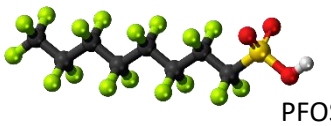
Testing the Geoprobe® SP16 and SP22 Groundwater Samplers

For PFAS Contamination

Technical Bulletin No. 2020DI03

April 2020



PFOS

Executive Summary

Geoprobe Systems® tested both the Screen Point 16 (SP16) and Screen Point 22 (SSP22) groundwater samplers to determine if under normal operating conditions components in the systems would contribute detectable PFAS compounds to groundwater sampled with these systems. This bulletin describes procedures and components used to conduct these tests. Water samples collected during these tests were submitted to an independent laboratory for analysis of 36 PFAS compounds. Laboratory testing found that water sampled through these systems were non-detect for all 36 PFAS compounds on the Wisconsin analyte list (Wisconsin DNR 2019).

Introduction

Over the last several years a large group of fluorinated organic compounds have emerged as a significant contaminant of concern on a national level. As a group these compounds have been named the polyfluorinated alkyl substances (PFAS). Two compounds of primary interest include perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). These compounds have been used in the manufacture of a wide array of industrial and commercial products. In 2016 the US EPA established a health advisory (HA) of 70 ng/l (parts per trillion) for PFOS and PFOA in drinking water (US EPA 2016A, 2016B, Federal Register May 25, 2016). This HA is for either compound alone or in combination. Subsequently, many states have begun establishing action levels for the PFAS compounds at levels equal to or below those set by the US EPA (California SWRCB 2019, Mass. DEP 2020, Michigan DEGLE 2019, Wisconsin DHS 2019). These very low action levels have led to concerns about the potential for cross contamination of both soil and groundwater samples by a wide array of commonly used materials during field sampling activities (Rodowa et al. 2020, Denly et al. 2019). Direct push groundwater sampling tools (ASTM D6001) are widely used during PFAS groundwater investigations. As such, many consultants, regulators and site owners will need to be confident that Geoprobe's GWP 1.75 system will not result in detectable PFAS cross contamination of collected groundwater samples. To address this need Geoprobe has conducted PFAS rinsate tests on the SP16 and SP22 groundwater samplers taken from new components in retail stock.

Objective

The objective is to evaluate the potential for PFAS cross contamination of groundwater samples by use of either the SP16 or SP22 groundwater samplers under normal operating conditions. This was

accomplished by conducting rinsate tests on the bench. The tests included all SP16 or SP22 system components used in field sampling operations that have contact with the sampled groundwater. The equipment used, procedures followed, and analytical results are presented below.

Materials of Construction

This bulletin describes testing of the SP16 and SP22 groundwater samplers for PFAS contaminants. Each of the samplers include components in series that are used to provide representative groundwater samples from selected permeable zones in unconsolidated formations. Geoprobe Systems has made every effort to eliminate any materials from the SP16 and SP22 samplers which could contribute PFAS compounds to the sample stream. The use of Teflon tape as a joint sealant on threaded fittings of the SP16 or SP22 tool strings is not recommended when sampling for PFAS compounds. Materials of construction in contact with the sampled water stream in the SP16 sampler include: alloy steel, stainless steel, low density polyethylene (LDPE) tubing, Buna o-rings (butadiene), and polyethylene. The SP22 sampler may be operated in different modes. When 1.25" inner drive rods are used to install a stainless steel screen the materials of construction are the same as the SP16 listed above. When ¾" PVC riser is used to install a slotted PVC screen the SP22 system obviously includes PVC. Both samplers were sampled with the tubing check valve (MN 214061) on 3/8"OD X ¼" ID low density polyethylene tubing (LDPE) tubing for the PFAS rinsate tests.

Equipment and Setup

The equipment used in the SP16 PFAS rinsate test (Table 1) and the SP22 PFAS rinsate test (Table 2) includes all components used in field operation of these groundwater samplers with the exception of additional probe rods due to space limitations. The SP16 sampler was tested with a stainless-steel screen (MN 214027) while the SP22 was tested with a ¾" PVC screen (MN 600218) and ¾" PVC riser (MN 201813). All components were taken from new stock ready for commercial sale. The equipment was set up on a bench to perform the rinsate tests of the SP16 and SP22 samplers (Photo 1 and 2 respectively). A schematic of each bench set up (Figure 1 and 2) reveals that all components of the samplers that have water contact during the sampling process were assembled as used in the field.

