5 %*
Water:	*5.0 %*
VOC content:	*94.50 %*

(Contd. on page 5)

(Contd. of page 4)

Solids content:	*>0.5 %*
*· **Other information***	*No further relevant information available.*

10 Stability and reactivity

- *· **Reactivity** No further relevant information available.*
- *· **Chemical stability***
- *· **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.*
- *· **Possibility of hazardous reactions** No dangerous reactions known.*
- *· **Conditions to avoid** No further relevant information available.*
- *· **Incompatible materials:** No further relevant information available.*
- *· **Hazardous decomposition products:** No dangerous decomposition products known.*

11 Toxicological information

- *· **Information on toxicological effects***
- *· **Acute toxicity:***

*· **LD/LC50 values that are relevant for classification:***		
67-56-1 methanol		
Oral	*LD50*	*5,628 mg/kg (rat)*
Dermal	*LD50*	*15,800 mg/kg (rabbit)*

- *· **Primary irritant effect:***
- *· **on the eye:** No irritating effect.*
- *· **Sensitization:** No sensitizing effects known.*
- *· **Additional toxicological information:***

The product shows the following dangers according to internally approved calculation methods for preparations:
Toxic

- *· **Carcinogenic categories***

*· **IARC (International Agency for Research on Cancer)***
None of the ingredients is listed.

*· **NTP (National Toxicology Program)***
None of the ingredients is listed.

*· **OSHA-Ca (Occupational Safety & Health Administration)***
None of the ingredients is listed.

12 Ecological information

- *· **Toxicity***
- *· **Aquatic toxicity:** No further relevant information available.*
- *· **Persistence and degradability** No further relevant information available.*
- *· **Behavior in environmental systems:***
- *· **Bioaccumulative potential** No further relevant information available.*
- *· **Mobility in soil** No further relevant information available.*
- *· **Additional ecological information:***
- *· **General notes:***

Water hazard class 2 (Self-assessment): hazardous for water
Do not allow product to reach ground water, water course or sewage system.
Danger to drinking water if even small quantities leak into the ground.

- *· **Results of PBT and vPvB assessment***
- *· **PBT:** Not applicable.*
- *· **vPvB:** Not applicable.*
- *· **Other adverse effects** No further relevant information available.*

13 Disposal considerations

- *· **Waste treatment methods***
- *· **Recommendation:** Must not be disposed of together with household garbage. Do not allow product to reach sewage system.*

- *· **Uncleaned packagings:***
- *· **Recommendation:** Disposal must be made according to official regulations.*
- *· **Recommended cleansing agent:** Water, if necessary with cleansing agents.*

(Contd. on page 6)

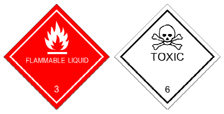
(Contd. of page 5)

14 Transport information

· ***UN-Number***	
· ***DOT, ADR, IMDG, IATA***	*UN1230*
· ***UN proper shipping name***	
· ***DOT***	*Methanol*
· ***ADR***	*1230 METHANOL*
· ***IMDG, IATA***	*METHANOL*

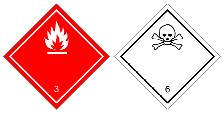
· ***Transport hazard class(es)***

· ***DOT***



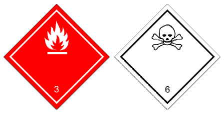
· ***Class***	*3 Flammable liquids*
· ***Label***	*3, 6.1*

· ***ADR***



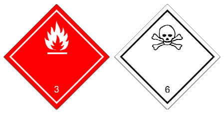
· ***Class***	*3 Flammable liquids*
· ***Label***	*3+6.1*

· ***IMDG***



· ***Class***	*3 Flammable liquids*
· ***Label***	*3/6.1*

· ***IATA***



· ***Class***	*3 Flammable liquids*
· ***Label***	*3 (6.1)*
· ***Packing group***	
· ***DOT, ADR, IMDG, IATA***	*II*
· ***Environmental hazards:***	*Not applicable.*
· ***Special precautions for user***	*Warning: Flammable liquids*
· ***Hazard identification number (Kemler code):***	*336*
· ***EMS Number:***	*F-E,S-D*
· ***Stowage Category***	*B*
· ***Stowage Code***	*SW2 Clear of living quarters.*
· ***Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code***	*Not applicable.*
· ***Transport/Additional information:***	
· ***ADR***	
· ***Excepted quantities (EQ)***	*Code: E2* *Maximum net quantity per inner packaging: 30 ml* *Maximum net quantity per outer packaging: 500 ml*
· ***IMDG***	
· ***Limited quantities (LQ)***	*1L*
· ***Excepted quantities (EQ)***	*Code: E2* *Maximum net quantity per inner packaging: 30 ml* *Maximum net quantity per outer packaging: 500 ml*

(Contd. on page 7)

(Contd. of page 6)

· ***UN "Model Regulation":***	*UN 1230 METHANOL, 3 (6.1), II*

15 Regulatory information

· ***Safety, health and environmental regulations/legislation specific for the substance or mixture*** *No further relevant information available.*
· ***Sara***

· ***Section 313 (Specific toxic chemical listings):***	
67-56-1	*methanol*

· ***TSCA (Toxic Substances Control Act):***		
67-56-1	*methanol*	*ACTIVE*
7732-18-5	*water, distilled, conductivity or of similar purity*	*ACTIVE*
1310-73-2	*sodium hydroxide*	*ACTIVE*

· ***Hazardous Air Pollutants***	
67-56-1	*methanol*

· ***Proposition 65***

· ***Chemicals known to cause cancer:***
None of the ingredients is listed.

· ***Chemicals known to cause reproductive toxicity for females:***
None of the ingredients is listed.

· ***Chemicals known to cause reproductive toxicity for males:***
None of the ingredients is listed.

· ***Chemicals known to cause developmental toxicity:***	
67-56-1	*methanol*

· ***Carcinogenic categories***

· ***EPA (Environmental Protection Agency)***
None of the ingredients is listed.

· ***TLV (Threshold Limit Value)***
None of the ingredients is listed.

· ***NIOSH-Ca (National Institute for Occupational Safety and Health)***
None of the ingredients is listed.

· ***GHS label elements*** *The product is classified and labeled according to the Globally Harmonized System (GHS).*
· ***Hazard pictograms***

GHS02 GHS06 GHS08

· ***Signal word*** *Danger*

· ***Hazard-determining components of labeling:***
methanol
· ***Hazard statements***
H225 Highly flammable liquid and vapor.
H331 Toxic if inhaled.
H370 Causes damage to the central nervous system and the visual organs.
· ***Precautionary statements***

P210	*Keep away from heat/sparks/open flames/hot surfaces. - No smoking.*
P240	*Ground/bond container and receiving equipment.*
P241	*Use explosion-proof electrical/ventilating/lighting/equipment.*
P242	*Use only non-sparking tools.*
P243	*Take precautionary measures against static discharge.*
P260	*Do not breathe dust/fume/gas/mist/vapors/spray.*
P280	*Wear protective gloves/protective clothing/eye protection/face protection.*
P303+P361+P353	*If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.*
P304+P340	*IF INHALED: Remove person to fresh air and keep comfortable for breathing.*
P307+P311	*IF exposed: Call a POISON CENTER or doctor/physician.*
P321	*Specific treatment (see on this label).*
P403+P233	*Store in a well-ventilated place. Keep container tightly closed.*
P403+P235	*Store in a well-ventilated place. Keep cool.*
P405	*Store locked up.*
P501	*Dispose of contents/container in accordance with local/regional/national/international regulations.*

(Contd. on page 8)

(Contd. of page 7)

· ***Chemical safety assessment:*** *A Chemical Safety Assessment has not been carried out.*

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· ***Department issuing SDS:*** *product safety department*
· ***Contact:***
Spex CertiPrep, LLC.
1-732-549-7144
· ***Date of preparation / last revision*** *06/29/2023*
· ***Abbreviations and acronyms:***
ADR: Accord relatif au transport international des marchandises dangereuses par route (European Agreement Concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
VOC: Volatile Organic Compounds (USA, EU)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
BEI: Biological Exposure Limit
Flammable Liquids 2: Flammable liquids – Category 2
Acute Toxicity - Inhalation 3: Acute toxicity – Category 3
Specific Target Organ Toxicity - Single Exposure 1: Specific target organ toxicity (single exposure) – Category 1

SAFETY DATA SHEET

This safety data sheet was created pursuant to the requirements of:
Regulation (EC) No. 1907/2006 and Regulation (EC) No. 1272/2008

Revision date 06-Apr-2023 **Revision Number** 1

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product Code(s)	CIL-ULM-10843-1.2
Product Name	9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid,(9CL-PF3ONS)(F53MBAJ) K Salt Unlabelled, 100 µg/mL In Methanol
Form	Not applicable
Pure substance/mixture	Mixture

1.2. Relevant identified uses of the substance or mixture and uses advised against

Recommended use	Laboratory use
Uses advised against	No information available

1.3. Details of the supplier of the safety data sheet

Supplier

LGC Limited
Queens Road
Teddington
Middlesex TW11 0LY
UNITED KINGDOM
:+44 (0) 20 8943 7000
Fax :+44 (0) 20 8943 2767
eMail : gb@lgcstandards.com

Web : www.lgcstandards.com

For further information, please contact

E-mail address	sds-request@lgcgroup.com

1.4. Emergency telephone number

Emergency Telephone	For Hazardous Materials or Dangerous Goods Incident Spill, Leak, Fire Exposure, or Accident Call CHEMTREC: USA & Canada 1-800-424-9300 Rest of the world +1 703-741-5970

Emergency Telephone - §45 - (EC)1272/2008	
Europe	**112**

SAFETY DATA SHEET

This safety data sheet was created pursuant to the requirements of:
Regulation (EC) No. 1907/2006 and Regulation (EC) No. 1272/2008

Revision date 06-Apr-2023 **Revision Number** 1

CIL-ULM-10843-1.2 - 9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid,(9CL-PF3ONS)(F53MBAJ) K Salt Unlabelled, 100 µg/mL In Methanol

Austria	No information available
Bulgaria	
Croatia	
Cyprus	
Czech Republic	
Denmark	
France	
Hungary	
Ireland	
Italy	
Lithuania	
Luxembourg	
Netherlands	
Norway	
Portugal	
Romania	
Slovakia	
Slovenia	
Spain	
Sweden	
Switzerland	

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Regulation (EC) No 1272/2008

Acute toxicity - Oral	Category 3 - (H301)
Acute toxicity - Dermal	Category 3 - (H311)
Acute toxicity - Inhalation (Dusts/Mists)	Category 3 - (H331)
Skin corrosion/irritation	Category 2 - (H315)
Serious eye damage/eye irritation	Category 2 - (H319)
Specific target organ toxicity — single exposure	Category 1 - (H370)
Flammable liquids	Category 2 - (H225)

2.2. Label elements

Contains Methanol

Signal word
Danger

Hazard statements
H301 - Toxic if swallowed
H311 - Toxic in contact with skin
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H331 - Toxic if inhaled
H370 - Causes damage to organs
H225 - Highly flammable liquid and vapour

Precautionary Statements - EU (§28, 1272/2008)
P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking
P260 - Do not breathe dust/fume/gas/mist/vapours/spray
P280 - Wear protective gloves/protective clothing/eye protection/face protection
P301 + P310 - IF SWALLOWED: Immediately call a POISON CENTER or doctor
P403 + P235 - Store in a well-ventilated place. Keep cool

2.3. Other hazards

No information available.

This mixture contains no substance considered to be persistent, bioaccumulating or toxic (PBT). This mixture contains no substance considered to be very persistent nor very bioaccumulating (vPvB).

Endocrine Disruptor Information This product does not contain any known or suspected endocrine disruptors.

Chemical name	EU - REACH (1907/2006) - Article 59(1) - Candidate List of Substances of Very High Concern (SVHC) for Authorisation	EU - REACH (1907/2006) - Endocrine Disruptor Assessment List of Substances
Methanol	-	-

SECTION 3: Composition/information on ingredients

3.1 Substances

Not applicable

3.2 Mixtures

Chemical name	Weight-%	REACH registration number	EC No (EU Index No)	Classification according to Regulation (EC) No. 1272/2008 [CLP]	Specific concentration limit (SCL)	M-Factor	M-Factor (long-term)
Methanol 67-56-1	80 - 100	-	200-659-6	Acute Tox. 3 (H301) Acute Tox. 3 (H311) Acute Tox. 3 (H331) Skin Irrit. 2 (H315) Eye Irrit. 2 (H319) STOT SE 1 (H370) Flam. Liq. 2 (H225)	STOT SE 1 :: C>=10% STOT SE 2 :: 3%<=C<10%		

Full text of H- and EUH-phrases: see section 16

Acute Toxicity Estimate
If LD50/LC50 data is not available or does not correspond to the classification category, then the appropriate conversion value from CLP Annex I, Table 3.1.2, is used to calculate the acute toxicity estimate (ATEmix) for classifying a mixture based on its components

Chemical name	Oral LD50 mg/kg	Dermal LD50 mg/kg	Inhalation LC50 - 4 hour - dust/mist - mg/L	Inhalation LC50 - 4 hour - vapour - mg/L	Inhalation LC50 - 4 hour - gas - ppm
Methanol 67-56-1	6200	15840	No data available	41.6976	No data available

This product does not contain candidate substances of very high concern at a concentration >=0.1% (Regulation (EC) No. 1907/2006 (REACH), Article 59)

SECTION 4: First aid measures

4.1. Description of first aid measures

General advice	Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.
Inhalation	Remove to fresh air. IF exposed or concerned: Get medical advice/attention. Get medical attention immediately if symptoms occur. If breathing has stopped, give artificial respiration. Get medical attention immediately. Immediate medical attention is required. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. If breathing is difficult, (trained personnel should) give oxygen.
Eye contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Keep eye wide open while rinsing. Do not rub affected area. Get immediate medical

advice/attention. Remove contact lenses, if present and easy to do. Continue rinsing.

Skin contact	Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Get immediate medical advice/attention.
Ingestion	Do NOT induce vomiting. Rinse mouth. Never give anything by mouth to an unconscious person. Get immediate medical advice/attention.
Self-protection of the first aider	Remove all sources of ignition. Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination. Use personal protective equipment as required. See section 8 for more information. Avoid contact with skin, eyes or clothing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Do not breathe vapour or mist.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms	May cause redness and tearing of the eyes. Burning sensation. Coughing and/ or wheezing. Difficulty in breathing.

4.3. Indication of any immediate medical attention and special treatment needed

Note to doctors	Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable Extinguishing Media	Dry chemical. Carbon dioxide (CO2). Water spray. Alcohol resistant foam.
Large Fire	CAUTION: Use of water spray when fighting fire may be inefficient.
Unsuitable extinguishing media	Do not scatter spilled material with high pressure water streams.

5.2. Special hazards arising from the substance or mixture

Specific hazards arising from the chemical	Risk of ignition. Keep product and empty container away from heat and sources of ignition. In the event of fire, cool tanks with water spray. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

5.3. Advice for firefighters

Special protective equipment and precautions for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions	Evacuate personnel to safe areas. Use personal protective equipment as required. See section 8 for more information. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Keep people away from and upwind of spill/leak. ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Pay attention to flashback. Take precautionary measures against static discharges. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Do not breathe vapour or mist.
Other information	Ventilate the area. Refer to protective measures listed in Sections 7 and 8.
For emergency responders	Use personal protection recommended in Section 8.

6.2. Environmental precautions

Environmental precautions	Refer to protective measures listed in Sections 7 and 8. Prevent further leakage or spillage if safe to do so. Prevent product from entering drains.

6.3. Methods and material for containment and cleaning up

Methods for containment	Stop leak if you can do it without risk. Do not touch or walk through spilled material. A vapour suppressing foam may be used to reduce vapours. Dyke far ahead of spill to collect run-off water. Keep out of drains, sewers, ditches and waterways. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal.
Methods for cleaning up	Take precautionary measures against static discharges. Dam up. Soak up with inert absorbent material. Pick up and transfer to properly labelled containers.
Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.

6.4. Reference to other sections

Reference to other sections	See section 8 for more information. See section 13 for more information.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Advice on safe handling	Use personal protection equipment. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use grounding and bonding connection when transferring this material to prevent static discharge, fire or explosion. Use spark-proof tools and explosion-proof equipment. Keep in an area equipped with sprinklers. Use according to package label instructions. Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Take off contaminated

clothing and wash it before reuse. Do not eat, drink or smoke when using this product. Do not breathe vapour or mist. In case of insufficient ventilation, wear suitable respiratory equipment. Handle product only in closed system or provide appropriate exhaust ventilation.

General hygiene considerations Contaminated work clothing should not be allowed out of the workplace. Regular cleaning of equipment, work area and clothing is recommended. Wash hands before breaks and immediately after handling the product. Remove and wash contaminated clothing and gloves, including the inside, before re-use. Do not breathe vapour or mist. Avoid contact with skin, eyes or clothing. Do not eat, drink or smoke when using this product. Wash hands before breaks and after work. Wear suitable gloves and eye/face protection.

7.2. Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat, sparks, flame and other sources of ignition (i.e., pilot lights, electric motors and static electricity). Keep in properly labelled containers. Do not store near combustible materials. Keep in an area equipped with sprinklers. Store in accordance with the particular national regulations. Store in accordance with local regulations. Keep out of the reach of children. Store locked up. Please refer to the manufacturer's certificate for specific storage and transport temperature conditions. Store only in the original receptacle unless other advice is given on the CoA.

7.3. Specific end use(s)

Risk Management Methods (RMM) The information required is contained in this Safety Data Sheet.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Exposure Limits

Chemical name	European Union	Austria	Belgium	Bulgaria	Croatia
Methanol 67-56-1	TWA: 200 ppm TWA: 260 mg/m^3 *	TWA: 200 ppm TWA: 260 mg/m^3 STEL 800 ppm STEL 1040 mg/m^3 H*	TWA: 200 ppm TWA: 266 mg/m^3 STEL: 250 ppm STEL: 333 mg/m^3 *	TWA: 200 ppm TWA: 260.0 mg/m^3 K*	TWA: 200 ppm TWA: 260 mg/m^3 *

Chemical name	Cyprus	Czech Republic	Denmark	Estonia	Finland
Methanol 67-56-1	* TWA: 200 ppm TWA: 260 mg/m^3	TWA: 250 mg/m^3 Ceiling: 1000 mg/m^3 *	TWA: 200 ppm TWA: 260 mg/m^3 H*	TWA: 200 ppm TWA: 250 mg/m^3 STEL: 250 ppm STEL: 350 mg/m^3 A*	TWA: 200 ppm TWA: 270 mg/m^3 STEL: 250 ppm STEL: 330 mg/m^3 iho*

Chemical name	France	Germany	Germany MAK	Greece	Hungary
Methanol 67-56-1	TWA: 200 ppm TWA: 260 mg/m^3 STEL: 1000 ppm STEL: 1300 mg/m^3 *	TWA: 100 ppm TWA: 130 mg/m^3 H*	TWA: 100 ppm TWA: 130 mg/m^3 Peak: 200 ppm Peak: 260 mg/m^3 *	TWA: 200 ppm TWA: 260 mg/m^3 STEL: 250 ppm STEL: 325 mg/m^3 skin - potential for cutaneous absorption	TWA: 260 mg/m^3 *

Chemical name	Ireland	Italy	Italy REL	Latvia	Lithuania
Methanol 67-56-1	TWA: 200 ppm TWA: 260 mg/m^3 STEL: 600 ppm STEL: 780 mg/m^3 Sk*	TWA: 200 ppm TWA: 260 mg/m^3 pelle*	TWA: 200 ppm TWA: 262 mg/m^3 STEL: 250 ppm STEL: 328 mg/m^3 *	TWA: 200 ppm TWA: 260 mg/m^3 *	* TWA: 200 ppm TWA: 260 mg/m^3

Chemical name	Luxembourg	Malta	Netherlands	Norway	Poland
Methanol 67-56-1	* TWA: 200 ppm TWA: 260 mg/m^3	* TWA: 200 ppm TWA: 260 mg/m^3	TWA: 133 mg/m^3 H*	TWA: 100 ppm TWA: 130 mg/m^3 STEL: 125 ppm STEL: 162.5 mg/m^3 H*	STEL: 300 mg/m^3 TWA: 100 mg/m^3 Prohibited - substances or mixtures containing Methanol in weight concentration >3%;except fuels used in the model building, powerboating, fuel cells and biofuels *

Chemical name	Portugal	Romania	Slovakia	Slovenia	Spain
Methanol 67-56-1	TWA: 200 ppm TWA: 260 mg/m^3 STEL: 250 ppm P*	TWA: 200 ppm TWA: 260 mg/m^3 *	TWA: 200 ppm TWA: 260 mg/m^3 *	TWA: 200 ppm TWA: 260 mg/m^3 STEL: STEL ppm STEL: STEL mg/m^3 *	TWA: 200 ppm TWA: 266 mg/m^3 vía dérmica*

Chemical name	Sweden	Switzerland	United Kingdom
Methanol 67-56-1	NGV: 200 ppm NGV: 250 mg/m^3 Vägledande KGV: 250 ppm Vägledande KGV: 350 mg/m^3 *	TWA: 200 ppm TWA: 260 mg/m^3 STEL: 800 ppm STEL: 1040 mg/m^3 H*	TWA: 200 ppm TWA: 266 mg/m^3 STEL: 250 ppm STEL: 333 mg/m^3 Sk*

Biological occupational exposure limits

Chemical name	European Union	Austria	Bulgaria	Croatia	Czech Republic

Methanol 67-56-1	-	-	-	7.0 mg/g Creatinine - urine (Methanol) - at the end of the work shift	0.47 mmol/L (urine - Methanol end of shift) 15 mg/L (urine - Methanol end of shift)

Chemical name	Denmark	Finland	France	Germany	Germany
Methanol 67-56-1	-	-	15 mg/L - urine (Methanol) - end of shift	15 mg/L (urine - Methanol end of shift) 15 mg/L (urine - Methanol for long-term exposures: at the end of the shift after several shifts) 15 mg/L - BAT (for long-term exposures: at the end of the shift after several shifts) urine 15 mg/L - BAT (end of exposure or end of shift) urine	15 mg/L (urine - Methanol end of shift) 15 mg/L (urine - Methanol for long-term exposures: at the end of the shift after several shifts)

Chemical name	Hungary	Ireland	Italy	Italy REL
Methanol 67-56-1	30 mg/L (urine - Methanol end of shift) 940 µmol/L (urine - Methanol end of shift)	15 mg/L (urine - Methanol end of shift)	-	15 mg/L - urine (Methanol) - end of shift

Chemical name	Latvia	Luxembourg	Romania	Slovakia
Methanol 67-56-1	-	-	-	30 mg/L (urine - Methanol end of exposure or work shift) 30 mg/L (urine - Methanol after all work shifts)

Chemical name	Slovenia	Spain	Switzerland	United Kingdom
Methanol 67-56-1	30 mg/L - urine (Methanol) - at the end of the work shift; for long-term exposure: at the end of the work shift after several consecutive workdays	15 mg/L (urine - Methanol end of shift)	30 mg/L (urine - Methanol end of shift, and after several shifts (for long-term exposures))	-

Derived No Effect Level (DNEL)	No information available.
Predicted No Effect Concentration (PNEC)	No information available.

8.2. Exposure controls

Personal protective equipment

Eye/face protection	Tight sealing safety goggles. Avoid contact with eyes. Wear safety glasses with side shields (or goggles).
Hand protection	Wear suitable gloves. Impervious gloves. The protective gloves to be used must comply with the specifications of EC Directive 89/686/EEC and the related standard EN374.
Skin and body protection	Long sleeved clothing. Chemical resistant apron. Antistatic boots. Wear suitable protective clothing.
Respiratory protection	No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.
General hygiene considerations	Contaminated work clothing should not be allowed out of the workplace. Regular cleaning of equipment, work area and clothing is recommended. Wash hands before breaks and immediately after handling the product. Remove and wash contaminated clothing and gloves, including the inside, before re-use. Do not breathe vapour or mist. Avoid contact with skin, eyes or clothing. Do not eat, drink or smoke when using this product. Wash hands before breaks and after work. Wear suitable gloves and eye/face protection.
Environmental exposure controls	Do not allow into any sewer, on the ground or into any body of water.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	Liquid
Appearance	Liquid
Colour	colourless
Odour	Pungent.
Odour threshold	No information available

Property	**Values**	**Remarks • Method**
Melting point / freezing point	-98 °C	None known
Initial boiling point and boiling range	64.7 °C	None known
Flammability	No data available	None known
Flammability Limit in Air		None known
Upper flammability or explosive limits	36 %(V)	
Lower flammability or explosive	6 %(V)	

limits		
Flash point	9.7 °C	CC (closed cup)
Autoignition temperature	455 °C	None known
Decomposition temperature		None known
pH	No data available	None known
pH (as aqueous solution)	No data available	No information available
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known
Water solubility	Water: Completely miscible	None known
Solubility(ies)	No data available	None known
Partition coefficient	-0.77	None known
Vapour pressure	130.3 hPa	@ 20°C
Relative density	0.791 g/ml	@ 25 °C
Bulk density	No data available	
Liquid Density	No data available	
Relative vapour density	1.11	None known
Particle characteristics		
Particle Size	No information available	
Particle Size Distribution	No information available	

9.2. Other information

9.2.1. Information with regards to physical hazard classes
Not applicable

9.2.2. Other safety characteristics
No information available

SECTION 10: Stability and reactivity

10.1. Reactivity

Reactivity No information available.

10.2. Chemical stability

Stability Stable under normal conditions.

Explosion data
Sensitivity to mechanical impact None.
Sensitivity to static discharge Yes.

10.3. Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

10.4. Conditions to avoid

Conditions to avoid	Heat, flames and sparks. Excessive heat.

10.5. Incompatible materials

Incompatible materials	Strong acids. Strong bases. Strong oxidising agents.
Hazardous decomposition products	None known based on information supplied.

SECTION 11: Toxicological information

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008

Information on likely routes of exposure

Product Information

Inhalation	Specific test data for the substance or mixture is not available. Toxic by inhalation. (based on components).
Eye contact	Specific test data for the substance or mixture is not available. Causes serious eye irritation. (based on components). May cause redness, itching, and pain.
Skin contact	Specific test data for the substance or mixture is not available. Causes skin irritation. (based on components). Toxic in contact with skin.
Ingestion	Specific test data for the substance or mixture is not available. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea. Toxic if swallowed. (based on components).

Symptoms related to the physical, chemical and toxicological characteristics

Symptoms	Redness. May cause redness and tearing of the eyes. Coughing and/ or wheezing. Difficulty in breathing.

Numerical measures of toxicity

Acute toxicity

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	100.00 mg/kg
ATEmix (dermal)	300.00 mg/kg
ATEmix (inhalation-dust/mist)	0.501 mg/l

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Methanol	= 6200 mg/kg (Rat)	= 15840 mg/kg (Rabbit)	= 22500 ppm (Rat) 8 h

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation Classification based on data available for ingredients. Causes skin irritation.

Serious eye damage/eye irritation Classification based on data available for ingredients. Causes serious eye irritation.

Respiratory or skin sensitisation No information available.

Germ cell mutagenicity No information available.

Carcinogenicity No information available.

Reproductive toxicity No information available.

STOT - single exposure Based on the classification criteria of the Globally Harmonized System as adopted in the country or region with which this safety data sheet complies, this product has been determined to cause systemic target organ toxicity from acute exposure. (STOT SE). Causes damage to organs if swallowed. Causes damage to organs in contact with skin.

STOT - repeated exposure No information available.

Aspiration hazard No information available.

11.2. Information on other hazards

11.2.1. Endocrine disrupting properties

Endocrine disrupting properties No information available.

11.2.2. Other information

Other adverse effects No information available.

SECTION 12: Ecological information

12.1. Toxicity

Ecotoxicity

Unknown aquatic toxicity Contains 0 % of components with unknown hazards to the aquatic environment.

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Methanol	-	LC50: 13500 - 17600mg/L (96h, Lepomis macrochirus) LC50: 18 - 20mL/L (96h, Oncorhynchus mykiss) LC50: 19500 - 20700mg/L (96h, Oncorhynchus mykiss) LC50: =28200mg/L (96h, Pimephales promelas) LC50: >100mg/L (96h, Pimephales promelas)	-	-

12.2. Persistence and degradability

Persistence and degradability No information available.

12.3. Bioaccumulative potential

Bioaccumulation No information available.

Component Information

Chemical name	Partition coefficient
Methanol	-0.77

12.4. Mobility in soil

Mobility in soil No information available.

12.5. Results of PBT and vPvB assessment

PBT and vPvB assessment

Chemical name	PBT and vPvB assessment
Methanol	The substance is not PBT / vPvB PBT assessment does not apply Further information relevant for the PBT assessment is necessary

12.6. Endocrine disrupting properties

Endocrine disrupting properties No information available.

12.7. Other adverse effects

No information available.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste from residues/unused products	Should not be released into the environment. Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Empty containers pose a potential fire and explosion hazard. Do not cut, puncture or weld containers.

SECTION 14: Transport information

IATA

14.1 UN number or ID number	UN1230
14.2 UN proper shipping name	Methanol mixture
14.3 Transport hazard class(es)	3
Subsidiary hazard class	6.1
14.4 Packing group	II
Description	UN1230, Methanol mixture, 3 (6.1), II
14.5 Environmental hazards	Not applicable
14.6 Special precautions for user	
Special Provisions	A113
ERG Code	3L

IMDG

14.1 UN number or ID number	UN1230
14.2 UN proper shipping name	Methanol mixture
14.3 Transport hazard class(es)	3
Subsidiary hazard class	6.1
14.4 Packing group	II

Description	UN1230, Methanol mixture, 3 (6.1), II, (9.7°C c.c.)
14.5 Marine pollutant	NP
14.6 Special precautions for user	
Special Provisions	279
EmS-No	F-E, S-D No information available
14.7 Maritime transport in bulk according to IMO instruments	No information available

RID

14.1 UN number or ID number	UN1230
14.2 UN proper shipping name	Methanol mixture
14.3 Transport hazard class(es)	3
Subsidiary hazard class	6.1
14.4 Packing group	II
Description	UN1230, Methanol mixture, 3 (6.1), II
14.5 Environmental hazards	Not applicable
14.6 Special precautions for user	
Special Provisions	279
Classification code	FT1

ADR

14.1 UN number or ID number	UN1230
14.2 UN proper shipping name	Methanol mixture
14.3 Transport hazard class(es)	3
Subsidiary hazard class	6.1
14.4 Packing group	II
Description	UN1230, Methanol mixture, 3 (6.1), II, (D/E)
14.5 Environmental hazards	Not applicable
14.6 Special precautions for user	
Special Provisions	279
Classification code	FT1
Tunnel restriction code	(D/E)

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

France
Occupational Illnesses (R-463-3, France)

Chemical name	French RG number	Title
Methanol 67-56-1	RG 84	-

Water hazard class (WGK)	obviously hazardous to water (WGK 2)

Poland	**SDS created according to the following Polish regulation: Act of February 25, 2011 on chemical substances and their mixtures (Journal of Laws of 2018, item 143, as amended). Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), establishing the European Chemicals Agency (EC) as amended. Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labeling and packaging of substances and mixtures, as amended. Regulation of the Minister of Health of 10 August 2012 on the criteria and method of classifying chemical substances and their mixtures (Journal of Laws of 2012, item 1018). Regulation of the Minister of Health of 20 April 2012 on labeling packaging of hazardous substances and mixtures and some mixtures (Journal of Laws of 2012, item 445). Regulation of the Minister of Family, Labor and Social Policy of 12 June 2018 on the maximum allowable concentrations and intensities of factors harmful to health in the work environment (Journal of Laws of 2018, item 1286). Announcement of the Minister of Economy, Labor and Social Policy of August 28, 2003 on the publication of the unified text of the Ordinance of the Minister of Labor and Social Policy on general health and safety at work regulations (Journal of Laws of 2003, No. 169, item 1650) . Regulation of the Minister of Health of 30 December 2004 on occupational safety and health related to the presence of chemical agents in the workplace (Journal of Laws of 2005, No. 11, item 86). Act of December 14, 2012 on waste (Journal of Laws of 2013, item 21) Regulation of the Minister of Health of December 30, 2004 on occupational health and safety related to the presence of chemical agents in the workplace (Journal U. of 2005, No. 11, item 86). Waste Act of December 14, 2012 (Journal of Laws of 2013, item 21). Act of 13 June 2013 on the management of packaging and packaging waste, Journal of Laws 2013, item 888). Government statement of September 24, 2002 - European Agreement on the International Carriage of Dangerous Goods by Road (ADR) (Journal of Laws No. 194, item 1629 and Journal of Laws of 2003, No. 207, item 2013 and 2014).**

European Union

Take note of Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work.

Authorisations and/or restrictions on use:

This product contains one or more substance(s) subject to restriction (Regulation (EC) No. 1907/2006 (REACH), Annex XVII)

DIRECTIVE (EU) 2021/1187 on the marketing and use of explosives precursors

Not applicable

Chemical name	Restricted substance per REACH Annex XVII	Substance subject to authorisation per REACH Annex XIV
Methanol - 67-56-1	69.	

Persistent Organic Pollutants

Not applicable

Dangerous substance category per Seveso Directive (2012/18/EU)

H2 - ACUTE TOXIC
H3 - STOT SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE
P5a - FLAMMABLE LIQUIDS
P5b - FLAMMABLE LIQUIDS
P5c - FLAMMABLE LIQUIDS

Named dangerous substances per Seveso Directive (2012/18/EU)

Chemical name	Lower-tier requirements (tons)	Upper-tier requirements (tons)
Methanol - 67-56-1	500	5000

Ozone-depleting substances (ODS) regulation (EC) 1005/2009

Not applicable

International Inventories

TSCA	Contact supplier for inventory compliance status
DSL/NDSL	Contact supplier for inventory compliance status
EINECS/ELINCS	Contact supplier for inventory compliance status
ENCS	Contact supplier for inventory compliance status
IECSC	Contact supplier for inventory compliance status
KECL	Contact supplier for inventory compliance status
PICCS	Contact supplier for inventory compliance status
AIIC	Contact supplier for inventory compliance status

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

15.2. Chemical safety assessment

Chemical Safety Report	A Chemical Safety Assessment is not required for this substance

SECTION 16: Other information

Key or legend to abbreviations and acronyms used in the safety data sheet

Full text of H-Statements referred to under section 3

H225 - Highly flammable liquid and vapour
H301 - Toxic if swallowed
H311 - Toxic in contact with skin
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H331 - Toxic if inhaled
H370 - Causes damage to organs

Legend

SVHC: Substances of Very High Concern for Authorisation:

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	*	Skin designation

Classification procedure	
Classification according to Regulation (EC) No. 1272/2008 [CLP]	Method Used
Acute oral toxicity	Calculation method
Acute dermal toxicity	Calculation method
Acute inhalation toxicity - gas	Calculation method
Acute inhalation toxicity - Vapour	Calculation method
Acute inhalation toxicity - dust/mist	Calculation method
Skin corrosion/irritation	Calculation method
Serious eye damage/eye irritation	Calculation method
Respiratory sensitisation	Calculation method
Skin sensitisation	Calculation method
Mutagenicity	Calculation method
Carcinogenicity	Calculation method
Reproductive toxicity	Calculation method
STOT - single exposure	Calculation method
STOT - repeated exposure	Calculation method
Acute aquatic toxicity	Calculation method
Chronic aquatic toxicity	Calculation method
Aspiration hazard	Calculation method
Ozone	Calculation method

Key literature references and sources for data used to compile the SDS

Agency for Toxic Substances and Disease Registry (ATSDR)
U.S. Environmental Protection Agency ChemView Database
European Food Safety Authority (EFSA)
EPA (Environmental Protection Agency)
Acute Exposure Guideline Level(s) (AEGL(s))

U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals
Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
Japan GHS Classification
Australian National Industrial Chemicals Notification and Assessment Scheme (NICNAS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
National Library of Medicine’s PubMed database (NLM PUBMED)
National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organisation for Economic Co-operation and Development Environment, Health, and Safety Publications
Organisation for Economic Co-operation and Development High Production Volume Chemicals Programme
Organisation for Economic Co-operation and Development Screening Information Data Set
World Health Organization

Revision date 06-Apr-2023

This material safety data sheet complies with the requirements of Regulation (EC) No. 1907/2006
Disclaimer
The information in this safety data sheet (SDS) has been prepared with due care and is true and accurate to the best of our knowledge. The user must determine the suitability of the information for its particular purpose, ensure compliance with existing laws and regulations, and be aware that other or additional safety or performance considerations may arise when using, handling and/ or storing the material. The information in this SDS does not purport to be all inclusive or a guarantee as to the properties of the material supplied, and should be used only as a guide. LGC makes no warranties or representations as to the accuracy and completeness of the information contained herein, shall not be held responsible for the suitability of this information for the user's intended purposes or the consequences of such use, and shall not be liable for any damage or loss, howsoever arising, direct or otherwise.

End of Safety Data Sheet

Safety Data Sheet
acc. to OSHA HCS

Printing date 08/14/2023 Revision date 08/14/2023

1 Identification

· **Product identifier**

· **Trade name: Hexafluoropropylene Oxide Dimer Acid**
· **Synonym** 2,3,3,3-tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid

· **Article number:** 37266
· **CAS Number:**
13252-13-6
· **EC number:**
236-236-8
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS05 Corrosion

Skin Corrosion 1C	H314 Causes severe skin burns and eye damage.
Eye Damage 1	H318 Causes serious eye damage.


GHS07

Acute Toxicity - Oral 4	H302 Harmful if swallowed.
Specific Target Organ Toxicity - Single Exposure 3	H335 May cause respiratory irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).

(Contd. on page 2)

(Contd. from page 1)

· **Hazard pictograms**


GHS05


GHS07

· **Signal word** Danger

· **Hazard statements**

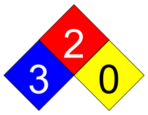
H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.
H335 May cause respiratory irritation.

· **Precautionary statements**

P260	Do not breathe dusts or mists.
P264	Wash 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/doctor if you feel unwell.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P321	Specific treatment (see on this label).
P363	Wash contaminated clothing before reuse.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 2
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*3
FIRE	2
REACTIVITY	0

Health = *3
Fire = 2
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

(Contd. on page 3)

Safety Data Sheet
acc. to OSHA HCS

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3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
13252-13-6 Hexafluoropropylene Oxide Dimer Acid
· **Identification number(s)**
· **EC number:** 236-236-8

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:** Supply fresh air; consult doctor in case of complaints.
· **After skin contact:** Generally the product does not irritate the skin.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:** Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
CO2, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** No special measures required.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Use neutralizing agent.
Dispose contaminated material as waste according to section 13.
Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**
· **PAC-1:** Substance is not listed.
· **PAC-2:** Substance is not listed.

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· **PAC-3:** Substance is not listed.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
No special precautions are necessary if used correctly.
Avoid breathing dust/fume/gas/mist/vapours/spray.
Avoid prolonged or repeated exposure.
Keep away from sources of ignition.
Take precautionary measures against static discharge.re.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see section 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

(Contd. on page 5)

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- **Penetration time of glove material**
  The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
- **Eye protection:**
  Safety glasses

Tightly sealed goggles

9 Physical and chemical properties

- **Information on basic physical and chemical properties**
- **General Information**

· **Appearance:**	
Form:	Liquid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C6HF11O3
· **Molecular Weight**	330.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not determined.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	60 °C (140 °F)
· **Flash point:**	60 °C (140 °F)
· **Flammability (solid, gaseous):**	Not applicable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not determined.
· **Density at 20 °C (68 °F):**	1.748 g/cm^3 (14.58706 lbs/gal)
· **Relative density**	Not determined.
· **Vapor density**	Not determined.
· **Evaporation rate**	Not determined.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not determined.
Kinematic:	Not determined.

(Contd. on page 6)

(Contd. from page 5)

· **Other information** No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** No irritant effect.
· **on the eye:** Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (Self-assessment): slightly hazardous for water
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

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Safety Data Sheet
acc. to OSHA HCS

(Contd. from page 6)

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is listed.
· **TSCA (Toxic Substances Control Act):** ACTIVE
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.

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Safety Data Sheet
acc. to OSHA HCS

(Contd. from page 7)

· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

· **Department issuing SDS:** Environment protection department.
· **Contact:** -
· **Date of preparation / last revision** 08/14/2023
· **Abbreviations and acronyms:**
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 4: Acute toxicity – Category 4
Skin Corrosion 1C: Skin corrosion/irritation – Category 1C
Eye Damage 1: Serious eye damage/eye irritation – Category 1
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3

Safety Data Sheet
acc. to OSHA HCS

Printing date 11/13/2023 Revision date 11/13/2023

1 Identification

· **Product identifier**

· **Trade name: N-ethyl Perfluorooctanesulfonamide**
· **Synonym**

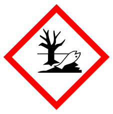
· **Article number:** 37263
· **CAS Number:**
4151-50-2
· **EC number:**
223-980-3
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**



GHS09 Environment

Aquatic Chronic 2	H411 Toxic to aquatic life with long lasting effects.

GHS07

Acute Toxicity - Oral 4	H302 Harmful if swallowed.
Acute Toxicity - Dermal 4	H312 Harmful in contact with skin.
Acute Toxicity - Inhalation 4	H332 Harmful if inhaled.
Skin Irritation 2	H315 Causes skin irritation.
Eye Irritation 2A	H319 Causes serious eye irritation.
Specific Target Organ Toxicity - Single Exposure 3	H335 May cause respiratory irritation.

(Contd. on page 2)

(Contd. from page 1)

· **Label elements**

· **GHS label elements**

The substance is classified and labeled according to the Globally Harmonized System (GHS).

· **Hazard pictograms**


GHS07


GHS09

· **Signal word** Warning

· **Hazard statements**

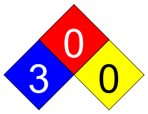
H302+H312+H332	Harmful if swallowed, in contact with skin or if inhaled.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H411	Toxic to aquatic life with long lasting effects.

· **Precautionary statements**

P261	Avoid breathing dust/fume/gas/mist/vapors/spray
P264	Wash thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P301+P312	If swallowed: Call a poison center/doctor if you feel unwell.
P330	Rinse mouth.
P302+P352	If on skin: Wash with plenty of water.
P321	Specific treatment (see on this label).
P304+P340	IF INHALED: Remove person to fresh air and keep 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.
P332+P313	If skin irritation occurs: Get medical advice/attention.
P362+P364	Take off contaminated clothing and wash it before reuse.
P337+P313	If eye irritation persists: Get medical advice/attention.
P391	Collect spillage.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	2
FIRE	0
REACTIVITY	0

Health = 2
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

(Contd. on page 3)

(Contd. from page 2)

· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
4151-50-2 N-ethyl Perfluorooctanesulfonamide
· **Identification number(s)**
· **EC number:** 223-980-3

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:**
Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:**
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:** Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures** Not required.
· **Environmental precautions:**
Inform respective authorities in case of seepage into water course or sewage system.
Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:** Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.

(Contd. on page 4)

(Contd. from page 3)

See Section 13 for disposal information.

· **Protective Action Criteria for Chemicals**
· **PAC-1:** Substance is not listed.
· **PAC-2:** Substance is not listed.
· **PAC-3:** Substance is not listed.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Thorough dedusting.
Ensure good ventilation/exhaustion at the workplace.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see section 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

(Contd. on page 5)

(Contd. from page 4)

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C10H6F17NO2S
· **Molecular Weight**	527.2 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.

(Contd. on page 6)

(Contd. from page 5)

· **Other information** No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Irritant to skin and mucous membranes.
· **on the eye:** Irritating effect.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Ecotoxical effects:**
· **Remark:** Toxic for fish
· **Additional ecological information:**
· **General notes:**
Water hazard class 2 (Self-assessment): hazardous for water
Do not allow product to reach ground water, water course or sewage system.
Danger to drinking water if even small quantities leak into the ground.
Also poisonous for fish and plankton in water bodies.
Toxic for aquatic organisms
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

(Contd. on page 7)

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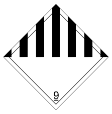
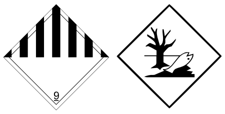
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number**	
· **DOT, IMDG, IATA**	UN3077
· **UN proper shipping name**	
· **DOT, IATA**	Environmentally hazardous substance, solid, n.o.s. (N-ethyl Perfluorooctanesulfonamide)
· **IMDG**	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (N-ethyl Perfluorooctanesulfonamide)
· **Transport hazard class(es)**	
· **DOT**	
	
· **Class**	9 Miscellaneous dangerous substances and articles
· **Label**	9
· **IMDG, IATA**	
	
· **Class**	9 Miscellaneous dangerous substances and articles
· **Label**	9
· **Packing group**	
· **DOT, IMDG, IATA**	III
· **Environmental hazards:**	
· **Marine pollutant:**	Symbol (fish and tree)
· **Special marking (IATA):**	Symbol (fish and tree)
· **Special precautions for user**	Warning: Miscellaneous dangerous substances and articles
· **Hazard identification number (Kemler code):**	90
· **EMS Number:**	F-A,S-F
· **Stowage Category**	A

(Contd. on page 8)

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· **Stowage Code**	SW23 When transported in BK3 bulk container, see 7.6.2.12 and 7.7.3.9.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	
· **DOT**	
· **Quantity limitations**	On passenger aircraft/rail: 400 kg On cargo aircraft only: 400 kg
· **IMDG**	
· **Limited quantities (LQ)**	5 kg
· **Excepted quantities (EQ)**	Code: E1 Maximum net quantity per inner packaging: 30 g Maximum net quantity per outer packaging: 1000 g
· **IATA**	
· **Remarks:**	When sold in quantities of less than or equal to 1 mL, or 1 g, with an Excepted Quantity Code of E1, E2, E4, or E5, this item meets the De Minimis Quantities exemption, per IATA 2.6.10. Therefore packaging does not have to be labeled as Dangerous Goods/Excepted Quantity.
· **UN "Model Regulation":**	UN 3077 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (N-ETHYL PERFLUOROOCTANESULFONAMIDE), 9, III

15 Regulatory information

- **Safety, health and environmental regulations/legislation specific for the substance or mixture**
  No further relevant information available.
- **Sara**
- **Section 355 (extremely hazardous substances):** Substance is not listed.
- **Section 313 (Specific toxic chemical listings):** Substance is listed.
- **TSCA (Toxic Substances Control Act):** ACTIVE
- **Hazardous Air Pollutants** Substance is not listed.
- **Proposition 65**
- **Chemicals known to cause cancer:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
- **Chemicals known to cause developmental toxicity:** Substance is not listed.