Table 1

Water Contact SP16 Components Assembled for PFAS Rinsate Testing

Item No.	Material Number	Description
1	202633	SP16 Drive Head
2	202632	Sampler Sheath
3	214027	Stainless Steel Screen, 0.04" (0.1 mm) slot
4	214036	Steel Expendable Point
5	601033	Grout Plug (plastic)
6	Various	Buna O-rings (MNs 202695, 213918, 102256, 214037)
7	601063	3/8"OD X ¼"ID LDPE tubing
8	214061*	Tubing Check Valve (stainless steel)

Table 2

Water Contact SP22 Components Assembled for PFAS Rinsate Testing

Item No.	Material Number	Description
1	204766	2.25” X 48” Probe rod
2	209991	SP22 Expendable Point Holder (holds point 214036)
3	214036	Expendable Point
4	201813	¾” PVC Riser
5	208102	SP22 PVC Screen Head Adpt
6	600218	PVC Screen 15” X 0.75” X 0.01” slot
7	208296	SP22 PVC Screen Plug
8	various	Buna O-rings
8	601063	3/8”OD X ¼”ID LDPE tubing
9	214061*	Tubing Check Valve (stainless steel)

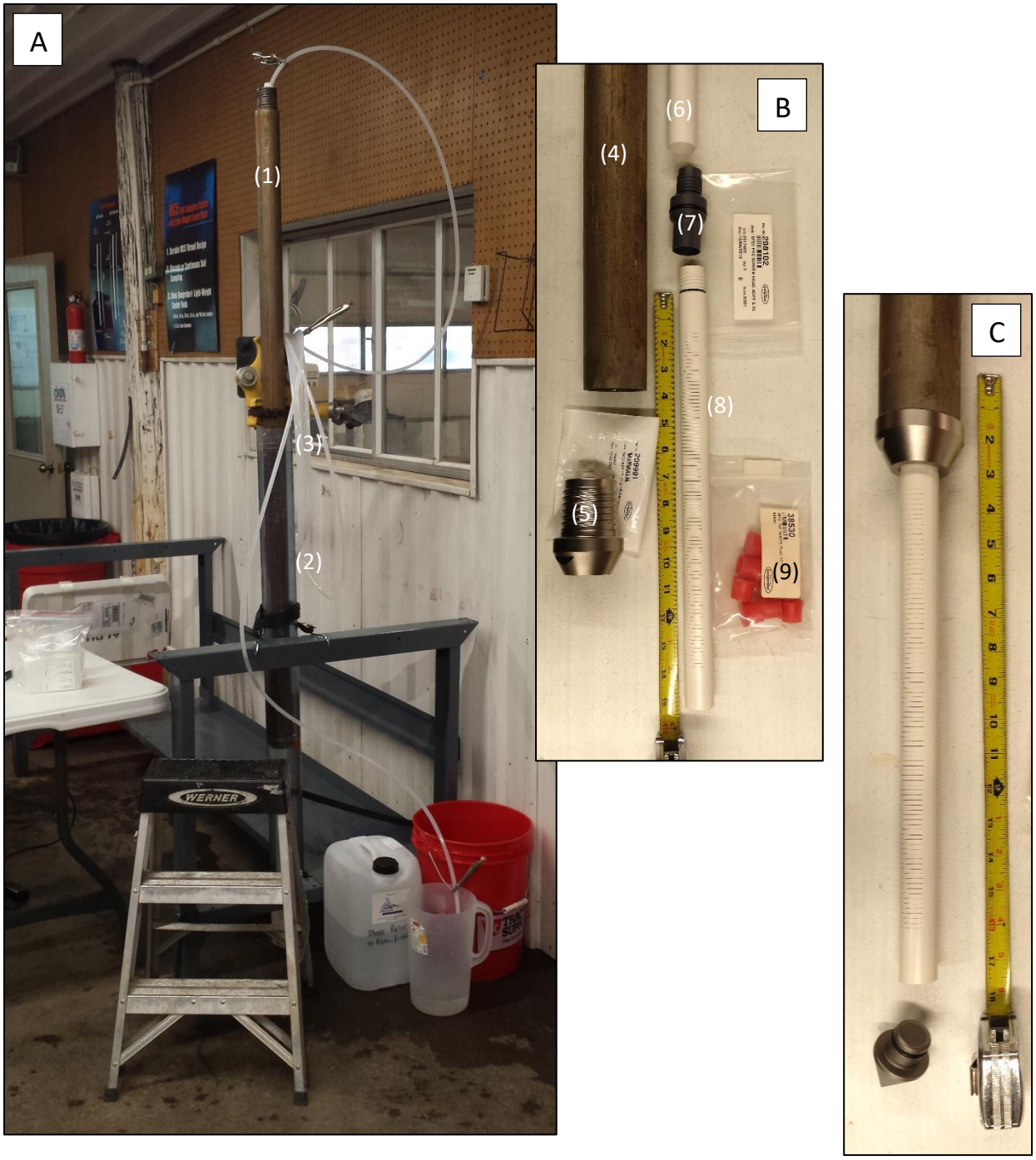
**The mechanical bladder pump (MN 214098) may be used when sampling for volatile organic compounds or inorganic analytes. Alternately, the syringe pump (MN 234560) may be used for sampling PFAS compounds or other analytes. Both pumps may be used in both groundwater samplers.*