- **Carcinogenic categories**
- **EPA (Environmental Protection Agency)** Substance is not listed.
- **TLV (Threshold Limit Value)** Substance is not listed.
- **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
- **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes

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no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

· **Department issuing SDS:** Environment protection department.
· **Contact:** -
· **Date of preparation / last revision** 11/13/2023
· **Abbreviations and acronyms:**
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 4: Acute toxicity – Category 4
Skin Irritation 2: Skin corrosion/irritation – Category 2
Eye Irritation 2A: Serious eye damage/eye irritation – Category 2A
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3
Aquatic Chronic 2: Hazardous to the aquatic environment - long-term aquatic hazard – Category 2

1 Identification

· **Product identifier**

· **Trade name: 2-(N-Ethylperfluorooctanesulfonamido)acetic Acid**

· **Article number:** 37363
· **CAS Number:**
2991-50-6
· **EC number:**
221-061-1
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**

GHS07

Acute Toxicity - Oral 4	H302 Harmful if swallowed.
Skin Irritation 2	H315 Causes skin irritation.
Eye Irritation 2A	H319 Causes serious eye irritation.
Specific Target Organ Toxicity - Single Exposure 3	H335 May cause respiratory irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).

(Contd. on page 2)

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· **Hazard pictograms**

GHS07

· **Signal word** Warning

· **Hazard statements**

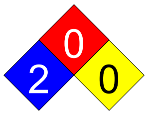
H302 Harmful if swallowed.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.

· **Precautionary statements**

P261	Avoid breathing dust/fume/gas/mist/vapors/spray
P264	Wash 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 eye protection / face protection.
P301+P312	If swallowed: Call a poison center/doctor if you feel unwell.
P330	Rinse mouth.
P302+P352	If on skin: Wash with plenty of water.
P321	Specific treatment (see on this label).
P304+P340	IF INHALED: Remove person to fresh air and keep 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.
P332+P313	If skin irritation occurs: Get medical advice/attention.
P362+P364	Take off contaminated clothing and wash it before reuse.
P337+P313	If eye irritation persists: Get medical advice/attention.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 2
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	2	Health = 2
FIRE	0	Fire = 0
REACTIVITY	0	Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

(Contd. on page 3)

(Contd. from page 2)

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
2991-50-6 2-(N-Ethylperfluorooctanesulfonamido)acetic Acid
· **Identification number(s)**
· **EC number:** 221-061-1

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:**
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:** Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** No special measures required.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures** Not required.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:** Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**
· **PAC-1:** Substance is not listed.
· **PAC-2:** Substance is not listed.
· **PAC-3:** Substance is not listed.

(Contd. on page 4)

(Contd. from page 3)

7 Handling and storage

- **Handling:**
- **Precautions for safe handling**
  No special precautions are necessary if used correctly.
  Avoid breathing dust/fume/gas/mist/vapours/spray.
  Avoid prolonged or repeated exposure.
  Keep away from sources of ignition.
  Take precautionary measures against static discharge.re.
- **Information about protection against explosions and fires:** No special measures required.

- **Conditions for safe storage, including any incompatibilities**
- **Storage:** Store in accordance with information listed on the product insert.
- **Requirements to be met by storerooms and receptacles:** No special requirements.
- **Information about storage in one common storage facility:** Not required.
- **Further information about storage conditions:** Keep receptacle tightly sealed.
- **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

- **Additional information about design of technical systems:** No further data; see item 7.

- **Control parameters**
- **Components with limit values that require monitoring at the workplace:** Not required.
- **Additional information:** The lists that were valid during the creation were used as basis.

- **Exposure controls**
- **Personal protective equipment:**
- **General protective and hygienic measures:**
  Keep away from foodstuffs, beverages and feed.
  Immediately remove all soiled and contaminated clothing.
  Wash hands before breaks and at the end of work.
  Avoid contact with the eyes and skin.
- **Breathing equipment:**
  In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
- **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
- **Material of gloves**
  The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
- **Penetration time of glove material**
  The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

(Contd. on page 5)

(Contd. from page 4)

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C12H8F17NO4S
· **Molecular Weight**	585.2 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
SOLUBILITY	DMF: 2 mg/ml; DMSO: 2 mg/ml
· **Other information**	No further relevant information available.

(Contd. on page 6)

(Contd. from page 5)

10 Stability and reactivity

- **Reactivity** No further relevant information available.
- **Chemical stability**
- **Thermal decomposition / conditions to be avoided:**
  No decomposition if used according to specifications.
- **Possibility of hazardous reactions** No dangerous reactions known.
- **Conditions to avoid** No further relevant information available.
- **Incompatible materials:** No further relevant information available.
- **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

- **Information on toxicological effects**
- **Acute toxicity:**
- **Primary irritant effect:**
- **on the skin:** Irritant to skin and mucous membranes.
- **on the eye:** Irritating effect.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**

- **Carcinogenic categories**
- **IARC (International Agency for Research on Cancer)** Substance is not listed.
- **NTP (National Toxicology Program)** Substance is not listed.
- **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

- **Toxicity**
- **Aquatic toxicity:** No further relevant information available.
- **Persistence and degradability** No further relevant information available.
- **Behavior in environmental systems:**
- **Bioaccumulative potential** No further relevant information available.
- **Mobility in soil** No further relevant information available.
- **Additional ecological information:**
- **General notes:**
  Water hazard class 1 (Self-assessment): slightly hazardous for water
  Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **Other adverse effects** No further relevant information available.

13 Disposal considerations

- **Waste treatment methods**
- **Recommendation:**
  Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

(Contd. on page 7)

(Contd. from page 6)

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is not listed.
· **TSCA (Toxic Substances Control Act):** INACTIVE
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of

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Safety Data Sheet
acc. to OSHA HCS

(Contd. from page 7)

these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 02/20/2023
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 4: Acute toxicity – Category 4
Skin Irritation 2: Skin corrosion/irritation – Category 2
Eye Irritation 2A: Serious eye damage/eye irritation – Category 2A
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3

AccuStandard®, Inc.
125 Market St., New Haven, CT 06513 USA
Tel: 203-786-5290 Fax: 203-786-5287

SAFETY DATA SHEET

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

1.1 - Product Identifiers

Catalog Name: PFOS-039S

Description: N-Ethyl-N-(2-hydroxyethyl)perfluorooctylsulphonamide (NEtFOSE) in Methanol

1.2 - Relevant Identified Uses of the Substance or Mixture

Laboratory Chemical Reference Material

1.3 - Supplier Details

Company: AccuStandard, Inc.
125 Market St.
New Haven, CT 06513 USA

Telephone Number: 203-786-5290

Fax: 203-786-5287

Email: edocs@accustandard.com

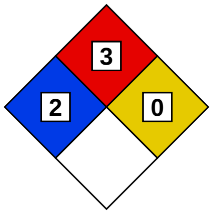
1.4 - Emergency Telephone Number

Emergency Phone #: AccuStandard, Inc.
1-203-502-7070 (USA)
+001-203-502-7070 (International)

24 hours / 7 days a week

SECTION 2 - HAZARDS IDENTIFICATION

2.1 - GHS Label Elements



*	2	HEALTH
	3	FLAMMABILITY
	0	PHYSICAL HAZARD

Signal Word: Danger

Hazard Codes:

H225 - Highly Flammable (Flammable liquids, category 2)

H301 - Toxic if swallowed. (Acute toxicity, oral, category 3)

H311 - Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

H315 - Irritating to skin. (Skin corrosion/irritation, category 2)

H320 - Irritating to eyes. (Eye damage/irritation, category 2B)

H332 - Harmful if inhaled. (Acute toxicity, inhalation, category 4)

H336 - Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

H360 - California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

H370 - Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

Precautionary Codes:

SECTION 2 - HAZARDS IDENTIFICATION *- continued*

2.1 - GHS Label Elements *- continued*

P202 - This product should only by used by persons trained in the safe handling of hazardous chemicals.

P233 - Store in a tightly closed container. (P404)

P262 - Do not get in eyes, on skin or clothing.

P264 - Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

P280 - Protective gloves must be worn to prevent skin contact.

P284 - Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

P331 - Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person.

P338 - Eye contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

P360 - Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

2.2 - Other Hazards

2.2.1 - Symptom of Exposure Health/Environment

Highly Flammable (Flammable liquids, category 2)

Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

After ingestion or inhalation, initial symptoms may be only that of mild intoxication, but may become severe after 12 or 18 hours.

POISON: May be fatal or cause blindness if swallowed.

Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

2.2.2 - Potential Health Effects

Irritating to eyes. (Eye damage/irritation, category 2B)

Irritating to skin. (Skin corrosion/irritation, category 2)

Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

Irritating to mucous membrane and upper respiratory system.

Harmful if inhaled. (Acute toxicity, inhalation, category 4)

Toxic if swallowed. (Acute toxicity, oral, category 3)

2.2.3 - Routes of Entry

Inhalation, ingestion or skin contact.

2.2.4 - Carcinogenicity

California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

SECTION 3 - COMPOSITION / ANALYTES DATA

Description: N-Ethyl-N-(2-hydroxyethyl)perfluorooctylsulphonamide (NEtFOSE) in Methanol

SECTION 3 - COMPOSITION / ANALYTES DATA *- continued*

			ACGIH -TLV (mg/m³)			OSHA -PEL (mg/m³)		
Analyte	CAS #	% Concentration	TWA	STEL	Skin	TWA	STEL	Skin
N-Ethyl-N-(2-hydroxyethyl)perfluorooctylsulphonamide	1691-99-2	0.010						
Methanol	67-56-1	99.990				260		

SECTION 4 - FIRST AID MEASURES

4.1 - First Aid Procedures - General

Get medical assistance for all cases of overexposure.

4.2 - Eye Contact

Eye contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. (P338)

4.3 - Skin Contact

Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse. (P360)

4.4 - Inhalation

Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

4.5 - Ingestion

Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person. (P331)

SECTION 5 - FIRE FIGHTING MEASURES

5.1 - Flammable Properties

Dangerous fire and explosive hazard.

Containers can build up pressure if exposed to heat.

Vapors can travel to a source of ignition and flash back.

During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

5.2 - Extinguishing Media

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.

5.3 - Protection of Firefighters

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

6.1 - Spill Response

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

SECTION 7 - HANDLING AND STORAGE

Store in a tightly closed container. (P404)

Store in a cool place below 14 °F (-10 °C).

Avoid breathing vapors or mists.

Use with adequate ventilation.

Do not get in eyes, on skin or clothing. (P262)

Avoid prolonged or repeated exposure.

This product should only by used by persons trained in the safe handling of hazardous chemicals. (P202)

SECTION 8 - EXPOSURE CONTROLS

8.1 - Engineering Controls/PPE

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available. (P264)

8.2 - General Hygene Considerations

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact. (P280)

(Chloroprene, natural rubber, nitrile, or equivalent)

Use eye protection tested and approved under the appropriate government standards such as NIOSH (US) or EN 166 (EU).

All recommendations are advisory only and must be evaluated by an industrial hygienist and/or safety officer familiar with the specific situation of anticipated use, such as concentration and amount of the substance in the workplace. Any recommendation should not be construed as offering an approval for any specific use of the product.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Clear liquid

Odor: N/A

Odor Threshold: N/A

pH: N/A

Melting Point: -93.9 °C

Boiling Point: 65 °C

Flash Point: 52 °F (11 °C) (tcc)

Evaporation Rate (Butyl Acetate=1): 5.9

Flammability Class: N/A

Lower Flammability Level: 6.7

Upper Flammability Level: 36.5

Vapor Pressure: 97 mmHg (20 °C)

Vapor Density (Air = 1): 1.1 g/L

Specific Gravity: 0.791 g/cm3

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES *- continued*

Solubility in Water: Very soluble

Partition Coefficient: log Pow: -0.77

Autoignition Temperature: 385 °C

Decomposition Temperature: N/A

Viscosity: N/A

VOC Content: N/A

Percent Volatile: 99.9+

SECTION 10 - STABILITY AND REACTIVITY

Stability: Stable

Materials to Avoid: Acids
Oxidizers

Hazardous Decomposition: Oxides of carbon; Formaldehyde

Hazardous Polymerization: Will not occur

Condition to Avoid: Heat; Contact with ignition sources

SECTION 11 - TOXICOLOGICAL INFORMATION

Human Health Toxicity

See section 2 for specific toxicological information for the ingredients of this product.

LD50 (Oral): Human - 143 mg/kg; Rat - 1500 mg/kg

LD50 (Dermal) : Rabbit - >2000 mg/kg

LC50 (Inhalation): Rat - >20 mg/L

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

No other information related to the toxicological properties of this product is available at this time.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Toxicity

By complying with sections 6 and 7 there should be no release to the environment.

LC50 (Fish): >1000 mg/L 96H

EC50 (Aquatic Invertebrate): >1000 mg/L 48H

BCF: 1.0

Hydrolyzes readily on contact with water. Readily biodegradable.

No other information related to the ecological properties of this product is available at this time.

SECTION 13 - DISPOSAL CONSIDERATIONS

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

SECTION 14 - TRANSPORT INFORMATION

Transportation Information (DOT/IATA)

SECTION 14 - TRANSPORT INFORMATION *- continued*

UN Number: UN1230

Class: 3

Packing Group: II

Proper Shipping Name: Methanol

Poison by Inhalation: No

Marine Pollutant: No

SECTION 15 - REGULATORY INFORMATION

This product contains a compound or compounds subject to EU Regulation (EC) No 1907/2006 (REACH) on Annex XIV, Annex XVII, and/or Article 59. Refer to the below table for details.

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

This product is subject to SARA section 313 reporting requirements.

All components are listed on the TSCA Inventory.

For laboratory, research and development use only. Not for manufacturing or commercial purposes.

In addition to federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

			REACH (1907/2006)		
Analyte	CAS #	% Concentration	Annex XIV	Annex XVII	Article 59
Methanol	67-56-1	99.990		X	

SECTION 16 - OTHER INFORMATION

This document has been designed to meet the requirements of OSHA, ANSI, GHS and CHIPs regulations. Chemicals are classified using the Globally Harmonized System for Classification and Labeling of Chemicals and CLP Regulation (EC) No. 1272/2008.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. The manufacturer will not assume any liability for the accuracy and completeness of this information. Final determination of the suitability of the material is the responsibility of the user. Although certain hazards are described herein, the user should not presume that these are the only hazards that exist. Since conditions and manner of use are outside of the manufacturers control, we make

NO WARRANTY OF MERCHANTABILITY, EXPRESSED OR IMPLIED, AND ASSUME NO LIABILITY RESULTING FROM ITS USE.

Legend : N/A = Not Available ND = Not Determined NR = Not Regulated

Alteration of any information contained herein without written permission from the manufacturer is strictly prohibited.

HMIS/NFPA HAZARD INDEX

0 - Minimal
1 - Slight
2 - Moderate
3 - Serious
4 - Severe

* - Additional Hazard

GHS HAZARD INDEX

Category 1 - Most Severe
Category 5 - Least Severe

**** End of Document ****

SAFETY DATA SHEET

Santa Cruz Biotechnology, Inc.
Revision date 10-Jul-2019
Version 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name	Nonafluoro-3,6-dioxaheptanoic acid
Product Code	SC-263954

Recommended use of the chemical and restrictions on use

For research use only. Not intended for diagnostic or therapeutic use.

Details of the supplier of the safety data sheet

Santa Cruz Biotechnology, Inc.
10410 Finnell Street
Dallas, TX 75220
831.457.3800
800.457.3801
scbt@scbt.com

Emergency telephone number

Chemtrec
1.800.424.9300 (Within USA)
+1.703.527.3887 (Outside USA)

2. HAZARDS IDENTIFICATION

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification

Skin corrosion/irritation	Category 1 Sub-category B
Serious eye damage/eye irritation	Category 1

Label elements

Signal word	Danger
Hazard statements	Causes severe skin burns and eye damage
Symbols/Pictograms	
Precautionary Statements - Prevention	Do not breathe dust/fume/gas/mist/vapors/spray Wash face, hands and any exposed skin thoroughly after handling Wear protective gloves/protective clothing/eye protection/face protection
Precautionary Statements - Response	Immediately call a POISON CENTER or doctor/physician IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing Immediately call a POISON CENTER or doctor/physician IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower Wash contaminated clothing before reuse IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing Immediately call a POISON CENTER or doctor/physician IF SWALLOWED: Rinse mouth. DO NOT induce vomiting
Precautionary Statements - Storage	Store locked up
Precautionary Statements - Disposal	Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Hazards not otherwise classified (HNOC)	Not applicable

Other Information

Unknown acute toxicity	100% of the mixture consists of ingredient(s) of unknown toxicity.

NFPA		
	Health hazards	-
	Flammability	-
	Stability	-
	Physical and chemical properties	-

HMIS		
	Health hazards	-
	Flammability	-
	Physical hazards	-
	Personal protection	-

3. COMPOSITION/INFORMATION ON INGREDIENTS

CAS No	151772-58-6
Molecular Weight	296.04
Formula	$C_5HF_9O_4$

Chemical name	CAS No.	Weight-%	Oral LD50	Dermal LD50	Inhalation LC50
Nonafluoro-3,6-dioxaheptanoic acid	151772-58-6	>98	-	-	-

4. FIRST AID MEASURES

First Aid Measures

General advice	Consult a physician if necessary. Remove to fresh air.
Eye contact	Wash with plenty of water.
Skin Contact	Wash skin with soap and water.
Inhalation	Remove to fresh air If breathing is difficult, give oxygen If not breathing, give artificial respiration
Ingestion	Never give anything by mouth to an unconscious person. Clean mouth with water.

Most important symptoms and effects, both acute and delayed

Symptoms	No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media

Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable Extinguishing Media	No information available.

Specific hazards arising from the chemical

Specific hazards arising from the chemical	No information available.
Hazardous combustion products	Carbon oxides. Hydrogen fluoride.

Explosion data

Sensitivity to Mechanical Impact	No information available.
Sensitivity to Static Discharge	No information available.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions	Ensure adequate ventilation, especially in confined areas.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	Pick up and transfer to properly labeled containers.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Keep containers tightly closed in a dry, cool and well-ventilated place. Store at room temperature.
Incompatible materials	None known based on information supplied.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering Controls	Showers Eyewash stations Ventilation systems

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses with side shields (or goggles).
Skin and Body Protection	Wear protective gloves and protective clothing.
Respiratory protection	If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.
General Hygiene Considerations	Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	liquid

Appearance	No information available
Odor	No information available

Property	**Values**
pH	No information available
Melting point/freezing point	No information available
Boiling point	145 °C
Flash point	No information available
Liquid Density	No information available
Evaporation rate	No information available
Upper flammability limits	No information available
Lower flammability limit	No information available
Vapor pressure	No information available
Vapor density	No information available
Specific gravity	No information available
Water solubility	No information available
Solubility in other solvents	No information available
Partition coefficient	No information available
Autoignition temperature	No information available
Decomposition temperature	No information available
Kinematic viscosity	No information available
Explosive properties	No information available
Oxidizing properties	No information available

10. STABILITY AND REACTIVITY

Reactivity	Not applicable
Chemical stability	Stable under recommended storage conditions.
Possibility of Hazardous Reactions	None under normal processing.
Hazardous polymerization	No information available.
Conditions to avoid	Extremes of temperature and direct sunlight.
Incompatible materials	Strong oxidizing agents.
Hazardous Decomposition Products	Carbon oxides. Hydrogen fluoride.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Inhalation	No data available.
Eye contact	No data available.
Skin Contact	No data available.
Ingestion	No data available.

Information on toxicological effects

Symptoms	No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Chronic Toxicity	No information available.

Numerical measures of toxicity - Product Information

Unknown acute toxicity	100% of the mixture consists of ingredient(s) of unknown toxicity

12. ECOLOGICAL INFORMATION

Ecotoxicity	May cause long lasting harmful effects to aquatic life

100% of the mixture consists of components(s) of unknown hazards to the aquatic environment.

Persistence and degradability	No information available.
Bioaccumulation	No information available.
Mobility	No information available.

13. DISPOSAL CONSIDERATIONS

Disposal of wastes	Disposal should be in accordance with applicable regional, national and local laws and regulations.
Contaminated packaging	Do not reuse container.
US EPA Waste Number	D002

14. TRANSPORT INFORMATION

DOT

UN/ID no	UN3265
Hazard Class	8
Packing Group	III
Proper shipping name	Corrosive liquid, acidic, organic, n.o.s.
Description	UN3265, Corrosive liquid, acidic, organic, n.o.s., 8, III
Emergency Response Guide Number	153

IMDG

UN/ID no	UN3265
Hazard Class	8
Packing Group	III
Proper shipping name	Corrosive liquid, acidic, organic, n.o.s.
Description	UN3265, Corrosive liquid, acidic, organic, n.o.s., 8, III
Special Provisions	223, 274
EmS-No	F-A, S-B

IATA

UN/ID no	UN3265
Hazard Class	8
Packing Group	III
Proper shipping name	Corrosive liquid, acidic, organic, n.o.s.
Description	UN3265, Corrosive liquid, acidic, organic, n.o.s., 8, III
ERG Code	8L

15. REGULATORY INFORMATION

International Inventories

All of the components in the product are on the following Inventory lists

No information available

X - Listed
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances

ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

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

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

This product does not contain any substances regulated by state right-to-know regulations

16. OTHER INFORMATION

Revision note	No information available

Disclaimer

The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

Safety Data Sheet
acc. to OSHA HCS

Printing date 08/18/2023 Revision date 08/18/2023

1 Identification

· **Product identifier**

· **Trade name: N-methyl Perfluorooctanesulfonamide**
· **Synonym** 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-N-methyl-1-octanesulfonamide

· **Article number:** 37264
· **CAS Number:**
31506-32-8
· **EC number:**
250-665-8
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**

GHS07

Acute Toxicity - Oral 4	H302 Harmful if swallowed.
Acute Toxicity - Dermal 4	H312 Harmful in contact with skin.
Acute Toxicity - Inhalation 4	H332 Harmful if inhaled.
Skin Irritation 2	H315 Causes skin irritation.
Eye Irritation 2A	H319 Causes serious eye irritation.
Specific Target Organ Toxicity - Single Exposure 3	H335 May cause respiratory irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).

(Contd. on page 2)

(Contd. from page 1)

· **Hazard pictograms**

GHS07

· **Signal word** Warning

· **Hazard statements**

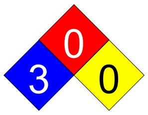
H302+H312+H332	Harmful if swallowed, in contact with skin or if inhaled.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.

· **Precautionary statements**

P261	Avoid breathing dust/fume/gas/mist/vapors/spray
P264	Wash 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/doctor if you feel unwell.
P330	Rinse mouth.
P302+P352	If on skin: Wash with plenty of water.
P321	Specific treatment (see on this label).
P304+P340	IF INHALED: Remove person to fresh air and keep 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.
P332+P313	If skin irritation occurs: Get medical advice/attention.
P362+P364	Take off contaminated clothing and wash it before reuse.
P337+P313	If eye irritation persists: Get medical advice/attention.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	2
FIRE	0
REACTIVITY	0

Health = 2
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

(Contd. on page 3)

(Contd. from page 2)

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
31506-32-8 N-methyl Perfluorooctanesulfonamide
· **Identification number(s)**
· **EC number:** 250-665-8

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:**
Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:**
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:** Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures** Not required.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:** Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**
· **PAC-1:** Substance is not listed.
· **PAC-2:** Substance is not listed.

(Contd. on page 4)

(Contd. from page 3)

· **PAC-3:** Substance is not listed.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Thorough dedusting.
Ensure good ventilation/exhaustion at the workplace.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see section 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

(Contd. on page 5)

(Contd. from page 4)

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C9H4F17NO2S
· **Molecular Weight**	513.2 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Other information**	No further relevant information available.

(Contd. on page 6)

(Contd. from page 5)

10 Stability and reactivity

- **Reactivity** No further relevant information available.
- **Chemical stability**
- **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
- **Possibility of hazardous reactions** No dangerous reactions known.
- **Conditions to avoid** No further relevant information available.
- **Incompatible materials:** No further relevant information available.
- **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

- **Information on toxicological effects**
- **Acute toxicity:**
- **Primary irritant effect:**
- **on the skin:** Irritant to skin and mucous membranes.
- **on the eye:** Irritating effect.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**

- **Carcinogenic categories**
- **IARC (International Agency for Research on Cancer)** Substance is not listed.
- **NTP (National Toxicology Program)** Substance is not listed.
- **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

- **Toxicity**
- **Aquatic toxicity:** No further relevant information available.
- **Persistence and degradability** No further relevant information available.
- **Behavior in environmental systems:**
- **Bioaccumulative potential** No further relevant information available.
- **Mobility in soil** No further relevant information available.
- **Additional ecological information:**
- **General notes:**
  Water hazard class 1 (Self-assessment): slightly hazardous for water
  Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **Other adverse effects** No further relevant information available.

13 Disposal considerations

- **Waste treatment methods**
- **Recommendation:**
  Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

(Contd. on page 7)

(Contd. from page 6)

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is listed.
· **TSCA (Toxic Substances Control Act):** ACTIVE
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of

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these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 08/18/2023
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 4: Acute toxicity – Category 4
Skin Irritation 2: Skin corrosion/irritation – Category 2
Eye Irritation 2A: Serious eye damage/eye irritation – Category 2A
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3

Safety Data Sheet
acc. to OSHA HCS

Printing date 08/03/2022 Revision date 08/03/2022

1 Identification

· **Product identifier**

· **Trade name: 2-(N-Methylperfluorooctanesulfonamido)acetic Acid**

· **Article number:** 37262
· **CAS Number:**
2355-31-9
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS07

Acute Tox. 4	H302 Harmful if swallowed.
Skin Irrit. 2	H315 Causes skin irritation.
Eye Irrit. 2A	H319 Causes serious eye irritation.
STOT SE 3	H335 May cause respiratory irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**


GHS07

(Contd. on page 2)

(Contd. from page 1)

· **Signal word** Warning

· **Hazard statements**

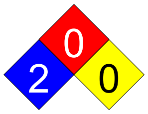
H302 Harmful if swallowed.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.

· **Precautionary statements**

P261	Avoid breathing dust/fume/gas/mist/vapors/spray
P264	Wash 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 / eye protection / face protection.
P301+P312	If swallowed: Call a poison center/doctor if you feel unwell.
P330	Rinse mouth.
P302+P352	If on skin: Wash with plenty of water.
P321	Specific treatment (see on this label).
P304+P340	IF INHALED: Remove person to fresh air and keep 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.
P332+P313	If skin irritation occurs: Get medical advice/attention.
P362+P364	Take off contaminated clothing and wash it before reuse.
P337+P313	If eye irritation persists: Get medical advice/attention.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 2
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	2
FIRE	0
REACTIVITY	0

Health = 2
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**

· **CAS No. Description**

2355-31-9 2-(N-Methylperfluorooctanesulfonamido)acetic Acid

(Contd. on page 3)

(Contd. from page 2)

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:**
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:** Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
May cause anemia, cough, CNS depression, drowsiness, headache, heart damage, lassitude (weakness, exhaustion), liver damage, narcosis, reproductive effects, teratogenic effects.
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** No special measures required.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures** Not required.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:** Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**
· **PAC-1:** Substance is not listed.
· **PAC-2:** Substance is not listed.
· **PAC-3:** Substance is not listed.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
No special precautions are necessary if used correctly.
Avoid breathing dust/fume/gas/mist/vapours/spray.
Avoid prolonged or repeated exposure.
Keep away from sources of ignition.
Take precautionary measures against static discharge.re.

(Contd. on page 4)

(Contd. from page 3)

· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:**

Tightly sealed goggles

(Contd. on page 5)

(Contd. from page 4)

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C11H6F17NO4S
· **Molecular Weight**	571.2 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
SOLUBILITY	EtOH
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.

(Contd. on page 6)

(Contd. from page 5)

· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Irritant to skin and mucous membranes.
· **on the eye:** Irritating effect.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (Self-assessment): slightly hazardous for water
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

(Contd. on page 7)

(Contd. from page 6)

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is not listed.
· **TSCA (Toxic Substances Control Act):** Substance is not listed.
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

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· **Department issuing SDS:** Environment protection department.

· **Contact:** -

· **Date of preparation / last revision** 08/03/2022 / -

· **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Tox. 4: Acute toxicity – Category 4
Skin Irrit. 2: Skin corrosion/irritation – Category 2
Eye Irrit. 2A: Serious eye damage/eye irritation – Category 2A
STOT SE 3: Specific target organ toxicity (single exposure) – Category 3

Safety Data Sheet
acc. to OSHA HCS

1 Identification

· **Product identifier**

· **Trade name: N-methyl Perfluorooctanesulfonamidoethanol**
· **Synonym**
1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-N-(2-hydroxyethyl)-N-methyl-1-octanesulfonamide

· **Article number:** 37265
· **CAS Number:**
24448-09-7
· **EC number:**
246-262-1
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**

GHS07

Acute Toxicity - Oral 4	H302 Harmful if swallowed.
Acute Toxicity - Dermal 4	H312 Harmful in contact with skin.
Acute Toxicity - Inhalation 4	H332 Harmful if inhaled.
Skin Irritation 2	H315 Causes skin irritation.
Eye Irritation 2A	H319 Causes serious eye irritation.
Specific Target Organ Toxicity - Single Exposure 3	H335 May cause respiratory irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).

(Contd. on page 2)

(Contd. from page 1)

· **Hazard pictograms**

GHS07

· **Signal word** Warning

· **Hazard statements**

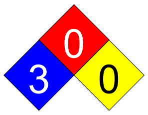
H302+H312+H332	Harmful if swallowed, in contact with skin or if inhaled.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.

· **Precautionary statements**

P261	Avoid breathing dust/fume/gas/mist/vapors/spray
P264	Wash 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/doctor if you feel unwell.
P330	Rinse mouth.
P302+P352	If on skin: Wash with plenty of water.
P321	Specific treatment (see on this label).
P304+P340	IF INHALED: Remove person to fresh air and keep 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.
P332+P313	If skin irritation occurs: Get medical advice/attention.
P362+P364	Take off contaminated clothing and wash it before reuse.
P337+P313	If eye irritation persists: Get medical advice/attention.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = 2
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

(Contd. on page 3)

(Contd. from page 2)

3 Composition/information on ingredients

- **Chemical characterization: Substances**
- **CAS No. Description**
  24448-09-7 N-methyl Perfluorooctanesulfonamidoethanol
- **Identification number(s)**
- **EC number:** 246-262-1

4 First-aid measures

- **Description of first aid measures**
- **General information:**
  Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
- **After inhalation:**
  Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
  In case of unconsciousness place patient stably in side position for transportation.
- **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
- **After eye contact:**
  Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
- **After swallowing:** Immediately call a doctor.
- **Information for doctor:**
- **Most important symptoms and effects, both acute and delayed**
  No further relevant information available.
- **Indication of any immediate medical attention and special treatment needed**
  No further relevant information available.

5 Fire-fighting measures

- **Extinguishing media**
- **Suitable extinguishing agents:**
  Use fire fighting measures that suit the environment.
  A solid water stream may be inefficient.
- **Special hazards arising from the substance or mixture** No further relevant information available.
- **Advice for firefighters**
- **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures** Not required.
- **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:** Ensure adequate ventilation.
- **Reference to other sections**
  See Section 7 for information on safe handling.
  See Section 8 for information on personal protection equipment.
  See Section 13 for disposal information.
- **Protective Action Criteria for Chemicals**
- **PAC-1:** Substance is not listed.
- **PAC-2:** Substance is not listed.

(Contd. on page 4)

(Contd. from page 3)

· **PAC-3:** Substance is not listed.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Thorough dedusting.
Ensure good ventilation/exhaustion at the workplace.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see section 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

(Contd. on page 5)

(Contd. from page 4)

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	A low melting solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C11H8F17NO3S
· **Molecular Weight**	557.2 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Other information**	No further relevant information available.

(Contd. on page 6)

(Contd. from page 5)

10 Stability and reactivity

- **Reactivity** No further relevant information available.
- **Chemical stability**
- **Thermal decomposition / conditions to be avoided:**
  No decomposition if used according to specifications.
- **Possibility of hazardous reactions** No dangerous reactions known.
- **Conditions to avoid** No further relevant information available.
- **Incompatible materials:** No further relevant information available.
- **Hazardous decomposition products:** No dangerous decomposition products known.

*

11 Toxicological information

- **RTECS Number** RG9701370
- **Information on toxicological effects**
- **Acute toxicity:**
- **Primary irritant effect:**
- **on the skin:** Irritant to skin and mucous membranes.
- **on the eye:** Irritating effect.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**

- **Carcinogenic categories**
- **IARC (International Agency for Research on Cancer)** Substance is not listed.
- **NTP (National Toxicology Program)** Substance is not listed.
- **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

- **Toxicity**
- **Aquatic toxicity:** No further relevant information available.
- **Persistence and degradability** No further relevant information available.
- **Behavior in environmental systems:**
- **Bioaccumulative potential** No further relevant information available.
- **Mobility in soil** No further relevant information available.
- **Additional ecological information:**
- **General notes:**
  Water hazard class 1 (Self-assessment): slightly hazardous for water
  Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **Other adverse effects** No further relevant information available.

(Contd. on page 7)

Safety Data Sheet
acc. to OSHA HCS

(Contd. from page 6)

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

*

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is listed.
· **TSCA (Toxic Substances Control Act):** ACTIVE
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.

(Contd. on page 8)

(Contd. from page 7)

- **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 08/14/2023
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 4: Acute toxicity – Category 4
Skin Irritation 2: Skin corrosion/irritation – Category 2
Eye Irritation 2A: Serious eye damage/eye irritation – Category 2A
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3

- *** Data compared to the previous version altered.**

WELLINGTON
LABORATORIES
SAFETY DATA SHEET

Perfluoro-n-butanoic acid (PFBA)

Scantec Nordic AB

Chemwatch Hazard Alert Code: **4**

Version No: **11.20**
Safety Data Sheet (Conforms to Annex II of REACH (1907/2006) - Regulation 2020/878)

Issue Date: **28/09/2023**
Print Date: **29/02/2024**
S.REACH.SWE.EN

SECTION 1 Identification of the substance / mixture and of the company / undertaking

1.1. Product Identifier

Product name	Perfluoro-n-butanoic acid (PFBA)
Chemical Name	Not Applicable
Synonyms	Methyl alcohol (methanol),Methyl hydrate (methanol),Methylol (methanol)
Proper shipping name	METHANOL
Chemical formula	Not Applicable
Other means of identification	Not Available

1.2. Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	This product is a solution of organic compound(s) in methanol for laboratory use only (see section 3). This material should only be used by those persons trained in the safe handling of hazardous chemicals. Please refer to the Certificate of Analysis (CofA) for further product information. Wellington Laboratories Inc. believes the information stated below to be reliable and accurate. This data is solely for reference purposes. Wellington Laboratories Inc. shall not be held liable for damages resulting from handling or contact with the above stated material.
Uses advised against	No specific uses advised against are identified.

1.3. Details of the manufacturer or supplier of the safety data sheet

Registered company name	**Scantec Nordic AB**	**Greyhound Chromatography & Allied Chemicals**	**Wellington Laboratories**
Address	Fabriksstraket 29 Jonsered 433 76 Sweden	6 Kelvin Park, Birkenhead, Merseyside CH41 1LT United Kingdom	345 Southgate Drive Guelph Ontario N1G 3M5 Canada
Telephone	+031 336 90 00	+44-0-151 649 4000	+1 519 822 2436
Fax	Not Available	+44-0-151 649 4001	+1 519 822 2849
Website	www.scantecnordic.se	www.greyhoundchrom.com	http://well-labs.com/
Email	info@scantecnordic.se	info@greyhoundchrom.com	orders@well-labs.com

1.4. Emergency telephone number

Association / Organisation	**CANUTEC**
Emergency telephone numbers	+1 888 226 8832 (North American)
Other emergency telephone numbers	+1 613 996 6666 (International)

SECTION 2 Hazards identification

2.1. Classification of the substance or mixture

> **Considered a hazardous mixture according to Reg. (EC) No 1272/2008 and their amendments. Classified as Dangerous Goods for transport purposes.**

NFPA 704 diamond

Note: The hazard category numbers found in GHS classification in section 2 of this SDSs are NOT to be used to fill in the NFPA 704 diamond. Blue = Health Red = Fire Yellow = Reactivity White = Special (Oxidizer or water reactive substances)

Classification according to regulation (EC) No 1272/2008 [CLP] and amendments [1]	H225 - Flammable Liquids Category 2, H301 - Acute Toxicity (Oral) Category 3, H311 - Acute Toxicity (Dermal) Category 3, H331 - Acute Toxicity (Inhalation) Category 3, H370 - Specific Target Organ Toxicity - Single Exposure Category 1
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI*

2.2. Label elements

Hazard pictogram(s)	
Signal word	**Danger**

Hazard statement(s)

H225	Highly flammable liquid and vapour.
H301	Toxic if swallowed.
H311	Toxic in contact with skin.
H331	Toxic if inhaled.
H370	Causes damage to organs.

Supplementary statement(s)

Not Applicable

CLP classification (additional)

Not Applicable

Precautionary statement(s) Prevention

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P260	Do not breathe mist/vapours/spray.
P264	Wash all exposed external body areas 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 and protective clothing.
P240	Ground and bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/intrinsically safe equipment.
P242	Use non-sparking tools.
P243	Take action to prevent static discharges.

Precautionary statement(s) Response

P301+P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor/physician/first aider.
P308+P311	IF exposed or concerned: Call a POISON CENTER/doctor/physician/first aider.
P330	Rinse mouth.
P370+P378	In case of fire: Use alcohol resistant foam or normal protein foam to extinguish.
P302+P352	IF ON SKIN: Wash with plenty of water and soap.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P361+P364	Take off immediately all contaminated clothing and wash it before reuse.
P303+P361+P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water [or shower].

Precautionary statement(s) Storage

P403+P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container to authorised hazardous or special waste collection point in accordance with any local regulation.

Material contains methanol, sodium hydroxide.

2.3. Other hazards

Cumulative effects may result following exposure*.

May produce discomfort of the eyes and skin*.

Vapours potentially cause drowsiness and dizziness*.

HARMFUL: may cause lung damage if swallowed

methanol	Listed in the Europe Regulation (EC) No 1907/2006 - Annex XVII (Restrictions may apply)

SECTION 3 Composition / information on ingredients

3.1.Substances

See 'Composition on ingredients' in Section 3.2

3.2.Mixtures

1. CAS No **2.EC No** **3.Index No** **4.REACH No**	**%[weight]**	**Name**	**Classification according to regulation (EC) No 1272/2008 [CLP] and amendments**	**SCL / M-Factor**	**Nanoform Particle Characteristics**
1. 67-56-1 2.200-659-6 3.603-001-00-X 4.Not Available	98.729	methanol *	Flammable Liquids Category 2, Acute Toxicity (Oral) Category 3, Acute Toxicity (Dermal) Category 3, Acute Toxicity (Inhalation) Category 3, Specific Target Organ Toxicity - Single Exposure Category 1; H225, H301, H311, H331, H370 [2]	* STOT SE 1; H370: C ≥ 10 % | STOT SE 2; H371: 3 % ≤ C < 10 %	Not Available
1. 375-22-4* 2.206-786-3 3.Not Available 4.Not Available	0.006	Perfluoro-n-butanoic acid	Not Classified [1]	Not Available	Not Available
1. 1310-73-2 2.215-185-5 3.011-002-00-6 4.Not Available	0.002	sodium hydroxide	Skin Corrosion/Irritation Category 1A; H314 [2]	Skin Corr. 1A; H314: C ≥ 5 % | Skin Corr. 1B; H314: 2 % ≤ C < 5 % | Skin Irrit. 2; H315: 0,5 % ≤ C < 2 % | Eye Irrit.2; H319: 0,5 % ≤ C < 2 %	Not Available
1. 7732-18-5 2.231-791-2 3.Not Available 4.Not Available	1.262	water	Not Classified [1]	Not Available	Not Available

Legend:	*1. Classified by Chemwatch; 2. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI; 3. Classification drawn from C&L; * EU IOELVs available; [e] Substance identified as having endocrine disrupting properties*

SECTION 4 First aid measures

4.1. Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: - Immediately hold eyelids apart and flush the eye continuously with running water. - Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. - Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.

	‣ Transport to hospital or doctor without delay. ‣ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: ‣ Quickly but gently, wipe material off skin with a dry, clean cloth. ‣ Immediately remove all contaminated clothing, including footwear. ‣ Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre. ‣ Transport to hospital, or doctor.
Inhalation	‣ If fumes or combustion products are inhaled remove from contaminated area. ‣ Lay patient down. Keep warm and rested. ‣ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ‣ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ‣ Transport to hospital, or doctor, without delay.
Ingestion	‣ If swallowed do **NOT** induce vomiting. ‣ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. ‣ Observe the patient carefully. ‣ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. ‣ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink. ‣ Seek medical advice. ‣ Avoid giving milk or oils. ‣ Avoid giving alcohol. ‣ If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomitus.

4.2 Most important symptoms and effects, both acute and delayed

See Section 11

4.3. Indication of any immediate medical attention and special treatment needed

Any material aspirated during vomiting may produce lung injury. Therefore emesis should not be induced mechanically or pharmacologically. Mechanical means should be used if it is considered necessary to evacuate the stomach contents; these include gastric lavage after endotracheal intubation. If spontaneous vomiting has occurred after ingestion, the patient should be monitored for difficult breathing, as adverse effects of aspiration into the lungs may be delayed up to 48 hours.
For acute and short term repeated exposures to methanol:
· Toxicity results from accumulation of formaldehyde/formic acid.
· Clinical signs are usually limited to CNS, eyes and GI tract Severe metabolic acidosis may produce dyspnea and profound systemic effects which may become intractable. All symptomatic patients should have arterial pH measured. Evaluate airway, breathing and circulation.
· Stabilise obtunded patients by giving naloxone, glucose and thiamine.
· Decontaminate with Ipecac or lavage for patients presenting 2 hours post-ingestion. Charcoal does not absorb well; the usefulness of cathartic is not established.
· Forced diuresis is not effective; haemodialysis is recommended where peak methanol levels exceed 50 mg/dL (this correlates with serum bicarbonate levels below 18 mEq/L).
· Ethanol, maintained at levels between 100 and 150 mg/dL, inhibits formation of toxic metabolites and may be indicated when peak methanol levels exceed 20 mg/dL. An intravenous solution of ethanol in D5W is optimal.
· Folate, as leucovorin, may increase the oxidative removal of formic acid. 4-methylpyrazole may be an effective adjunct in the treatment. 8.Phenytoin may be preferable to diazepam for controlling seizure.

[Ellenhorn Barceloux: Medical Toxicology]

Methanol poisoning can be treated with fomepizole, or if unavailable, ethanol. Both drugs act to reduce the action of alcohol dehydrogenase on methanol by means of competitive inhibition. Ethanol, the active ingredient in alcoholic beverages, acts as a competitive inhibitor by more effectively binding and saturating the alcohol dehydrogenase enzyme in the liver, thus blocking the binding of methanol. Methanol is excreted by the kidneys without being converted into the very toxic metabolites formaldehyde and formic acid. Alcohol dehydrogenase instead enzymatically converts ethanol to acetaldehyde, a much less toxic organic molecule. Additional treatment may include sodium bicarbonate for metabolic acidosis, and hemodialysis or hemodiafiltration to remove methanol and formate from the blood. Folinic acid or folic acid is also administered to enhance the metabolism of formate.

BIOLOGICAL EXPOSURE INDEX - BEI

Determinant	Index	Sampling Time	Comment
1. Methanol in urine	15 mg/l	End of shift	B, NS
2. Formic acid in urine	80 mg/gm creatinine	Before the shift at end of workweek	B, NS

B: Background levels occur in specimens collected from subjects **NOT** exposed.
NS: Non-specific determinant - observed following exposure to other materials.

SECTION 5 Firefighting measures

5.1. Extinguishing media

Water may be an ineffective extinguishing media for methanol fires; static explosions are reported for aqueous solutions as dilute as 30%. Water may be used to cool containers.

- Alcohol stable foam.
- Dry chemical powder.
- BCF (where regulations permit).

- Carbon dioxide.
- Water spray or fog - Large fires only.

5.2. Special hazards arising from the substrate or mixture

Fire Incompatibility	Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

5.3. Advice for firefighters

Fire Fighting	Alert Fire Brigade and tell them location and nature of hazard. May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or water course. Consider evacuation (or protect in place). Fight fire from a safe distance, with adequate cover. If safe, switch off electrical equipment until vapour fire hazard removed. Use water delivered as a fine spray to control fire and cool adjacent area. Avoid spraying water onto liquid pools. **DO NOT** approach containers suspected to be hot. Cool fire exposed containers with water spray from a protected location. If safe to do so, remove containers from path of fire.
Fire/Explosion Hazard	Liquid and vapour are highly flammable. Severe fire hazard when exposed to heat, flame and/or oxidisers. Vapour may travel a considerable distance to source of ignition. Heating may cause expansion or decomposition leading to violent rupture of containers. On combustion, may emit toxic fumes of carbon monoxide (CO). Combustion products include: , carbon dioxide (CO2) , formaldehyde , other pyrolysis products typical of burning organic material.

SECTION 6 Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

See section 8

6.2. Environmental precautions

See section 12

6.3. Methods and material for containment and cleaning up

Minor Spills	Remove all ignition sources. Clean up all spills immediately. Avoid breathing vapours and contact with skin and eyes. Control personal contact with the substance, by using protective equipment. Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Major Spills	Clear area of personnel and move upwind. Alert Fire Brigade and tell them location and nature of hazard. May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or water course. Consider evacuation (or protect in place). No smoking, naked lights or ignition sources. Increase ventilation. Stop leak if safe to do so. Water spray or fog may be used to disperse vapour. Contain or absorb spill with sand, earth or vermiculite. Use only spark-free shovels and explosion proof equipment. Collect recoverable product into labelled containers for recycling. Collect solid residues and seal in labelled drums for disposal. Wash area and prevent runoff into drains. After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using. If contamination of drains or waterways occurs, advise emergency services.

6.4. Reference to other sections

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 Handling and storage

7.1. Precautions for safe handling

Safe handling	‣ Containers, even those that have been emptied, may contain explosive vapours. ‣ Do NOT cut, drill, grind, weld or perform similar operations on or near containers. ‣ Avoid all personal contact, including inhalation. ‣ Wear protective clothing when risk of exposure occurs. ‣ Use in a well-ventilated area. ‣ Prevent concentration in hollows and sumps. ‣ **DO NOT** enter confined spaces until atmosphere has been checked. ‣ Avoid smoking, naked lights, heat or ignition sources. ‣ When handling, **DO NOT** eat, drink or smoke. ‣ Vapour may ignite on pumping or pouring due to static electricity. ‣ **DO NOT** use plastic buckets. ‣ Earth and secure metal containers when dispensing or pouring product. ‣ Use spark-free tools when handling. ‣ Avoid contact with incompatible materials. ‣ Keep containers securely sealed. ‣ Avoid physical damage to containers. ‣ Always wash hands with soap and water after handling. ‣ Work clothes should be laundered separately. ‣ Use good occupational work practice. ‣ Observe manufacturer's storage and handling recommendations contained within this SDS. ‣ Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions. ‣ **DO NOT** allow clothing wet with material to stay in contact with skin
Fire and explosion protection	See section 5
Other information	‣ Store in original containers in approved flame-proof area. ‣ No smoking, naked lights, heat or ignition sources. ‣ **DO NOT** store in pits, depression, basement or areas where vapours may be trapped. ‣ Keep containers securely sealed. ‣ Store away from incompatible materials in a cool, dry well ventilated area. ‣ Protect containers against physical damage and check regularly for leaks. ‣ Observe manufacturer's storage and handling recommendations contained within this MSDS. ‣ Tank storage: Tanks must be specifically designed for use with this product. Bulk storage tanks should be diked (bunded). Locate tanks away from heat and other sources of ignition. Cleaning, inspection and maintenance of storage tanks is a specialist operation, which requires the implementation of strict procedures and precautions. ‣ Keep in a cool place. Electrostatic charges will be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk. The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable. ‣ For containers, or container linings use mild steel, stainless steel. Examples of suitable materials are: high density polyethylene (HDPE), polypropylene (PP), and Viton (FMK), which have been specifically tested for compatibility with this product. ‣ For container linings, use amine-adduct cured epoxy paint. ‣ For seals and gaskets use: graphite, PTFE, Viton A, Viton B. ‣ Unsuitable material: Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Examples of materials to avoid are: natural rubber (NR), nitrile rubber (NBR), ethylene propylene rubber (EPDM), polymethyl methacrylate (PMMA), polystyrene, polyvinyl chloride (PVC), polyisobutylene. However, some may be suitable for glove materials. ‣ Do not cut, drill, grind, weld or perform similar operations on or near containers. Containers, even those that have been emptied, can contain explosive vapours.

7.2. Conditions for safe storage, including any incompatibilities

Suitable container	‣ Glass container is suitable for laboratory quantities ‣ Packing as supplied by manufacturer. ‣ Plastic containers may only be used if approved for flammable liquid. ‣ Check that containers are clearly labelled and free from leaks. ‣ For low viscosity materials (i) : Drums and jerry cans must be of the non-removable head type. (ii) : Where a can is to be used as an inner package, the can must have a screwed enclosure. ‣ For materials with a viscosity of at least 2680 cSt. (23 deg. C) ‣ For manufactured product having a viscosity of at least 250 cSt. (23 deg. C) ‣ Manufactured product that requires stirring before use and having a viscosity of at least 20 cSt (25 deg. C): (i) Removable head packaging; (ii) Cans with friction closures and (iii) low pressure tubes and cartridges may be used. ‣ Where combination packages are used, and the inner packages are of glass, there must be sufficient inert cushioning material in contact with inner and outer packages

	‣ In addition, where inner packagings are glass and contain liquids of packing group I there must be sufficient inert absorbent to absorb any spillage, unless the outer packaging is a close fitting moulded plastic box and the substances are not incompatible with the plastic.
Storage incompatibility	Methanol: ‣ reacts violently with strong oxidisers, acetyl bromide, alkyl aluminium salts, beryllium dihydride, bromine, chromic acid, 1-chloro-3,3-difluoro-2-methoxycyclopropene, cyanuric chloride, diethylzinc, isophthaloyl chloride, nitric acid, perchloric acid, potassium-tert-butoxide, potassium sulfur diimide, Raney nickel catalysts, 2,4,6-trichlorotriazine, triethylaluminium, 1,3,3-trifluoro-2-methoxycyclopropene ‣ is incompatible with strong acids, strong caustics, alkaline earth and alkali metals, aliphatic amines, acetaldehyde, benzoyl peroxide, 1,3-bis(di-n-cyclopentadienyl iron)-2-propen-1-one, calcium carbide, chloroform, chromic anhydride, chromium trioxide, dialkylzinc, dichlorine oxide, dichloromethane, ethylene oxide, hypochlorous acid, isocyanates, isopropyl chlorocarbonate, lithium tetrahydroaluminate, magnesium, methyl azide, nitrogen dioxide, palladium, pentafluoroguanidine, perchloryl fluoride, phosphorus pentasulfide, phosphorus trioxide, potassium, tangerine oil, triisobutylaluminium ‣ mixtures with lead perchlorate, sodium hypochlorite are explosive ‣ may react with metallic aluminium at high temperatures ‣ slowly corrodes lead and aluminium ‣ may generate electrostatic charges, due to low conductivity, on flow or agitation ‣ attacks some plastics, rubber and coatings. Static induced flash fires have happened when filling plastic containers with methanol / water solutions with as low as 30% methanol content Alcohols ‣ are incompatible with strong acids, acid chlorides, acid anhydrides, oxidising and reducing agents. ‣ reacts, possibly violently, with alkaline metals and alkaline earth metals to produce hydrogen ‣ react with strong acids, strong caustics, aliphatic amines, isocyanates, acetaldehyde, benzoyl peroxide, chromic acid, chromium oxide, dialkylzincs, dichlorine oxide, ethylene oxide, hypochlorous acid, isopropyl chlorocarbonate, lithium tetrahydroaluminate, nitrogen dioxide, pentafluoroguanidine, phosphorus halides, phosphorus pentasulfide, tangerine oil, triethylaluminium, triisobutylaluminium ‣ should not be heated above 49 deg. C. when in contact with aluminium equipment ‣ Avoid storage with reducing agents.
Hazard categories in accordance with Regulation (EC) No 1272/2008	H2: Acute Toxic, H3: STOT Specific Target Organ Toxicity – Single Exposure, P5a: Flammable Liquids, P5b: Flammable Liquids, P5c: Flammable Liquids
Qualifying quantity (tonnes) of dangerous substances as referred to in Article 3(10) for the application of	H2 Lower- / Upper-tier requirements: 50 / 200 H3 Lower- / Upper-tier requirements: 50 / 200 P5a Lower- / Upper-tier requirements: 10 / 50 P5b Lower- / Upper-tier requirements: 50 / 200 P5c Lower- / Upper-tier requirements: 5 000 / 50 000

7.3. Specific end use(s)

See section 1.2

SECTION 8 Exposure controls / personal protection

8.1. Control parameters

Ingredient	**DNELs** **Exposure Pattern Worker**	**PNECs** **Compartment**
methanol	Dermal 1 601 mg/kg bw/day (Systemic, Chronic) Inhalation 11.67 mg/m^3 (Systemic, Chronic) Inhalation 20 mg/m^3 (Local, Chronic) Dermal 20 mg/kg bw/day (Systemic, Acute) Inhalation 130 mg/m^3 (Systemic, Acute) Inhalation 40 mg/m^3 (Local, Acute) *Dermal 4 mg/kg bw/day (Systemic, Chronic) ** *Inhalation 2.9 mg/m^3 (Systemic, Chronic) ** *Oral 1 mg/kg bw/day (Systemic, Chronic) ** *Inhalation 26 mg/m^3 (Local, Chronic) ** *Dermal 4 mg/kg bw/day (Systemic, Acute) ** *Inhalation 26 mg/m^3 (Systemic, Acute) ** *Oral 4 mg/kg bw/day (Systemic, Acute) ** *Inhalation 26 mg/m^3 (Local, Acute) **	Not Available
sodium hydroxide	Inhalation 2.05 mg/m^3 (Systemic, Chronic) Inhalation 1 mg/m^3 (Local, Chronic) Inhalation 2 mg/m^3 (Local, Acute) *Inhalation 0.51 mg/m^3 (Systemic, Chronic) ** *Oral 10 mg/kg bw/day (Systemic, Chronic) ** *Inhalation 1 mg/m^3 (Local, Chronic) **	Not Available

Ingredient	DNELs Exposure Pattern Worker	PNECs Compartment
water	Dermal 0.02 mg/kg bw/day (Systemic, Chronic) Inhalation 0.12 mg/m³ (Systemic, Chronic) Inhalation 0.11 mg/m³ (Local, Chronic) Dermal 5 mg/kg bw/day (Systemic, Acute) Inhalation 2.5 mg/m³ (Systemic, Acute) Inhalation 0.33 mg/m³ (Local, Acute) *Dermal 0.35 mg/kg bw/day (Systemic, Chronic) ** *Inhalation 0.144 mg/m³ (Systemic, Chronic) ** *Oral 0.08 mg/kg bw/day (Systemic, Chronic) ** *Inhalation 0.03 mg/m³ (Local, Chronic) ** *Dermal 2.5 mg/kg bw/day (Systemic, Acute) ** *Inhalation 1.96 mg/m³ (Systemic, Acute) ** *Oral 2.5 mg/kg bw/day (Systemic, Acute) ** *Inhalation 0.09 mg/m³ (Local, Acute) **	Not Available

* Values for General Population

Occupational Exposure Limits (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
EU Consolidated List of Indicative Occupational Exposure Limit Values (IOELVs)	methanol	Methanol	200 ppm / 260 mg/m3	Not Available	Not Available	Skin

Emergency Limits

Ingredient	TEEL-1	TEEL-2	TEEL-3
methanol	Not Available	Not Available	Not Available
Perfluoro-n-butanoic acid	0.5 mg/m3	5.5 mg/m3	33 mg/m3
sodium hydroxide	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
methanol	6,000 ppm	Not Available
Perfluoro-n-butanoic acid	Not Available	Not Available
sodium hydroxide	10 mg/m3	Not Available
water	Not Available	Not Available

Occupational Exposure Banding

Ingredient	Occupational Exposure Band Rating	Occupational Exposure Band Limit
sodium hydroxide	C	> 0.1 to ≤ milligrams per cubic meter of air (mg/m³)
Notes:	*Occupational exposure banding is a process of assigning chemicals into specific categories or bands based on a chemical's potency and the adverse health outcomes associated with exposure. The output of this process is an occupational exposure band (OEB), which corresponds to a range of exposure concentrations that are expected to protect worker health.*	

8.2. Exposure controls

8.2.1. Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The basic types of engineering controls are: Process controls which involve changing the way a job activity or process is done to reduce the risk. Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use. Employers may need to use multiple types of controls to prevent employee overexposure. For flammable liquids and flammable gases, local exhaust ventilation or a process enclosure ventilation system may be required. Ventilation equipment should be explosion-resistant. Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:	Air Speed:

solvent, vapours, degreasing etc., evaporating from tank (in still air).	0.25-0.5 m/s (50-100 f/min.)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)	0.5-1 m/s (100-200 f/min.)
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favourable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min.) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.
· Adequate ventilation is typically taken to be that which limits the average concentration to no more than 25% of the LEL within the building, room or enclosure containing the dangerous substance.
· Ventilation for plant and machinery is normally considered adequate if it limits the average concentration of any dangerous substance that might potentially be present to no more than 25% of the LEL. However, an increase up to a maximum 50% LEL can be acceptable where additional safeguards are provided to prevent the formation of a hazardous explosive atmosphere. For example, gas detectors linked to emergency shutdown of the process might be used together with maintaining or increasing the exhaust ventilation on solvent evaporating ovens and gas turbine enclosures.
· Temporary exhaust ventilation systems may be provided for non-routine higher-risk activities, such as cleaning, repair or maintenance in tanks or other confined spaces or in an emergency after a release. The work procedures for such activities should be carefully considered.. The atmosphere should be continuously monitored to ensure that ventilation is adequate and the area remains safe. Where workers will enter the space, the ventilation should ensure that the concentration of the dangerous substance does not exceed 10% of the LEL (irrespective of the provision of suitable breathing apparatus)

8.2.2. Individual protection measures, such as personal protective equipment

Eye and face protection

- Safety glasses with side shields.
- Chemical goggles. [AS/NZS 1337.1, EN166 or national equivalent]
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

Skin protection

See Hand protection below

Hands/feet protection

- Wear chemical protective gloves, e.g. PVC.
- Wear safety footwear or safety gumboots, e.g. Rubber

The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.
Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:
· frequency and duration of contact,
· chemical resistance of glove material,
· glove thickness and
· dexterity
Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739, AS/NZS 2161.1 or national equivalent).
· When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.

	· When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended. · Some glove polymer types are less affected by movement and this should be taken into account when considering gloves for long-term use. · Contaminated gloves should be replaced. As defined in ASTM F-739-96 in any application, gloves are rated as: · Excellent when breakthrough time > 480 min · Good when breakthrough time > 20 min · Fair when breakthrough time < 20 min · Poor when glove material degrades For general applications, gloves with a thickness typically greater than 0.35 mm, are recommended. It should be emphasised that glove thickness is not necessarily a good predictor of glove resistance to a specific chemical, as the permeation efficiency of the glove will be dependent on the exact composition of the glove material. Therefore, glove selection should also be based on consideration of the task requirements and knowledge of breakthrough times. Glove thickness may also vary depending on the glove manufacturer, the glove type and the glove model. Therefore, the manufacturers technical data should always be taken into account to ensure selection of the most appropriate glove for the task. Note: Depending on the activity being conducted, gloves of varying thickness may be required for specific tasks. For example: · Thinner gloves (down to 0.1 mm or less) may be required where a high degree of manual dexterity is needed. However, these gloves are only likely to give short duration protection and would normally be just for single use applications, then disposed of. · Thicker gloves (up to 3 mm or more) may be required where there is a mechanical (as well as a chemical) risk i.e. where there is abrasion or puncture potential Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.
Body protection	See Other protection below
Other protection	‣ Overalls. ‣ PVC Apron. ‣ PVC protective suit may be required if exposure severe. ‣ Eyewash unit. ‣ Ensure there is ready access to a safety shower. ‣ Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity. ‣ For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets). ‣ Non sparking safety or conductive footwear should be considered. Conductive footwear describes a boot or shoe with a sole made from a conductive compound chemically bound to the bottom components, for permanent control to electrically ground the foot an shall dissipate static electricity from the body to reduce the possibility of ignition of volatile compounds. Electrical resistance must range between 0 to 500,000 ohms. Conductive shoes should be stored in lockers close to the room in which they are worn. Personnel who have been issued conductive footwear should not wear them from their place of work to their homes and return.

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
"Forsberg Clothing Performance Index".
The effect(s) of the following substance(s) are taken into account in the ***computer-generated*** selection:
Perfluoro-n-butanoic acid (PFBA)

Material	CPI
BUTYL	A
NEOPRENE	B
BUTYL/NEOPRENE	C
NAT+NEOPR+NITRILE	C
NATURAL RUBBER	C
NATURAL+NEOPRENE	C
NEOPRENE/NATURAL	C
NITRILE	C
NITRILE+PVC	C
PE	C
PE/EVAL/PE	C
PVA	C
PVC	C
PVDC/PE/PVDC	C
SARANEX-23	C
SARANEX-23 2-PLY	C

Respiratory protection

Type AX Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

Where the concentration of gas/particulates in the breathing zone, approaches or exceeds the "Exposure Standard" (or ES), respiratory protection is required. Degree of protection varies with both face-piece and Class of filter; the nature of protection varies with Type of filter.

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 5 x ES	AX-AUS / Class 1	-	AX-PAPR-AUS / Class 1
up to 25 x ES	Air-line*	AX-2	AX-PAPR-2
up to 50 x ES	-	AX-3	-
50+ x ES	-	Air-line**	-

* - Continuous-flow; ** - Continuous-flow or positive pressure demand
^ - Full-face
A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

- Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content.
- The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations,

TEFLON	C
VITON	C
VITON/CHLOROBUTYL	C
VITON/NEOPRENE	C

* CPI - Chemwatch Performance Index
A: Best Selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to Dangerous Choice for other than short term immersion
NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -
* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

only restricted use of cartridge respirators is considered appropriate.

- Cartridge performance is affected by humidity. Cartridges should be changed after 2 hr of continuous use unless it is determined that the humidity is less than 75%, in which case, cartridges can be used for 4 hr. Used cartridges should be discarded daily, regardless of the length of time used

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Required minimum protection factor	Maximum gas/vapour concentration present in air p.p.m. (by volume)	Half-face Respirator	Full-Face Respirator
up to 10	1000	AX-AUS / Class 1	-
up to 50	1000	-	AX-AUS / Class 1
up to 50	5000	Airline *	-
up to 100	5000	-	AX-2
up to 100	10000	-	AX-3
100+		-	Airline**

** - Continuous-flow or positive pressure demand.
A(All classes) = Organic vapours, B AUS or B1 = Acid gases, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 deg C)

8.2.3. Environmental exposure controls

See section 12

SECTION 9 Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	Clear/Colourless with Characteristic Odour

Physical state	Liquid	**Relative density (Water = 1)**	0.791
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	455
pH (as supplied)	Not Applicable	**Decomposition temperature (°C)**	Not Available
Melting point / freezing point (°C)	-98	**Viscosity (cSt)**	Not Available
Initial boiling point and boiling range (°C)	64.7	**Molecular weight (g/mol)**	32.04
Flash point (°C)	12	**Taste**	Not Available
Evaporation rate	4.1 BuAC = 1	**Explosive properties**	Not Available
Flammability	HIGHLY FLAMMABLE.	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	31	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	6	**Volatile Component (%vol)**	Not Available
Vapour pressure (kPa)	13	**Gas group**	Not Available
Solubility in water	Immiscible	**pH as a solution (1%)**	Not Applicable
Vapour density (Air = 1)	1.11	**VOC g/L**	Not Available

Nanoform Solubility	Not Available	**Nanoform Particle Characteristics**	Not Available
Particle Size	Not Available		

9.2. Other information

Not Available

SECTION 10 Stability and reactivity

10.1.Reactivity	See section 7.2
10.2. Chemical stability	‣ Static induced flash fires have happened when filling plastic containers with methanol / water solutions with as low as 30% methanol content. ‣ Unstable in the presence of incompatible materials. ‣ Product is considered stable. ‣ Hazardous polymerisation will not occur.
10.3. Possibility of hazardous reactions	See section 7.2
10.4. Conditions to avoid	See section 7.2
10.5. Incompatible materials	See section 7.2
10.6. Hazardous decomposition products	See section 5.3

SECTION 11 Toxicological information

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008

Inhaled	Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may produce toxic effects. The material is not thought to produce respiratory irritation (as classified by EC Directives using animal models). Nevertheless inhalation of vapours, fumes or aerosols, especially for prolonged periods, may produce respiratory discomfort and occasionally, distress. Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by sleepiness, reduced alertness, loss of reflexes, lack of co-ordination, and vertigo. Minor but regular methanol exposures may effect the central nervous system, optic nerves and retinae. Symptoms may be delayed, with headache, fatigue, nausea, blurring of vision and double vision. Continued or severe exposures may cause damage to optic nerves, which may become severe with permanent visual impairment even blindness resulting. **WARNING**: Methanol is only slowly eliminated from the body and should be regarded as a cumulative poison which cannot be made non-harmful [*CCINFO*]
Ingestion	**Toxic effects** may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 40 gram may be fatal or may produce serious damage to the health of the individual. Methanol may produce a burning or painful sensation in the mouth, throat, chest, and stomach. This may be accompanied by nausea, vomiting, headache, dizziness, shortness of breath, weakness, fatigue, leg cramps, restlessness, confusion, drunken behaviour, visual disturbance, drowsiness, coma and death. 60-200 ml of methanol is a fatal dose for most adults with as little as 10 ml producing blindness. In massive overdose, liver, kidney, heart and muscle injury have been described. Even ingestion of small amounts of methanol is enough to seriously damage parts of the central nervous system, leading to permanent brain and/or nerve problems. Swallowing of the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis; serious consequences may result. (ICSC13733)
Skin Contact	Skin contact with the material may produce toxic effects; systemic effects may result following absorption. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected. There is strong evidence to suggest that this material, on a single contact with skin, can cause serious, irreversible damage of organs. There is some evidence to suggest that the material may cause moderate inflammation of the skin either following direct contact or after a delay of some time. Repeated exposure can cause contact dermatitis which is characterised by redness, swelling and blistering.
Eye	Methanol is a mild to moderate eye irritant. High vapor concentration or liquid contact with eyes causes irritation, tearing, and burning. Direct contact of the eye with ethanol may cause immediate stinging and burning with reflex closure of the lid and tearing, transient injury of the corneal epithelium and hyperaemia of the conjunctiva. There is some evidence that material may produce eye irritation in some persons and produce eye damage 24 hours or more after instillation. Moderate inflammation may be expected with redness; conjunctivitis may occur with prolonged exposure.

Chronic	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. This material can cause serious damage if one is exposed to it for long periods. It can be assumed that it contains a substance which can produce severe defects. Ample evidence exists, from results in experimentation, that developmental disorders are directly caused by human exposure to the material. Long-term exposure to methanol vapour, at concentrations exceeding 3000 ppm, may produce cumulative effects characterised by gastrointestinal disturbances (nausea, vomiting), headache, ringing in the ears, insomnia, trembling, unsteady gait, vertigo, conjunctivitis and clouded or double vision. Liver and/or kidney injury may also result.

	TOXICITY	IRRITATION
Perfluoro-n-butanoic acid (PFBA)	Not Available	Not Available
methanol	**TOXICITY**	**IRRITATION**
	Dermal (rabbit) LD50: 15800 mg/kg[2]	Eye (rabbit): 100 mg/24h-moderate
	Inhalation(Rat) LC50: 64000 ppm4h[2]	Eye (rabbit): 40 mg-moderate
	Oral (Rat) LD50: 5628 mg/kg[2]	Eye: no adverse effect observed (not irritating)[1]
		Skin (rabbit): 20 mg/24 h-moderate
		Skin: no adverse effect observed (not irritating)[1]
Perfluoro-n-butanoic acid	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
sodium hydroxide	**TOXICITY**	**IRRITATION**
	Dermal (rabbit) LD50: 1350 mg/kg[2]	Eye (rabbit): 0.05 mg/24h SEVERE
	Oral (Rabbit) LD50; 325 mg/kg[1]	Eye (rabbit):1 mg/24h SEVERE
		Eye (rabbit):1 mg/30s rinsed-SEVERE
		Eye: adverse effect observed (irritating)[1]
		Skin (rabbit): 500 mg/24h SEVERE
		Skin: adverse effect observed (corrosive)[1]
water	**TOXICITY**	**IRRITATION**
	Oral (Rat) LD50: >90000 mg/kg[2]	Not Available

Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2. Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*

METHANOL	The material may cause skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin.
SODIUM HYDROXIDE	Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. Other criteria for diagnosis of RADS include a reversible airflow pattern on lung function tests, moderate to severe bronchial hyperreactivity on methacholine challenge testing, and the lack of minimal lymphocytic inflammation, without eosinophilia. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. On the other hand, industrial bronchitis is a disorder that occurs as a result of exposure due to high concentrations of irritating substance (often particles) and is completely reversible after exposure ceases. The disorder is characterized by difficulty breathing, cough and mucus production. The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.
WATER	No significant acute toxicological data identified in literature search.

Acute Toxicity	✓	**Carcinogenicity**	✗
Skin Irritation/Corrosion	✗	**Reproductivity**	✗
Serious Eye Damage/Irritation	✗	**STOT - Single Exposure**	✓
Respiratory or Skin sensitisation	✗	**STOT - Repeated Exposure**	✗

Mutagenicity	✗	**Aspiration Hazard**	✗

Legend: ✗ *– Data either not available or does not fill the criteria for classification*
✓ *– Data available to make classification*

11.2 Information on other hazards

11.2.1. Endocrine disrupting properties

No evidence of endocrine disrupting properties were found in the current literature.

11.2.2. Other information

See Section 11.1

SECTION 12 Ecological information

12.1. Toxicity

	Endpoint	Test Duration (hr)	Species	Value	Source
Perfluoro-n-butanoic acid (PFBA)	Not Available	Not Available	Not Available	Not Available	Not Available
methanol	EC50	48h	Crustacea	>10000mg/l	2
	EC50	96h	Algae or other aquatic plants	14.11-20.623mg/l	4
	NOEC(ECx)	720h	Fish	0.007mg/L	4
	LC50	96h	Fish	290mg/l	2
Perfluoro-n-butanoic acid	EC50	48h	Crustacea	180.008-183.218mg/L	4
	EC10(ECx)	48h	Algae or other aquatic plants	42-92mg/l	4
	LC50	96h	Fish	>3000mg/l	4
sodium hydroxide	EC50	48h	Crustacea	34.59-47.13mg/l	4
	EC50(ECx)	48h	Crustacea	34.59-47.13mg/l	4
	LC50	96h	Fish	144-267mg/l	4
water	Not Available	Not Available	Not Available	Not Available	Not Available
Legend:	*Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data*				

For Methanol: Log Kow: -0.82 to -0.66; Koc: 1; Henry s Law Constant: 4.55x10-6 atm-cu m/mole; Vapor Pressure: 127 mm Hg; BCF: < 10.
Atmospheric Fate: Methanol is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase methanol is broken down in the atmosphere by reactions with hydroxyl radicals; the half-life for this reaction in air is estimated to be 17 days.
Terrestrial Fate: Methanol is expected to have very high mobility in soil. Evaporation of methanol from moist/dry soil surfaces is expected to be an important fate process. Biological breakdown in soil is expected to be an important fate process for methanol based on half-lives of 1 day, in sandy silt loam, and 3.2 days in sandy loam.
Aquatic Fate: Methanol is not expected to adsorb to suspended solids and sediment and the substance mixes in water. The substance is expected to evaporate from water surfaces with half-lives, for a model river, of 3 days, and 35 days, for a model lake. Concentration of the substance in aquatic organisms is expected to be low. Breakdown by water and sunlight are not expected to be an important environmental fate processes. The substance is expected to be broken down by microorganisms in water.
Ecotoxicity: Methanol is non-toxic to fish, including fathead minnow, rainbow trout, bluegill sunfish, and guppy. The substance is also non-toxic to aquatic invertebrates, including Daphnia pulex water fleas, brine and brown shrimp. The substances are non-toxic to shellfish, including mussels, marine bacterium, including Photobacterium phosphoreum, and the protozoan Tetrahymena pyriformis.

DO NOT discharge into sewer or waterways.

12.2. Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air

Ingredient	Persistence: Water/Soil	Persistence: Air
methanol	LOW	LOW
Perfluoro-n-butanoic acid	HIGH	HIGH
sodium hydroxide	LOW	LOW
water	LOW	LOW

12.3. Bioaccumulative potential

Ingredient	Bioaccumulation
methanol	LOW (BCF = 10)
Perfluoro-n-butanoic acid	LOW (LogKOW = 2.4347)
sodium hydroxide	LOW (LogKOW = -3.8796)

12.4. Mobility in soil

Ingredient	Mobility
methanol	HIGH (KOC = 1)
Perfluoro-n-butanoic acid	LOW (KOC = 58.43)
sodium hydroxide	LOW (KOC = 14.3)

12.5. Results of PBT and vPvB assessment

	P	B	T
Relevant available data	Not Available	Not Available	Not Available
PBT	✗	✗	✗
vPvB	✗	✗	✗

PBT Criteria fulfilled?	No
vPvB	No

12.6. Endocrine disrupting properties

No evidence of endocrine disrupting properties were found in the current literature.

12.7. Other adverse effects

No evidence of ozone depleting properties were found in the current literature.

SECTION 13 Disposal considerations

13.1. Waste treatment methods

Product / Packaging disposal	‣ Containers may still present a chemical hazard/ danger when empty. ‣ Return to supplier for reuse/ recycling if possible. Otherwise: ‣ If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill. ‣ Where possible retain label warnings and SDS and observe all notices pertaining to the product. Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked. A Hierarchy of Controls seems to be common - the user should investigate: ‣ Reduction ‣ Reuse ‣ Recycling ‣ Disposal (if all else fails) This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate. ‣ **DO NOT** allow wash water from cleaning or process equipment to enter drains. ‣ It may be necessary to collect all wash water for treatment before disposal. ‣ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first. ‣ Where in doubt contact the responsible authority. ‣ Recycle wherever possible.

	‣ Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified. ‣ Dispose of by: burial in a land-fill specifically licensed to accept chemical and / or pharmaceutical wastes or Incineration in a licensed apparatus (after admixture with suitable combustible material). ‣ Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.
Waste treatment options	Not Available
Sewage disposal options	Not Available

SECTION 14 Transport information

Labels Required

	 
Marine Pollutant	NO

Land transport (ADR-RID)

14.1. **UN number or ID number**	1230	
14.2. **UN proper shipping name**	METHANOL	
14.3. **Transport hazard class(es)**	Class	3
	Subsidiary Hazard	6.1
14.4. **Packing group**	II	
14.5. **Environmental hazard**	Not Applicable	
14.6. **Special precautions for user**	Hazard identification (Kemler)	336
	Classification code	FT1
	Hazard Label	3 +6.1
	Special provisions	279
	Limited quantity	1 L
	Tunnel Restriction Code	D/E

Air transport (ICAO-IATA / DGR)

14.1. **UN number**	1230	
14.2. **UN proper shipping name**	Methanol	
14.3. **Transport hazard class(es)**	ICAO/IATA Class	3
	ICAO / IATA Subsidiary Hazard	6.1
	ERG Code	3L
14.4. **Packing group**	II	
14.5. **Environmental hazard**	Not Applicable	
14.6. **Special precautions for user**	Special provisions	A113
	Cargo Only Packing Instructions	364
	Cargo Only Maximum Qty / Pack	60 L
	Passenger and Cargo Packing Instructions	352
	Passenger and Cargo Maximum Qty / Pack	1 L
	Passenger and Cargo Limited Quantity Packing Instructions	Y341
	Passenger and Cargo Limited Maximum Qty / Pack	1 L

Sea transport (IMDG-Code / GGVSee)

14.1. **UN number**	1230
14.2. **UN proper shipping name**	METHANOL
14.3. **Transport hazard class(es)**	IMDG Class: 3 IMDG Subsidiary Hazard: 6.1
14.4. **Packing group**	II
14.5 **Environmental hazard**	Not Applicable
14.6. **Special precautions for user**	EMS Number: F-E , S-D Special provisions: 279 Limited Quantities: 1 L

Inland waterways transport (ADN)

14.1. **UN number**	1230
14.2. **UN proper shipping name**	METHANOL
14.3. **Transport hazard class(es)**	3 | 6.1
14.4. **Packing group**	II
14.5. **Environmental hazard**	Not Applicable
14.6. **Special precautions for user**	Classification code: FT1 Special provisions: 279; 802 Limited quantity: 1 L Equipment required: PP, EP, EX, TOX, A Fire cones number: 2

14.7. Maritime transport in bulk according to IMO instruments

14.7.1. Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

14.7.2. Transport in bulk in accordance with MARPOL Annex V and the IMSBC Code

Product name	Group
methanol	Not Available
Perfluoro-n-butanoic acid	Not Available
sodium hydroxide	Not Available
water	Not Available

14.7.3. Transport in bulk in accordance with the IGC Code

Product name	Ship Type
methanol	Not Available
Perfluoro-n-butanoic acid	Not Available
sodium hydroxide	Not Available
water	Not Available

SECTION 15 Regulatory information

15.1. Safety, health and environmental regulations / legislation specific for the substance or mixture

methanol is found on the following regulatory lists

Chemical Footprint Project - Chemicals of High Concern List

EU Consolidated List of Indicative Occupational Exposure Limit Values (IOELVs)

EU European Chemicals Agency (ECHA) Community Rolling Action Plan (CoRAP) List of Substances

EU REACH Regulation (EC) No 1907/2006 - Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles

Europe EC Inventory

European Union - European Inventory of Existing Commercial Chemical Substances (EINECS)

European Union (EU) Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures - Annex VI

Sweden Swedish Chemicals Agency (KEMI) Restricted Substances Database

Perfluoro-n-butanoic acid is found on the following regulatory lists

Europe EC Inventory

European Union - European Inventory of Existing Commercial Chemical Substances (EINECS)

sodium hydroxide is found on the following regulatory lists

Europe EC Inventory

European Union - European Inventory of Existing Commercial Chemical Substances (EINECS)

European Union (EU) Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures - Annex VI

water is found on the following regulatory lists

Europe EC Inventory

European Union - European Inventory of Existing Commercial Chemical Substances (EINECS)

Additional Regulatory Information

Not Applicable

This safety data sheet is in compliance with the following EU legislation and its adaptations - as far as applicable - : Directives 98/24/EC, - 92/85/EEC, - 94/33/EC, - 2008/98/EC, - 2010/75/EU; Commission Regulation (EU) 2020/878; Regulation (EC) No 1272/2008 as updated through ATPs.

Information according to 2012/18/EU (Seveso III):

Seveso Category	H2, H3, P5a, P5b, P5c

15.2. Chemical safety assessment

No Chemical Safety Assessment has been carried out for this substance/mixture by the supplier.

National Inventory Status

National Inventory	Status
Australia - AIIC / Australia Non-Industrial Use	Yes
Canada - DSL	No (Perfluoro-n-butanoic acid)
Canada - NDSL	No (methanol; sodium hydroxide; water)
China - IECSC	Yes
Europe - EINEC / ELINCS / NLP	Yes
Japan - ENCS	Yes
Korea - KECI	Yes
New Zealand - NZIoC	Yes
Philippines - PICCS	No (Perfluoro-n-butanoic acid)
USA - TSCA	Yes
Taiwan - TCSI	Yes
Mexico - INSQ	No (Perfluoro-n-butanoic acid)
Vietnam - NCI	Yes
Russia - FBEPH	Yes
Legend:	*Yes = All CAS declared ingredients are on the inventory* *No = One or more of the CAS listed ingredients are not on the inventory. These ingredients may be exempt or will require registration.*

SECTION 16 Other information

Revision Date	28/09/2023

Initial Date	16/09/2017

Full text Risk and Hazard codes

H314	Causes severe skin burns and eye damage.

SDS Version Summary

Version	Date of Update	Sections Updated
10.20	28/09/2023	Toxicological information - Acute Health (skin), Hazards identification - Classification, Composition / information on ingredients - Ingredients

Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

For detailed advice on Personal Protective Equipment, refer to the following EU CEN Standards:
EN 166 Personal eye-protection
EN 340 Protective clothing
EN 374 Protective gloves against chemicals and micro-organisms
EN 13832 Footwear protecting against chemicals
EN 133 Respiratory protective devices

Definitions and abbreviations

- PC－TWA: Permissible Concentration-Time Weighted Average
- PC－STEL: Permissible Concentration-Short Term Exposure Limit
- IARC: International Agency for Research on Cancer
- ACGIH: American Conference of Governmental Industrial Hygienists
- STEL: Short Term Exposure Limit
- TEEL: Temporary Emergency Exposure Limit。
- IDLH: Immediately Dangerous to Life or Health Concentrations
- ES: Exposure Standard
- OSF: Odour Safety Factor
- NOAEL: No Observed Adverse Effect Level
- LOAEL: Lowest Observed Adverse Effect Level
- TLV: Threshold Limit Value
- LOD: Limit Of Detection
- OTV: Odour Threshold Value
- BCF: BioConcentration Factors
- BEI: Biological Exposure Index
- DNEL: Derived No-Effect Level
- PNEC: Predicted no-effect concentration

- AIIC: Australian Inventory of Industrial Chemicals
- DSL: Domestic Substances List
- NDSL: Non-Domestic Substances List
- IECSC: Inventory of Existing Chemical Substance in China
- EINECS: European INventory of Existing Commercial chemical Substances
- ELINCS: European List of Notified Chemical Substances
- NLP: No-Longer Polymers
- ENCS: Existing and New Chemical Substances Inventory
- KECI: Korea Existing Chemicals Inventory
- NZIoC: New Zealand Inventory of Chemicals
- PICCS: Philippine Inventory of Chemicals and Chemical Substances
- TSCA: Toxic Substances Control Act
- TCSI: Taiwan Chemical Substance Inventory
- INSQ: Inventario Nacional de Sustancias Químicas
- NCI: National Chemical Inventory
- FBEPH: Russian Register of Potentially Hazardous Chemical and Biological Substances

Classification and procedure used to derive the classification for mixtures according to Regulation (EC) 1272/2008 [CLP]

Classification according to	Classification Procedure

regulation (EC) No 1272/2008 [CLP] and amendments	
Flammable Liquids Category 2, H225	On basis of test data
Acute Toxicity (Oral) Category 3, H301	On basis of test data
Acute Toxicity (Dermal) Category 3, H311	On basis of test data
Acute Toxicity (Inhalation) Category 3, H331	On basis of test data
Specific Target Organ Toxicity - Single Exposure Category 1, H370	Minimum classification

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Safety Data Sheet

according to Regulation (EC) No 1907/2006

***N*-Ethyl-*N*-methyl-*N*-propylammonium perfluorobutanesulfonate**

Revision Date:	9/22/2022	
Date Issued:	9/22/2022	Version: 2

1 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

1.1 Product identifier

Product name	*N*-Ethyl-*N*-methyl-*N*-propylammonium perfluorobutanesulfonate
Product code	IL-0338
CAS	1186599-90-5
REACH No.	A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses	Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Supplier	IoLiTec Ionic Liquids Technologies GmbH Im Zukunftspark 9 D – 74076 Heilbronn Germany
Telephone	+49 (0)7131-89839-0
Fax	+49 (0)7131-89839-109
Email	msds@iolitec.de

1.4 Emergency telephone number

Emergency telephone	+49 (0)151-41255671

2 HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Classification (REGULTATION (EC) No 1272/2008)

Caution! Substance not yet fully tested. Risks cannot be excluded if the product is handled inappropriately. For laboratory use only!

2.2 Label elements

Labelling (REGULATION (EC) No 1272/2008)

Substance not yet fully tested.

Hazard statements

H-phrases	Substance not yet fully tested.

Precautionary statements

P phrases

P262:	Do not get in eyes, on skin, or on clothing.
P280:	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P305 + P351 + P338:	IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do – continue rinsing.
P313:	Get medical advice/attention.

2.3 Other hazards

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

3 COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

N-Ethyl-*N*-methyl-*N*-propylammonium perfluorobutanesulfonate

CAS: 1186599-90-5

Ingredient name	Contents	Classification
N-Ethyl-*N*-methyl-*N*-propylammonium perfluorobutanesulfonate	99%	Substance not yet fully tested!

Nonafluorobutane-1-sulfonic acid is included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH).

4 FIRST AID MEASURES

4.1 Description of first aid measures

General

Contaminated clothing should be removed and washed before being reused.

Inhalation

Move the exposed person to fresh air at once. If respiratory problems, provide artificial respiration/oxygen.

Ingestion

Immediately rinse mouth and provide fresh air. Do not induce vomiting. Get medical attention immediately.

Skin

Wash the skin immediately with soap and water.

Eyes

Promptly wash eyes with plenty of water while lifting the eye lids. Continue to rinse for at least 15 minutes. Get medical attention immediately. Continue to rinse.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5 FIRE FIGHTING MEASURES

5.1 Extinguishing media

Use: Water spray, fog or mist. Carbon dioxides (CO_2). Dry chemicals, sand, dolomite etc.

5.2. Special hazards arising from the substance or mixture

Avoid water in straight hose stream, will scatter and spread fire. Keep run-off water out of sewers and water sources. Dike for water control. Fire causes formation of toxic gases.

5.3. Advice for firefighters

Wear self-contained breathing apparatus as combustion may produce hazardous fumes.

6 ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear protective clothing and avoid inhalation of vapor, skin or eye contact.

6.2 Environmental precautions

Avoid washing into water courses. Avoid contaminating public drains or water supply.

6.3 Methods and materials for containment and cleaning up

Avoid contact with skin or inhalation of spillage, dust or vapor. Avoid dust formation. Collect and reclaim or dispose in sealed containers in license waste. Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Ventilate.

6.4 Reference to other sections

For disposal see section 13.

7 HANDLING AND STORAGE

7.1 Precautions for safe handling

Keep away from heat, sparks and open flame. Do not use in confined spaces without adequate ventilation and/or respirator.

7.2 Conditions for safe storage, including any incompatibilities

Store at moderate temperatures in dry, well-ventilated area.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Control parameters

Ingredients with workplace control parameters

8.2 Exposure controls

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

Body Protection

Impervious clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

9 PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Appearance	Liquid.
Color	Colorless to orange.
Odor/taste	No characteristic odor.

9.2 Other safety information

No data available

10 STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

No particular stability concerns.

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

Avoid contact to strong oxidizers and bases.

10.5 Incompatible materials

Strong oxidizing agents

10.6 Hazardous decomposition products

High temperatures generate: Corrosive gases/vapor/fumes of: Carbon dioxide (CO_2). Carbon monoxide (CO). Nitrous gases (NO_x). Hydrogen fluoride (HF).

11 TOXICOLOGICAL INFORMATION

11.1 Information on hazard classes

Acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

Reproductive toxicity

no data available

Specific target organ toxicity - single exposure

Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure

no data available

Aspiration hazard

no data available

11.2 Information on other hazards

Potential health effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. Causes skin irritation.
Eyes	Causes serious eye irritation.

Signs and Symptoms of Exposure

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Additional Information

RTECS: Not available

12 ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

This substance/mixture contains no components considered to be either persistent**,** bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Other adverse effects

No data available

13 DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Contact specialist disposal companies. Dispose of in accordance with Local Authority requirements. Recover and reclaim or recycle, if practical.

14 TRANSPORT INFORMATION

14.1 UN number

ADR/RID: -	IMDG: -	IATA: -

14.2 UN proper shipping name

ADR/RID: Not dangerous goods
IMDG: Not dangerous goods
IATA: Not dangerous goods

14.3 Transport hazard class(es)

ADR/RID: -	IMDG: -	IATA: -

14.4 Packaging group

ADR/RID: -	IMDG: -	IATA: -

14.5 Environmental hazards

ADR/RID: no	IMDG Marine pollutant: no	IATA: no

14.6 Special precautions for user

No data available

15 REGULATORY INFORMATION

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

This safety datasheet complies with the requirements of Regulation (EC) No. 1907/2006.

Authorisations and/or restrictions on use

Contains <1% Nonafluorobutane-1-sulfonic acid - REACH - Candidate List of Substances of Very High Concern for Authorisation (Article 59).

15.2 Chemical safety assessment

no data available

Country specific information

Germany	WGK: 3	(Self-Classification)

16 OTHER INFORMATION

DISCLAIMER

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Safety Data Sheet
acc. to OSHA HCS

Printing date 10/25/2022 Revision date 10/25/2022

1 Identification

· **Product identifier**

· **Trade name: Perfluorodecanoic Acid**

· **Article number:** 37244
· **CAS Number:**
335-76-2
· **EC number:**
206-400-3
· **Index number:**
607-720-00-X
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS06 Skull and crossbones

Acute Toxicity - Oral 3	H301	Toxic if swallowed.


GHS08 Health hazard

Carcinogenicity 2	H351	Suspected of causing cancer.
Toxic to Reproduction 1B	H360-H362	May damage fertility or the unborn child. May cause harm to breast-fed children.

(Contd. on page 2)

(Contd. from page 1)

GHS07

Skin Irritation 2	H315	Causes skin irritation.
Eye Irritation 2A	H319	Causes serious eye irritation.
Specific Target Organ Toxicity - Single Exposure 3	H335	May cause respiratory irritation.

· **Label elements**

· **GHS label elements**

The substance is classified and labeled according to the Globally Harmonized System (GHS).

· **Hazard pictograms**

GHS06

GHS07

GHS08

· **Signal word** Danger

· **Hazard statements**

H301	Toxic if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H351	Suspected of causing cancer.
H360-H362	May damage fertility or the unborn child. May cause harm to breast-fed children.
H335	May cause respiratory irritation.

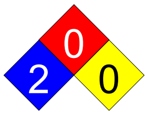
· **Precautionary statements**

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dusts or mists.
P263	Avoid contact during pregnancy/while nursing.
P264	Wash 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+P310	If swallowed: Immediately call a poison center/doctor.
P321	Specific treatment (see on this label).
P330	Rinse mouth.
P302+P352	If on skin: Wash with plenty of water.
P304+P340	IF INHALED: Remove person to fresh air and keep 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.
P308+P313	IF exposed or concerned: Get medical advice/attention.
P312	Call a poison center/doctor if you feel unwell.
P362+P364	Take off contaminated clothing and wash it before reuse.
P332+P313	If skin irritation occurs: Get medical advice/attention.
P337+P313	If eye irritation persists: Get medical advice/attention.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

(Contd. on page 3)

(Contd. from page 2)

· **Classification system:**
· **NFPA ratings (scale 0 - 4)**



Health = 2
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = *2
Fire = 0
Reactivity = 0

· **Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:**

335-76-2	Perfluorodecanoic Acid

· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
335-76-2 Perfluorodecanoic Acid
· **Identification number(s)**
· **EC number:** 206-400-3
· **Index number:** 607-720-00-X

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Immediately remove any clothing soiled by the product.
In case of irregular breathing or respiratory arrest provide artificial respiration.
· **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:**
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:** Do not induce vomiting; immediately call for medical help.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
May cause anemia, cough, CNS depression, drowsiness, headache, heart damage, lassitude (weakness, exhaustion), liver damage, narcosis, reproductive effects, teratogenic effects.
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

(Contd. on page 4)

Safety Data Sheet
acc. to OSHA HCS

(Contd. from page 3)

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** No special measures required.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures** Not required.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**
· **PAC-1:** Substance is not listed.
· **PAC-2:** Substance is not listed.
· **PAC-3:** Substance is not listed.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling** Thorough dedusting.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.