PFAS Rinsate Procedure

After the SP16 and SP22 samplers were assembled on the bench as described above the following steps were performed to complete the PFAS rinsate test of each system.

1) De-ionized (DI) water was added to fill the standpipe. Then the peristaltic pump was used to maintain the DI water level in the standpipe as five liters of DI water were manually pumped through the sampler with the tubing check valve. Water was purged through the sampler at approximately 250ml/min.
2) After the DI purge was completed the water was purged from the sample line and the standpipe was emptied.
3) Next, PFAS Free water supplied by Alpha Laboratory was used to fill the standpipe. Again, the peristaltic pump was used to maintain the water level in the standpipe as water was manually purged through the sampler with the tubing check valve. A total of 3 liters of PFAS free water was purged through each sampler in this manner at a flow rate of approximately 250 ml/min.
4) After 3 liters of PFAS free water were purged through the samplers two 250ml HDPE sample bottles were filled with water flowing out of the sample line (Figures 1 and 2). The bottles were capped, labeled, and stored at approximately 4° C for shipment to Alpha Laboratory. The chain-of-custody form was completed and samples were sent by express shipping to the lab.

Photograph 1: *A) Bench set up of SP16 (1) in 3" clear PVC standpipe (2) with 40 ft of 3/8" LDPE tubing (3) and check valve (not visible) used for purging. B) Screen sheath (4) with 1 ft of exposed stainless steel screen (5) in the PFAS free water-filled standpipe. C) Tubing check valve installed on 3/8" LDPE tubing used for purging/sampling. D) Other components used in the rinsate test include (5) stainless steel screen (6) extension rod with screen push adapter (7) expendable points (8) SP16 drive head and (9) grout plugs.*



Photograph 2: *A) Bench set up of SP22 (1) in 3" clear PVC standpipe (2) with 40 ft of 3/8" LDPE tubing (3) and check valve (not visible) used for purging. B) Components used in the rinsate test include (4) steel 2.25" probe rod (5) expendable point holder (6) ¾" PVC riser (7) PVC Screen Head adapter (8) ¾" PVC screen, 10 slot (9) grout plugs. C) PVC screen on riser installed through 2.25" probe rod and expendable point holder.*

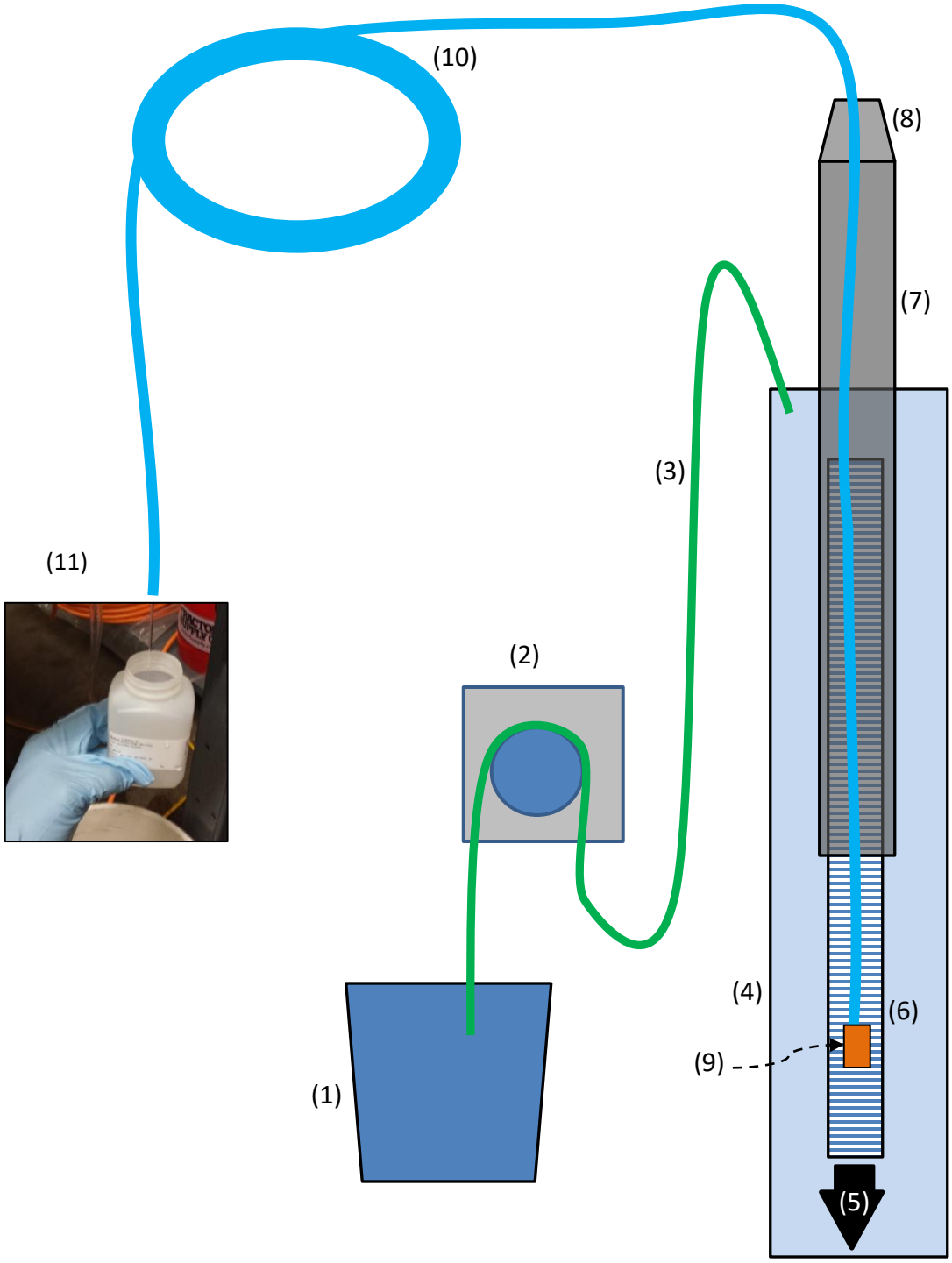


Figure 1: *Bench set up of SP16 for Rinsate Test. (1) Container of DI water, then PFAS free water (2) peristaltic pump (3) water supply line (4) 3" clear PVC standpipe (5) expendable point (6) stainless steel screen partially deployed (12") as often done for field sampling(7) screen sheath (8) drive head (9) check valve (10) 40 ft of 3/8" LDPE tubing used for purging. Peristaltic pump used to maintain water level near top of standpipe. Not to scale.*