(Contd. on page 5)

(Contd. from page 4)

Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.

· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.

· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C10HF19O2
· **Molecular Weight**	514.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.

(Contd. on page 6)

(Contd. from page 5)

· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
SOLUBILITY	DMF: 1 mg/ml; Ethanol: 2 mg/ml; DMSO: insoluble; PBS (pH 7.2): insoluble
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**

· **LD/LC50 values that are relevant for classification:**		
Oral	LD50	111 mg/kg (mouse)
		57 mg/kg (rat)
	TDLO	0.72 mg/kg (mouse)
	Intraperitoneal TDLO	20 mg/kg (rat)
	Intraperitoneal LD50	150 mg/kg (mouse)
		40 mg/kg (rat)

· **Primary irritant effect:**
· **on the skin:** Irritant to skin and mucous membranes.
· **on the eye:** Irritating effect.
· **Sensitization:** No sensitizing effects known.

(Contd. on page 7)

(Contd. from page 6)

· **Additional toxicological information:**

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 3 (Self-assessment): extremely hazardous for water
Do not allow product to reach ground water, water course or sewage system, even in small quantities.
Danger to drinking water if even extremely small quantities leak into the ground.
· **Results of PBT and vPvB assessment**

· **PBT:**	
335-76-2	Perfluorodecanoic Acid

· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number**	
· **DOT, IMDG, IATA**	UN3288
· **UN proper shipping name**	
· **DOT, IATA**	Toxic solid, inorganic, n.o.s. (Perfluorodecanoic Acid)
· **IMDG**	TOXIC SOLID, INORGANIC, N.O.S. (Perfluorodecanoic Acid)

(Contd. on page 8)

(Contd. from page 7)

· Transport hazard class(es)

· DOT

· Class	6.1 Toxic substances
· Label	6.1

· IMDG, IATA

· Class	6.1 Toxic substances
· Label	6.1
· Packing group	
· DOT, IMDG, IATA	III
· Environmental hazards:	Not applicable.
· Special precautions for user	Warning: Toxic substances
· Hazard identification number (Kemler code):	60
· EMS Number:	F-A,S-A
· Stowage Category	A
· Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code	Not applicable.
· Transport/Additional information:	
· DOT	
· Quantity limitations	On passenger aircraft/rail: 100 kg On cargo aircraft only: 200 kg
· IMDG	
· Limited quantities (LQ)	5 kg
· Excepted quantities (EQ)	Code: E1 Maximum net quantity per inner packaging: 30 g Maximum net quantity per outer packaging: 1000 g
· IATA	
· Remarks:	When sold in quantities of less than or equal to 1 mL, or 1 g, with an Excepted Quantity Code of E1, E2, E4, or E5, this item meets the De Minimis Quantities exemption, per IATA 2.6.10. Therefore packaging does not have to be labeled as Dangerous Goods/Excepted Quantity.
· UN "Model Regulation":	UN 3288 TOXIC SOLID, INORGANIC, N.O.S. (PERFLUORODECANOIC ACID), 6.1, III

(Contd. on page 9)

(Contd. from page 8)

15 Regulatory information

- **Safety, health and environmental regulations/legislation specific for the substance or mixture**
  No further relevant information available.
- **Sara**
- **Section 355 (extremely hazardous substances):** Substance is not listed.
- **Section 313 (Specific toxic chemical listings):** Substance is listed.
- **TSCA (Toxic Substances Control Act):** ACTIVE
- **Hazardous Air Pollutants** Substance is not listed.
- **Proposition 65**
- **Chemicals known to cause cancer:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
- **Chemicals known to cause developmental toxicity:** Substance is not listed.

- **Carcinogenic categories**
- **EPA (Environmental Protection Agency)** Substance is not listed.
- **TLV (Threshold Limit Value)** Substance is not listed.
- **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
- **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 10/25/2022
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 3: Acute toxicity – Category 3
Skin Irritation 2: Skin corrosion/irritation – Category 2
Eye Irritation 2A: Serious eye damage/eye irritation – Category 2A
Carcinogenicity 2: Carcinogenicity – Category 2
Toxic to Reproduction 1B: Reproductive toxicity – Category 1B
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3

Safety Data Sheet
acc. to OSHA HCS

Printing date 01/09/2023 Revision date 01/09/2023

1 Identification

· **Product identifier**

· **Trade name: Perfluorododecanoic Acid**

· **Article number:** 37245
· **CAS Number:**
307-55-1
· **EC number:**
206-203-2
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

*

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS08 Health hazard

Carcinogenicity 2	H351	Suspected of causing cancer.
Toxic to Reproduction 1B	H360-H362	May damage fertility or the unborn child. May cause harm to breast-fed children.
Specific Target Organ Toxicity - Repeated Exposure 1	H372	Causes damage to organs through prolonged or repeated exposure.


GHS07

Acute Toxicity - Inhalation 4	H332	Harmful if inhaled.
Skin Irritation 2	H315	Causes skin irritation.

(Contd. on page 2)

(Contd. from page 1)

Eye Irritation 2A	H319	Causes serious eye irritation.
Specific Target Organ Toxicity - Single Exposure 3	H335	May cause respiratory irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**


GHS07


GHS08

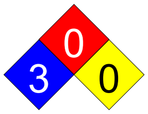
· **Signal word** Danger
· **Hazard statements**

H332	Harmful if inhaled.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H351	Suspected of causing cancer.
H360-H362	May damage fertility or the unborn child. May cause harm to breast-fed children.
H335	May cause respiratory irritation.
H372	Causes damage to organs through prolonged or repeated exposure.

· **Precautionary statements**

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dusts or mists.
P263	Avoid contact during pregnancy/while nursing.
P264	Wash 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.
P302+P352	If on skin: Wash with plenty of water.
P304+P340	IF INHALED: Remove person to fresh air and keep 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.
P308+P313	IF exposed or concerned: Get medical advice/attention.
P312	Call a poison center/doctor if you feel unwell.
P321	Specific treatment (see on this label).
P314	Get medical advice/attention if you feel unwell.
P362+P364	Take off contaminated clothing and wash it before reuse.
P332+P313	If skin irritation occurs: Get medical advice/attention.
P337+P313	If eye irritation persists: Get medical advice/attention.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**
· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

(Contd. on page 3)

(Contd. from page 2)

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*2
FIRE	0
REACTIVITY	0

Health = *2
Fire = 0
Reactivity = 0

· **Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.

· **vPvB:**	
307-55-1	Perfluorododecanoic Acid

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
307-55-1 Perfluorododecanoic Acid
· **Identification number(s)**
· **EC number:** 206-203-2

*
4 First-aid measures

· **Description of first aid measures**
· **General information:**
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:**
Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:**
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:** If symptoms persist consult doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

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5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.

(Contd. on page 4)

(Contd. from page 3)

· **Advice for firefighters**
· **Protective equipment:** Mouth respiratory protective device.

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6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures** Not required.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**
· **PAC-1:** Substance is not listed.
· **PAC-2:** Substance is not listed.
· **PAC-3:** Substance is not listed.

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7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Thorough dedusting.
Ensure good ventilation/exhaustion at the workplace.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

*

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.

(Contd. on page 5)

(Contd. from page 4)

· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C12HF23O2
· **Molecular Weight**	614.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.

(Contd. on page 6)

Safety Data Sheet
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(Contd. from page 5)

· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **RTECS Number** JR3740000
· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Irritant to skin and mucous membranes.
· **on the eye:** Irritating effect.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.

(Contd. on page 7)

(Contd. from page 6)

· **Additional ecological information:**

· **General notes:**
Water hazard class 3 (Assessment by list): extremely hazardous for water
Do not allow product to reach ground water, water course or sewage system, even in small quantities.
Danger to drinking water if even extremely small quantities leak into the ground.

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:**	
307-55-1	Perfluorododecanoic Acid

· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**

· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**

· **Recommendation:** Disposal must be made according to official regulations.

*

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.

· **Sara**

· **Section 355 (extremely hazardous substances):** Substance is not listed.

· **Section 313 (Specific toxic chemical listings):** Substance is listed.

· **TSCA (Toxic Substances Control Act):** ACTIVE

(Contd. on page 8)

(Contd. from page 7)

- **Hazardous Air Pollutants** Substance is not listed.
- **Proposition 65**
- **Chemicals known to cause cancer:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
- **Chemicals known to cause developmental toxicity:** Substance is not listed.

- **Carcinogenic categories**
- **EPA (Environmental Protection Agency)** Substance is not listed.
- **TLV (Threshold Limit Value)** Substance is not listed.
- **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
- **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 01/09/2023
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Inhalation 4: Acute toxicity – Category 4
Skin Irritation 2: Skin corrosion/irritation – Category 2
Eye Irritation 2A: Serious eye damage/eye irritation – Category 2A
Carcinogenicity 2: Carcinogenicity – Category 2
Toxic to Reproduction 1B: Reproductive toxicity – Category 1B
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3
Specific Target Organ Toxicity - Repeated Exposure 1: Specific target organ toxicity (repeated exposure) – Category 1

- *** Data compared to the previous version altered.**

Conforms to OSHA Hazard Communication Standard (HCS) (29 CFR 1910.1200 / revised 2012)

SAFETY DATA SHEET

PFC and PFAS, Individual Compounds (≤ 100 µg/mL), in Methanol VI

SECTION 1: Identification

1.1. Product identifier

Trade name

PFC and PFAS, Individual Compounds (≤ 100 µg/mL), in Methanol VI

Product no.

C11340.16, C13264.24, C14863.8, C14173.10, C14846.11, C14717.30, C2145.8, C2845.9, C2848.10, C14797.5, C15034.8, C14847.8, C14172.7, C14963.12, C14460.7, C14170.4, C14171.5, C14949.7, C14848.12, C14952.5

1.2. Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses of the substance or mixture

Laboratory use
Restricted to professional users.

Uses advised against

None known.

1.3. Details of the supplier of the safety data sheet

Company and address

Chiron AS
Stiklestadveien 1
N-7041 TRONDHEIM

Contact person

Solveig Bye Hauge

E-mail

quality@chiron.no

SDS date

10/31/2023

SDS Version

1.0

1.4. Emergency telephone number

Contact the poison control at 1-800-222-1222 (24/7) or use the webPOISONCONTROL® (triage.webpoisoncontrol.org) to get specific guidance for your case
See also section 4 “First aid measures”.

SECTION 2: Hazard(s) identification

OSHA/HCS status

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

2.1. Classification of the substance or mixture

Flam. Liq. 2; H225, Highly flammable liquid and vapour.
Acute Tox. 3; H301, Toxic if swallowed.
Acute Tox. 3; H311, Toxic in contact with skin.
Acute Tox. 3; H331, Toxic if inhaled.
STOT SE 1; H370, Causes damage to organs.

2.2. Label elements

Hazard pictogram(s)

Signal word

Danger

Hazard statement(s)

Highly flammable liquid and vapour. (H225)
Toxic if swallowed, in contact with skin or if inhaled. (H301+H311+H331)
Causes damage to organs. (H370)

Precautionary statement(s)

General

-

Prevention

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. (P210)
Keep container tightly closed. (P233)
Do not breathe vapour/mist. (P260)
Wash hands and exposed skin thoroughly after handling. (P264)
Wear face protection/protective gloves/protective clothing. (P280)

Response

IF SWALLOWED: Immediately call a POISON CENTER/doctor. (P301+P310)
IF INHALED: Remove person to fresh air and keep comfortable for breathing. (P304+P340)
IF exposed or concerned: Call a POISON CENTER/doctor (P308+P311)
Call a doctor/POISON CENTER. (P311)
Rinse mouth. (P330)
Take off immediately all contaminated clothing and wash it before reuse. (P361+P364)
In case of fire: Use water mist/carbon dioxide/alcohol-resistant foam to extinguish. (P370+P378)

Storage

Store in a well-ventilated place. Keep container tightly closed. (P403+P233)
Store in a well-ventilated place. Keep cool. (P403+P235)

Disposal

Dispose of contents/container in accordance with local regulation
(P501)

Additional labelling

Not applicable.

2.3. Other hazards

Additional warnings

This mixture/product does not contain any substances considered to meet the criteria classifying them as PBT and/or vPvB.

SECTION 3: Composition/Information on Ingredients

3.1. Substances

Not applicable. This product is a mixture.

3.2. Mixtures

Product/substance	Identifiers	% w/w	Classification	Note
Methanol	CAS No.: 67-56-1	≥99.98 %	Flam. Liq. 2, H225 Acute Tox. 3, H301 Acute Tox. 3, H311 Acute Tox. 3, H331 STOT SE 1, H370 (SCL: 10.00 %) STOT SE 2, H371 (SCL: 3.00 %)	
6:2 DiPAPS, Sodium salt	CAS No.: 407582-79-0	<0.02%		
10:2 DiPAPS sodium salt	CAS No.: 120433-74-1	<0.02%		
n-Perfluorooctanesulfonic acid	CAS No.: 1763-23-1	<0.02%	Acute Tox. 4, H302 Acute Tox. 4, H332 Carc. 2, H351 Repr. 1B, H360D Lact. H362 STOT RE 1, H372	
2H-Perfluoro-2-decenoic acid	CAS No.: 70887-84-2	<0.02%	Acute Tox. 3, H301 Eye Dam. 1, H318 Acute Tox. 4, H332 Carc. 2, H351	

			Repr. 2, H361 STOT RE 1, H372
N-(2-Hydroxyethyl)-N-methylperfluorooctanesulfonamide-d7	CAS No.: 1265205-95-5	<0.02%	Acute Tox. 4, H302 Acute Tox. 4, H312 Skin Irrit. 2, H315 Eye Irrit. 2, H319 Acute Tox. 4, H332 STOT SE 3, H335
Didecyldimethylammonium perfluorooctane sulfonate	CAS No.: 251099-16-8	<0.02%	
1H,1H-Perfluorooctan-1-ol	CAS No.: 307-30-2	<0.02%	Skin Irrit. 2, H315 Eye Irrit. 2, H319 STOT SE 3, H335
1H,1H-Perfluorononan-1-ol	CAS No.: 423-56-3	<0.02%	Skin Irrit. 2, H315 Eye Irrit. 2, H319 STOT SE 3, H335
1H,1H-Perfluorodecan-1-ol	CAS No.: 307-37-9	<0.02%	Skin Irrit. 2, H315 Eye Irrit. 2, H319 STOT SE 3, H335
Perfluoropentanesulfonic acid, sodium salt	CAS No.: 630402-22-1	<0.02%	Acute Tox. 4, H302 Skin Irrit. 2, H315 Eye Irrit. 2, H319 STOT SE 3, H335
2H,2H,3H,3H-Perfluorooctanoic acid	CAS No.: 914637-49-3	<0.02%	Skin Corr. 1, H314
N-Methyl-n-perfluorobutanesulfonylglycine	CAS No.: 159381-10-9	<0.02 %	Acute Tox. 4, H302 Acute Tox. 4, H312 Skin Irrit. 2, H315 Eye Irrit. 2, H319 Acute Tox. 4, H332 STOT SE 3, H335
Perfluorododecanesulfonic acid	CAS No.: 79780-39-5	<0.02%	
Dodecafluoro-3H-4,8-dioxanonanoic acid	CAS No.: 919005-14-4	<0.02%	Met. Corr. 1, H290 Skin Corr. 1A, H314 Eye Dam. 1, H318 1, HHNOC071
n-Perfluorobutanesulfonamide	CAS No.: 30334-69-1	<0.02%	Acute Tox. 4, H302 Acute Tox. 4, H312 Skin Irrit. 2, H315 Eye Irrit. 2, H319 Acute Tox. 4, H332 STOT SE 3, H335
N-Methyl-n-perfluorobutanesulfonamide	CAS No.: 68298-12-4	<0.02%	Acute Tox. 4, H302 Eye Irrit. 2, H319 Repr. 2, H361
N-Methyl-n-perfluorobutanesulfonylglycine-d3	CAS No.:	<0.02%	
N-Ethyl-N-(2-hydroxyethyl)perfluorooctanesulphonamide-d9	CAS No.: 1691-99-2	<0.02%	Acute Tox. 3, H301 Acute Tox. 4, H332 Carc. 2, H351 Repr. 1A, H360D Lact. H362

			STOT RE 1, H372
N-Methyl-n-perfluorobutanesulfonamide-d3	CAS No.:	<0.02%	Acute Tox. 4, H302 Eye Irrit. 2, H319 Repr. 2, H361

Where the concentration of an ingredient is expressed as a range the exact concentration has been withheld as a trade secret.

See full text of H-phrases in section 16. Occupational exposure limits are listed in section 8, if these are available.

Other information

-

SECTION 4: First-aid measures

4.1. Description of first aid measures

General information

If breathing is irregular, drowsiness, loss of consciousness or cramps: Call 911 and give immediate treatment (first aid).

Contact a doctor if in doubt about the injured person’s condition or if the symptoms persist. Never give an unconscious person water or other drink.

Inhalation

Upon breathing difficulties or irritation of the respiratory tract: Bring the injured person into fresh air. Make sure the injured person is continuously monitored. Prevent shock by keeping the injured person warm and calm. If breathing ceases, give mouth-to-mouth resuscitation. If unconscious, roll the injured person into recovery position. Call an ambulance.

Skin contact

Remove contaminated clothing and shoes immediately. Ensure to wash exposed skin thoroughly with water and soap. Skin cleanser can be used. DO NOT use solvents or thinners.

If skin irritation occurs: Get medical advice/attention.

Eye contact

If in eyes: Flush eyes with water or saline water (20-30 °C) for at least 5 minutes. Remove contact lenses. Seek medical assistance and continue flushing during transport.

Ingestion

In the case of ingestion, contact a doctor immediately. If the person is conscious, give them water. DO NOT try to induce vomiting unless this is recommended by a doctor. Hold head facing down to prevent vomit from returning to the mouth and throat. Prevent shock by keeping the injured person warm and calm. Initiate immediate resuscitation if breathing stops. If unconscious, roll the injured person into recovery position. Call an ambulance.

Burns

Rinse with water until pain stops then continue to rinse for 30 minutes.

4.2. Most important symptoms and effects, both acute and delayed

Neurotoxic effects: This product contains organic solvents, which may cause adverse effects to the nervous system. Symptoms of neurotoxicity include: loss of appetite, headache, dizziness, ringing in ears, tingling sensations of skin, sensitivity to the cold, cramps, difficulty in concentrating, tiredness, etc. Repeated exposure to solvents can result in the breaking down of the skin's natural fat layer and may result in an increased absorption potential of other hazardous substances at the area of exposure.

4.3. Indication of any immediate medical attention and special treatment needed

IF exposed or concerned:

Get immediate medical advice/attention.

Information to medics

Bring this safety data sheet or the label from this product.

SECTION 5: Fire-fighting measures

5.1. Extinguishing media

Suitable extinguishing media: Alcohol-resistant foam, carbon dioxide, powder, water mist.

Unsuitable extinguishing media: Waterjets should not be used, since they can spread the fire.

5.2. Special hazards arising from the substance or mixture

Highly flammable liquid and vapour.
In use may form flammable/explosive vapour-air mixture.
Fire will result in dense smoke. Exposure to combustion products may harm your health. Closed containers, which are exposed to fire, should be cooled with water. Do not allow fire-extinguishing water to enter the sewage system and nearby surface waters.
If the product is exposed to high temperatures, e.g. in the event of fire, dangerous decomposition compounds are produced. These are:
Carbon oxides (CO / CO2)

5.3. Advice for firefighters

Wear self-contained breathing apparatus and protective clothing to prevent contact. Upon direct exposure contact the Poison Help Line on 1-800-222-1222 (24/7) in order to obtain further advice.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Storages not yet ignited must be cooled by water mist. Remove flammable materials if conditions allow it. Ensure sufficient ventilation.
Avoid direct contact with spilled substances.
Ensure adequate ventilation, especially in confined areas.
Avoid inhalation of vapours from spilled material.
Contaminated areas may be slippery.

6.2. Environmental precautions

Avoid discharge to lakes, streams, sewers, etc.
Keep unauthorized persons away from the spill

6.3. Methods and material for containment and cleaning up

Limit spillage and collect using granular absorbent or similar materials, and dispose of it in accordance with the regulations on dangerous waste.
Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations.
Wherever possible cleaning should be performed with normal cleaning agents. Avoid use of solvents.

6.4. Reference to other sections

See section 13 “Disposal considerations” on handling of waste.
See section 8 "Exposure controls/personal protection" for protective measures.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Ground and bond container and receiving equipment.
Use explosion-proof [electrical/lighting/ventilating] equipment.
Use non-sparking tools.
Take action to prevent static discharges.
Avoid direct contact with the product.
Avoid contact during pregnancy and while nursing.
Smoking, drinking and consumption of food is not allowed in the work area.
See section 8 "Exposure controls/personal protection" for information on personal protection.

7.2. Conditions for safe storage, including any incompatibilities

Store locked up. A sign warning of toxic materials shall be affixed the room and cupboard containing the product(s).
Containers that have been opened must be carefully resealed and kept upright to prevent leakage.
Take action to prevent static discharges.
Must be stored in a cool and well-ventilated area, away from possible sources of ignition.

Recommended storage material

Glass

Liquid class

Flammable liquid / Class IB (NFPA 30)

Storage temperature

Freezer , -18 to -24°C

Incompatible materials

Strong acids, strong bases, strong oxidizing agents, and strong reducing agents.

7.3. Specific end use(s)

This product should only be used for applications quoted in section 1.2.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Methanol
Short term exposure limit (STEL) (ACGIH TLV) (ppm): 250
Short term exposure limit (STEL) (NIOSH REL) (ppm): 250
Long term exposure limit (OSHA Table Z-1) (mg/m³): 260
Long term exposure limit (OSHA Table Z-1) (ppm): 200
Long term exposure limit (ACGIH TLV) (ppm): 200

Part 1910 - Occupational Safety and Health Standards (29 CFR 1910.1000 TABLE Z-1 - Limits for Air Contaminants)

8.2. Exposure controls

Compliance with the given occupational exposure limits values should be controlled on a regular basis.

General recommendations

Smoking, drinking and consumption of food is not allowed in the work area.

Exposure scenarios

There are no exposure scenarios implemented for this product.

Exposure limits

Professional users are subjected to the legally set maximum concentrations for occupational exposure. See occupational hygiene limit values above.

Appropriate technical measures

The formation of vapours must be kept at a minimum and below current limit values (see above). Installation of a local exhaust system if normal air flow in the work room is not sufficient is recommended. Ensure eyewash and emergency showers are clearly marked.
Apply standard precautions during use of the product. Avoid inhalation of vapours.

Hygiene measures

In between use of the product and at the end of the working day all exposed areas of the body must be washed thoroughly. Always wash hands, forearms and face.

Measures to avoid environmental exposure

Keep damming materials near the workplace. If possible, collect spillage during work.

Individual protection measures, such as personal protective equipment

Generally

Use only protective equipment with a recognized certification mark, e.g. the UL mark.

Respiratory Equipment

Work situation	Type	Class	Colour	Standards	
In case of inadequate ventilation	AX		Brown	EN14387	

Skin protection

Recommended	Type/Category	Standards	
Dedicated work clothing should be worn.	-	-	

Hand protection

Work situation	Material	Glove thickness (mm)	Breakthrough time (min.)	Standards	
In the event of short termed exposure or low concentrations	Nitrile	0,38	> 30	EN374-2, EN374-3, EN388	

Work situation	Material	Glove thickness (mm)	Breakthrough time (min.)	Standards
In the event of prolonged exposure or high concentrations	Butyl	0,7	> 480	EN374-2, EN374-3, EN388, EN421
When there is risk of splash- / intermittent exposure	Fluoropolymer elastomer (e.g. Viton®)	0,7	> 120	EN374-2, EN374-3, EN388
	Gloves	-	-	EN374

Eye protection

Type	Standards
Face shield alternatively safety glasses with side shields.	EN166

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state
Liquid

Colour
Transparent

Odour
Sharp/pungent

Odour threshold (ppm)
No data available

pH
No data available

Density (g/cm^3)
Testing not relevant or not possible due to the nature of the product.

-

Relative density
0.7923

Kinematic viscosity
0.54 - 0.59 mm^2/s (20 °C)

Dynamic viscosity
> 0.544 - < 0.59 mPa.s (25 °C)

Phase changes

Melting point (°F)
-

Melting point (°C)
-98

Softening point/range (waxes and pastes) (°F)
Does not apply to liquids.

Boiling point (°F)
-

Boiling point (°C)
64.7

Vapour pressure
130.3 hPa (20 °C)

Vapour density
1.11

Decomposition temperature (°F)

Not applicable

Evaporation rate (n-butylacetate = 100)

No data available

Data on fire and explosion hazards

Flash point (°F)

-

Flash point (°C)

9.7

Flammability (°F)

The material is ignitable.

Auto-ignition temperature (°F)

-

Auto-ignition temperature (°C)

455

Explosion limits (% v/v)

6 - 36

Solubility

Solubility in water

Completely soluble

n-octanol/water coefficient

-0.77

Solubility in fat (g/L)

No data available

9.2. Other information

Evaporation rate (n-butylacetate = 100)

No data available

Other physical and chemical parameters

No data available.

Oxidizing properties

Not applicable

SECTION 10: Stability and reactivity

10.1. Reactivity

No data available.

10.2. Chemical stability

The product is stable under the conditions, noted in section 7 “Handling and storage”.

10.3. Possibility of hazardous reactions

None known.

10.4. Conditions to avoid

Avoid static electricity.

Do not expose to any forms of heat (e.g. solar radiation). May lead to excess pressure.

10.5. Incompatible materials

Strong acids, strong bases, strong oxidizing agents, and strong reducing agents.

10.6. Hazardous decomposition products

The product is not degraded when used as specified in section 1.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity

Product/substance	Methanol
Species:	Rat
Route of exposure:	Oral
Test:	LD50
Result:	5628 mg/kg

Product/substance	Methanol
Species:	Rabbit
Route of exposure:	Dermal
Test:	LD50
Result:	15800 mg/kg

Product/substance	Methanol
Species:	Rat
Route of exposure:	Inhalation
Test:	LC50
Result:	64000 mg/kg

Product/substance	Methanol
Species:	Rat
Route of exposure:	Inhalation
Test:	LC50
Result:	85.3 mg/l

Toxic if swallowed.
Toxic in contact with skin.
Toxic if inhaled.

Skin corrosion/irritation

Based on available data, the classification criteria are not met.

Serious eye damage/irritation

Based on available data, the classification criteria are not met.

Respiratory sensitisation

Based on available data, the classification criteria are not met.

Skin sensitisation

Based on available data, the classification criteria are not met.

Germ cell mutagenicity

Based on available data, the classification criteria are not met.

Carcinogenicity

Based on available data, the classification criteria are not met.

Reproductive toxicity

Based on available data, the classification criteria are not met.

STOT-single exposure

Causes damage to organs.

STOT-repeated exposure

Based on available data, the classification criteria are not met.

Aspiration hazard

Based on available data, the classification criteria are not met.

Long term effects

Neurotoxic effects: This product contains organic solvents, which may cause adverse effects to the nervous system. Symptoms of neurotoxicity include: loss of appetite, headache, dizziness, ringing in ears, tingling sensations of skin, sensitivity to the cold, cramps, difficulty in concentrating, tiredness, etc. Repeated exposure to solvents can result in the breaking down of the skin's natural fat layer and may result in an increased absorption potential of other hazardous substances at the area of exposure.

Other information

None known.

SECTION 12: Ecological information

12.1. Toxicity

Product/substance	Methanol
Species:	Fish, Poecilia reticulata
Test:	LC50
Result:	11.5 mg/l

Product/substance	Methanol
Species:	Algae, Chlorella pyrenoidosa

Test: EC50
Result: 3.6 mg/l

Product/substance Methanol
Species: Crustacean, Daphnia magna
Test: EC50
Result: > 10000 mg/l

12.2. Persistence and degradability

No data available.

12.3. Bioaccumulative potential

No data available.

12.4. Mobility in soil

No data available.

12.5. Results of PBT and vPvB assessment

This mixture/product does not contain any substances considered to meet the criteria classifying them as PBT and/or vPvB.

12.6. Other adverse effects

None known.

SECTION 13: Disposal considerations

RCRA Hazardous waste ("P" and "U" list) (40 CFR 261)

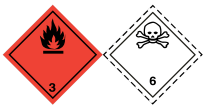
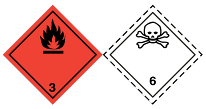
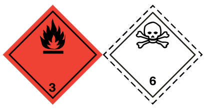
Methanol is listed with EPA Hazardous Waste Number: U154

Specific labelling

Contaminated packing

Packaging containing residues of the product must be disposed of similarly to the product.

SECTION 14: Transport information

	14.1 UN / ID	**14.2 UN proper shipping name**	**14.3 Hazard class(es)**	**14.4 PG***	**14.5 Env****	**Other information:**
DOT	UN1230	METHANOL	Transport hazard class: 3 Label: 3+6.1 Classification code: FT1 	II	No	Limited quantities: 1 L Tunnel restriction code: (D/E) See below for additional information.
IMDG	UN1230	METHANOL	Transport hazard class: 3 Label: 3+6.1 Classification code: FT1 	II	No	Limited quantities: 1 L EmS: F-E S-D See below for additional information.
IATA	UN1230	METHANOL	Transport hazard class: 3 Label: 3+6.1 Classification code: FT1 	II	No	See below for additional information.

* Packing group

** Environmental hazards

Additional information

Although this product is environmentally hazardous, the environmentally hazardous substance mark has been

omitted as the product is supplied in packaging with a maximum quantity of 5 L / 5 kg.
-
DOT / See § 172.101 Hazardous Materials Table for any information on special provisions, requirements, or warnings in connection with transport. See § 172.602, for instructions in writing regarding mitigation of damages in relation to incidents or accidents during transport.
IMDG / See section 3.2.1, for any information on special provisions, requirements, or warnings in connection with transport.
IATA / See Table 4.2 for any information on special provisions, requirements, or warnings in connection with transport.
This product is within scope of the regulations of transport of dangerous goods.

14.6. Special precautions for user

Not applicable.

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

No data available.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

15.2. U.S. Federal regulations

TSCA (the non-confidential portion)

Methanol is listed

Clean Air Act

Methanol is regulated as a hazardous air pollutant (HAPS)

EPCRA Section 302

None of the components are listed

EPCRA Section 304

None of the components are listed

EPCRA section 313

Methanol is listed

CERCLA

Methanol is regulated with a Reportable Quantity (RQ) of: 5000 pounds

State regulations

California / Prop. 65

Methanol is known to cause: Developmental Toxicity
NSRL/MADL (µg/day): 47,000 (inhalation) 23,000 (oral)

—

Massachusetts / Right To Know Act

Methanol is listed

New Jersey / Right To Know Act

Methanol / Substance number: 1222
Methanol is on the Special Health Hazard Substance List

—

New York / Right To Know Act

Methanol is listed
Methanol is regulated with a Reportable Quantity (RQ) of: 5000 pounds
Methanol is regulated with a Treshold Reporting Quantity (TRQ) of: 10 pounds

—

Pennsylvania / Right To Know Act

Methanol is listed
Methanol is hazardous to the environment (E)

—

15.4. Restrictions for application

Restricted to professional users.
Pregnant women and women breastfeeding must not be exposed to this product. The risk, and possible technical precautions or design of the workplace needed to eliminate exposure, must be considered.

15.5. Demands for specific education

No specific requirements.

15.6. Additional information

Not applicable.

15.7. Chemical safety assessment

No

15.8. Sources

OSHA Hazard Communication Standard (29 CFR 1910.1200)

SECTION 16: Other information

Full text of H-phrases as mentioned in section 3

H225, Highly flammable liquid and vapour.
H290, May be corrosive to metals.
H301, Toxic if swallowed.
H302, Harmful if swallowed.
H311, Toxic in contact with skin.
H312, Harmful in contact with skin.
H314, Causes severe skin burns and eye damage.
H315, Causes skin irritation.
H318, Causes serious eye damage.
H319, Causes serious eye irritation.
H331, Toxic if inhaled.
H332, Harmful if inhaled.
H335, May cause respiratory irritation.
H351, Suspected of causing cancer.
H360D, May damage the unborn child.
H361, Suspected of damaging fertility or the unborn child.
H362, May cause harm to breast-fed children.
H370, Causes damage to organs.
H371, May cause damage to organs.
H372, Causes damage to organs through prolonged or repeated exposure.
HHNOC071, Corrosive to the respiratory tract.

The full text of identified uses as mentioned in section 1

None known.

Abbreviations and acronyms

ACGIH = American Conference of Governmental Industrial Hygienists
ADN = European Provisions concerning the International Carriage of Dangerous Goods by Inland Waterway
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
CAS = Chemical Abstracts Service
CERCLA = Comprehensive Environmental Response Compensation and Liability Act
DOT = Department of Transportation
EINECS = European Inventory of Existing Commercial chemical Substances
EPCRA = Emergency Planning and Community Right-To-Know Act
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
HCIS = Hazardous Chemical Information System
HNOC = Hazards Not Otherwise Classified
IARC = International Agency for Research on Cancer
IATA = International Air Transport Association
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
NFPA = National Fire Protection Association
NIOSH = National Institute for Occupational Safety and Health
OECD = Organisation for Economic Co-operation and Development
OSHA = Occupational Safety and Health Administration
PBT = Persistent, Bioaccumulative and Toxic
RCRA = Resource Conservation and Recovery Act
RID = The Regulations concerning the International Carriage of Dangerous Goods by Rail
RRN = REACH Registration Number
SARA = Superfund Amendments and Reauthorization Act
SCL = A specific concentration limit.

STEL = Short-term exposure limits
STOT-RE = Specific Target Organ Toxicity - Repeated Exposure
STOT-SE = Specific Target Organ Toxicity - Single Exposure
TSCA = The Toxic Substances Control Act
TWA = Time weighted average
UN = United Nations
UVBC = Unknown or variable composition, complex reaction products or of biological materials
VOC = Volatile Organic Compound
vPvB = Very Persistent and Very Bioaccumulative

Additional information

The classification of the mixture in regard of health hazards is in accordance with the calculation methods given by HCS (29 CFR 1910.1200).

The classification of the mixture in regard to physical hazards has been based on experimental data.

The safety data sheet is validated by

Stine Rapp

Other

A change (in proportion to the last essential change (first cipher in SDS version, see section 1)) is marked with a blue triangle.

The information in this safety data sheet applies only to this specific product (mentioned in section 1) and is not necessarily correct for use with other chemicals/products.

It is recommended to hand over this safety data sheet to the actual user of the product. Information in this safety data sheet cannot be used as a product specification.

Country-language: US-en

Safety Data Sheet
acc. to OSHA HCS

1 Identification

· **Product identifier**

· **Trade name: Perfluorodecanesulfonic Acid**

· **Article number:** 34990
· **CAS Number:**
335-77-3
· **EC number:**
206-401-9
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS07

Skin Irrit. 2	H315 Causes skin irritation.
Eye Irrit. 2A	H319 Causes serious eye irritation.
STOT SE 3	H335 May cause respiratory irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).

(Contd. on page 2)

(Contd. from page 1)

· **Hazard pictograms**

GHS07

· **Signal word** Warning

· **Hazard statements**

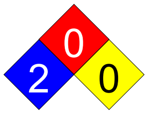
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.

· **Precautionary statements**

P261	Avoid breathing dust/fume/gas/mist/vapors/spray
P264	Wash thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves / eye protection / face protection.
P302+P352	If on skin: Wash with plenty of water.
P304+P340	IF INHALED: Remove person to fresh air and keep 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.
P312	Call a poison center/doctor if you feel unwell.
P321	Specific treatment (see on this label).
P362+P364	Take off contaminated clothing and wash it before reuse.
P332+P313	If skin irritation occurs: Get medical advice/attention.
P337+P313	If eye irritation persists: Get medical advice/attention.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 2
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = 2
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**

· **CAS No. Description**

335-77-3 Perfluorodecanesulfonic Acid

(Contd. on page 3)

Safety Data Sheet
acc. to OSHA HCS

(Contd. from page 2)

- **Identification number(s)**
- **EC number:** 206-401-9

4 First-aid measures

- **Description of first aid measures**
- **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
- **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
- **After eye contact:**
  Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
- **After swallowing:** If symptoms persist consult doctor.
- **Information for doctor:**
- **Most important symptoms and effects, both acute and delayed**
  May cause anemia, cough, CNS depression, drowsiness, headache, heart damage, lassitude (weakness, exhaustion), liver damage, narcosis, reproductive effects, teratogenic effects.
  No further relevant information available.
- **Indication of any immediate medical attention and special treatment needed**
  No further relevant information available.

5 Fire-fighting measures

- **Extinguishing media**
- **Suitable extinguishing agents:**
  Use fire fighting measures that suit the environment.
  A solid water stream may be inefficient.
- **Special hazards arising from the substance or mixture** No further relevant information available.
- **Advice for firefighters**
- **Protective equipment:** No special measures required.

6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures** Not required.
- **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:** Ensure adequate ventilation.
- **Reference to other sections**
  See Section 7 for information on safe handling.
  See Section 8 for information on personal protection equipment.
  See Section 13 for disposal information.
- **Protective Action Criteria for Chemicals**
- **PAC-1:** Substance is not listed.
- **PAC-2:** Substance is not listed.
- **PAC-3:** Substance is not listed.

7 Handling and storage

- **Handling:**
- **Precautions for safe handling**
  No special precautions are necessary if used correctly.
  Avoid breathing dust/fume/gas/mist/vapours/spray.
  Avoid prolonged or repeated exposure.
  Keep away from sources of ignition.

(Contd. on page 4)

(Contd. from page 3)

Take precautionary measures against static discharge.re.

· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:**

Tightly sealed goggles

(Contd. on page 5)

Safety Data Sheet
acc. to OSHA HCS

(Contd. from page 4)

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C10HF21O3S
· **Molecular Weight**	600.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
SOLUBILITY	DMSO
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.

(Contd. on page 6)

Safety Data Sheet
acc. to OSHA HCS

(Contd. from page 5)

· **Incompatible materials:** Bases, Strong oxidizing agents, Reducing agents
· **Hazardous decomposition products:** Carbon oxides, Hydrogen fluoride

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Irritant to skin and mucous membranes.
· **on the eye:** Irritating effect.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (Self-assessment): slightly hazardous for water
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

(Contd. on page 7)

(Contd. from page 6)

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is not listed.
· **TSCA (Toxic Substances Control Act):** INACTIVE
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

(Contd. on page 8)

(Contd. from page 7)

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 02/14/2022 / -
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Skin Irrit. 2: Skin corrosion/irritation – Category 2
Eye Irrit. 2A: Serious eye damage/eye irritation – Category 2A
STOT SE 3: Specific target organ toxicity (single exposure) – Category 3

AccuStandard®, Inc.
125 Market St., New Haven, CT 06513 USA
Tel: 203-786-5290 Fax: 203-786-5287

SAFETY DATA SHEET

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

1.1 - Product Identifiers

Catalog Name: PFOA-019S-0.02X

Description: Perfluoro(2-ethoxyethane)sulphonic acid in Methanol

1.2 - Relevant Identified Uses of the Substance or Mixture

Laboratory Chemical Reference Material

1.3 - Supplier Details

Company: AccuStandard, Inc.
125 Market St.
New Haven, CT 06513 USA

Telephone Number: 203-786-5290

Fax: 203-786-5287

Email: edocs@accustandard.com

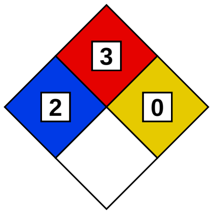
1.4 - Emergency Telephone Number

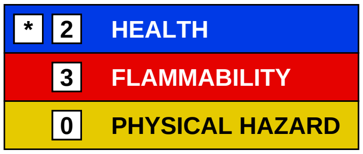
Emergency Phone #: AccuStandard, Inc.
1-203-502-7070 (USA)
+001-203-502-7070 (International)

24 hours / 7 days a week

SECTION 2 - HAZARDS IDENTIFICATION

2.1 - GHS Label Elements





*	2	HEALTH
	3	FLAMMABILITY
	0	PHYSICAL HAZARD

Signal Word: Danger

Hazard Codes:

H225 - Highly Flammable (Flammable liquids, category 2)

H301 - Toxic if swallowed. (Acute toxicity, oral, category 3)

H311 - Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

H315 - Irritating to skin. (Skin corrosion/irritation, category 2)

H320 - Irritating to eyes. (Eye damage/irritation, category 2B)

H332 - Harmful if inhaled. (Acute toxicity, inhalation, category 4)

H336 - Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

H360 - California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

H370 - Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

Precautionary Codes:

SECTION 2 - HAZARDS IDENTIFICATION *- continued*

2.1 - GHS Label Elements *- continued*

P202 - This product should only by used by persons trained in the safe handling of hazardous chemicals.

P233 - Store in a tightly closed container. (P404)

P262 - Do not get in eyes, on skin or clothing.

P264 - Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

P280 - Protective gloves must be worn to prevent skin contact.

P284 - Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

P331 - Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person.

P338 - Eye contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

P360 - Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

2.2 - Other Hazards

2.2.1 - Symptom of Exposure Health/Environment

Highly Flammable (Flammable liquids, category 2)

Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

After ingestion or inhalation, initial symptoms may be only that of mild intoxication, but may become severe after 12 or 18 hours.

POISON: May be fatal or cause blindness if swallowed.

Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

2.2.2 - Potential Health Effects

Irritating to eyes. (Eye damage/irritation, category 2B)

Irritating to skin. (Skin corrosion/irritation, category 2)

Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

Irritating to mucous membrane and upper respiratory system.

Harmful if inhaled. (Acute toxicity, inhalation, category 4)

Toxic if swallowed. (Acute toxicity, oral, category 3)

2.2.3 - Routes of Entry

Inhalation, ingestion or skin contact.

2.2.4 - Carcinogenicity

California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

SECTION 3 - COMPOSITION / ANALYTES DATA

Description: Perfluoro(2-ethoxyethane)sulphonic acid in Methanol

SECTION 3 - COMPOSITION / ANALYTES DATA *- continued*

			ACGIH -TLV (mg/m³)			OSHA -PEL (mg/m³)		
Analyte	CAS #	% Concentration	TWA	STEL	Skin	TWA	STEL	Skin
Perfluoro(2-ethoxyethane)sulphonic acid	113507-82-7	<0.001						
Methanol	67-56-1	>99.999				260		

SECTION 4 - FIRST AID MEASURES

4.1 - First Aid Procedures - General

Get medical assistance for all cases of overexposure.

4.2 - Eye Contact

Eye contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. (P338)

4.3 - Skin Contact

Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse. (P360)

4.4 - Inhalation

Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

4.5 - Ingestion

Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person. (P331)

SECTION 5 - FIRE FIGHTING MEASURES

5.1 - Flammable Properties

Dangerous fire and explosive hazard.

Containers can build up pressure if exposed to heat.

Vapors can travel to a source of ignition and flash back.

During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

5.2 - Extinguishing Media

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.

5.3 - Protection of Firefighters

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

6.1 - Spill Response

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

SECTION 7 - HANDLING AND STORAGE

Store in a tightly closed container. (P404)

Store in a cool place below 14 °F (-10 °C).

Avoid breathing vapors or mists.

Use with adequate ventilation.

Do not get in eyes, on skin or clothing. (P262)

Avoid prolonged or repeated exposure.

This product should only by used by persons trained in the safe handling of hazardous chemicals. (P202)

SECTION 8 - EXPOSURE CONTROLS

8.1 - Engineering Controls/PPE

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available. (P264)

8.2 - General Hygene Considerations

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact. (P280)

(Chloroprene, natural rubber, nitrile, or equivalent)

Use eye protection tested and approved under the appropriate government standards such as NIOSH (US) or EN 166 (EU).

All recommendations are advisory only and must be evaluated by an industrial hygienist and/or safety officer familiar with the specific situation of anticipated use, such as concentration and amount of the substance in the workplace. Any recommendation should not be construed as offering an approval for any specific use of the product.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Clear liquid

Odor: N/A

Odor Threshold: N/A

pH: N/A

Melting Point: -93.9 °C

Boiling Point: 65 °C

Flash Point: 52 °F (11 °C) (tcc)

Evaporation Rate (Butyl Acetate=1): 5.9

Flammability Class: N/A

Lower Flammability Level: 6.7

Upper Flammability Level: 36.5

Vapor Pressure: 97 mmHg (20 °C)

Vapor Density (Air = 1): 1.1 g/L

Specific Gravity: 0.791 g/cm3

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES *- continued*

Solubility in Water: Very soluble

Partition Coefficient: log Pow: -0.77

Autoignition Temperature: 385 °C

Decomposition Temperature: N/A

Viscosity: N/A

VOC Content: N/A

Percent Volatile: 99.9+

SECTION 10 - STABILITY AND REACTIVITY

Stability: Stable

Materials to Avoid: Acids
Oxidizers

Hazardous Decomposition: Oxides of carbon; Formaldehyde

Hazardous Polymerization: Will not occur

Condition to Avoid: Heat; Contact with ignition sources

SECTION 11 - TOXICOLOGICAL INFORMATION

Human Health Toxicity

See section 2 for specific toxicological information for the ingredients of this product.