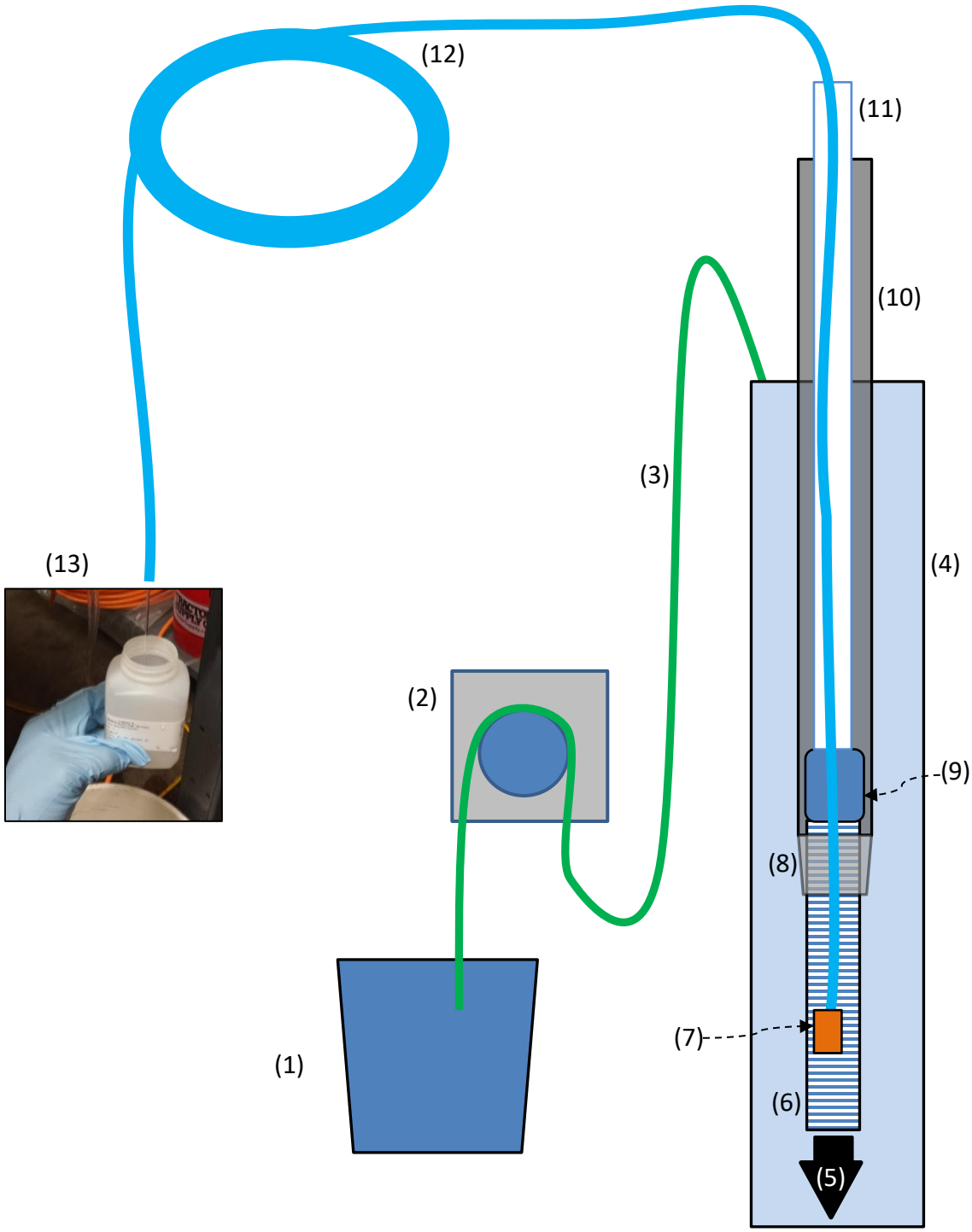


Figure 2: *Bench set up of SP22 for Rinsate Test. (1) Container of DI water, then PFAS free water (2) peristaltic pump (3) water supply line (4) 3" clear PVC standpipe (5) expendable point (6) PVC 10-slot screen (7) check valve (8) cutting shoe (9) PVC screen head (10) 2.25" Probe rod (11) ¾" PVC riser (12) 40 ft of 3/8" LDPE tubing used for purging (13) sample collection. PVC screen head and riser isolates water from rod contact. Peristaltic pump used to maintain water level near top of standpipe during purging/sampling. Not to scale.*