LD50 (Oral): Human - 143 mg/kg; Rat - 1500 mg/kg

LD50 (Dermal) : Rabbit - >2000 mg/kg

LC50 (Inhalation): Rat - >20 mg/L

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

No other information related to the toxicological properties of this product is available at this time.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Toxicity

By complying with sections 6 and 7 there should be no release to the environment.

LC50 (Fish): >1000 mg/L 96H

EC50 (Aquatic Invertebrate): >1000 mg/L 48H

BCF: 1.0

Hydrolyzes readily on contact with water. Readily biodegradable.

No other information related to the ecological properties of this product is available at this time.

SECTION 13 - DISPOSAL CONSIDERATIONS

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

SECTION 14 - TRANSPORT INFORMATION

Transportation Information (DOT/IATA)

SECTION 14 - TRANSPORT INFORMATION *- continued*

UN Number: UN1230

Class: 3

Packing Group: II

Proper Shipping Name: Methanol

Poison by Inhalation: No

Marine Pollutant: No

SECTION 15 - REGULATORY INFORMATION

This product contains a compound or compounds subject to EU Regulation (EC) No 1907/2006 (REACH) on Annex XIV, Annex XVII, and/or Article 59. Refer to the below table for details.

Not all components are listed on the TSCA Inventory.

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

This product is subject to SARA section 313 reporting requirements.

For laboratory, research and development use only. Not for manufacturing or commercial purposes.

In addition to federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

			REACH (1907/2006)		
Analyte	CAS #	% Concentration	Annex XIV	Annex XVII	Article 59
Methanol	67-56-1	>99.999		X	

SECTION 16 - OTHER INFORMATION

This document has been designed to meet the requirements of OSHA, ANSI, GHS and CHIPs regulations. Chemicals are classified using the Globally Harmonized System for Classification and Labeling of Chemicals and CLP Regulation (EC) No. 1272/2008.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. The manufacturer will not assume any liability for the accuracy and completeness of this information. Final determination of the suitability of the material is the responsibility of the user. Although certain hazards are described herein, the user should not presume that these are the only hazards that exist. Since conditions and manner of use are outside of the manufacturers control, we make

NO WARRANTY OF MERCHANTABILITY, EXPRESSED OR IMPLIED, AND ASSUME NO LIABILITY RESULTING FROM ITS USE.

Legend : N/A = Not Available ND = Not Determined NR = Not Regulated

Alteration of any information contained herein without written permission from the manufacturer is strictly prohibited.

HMIS/NFPA HAZARD INDEX

0 - Minimal
1 - Slight
2 - Moderate
3 - Serious
4 - Severe

* - Additional Hazard

GHS HAZARD INDEX

Category 1 - Most Severe
Category 5 - Least Severe

**** End of Document ****

Safety Data Sheet
acc. to OSHA HCS

1 Identification

· **Product identifier**

· **Trade name: Perfluoroheptanoic Acid**

· **Article number:** 37247
· **CAS Number:**
375-85-9
· **EC number:**
206-798-9
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS08 Health hazard

Toxic to Reproduction 1B	H360 May damage fertility or the unborn child.
Specific Target Organ Toxicity - Repeated Exposure 1	H372 Causes damage to organs through prolonged or repeated exposure.


GHS05 Corrosion

Skin Corrosion 1A	H314 Causes severe skin burns and eye damage.
Eye Damage 1	H318 Causes serious eye damage.

(Contd. on page 2)

(Contd. from page 1)


GHS07

Acute Toxicity - Oral 4	H302 Harmful if swallowed.
Aquatic Acute 3	H402 Harmful to aquatic life.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**


GHS05

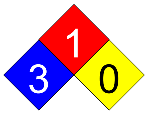

GHS07


GHS08

· **Signal word** Danger
· **Hazard statements**
H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.
H360 May damage fertility or the unborn child.
H372 Causes damage to organs through prolonged or repeated exposure.
H402 Harmful to aquatic life.
· **Precautionary statements**

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dusts or mists.
P264	Wash thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P301+P312	If swallowed: Call a poison center/doctor if you feel unwell.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P308+P313	IF exposed or concerned: Get medical advice/attention.
P321	Specific treatment (see on this label).
P314	Get medical advice/attention if you feel unwell.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**
· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 1
Reactivity = 0

(Contd. on page 3)

(Contd. from page 2)

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*3
FIRE	1
REACTIVITY	0

Health = *3
Fire = 1
Reactivity = 0

· **Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
375-85-9 Perfluoroheptanoic Acid
· **Identification number(s)**
· **EC number:** 206-798-9

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Immediately remove any clothing soiled by the product.
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:**
Immediately call a doctor.
Drink copious amounts of water and provide fresh air. Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
May cause anemia, cough, CNS depression, drowsiness, headache, heart damage, lassitude (weakness, exhaustion), liver damage, narcosis, reproductive effects, teratogenic effects.
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** No special measures required.

(Contd. on page 4)

(Contd. from page 3)

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Use neutralizing agent.
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**
· **PAC-1:** Substance is not listed.
· **PAC-2:** Substance is not listed.
· **PAC-3:** Substance is not listed.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling** Thorough dedusting.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.

(Contd. on page 5)

(Contd. from page 4)

· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	A low melting solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C7HF13O2
· **Molecular Weight**	364.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	30 °C (86 °F)
Boiling point/Boiling range:	175–177 °C (347–350.6 °F)
· **Flash point:**	>113 °C (>235.4 °F)
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.

(Contd. on page 6)

(Contd. from page 5)

· **Density at 20 °C (68 °F):**	1.792 g/cm³ (14.95424 lbs/gal)
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
SOLUBILITY	2 mg/ml PBS
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **RTECS Number** MJ2415000
· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Strong caustic effect on skin and mucous membranes.
· **on the eye:**
Strong caustic effect.
Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.

(Contd. on page 7)

(Contd. from page 6)

- **Persistence and degradability** No further relevant information available.
- **Behavior in environmental systems:**
- **Bioaccumulative potential** No further relevant information available.
- **Mobility in soil** No further relevant information available.
- **Additional ecological information:**
- **General notes:**
  Water hazard class 2 (Self-assessment): hazardous for water
  Do not allow product to reach ground water, water course or sewage system.
  Must not reach bodies of water or drainage ditch undiluted or unneutralized.
  Danger to drinking water if even small quantities leak into the ground.
- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **Other adverse effects** No further relevant information available.

13 Disposal considerations

- **Waste treatment methods**
- **Recommendation:**
  Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

- **Uncleaned packagings:**
- **Recommendation:** Disposal must be made according to official regulations.

*

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

- **Safety, health and environmental regulations/legislation specific for the substance or mixture**
  No further relevant information available.

(Contd. on page 8)

(Contd. from page 7)

· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is not listed.
· **TSCA (Toxic Substances Control Act):** ACTIVE
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

· **Department issuing SDS:** Environment protection department.
· **Contact:** -
· **Date of preparation / last revision** 10/10/2022
· **Abbreviations and acronyms:**
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 4: Acute toxicity – Category 4
Skin Corrosion 1A: Skin corrosion/irritation – Category 1A
Eye Damage 1: Serious eye damage/eye irritation – Category 1
Toxic to Reproduction 1B: Reproductive toxicity – Category 1B
Specific Target Organ Toxicity - Repeated Exposure 1: Specific target organ toxicity (repeated exposure) – Category 1
Aquatic Acute 3: Hazardous to the aquatic environment - acute aquatic hazard – Category 3
· *** Data compared to the previous version altered.**

Safety Data Sheet
acc. to OSHA HCS

Printing date 11/07/2023 Revision date 11/07/2023

1 Identification

· **Product identifier**

· **Trade name: Perfluoroheptanesulfonic Acid**
· **Synonym**

· **Article number:** 37246
· **CAS Number:**
375-92-8
· **EC number:**
206-800-8
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS05 Corrosion

Skin Corrosion 1B	H314 Causes severe skin burns and eye damage.
Eye Damage 1	H318 Causes serious eye damage.


GHS07

Acute Toxicity - Oral 4	H302 Harmful if swallowed.
Acute Toxicity - Dermal 4	H312 Harmful in contact with skin.
Acute Toxicity - Inhalation 4	H332 Harmful if inhaled.
Specific Target Organ Toxicity - Single Exposure 3	H335 May cause respiratory irritation.

(Contd. on page 2)

(Contd. from page 1)

· **Label elements**

· **GHS label elements**

The substance is classified and labeled according to the Globally Harmonized System (GHS).

· **Hazard pictograms**


GHS05


GHS07

· **Signal word** Danger

· **Hazard statements**

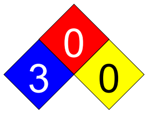
H302+H312+H332	Harmful if swallowed, in contact with skin or if inhaled.
H314	Causes severe skin burns and eye damage.
H335	May cause respiratory irritation.

· **Precautionary statements**

P260	Do not breathe dusts or mists.
P264	Wash 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/doctor if you feel unwell.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P321	Specific treatment (see on this label).
P362+P364	Take off contaminated clothing and wash it before reuse.
P363	Wash contaminated clothing before reuse.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*3
FIRE	0
REACTIVITY	0

Health = *3
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

(Contd. on page 3)

(Contd. from page 2)

3 Composition/information on ingredients

- **Chemical characterization: Substances**
- **CAS No. Description**
  375-92-8 Perfluoroheptanesulfonic Acid
- **Identification number(s)**
- **EC number:** 206-800-8

4 First-aid measures

- **Description of first aid measures**
- **General information:**
  Immediately remove any clothing soiled by the product.
  Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
- **After inhalation:**
  Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
  In case of unconsciousness place patient stably in side position for transportation.
- **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
- **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
- **After swallowing:**
  Immediately call a doctor.
  Drink copious amounts of water and provide fresh air. Immediately call a doctor.
- **Information for doctor:**
- **Most important symptoms and effects, both acute and delayed**
  No further relevant information available.
- **Indication of any immediate medical attention and special treatment needed**
  No further relevant information available.

5 Fire-fighting measures

- **Extinguishing media**
- **Suitable extinguishing agents:**
  Use fire fighting measures that suit the environment.
  A solid water stream may be inefficient.
- **Special hazards arising from the substance or mixture** No further relevant information available.
- **Advice for firefighters**
- **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures**
  Wear protective equipment. Keep unprotected persons away.
- **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:**
  Use neutralizing agent.
  Dispose contaminated material as waste according to section 13.
  Ensure adequate ventilation.
- **Reference to other sections**
  See Section 7 for information on safe handling.

(Contd. on page 4)

(Contd. from page 3)

See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

- **Protective Action Criteria for Chemicals**
- **PAC-1:** Substance is not listed.
- **PAC-2:** Substance is not listed.
- **PAC-3:** Substance is not listed.

7 Handling and storage

- **Handling:**
- **Precautions for safe handling**
  Thorough dedusting.
  Ensure good ventilation/exhaustion at the workplace.
- **Information about protection against explosions and fires:** No special measures required.

- **Conditions for safe storage, including any incompatibilities**
- **Storage:** Store in accordance with information listed on the product insert.
- **Requirements to be met by storerooms and receptacles:** No special requirements.
- **Information about storage in one common storage facility:** Not required.
- **Further information about storage conditions:** Keep receptacle tightly sealed.
- **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

- **Additional information about design of technical systems:** No further data; see section 7.

- **Control parameters**
- **Components with limit values that require monitoring at the workplace:** Not required.
- **Additional information:** The lists that were valid during the creation were used as basis.

- **Exposure controls**
- **Personal protective equipment:**
- **General protective and hygienic measures:**
  Keep away from foodstuffs, beverages and feed.
  Immediately remove all soiled and contaminated clothing.
  Wash hands before breaks and at the end of work.
  Avoid contact with the eyes.
  Avoid contact with the eyes and skin.
- **Breathing equipment:**
  In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
- **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

(Contd. on page 5)

(Contd. from page 4)

- **Material of gloves**
  The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
- **Penetration time of glove material**
  The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
- **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C7HF15O3S
· **Molecular Weight**	450.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.

(Contd. on page 6)

(Contd. from page 5)

Kinematic:	Not applicable.
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Caustic effect on skin and mucous membranes.
· **on the eye:**
Strong caustic effect.
Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (Self-assessment): slightly hazardous for water
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

(Contd. on page 7)

(Contd. from page 6)

· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is not listed.
· **TSCA (Toxic Substances Control Act):** INACTIVE
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.

(Contd. on page 8)

(Contd. from page 7)

- **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
- **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 11/07/2023
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 4: Acute toxicity – Category 4
Skin Corrosion 1B: Skin corrosion/irritation – Category 1B
Eye Damage 1: Serious eye damage/eye irritation – Category 1
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3

Safety Data Sheet
acc. to OSHA HCS

Printing date 10/25/2022 Revision date 10/25/2022

1 Identification

· **Product identifier**

· **Trade name: Perfluorohexanoic Acid**

· **Article number:** 37249
· **CAS Number:**
307-24-4
· **EC number:**
206-196-6
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS05 Corrosion

Skin Corrosion 1B H314 Causes severe skin burns and eye damage.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**


GHS05

· **Signal word** Danger

(Contd. on page 2)

(Contd. from page 1)

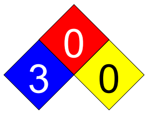
· **Hazard statements**
H314 Causes severe skin burns and eye damage.

· **Precautionary statements**

P260	Do not breathe dusts or mists.
P264	Wash thoroughly after handling.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P321	Specific treatment (see on this label).
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = 3
Fire = 0
Reactivity = 0

· **Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
307-24-4 Perfluorohexanoic Acid
· **Identification number(s)**
· **EC number:** 206-196-6

4 First-aid measures

· **Description of first aid measures**
· **General information:** Immediately remove any clothing soiled by the product.
· **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:** Drink copious amounts of water and provide fresh air. Immediately call a doctor.

(Contd. on page 3)

(Contd. from page 2)

- **Information for doctor:**
- **Most important symptoms and effects, both acute and delayed**
  May cause anemia, cough, CNS depression, drowsiness, headache, heart damage, lassitude (weakness, exhaustion), liver damage, narcosis, reproductive effects, teratogenic effects.
  No further relevant information available.
- **Indication of any immediate medical attention and special treatment needed**
  No further relevant information available.

5 Fire-fighting measures

- **Extinguishing media**
- **Suitable extinguishing agents:**
  Use fire fighting measures that suit the environment.
  A solid water stream may be inefficient.
- **Special hazards arising from the substance or mixture** No further relevant information available.
- **Advice for firefighters**
- **Protective equipment:** No special measures required.

6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures**
  Wear protective equipment. Keep unprotected persons away.
- **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:**
  Use neutralizing agent.
  Dispose contaminated material as waste according to item 13.
  Ensure adequate ventilation.
- **Reference to other sections**
  See Section 7 for information on safe handling.
  See Section 8 for information on personal protection equipment.
  See Section 13 for disposal information.
- **Protective Action Criteria for Chemicals**
- **PAC-1:** Substance is not listed.
- **PAC-2:** Substance is not listed.
- **PAC-3:** Substance is not listed.

7 Handling and storage

- **Handling:**
- **Precautions for safe handling** Thorough dedusting.
- **Information about protection against explosions and fires:** No special measures required.

- **Conditions for safe storage, including any incompatibilities**
- **Storage:** Store in accordance with information listed on the product insert.
- **Requirements to be met by storerooms and receptacles:** No special requirements.
- **Information about storage in one common storage facility:** Not required.
- **Further information about storage conditions:** Keep receptacle tightly sealed.
- **Specific end use(s)** No further relevant information available.

(Contd. on page 4)

(Contd. from page 3)

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
· **Breathing equipment:** Not required.
· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**
· **General Information**
· **Appearance:**

Form:	Solid
Color:	According to product specification
· **Odor:**	Characteristic
· **Structural Formula**	C6HF11O2
· **Molecular Weight**	314.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.

(Contd. on page 5)

(Contd. from page 4)

· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
SOLUBILITY	2 mg/ml DMSO
· **Other information**	No further relevant information available.

10 Stability and reactivity

- · **Reactivity** No further relevant information available.
- · **Chemical stability**
- · **Thermal decomposition / conditions to be avoided:**
  No decomposition if used according to specifications.
- · **Possibility of hazardous reactions** No dangerous reactions known.
- · **Conditions to avoid** No further relevant information available.
- · **Incompatible materials:** No further relevant information available.
- · **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

- · **RTECS Number** MO8445000
- · **Information on toxicological effects**
- · **Acute toxicity:**
- · **Primary irritant effect:**
- · **on the skin:** Caustic effect on skin and mucous membranes.
- · **on the eye:** Strong caustic effect.

(Contd. on page 6)

(Contd. from page 5)

· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (Self-assessment): slightly hazardous for water
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated

(Contd. on page 7)

(Contd. from page 6)

· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is not listed.
· **TSCA (Toxic Substances Control Act):** ACTIVE
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

· **Department issuing SDS:** Environment protection department.
· **Contact:** -
· **Date of preparation / last revision** 10/25/2022
· **Abbreviations and acronyms:**
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic

(Contd. on page 8)

(Contd. from page 7)

vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Skin Corrosion 1B: Skin corrosion/irritation – Category 1B

Safety Data Sheet
acc. to OSHA HCS

Printing date 05/21/2024 Revision date 05/21/2024

*
1 Identification

· **Product identifier**

· **Trade name: Perfluorohexanesulfonic Acid**
· **Synonym**
1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-1-hexanesulfonic acid
PFHxS

· **Article number:** 37248
· **CAS Number:**
355-46-4
· **EC number:**
206-587-1
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

*
2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS05 Corrosion

Skin Corrosion 1B	H314 Causes severe skin burns and eye damage.
Eye Damage 1	H318 Causes serious eye damage.


GHS07

Acute Toxicity - Oral 4	H302 Harmful if swallowed.
Acute Toxicity - Dermal 4	H312 Harmful in contact with skin.
Acute Toxicity - Inhalation 4	H332 Harmful if inhaled.

(Contd. on page 2)

(Contd. from page 1)

· **Label elements**

· **GHS label elements**

The substance is classified and labeled according to the Globally Harmonized System (GHS).

· **Hazard pictograms**

GHS05

GHS07

· **Signal word** Danger

· **Hazard statements**

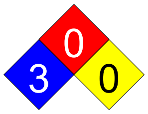
H302+H312+H332	Harmful if swallowed, in contact with skin or if inhaled.
H314	Causes severe skin burns and eye damage.

· **Precautionary statements**

P260	Do not breathe dusts or mists.
P264	Wash 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/doctor if you feel unwell.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P321	Specific treatment (see on this label).
P362+P364	Take off contaminated clothing and wash it before reuse.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*3
FIRE	0
REACTIVITY	0

Health = *3
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

(Contd. on page 3)

(Contd. from page 2)

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
355-46-4 Perfluorohexanesulfonic Acid
· **Identification number(s)**
· **EC number:** 206-587-1

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Immediately remove any clothing soiled by the product.
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:**
Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:**
Immediately call a doctor.
Drink copious amounts of water and provide fresh air. Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Use neutralizing agent.
Dispose contaminated material as waste according to section 13.
Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.

(Contd. on page 4)

(Contd. from page 3)

See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

- **Protective Action Criteria for Chemicals**
- **PAC-1:** Substance is not listed.
- **PAC-2:** Substance is not listed.
- **PAC-3:** Substance is not listed.

7 Handling and storage

- **Handling:**
- **Precautions for safe handling**
  Thorough dedusting.
  Ensure good ventilation/exhaustion at the workplace.
- **Information about protection against explosions and fires:** No special measures required.

- **Conditions for safe storage, including any incompatibilities**
- **Storage:** Store in accordance with information listed on the product insert.
- **Requirements to be met by storerooms and receptacles:** No special requirements.
- **Information about storage in one common storage facility:** Not required.
- **Further information about storage conditions:** Keep receptacle tightly sealed.
- **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

- **Additional information about design of technical systems:** No further data; see section 7.

- **Control parameters**
- **Components with limit values that require monitoring at the workplace:** Not required.
- **Additional information:** The lists that were valid during the creation were used as basis.

- **Exposure controls**
- **Personal protective equipment:**
- **General protective and hygienic measures:**
  Keep away from foodstuffs, beverages and feed.
  Immediately remove all soiled and contaminated clothing.
  Wash hands before breaks and at the end of work.
  Avoid contact with the eyes.
  Avoid contact with the eyes and skin.
- **Breathing equipment:**
  In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
- **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

(Contd. on page 5)

(Contd. from page 4)

· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**

Tightly sealed goggles

*

9 Physical and chemical properties

· **Information on basic physical and chemical properties**
· **General Information**

· **Appearance:**	
Form:	A low melting solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C6HF13O3S
· **Molecular Weight**	400.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	238.5 °C (461.3 °F)
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density at 20 °C (68 °F):**	1.841 g/cm^3 (15.36315 lbs/gal)
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.

(Contd. on page 6)

(Contd. from page 5)

Kinematic:	Not applicable.
SOLUBILITY	DMF: 10 mg/ml; DMSO: 10 mg/ml; Ethanol: 10 mg/ml
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **RTECS Number** MO4247000
· **Information on toxicological effects**
· **Acute toxicity:**

· **LD/LC50 values that are relevant for classification:**

Oral	TDLO	6.1 mg/kg (mouse)

· **Primary irritant effect:**
· **on the skin:** Caustic effect on skin and mucous membranes.
· **on the eye:**
Strong caustic effect.
Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (Self-assessment): slightly hazardous for water

(Contd. on page 7)

(Contd. from page 6)

Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.

- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **Other adverse effects** No further relevant information available.

13 Disposal considerations

- **Waste treatment methods**
- **Recommendation:**
  Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

- **Uncleaned packagings:**
- **Recommendation:** Disposal must be made according to official regulations.

*

14 Transport information

· **UN-Number**	
· **DOT, IMDG, IATA**	UN1759
· **UN proper shipping name**	
· **DOT**	Corrosive solids, n.o.s. (Perfluorohexanesulfonic Acid)
· **IMDG**	CORROSIVE SOLID, N.O.S. (Perfluorohexanesulfonic Acid)
· **IATA**	Corrosive solid, n.o.s. (Perfluorohexanesulfonic Acid)
· **Transport hazard class(es)**	
· **DOT**	
	
· **Class**	8 Corrosive substances
· **Label**	8
· **IMDG, IATA**	
	
· **Class**	8 Corrosive substances
· **Label**	8
· **Packing group**	
· **DOT, IMDG, IATA**	II
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Warning: Corrosive substances
· **Hazard identification number (Kemler code):**	80

(Contd. on page 8)

(Contd. from page 7)

· **EMS Number:**	F-A,S-B
· **Stowage Category**	A
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	
· **DOT**	
· **Quantity limitations**	On passenger aircraft/rail: 15 kg On cargo aircraft only: 50 kg
· **IMDG**	
· **Limited quantities (LQ)**	1 kg
· **Excepted quantities (EQ)**	Code: E2 Maximum net quantity per inner packaging: 30 g Maximum net quantity per outer packaging: 500 g
· **IATA**	
· **Remarks:**	When sold in quantities of less than or equal to 1 mL, or 1 g, with an Excepted Quantity Code of E1, E2, E4, or E5, this item meets the De Minimis Quantities exemption, per IATA 2.6.10. Therefore packaging does not have to be labeled as Dangerous Goods/Excepted Quantity.
· **UN "Model Regulation":**	UN 1759 CORROSIVE SOLID, N.O.S. (PERFLUOROHEXANESULFONIC ACID), 8, II

15 Regulatory information

- **Safety, health and environmental regulations/legislation specific for the substance or mixture**
  No further relevant information available.
- **Sara**
- **Section 355 (extremely hazardous substances):** Substance is not listed.
- **Section 313 (Specific toxic chemical listings):** Substance is listed.
- **TSCA (Toxic Substances Control Act):** ACTIVE
- **Hazardous Air Pollutants** Substance is not listed.
- **Proposition 65**
- **Chemicals known to cause cancer:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
- **Chemicals known to cause developmental toxicity:** Substance is not listed.

- **Carcinogenic categories**
- **EPA (Environmental Protection Agency)** Substance is not listed.
- **TLV (Threshold Limit Value)** Substance is not listed.
- **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
- **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of

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these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 05/21/2024 / -
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 4: Acute toxicity – Category 4
Skin Corrosion 1B: Skin corrosion/irritation – Category 1B
Eye Damage 1: Serious eye damage/eye irritation – Category 1

- *** Data compared to the previous version altered.**

AccuStandard®, Inc.
125 Market St., New Haven, CT 06513 USA
Tel: 203-786-5290 Fax: 203-786-5287

SAFETY DATA SHEET

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

1.1 - Product Identifiers

Catalog Name: PFOA-021S

Description: Perfluoro(4-methoxybutanoic) acid

1.2 - Relevant Identified Uses of the Substance or Mixture

Laboratory Chemical Reference Material

1.3 - Supplier Details

Company: AccuStandard, Inc.
125 Market St.
New Haven, CT 06513 USA

Telephone Number: 203-786-5290

Fax: 203-786-5287

Email: edocs@accustandard.com

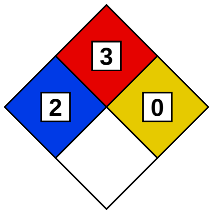
1.4 - Emergency Telephone Number

Emergency Phone #: AccuStandard, Inc.
1-203-502-7070 (USA)
+001-203-502-7070 (International)

24 hours / 7 days a week

SECTION 2 - HAZARDS IDENTIFICATION

2.1 - GHS Label Elements



*	2	HEALTH
	3	FLAMMABILITY
	0	PHYSICAL HAZARD

Signal Word: Danger

Hazard Codes:

H225 - Highly Flammable (Flammable liquids, category 2)

H301 - Toxic if swallowed. (Acute toxicity, oral, category 3)

H311 - Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

H315 - Irritating to skin. (Skin corrosion/irritation, category 2)

H320 - Irritating to eyes. (Eye damage/irritation, category 2B)

H332 - Harmful if inhaled. (Acute toxicity, inhalation, category 4)

H336 - Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

H360 - California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

H370 - Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

Precautionary Codes:

SECTION 2 - HAZARDS IDENTIFICATION *- continued*

2.1 - GHS Label Elements *- continued*

P202 - This product should only by used by persons trained in the safe handling of hazardous chemicals.

P233 - Store in a tightly closed container. (P404)

P262 - Do not get in eyes, on skin or clothing.

P264 - Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

P280 - Protective gloves must be worn to prevent skin contact.

P284 - Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

P331 - Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person.

P338 - Eye contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

P360 - Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

2.2 - Other Hazards

2.2.1 - Symptom of Exposure Health/Environment

Highly Flammable (Flammable liquids, category 2)

Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

After ingestion or inhalation, initial symptoms may be only that of mild intoxication, but may become severe after 12 or 18 hours.

POISON: May be fatal or cause blindness if swallowed.

Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

2.2.2 - Potential Health Effects

Irritating to eyes. (Eye damage/irritation, category 2B)

Irritating to skin. (Skin corrosion/irritation, category 2)

Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

Irritating to mucous membrane and upper respiratory system.

Harmful if inhaled. (Acute toxicity, inhalation, category 4)

Toxic if swallowed. (Acute toxicity, oral, category 3)

2.2.3 - Routes of Entry

Inhalation, ingestion or skin contact.

2.2.4 - Carcinogenicity

California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

SECTION 3 - COMPOSITION / ANALYTES DATA

Description: Perfluoro(4-methoxybutanoic) acid

SECTION 3 - COMPOSITION / ANALYTES DATA *- continued*

			ACGIH -TLV (mg/m³)			OSHA -PEL (mg/m³)		
Analyte	CAS #	% Concentration	TWA	STEL	Skin	TWA	STEL	Skin
Perfluoro(4-methoxybutanoic) acid	863090-89-5	0.010						
Methanol	67-56-1	99.990				260		

SECTION 4 - FIRST AID MEASURES

4.1 - First Aid Procedures - General

Get medical assistance for all cases of overexposure.

4.2 - Eye Contact

Eye contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. (P338)

4.3 - Skin Contact

Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse. (P360)

4.4 - Inhalation

Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

4.5 - Ingestion

Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person. (P331)

SECTION 5 - FIRE FIGHTING MEASURES

5.1 - Flammable Properties

Dangerous fire and explosive hazard.

Containers can build up pressure if exposed to heat.

Vapors can travel to a source of ignition and flash back.

During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

5.2 - Extinguishing Media

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.

5.3 - Protection of Firefighters

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

6.1 - Spill Response

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

SECTION 7 - HANDLING AND STORAGE

Store in a tightly closed container. (P404)

Store in a cool place below 14 °F (-10 °C).

Avoid breathing vapors or mists.

Use with adequate ventilation.

Do not get in eyes, on skin or clothing. (P262)

Avoid prolonged or repeated exposure.

This product should only by used by persons trained in the safe handling of hazardous chemicals. (P202)

SECTION 8 - EXPOSURE CONTROLS

8.1 - Engineering Controls/PPE

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available. (P264)

8.2 - General Hygene Considerations

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact. (P280)

(Chloroprene, natural rubber, nitrile, or equivalent)

Use eye protection tested and approved under the appropriate government standards such as NIOSH (US) or EN 166 (EU).

All recommendations are advisory only and must be evaluated by an industrial hygienist and/or safety officer familiar with the specific situation of anticipated use, such as concentration and amount of the substance in the workplace. Any recommendation should not be construed as offering an approval for any specific use of the product.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Clear liquid

Odor: N/A

Odor Threshold: N/A

pH: N/A

Melting Point: -93.9 °C

Boiling Point: 65 °C

Flash Point: 52 °F (11 °C) (tcc)

Evaporation Rate (Butyl Acetate=1): 5.9

Flammability Class: N/A

Lower Flammability Level: 6.7

Upper Flammability Level: 36.5

Vapor Pressure: 97 mmHg (20 °C)

Vapor Density (Air = 1): 1.1 g/L

Specific Gravity: 0.791 g/cm3

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES *- continued*

Solubility in Water: Very soluble

Partition Coefficient: log Pow: -0.77

Autoignition Temperature: 385 °C

Decomposition Temperature: N/A

Viscosity: N/A

VOC Content: N/A

Percent Volatile: 99.9+

SECTION 10 - STABILITY AND REACTIVITY

Stability: Stable

Materials to Avoid: Acids
Oxidizers

Hazardous Decomposition: Oxides of carbon; Formaldehyde

Hazardous Polymerization: Will not occur

Condition to Avoid: Heat; Contact with ignition sources

SECTION 11 - TOXICOLOGICAL INFORMATION

Human Health Toxicity

See section 2 for specific toxicological information for the ingredients of this product.

LD50 (Oral): Human - 143 mg/kg; Rat - 1500 mg/kg

LD50 (Dermal) : Rabbit - >2000 mg/kg

LC50 (Inhalation): Rat - >20 mg/L

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

No other information related to the toxicological properties of this product is available at this time.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Toxicity

By complying with sections 6 and 7 there should be no release to the environment.

LC50 (Fish): >1000 mg/L 96H

EC50 (Aquatic Invertebrate): >1000 mg/L 48H

BCF: 1.0

Hydrolyzes readily on contact with water. Readily biodegradable.

No other information related to the ecological properties of this product is available at this time.

SECTION 13 - DISPOSAL CONSIDERATIONS

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

SECTION 14 - TRANSPORT INFORMATION

Transportation Information (DOT/IATA)

SECTION 14 - TRANSPORT INFORMATION *- continued*

UN Number: UN1230

Class: 3

Packing Group: II

Proper Shipping Name: Methanol

Poison by Inhalation: No

Marine Pollutant: No

SECTION 15 - REGULATORY INFORMATION

This product contains a compound or compounds subject to EU Regulation (EC) No 1907/2006 (REACH) on Annex XIV, Annex XVII, and/or Article 59. Refer to the below table for details.

Not all components are listed on the TSCA Inventory.

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

This product is subject to SARA section 313 reporting requirements.

For laboratory, research and development use only. Not for manufacturing or commercial purposes.

In addition to federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

			REACH (1907/2006)		
Analyte	CAS #	% Concentration	Annex XIV	Annex XVII	Article 59
Methanol	67-56-1	99.990		X	

SECTION 16 - OTHER INFORMATION

This document has been designed to meet the requirements of OSHA, ANSI, GHS and CHIPs regulations. Chemicals are classified using the Globally Harmonized System for Classification and Labeling of Chemicals and CLP Regulation (EC) No. 1272/2008.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. The manufacturer will not assume any liability for the accuracy and completeness of this information. Final determination of the suitability of the material is the responsibility of the user. Although certain hazards are described herein, the user should not presume that these are the only hazards that exist. Since conditions and manner of use are outside of the manufacturers control, we make

NO WARRANTY OF MERCHANTABILITY, EXPRESSED OR IMPLIED, AND ASSUME NO LIABILITY RESULTING FROM ITS USE.

Legend : N/A = Not Available ND = Not Determined NR = Not Regulated

Alteration of any information contained herein without written permission from the manufacturer is strictly prohibited.

HMIS/NFPA HAZARD INDEX

0 - Minimal
1 - Slight
2 - Moderate
3 - Serious
4 - Severe

* - Additional Hazard

GHS HAZARD INDEX

Category 1 - Most Severe
Category 5 - Least Severe

**** End of Document ****

Safety Data Sheet
acc. to OSHA HCS

Printing date 08/18/2023 Revision date 08/18/2023

1 Identification

· **Product identifier**

· **Trade name: Perfluoro-3-methoxypropanoic Acid**
· **Synonym** 2,2,3,3-tetrafluoro-3-(trifluoromethoxy)-propanoic acid

· **Article number:** 37268
· **CAS Number:**
377-73-1
· **EC number:**
876-098-1
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**

GHS05 Corrosion

Skin Corrosion 1B	H314 Causes severe skin burns and eye damage.
Eye Damage 1	H318 Causes serious eye damage.

GHS07

Specific Target Organ Toxicity - Single Exposure 3	H335 May cause respiratory irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).

(Contd. on page 2)

(Contd. from page 1)

· **Hazard pictograms**


GHS05


GHS07

· **Signal word** Danger

· **Hazard statements**

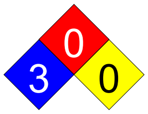
H314 Causes severe skin burns and eye damage.
H335 May cause respiratory irritation.

· **Precautionary statements**

P260	Do not breathe dusts or mists.
P264	Wash thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P321	Specific treatment (see on this label).
P363	Wash contaminated clothing before reuse.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*3
FIRE	0
REACTIVITY	0

Health = *3
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**

· **CAS No. Description**

377-73-1 Perfluoro-3-methoxypropanoic Acid

(Contd. on page 3)

(Contd. from page 2)

· **Identification number(s)**
· **EC number:** 876-098-1

4 First-aid measures

· **Description of first aid measures**
· **General information:** Immediately remove any clothing soiled by the product.
· **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:** Drink copious amounts of water and provide fresh air. Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** No special measures required.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Use neutralizing agent.
Dispose contaminated material as waste according to section 13.
Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**
· **PAC-1:** Substance is not listed.
· **PAC-2:** Substance is not listed.
· **PAC-3:** Substance is not listed.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling** Thorough dedusting.
· **Information about protection against explosions and fires:** No special measures required.

(Contd. on page 4)

(Contd. from page 3)

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see section 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:**

Tightly sealed goggles

(Contd. on page 5)

(Contd. from page 4)

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C4HF7O3
· **Molecular Weight**	230 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.

(Contd. on page 6)

(Contd. from page 5)

· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **RTECS Number** UF7772000
· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Caustic effect on skin and mucous membranes.
· **on the eye:**
Strong caustic effect.
Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (Self-assessment): slightly hazardous for water
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

(Contd. on page 7)

(Contd. from page 6)

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is not listed.
· **TSCA (Toxic Substances Control Act):** Substance is not listed.
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of

(Contd. on page 8)

(Contd. from page 7)

these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 08/18/2023
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Skin Corrosion 1B: Skin corrosion/irritation – Category 1B
Eye Damage 1: Serious eye damage/eye irritation – Category 1
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3

WELLINGTON
LABORATORIES

SAFETY DATA SHEET

Perfluoro-n-nonanoic acid (PFNA)

Scantec Nordic AB

Chemwatch Hazard Alert Code: **4**

Version No: **8.10**
Safety Data Sheet (Conforms to Annex II of REACH (1907/2006) - Regulation 2020/878)

Issue Date: **20/10/2023**
Print Date: **20/02/2024**
S.REACH.SWE.EN

SECTION 1 Identification of the substance / mixture and of the company / undertaking

1.1. Product Identifier

Product name	Perfluoro-n-nonanoic acid (PFNA)
Chemical Name	Not Applicable
Synonyms	Methyl alcohol (methanol),Methyl hydrate (methanol),Methylol (methanol)
Proper shipping name	METHANOL
Chemical formula	Not Applicable
Other means of identification	Not Available

1.2. Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	This product is a solution of organic compound(s) in methanol for laboratory use only (see section 3). This material should only be used by those persons trained in the safe handling of hazardous chemicals. Please refer to the Certificate of Analysis (CofA) for further product information. Wellington Laboratories Inc. believes the information stated below to be reliable and accurate. This data is solely for reference purposes. Wellington Laboratories Inc. shall not be held liable for damages resulting from handling or contact with the above stated material.
Uses advised against	No specific uses advised against are identified.

1.3. Details of the manufacturer or supplier of the safety data sheet

Registered company name	**Scantec Nordic AB**	**Greyhound Chromatography & Allied Chemicals**	**Wellington Laboratories**
Address	Fabriksstraket 29 Jonsered 433 76 Sweden	6 Kelvin Park, Birkenhead, Merseyside CH41 1LT United Kingdom	345 Southgate Drive Guelph Ontario N1G 3M5 Canada
Telephone	+031 336 90 00	+44-0-151 649 4000	+1 519 822 2436
Fax	Not Available	+44-0-151 649 4001	+1 519 822 2849
Website	www.scantecnordic.se	www.greyhoundchrom.com	http://well-labs.com/
Email	info@scantecnordic.se	info@greyhoundchrom.com	orders@well-labs.com

1.4. Emergency telephone number

Association / Organisation	**CANUTEC**
Emergency telephone numbers	+1 888 226 8832 (North American)
Other emergency telephone numbers	+1 613 996 6666 (International)

SECTION 2 Hazards identification

2.1. Classification of the substance or mixture

Considered a hazardous mixture according to Reg. (EC) No 1272/2008 and their amendments. Classified as Dangerous Goods for transport purposes.

NFPA 704 diamond

Note: The hazard category numbers found in GHS classification in section 2 of this SDSs are NOT to be used to fill in the NFPA 704 diamond. Blue = Health Red = Fire Yellow = Reactivity White = Special (Oxidizer or water reactive substances)

Classification according to regulation (EC) No 1272/2008 [CLP] and amendments [1]	H225 - Flammable Liquids Category 2, H301 - Acute Toxicity (Oral) Category 3, H311 - Acute Toxicity (Dermal) Category 3, H331 - Acute Toxicity (Inhalation) Category 3, H370 - Specific Target Organ Toxicity - Single Exposure Category 1
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI*

2.2. Label elements

Hazard pictogram(s)	
Signal word	**Danger**

Hazard statement(s)

H225	Highly flammable liquid and vapour.
H301	Toxic if swallowed.
H311	Toxic in contact with skin.
H331	Toxic if inhaled.
H370	Causes damage to organs.

Supplementary statement(s)

Not Applicable

CLP classification (additional)

Not Applicable

Precautionary statement(s) Prevention

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P260	Do not breathe mist/vapours/spray.
P264	Wash all exposed external body areas 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 and protective clothing.
P240	Ground and bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/intrinsically safe equipment.
P242	Use non-sparking tools.
P243	Take action to prevent static discharges.

Precautionary statement(s) Response

P301+P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor/physician/first aider.
P308+P311	IF exposed or concerned: Call a POISON CENTER/doctor/physician/first aider.
P330	Rinse mouth.
P370+P378	In case of fire: Use alcohol resistant foam or normal protein foam to extinguish.
P302+P352	IF ON SKIN: Wash with plenty of water and soap.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P361+P364	Take off immediately all contaminated clothing and wash it before reuse.
P303+P361+P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water [or shower].

Precautionary statement(s) Storage

P403+P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container to authorised hazardous or special waste collection point in accordance with any local regulation.

CLP Article 18 Product Identifiers

Material contains methanol, sodium hydroxide.

2.3. Other hazards

Cumulative effects may result following exposure*.

May produce discomfort of the eyes and skin*.

Vapours potentially cause drowsiness and dizziness*.

HARMFUL: may cause lung damage if swallowed

methanol	Listed in the Europe Regulation (EC) No 1907/2006 - Annex XVII (Restrictions may apply)
Perfluoro-n-nonanoic acid	Listed in the European Chemicals Agency (ECHA) Candidate List of Substances of Very High Concern for Authorisation
Perfluoro-n-nonanoic acid	Listed in the Europe Regulation (EC) No 1907/2006 - Annex XVII (Restrictions may apply)

SECTION 3 Composition / information on ingredients

3.1.Substances

See 'Composition on ingredients' in Section 3.2

3.2.Mixtures

1. CAS No **2.EC No** **3.Index No** **4.REACH No**	**%[weight]**	**Name**	**Classification according to regulation (EC) No 1272/2008 [CLP] and amendments**	**SCL / M-Factor**	**Nanoform Particle Characteristics**
1. 67-56-1 2.200-659-6 3.603-001-00-X 4.Not Available	98.729	methanol *	Flammable Liquids Category 2, Acute Toxicity (Oral) Category 3, Acute Toxicity (Dermal) Category 3, Acute Toxicity (Inhalation) Category 3, Specific Target Organ Toxicity - Single Exposure Category 1; H225, H301, H311, H331, H370 [2]	* STOT SE 1; H370: C ≥ 10 % | STOT SE 2; H371: 3 % ≤ C < 10 %	Not Available
1. 375-95-1* 2.206-801-3 3.607-718-00-9 4.Not Available	0.006	Perfluoro-n-nonanoic acid	Not Classified [1]	Not Available	Not Available
1. 7732-18-5 2.231-791-2 3.Not Available 4.Not Available	1.262	water	Not Classified [1]	Not Available	Not Available
1. 1310-73-2 2.215-185-5 3.011-002-00-6 4.Not Available	0.002	sodium hydroxide	Skin Corrosion/Irritation Category 1A; H314 [2]	Skin Corr. 1A; H314: C ≥ 5 % | Skin Corr. 1B; H314: 2 % ≤ C < 5 % | Skin Irrit. 2; H315: 0,5 % ≤ C < 2 % | Eye Irrit.2; H319: 0,5 % ≤ C < 2 %	Not Available

Legend:	*1. Classified by Chemwatch; 2. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI; 3. Classification drawn from C&L; * EU IOELVs available; [e] Substance identified as having endocrine disrupting properties*

SECTION 4 First aid measures

4.1. Description of first aid measures

Eye Contact	If this product comes in contact with the eyes:

	▸ Immediately hold eyelids apart and flush the eye continuously with running water. ▸ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▸ Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. ▸ Transport to hospital or doctor without delay. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: ▸ Quickly but gently, wipe material off skin with a dry, clean cloth. ▸ Immediately remove all contaminated clothing, including footwear. ▸ Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre. ▸ Transport to hospital, or doctor.
Inhalation	▸ If fumes or combustion products are inhaled remove from contaminated area. ▸ Lay patient down. Keep warm and rested. ▸ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ▸ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ▸ Transport to hospital, or doctor, without delay.
Ingestion	▸ If swallowed do **NOT** induce vomiting. ▸ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. ▸ Observe the patient carefully. ▸ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. ▸ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink. ▸ Seek medical advice. ▸ Avoid giving milk or oils. ▸ Avoid giving alcohol. ▸ If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomitus.

4.2 Most important symptoms and effects, both acute and delayed

See Section 11

4.3. Indication of any immediate medical attention and special treatment needed

Any material aspirated during vomiting may produce lung injury. Therefore emesis should not be induced mechanically or pharmacologically. Mechanical means should be used if it is considered necessary to evacuate the stomach contents; these include gastric lavage after endotracheal intubation. If spontaneous vomiting has occurred after ingestion, the patient should be monitored for difficult breathing, as adverse effects of aspiration into the lungs may be delayed up to 48 hours.
For acute and short term repeated exposures to methanol:
· Toxicity results from accumulation of formaldehyde/formic acid.
· Clinical signs are usually limited to CNS, eyes and GI tract Severe metabolic acidosis may produce dyspnea and profound systemic effects which may become intractable. All symptomatic patients should have arterial pH measured. Evaluate airway, breathing and circulation.
· Stabilise obtunded patients by giving naloxone, glucose and thiamine.
· Decontaminate with Ipecac or lavage for patients presenting 2 hours post-ingestion. Charcoal does not absorb well; the usefulness of cathartic is not established.
· Forced diuresis is not effective; haemodialysis is recommended where peak methanol levels exceed 50 mg/dL (this correlates with serum bicarbonate levels below 18 mEq/L).
· Ethanol, maintained at levels between 100 and 150 mg/dL, inhibits formation of toxic metabolites and may be indicated when peak methanol levels exceed 20 mg/dL. An intravenous solution of ethanol in D5W is optimal.
· Folate, as leucovorin, may increase the oxidative removal of formic acid. 4-methylpyrazole may be an effective adjunct in the treatment. 8.Phenytoin may be preferable to diazepam for controlling seizure.

[Ellenhorn Barceloux: Medical Toxicology]

Methanol poisoning can be treated with fomepizole, or if unavailable, ethanol. Both drugs act to reduce the action of alcohol dehydrogenase on methanol by means of competitive inhibition. Ethanol, the active ingredient in alcoholic beverages, acts as a competitive inhibitor by more effectively binding and saturating the alcohol dehydrogenase enzyme in the liver, thus blocking the binding of methanol. Methanol is excreted by the kidneys without being converted into the very toxic metabolites formaldehyde and formic acid. Alcohol dehydrogenase instead enzymatically converts ethanol to acetaldehyde, a much less toxic organic molecule. Additional treatment may include sodium bicarbonate for metabolic acidosis, and hemodialysis or hemodiafiltration to remove methanol and formate from the blood. Folinic acid or folic acid is also administered to enhance the metabolism of formate.

BIOLOGICAL EXPOSURE INDEX - BEI

Determinant	Index	Sampling Time	Comment
1. Methanol in urine	15 mg/l	End of shift	B, NS
2. Formic acid in urine	80 mg/gm creatinine	Before the shift at end of workweek	B, NS

B: Background levels occur in specimens collected from subjects **NOT** exposed.
NS: Non-specific determinant - observed following exposure to other materials.

SECTION 5 Firefighting measures

5.1. Extinguishing media

Water may be an ineffective extinguishing media for methanol fires; static explosions are reported for aqueous solutions as dilute as 30%. Water may be used to cool containers.

- Alcohol stable foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.
- Water spray or fog - Large fires only.

5.2. Special hazards arising from the substrate or mixture

Fire Incompatibility	Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

5.3. Advice for firefighters

Fire Fighting	Alert Fire Brigade and tell them location and nature of hazard. May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or water course. Consider evacuation (or protect in place). Fight fire from a safe distance, with adequate cover. If safe, switch off electrical equipment until vapour fire hazard removed. Use water delivered as a fine spray to control fire and cool adjacent area. Avoid spraying water onto liquid pools. **DO NOT** approach containers suspected to be hot. Cool fire exposed containers with water spray from a protected location. If safe to do so, remove containers from path of fire.
Fire/Explosion Hazard	Liquid and vapour are highly flammable. Severe fire hazard when exposed to heat, flame and/or oxidisers. Vapour may travel a considerable distance to source of ignition. Heating may cause expansion or decomposition leading to violent rupture of containers. On combustion, may emit toxic fumes of carbon monoxide (CO). Combustion products include: , carbon dioxide (CO2) , formaldehyde , other pyrolysis products typical of burning organic material.

SECTION 6 Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

See section 8

6.2. Environmental precautions

See section 12

6.3. Methods and material for containment and cleaning up

Minor Spills	Remove all ignition sources. Clean up all spills immediately. Avoid breathing vapours and contact with skin and eyes. Control personal contact with the substance, by using protective equipment. Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Major Spills	Clear area of personnel and move upwind. Alert Fire Brigade and tell them location and nature of hazard. May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or water course. Consider evacuation (or protect in place). No smoking, naked lights or ignition sources. Increase ventilation. Stop leak if safe to do so. Water spray or fog may be used to disperse vapour. Contain or absorb spill with sand, earth or vermiculite. Use only spark-free shovels and explosion proof equipment. Collect recoverable product into labelled containers for recycling. Collect solid residues and seal in labelled drums for disposal.

	- Wash area and prevent runoff into drains. - After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using. - If contamination of drains or waterways occurs, advise emergency services.

6.4. Reference to other sections

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 Handling and storage

7.1. Precautions for safe handling

Safe handling	- Containers, even those that have been emptied, may contain explosive vapours. - Do NOT cut, drill, grind, weld or perform similar operations on or near containers. - Avoid all personal contact, including inhalation. - Wear protective clothing when risk of exposure occurs. - Use in a well-ventilated area. - Prevent concentration in hollows and sumps. - **DO NOT** enter confined spaces until atmosphere has been checked. - Avoid smoking, naked lights, heat or ignition sources. - When handling, **DO NOT** eat, drink or smoke. - Vapour may ignite on pumping or pouring due to static electricity. - **DO NOT** use plastic buckets. - Earth and secure metal containers when dispensing or pouring product. - Use spark-free tools when handling. - Avoid contact with incompatible materials. - Keep containers securely sealed. - Avoid physical damage to containers. - Always wash hands with soap and water after handling. - Work clothes should be laundered separately. - Use good occupational work practice. - Observe manufacturer's storage and handling recommendations contained within this SDS. - Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions. - **DO NOT** allow clothing wet with material to stay in contact with skin
Fire and explosion protection	See section 5
Other information	- Store in original containers in approved flame-proof area. - No smoking, naked lights, heat or ignition sources. - **DO NOT** store in pits, depression, basement or areas where vapours may be trapped. - Keep containers securely sealed. - Store away from incompatible materials in a cool, dry well ventilated area. - Protect containers against physical damage and check regularly for leaks. - Observe manufacturer's storage and handling recommendations contained within this MSDS. - Tank storage: Tanks must be specifically designed for use with this product. Bulk storage tanks should be diked (bunded). Locate tanks away from heat and other sources of ignition. Cleaning, inspection and maintenance of storage tanks is a specialist operation, which requires the implementation of strict procedures and precautions. - Keep in a cool place. Electrostatic charges will be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk. The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable. - For containers, or container linings use mild steel, stainless steel. Examples of suitable materials are: high density polyethylene (HDPE), polypropylene (PP), and Viton (FMK), which have been specifically tested for compatibility with this product. - For container linings, use amine-adduct cured epoxy paint. - For seals and gaskets use: graphite, PTFE, Viton A, Viton B. - Unsuitable material: Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Examples of materials to avoid are: natural rubber (NR), nitrile rubber (NBR), ethylene propylene rubber (EPDM), polymethyl methacrylate (PMMA), polystyrene, polyvinyl chloride (PVC), polyisobutylene. However, some may be suitable for glove materials. - Do not cut, drill, grind, weld or perform similar operations on or near containers. Containers, even those that have been emptied, can contain explosive vapours.

7.2. Conditions for safe storage, including any incompatibilities

Suitable container	- Glass container is suitable for laboratory quantities - Packing as supplied by manufacturer. - Plastic containers may only be used if approved for flammable liquid. - Check that containers are clearly labelled and free from leaks. - For low viscosity materials (i) : Drums and jerry cans must be of the non-removable head type. (ii) : Where a can is to be used as an inner package, the can must have a screwed enclosure. - For materials with a viscosity of at least 2680 cSt. (23 deg. C) - For manufactured product having a viscosity of at least 250 cSt. (23 deg. C)

	▸ Manufactured product that requires stirring before use and having a viscosity of at least 20 cSt (25 deg. C): (i) Removable head packaging; (ii) Cans with friction closures and (iii) low pressure tubes and cartridges may be used. ▸ Where combination packages are used, and the inner packages are of glass, there must be sufficient inert cushioning material in contact with inner and outer packages ▸ In addition, where inner packagings are glass and contain liquids of packing group I there must be sufficient inert absorbent to absorb any spillage, unless the outer packaging is a close fitting moulded plastic box and the substances are not incompatible with the plastic.
Storage incompatibility	Methanol: ▸ reacts violently with strong oxidisers, acetyl bromide, alkyl aluminium salts, beryllium dihydride, bromine, chromic acid, 1-chloro-3,3-difluoro-2-methoxycyclopropene, cyanuric chloride, diethylzinc, isophthaloyl chloride, nitric acid, perchloric acid, potassium-tert-butoxide, potassium sulfur diimide, Raney nickel catalysts, 2,4,6-trichlorotriazine, triethylaluminium, 1,3,3-trifluoro-2-methoxycyclopropene ▸ is incompatible with strong acids, strong caustics, alkaline earth and alkali metals, aliphatic amines, acetaldehyde, benzoyl peroxide, 1,3-bis(di-n-cyclopentadienyl iron)-2-propen-1-one, calcium carbide, chloroform, chromic anhydride, chromium trioxide, dialkylzinc, dichlorine oxide, dichloromethane, ethylene oxide, hypochlorous acid, isocyanates, isopropyl chlorocarbonate, lithium tetrahydroaluminate, magnesium, methyl azide, nitrogen dioxide, palladium, pentafluoroguanidine, perchloryl fluoride, phosphorus pentasulfide, phosphorus trioxide, potassium, tangerine oil, triisobutylaluminium ▸ mixtures with lead perchlorate, sodium hypochlorite are explosive ▸ may react with metallic aluminium at high temperatures ▸ slowly corrodes lead and aluminium ▸ may generate electrostatic charges, due to low conductivity, on flow or agitation ▸ attacks some plastics, rubber and coatings. Static induced flash fires have happened when filling plastic containers with methanol / water solutions with as low as 30% methanol content Alcohols ▸ are incompatible with strong acids, acid chlorides, acid anhydrides, oxidising and reducing agents. ▸ reacts, possibly violently, with alkaline metals and alkaline earth metals to produce hydrogen ▸ react with strong acids, strong caustics, aliphatic amines, isocyanates, acetaldehyde, benzoyl peroxide, chromic acid, chromium oxide, dialkylzincs, dichlorine oxide, ethylene oxide, hypochlorous acid, isopropyl chlorocarbonate, lithium tetrahydroaluminate, nitrogen dioxide, pentafluoroguanidine, phosphorus halides, phosphorus pentasulfide, tangerine oil, triethylaluminium, triisobutylaluminium ▸ should not be heated above 49 deg. C. when in contact with aluminium equipment ▸ Avoid storage with reducing agents.
Hazard categories in accordance with Regulation (EC) No 1272/2008	H2: Acute Toxic, H3: STOT Specific Target Organ Toxicity – Single Exposure, P5a: Flammable Liquids, P5b: Flammable Liquids, P5c: Flammable Liquids
Qualifying quantity (tonnes) of dangerous substances as referred to in Article 3(10) for the application of	H2 Lower- / Upper-tier requirements: 50 / 200 H3 Lower- / Upper-tier requirements: 50 / 200 P5a Lower- / Upper-tier requirements: 10 / 50 P5b Lower- / Upper-tier requirements: 50 / 200 P5c Lower- / Upper-tier requirements: 5 000 / 50 000

7.3. Specific end use(s)

See section 1.2

SECTION 8 Exposure controls / personal protection

8.1. Control parameters

Ingredient	DNELs Exposure Pattern Worker	PNECs Compartment
methanol	Dermal 1 601 mg/kg bw/day (Systemic, Chronic) Inhalation 11.67 mg/m^3 (Systemic, Chronic) Inhalation 20 mg/m^3 (Local, Chronic) Dermal 20 mg/kg bw/day (Systemic, Acute) Inhalation 130 mg/m^3 (Systemic, Acute) Inhalation 40 mg/m^3 (Local, Acute) *Dermal 4 mg/kg bw/day (Systemic, Chronic) ** *Inhalation 2.9 mg/m^3 (Systemic, Chronic) ** *Oral 1 mg/kg bw/day (Systemic, Chronic) ** *Inhalation 26 mg/m^3 (Local, Chronic) ** *Dermal 4 mg/kg bw/day (Systemic, Acute) ** *Inhalation 26 mg/m^3 (Systemic, Acute) ** *Oral 4 mg/kg bw/day (Systemic, Acute) ** *Inhalation 26 mg/m^3 (Local, Acute) **	Not Available
water	Dermal 0.02 mg/kg bw/day (Systemic, Chronic) Inhalation 0.12 mg/m^3 (Systemic, Chronic) Inhalation 0.11 mg/m^3 (Local, Chronic)	Not Available

Ingredient	DNELs Exposure Pattern Worker	PNECs Compartment
	Dermal 5 mg/kg bw/day (Systemic, Acute) Inhalation 2.5 mg/m³ (Systemic, Acute) Inhalation 0.33 mg/m³ (Local, Acute) *Dermal 0.35 mg/kg bw/day (Systemic, Chronic) ** *Inhalation 0.144 mg/m³ (Systemic, Chronic) ** *Oral 0.08 mg/kg bw/day (Systemic, Chronic) ** *Inhalation 0.03 mg/m³ (Local, Chronic) ** *Dermal 2.5 mg/kg bw/day (Systemic, Acute) ** *Inhalation 1.96 mg/m³ (Systemic, Acute) ** *Oral 2.5 mg/kg bw/day (Systemic, Acute) ** *Inhalation 0.09 mg/m³ (Local, Acute) **	
sodium hydroxide	Inhalation 2.05 mg/m³ (Systemic, Chronic) Inhalation 1 mg/m³ (Local, Chronic) Inhalation 2 mg/m³ (Local, Acute) *Inhalation 0.51 mg/m³ (Systemic, Chronic) ** *Oral 10 mg/kg bw/day (Systemic, Chronic) ** *Inhalation 1 mg/m³ (Local, Chronic) **	Not Available

* Values for General Population

Occupational Exposure Limits (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
EU Consolidated List of Indicative Occupational Exposure Limit Values (IOELVs)	methanol	Methanol	200 ppm / 260 mg/m3	Not Available	Not Available	Skin

Emergency Limits

Ingredient	TEEL-1	TEEL-2	TEEL-3
methanol	Not Available	Not Available	Not Available
sodium hydroxide	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
methanol	6,000 ppm	Not Available
Perfluoro-n-nonanoic acid	Not Available	Not Available
water	Not Available	Not Available
sodium hydroxide	10 mg/m3	Not Available

Occupational Exposure Banding

Ingredient	Occupational Exposure Band Rating	Occupational Exposure Band Limit
sodium hydroxide	C	> 0.1 to ≤ milligrams per cubic meter of air (mg/m³)
Notes:	*Occupational exposure banding is a process of assigning chemicals into specific categories or bands based on a chemical's potency and the adverse health outcomes associated with exposure. The output of this process is an occupational exposure band (OEB), which corresponds to a range of exposure concentrations that are expected to protect worker health.*	

8.2. Exposure controls

8.2.1. Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The basic types of engineering controls are: Process controls which involve changing the way a job activity or process is done to reduce the risk. Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use. Employers may need to use multiple types of controls to prevent employee overexposure. For flammable liquids and flammable gases, local exhaust ventilation or a process enclosure ventilation system may be required. Ventilation equipment should be explosion-resistant. Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant. Type of Contaminant: Air Speed:

solvent, vapours, degreasing etc., evaporating from tank (in still air).	0.25-0.5 m/s (50-100 f/min.)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)	0.5-1 m/s (100-200 f/min.)
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favourable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min.) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.
· Adequate ventilation is typically taken to be that which limits the average concentration to no more than 25% of the LEL within the building, room or enclosure containing the dangerous substance.
· Ventilation for plant and machinery is normally considered adequate if it limits the average concentration of any dangerous substance that might potentially be present to no more than 25% of the LEL. However, an increase up to a maximum 50% LEL can be acceptable where additional safeguards are provided to prevent the formation of a hazardous explosive atmosphere. For example, gas detectors linked to emergency shutdown of the process might be used together with maintaining or increasing the exhaust ventilation on solvent evaporating ovens and gas turbine enclosures.
· Temporary exhaust ventilation systems may be provided for non-routine higher-risk activities, such as cleaning, repair or maintenance in tanks or other confined spaces or in an emergency after a release. The work procedures for such activities should be carefully considered.. The atmosphere should be continuously monitored to ensure that ventilation is adequate and the area remains safe. Where workers will enter the space, the ventilation should ensure that the concentration of the dangerous substance does not exceed 10% of the LEL (irrespective of the provision of suitable breathing apparatus)

8.2.2. Individual protection measures, such as personal protective equipment

Eye and face protection

- Safety glasses with side shields.
- Chemical goggles. [AS/NZS 1337.1, EN166 or national equivalent]
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

Skin protection

See Hand protection below

Hands/feet protection

- Wear chemical protective gloves, e.g. PVC.
- Wear safety footwear or safety gumboots, e.g. Rubber

The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.
Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:
· frequency and duration of contact,
· chemical resistance of glove material,
· glove thickness and
· dexterity
Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739, AS/NZS 2161.1 or national equivalent).
· When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.

	· When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended. · Some glove polymer types are less affected by movement and this should be taken into account when considering gloves for long-term use. · Contaminated gloves should be replaced. As defined in ASTM F-739-96 in any application, gloves are rated as: · Excellent when breakthrough time > 480 min · Good when breakthrough time > 20 min · Fair when breakthrough time < 20 min · Poor when glove material degrades For general applications, gloves with a thickness typically greater than 0.35 mm, are recommended. It should be emphasised that glove thickness is not necessarily a good predictor of glove resistance to a specific chemical, as the permeation efficiency of the glove will be dependent on the exact composition of the glove material. Therefore, glove selection should also be based on consideration of the task requirements and knowledge of breakthrough times. Glove thickness may also vary depending on the glove manufacturer, the glove type and the glove model. Therefore, the manufacturers technical data should always be taken into account to ensure selection of the most appropriate glove for the task. Note: Depending on the activity being conducted, gloves of varying thickness may be required for specific tasks. For example: · Thinner gloves (down to 0.1 mm or less) may be required where a high degree of manual dexterity is needed. However, these gloves are only likely to give short duration protection and would normally be just for single use applications, then disposed of. · Thicker gloves (up to 3 mm or more) may be required where there is a mechanical (as well as a chemical) risk i.e. where there is abrasion or puncture potential Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.
Body protection	See Other protection below
Other protection	‣ Overalls. ‣ PVC Apron. ‣ PVC protective suit may be required if exposure severe. ‣ Eyewash unit. ‣ Ensure there is ready access to a safety shower. ‣ Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity. ‣ For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets). ‣ Non sparking safety or conductive footwear should be considered. Conductive footwear describes a boot or shoe with a sole made from a conductive compound chemically bound to the bottom components, for permanent control to electrically ground the foot an shall dissipate static electricity from the body to reduce the possibility of ignition of volatile compounds. Electrical resistance must range between 0 to 500,000 ohms. Conductive shoes should be stored in lockers close to the room in which they are worn. Personnel who have been issued conductive footwear should not wear them from their place of work to their homes and return.

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
"Forsberg Clothing Performance Index".
The effect(s) of the following substance(s) are taken into account in the ***computer-generated*** selection:
Perfluoro-n-nonanoic acid (PFNA)

Material	CPI
BUTYL	A
NEOPRENE	B
BUTYL/NEOPRENE	C
NAT+NEOPR+NITRILE	C
NATURAL RUBBER	C
NATURAL+NEOPRENE	C
NEOPRENE/NATURAL	C
NITRILE	C
NITRILE+PVC	C
PE	C
PE/EVAL/PE	C
PVA	C
PVC	C
PVDC/PE/PVDC	C
SARANEX-23	C
SARANEX-23 2-PLY	C

Respiratory protection

Type AX Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

Where the concentration of gas/particulates in the breathing zone, approaches or exceeds the "Exposure Standard" (or ES), respiratory protection is required. Degree of protection varies with both face-piece and Class of filter; the nature of protection varies with Type of filter.

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 5 x ES	AX-AUS / Class 1	-	AX-PAPR-AUS / Class 1
up to 25 x ES	Air-line*	AX-2	AX-PAPR-2
up to 50 x ES	-	AX-3	-
50+ x ES	-	Air-line**	-

* - Continuous-flow; ** - Continuous-flow or positive pressure demand
^ - Full-face
A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

- Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content.
- The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations,

TEFLON	C
VITON	C
VITON/CHLOROBUTYL	C
VITON/NEOPRENE	C

* CPI - Chemwatch Performance Index
A: Best Selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to Dangerous Choice for other than short term immersion

NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -

* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

only restricted use of cartridge respirators is considered appropriate.

- Cartridge performance is affected by humidity. Cartridges should be changed after 2 hr of continuous use unless it is determined that the humidity is less than 75%, in which case, cartridges can be used for 4 hr. Used cartridges should be discarded daily, regardless of the length of time used

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Required minimum protection factor	Maximum gas/vapour concentration present in air p.p.m. (by volume)	Half-face Respirator	Full-Face Respirator
up to 10	1000	AX-AUS / Class 1	-
up to 50	1000	-	AX-AUS / Class 1
up to 50	5000	Airline *	-
up to 100	5000	-	AX-2
up to 100	10000	-	AX-3
100+		-	Airline**

** - Continuous-flow or positive pressure demand.
A(All classes) = Organic vapours, B AUS or B1 = Acid gases, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 deg C)

8.2.3. Environmental exposure controls

See section 12

SECTION 9 Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	Clear/Colourless with Characteristic Odour

Physical state	Liquid	**Relative density (Water = 1)**	0.791
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	455
pH (as supplied)	Not Applicable	**Decomposition temperature (°C)**	Not Available
Melting point / freezing point (°C)	-98	**Viscosity (cSt)**	Not Available
Initial boiling point and boiling range (°C)	64.7	**Molecular weight (g/mol)**	32.04
Flash point (°C)	12	**Taste**	Not Available
Evaporation rate	4.1 BuAC = 1	**Explosive properties**	Not Available
Flammability	HIGHLY FLAMMABLE.	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	31	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	6	**Volatile Component (%vol)**	Not Available
Vapour pressure (kPa)	13	**Gas group**	Not Available
Solubility in water	Immiscible	**pH as a solution (1%)**	Not Applicable
Vapour density (Air = 1)	1.11	**VOC g/L**	Not Available

Nanoform Solubility	Not Available	**Nanoform Particle Characteristics**	Not Available
Particle Size	Not Available		

9.2. Other information

Not Available

SECTION 10 Stability and reactivity

10.1.Reactivity	See section 7.2
10.2. Chemical stability	‣ Static induced flash fires have happened when filling plastic containers with methanol / water solutions with as low as 30% methanol content. ‣ Unstable in the presence of incompatible materials. ‣ Product is considered stable. ‣ Hazardous polymerisation will not occur.
10.3. Possibility of hazardous reactions	See section 7.2
10.4. Conditions to avoid	See section 7.2
10.5. Incompatible materials	See section 7.2
10.6. Hazardous decomposition products	See section 5.3

SECTION 11 Toxicological information

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008

Inhaled	Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may produce toxic effects. The material is not thought to produce respiratory irritation (as classified by EC Directives using animal models). Nevertheless inhalation of vapours, fumes or aerosols, especially for prolonged periods, may produce respiratory discomfort and occasionally, distress. Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by sleepiness, reduced alertness, loss of reflexes, lack of co-ordination, and vertigo. Minor but regular methanol exposures may effect the central nervous system, optic nerves and retinae. Symptoms may be delayed, with headache, fatigue, nausea, blurring of vision and double vision. Continued or severe exposures may cause damage to optic nerves, which may become severe with permanent visual impairment even blindness resulting. **WARNING**: Methanol is only slowly eliminated from the body and should be regarded as a cumulative poison which cannot be made non-harmful [*CCINFO*]
Ingestion	**Toxic effects** may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 40 gram may be fatal or may produce serious damage to the health of the individual. Methanol may produce a burning or painful sensation in the mouth, throat, chest, and stomach. This may be accompanied by nausea, vomiting, headache, dizziness, shortness of breath, weakness, fatigue, leg cramps, restlessness, confusion, drunken behaviour, visual disturbance, drowsiness, coma and death. 60-200 ml of methanol is a fatal dose for most adults with as little as 10 ml producing blindness. In massive overdose, liver, kidney, heart and muscle injury have been described. Even ingestion of small amounts of methanol is enough to seriously damage parts of the central nervous system, leading to permanent brain and/or nerve problems. Swallowing of the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis; serious consequences may result. (ICSC13733)
Skin Contact	Skin contact with the material may produce toxic effects; systemic effects may result following absorption. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected. There is strong evidence to suggest that this material, on a single contact with skin, can cause serious, irreversible damage of organs. There is some evidence to suggest that the material may cause moderate inflammation of the skin either following direct contact or after a delay of some time. Repeated exposure can cause contact dermatitis which is characterised by redness, swelling and blistering.
Eye	Methanol is a mild to moderate eye irritant. High vapor concentration or liquid contact with eyes causes irritation, tearing, and burning. Direct contact of the eye with ethanol may cause immediate stinging and burning with reflex closure of the lid and tearing, transient injury of the corneal epithelium and hyperaemia of the conjunctiva. There is some evidence that material may produce eye irritation in some persons and produce eye damage 24 hours or more after instillation. Moderate inflammation may be expected with redness; conjunctivitis may occur with prolonged exposure.

Chronic	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. This material can cause serious damage if one is exposed to it for long periods. It can be assumed that it contains a substance which can produce severe defects. Ample evidence exists, from results in experimentation, that developmental disorders are directly caused by human exposure to the material. Long-term exposure to methanol vapour, at concentrations exceeding 3000 ppm, may produce cumulative effects characterised by gastrointestinal disturbances (nausea, vomiting), headache, ringing in the ears, insomnia, trembling, unsteady gait, vertigo, conjunctivitis and clouded or double vision. Liver and/or kidney injury may also result.

	TOXICITY	**IRRITATION**
Perfluoro-n-nonanoic acid (PFNA)	Not Available	Not Available

	TOXICITY	**IRRITATION**
methanol	Dermal (rabbit) LD50: 15800 mg/kg[2]	Eye (rabbit): 100 mg/24h-moderate
	Inhalation(Rat) LC50: 64000 ppm4h[2]	Eye (rabbit): 40 mg-moderate
	Oral (Rat) LD50: 5628 mg/kg[2]	Eye: no adverse effect observed (not irritating)[1]
		Skin (rabbit): 20 mg/24 h-moderate
		Skin: no adverse effect observed (not irritating)[1]

	TOXICITY	**IRRITATION**
Perfluoro-n-nonanoic acid	Not Available	Not Available

	TOXICITY	**IRRITATION**
water	Oral (Rat) LD50: >90000 mg/kg[2]	Not Available

	TOXICITY	**IRRITATION**
sodium hydroxide	Dermal (rabbit) LD50: 1350 mg/kg[2]	Eye (rabbit): 0.05 mg/24h SEVERE
	Oral (Rabbit) LD50; 325 mg/kg[1]	Eye (rabbit):1 mg/24h SEVERE
		Eye (rabbit):1 mg/30s rinsed-SEVERE
		Eye: adverse effect observed (irritating)[1]
		Skin (rabbit): 500 mg/24h SEVERE
		Skin: adverse effect observed (corrosive)[1]

Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2. Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*

METHANOL	The material may cause skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin.
WATER	No significant acute toxicological data identified in literature search.
SODIUM HYDROXIDE	Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. Other criteria for diagnosis of RADS include a reversible airflow pattern on lung function tests, moderate to severe bronchial hyperreactivity on methacholine challenge testing, and the lack of minimal lymphocytic inflammation, without eosinophilia. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. On the other hand, industrial bronchitis is a disorder that occurs as a result of exposure due to high concentrations of irritating substance (often particles) and is completely reversible after exposure ceases. The disorder is characterized by difficulty breathing, cough and mucus production. The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.

Acute Toxicity	✓	**Carcinogenicity**	✗
Skin Irritation/Corrosion	✗	**Reproductivity**	✗
Serious Eye Damage/Irritation	✗	**STOT - Single Exposure**	✓
Respiratory or Skin sensitisation	✗	**STOT - Repeated Exposure**	✗

Mutagenicity	✗	**Aspiration Hazard**	✗

Legend: ✗ *– Data either not available or does not fill the criteria for classification*
✓ *– Data available to make classification*

11.2 Information on other hazards

11.2.1. Endocrine disrupting properties

No evidence of endocrine disrupting properties were found in the current literature.

11.2.2. Other information

See Section 11.1

SECTION 12 Ecological information

12.1. Toxicity

	Endpoint	Test Duration (hr)	Species	Value	Source
Perfluoro-n-nonanoic acid (PFNA)	Not Available	Not Available	Not Available	Not Available	Not Available
methanol	EC50	48h	Crustacea	>10000mg/l	2
	EC50	96h	Algae or other aquatic plants	14.11-20.623mg/l	4
	NOEC(ECx)	720h	Fish	0.007mg/L	4
	LC50	96h	Fish	290mg/l	2
Perfluoro-n-nonanoic acid	EC50	48h	Crustacea	21.812-32.486mg/L	4
	EC50	72h	Algae or other aquatic plants	129.942mg/L	4
	NOEC(ECx)	504h	Crustacea	0.008mg/l	4
water	Not Available	Not Available	Not Available	Not Available	Not Available
sodium hydroxide	EC50	48h	Crustacea	34.59-47.13mg/l	4
	EC50(ECx)	48h	Crustacea	34.59-47.13mg/l	4
	LC50	96h	Fish	144-267mg/l	4
Legend:	*Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data*				

For Methanol: Log Kow: -0.82 to -0.66; Koc: 1; Henry s Law Constant: 4.55x10-6 atm-cu m/mole; Vapor Pressure: 127 mm Hg; BCF: < 10.
Atmospheric Fate: Methanol is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase methanol is broken down in the atmosphere by reactions with hydroxyl radicals; the half-life for this reaction in air is estimated to be 17 days.
Terrestrial Fate: Methanol is expected to have very high mobility in soil. Evaporation of methanol from moist/dry soil surfaces is expected to be an important fate process. Biological breakdown in soil is expected to be an important fate process for methanol based on half-lives of 1 day, in sandy silt loam, and 3.2 days in sandy loam.
Aquatic Fate: Methanol is not expected to adsorb to suspended solids and sediment and the substance mixes in water. The substance is expected to evaporate from water surfaces with half-lives, for a model river, of 3 days, and 35 days, for a model lake. Concentration of the substance in aquatic organisms is expected to be low. Breakdown by water and sunlight are not expected to be an important environmental fate processes. The substance is expected to be broken down by microorganisms in water.
Ecotoxicity: Methanol is non-toxic to fish, including fathead minnow, rainbow trout, bluegill sunfish, and guppy. The substance is also non-toxic to aquatic invertebrates, including Daphnia pulex water fleas, brine and brown shrimp. The substances are non-toxic to shellfish, including mussels, marine bacterium, including Photobacterium phosphoreum, and the protozoan Tetrahymena pyriformis.

DO NOT discharge into sewer or waterways.

12.2. Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air

Ingredient	Persistence: Water/Soil	Persistence: Air
methanol	LOW	LOW
Perfluoro-n-nonanoic acid	HIGH	HIGH
water	LOW	LOW
sodium hydroxide	LOW	LOW

12.3. Bioaccumulative potential

Ingredient	Bioaccumulation
methanol	LOW (BCF = 10)
Perfluoro-n-nonanoic acid	LOW (LogKOW = 7.2652)
sodium hydroxide	LOW (LogKOW = -3.8796)

12.4. Mobility in soil

Ingredient	Mobility
methanol	HIGH (KOC = 1)
Perfluoro-n-nonanoic acid	LOW (KOC = 123000)
sodium hydroxide	LOW (KOC = 14.3)

12.5. Results of PBT and vPvB assessment

	P	B	T
Relevant available data	Not Available	Not Available	Not Available
PBT	✗	✗	✗
vPvB	✗	✗	✗

PBT Criteria fulfilled?	No
vPvB	No

12.6. Endocrine disrupting properties

No evidence of endocrine disrupting properties were found in the current literature.

12.7. Other adverse effects

No evidence of ozone depleting properties were found in the current literature.

SECTION 13 Disposal considerations

13.1. Waste treatment methods

Product / Packaging disposal	‣ Containers may still present a chemical hazard/ danger when empty. ‣ Return to supplier for reuse/ recycling if possible. Otherwise: ‣ If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill. ‣ Where possible retain label warnings and SDS and observe all notices pertaining to the product. Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked. A Hierarchy of Controls seems to be common - the user should investigate: ‣ Reduction ‣ Reuse ‣ Recycling ‣ Disposal (if all else fails) This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate. ‣ **DO NOT** allow wash water from cleaning or process equipment to enter drains. ‣ It may be necessary to collect all wash water for treatment before disposal. ‣ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first. ‣ Where in doubt contact the responsible authority. ‣ Recycle wherever possible.

	- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified. - Dispose of by: burial in a land-fill specifically licensed to accept chemical and / or pharmaceutical wastes or Incineration in a licensed apparatus (after admixture with suitable combustible material). - Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.
Waste treatment options	Not Available
Sewage disposal options	Not Available

SECTION 14 Transport information

Labels Required

	
Marine Pollutant	NO

Land transport (ADR-RID)

14.1. **UN number or ID number**	1230	
14.2. **UN proper shipping name**	METHANOL	
14.3. **Transport hazard class(es)**	Class	3
	Subsidiary Hazard	6.1
14.4. **Packing group**	II	
14.5. **Environmental hazard**	Not Applicable	
14.6. **Special precautions for user**	Hazard identification (Kemler)	336
	Classification code	FT1
	Hazard Label	3 +6.1
	Special provisions	279
	Limited quantity	1 L
	Tunnel Restriction Code	D/E

Air transport (ICAO-IATA / DGR)

14.1. **UN number**	1230	
14.2. **UN proper shipping name**	Methanol	
14.3. **Transport hazard class(es)**	ICAO/IATA Class	3
	ICAO / IATA Subsidiary Hazard	6.1
	ERG Code	3L
14.4. **Packing group**	II	
14.5. **Environmental hazard**	Not Applicable	
14.6. **Special precautions for user**	Special provisions	A113
	Cargo Only Packing Instructions	364
	Cargo Only Maximum Qty / Pack	60 L
	Passenger and Cargo Packing Instructions	352
	Passenger and Cargo Maximum Qty / Pack	1 L
	Passenger and Cargo Limited Quantity Packing Instructions	Y341
	Passenger and Cargo Limited Maximum Qty / Pack	1 L

Sea transport (IMDG-Code / GGVSee)

14.1. **UN number**	1230
14.2. **UN proper shipping name**	METHANOL
14.3. **Transport hazard class(es)**	IMDG Class: 3 IMDG Subsidiary Hazard: 6.1
14.4. **Packing group**	II
14.5 **Environmental hazard**	Not Applicable
14.6. **Special precautions for user**	EMS Number: F-E , S-D Special provisions: 279 Limited Quantities: 1 L

Inland waterways transport (ADN)

14.1. **UN number**	1230
14.2. **UN proper shipping name**	METHANOL
14.3. **Transport hazard class(es)**	3 | 6.1
14.4. **Packing group**	II
14.5. **Environmental hazard**	Not Applicable
14.6. **Special precautions for user**	Classification code: FT1 Special provisions: 279; 802 Limited quantity: 1 L Equipment required: PP, EP, EX, TOX, A Fire cones number: 2

14.7. Maritime transport in bulk according to IMO instruments

14.7.1. Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

14.7.2. Transport in bulk in accordance with MARPOL Annex V and the IMSBC Code

Product name	Group
methanol	Not Available
Perfluoro-n-nonanoic acid	Not Available
water	Not Available
sodium hydroxide	Not Available

14.7.3. Transport in bulk in accordance with the IGC Code

Product name	Ship Type
methanol	Not Available
Perfluoro-n-nonanoic acid	Not Available
water	Not Available
sodium hydroxide	Not Available

SECTION 15 Regulatory information

15.1. Safety, health and environmental regulations / legislation specific for the substance or mixture

methanol is found on the following regulatory lists

Chemical Footprint Project - Chemicals of High Concern List

EU Consolidated List of Indicative Occupational Exposure Limit Values (IOELVs)

EU European Chemicals Agency (ECHA) Community Rolling Action Plan (CoRAP) List of Substances

EU REACH Regulation (EC) No 1907/2006 - Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles

Europe EC Inventory

European Union - European Inventory of Existing Commercial Chemical Substances (EINECS)

European Union (EU) Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures - Annex VI

Sweden Swedish Chemicals Agency (KEMI) Restricted Substances Database

Perfluoro-n-nonanoic acid is found on the following regulatory lists

Chemical Footprint Project - Chemicals of High Concern List

EU REACH Regula\tion (EC) No 1907/2006 - Annex XVII (Appendix 6) Reproductive toxicants: Category 1 B

EU REACH Regulation (EC) No 1907/2006 - Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles

EU REACH Regulation (EC) No 1907/2006 - Proposals to identify Substances of Very High Concern: Annex XV reports for commenting by Interested Parties previous consultation

Europe EC Inventory

Europe European Chemicals Agency (ECHA) Candidate List of Substances of Very High Concern for Authorisation

European Union - European Inventory of Existing Commercial Chemical Substances (EINECS)

European Union (EU) Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures - Annex VI

Sweden Swedish Chemicals Agency (KEMI) Restricted Substances Database

water is found on the following regulatory lists

Europe EC Inventory

European Union - European Inventory of Existing Commercial Chemical Substances (EINECS)

sodium hydroxide is found on the following regulatory lists

Europe EC Inventory

European Union - European Inventory of Existing Commercial Chemical Substances (EINECS)

European Union (EU) Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures - Annex VI

Additional Regulatory Information

Not Applicable

This safety data sheet is in compliance with the following EU legislation and its adaptations - as far as applicable - : Directives 98/24/EC, - 92/85/EEC, - 94/33/EC, - 2008/98/EC, - 2010/75/EU; Commission Regulation (EU) 2020/878; Regulation (EC) No 1272/2008 as updated through ATPs.

Information according to 2012/18/EU (Seveso III):

Seveso Category	H2, H3, P5a, P5b, P5c

15.2. Chemical safety assessment

No Chemical Safety Assessment has been carried out for this substance/mixture by the supplier.

National Inventory Status

National Inventory	Status
Australia - AIIC / Australia Non-Industrial Use	No (Perfluoro-n-nonanoic acid)
Canada - DSL	No (Perfluoro-n-nonanoic acid)
Canada - NDSL	No (methanol; Perfluoro-n-nonanoic acid; water; sodium hydroxide)
China - IECSC	No (Perfluoro-n-nonanoic acid)
Europe - EINEC / ELINCS / NLP	Yes
Japan - ENCS	Yes
Korea - KECI	No (Perfluoro-n-nonanoic acid)
New Zealand - NZIoC	No (Perfluoro-n-nonanoic acid)
Philippines - PICCS	No (Perfluoro-n-nonanoic acid)
USA - TSCA	Yes
Taiwan - TCSI	Yes
Mexico - INSQ	No (Perfluoro-n-nonanoic acid)
Vietnam - NCI	Yes

National Inventory	Status
Russia - FBEPH	Yes
Legend:	*Yes = All CAS declared ingredients are on the inventory* *No = One or more of the CAS listed ingredients are not on the inventory. These ingredients may be exempt or will require registration.*

SECTION 16 Other information

Revision Date	20/10/2023
Initial Date	27/09/2017

Full text Risk and Hazard codes

H314	Causes severe skin burns and eye damage.

SDS Version Summary

Version	Date of Update	Sections Updated
7.10	20/10/2023	Hazards identification - Classification, Composition / information on ingredients - Ingredients, Accidental release measures - Spills (major)

Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

For detailed advice on Personal Protective Equipment, refer to the following EU CEN Standards:
EN 166 Personal eye-protection
EN 340 Protective clothing
EN 374 Protective gloves against chemicals and micro-organisms
EN 13832 Footwear protecting against chemicals
EN 133 Respiratory protective devices

Definitions and abbreviations

- PC－TWA: Permissible Concentration-Time Weighted Average
- PC－STEL: Permissible Concentration-Short Term Exposure Limit
- IARC: International Agency for Research on Cancer
- ACGIH: American Conference of Governmental Industrial Hygienists
- STEL: Short Term Exposure Limit
- TEEL: Temporary Emergency Exposure Limit。
- IDLH: Immediately Dangerous to Life or Health Concentrations
- ES: Exposure Standard
- OSF: Odour Safety Factor
- NOAEL: No Observed Adverse Effect Level
- LOAEL: Lowest Observed Adverse Effect Level
- TLV: Threshold Limit Value
- LOD: Limit Of Detection
- OTV: Odour Threshold Value
- BCF: BioConcentration Factors
- BEI: Biological Exposure Index
- DNEL: Derived No-Effect Level
- PNEC: Predicted no-effect concentration

- AIIC: Australian Inventory of Industrial Chemicals
- DSL: Domestic Substances List
- NDSL: Non-Domestic Substances List
- IECSC: Inventory of Existing Chemical Substance in China
- EINECS: European INventory of Existing Commercial chemical Substances
- ELINCS: European List of Notified Chemical Substances
- NLP: No-Longer Polymers
- ENCS: Existing and New Chemical Substances Inventory
- KECI: Korea Existing Chemicals Inventory

- NZIoC: New Zealand Inventory of Chemicals
- PICCS: Philippine Inventory of Chemicals and Chemical Substances
- TSCA: Toxic Substances Control Act
- TCSI: Taiwan Chemical Substance Inventory
- INSQ: Inventario Nacional de Sustancias Químicas
- NCI: National Chemical Inventory
- FBEPH: Russian Register of Potentially Hazardous Chemical and Biological Substances

Classification and procedure used to derive the classification for mixtures according to Regulation (EC) 1272/2008 [CLP]

Classification according to regulation (EC) No 1272/2008 [CLP] and amendments	Classification Procedure
Flammable Liquids Category 2, H225	On basis of test data
Acute Toxicity (Oral) Category 3, H301	On basis of test data
Acute Toxicity (Dermal) Category 3, H311	On basis of test data
Acute Toxicity (Inhalation) Category 3, H331	On basis of test data
Specific Target Organ Toxicity - Single Exposure Category 1, H370	Minimum classification

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Safety Data Sheet
acc. to OSHA HCS

Printing date 05/05/2023 Revision date 05/05/2023

1 Identification

· **Product identifier**

· **Trade name: Perfluorononanesulfonic Acid (sodium salt)**

· **Article number:** 38908
· **CAS Number:**
98789-57-2
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS06 Skull and crossbones

Acute Toxicity - Oral 3 H301 Toxic if swallowed.


GHS09 Environment

Aquatic Chronic 2 H411 Toxic to aquatic life with long lasting effects.


GHS07

Acute Toxicity - Inhalation 4 H332 Harmful if inhaled.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).

(Contd. on page 2)

(Contd. from page 1)

· **Hazard pictograms**

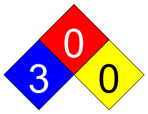

GHS06


GHS09

· **Signal word** Danger
· **Hazard statements**
H301 Toxic if swallowed.
H332 Harmful if inhaled.
H411 Toxic to aquatic life with long lasting effects.
· **Precautionary statements**

P261	Avoid breathing dust/fume/gas/mist/vapors/spray
P264	Wash thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P301+P310	If swallowed: Immediately call a poison center/doctor.
P321	Specific treatment (see on this label).
P330	Rinse mouth.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312	Call a poison center/doctor if you feel unwell.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**
· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	2
FIRE	0
REACTIVITY	0

Health = 2
Fire = 0
Reactivity = 0

· **Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
98789-57-2 Perfluorononanesulfonic Acid (sodium salt)

(Contd. on page 3)

(Contd. from page 2)

4 First-aid measures

- **Description of first aid measures**
- **General information:**
  Immediately remove any clothing soiled by the product.
  Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
  In case of irregular breathing or respiratory arrest provide artificial respiration.
- **After inhalation:**
  Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
  In case of unconsciousness place patient stably in side position for transportation.
- **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
- **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
- **After swallowing:** Do not induce vomiting; immediately call for medical help.
- **Information for doctor:**
- **Most important symptoms and effects, both acute and delayed**
  No further relevant information available.
- **Indication of any immediate medical attention and special treatment needed**
  No further relevant information available.

5 Fire-fighting measures

- **Extinguishing media**
- **Suitable extinguishing agents:**
  Use fire fighting measures that suit the environment.
  A solid water stream may be inefficient.
- **Special hazards arising from the substance or mixture** No further relevant information available.
- **Advice for firefighters**
- **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures** Not required.
- **Environmental precautions:**
  Inform respective authorities in case of seepage into water course or sewage system.
  Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:**
  Dispose contaminated material as waste according to section 13.
  Ensure adequate ventilation.
- **Reference to other sections**
  See Section 7 for information on safe handling.
  See Section 8 for information on personal protection equipment.
  See Section 13 for disposal information.
- **Protective Action Criteria for Chemicals**
- **PAC-1:** Substance is not listed.
- **PAC-2:** Substance is not listed.
- **PAC-3:** Substance is not listed.

(Contd. on page 4)

Safety Data Sheet
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(Contd. from page 3)

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Thorough dedusting.
Ensure good ventilation/exhaustion at the workplace.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see section 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
· **Protection of hands:**
The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:** Not required.

9 Physical and chemical properties

· **Information on basic physical and chemical properties**
· **General Information**
· **Appearance:**

Form:	Solid

(Contd. on page 5)

(Contd. from page 4)

Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C9F19O3S • Na
· **Molecular Weight**	572.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

(Contd. on page 6)

(Contd. from page 5)

11 Toxicological information

- **Information on toxicological effects**
- **Acute toxicity:**
- **Primary irritant effect:**
- **on the skin:** No irritant effect.
- **on the eye:** No irritating effect.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**

- **Carcinogenic categories**
- **IARC (International Agency for Research on Cancer)** Substance is not listed.
- **NTP (National Toxicology Program)** Substance is not listed.
- **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

- **Toxicity**
- **Aquatic toxicity:** No further relevant information available.
- **Persistence and degradability** No further relevant information available.
- **Behavior in environmental systems:**
- **Bioaccumulative potential** No further relevant information available.
- **Mobility in soil** No further relevant information available.
- **Ecotoxical effects:**
- **Remark:** Toxic for fish
- **Additional ecological information:**
- **General notes:**
  Water hazard class 3 (Self-assessment): extremely hazardous for water
  Do not allow product to reach ground water, water course or sewage system, even in small quantities.
  Danger to drinking water if even extremely small quantities leak into the ground.
  Also poisonous for fish and plankton in water bodies.
  Toxic for aquatic organisms
- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **Other adverse effects** No further relevant information available.

13 Disposal considerations

- **Waste treatment methods**
- **Recommendation:**
  Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

- **Uncleaned packagings:**
- **Recommendation:** Disposal must be made according to official regulations.

(Contd. on page 7)

(Contd. from page 6)

14 Transport information

· **UN-Number**	
· **DOT, IMDG, IATA**	UN3288
· **UN proper shipping name**	
· **DOT, IATA**	Toxic solid, inorganic, n.o.s. (Perfluorononanesulfonic Acid (sodium salt))
· **IMDG**	TOXIC SOLID, INORGANIC, N.O.S. (Perfluorononanesulfonic Acid (sodium salt))

· **Transport hazard class(es)**

· **DOT**

· **Class**	6.1 Toxic substances
· **Label**	6.1

· **IMDG, IATA**

· **Class**	6.1 Toxic substances
· **Label**	6.1
· **Packing group**	
· **DOT, IMDG, IATA**	III
· **Environmental hazards:**	Environmentally hazardous substance, solid
· **Special precautions for user**	Warning: Toxic substances
· **Hazard identification number (Kemler code):**	60
· **EMS Number:**	F-A,S-A
· **Stowage Category**	A
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	
· **DOT**	
· **Quantity limitations**	On passenger aircraft/rail: 100 kg On cargo aircraft only: 200 kg
· **IMDG**	
· **Limited quantities (LQ)**	5 kg
· **Excepted quantities (EQ)**	Code: E1 Maximum net quantity per inner packaging: 30 g Maximum net quantity per outer packaging: 1000 g
· **IATA**	
· **Remarks:**	When sold in quantities of less than or equal to 1 mL, or 1 g, with an Excepted Quantity Code of E1, E2, E4, or E5, this item meets the De Minimis Quantities exemption, per IATA 2.6.10.