Analytical Results

The rinsate water samples were submitted to Alpha Analytical, Inc. (Westborough, MA) for analysis. Alpha Analytical holds both DOD ELAP and NELAC certification for both EPA Method 537 as well as their proprietary LC/MS/MS isotope dilution method for PFAS compounds. Alpha Analytical utilizes solid phase extraction (SPE) with liquid chromatography and tandem mass spectrometry (LC/MS/MS) protocols for PFAS analysis of aqueous samples. The rinsate samples were analyzed for the Wisconsin list of 36 PFAS compounds (Wisconsin DNR 2019) using Alpha Labs proprietary isotope dilution LC/MS/MS method. Both the SP16 and SP22 rinsate samples (SP16A and SP22A respectively) were nondetect for all 36 PFAS compounds at the method reporting limits. The reporting limits for most of the compounds are below 2 ng/l. The Alpha Laboratory reports for the SP16 and SP22 PFAS rinsate samples are attached (Appendix I).

This PFAS rinsate test is a point-in-time test of an SP16 and SP22 system taken from new components in retail stock. The results reported here should be representative of new equipment purchased from Geoprobe Systems®. However, these results may not be representative of other SP16 or SP22 systems that have been previously used at other sites. If needed, each groundwater sampler system could be rinsate tested prior to use onsite to verify its current status relative to the presence/absence of PFAS compounds or other analytes of concern. If a rinsate test is performed be sure to separately sample the water before it is used for the rinsate test to verify the water source is PFAS free. This blank water sample can be held at the lab until the rinsate sample is tested. Then analyzed only if the rinsate test sample is positive for any PFAS analytes.

References and Links

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U.S. EPA, 2016B. Supporting Documents for Drinking Water Health Advisories for PFOA and PFOS. https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos

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Wisconsin Dept. of Natural Res. 2019. Wisconsin PFAS Aqueous (Non-Potable Water) and Non-Aqueous Matrices Method Expectations – Version 12.16.2019 – Per- and Polyfluorinated Alkyl Substances (PFAS) Analysis Using Isotope Dilution by LC/MS/MS. https://dnr.wi.gov/topic/LabCert/documents/EA-19-0001-C.pdf (see pages 13 & 14).

Appendix I

Alpha Analytical Laboratory Report

SP16 and SP22 Groundwater Samplers

PFAS Rinsate Test

Serial_No:04062015:58

Project Name: GEOPROBE PFAS TEST
Lab Number: L2013902
Project Number: 7200352
Report Date: 04/06/20

SAMPLE RESULTS

Lab ID: L2013902-01
Client ID: SP16A
Sample Location: DI BLDG

Date Collected: 03/26/20 14:05
Date Received: 03/31/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 134,LCMSMS-ID
Analytical Date: 04/02/20 22:50
Analyst: JW

Extraction Method: ALPHA 23528
Extraction Date: 04/01/20 09:58

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorobutanoic Acid (PFBA)	ND		ng/l	1.78	–	1
Perfluoropentanoic Acid (PFPeA)	ND		ng/l	1.78	–	1
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	1.78	–	1
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	ND		ng/l	1.78	–	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	1.78	–	1
Perfluoropentanesulfonic Acid (PFPeS)	ND		ng/l	1.78	–	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	1.78	–	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	1.78	–	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.78	–	1
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND		ng/l	1.78	–	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		ng/l	1.78	–	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	1.78	–	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.78	–	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	1.78	–	1
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND		ng/l	1.78	–	1
Perfluorononanesulfonic Acid (PFNS)	ND		ng/l	1.78	–	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	1.78	–	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	1.78	–	1
Perfluorodecanesulfonic Acid (PFDS)	ND		ng/l	1.78	–	1
Perfluorooctanesulfonamide (FOSA)	ND		ng/l	1.78	–	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	1.78	–	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	1.78	–	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	1.78	–	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	1.78	–	1
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND		ng/l	44.6	–	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	1.78	–	1
Perfluorohexadecanoic Acid (PFHxDA)	ND		ng/l	3.57	–	1