(Contd. on page 8)

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·	Therefore packaging does not have to be labeled as Dangerous Goods/Excepted Quantity.
· **UN "Model Regulation":**	UN 3288 TOXIC SOLID, INORGANIC, N.O.S. (PERFLUORONONANESULFONIC ACID (SODIUM SALT)), 6.1, III, ENVIRONMENTALLY HAZARDOUS

15 Regulatory information

- **Safety, health and environmental regulations/legislation specific for the substance or mixture** No further relevant information available.
- **Sara**
- **Section 355 (extremely hazardous substances):** Substance is not listed.
- **Section 313 (Specific toxic chemical listings):** Substance is not listed.
- **TSCA (Toxic Substances Control Act):** Substance is not listed.
- **Hazardous Air Pollutants** Substance is not listed.
- **Proposition 65**
- **Chemicals known to cause cancer:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
- **Chemicals known to cause developmental toxicity:** Substance is not listed.

- **Carcinogenic categories**
- **EPA (Environmental Protection Agency)** Substance is not listed.
- **TLV (Threshold Limit Value)** Substance is not listed.
- **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
- **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 05/05/2023
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit

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Acute Toxicity - Oral 3: Acute toxicity – Category 3
Acute Toxicity - Inhalation 4: Acute toxicity – Category 4
Aquatic Chronic 2: Hazardous to the aquatic environment - long-term aquatic hazard – Category 2

Safety Data Sheet
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* 1 Identification

· **Product identifier**

· **Trade name: Perfluorooctanoic Acid (PFOA)**

· **Part number:** N-1588
· **CAS Number:**
335-67-1
· **EC number:**
206-397-9
· **Index number:**
607-704-00-2
· **Application of the substance / the mixture** Reagents and Standards for Analytical Chemical Laboratory Use

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Agilent Technologies, Inc.
5301 Stevens Creek Blvd.
Santa Clara, CA 95051 USA

· **Information department:**
Telephone: 800-227-9770
e-mail: pdl-msds_author@agilent.com
· **Emergency telephone number:** CHEMTREC®: 1-800-424-9300

* 2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS08 Health hazard

Carc. 2	H351	Suspected of causing cancer.
Repr. 1B	H360	May damage fertility or the unborn child.
STOT RE 1	H372	Causes damage to the liver through prolonged or repeated exposure.


GHS05 Corrosion

Eye Dam. 1	H318	Causes serious eye damage.


GHS07

Acute Tox. 4	H302	Harmful if swallowed.
Acute Tox. 4	H332	Harmful if inhaled.

· **Label elements**
· **GHS label elements** The substance is classified and labeled according to the Globally Harmonized System (GHS).

(Contd. on page 2)

(Contd. of page 1)

· **Hazard pictograms**

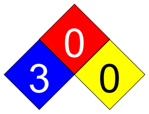

GHS05


GHS07


GHS08

· **Signal word** Danger

· **Hazard-determining components of labeling:**
perfluorooctanoic acid (PFOA)
· **Hazard statements**
Harmful if swallowed or if inhaled.
Causes serious eye damage.
Suspected of causing cancer.
May damage fertility or the unborn child.
Causes damage to the liver through prolonged or repeated exposure.
· **Precautionary statements**
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Do not breathe dust/fume/gas/mist/vapors/spray.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/protective clothing/eye protection/face protection.
If swallowed: Call a poison center/doctor if you feel unwell.
Rinse mouth.
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.
Continue rinsing.
Immediately call a poison center/doctor.
IF exposed or concerned: Get medical advice/attention.
Get medical advice/attention if you feel unwell.
Store locked up.
Dispose of contents/container in accordance with local/regional/national/international regulations.
· **Classification system:**
· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*3
FIRE	0
REACTIVITY	0

Health = *3
Fire = 0
Reactivity = 0

· **Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.

(Contd. on page 3)

(Contd. of page 2)

· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
335-67-1 perfluorooctanoic acid (PFOA)
· **Identification number(s)**
· **EC number:** 206-397-9
· **Index number:** 607-704-00-2

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:**
Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist. In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Generally the product does not irritate the skin.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:** Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed** No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:** Use fire fighting measures that suit the environment.
· **Special hazards arising from the substance or mixture**
During heating or in case of fire poisonous gases are produced.
· **Advice for firefighters**
· **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Mount respiratory protective device.
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Use neutralizing agent.
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.

(Contd. on page 4)

(Contd. of page 3)

· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

· **Protective Action Criteria for Chemicals**

· **PAC-1:**	
	1.1 mg/m³

· **PAC-2:**	
	12 mg/m³

· **PAC-3:**	
	75 mg/m³

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Thorough dedusting.
Ensure good ventilation/exhaustion at the workplace.
Open and handle receptacle with care.
· **Information about protection against explosions and fires:** Keep respiratory protective device available.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

* 8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
When used as intended with Agilent instruments, the use of the product under normal laboratory conditions and with standard practices does not result in significant airborne exposures and therefore respiratory protection is not needed.
Under an emergency condition where a respirator is deemed necessary, use a NIOSH or equivalent approved device/equipment with appropriate organic or acid gas cartridge.

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· **Protection of hands:**
Although not recommended for constant contact with the chemicals or for clean-up, nitrile gloves 11-13 mil thickness are recommended for normal use. The breakthrough time is 1 hr. For cleaning a spill where there is direct contact of the chemical, butyl rubber gloves are recommended 12-15 mil thickness with breakthrough times exceeding 4 hrs. Supplier recommendations should be followed.

· **Material of gloves**
For normal use: nitrile rubber, 11-13 mil thickness
For direct contact with the chemical: butyl rubber, 12-15 mil thickness
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· **Penetration time of glove material**
For normal use: nitrile rubber: 1 hour
For direct contact with the chemical: butyl rubber: >4 hours

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	55-56 °C (131-132.8 °F)
Boiling point/Boiling range:	190 °C (374 °F)
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure at 20 °C (68 °F):**	0.69 hPa (0.5 mm Hg)
· **Density at 20 °C (68 °F):**	0.9 g/cm^3 (7.5105 lbs/gal)
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.

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· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with** **Water at 20 °C (68 °F):**	3.4 g/l
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
VOC content:	0.00 % 0.0 g/l / 0.00 lb/gal
Solids content:	100.0 %
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**

· **LD/LC50 values that are relevant for classification:**		
ATE (Acute Toxicity Estimate)		
Oral	LD50	500 mg/kg
Inhalative	LC50/4 h	1.5 mg/L

· **Primary irritant effect:**
· **on the skin:** No irritant effect.
· **on the eye:** Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**

· **Carcinogenic categories**

· **IARC (International Agency for Research on Cancer)**
2B

· **NTP (National Toxicology Program)**
Substance is not listed.

(Contd. on page 7)

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· **OSHA-Ca (Occupational Safety & Health Administration)**

Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 2 (Assessment by list): hazardous for water
Do not allow product to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.
Danger to drinking water if even small quantities leak into the ground.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number**	
· **DOT, IMDG, IATA**	UN3261
· **UN proper shipping name**	
· **DOT**	Corrosive solid, acidic, organic, n.o.s. (perfluorooctanoic acid (PFOA))
· **IMDG, IATA**	CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S. (perfluorooctanoic acid (PFOA))

(Contd. on page 8)

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· **Transport hazard class(es)**

· **IATA**

· **Class**	8 Corrosive substances
· **Label**	8
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Warning: Corrosive substances
· **Danger code (Kemler):**	80
· **EMS Number:**	F-A,S-B
· **Segregation groups**	Acids
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	
· **DOT**	
· **Quantity limitations**	On passenger aircraft/rail: 25 kg On cargo aircraft only: 100 kg
· **IMDG**	
· **Limited quantities (LQ)**	5 kg
· **Excepted quantities (EQ)**	Code: E1 Maximum net quantity per inner packaging: 30 g Maximum net quantity per outer packaging: 1000 g
· **UN "Model Regulation":**	UN 3261 CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S. (PERFLUOROOCTANOIC ACID (PFOA)), 8, III

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**

· **Sara**

· **Section 355 (extremely hazardous substances):**

Substance is not listed.

· **Section 313 (Specific toxic chemical listings):**

Substance is not listed.

· **TSCA (Toxic Substances Control Act):**

Substance is listed.

· **Proposition 65**

· **Chemicals known to cause cancer:**

Substance is not listed.

· **Chemicals known to cause reproductive toxicity for females:**

Substance is not listed.

(Contd. on page 9)

(Contd. of page 8)

· **Chemicals known to cause reproductive toxicity for males:**

Substance is not listed.

· **Chemicals known to cause developmental toxicity:**

Substance is listed.

· **Carcinogenic categories**

· **EPA (Environmental Protection Agency)**

Substance is not listed.

· **TLV (Threshold Limit Value established by ACGIH)**

Substance is not listed.

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**

Substance is not listed.

· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

*

16 Other information

The information contained in this document is based on Agilent's state of knowledge at the time of preparation. No warranty as to its accurateness, completeness or suitability for a particular purpose is expressed or implied.

· **Date of preparation / last revision** 03/23/2019 / 1

· **Abbreviations and acronyms:**

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
ACGIH: American Conference of Governmental Industrial Hygienists
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
VOC: Volatile Organic Compounds (USA, EU)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Tox. 4: Acute toxicity – Category 4
Eye Dam. 1: Serious eye damage/eye irritation – Category 1
Carc. 2: Carcinogenicity – Category 2
Repr. 1B: Reproductive toxicity – Category 1B
STOT RE 1: Specific target organ toxicity (repeated exposure) – Category 1

· *** Data compared to the previous version altered.**

Safety Data Sheet
acc. to OSHA HCS

Printing date 04/01/2019 Version Number 2 Reviewed on 04/01/2019

* 1 Identification

· **Product identifier**

· **Trade name: PFOA/PFOS Standard (1X1 mL)**

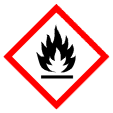
· **Part number:** PFM-100-1
· **Application of the substance / the mixture** Reagents and Standards for Analytical Chemical Laboratory Use

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Agilent Technologies, Inc.
5301 Stevens Creek Blvd.
Santa Clara, CA 95051 USA

· **Information department:**
Telephone: 800-227-9770
e-mail: pdl-msds_author@agilent.com
· **Emergency telephone number:** CHEMTREC®: 1-800-424-9300

* 2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS02 Flame

Flam. Liq. 2 H225 Highly flammable liquid and vapor.


GHS06 Skull and crossbones

Acute Tox. 3 H331 Toxic if inhaled.


GHS08 Health hazard

Carc. 2 H351 Suspected of causing cancer.
Repr. 1B H360 May damage fertility or the unborn child.
STOT SE 1 H370 Causes damage to organs.

· **Label elements**
· **GHS label elements** The product is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**


GHS02


GHS06


GHS08

· **Signal word** Danger

· **Hazard-determining components of labeling:**
methanol
perfluorooctanoic acid (PFOA)
perfluorooctane sulfonic acid (PFOS)

(Contd. on page 2)

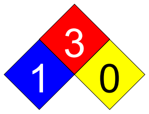
(Contd. of page 1)

· **Hazard statements**
Highly flammable liquid and vapor.
Toxic if inhaled.
Suspected of causing cancer.
May damage fertility or the unborn child.
Causes damage to organs.

· **Precautionary statements**
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting/equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Do not breathe dust/fume/gas/mist/vapors/spray.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/protective clothing/eye protection/face protection.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
IF exposed or concerned: Get medical advice/attention.
Specific treatment (see on this label).
In case of fire: Use for extinction: CO2, powder or water spray.
Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.
Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 1
Fire = 3
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = *1
Fire = 3
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Mixtures**

· **Description:** Mixture of the substances listed below with nonhazardous additions.

(Contd. on page 3)

(Contd. of page 2)

· **Dangerous components:**

67-56-1	methanol	99.747%
335-67-1	perfluorooctanoic acid (PFOA)	0.126%
1763-23-1	perfluorooctane sulfonic acid (PFOS)	0.126%

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Immediately remove any clothing soiled by the product.
Remove breathing apparatus only after contaminated clothing have been completely removed.
In case of irregular breathing or respiratory arrest provide artificial respiration.
· **After inhalation:**
Supply fresh air or oxygen; call for doctor.
In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:** If symptoms persist consult doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed** No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
CO2, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
· **For safety reasons unsuitable extinguishing agents:** Water with full jet
· **Special hazards arising from the substance or mixture**
During heating or in case of fire poisonous gases are produced.
· **Advice for firefighters**
· **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Mount respiratory protective device.
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

(Contd. on page 4)

(Contd. of page 3)

· **Protective Action Criteria for Chemicals**

· **PAC-1:**		
67-56-1	methanol	530 ppm
335-67-1	perfluorooctanoic acid (PFOA)	1.1 mg/m³

· **PAC-2:**		
67-56-1	methanol	2,100 ppm
335-67-1	perfluorooctanoic acid (PFOA)	12 mg/m³

· **PAC-3:**		
67-56-1	methanol	7200* ppm
335-67-1	perfluorooctanoic acid (PFOA)	75 mg/m³

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Ensure good ventilation/exhaustion at the workplace.
Open and handle receptacle with care.
Prevent formation of aerosols.
· **Information about protection against explosions and fires:**
Keep ignition sources away - Do not smoke.
Protect against electrostatic charges.
Keep respiratory protective device available.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:** Store in a cool location.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:**
Keep receptacle tightly sealed.
Store in cool, dry conditions in well sealed receptacles.
· **Specific end use(s)** No further relevant information available.

*

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

· **Control parameters**

· **Components with limit values that require monitoring at the workplace:**	
67-56-1 methanol	
PEL	Long-term value: 260 mg/m³, 200 ppm
REL	Short-term value: 325 mg/m³, 250 ppm Long-term value: 260 mg/m³, 200 ppm Skin
TLV	Short-term value: 328 mg/m³, 250 ppm Long-term value: 262 mg/m³, 200 ppm Skin; BEI

(Contd. on page 5)

(Contd. of page 4)

· **Ingredients with biological limit values:**

67-56-1 methanol	
BEI	15 mg/L Medium: urine Time: end of shift Parameter: Methanol (background, nonspecific)

· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
· **Breathing equipment:**
When used as intended with Agilent instruments, the use of the product under normal laboratory conditions and with standard practices does not result in significant airborne exposures and therefore respiratory protection is not needed.
Under an emergency condition where a respirator is deemed necessary, use a NIOSH or equivalent approved device/equipment with appropriate organic or acid gas cartridge.
· **Protection of hands:**
Although not recommended for constant contact with the chemicals or for clean-up, nitrile gloves 11-13 mil thickness are recommended for normal use. The breakthrough time is 1 hr. For cleaning a spill where there is direct contact of the chemical, butyl rubber gloves are recommended 12-15 mil thickness with breakthrough times exceeding 4 hrs. Supplier recommendations should be followed.
· **Material of gloves**
For normal use: nitrile rubber, 11-13 mil thickness
For direct contact with the chemical: butyl rubber, 12-15 mil thickness
· **Penetration time of glove material**
For normal use: nitrile rubber: 1 hour
For direct contact with the chemical: butyl rubber: >4 hours
· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**
· **General Information**
· **Appearance:**

Form:	Fluid
Color:	Colorless
· **Odor:**	Alcohol-like
· **Odor threshold:**	Not determined.
· **pH-value:**	Not determined.

(Contd. on page 6)

(Contd. of page 5)

· **Change in condition**	
Melting point/Melting range:	-98 °C (-144.4 °F)
Boiling point/Boiling range:	64.7 °C (148.5 °F)
· **Flash point:**	9 °C (48.2 °F)
· **Flammability (solid, gaseous):**	Not applicable.
· **Ignition temperature:**	455 °C (851 °F)
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Product is not selfigniting.
· **Danger of explosion:**	Product is not explosive. However, formation of explosive air/vapor mixtures are possible.
· **Explosion limits:**	
Lower:	5.5 Vol %
Upper:	44 Vol %
· **Vapor pressure at 20 °C (68 °F):**	100 hPa (75 mm Hg)
· **Density at 20 °C (68 °F):**	0.8007 g/cm³ (6.68184 lbs/gal)
· **Relative density**	Not determined.
· **Vapor density**	Not determined.
· **Evaporation rate**	Not determined.
· **Solubility in / Miscibility with**	
Water:	Not miscible or difficult to mix.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not determined.
Kinematic:	Not determined.
· **Solvent content:**	
Organic solvents:	99.7 %
VOC content:	99.75 % 798.7 g/l / 6.67 lb/gal
Solids content:	0.3 %
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

(Contd. on page 7)

(Contd. of page 6)

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**

· **LD/LC50 values that are relevant for classification:**		
ATE (Acute Toxicity Estimate)		
Inhalative	LC50/4 h	3.01 mg/L

67-56-1 methanol		
Oral	LD50	5,628 mg/kg (rat)
Dermal	LD50	15,800 mg/kg (rabbit)
1763-23-1 perfluorooctane sulfonic acid (PFOS)		
Oral	LD50	154 mg/kg (rat)

· **Primary irritant effect:**
· **on the skin:** No irritant effect.
· **on the eye:** No irritating effect.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
The product shows the following dangers according to internally approved calculation methods for preparations:
Toxic

· **Carcinogenic categories**

· **IARC (International Agency for Research on Cancer)**		
335-67-1	perfluorooctanoic acid (PFOA)	2B

· **NTP (National Toxicology Program)**
None of the ingredients is listed.

· **OSHA-Ca (Occupational Safety & Health Administration)**
None of the ingredients is listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 2 (Self-assessment): hazardous for water
Do not allow product to reach ground water, water course or sewage system.
Danger to drinking water if even small quantities leak into the ground.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

(Contd. on page 8)

(Contd. of page 7)

· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

*

14 Transport information

· **Not Regulated, De minimus Quantities** -

· **UN-Number**
· **DOT, IMDG, IATA** UN1230

· **UN proper shipping name**
· **DOT** Methanol solution
· **IMDG, IATA** METHANOL solution

· **Transport hazard class(es)**

· **DOT**

· **Class** 3 Flammable liquids
· **Label** 3, 6.1

· **IMDG**

· **Class** 3 Flammable liquids
· **Label** 3/6.1

· **IATA**

· **Class** 3 Flammable liquids
· **Label** 3 (6.1)

· **Packing group**
· **DOT, IMDG, IATA** II

· **Environmental hazards:** Not applicable.

(Contd. on page 9)

(Contd. of page 8)

· **Special precautions for user**	Warning: Flammable liquids
· **Danger code (Kemler):**	336
· **EMS Number:**	F-E,S-D
· **Stowage Category**	B
· **Stowage Code**	SW2 Clear of living quarters.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	
· **DOT**	
· **Quantity limitations**	On passenger aircraft/rail: 1 L On cargo aircraft only: 60 L
· **IMDG**	
· **Limited quantities (LQ)**	1L
· **Excepted quantities (EQ)**	Code: E2 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 500 ml
· **UN "Model Regulation":**	UN 1230 METHANOL SOLUTION, 3 (6.1), II

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **Sara**

· **Section 355 (extremely hazardous substances):**

None of the ingredients is listed.

· **Section 313 (Specific toxic chemical listings):**

67-56-1	methanol

· **TSCA (Toxic Substances Control Act):**

All ingredients are listed.

· **TSCA new (21st Century Act): (Substances not listed)**

1763-23-1	perfluorooctane sulfonic acid (PFOS)

· **Proposition 65**

· **Chemicals known to cause cancer:**

None of the ingredients is listed.

· **Chemicals known to cause reproductive toxicity for females:**

None of the ingredients is listed.

· **Chemicals known to cause reproductive toxicity for males:**

None of the ingredients is listed.

· **Chemicals known to cause developmental toxicity:**

All ingredients are listed.

(Contd. on page 10)

(Contd. of page 9)

· **Carcinogenic categories**

· **EPA (Environmental Protection Agency)**

None of the ingredients is listed.

· **TLV (Threshold Limit Value established by ACGIH)**

None of the ingredients is listed.

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**

None of the ingredients is listed.

· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

The information contained in this document is based on Agilent's state of knowledge at the time of preparation. No warranty as to its accurateness, completeness or suitability for a particular purpose is expressed or implied.

· **Date of preparation / last revision** 04/01/2019 / 1

· **Abbreviations and acronyms:**

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
ACGIH: American Conference of Governmental Industrial Hygienists
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
VOC: Volatile Organic Compounds (USA, EU)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
BEI: Biological Exposure Limit
Flam. Liq. 2: Flammable liquids – Category 2
Acute Tox. 3: Acute toxicity – Category 3
Carc. 2: Carcinogenicity – Category 2
Repr. 1B: Reproductive toxicity – Category 1B
STOT SE 1: Specific target organ toxicity (single exposure) – Category 1

· *** Data compared to the previous version altered.**

Safety Data Sheet
acc. to OSHA HCS

1 Identification

- **Product identifier**

- **Trade name: Perfluorooctanesulfonamide**
- **Synonym**

- **Article number:** 37258
- **CAS Number:**
  754-91-6
- **EC number:**
  212-046-0
- **Application of the substance / the mixture**
  This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

- **Details of the supplier of the safety data sheet**
- **Manufacturer/Supplier:**
  Cayman Chemical Co.
  1180 E. Ellsworth Rd.
  Ann Arbor, MI 48108
  USA

- **Information department:** Product safety department
- **Emergency telephone number:**
  During normal opening times: +1 (734) 971-3335
  US/CANADA: 800-424-9300
  Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

- **Classification of the substance or mixture**

GHS06 Skull and crossbones

Acute Toxicity - Oral 3	H301 Toxic if swallowed.

GHS09 Environment

Aquatic Acute 1	H400 Very toxic to aquatic life.
Aquatic Chronic 1	H410 Very toxic to aquatic life with long lasting effects.

GHS07

Skin Irritation 2	H315 Causes skin irritation.

(Contd. on page 2)

(Contd. from page 1)

Eye Irritation 2A	H319 Causes serious eye irritation.
Specific Target Organ Toxicity - Single Exposure 3	H335 May cause respiratory irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**


GHS06

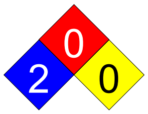

GHS07


GHS09

· **Signal word** Danger
· **Hazard statements**
H301 Toxic if swallowed.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
H410 Very toxic to aquatic life with long lasting effects.
· **Precautionary statements**

P261	Avoid breathing dust/fume/gas/mist/vapors/spray
P264	Wash thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear eye protection / face protection.
P301+P310	If swallowed: Immediately call a poison center/doctor.
P321	Specific treatment (see on this label).
P330	Rinse mouth.
P302+P352	If on skin: Wash with plenty of water.
P304+P340	IF INHALED: Remove person to fresh air and keep 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.
P312	Call a poison center/doctor if you feel unwell.
P362+P364	Take off contaminated clothing and wash it before reuse.
P332+P313	If skin irritation occurs: Get medical advice/attention.
P337+P313	If eye irritation persists: Get medical advice/attention.
P391	Collect spillage.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**
· **NFPA ratings (scale 0 - 4)**



Health = 2
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	2
FIRE	0
REACTIVITY	0

Health = 2
Fire = 0
Reactivity = 0

(Contd. on page 3)

(Contd. from page 2)

- **Other hazards**
- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.

3 Composition/information on ingredients

- **Chemical characterization: Substances**
- **CAS No. Description**
  754-91-6 Perfluorooctanesulfonamide
- **Identification number(s)**
- **EC number:** 212-046-0

4 First-aid measures

- **Description of first aid measures**
- **General information:**
  Immediately remove any clothing soiled by the product.
  In case of irregular breathing or respiratory arrest provide artificial respiration.
- **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
- **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
- **After eye contact:**
  Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
- **After swallowing:** Do not induce vomiting; immediately call for medical help.
- **Information for doctor:**
- **Most important symptoms and effects, both acute and delayed**
  No further relevant information available.
- **Indication of any immediate medical attention and special treatment needed**
  No further relevant information available.

5 Fire-fighting measures

- **Extinguishing media**
- **Suitable extinguishing agents:**
  Use fire fighting measures that suit the environment.
  A solid water stream may be inefficient.
- **Special hazards arising from the substance or mixture** No further relevant information available.
- **Advice for firefighters**
- **Protective equipment:** No special measures required.

6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures** Not required.
- **Environmental precautions:**
  Inform respective authorities in case of seepage into water course or sewage system.
  Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:**
  Dispose contaminated material as waste according to section 13.
  Ensure adequate ventilation.

(Contd. on page 4)

(Contd. from page 3)

- **Reference to other sections**
  See Section 7 for information on safe handling.
  See Section 8 for information on personal protection equipment.
  See Section 13 for disposal information.
- **Protective Action Criteria for Chemicals**
- **PAC-1:** Substance is not listed.
- **PAC-2:** Substance is not listed.
- **PAC-3:** Substance is not listed.

7 Handling and storage

- **Handling:**
- **Precautions for safe handling**
  No special precautions are necessary if used correctly.
  Avoid breathing dust/fume/gas/mist/vapours/spray.
  Avoid prolonged or repeated exposure.
  Keep away from sources of ignition.
  Take precautionary measures against static discharge.re.
- **Information about protection against explosions and fires:** No special measures required.

- **Conditions for safe storage, including any incompatibilities**
- **Storage:** Store in accordance with information listed on the product insert.
- **Requirements to be met by storerooms and receptacles:** No special requirements.
- **Information about storage in one common storage facility:** Not required.
- **Further information about storage conditions:** Keep receptacle tightly sealed.
- **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

- **Additional information about design of technical systems:** No further data; see section 7.

- **Control parameters**
- **Components with limit values that require monitoring at the workplace:** Not required.
- **Additional information:** The lists that were valid during the creation were used as basis.

- **Exposure controls**
- **Personal protective equipment:**
- **General protective and hygienic measures:**
  Keep away from foodstuffs, beverages and feed.
  Immediately remove all soiled and contaminated clothing.
  Wash hands before breaks and at the end of work.
  Avoid contact with the eyes and skin.
- **Breathing equipment:**
  In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
- **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.

(Contd. on page 5)

(Contd. from page 4)

Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Lyophilized powder lyophilized A solution in acetonitrile Solid material
Color:	White Not determined.
· **Odor:**	Characteristic
· **Odor threshold:**	Not determined.
· **pH-value:**	Not determined.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Not applicable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not determined.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not determined.
· **Evaporation rate**	Not applicable.

(Contd. on page 6)

(Contd. from page 5)

· **Solubility in / Miscibility with** **Water:**	 Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:** **Dynamic:** **Kinematic:**	 Not determined. Not determined.
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Irritant to skin and mucous membranes.
· **on the eye:** Irritating effect.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Ecotoxical effects:**
· **Remark:** Very toxic for fish
· **Additional ecological information:**
· **General notes:**
Water hazard class 3 (Self-assessment): extremely hazardous for water
Do not allow product to reach ground water, water course or sewage system, even in small quantities.

(Contd. on page 7)

(Contd. from page 6)

Danger to drinking water if even extremely small quantities leak into the ground.
Also poisonous for fish and plankton in water bodies.
Very toxic for aquatic organisms

- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **Other adverse effects** No further relevant information available.

13 Disposal considerations

- **Waste treatment methods**
- **Recommendation:**

Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

- **Uncleaned packagings:**
- **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number**	
· **DOT, IMDG, IATA**	UN3288
· **UN proper shipping name**	
· **DOT, IATA**	Toxic solid, inorganic, n.o.s. (Perfluorooctanesulfonamide)
· **IMDG**	TOXIC SOLID, INORGANIC, N.O.S. (Perfluorooctanesulfonamide)
· **Transport hazard class(es)**	
· **DOT**	
	
· **Class**	6.1 Toxic substances
· **Label**	6.1
· **IMDG, IATA**	
	
· **Class**	6.1 Toxic substances
· **Label**	6.1
· **Packing group**	
· **DOT, IMDG, IATA**	III
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Warning: Toxic substances
· **Hazard identification number (Kemler code):**	60

(Contd. on page 8)

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· **EMS Number:**	F-A,S-A
· **Stowage Category**	A
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	
· **DOT**	
· **Quantity limitations**	On passenger aircraft/rail: 100 kg On cargo aircraft only: 200 kg
· **IMDG**	
· **Limited quantities (LQ)**	5 kg
· **Excepted quantities (EQ)**	Code: E1 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 1000 ml
· **IATA**	
· **Remarks:**	When sold in quantities of less than or equal to 1 mL, or 1 g, with an Excepted Quantity Code of E1, E2, E4, or E5, this item meets the De Minimis Quantities exemption, per IATA 2.6.10. Therefore packaging does not have to be labeled as Dangerous Goods/Excepted Quantity.
· **UN "Model Regulation":**	UN 3288 TOXIC SOLID, INORGANIC, N.O.S. (PERFLUOROOCTANESULFONAMIDE), 6.1, III, ENVIRONMENTALLY HAZARDOUS

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.
· **Sara**
· **Section 355 (extremely hazardous substances):** Substance is not listed.
· **Section 313 (Specific toxic chemical listings):** Substance is not listed.
· **TSCA (Toxic Substances Control Act):** Substance is not listed.
· **Hazardous Air Pollutants** Substance is not listed.
· **Proposition 65**
· **Chemicals known to cause cancer:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
· **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
· **Chemicals known to cause developmental toxicity:** Substance is not listed.

· **Carcinogenic categories**
· **EPA (Environmental Protection Agency)** Substance is not listed.
· **TLV (Threshold Limit Value)** Substance is not listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes

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no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

· **Department issuing SDS:** Environment protection department.
· **Contact:** -
· **Date of preparation / last revision** 11/16/2023
· **Abbreviations and acronyms:**
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 3: Acute toxicity – Category 3
Skin Irritation 2: Skin corrosion/irritation – Category 2
Eye Irritation 2A: Serious eye damage/eye irritation – Category 2A
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3
Aquatic Acute 1: Hazardous to the aquatic environment - acute aquatic hazard – Category 1
Aquatic Chronic 1: Hazardous to the aquatic environment - long-term aquatic hazard – Category 1

Safety Data Sheet
acc. to OSHA HCS

Printing date 08/14/2023 Revision date 08/14/2023

1 Identification

· **Product identifier**

· **Trade name: Perfluoropentanoic Acid**
· **Synonym** 2,2,3,3,4,4,5,5,5-nonafluoro-pentanoic acid

· **Article number:** 37254
· **CAS Number:**
2706-90-3
· **EC number:**
220-300-7
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS08 Health hazard

Toxic to Reproduction 2 H361 Suspected of damaging fertility or the unborn child.


GHS05 Corrosion

Skin Corrosion 1B	H314 Causes severe skin burns and eye damage.
Eye Damage 1	H318 Causes serious eye damage.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).

(Contd. on page 2)

(Contd. from page 1)

· **Hazard pictograms**


GHS05


GHS08

· **Signal word** Danger

· **Hazard statements**

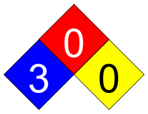
H314 Causes severe skin burns and eye damage.
H361 Suspected of damaging fertility or the unborn child.

· **Precautionary statements**

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dusts or mists.
P264	Wash thoroughly after handling.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P308+P313	IF exposed or concerned: Get medical advice/attention.
P321	Specific treatment (see on this label).
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*3
FIRE	0
REACTIVITY	0

Health = *3
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**

· **CAS No. Description**

2706-90-3 Perfluoropentanoic Acid

(Contd. on page 3)

(Contd. from page 2)

- **Identification number(s)**
- **EC number:** 220-300-7

4 First-aid measures

- **Description of first aid measures**
- **General information:** Immediately remove any clothing soiled by the product.
- **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
- **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
- **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
- **After swallowing:** Drink copious amounts of water and provide fresh air. Immediately call a doctor.
- **Information for doctor:**
- **Most important symptoms and effects, both acute and delayed**
  No further relevant information available.
- **Indication of any immediate medical attention and special treatment needed**
  No further relevant information available.

5 Fire-fighting measures

- **Extinguishing media**
- **Suitable extinguishing agents:**
  Use fire fighting measures that suit the environment.
  A solid water stream may be inefficient.
- **Special hazards arising from the substance or mixture** No further relevant information available.
- **Advice for firefighters**
- **Protective equipment:** No special measures required.

6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures**
  Wear protective equipment. Keep unprotected persons away.
- **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:**
  Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
  Use neutralizing agent.
  Dispose contaminated material as waste according to section 13.
  Ensure adequate ventilation.
- **Reference to other sections**
  See Section 7 for information on safe handling.
  See Section 8 for information on personal protection equipment.
  See Section 13 for disposal information.
- **Protective Action Criteria for Chemicals**
- **PAC-1:** Substance is not listed.
- **PAC-2:** Substance is not listed.
- **PAC-3:** Substance is not listed.

(Contd. on page 4)

(Contd. from page 3)

7 Handling and storage

- **Handling:**
- **Precautions for safe handling**
  No special precautions are necessary if used correctly.
  Avoid breathing dust/fume/gas/mist/vapours/spray.
  Avoid prolonged or repeated exposure.
  Keep away from sources of ignition.
  Take precautionary measures against static discharge.re.
- **Information about protection against explosions and fires:** No special measures required.

- **Conditions for safe storage, including any incompatibilities**
- **Storage:** Store in accordance with information listed on the product insert.
- **Requirements to be met by storerooms and receptacles:** No special requirements.
- **Information about storage in one common storage facility:** Not required.
- **Further information about storage conditions:** Keep receptacle tightly sealed.
- **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

- **Additional information about design of technical systems:** No further data; see section 7.

- **Control parameters**
- **Components with limit values that require monitoring at the workplace:** Not required.
- **Additional information:** The lists that were valid during the creation were used as basis.

- **Exposure controls**
- **Personal protective equipment:**
- **General protective and hygienic measures:**
  Keep away from foodstuffs, beverages and feed.
  Immediately remove all soiled and contaminated clothing.
  Wash hands before breaks and at the end of work.
  Avoid contact with the eyes.
  Avoid contact with the eyes and skin.
- **Breathing equipment:** Not required.
- **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

- **Material of gloves**
  The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
- **Penetration time of glove material**
  The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

(Contd. on page 5)

(Contd. from page 4)

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Liquid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C5HF9O2
· **Molecular Weight**	264 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not determined.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Not applicable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not determined.
· **Density:**	Not determined.
· **Relative density**	Not determined.
· **Vapor density**	Not determined.
· **Evaporation rate**	Not determined.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not determined.
Kinematic:	Not determined.
· **Other information**	No further relevant information available.

(Contd. on page 6)

(Contd. from page 5)

10 Stability and reactivity

- **Reactivity** No further relevant information available.
- **Chemical stability**
- **Thermal decomposition / conditions to be avoided:**
  No decomposition if used according to specifications.
- **Possibility of hazardous reactions** No dangerous reactions known.
- **Conditions to avoid** No further relevant information available.
- **Incompatible materials:** No further relevant information available.
- **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

- **Information on toxicological effects**
- **Acute toxicity:**
- **Primary irritant effect:**
- **on the skin:** Caustic effect on skin and mucous membranes.
- **on the eye:**
  Strong caustic effect.
  Strong irritant with the danger of severe eye injury.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**
  Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

- **Carcinogenic categories**
- **IARC (International Agency for Research on Cancer)** Substance is not listed.
- **NTP (National Toxicology Program)** Substance is not listed.
- **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

- **Toxicity**
- **Aquatic toxicity:** No further relevant information available.
- **Persistence and degradability** No further relevant information available.
- **Behavior in environmental systems:**
- **Bioaccumulative potential** No further relevant information available.
- **Mobility in soil** No further relevant information available.
- **Additional ecological information:**
- **General notes:**
  Water hazard class 1 (Self-assessment): slightly hazardous for water
  Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
  Must not reach bodies of water or drainage ditch undiluted or unneutralized.
- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **Other adverse effects** No further relevant information available.

(Contd. on page 7)

(Contd. from page 6)

13 Disposal considerations

- **Waste treatment methods**
- **Recommendation:**
  Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

- **Uncleaned packagings:**
- **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

- **Safety, health and environmental regulations/legislation specific for the substance or mixture**
  No further relevant information available.
- **Sara**
- **Section 355 (extremely hazardous substances):** Substance is not listed.
- **Section 313 (Specific toxic chemical listings):** Substance is not listed.
- **TSCA (Toxic Substances Control Act):** ACTIVE
- **Hazardous Air Pollutants** Substance is not listed.
- **Proposition 65**
- **Chemicals known to cause cancer:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
- **Chemicals known to cause developmental toxicity:** Substance is not listed.

- **Carcinogenic categories**
- **EPA (Environmental Protection Agency)** Substance is not listed.
- **TLV (Threshold Limit Value)** Substance is not listed.
- **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.

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Safety Data Sheet
acc. to OSHA HCS

(Contd. from page 7)

· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

· **Department issuing SDS:** Environment protection department.
· **Contact:** -
· **Date of preparation / last revision** 08/14/2023
· **Abbreviations and acronyms:**
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Skin Corrosion 1B: Skin corrosion/irritation – Category 1B
Eye Damage 1: Serious eye damage/eye irritation – Category 1
Toxic to Reproduction 2: Reproductive toxicity – Category 2

1 Identification

· **Product identifier**

· **Trade name: Perfluoropentanesulfonic Acid**
· **Synonym**

· **Article number:** 37253
· **CAS Number:**
2706-91-4
· **EC number:**
220-301-2
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS05 Corrosion

Skin Corrosion 1A	H314 Causes severe skin burns and eye damage.
Eye Damage 1	H318 Causes serious eye damage.


GHS07

Acute Toxicity - Oral 4	H302 Harmful if swallowed.
Specific Target Organ Toxicity - Single Exposure 3	H335 May cause respiratory irritation.

· **Label elements**
· **GHS label elements**
The substance is classified and labeled according to the Globally Harmonized System (GHS).

(Contd. on page 2)

(Contd. from page 1)

· **Hazard pictograms**

GHS05

GHS07

· **Signal word** Danger

· **Hazard statements**

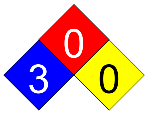
H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.
H335 May cause respiratory irritation.

· **Precautionary statements**

P260	Do not breathe dusts or mists.
P264	Wash 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/doctor if you feel unwell.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P321	Specific treatment (see on this label).
P363	Wash contaminated clothing before reuse.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*3
FIRE	0
REACTIVITY	0

Health = *3
Fire = 0
Reactivity = 0

· **Other hazards**

· **Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

(Contd. on page 3)

(Contd. from page 2)

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
2706-91-4 Perfluoropentanesulfonic Acid
· **Identification number(s)**
· **EC number:** 220-301-2

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Immediately remove any clothing soiled by the product.
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:**
Immediately call a doctor.
Drink copious amounts of water and provide fresh air. Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** No special measures required.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Use neutralizing agent.
Dispose contaminated material as waste according to section 13.
Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

(Contd. on page 4)

(Contd. from page 3)

- **Protective Action Criteria for Chemicals**
- **PAC-1:** Substance is not listed.
- **PAC-2:** Substance is not listed.
- **PAC-3:** Substance is not listed.

7 Handling and storage

- **Handling:**
- **Precautions for safe handling** Thorough dedusting.
- **Information about protection against explosions and fires:** No special measures required.

- **Conditions for safe storage, including any incompatibilities**
- **Storage:** Store in accordance with information listed on the product insert.
- **Requirements to be met by storerooms and receptacles:** No special requirements.
- **Information about storage in one common storage facility:** Not required.
- **Further information about storage conditions:** Keep receptacle tightly sealed.
- **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

- **Additional information about design of technical systems:** No further data; see section 7.

- **Control parameters**
- **Components with limit values that require monitoring at the workplace:** Not required.
- **Additional information:** The lists that were valid during the creation were used as basis.

- **Exposure controls**
- **Personal protective equipment:**
- **General protective and hygienic measures:**
  Keep away from foodstuffs, beverages and feed.
  Immediately remove all soiled and contaminated clothing.
  Wash hands before breaks and at the end of work.
  Avoid contact with the eyes.
  Avoid contact with the eyes and skin.
- **Breathing equipment:**
  In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
- **Protection of hands:**

  Protective gloves

  The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
  Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
  Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
- **Material of gloves**
  The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
- **Penetration time of glove material**
  The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

(Contd. on page 5)

(Contd. from page 4)

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C5HF11O3S
· **Molecular Weight**	350.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	>300 °C (>572 °F)
Boiling point/Boiling range:	225 °C (437 °F)
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density at 20 °C (68 °F):**	1.844 g/cm^3 (15.38818 lbs/gal)
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Other information**	No further relevant information available.

(Contd. on page 6)

(Contd. from page 5)

10 Stability and reactivity

- **Reactivity** No further relevant information available.
- **Chemical stability**
- **Thermal decomposition / conditions to be avoided:**
  No decomposition if used according to specifications.
- **Possibility of hazardous reactions** No dangerous reactions known.
- **Conditions to avoid** No further relevant information available.
- **Incompatible materials:** No further relevant information available.
- **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

- **Information on toxicological effects**
- **Acute toxicity:**
- **Primary irritant effect:**
- **on the skin:** Strong caustic effect on skin and mucous membranes.
- **on the eye:**
  Strong caustic effect.
  Strong irritant with the danger of severe eye injury.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**
  Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

- **Carcinogenic categories**
- **IARC (International Agency for Research on Cancer)** Substance is not listed.
- **NTP (National Toxicology Program)** Substance is not listed.
- **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

- **Toxicity**
- **Aquatic toxicity:** No further relevant information available.
- **Persistence and degradability** No further relevant information available.
- **Behavior in environmental systems:**
- **Bioaccumulative potential** No further relevant information available.
- **Mobility in soil** No further relevant information available.
- **Additional ecological information:**
- **General notes:**
  Water hazard class 1 (Self-assessment): slightly hazardous for water
  Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
  Must not reach bodies of water or drainage ditch undiluted or unneutralized.
- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **Other adverse effects** No further relevant information available.

(Contd. on page 7)

(Contd. from page 6)

13 Disposal considerations

- **Waste treatment methods**
- **Recommendation:**
  Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

- **Uncleaned packagings:**
- **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

- **Safety, health and environmental regulations/legislation specific for the substance or mixture**
  No further relevant information available.
- **Sara**
- **Section 355 (extremely hazardous substances):** Substance is not listed.
- **Section 313 (Specific toxic chemical listings):** Substance is not listed.
- **TSCA (Toxic Substances Control Act):** INACTIVE
- **Hazardous Air Pollutants** Substance is not listed.
- **Proposition 65**
- **Chemicals known to cause cancer:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
- **Chemicals known to cause developmental toxicity:** Substance is not listed.

- **Carcinogenic categories**
- **EPA (Environmental Protection Agency)** Substance is not listed.
- **TLV (Threshold Limit Value)** Substance is not listed.
- **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.

(Contd. on page 8)

(Contd. from page 7)

· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

· **Department issuing SDS:** Environment protection department.
· **Contact:** -
· **Date of preparation / last revision** 11/28/2023
· **Abbreviations and acronyms:**
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Oral 4: Acute toxicity – Category 4
Skin Corrosion 1A: Skin corrosion/irritation – Category 1A
Eye Damage 1: Serious eye damage/eye irritation – Category 1
Specific Target Organ Toxicity - Single Exposure 3: Specific target organ toxicity (single exposure) – Category 3

Safety Data Sheet
acc. to OSHA HCS

1 Identification

· **Product identifier**

· **Trade name: Perfluorotetradecanoic Acid**
· **Synonym**

· **Article number:** 37255
· **CAS Number:**
376-06-7
· **EC number:**
206-803-4
· **Application of the substance / the mixture**
This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Cayman Chemical Co.
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
USA

· **Information department:** Product safety department
· **Emergency telephone number:**
During normal opening times: +1 (734) 971-3335
US/CANADA: 800-424-9300
Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

· **Classification of the substance or mixture**

GHS08 Health hazard

Carcinogenicity 2	H351	Suspected of causing cancer.
Toxic to Reproduction 1B	H360-H362	May damage fertility or the unborn child. May cause harm to breast-fed children.
Specific Target Organ Toxicity - Repeated Exposure 1	H372	Causes damage to organs through prolonged or repeated exposure.

GHS05 Corrosion

Skin Corrosion 1B	H314	Causes severe skin burns and eye damage.

(Contd. on page 2)

(Contd. from page 1)

GHS07

Acute Toxicity - Inhalation 4	H332	Harmful if inhaled.

· **Label elements**

· **GHS label elements**

The substance is classified and labeled according to the Globally Harmonized System (GHS).

· **Hazard pictograms**

GHS05 GHS07 GHS08

· **Signal word** Danger

· **Hazard statements**

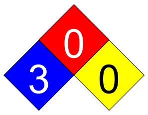
H332	Harmful if inhaled.
H314	Causes severe skin burns and eye damage.
H351	Suspected of causing cancer.
H360-H362	May damage fertility or the unborn child. May cause harm to breast-fed children.
H372	Causes damage to organs through prolonged or repeated exposure.

· **Precautionary statements**

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dusts or mists.
P263	Avoid contact during pregnancy/while nursing.
P264	Wash 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+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep 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/doctor.
P308+P313	IF exposed or concerned: Get medical advice/attention.
P321	Specific treatment (see on this label).
P314	Get medical advice/attention if you feel unwell.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

(Contd. on page 3)

(Contd. from page 2)

· **HMIS-ratings (scale 0 - 4)**

HEALTH	*3
FIRE	0
REACTIVITY	0

Health = *3
Fire = 0
Reactivity = 0

· **Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.

· **vPvB:**	
376-06-7	Perfluorotetradecanoic Acid

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
376-06-7 Perfluorotetradecanoic Acid
· **Identification number(s)**
· **EC number:** 206-803-4

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Immediately remove any clothing soiled by the product.
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:**
Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:** Drink copious amounts of water and provide fresh air. Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
Use fire fighting measures that suit the environment.
A solid water stream may be inefficient.
· **Special hazards arising from the substance or mixture** No further relevant information available.

(Contd. on page 4)

(Contd. from page 3)

· **Advice for firefighters**
· **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Use neutralizing agent.
Dispose contaminated material as waste according to section 13.
Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**
· **PAC-1:** Substance is not listed.
· **PAC-2:** Substance is not listed.
· **PAC-3:** Substance is not listed.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Thorough dedusting.
Ensure good ventilation/exhaustion at the workplace.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:** Store in accordance with information listed on the product insert.
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see section 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes and skin.

(Contd. on page 5)

(Contd. from page 4)

· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.

· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	A low melting solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Structural Formula**	C14HF27O2
· **Molecular Weight**	714.1 g/mol
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Ignition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.

(Contd. on page 6)

(Contd. from page 5)

Upper:	Not determined.
· **Vapor pressure:**	Not applicable.
· **Density:** · **Relative density** · **Vapor density** · **Evaporation rate**	Not determined. Not determined. Not applicable. Not applicable.
· **Solubility in / Miscibility with Water:**	Not determined.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:** **Dynamic:** **Kinematic:**	 Not applicable. Not applicable.
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Caustic effect on skin and mucous membranes.
· **on the eye:** Strong caustic effect.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

· **Carcinogenic categories**
· **IARC (International Agency for Research on Cancer)** Substance is not listed.
· **NTP (National Toxicology Program)** Substance is not listed.
· **OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.

(Contd. on page 7)

(Contd. from page 6)

· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 2 (Self-assessment): hazardous for water
Do not allow product to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.
Danger to drinking water if even small quantities leak into the ground.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.

· **vPvB:**	
376-06-7	Perfluorotetradecanoic Acid

· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number** · **DOT, IMDG, IATA**	not regulated
· **UN proper shipping name** · **DOT, IMDG, IATA**	not regulated
· **Transport hazard class(es)** · **DOT, ADN, IMDG, IATA** · **Class**	not regulated
· **Packing group** · **DOT, IMDG, IATA**	not regulated
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	not regulated

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
No further relevant information available.

(Contd. on page 8)

(Contd. from page 7)

- **Sara**
- **Section 355 (extremely hazardous substances):** Substance is not listed.
- **Section 313 (Specific toxic chemical listings):** Substance is listed.
- **TSCA (Toxic Substances Control Act):** ACTIVE
- **Hazardous Air Pollutants** Substance is not listed.
- **Proposition 65**
- **Chemicals known to cause cancer:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for females:** Substance is not listed.
- **Chemicals known to cause reproductive toxicity for males:** Substance is not listed.
- **Chemicals known to cause developmental toxicity:** Substance is not listed.

- **Carcinogenic categories**
- **EPA (Environmental Protection Agency)** Substance is not listed.
- **TLV (Threshold Limit Value)** Substance is not listed.
- **NIOSH-Ca (National Institute for Occupational Safety and Health)** Substance is not listed.
- **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

- **Department issuing SDS:** Environment protection department.
- **Contact:** -
- **Date of preparation / last revision** 09/26/2023
- **Abbreviations and acronyms:**

IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Toxicity - Inhalation 4: Acute toxicity – Category 4
Skin Corrosion 1B: Skin corrosion/irritation – Category 1B
Carcinogenicity 2: Carcinogenicity – Category 2
Toxic to Reproduction 1B: Reproductive toxicity – Category 1B
Specific Target Organ Toxicity - Repeated Exposure 1: Specific target organ toxicity (repeated exposure) – Category 1

SAFETY DATA SHEET

Version 6.3
Revision Date 10/27/2021
Print Date 10/05/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Perfluorotridecanoic acid

Product Number : 654973
Brand : Aldrich
CAS-No. : 72629-94-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

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

Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 4), H332
Carcinogenicity (Category 2), H351
Reproductive toxicity (Category 1B), H360
Effects on or via lactation, H362
Specific target organ toxicity - repeated exposure (Category 1), Liver, H372

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

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)

H302 + H332	Harmful if swallowed or if inhaled.
H351	Suspected of causing cancer.
H360	May damage fertility or the unborn child.
H362	May cause harm to breast-fed children.
H372	Causes damage to organs (Liver) through prolonged or repeated exposure.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P263	Avoid contact during pregnancy/ while nursing.
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 + P330	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor if you feel unwell.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

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

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SECTION 3: Composition/information on ingredients

3.1 Substances

Formula : $C_{13}HF_{25}O_2$

Molecular weight : 664.11 g/mol

CAS-No. : 72629-94-8

EC-No. : 276-745-2

Component	Classification	Concentration
Perfluorotridecanoic acid		
	Acute Tox. 4; Carc. 2; Repr. 1B; Lact. ; STOT RE 1; H302, H332, H351, H360, H362, H372	<= 100 %

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

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Immediately call in physician. If breathing stops: immediately apply artificial respiration, if necessary also oxygen.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Nature of decomposition products not known.
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class
Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

Respiratory protection
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 112 - 123 °C (234 - 253 °F) - lit.
f)	Initial boiling point and boiling range	No data available
g)	Flash point	()Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid,	No data available

	gas)	
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

no information available

10.5 Incompatible materials

Strong oxidizing agents

10.6 Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Acute toxicity estimate Oral - 500.1 mg/kg
(Expert judgment)
Acute toxicity estimate Inhalation - 4 h - 11.1 mg/l - vapor

(Expert judgment)
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available
No data available
No data available

Carcinogenicity
Suspected of causing cancer.

IARC:	No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
NTP:	No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is on OSHA’s list of regulated carcinogens.

Reproductive toxicity
May damage the unborn child.
Studies indicating a hazard to babies during the lactation period

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Causes damage to organs through prolonged or repeated exposure. - Liver

Aspiration hazard
No data available

11.2 Additional Information

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

After absorption:

gastric pain
Nausea
Vomiting

Drowsiness
somnolence

Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

12.1 Toxicity

No data available

Toxicity to daphnia and other aquatic invertebrates	Remarks: No data available (Perfluorotridecanoic acid)
Toxicity to algae	Remarks: No data available (Perfluorotridecanoic acid)

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

DOT (US)

Not dangerous goods

IMDG

Not dangerous goods

IATA
Not dangerous goods

Further information
Not classified as dangerous in the meaning of transport regulations.

SECTION 15: Regulatory information

SARA 302 Components
This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
No SARA Hazards

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

Perfluorotridecanoic acid	CAS-No. 72629-94-8	Revision Date

New Jersey Right To Know Components

Perfluorotridecanoic acid	CAS-No. 72629-94-8	Revision Date

SECTION 16: Other information

Further information
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

The branding on the header and/or footer of this document may temporarily not visually match the product purchased as we transition our branding. However, all of the information in the document regarding the product remains unchanged and matches the product ordered. For further information please contact mlsbranding@sial.com.

Version: 6.3 Revision Date: 10/27/2021 Print Date: 10/05/2024

SAFETY DATA SHEET

Version 6.8
Revision Date 09/07/2024
Print Date 09/08/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name	:	Perfluoroundecanoic acid
Product Number	:	446777
Brand	:	Aldrich
CAS-No.	:	2058-94-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses	:	Laboratory chemicals, Synthesis of substances
Uses advised against	:	The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient’s responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich Inc. 3050 SPRUCE ST ST. LOUIS MO 63103 UNITED STATES
Telephone	:	+1 314 771-5765
Fax	:	+1 800 325-5052

1.4 Emergency telephone

Emergency Phone #	:	800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

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

Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 4), H332
Serious eye damage (Category 1), H318
Carcinogenicity (Category 2), H351

Reproductive toxicity (Category 1B), H360
Effects on or via lactation, H362
Specific target organ toxicity - repeated exposure (Category 1), Liver, H372

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

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal Word Danger

Hazard Statements	
H302 + H332	Harmful if swallowed or if inhaled.
H318	Causes serious eye damage.
H351	Suspected of causing cancer.
H360	May damage fertility or the unborn child.
H362	May cause harm to breast-fed children.
H372	Causes damage to organs (Liver) through prolonged or repeated exposure.

Precautionary Statements	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust.
P263	Avoid contact during pregnancy/ while nursing.
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 + P330	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor if you feel unwell.
P305 + P351 + P338 + P310	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

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

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SECTION 3: Composition/information on ingredients

3.1 Substances

Formula : $C_{11}HF_{21}O_2$
Molecular weight : 564.09 g/mol
CAS-No. : 2058-94-8

EC-No. : 218-165-4

Component	Classification	Concentration
Henicosafluoroundecanoic acid		
	Acute Tox. 4; Eye Dam. 1; Carc. 2; Repr. 1B; Lact. ; STOT RE 1; H302, H332, H318, H351, H360, H362, H372	<= 100 %

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

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Immediately call in physician. If breathing stops: immediately apply artificial respiration, if necessary also oxygen.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides
Hydrogen fluoride
Combustible.
Vapors are heavier than air and may spread along floors.
Forms explosive mixtures with air on intense heating.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Work under hood. Do not inhale substance/mixture.

Hygiene measures

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class
Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

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SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection
Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter type P3

The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/ range: 96 - 101 °C (205 - 214 °F) - lit.
f)	Initial boiling point and boiling range	160 °C 320 °F at 80 hPa - lit.
g)	Flash point	113 °C (235 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available

s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

Forms explosive mixtures with air on intense heating.
A range from approx. 15 Kelvin below the flash point is to be rated as critical.
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

Violent reactions possible with:
Oxidizing agents

10.4 Conditions to avoid

Strong heating.

10.5 Incompatible materials

No data available

10.6 Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Acute toxicity estimate Oral - 500.1 mg/kg
(Expert judgment)
Acute toxicity estimate Inhalation - 4 h - 11.1 mg/l - vapor

(Expert judgment)
Dermal: No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
Remarks: Causes serious eye damage.

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
Suspected of causing cancer.

IARC:	No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
NTP:	No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is on OSHA’s list of regulated carcinogens.

Reproductive toxicity
May damage the unborn child.
Studies indicating a hazard to babies during the lactation period

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Causes damage to organs through prolonged or repeated exposure.
- Liver

Aspiration hazard
No data available

11.2 Additional Information

After absorption:

gastric pain
Nausea
Vomiting
Drowsiness
somnolence

Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

12.1 Toxicity

No data available

Toxicity to daphnia and other aquatic invertebrates	Remarks: No data available (Henicosafluoroundecanoic acid)
Toxicity to algae	Remarks: No data available (Henicosafluoroundecanoic acid)
Toxicity to daphnia and other aquatic	Remarks: No data available (Henicosafluoroundecanoic acid)

invertebrates(Chronic toxicity)

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)
Not dangerous goods

IMDG
Not dangerous goods

IATA
Not dangerous goods

Further information
Not classified as dangerous in the meaning of transport regulations.

SECTION 15: Regulatory information

CERCLA Reportable Quantity

This material does not contain any components with a CERCLA RQ.

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Acute Health Hazard

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

US State Regulations

Massachusetts Right To Know

No components are subject to the Massachusetts Right to Know Act.

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

Washington Chemicals of High Concern

Product does not contain any listed chemicals

The ingredients of this product are reported in the following inventories:

TSCA : Product contains substance(s) not listed on TSCA inventory.

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact

Version: 6.8 Revision Date: 09/07/2024 Print Date: 09/08/2024

APPENDIX F

JOBSITE SAFETY INSPECTION CHECKLIST

Job Safety Inspection Checklist **Health & Safety**	LANGAN
Document #: HSE-HASP-JSIC-FRM-01	Version #: 01

Date: ______________________ **Inspected By:** ______________________

Location: ______________________ **Project #:** ______________________

Check one of the following: **A:** Acceptable **NA**: Not Applicable **D**: Deficiency

	A	NA	D	Remarks
1. HASP available on site for inspection?				
2. Health & Safety Compliance agreement (in HASP) appropriately signed by Langan employees and subcontractors?				
3. Hospital route map with directions posted on site?				
4. Emergency Notification List posted on site?				
5. First Aid kit available and properly stocked?				
6. Personnel trained in CPR/First Aid on site?				
7. SDSs readily available, and workers knowledgeable about the specific chemicals and compounds to which they may be exposed?				
8. Appropriate PPE being worn by Langan employees and subcontractors?				
9. Project site safe practices ("Standing Orders") posted?				
10. Project staff have 40-hr./8-hr./Supervisor HAZWOPER training?				
11. Project staff medically cleared to work in hazardous waste sites and fit-tested to wear respirators, if needed?				
12. Respiratory protection readily available?				
13. Health & Safety Incident Report forms available?				
14. Air monitoring instruments calibrated daily and results recorded on the Daily Instrument Calibration check sheet?				
15. Air monitoring readings recorded on the air monitoring data sheet/field logbook?				
16. Subcontract workers have received 40-hr./8-hr./Spvsr. HAZWOPER training, as appropriate?				
17. Subcontract workers medically cleared to work on site, and fit-tested for respirator wear?				
18. Subcontract workers have respirators readily available?				
19. Markouts of underground utilities done prior to initiating subsurface activities?				

20. Decontamination procedures being followed as outlined in HASP?				
21. Are tools in good condition and properly used?				
22. Drilling performed in areas free from underground objects including utilities?				
23. Adequate size/type fire extinguisher supplied?				
24. Equipment at least 20 feet from overhead powerlines?				
25. Evidence that drilling operator is responsible for the safety of his rig.				
26. Trench sides shored, layed back, or boxed?				
27. Underground utilities located, and authorities contacted before digging?				
28. Ladders in trench (25-foot spacing)?				
29. Excavated material placed more than 2 feet away from excavation edge?				
30. Public protected from exposure to open excavation?				
31. People entering the excavation regarding it as a permit-required confined space and following appropriate procedures?				
32. Confined space entry permit is completed and posted?				
33. Persons knowledgable about the conditions and characteristics of the confined space?				
34. Persons engaged in confined space operations have been trained in safe entry and rescue (non-entry)?				
35. Full body harnesses, lifelines, and hoisting apparatus available for rescue needs?				
36. Attendant and/or supervisor certified in basic first aid and CPR?				
37. Confined space atmosphere checked before entry and continuously while the work is going on?				
38. Results of confined space atmosphere testing recorded?				
39. Evidence of coordination with off-site rescue services to perform entry rescue, if needed?				
40. Are extension cords rated for this work being used and are they properly maintained?				
41. Are GFCIs provided and being used?				

Unsafe Acts: ____

Notes: ____

APPENDIX G

JOB SAFETY ANALYSIS FORM

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Direct-Push Soil Borings**
JSA Number: **JSA004-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.

***S** – **Stop**, what has changed?*
***T** – **Think** about the task*
***E** – **Evaluate** potential hazards*
***P** – **Plan** safe approach*
***S** - **Start** task / **Stop** & regroup*

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☒ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	

☒ Other: Half-face respirator, dust cartridges, PID (if applicable)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. Move equipment to work site	1. Back strain when lifting equipment 2. Slips/ Trips/ Falls while moving equipment 3. Traffic (if applicable) 4. Pinched fingers or running over toes during geoprobe set-up 5. Overturn drilling rig while transporting to loading dock on flat-bed tow truck	1. Use proper lifting technique (use legs for bending and lifting and not the back)/ Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle 2. Use proper lifting technique (use legs for bending and lifting and not the back) / Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle / Have unobstructed path to vehicle or collection point / Do not lift/walk with boxes that are heavy/difficult to lift 3. Wear high visibility safety vests or clothing / Exercise caution 4. Wear proper PPE (cut-resistant gloves) / Stay alert, be aware of geoprobe rig at all times 5. Drill rig should be parked in center of flat-bed tow truck / Emergency brake shall be used at all times during transport on the flat-bed truck/ All unnecessary personnel should stay away from the flat-bed truck during moving activities
2. Calibration of monitoring equipment	1. Skin or eye contact with calibration chemicals 2. Pinch fingers in monitoring equipment	1. Wear proper PPE (safety glasses/ goggles) 2. Wear proper PPE (leather gloves)
3. Set-up geoprobe rig	1. Geoprobe rig movement	1. All field personnel should stay clear of the geoprobe rig while moving / Use a spotter when backing up the geoprobe
4. Advance geoprobe rods below ground surface to desired depth	1. Underground utilities 2. High noise levels	1. Clean all subsurface soil borings to a minimum of 5 feet below grade 2. Wear proper PPE (hearing protection)
5. Remove and open acetate liner	1. Pinched fingers while removing macrocore 2. Cuts/lacerations when cutting acetate liner open	1. Wear proper PPE (nitrile gloves, cut-resistant or leather gloves 2. Wear proper PPE (cut-resistant or leather gloves)

JSA Title: Direct-Push Soil Borings
JSA Number: JSA004-01

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
5. Remove and open acetate liner (cont'd)	3. Exposure to hazardous vapors 4. Skin contact with contaminated soil	3. Do not place face over acetate liner when opening / Monitor hazardous vapors in air with PID / Upgrade PPE as necessary based on levels contained in the Health and Safety Plan 4. Wear proper PPE (nitrile gloves)
6. Sample Collections a) Monitor parameters b) Prepare sample containers and labels	1. Contact with potentially contaminated soil 2. Lacerations from broken sample bottles 3. Back strain while transporting full coolers 4. Internal exposure to contaminants and metals through inhalation of dust 5. Slips/ Trips/ Falls	1. Use monitoring devices / Wear proper PPE (safety glasses, nitrile gloves) 2. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage 3. Use proper lifting techniques / Do not lift heavy loads without assistance 4. Avoid creating dust / If necessary, wear a half mask respirator with applicable dust cartridge / Inspect respirator for damage and cleanliness prior to use / Clean respirator after each use and store in a clean, secure location 5. Be alert / Follow good housekeeping procedures
7. Remove excess soil from acetate liner and place in 55-gallon drum (IF NOT PERFORMED BY LANGAN, REMOVE!)	1. Cuts/lacerations from acetate liner 2. Pinched fingers/hand while opening/closing drum 3. Skin contact with contaminated soil 4. Soil debris in eyes	1. Wear proper PPE (cut-resistant or leather gloves) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Wear proper PPE (nitrile gloves) 4. Wear proper PPE (safety glasses)
8. Transport drums to central staging location (IF NOT PERFORMED BY LANGAN, REMOVE!)	1. Back, arm or shoulder strain from moving drums 2. Pinch fingers/hand in drum cart when moving drums 3. Pinch fingers/hand when operating lift-gate on vehicle 4. Contact with potentially contaminated groundwater when moving improperly sealed drums 5. Slips when moving drums 6. Drop drum on feet/toes	1. Use drum cart for moving drums / Use proper lifting techniques / Do not lift heavy loads without assistance 2. Wear proper PPE (cut-resistant or leather gloves) 3. Wear proper PPE (cut-resistant or leather gloves) 4. Wear proper PPE (nitrile gloves underneath work gloves) 5. Follow good housekeeping procedures / Ensure route to move drum and storage space is free from obstructions 6. Wear proper PPE (safety shoes) / Work in a safe manner to prevent dropped drum
9. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 5. Wear high visibility clothing & vest / Use cones or signs to designate work area 6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 7. Wear hearing protection

JSA Title: Direct-Push Soil Borings
JSA Number: JSA004-01

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
9. All activities (cont'd)	8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries	8. Wear hard hat / Avoid areas were overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 10. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Driving (Travel)**
JSA Number: **JSA059**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.

S – Stop, *what has changed?*
T – Think *about the task*
E – Evaluate *potential hazards*
P – Plan *safe approach*
S - Start *task /* **Stop** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☐ Safety Boots	☐ Long Sleeves	☐ Safety Vest (Class 2)	☐ Hard Hat	☐ Hearing Protection
☐ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☐ Nitrile Gloves	☐ PVC Gloves
☐ Task Specific Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	☐ Impact Gloves

☒ Other: Seat belt utilized, Travel Route, Itinerary

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. Vehicle inspection prior to departure	1. Slip, Trip, Fall 2. Hitting obstructions, unseen objects 3. Vehicle start: Rotating parts, belts, dashboard light indicators 4. Opening and closing vehicle doors	1. Do not carry anything when entering vehicle. Load equipment/bags/gear into vehicle first 2. Perform a 360º vehicle walk around to identify any hazards/objects in vehicle vicinity. Identify safest way to depart. Inspect vehicle for any damage that occurred on vehicle while not in motion. 3. Listen to engine when starting vehicle, make sure radio is off to listen to engine/belts. Note if any dashboard indicator lights indicate a vehicular issue 4. Check to make sure fingers, other body parts, or equipment are not between door/tailgate and frame before closing doors
2. Driving Vehicle	1. Backing up 2. Driving 3. Road Rage 4. Wildlife 5. Fatigue / Under the influnce 6. Distracted driving 7. Other vehicle 8. Other objects	1. Use a spotter to back up if available. Only back up if first forward motion is not a possibility. If backing up, honk horn prior to backing up 2. Drive defensively and abide by all laws. Know intended travel route (have directions). Obey posted signage. 3. Do not engage aggressive drivers, do not respond to hostile drivers/road rage, pass with caution. 4. Watch for wildlife signs. Reduce speed when wildlife is nearby. Avoid swerving into stationary items or oncoming traffic. 5. Ensure proper rest before travel. Pull over if you become drowsy. No alcohol or drugs prior to or while driving.

JSA Title: Travel
JSA Number:

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		6. No use of hands free devices or cell phones while driving. Focus on driving and avoid all distractions while driving. 7. Maintain safe distance from vehicles in front. Proper following distance – 3 second rule 8. Scan area in front of vehicle for flying objects. Be alert when approaching oncoming vehicles on curved or winding portions of the road. Proper clearance around objects - turning radius. Ensure windshield is safe – no cracks or other damage.
9. Weather	1. Inclement Weather	1. Check for inclement weather prior to travel. Have appropriate wiper fluid, antifreeze, salt, sand etc. as needed. Take alternate route if necessary
10. Vehicle Fueling	1. Damage to vehicle/fuel pumps 2. Slip/Trips/Falls 3. Fuel Spills 4. Fires/Explosion/Burns	1. Pay attention and use caution when approaching fuel pumps. Ensure fuel nozzle is removed from vehicle prior to leaving. Ensure vehicle is placed in "park" and turned-off before exiting vehicle 2. Do not attempt to step over fuel hose while fueling. 3. Insert fuel nozzle fully to avoid spills. Never leave vehicle unattended while fueling. Know where Emergency Stop Button is located. Notify fuel station employees if fuel spill occurs. Do not overfill vehicles, stop fueling when auto-shutoff works. 4. Touch vehicle and pump prior to fueling to dissipate static electricity. No smoking and no cellphones while fueling.
11. Parking	1. Parking Vehicle	1. Park so when departing on next trip the first motion is forward. Use a spotter if one is available. Park in well-lit secure areas

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: Environmental Sampling
JSA Number: JSA021-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.

S – *Stop, what has changed?*
T – *Think about the task*
E – *Evaluate potential hazards*
P – *Plan safe approach*
S - *Start task / **Stop** & regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☐ Hard Hat	☐ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☐ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☒ Insect/Animal Repellent	☒ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	

☒ Other: Tyvek Sleeves

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. Drive to sample location	1. Unfamiliar terrain	1. Pay attention to road conditions such as road erosion, unprotected embankments, and soft road conditions.
2. Sample Collection (Walking)	1. Slip/Trips/Falls 2. Back strains 3. Wildlife (Insects, Stray animals, rodents) 4. Poisonous vegetation	1. Minimize distance to sample area/ Plan route and check surface prior to carrying heavy equipment/ Locate safest access point/ Follow good housekeeping procedures/ Mark significant below grade hazards (holes, trenches) with spray paint or cones/ Wear foot protection with ankle support and gripping soles. 2. Use proper lifting techniques/ Use wheeled transport/ Obtain assistance where and when needed/ Consider load weight when evaluating what is safe and unsafe to carry. 3. Be aware of surroundings for the presence of wildlife/ Do not approach stray animals/ Carry and use animal repellant when needed/ Use bug spray when needed. 4. Keep skin covered/ Identify and avoid poisonous vegetation/ Clean areas after contact with suspected vegetation.
3. Sample Collection (Water)	1. Drowning Hazards 2. Chemical burns (when adding acid preservative to sample) 3. Back Strains 4. Ergonomic issues 5. Slip/Trips/Falls	1. Use buddy system. 2. Wear proper PPE (Nitrile gloves, Tyvek Sleeves) 3. Use proper lifting techniques/ Use wheeled transport/ Obtain assistance where and when needed/ Consider load weight when evaluating what is safe or unsafe to carry. 4. When possible avoid bending over for long periods of time/ Use a small stool for sitting or knee pad for kneeling. 5. Minimize distance to sample area/ Plan route and check surface prior to

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		carrying heavy equipment/ Locate safest access point/ Follow good housekeeping procedures/ Mark significant below grade hazards (holes, trenches) with spray paint or cones/ Wear foot protection with ankle support and gripping soles/ Avoid standing water or slippery terrain.
4. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels 8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 5. Wear high visibility clothing & vest / Use cones or signs to designate work area 6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 7. Wear hearing protection 8. Wear hard hat / Avoid areas were overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 10. Wear safety glasses

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: Groundwater Sampling
JSA Number: JSA008-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.

S – Stop, *what has changed?*
T – Think *about the task*
E – Evaluate *potential hazards*
P – Plan *safe approach*
S - Start task / Stop *& regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☐ Hard Hat	☐ Hearing Protection
☒ Safety Glasses	☒ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	

☒ Other: Tyvek sleeves, Dermal Protection, PID

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. Transport equipment to work area	1. Back Strain 2. Slips/ Trips/ Falls 3. Traffic 4. Cuts/abrasions from equipment 5. Contusions from dropped equipment	1. Use proper lifting techniuqes / Use wheeled transport 2. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 3. Wear proper PPE (high visibility vest or clothing) 4. Wear proper PPE (leather gloves, long sleeves) 5. Wear proper PPE (safety shoes)
2. Remove well cover if present	1. Scrape knuckles/hand 2. Strain wrist/bruise plam 3. Pinch fingers or hand	1. Wear proper PPE (leather gloves) 2. Using a hammer, tap the end of the wrench to loosen grip of bolts 3. Wear proper PPE (leather gloves)
3. Remove well cap and lock if present	1. Well can pops from pressure 2. Exposure to hazardous substances through inhalation or dermal exposure 3. Scrape knuckles/hand 4. Strain write/bruise palm	1. Remove cap slowly to relieve pressure / Do not place face over well when opening / Wear proper PPE (safety glasses) 2. Use direct air monitoring/reading instrument (i.e. PID) / Be familiar with and follow actions prescribed in the HASP / Wear proper PPE (nitrile gloves) 3. Wear proper PPE (leather gloves) 4. Using hammer, tap the end of the wrench to loosen grip
4. Measure head-space vapor levels	1. Exposure to hazardous substances through inhalation	1. Do not place face over well when collecting measurement
5. Remove deciated tubing (if necessary)	1. Exposure to hazardous substances through inhalation or dermal exposure 2. Tubing swings around after removal	1. Wear proper PPE (nitrile gloves, Tyvek sleeves) 2. Wear proper PPE (safety glasses)
6. Set-up plastic sheeting for work site around the area	1. Lacerations when cutting plastic sheeting	1. Use scissors to cut plastic sheeting / Cut motions should always be away from body and body parts

JSA Title: Groundwater Sampling
JSA Number: JSA008-01

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
7. Calibrate monitoring equipment	1. Skin or eye contact with calibration chemicals 2. Pinch fingers or hand in monitoring equipment	1. Wear proper PPE (safety glasses, nitrile gloves) 2. Wear proper PPE (leather gloves) / Avoid pinch points
8. Install sampling pump in well (if necessary)	1. Hand injuries during installation of pump 2. Lacerations when cutting tubing 3. Back strain during installation of pump 4. Physical hazards associated with manual lifting of heavy equipment 5. Back strain from starting generator 6. Burns from hot exhaust from generator 7. Electrical shock from improper use of generator and pump 8. Contaminated water spray from loose connections	1. Wear proper PPE (leather gloves, nitrile gloves) 2. Use safey tubing cutter 3. Use proper lifting techniques 4. Use proper lifting techniques / Use wheeled transport for heavy equipment 5. Use arm when starting generator / Do not over-strain if generator does not start 6. Do not touch generator near exhaust / Use proper handle to carry / Allow generator to cool down before moving 7. Properly plug in pump to generator / Do not allow the pump or generator to contact water / Check for breaks in the cord 8. Check all tubing connections to ensure they are tight and secure
10. Flushed water	1. Contact with potentially contaminated water 2. Tripping potential on sample discharge lines and pump electric line	1. Wear proper PPE (safety glasses, nitrile gloves) 2. Use proper lifting techniques / Use wheeled transport 3. Organize discharge of electric line to keep out of way as much as possible / Mark potential tripping hazards with caution tape or safety cones
11. Sample water collection	1. Contact with potentially contaminated groundwater through dermal exposure 2. Contact with and burns from acid used for sample preservation 3. Tripping potential on sample discharge lines and pump electric line 4. Lacerations from broken sample bottles 5. Back strain when transporting coolers full of collected samples 6. Slips/ Trips/ Falls	1. Wear proper PPE (safety glasses, nitrile gloves) 2. Wear proper PPE (safety glasses, nitrile gloves) / Ensure sample bottle lids are secure before use and after sample collection 3. Organize line to keep out of the way as much as possible / Mark potential tripping hazards with caution tape or safety cones 4. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage / Wrap glass bottles in bubble wrap, if possible 5. Use proper lifting techniques / Use wheeled transport / Seek assistance if coolers weight exceeds 50lbs. / Minimize distance to vehicle 6. Have unobstructed path to vehicle or collection point / Follow good housekeeping procedures / Do not lift/walk with coolers that are too heavy/difficult to lift
17. Decontaminate equipment	1. Splashing water/soap from decontamination 2. Contact with potentially contaminated groundwater through dermal exposure 3. Electrical shock from broken electric cords	1. Wear proper PPE (safety glasses) 2. Wear proper PPE (safety glasses, dermal protection) 3. Properly plug in pump to generator / Do not allow the pump or generator to contact water / Check for breaks in the cord
18. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels 8. Overhead hazards 9. Heat Stress/ Cold Stress	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 5. Wear high visibility clothing & vest / Use cones or signs to designate work area

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	10. Eye Injuries	6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 7. Wear hearing protection 8. Wear hard hat / Avoid areas were overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 10. Wear safety glasses

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Groundwater/Product Purgeing/Sampling with Bailer**
JSA Number: **JSA053**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.

S – Stop, *what has changed?*
T – Think *about the task*
E – Evaluate *potential hazards*
P – Plan *safe approach*
S - Start *task /* **Stop** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☒ Safety Goggles	☒ Face Shield	☒ Nitrile Gloves	☒ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☒ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	

☒ Other: Tyvek sleeves, Dermal Protection, PID, absorbent pads

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. Transport equipment to work area	1. Back Strain 2. Slips/ Trips/ Falls 3. Traffic 4. Cuts/abrasions from equipment 5. Contusions from dropped equipment	1. Use proper lifting techniuqes / Use wheeled transport 2. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 3. Wear proper PPE (high visibility vest or clothing) 4. Wear proper PPE (leather gloves, long sleeves) 5. Wear proper PPE (safety shoes)
2. Remove well cover	1. Scrape knuckles/hand 2. Strain wrist/bruise plam 3. Pinch fingers or hand	1. Wear proper PPE (leather gloves) 2. Using a hammer, tap the end of the wrench to loosen grip of bolts 3. Wear proper PPE (leather gloves)
3. Remove well cap and lock	1. Well can pops from pressure 2. Exposure to hazardous substances through inhalation or dermal exposure 3. Scrape knuckles/hand 4. Pinch points 5. Strain write/bruise palm	1. Remove cap slowly to relieve pressure / Do not place face over well when opening / Wear proper PPE (safety glasses, face shield, hand protection) 2. Use direct air monitoring/reading instrument (i.e. PID) / Be familiar with and follow actions prescribed in the HASP / Wear proper PPE (nitrile gloves) 3. Wear proper PPE (leather gloves) 4. Using hammer, tap the end of the wrench to loosen grip
4. Measure head-space vapor levels	1. Exposure to hazardous substances through inhalation	1. Do not place face over well when collecting measurement
5. Set-up plastic sheeting/absorbent pads for work site around the well	1. Lacerations when cutting plastic sheeting/absorbent pads	1. Use scissors to cut plastic sheeting/absorbent pads / Cut motions should always be away from body and body parts
6. Lower Bailer sleeve into	1. Repetitive motion injury (pulled arm/back	1. Take breaks while lowering bailer into well/ Use a mechanical device to

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
well	muscles) 2. Dehydration	lower bailer into well/ Rotate employees (take turns conducting the manual labor portion) 2. Take breaks and drink water.
7. Purge/Sample water/product collection	1. Contact with potentially contaminated groundwater or product through dermal exposure 2. Contact with and burns from acid used for sample preservation 3. Tripping potential on sampling lanyard 4. Lacerations from broken sample bottles 5. Back strain when transporting coolers full of collected samples 6. Slips/ Trips/ Falls	1. Wear proper PPE (safety glasses, nitrile gloves, safety shield, Tyvek) 2. Ensure sample bottle lids are secure before use and after sample collection 3. Organize lanyard to keep out of the way as much as possible / Mark potential tripping hazards with caution tape or safety cones 3. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage / Wrap glass bottles in bubble wrap, if possible 4. Use proper lifting techniques / Use wheeled transport / Seek assistance if coolers weight exceeds 50lbs. / Minimize distance to vehicle 5. Have unobstructed path to vehicle or collection point / Follow good housekeeping procedures / Do not lift/walk with coolers that are too heavy/difficult to lift
8. Retieval of bailer	1. Repetitive motion injury (pulled arm/back muscles) 2. Dehydration	1. Take breaks while retrieving bailer out of the well/ Use a mechanical device to raise bailer out of well/ Rotate employees (take turns conducting the manual labor portion) 2. Take breaks and drink water.
9. Pack-up equipment	1. Back strain when removing or lifting heavy equipment	1. Use proper lifting technique / Use wheeled transport for heavy equipment
10. Replace well cap and lock	1. Scrape fingers/hand 2. Strain wrist/bruise palm	1. Wear proper PPE (leather gloves) 2. Using hammer, tap the end of the well cap to tighten grip
11. Replace well cover	1. Scrape knuckles/hand 2. Strain write/bruise palm 3. Pinch fingers or hand	1. Wear proper PPE (leather gloves) 2. Using hammer, tap the end of the wrench to tighten the grip of the bolts 3. Wear proper PPE (leather gloves)
12. Place used PPE in designated dispoal drum	1. Pressure build-up inside drum 2. Pinch hazard	1. Remove cap from bung hole in drum to relieve pressure 2. Wear proper PPE (leather gloves) 3. Product drums may require additional spill protecton/electrical grounding, check local regulations
13. Decontaminate equipment	1. Splashing water/soap from decontamination 2. Contact with potentially contaminated groundwater through dermal exposure	1. Wear proper PPE (safety glasses) 2. Wear proper PPE (safety glasses, dermal protection)
14. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels 8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 5. Wear high visibility clothing & vest / Use cones or signs to designate work area 6. Be aware of surroundings at all times, including the presence of wildlife/

JSA Title: Groundwater/Product Purging/ Sampling with Bailer
JSA Number: JSA053

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 7. Wear hearing protection 8. Wear hard hat / Avoid areas were overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 10. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Hand Auger Soil Sampling**
JSA Number: **JSA003-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.

S – Stop, what has changed?
T – Think about the task
E – Evaluate potential hazards
P – Plan safe approach
S - Start task / **Stop** & regroup

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	

☒ Other: Half-face respirator, dust cartridges, PID (if applicable)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. Unpack equipment	1. Slips/ Trips/ Falls 2. Physical hazards including strains and hand injury	1. Be aware of hazards in area/ Place safety cones in areas of potential slips/trips/falls 2. Use proper lifting techniques / Do not lift heavy loads without assitance / Avoid putting hands near pinch points / Wear proper PPE (leather gloves)
2. Calibration of monitoring equipment	1. Skin or eye contact with calibration chemicals 2. Pinch fingers in monitoring equipment	1. Wear proper PPE (safety glasses/ goggles) 2. Wear proper PPE (leather gloves)
3. Advancing and removing hand auger	1. Physical hazards including back strain and hand injury	1. Twist auger using arms and shoulders/ Do not over exert / Keep back in neutral position, bend at the knees / Request assistance when needed / Remove auger from ground keeping back in neutral position and lift using legs
4. Sample collections a) Monitor parameters b) Prepare sample containers and labels c) Collect soil sample d) Securely cap containers, label and store in sample cooler until shipping e) Deliver cooler to lab or courier to lab	1. Contact with potentially contaminated soil 2. Lacerations from broken sample bottles 3. Back strain with transporting coolers 4. Internal exposure to contaminants through inhalation of dust 5. Slips/ Trips/ Falls	1. Use monitoring devices / Wear proper PPE (safety glasses, nitrile gloves) 2. Do not over-tighten bottles caps / Handle bottles safety to prevent breakage 3. Use proper lifting techniques / Do not lift heavy loads without assistance 4. Avoid creating dust / If necessary, wear a half-face respirator with applicable dust cartridges / Inspect respirator for damage and cleanliness prior to use / Clean respirator after each use and store in a clean, secure location 5. Be alert / Follow good housekeeping procedures
5. Decontamination of equipment	1. Splashing water/soap from decontamination 2. Contact with potentially contaminated soil	1. Wear proper PPE (safety glasses, gloves) 2. Wear proper PPE (safety glasses, gloves)
6. All activities	1. Slips/ Trips/ Falls	1. Be aware of potential trip hazards / Follow good housekeeping

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
6. All activities (cont'd)		procedures/ Mark significant hazards
	2. Hand injuries, cuts or lacerations during manual handling of materials	2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves
	3. Foot injuries	3. Wear Langan approved safety shoes
	4. Back injuries	4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible
	5. Traffic	5. Wear high visibility clothing & vest / Use cones or signs to designate work area
	6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)	6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed
	7. High Noise levels	7. Wear hearing protection
	8. Overhead hazards	8. Wear hard hat / Avoid areas were overhead hazards exist.
	9. Heat Stress/ Cold Stress	9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress
	10. Eye Injuries	10. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: Surface Water Sampling
JSA Number: JSA009-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.

S – ***Stop***, *what has changed?*
T – ***Think*** *about the task*
E – ***Evaluate*** *potential hazards*
P – ***Plan*** *safe approach*
S - ***Start*** *task /* ***Stop*** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☒ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☒ Life Vest/Jacket	
☐ Other				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. Transport equipment to work site	1. Back strain 2. Slips/ Trips/ Falls 3. Traffic 4. Cuts/abrasions from equipment 5. Contusions from dropped equipment	1. Use proper lifting techniques / Use wheeled transport 2. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 3. Wear proper PPE (high visibility vest or clothing) 4. Wear proper PPE (leather gloves, long sleeves) 5. Wear proper PPE (safety shoes)
2. Collect water samples	1. Potential drowning hazard working around water 2. Contact with potentially contaminated water through dermal exposure 3. Contact and burns from acid used for sample preservation 4. Lacerations from broken sample bottles 5. Back strain when transporting cooler full of collected samples 6. Slips/ Trips/ Falls	1. Always work with a partner when working around water / Wear proper PPE when working in moving water or water deeper than 2ft. (floatation device- i.e. Life vest/jacket) / Select a working area where the footing is stable / Do not stand in or attempt to cross swift moving water 2. Wear proper PPE (safety glasses, nitrile gloves) 3. Wear proper PPE (safety glasses, nitrile gloves) / Ensure sample bottle lids are secure before use and after sample collection 4. Do not over-tighten bottle caps / Handle bottles safely to avoid breakage / Wrap glass bottles in bubble wrap, if possible 5. Use proper lifting techniques / Use wheeled transport / Seek assistance if cooler's weight exceeds 50lbs. / Minimize distance to vehicle 6. Have unobstructed path to vehicle or collection point / Follow good housekeeping procedures / Do not lift/walk with coolers that are too heavy/difficult to lift
3. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty

JSA Title: Surface Water Sampling
JSA Number: JSA009-01

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
3. All activities (cont'd)	4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels 8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries	objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 5. Wear high visibility clothing & vest / Use cones or signs to designate work area 6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 7. Wear hearing protection 8. Wear hard hat / Avoid areas were overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 10. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Well Installation**
JSA Number: **JSA019-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.

TAKE 5

S – Stop, *what has changed?*
T – Think *about the task*
E – Evaluate *potential hazards*
P – Plan *safe approach*
S - Start *task /* **Stop** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: PID, Tyvek sleeves				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. Move equipment to work site	1. Back strain when lifting equipment	1. Use proper lifting technique (use legs for bending and lifting and not the back)/ Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle
	2. Slips/ Trips/ Falls while moving equipment	2. Use proper lifting technique (use legs for bending and lifting and not the back) / Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle / Have unobstructed path to vehicle or collection point / Do not lift/walk with boxes that are heavy/difficult to lift
	3. Traffic (if applicable)	3. Wear high visibility safety vests or clothing / Exercise caution
	4. Pinched fingers or running over toes during geoprobe set-up	4. Wear proper PPE (cut-resistant gloves) / Stay alert, be aware of geoprobe rig at all times
	5. Overturn drilling rig while transporting to loading dock on flat-bed tow truck	5. Drill rig should be parked in center of flat-bed tow truck / Emergency brake shall be used at all times during transport on the flat-bed truck/ All unnecessary personnel should stay away from the flat-bed truck during moving activities
2. Calibration of monitoring equipment	1. Skin or eye contact with calibration chemicals 2. Pinch fingers in monitoring equipment	1. Wear proper PPE (safety glasses/ goggles) 2. Wear proper PPE (leather gloves)
3. Set-up geoprobe rig	1. Geoprobe rig movement	1. All field personnel should stay clear of the geoprobe rig while moving / Use a spotter when backing up the geoprobe
4. Advance geoprobe rods below ground surface to desired depth	1. Underground utilities 2. High noise levels	1. Clean all subsurface soil borings to a minimum of 5 feet below grade 2. Wear proper PPE (hearing protection)
5. Remove and open acetate	1. Pinched fingers while removing macrocore	1. Wear proper PPE (nitrile gloves, cut-resistant or leather gloves

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
liner 5. Remove and open acetate liner (cont'd)	2. Cuts/lacerations when cutting acetate liner open 3. Exposure to hazardous vapors 4. Skin contact with contaminated soil	2. Wear proper PPE (cut-resistant or leather gloves) 3. Do not place face over acetate liner when opening / Monitor hazardous vapors in air with PID / Upgrade PPE as necessary based on levels contained in the Health and Safety Plan 4. Wear proper PPE (nitrile gloves)
6. Remove excess soil from acetate liner and place in 55-gallon drum (IF NOT PERFORMED BY LANGAN, REMOVE!)	1. Cuts/lacerations from acetate liner 2. Pinched fingers/hand while opening/closing drum 3. Skin contact with contaminated soil 4. Soil debris in eyes	1. Wear proper PPE (cut-resistant or leather gloves) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Wear proper PPE (nitrile gloves) 4. Wear proper PPE (safety glasses)
7. Attach hollow-stem augers to the geoprobe rig; Advance augers and attach additional augers until desired depth is reached	1. Strain wrist/bruise palm 2. Pinched fingers 3. Back Strain 4. Clothing entanglement 5. Carbon monoxide poisoning 6. Bruise toes/foot 7. High noise levels 8. Skin contact with contaminated soil	1. Wear proper PPE (cut-resistant or leather gloves) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Use proper lifting techniques 4. Wear proper work attire(no loose clothing/strings) 5. Properly ventilate work area 6. Wear proper PPE (safety shoes) 7. Wear proper PPE (hearing protection) 8. Wear proper PPE (Tyvek sleeves, nitrile gloves)
8. Install monitoring well	1. Pinched fingers 2. Lacerations/abrasions 3. Back Strain	1. Wear proper PPE (cut-resistant or leather gloves) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Use proper lifting techniques
9. Tremie-grout annulus space above bentonite seal	1. Back strain 2. Pinched fingers	1. Use proper lifting techniques 2. Wear proper PPE (cut-resistant or leather gloves)
10. Install flush-mount monitoring well pad	1. Splashed concrete 2. Pinched fingers 3. Cuts/lacerations	1. Wear proper PPE (safety glasses) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Wear proper PPE (cut-resistant or leather gloves)
11. Decontaminate equipment	1. Splashing water/soap 2. Contact with potentially contaminated groundwater/soil through dermal exposure 3. Electrical shock from broken electric cords	1. Wear proper PPE (safety glasses) 2. Wear proper PPE (safety glasses, dermal protection) 3. Properly plug in pump to generator / Do not allow the pump or generator to contact water / Check for breaks in the cord
12. Transport drums to central staging location (IF NOT PERFORMED BY LANGAN, REMOVE!)	1. Back, arm or shoulder strain from moving drums 2. Pinch fingers/hand in drum cart when moving drums 3. Pinch fingers/hand when operating lift-gate on vehicle 4. Contact with potentially contaminated groundwater when moving improperly sealed drums 5. Slips when moving drums 6. Drop drum on feet/toes	1. Use drum cart for moving drums / Use proper lifting techniques / Do not lift heavy loads without assistance 2. Wear proper PPE (cut-resistant or leather gloves) 3. Wear proper PPE (cut-resistant or leather gloves) 4. Wear proper PPE (nitrile gloves underneath work gloves) 5. Follow good housekeeping procedures / Ensure route to move drum and storage space is free from obstructions 6. Wear proper PPE (safety shoes) / Work in a safe manner to prevent dropped drum
13. All activities	1. Slips/ Trips/ Falls	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards

JSA Title: Well Installation
JSA Number: JSA019-01

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
13. All activities (cont'd)	2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels 8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries	2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 5. Wear high visibility clothing & vest / Use cones or signs to designate work area 6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 7. Wear hearing protection 8. Wear hard hat / Avoid areas were overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 10. Wear safety glasses
Additional items.		
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