Serial_No:04062015:58

Project Name: GEOPROBE PFAS TEST **Lab Number:** L2013902

Project Number: 7200352 **Report Date:** 04/06/20

SAMPLE RESULTS

Lab ID: L2013902-01 Date Collected: 03/26/20 14:05

Client ID: SP16A Date Received: 03/31/20

Sample Location: DI BLDG Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorooctadecanoic Acid (PFODA)	ND		ng/l	3.57	–	1
Perfluorododecane Sulfonic Acid (PFDoDS)	ND		ng/l	1.78	–	1
1H,1H,2H,2H-Perfluorododecanesulfonic Acid (10:2FTS)	ND		ng/l	4.46	–	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	1.78	–	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	1.78	–	1
N-Methyl Perfluorooctane Sulfonamide (NMeFOSA)	ND		ng/l	17.8	–	1
N-Ethyl Perfluorooctane Sulfonamide (NEtFOSA)	ND		ng/l	17.8	–	1
N-Methyl Perfluorooctanesulfonamido Ethanol (NMeFOSE)	ND		ng/l	44.6	–	1
N-Ethyl Perfluorooctanesulfonamido Ethanol (NEtFOSE)	ND		ng/l	44.6	–	1
PFOA/PFOS, Total	ND		ng/l	1.78	–	1
PFAS, Total (5)	ND		ng/l	1.78	–	1

Serial_No:04062015:58

Project Name: GEOPROBE PFAS TEST
Lab Number: L2013902
Project Number: 7200352
Report Date: 04/06/20

SAMPLE RESULTS

Lab ID: L2013902-03
Client ID: SP22A
Sample Location: DI BLDG

Date Collected: 03/26/20 15:55
Date Received: 03/31/20
Field Prep: Not Specified

Sample Depth:
Matrix: Water
Analytical Method: 134,LCMSMS-ID
Analytical Date: 04/02/20 23:06
Analyst: JW

Extraction Method: ALPHA 23528
Extraction Date: 04/01/20 09:58

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorobutanoic Acid (PFBA)	ND		ng/l	1.85	–	1
Perfluoropentanoic Acid (PFPeA)	ND		ng/l	1.85	–	1
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	1.85	–	1
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	ND		ng/l	1.85	–	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	1.85	–	1
Perfluoropentanesulfonic Acid (PFPeS)	ND		ng/l	1.85	–	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	1.85	–	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	1.85	–	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.85	–	1
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND		ng/l	1.85	–	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		ng/l	1.85	–	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	1.85	–	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.85	–	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	1.85	–	1
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND		ng/l	1.85	–	1
Perfluorononanesulfonic Acid (PFNS)	ND		ng/l	1.85	–	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	1.85	–	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	1.85	–	1
Perfluorodecanesulfonic Acid (PFDS)	ND		ng/l	1.85	–	1
Perfluorooctanesulfonamide (FOSA)	ND		ng/l	1.85	–	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	1.85	–	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	1.85	–	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	1.85	–	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	1.85	–	1
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND		ng/l	46.3	–	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	1.85	–	1
Perfluorohexadecanoic Acid (PFHxDA)	ND		ng/l	3.70	–	1

Serial_No:04062015:58

Project Name: GEOPROBE PFAS TEST
Lab Number: L2013902
Project Number: 7200352
Report Date: 04/06/20

SAMPLE RESULTS

Lab ID: L2013902-03
Client ID: SP22A
Sample Location: DI BLDG

Date Collected: 03/26/20 15:55
Date Received: 03/31/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorooctadecanoic Acid (PFODA)	ND		ng/l	3.70	–	1
Perfluorododecane Sulfonic Acid (PFDoDS)	ND		ng/l	1.85	–	1
1H,1H,2H,2H-Perfluorododecanesulfonic Acid (10:2FTS)	ND		ng/l	4.63	–	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	1.85	–	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	1.85	–	1
N-Methyl Perfluorooctanesulfonamido Ethanol (NMeFOSE)	ND		ng/l	46.3	–	1
N-Ethyl Perfluorooctanesulfonamido Ethanol (NEtFOSE)	ND		ng/l	46.3	–	1
PFOA/PFOS, Total	ND		ng/l	1.85	–	1
PFAS, Total (5)	ND		ng/l	1.85	–	1