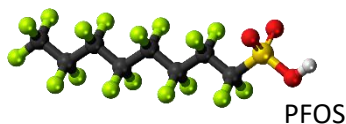


Testing the Geoprobe® Hydraulic Profiling Tool (HPT) System For PFAS Contamination

Technical Bulletin No. 2020DI01

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Executive Summary

Geoprobe Systems conducted a test of an HPT logging system to determine if components in the HPT system would contribute PFAS compounds to water pumped through the HPT system under simulated system use. The bulletin describes procedures and equipment used to conduct this test. HPT injection water collected in this test was submitted to an independent laboratory for analysis of PFAS compounds. Laboratory testing found HPT injection water to have no detectable levels of all 36 PFAS compounds on the Wisconsin analyte list (Wisconsin DHS 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 USEPA established a health advisory (HA) of 70 ng/l (parts per trillion) for PFOS and PFOA in drinking water (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 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). Since the HPT is widely used during soil and groundwater investigations (ASTM D8037) many consultants, regulators and site owners have expressed concern about the potential for Geoprobe's HPT system (which injects water to assess formation permeability) to cause detectable PFAS contamination. To address these concerns Geoprobe has conducted a PFAS rinsate test on an HPT system taken from new components in retail stock.

Objective

The objective is to evaluate the potential for PFAS contamination of soil or groundwater by water injected into the soil or unconsolidated formation as HPT logging is performed. This was accomplished by conducting a rinsate test that includes all HPT system components used in field logging operations

that have contact with the injected water. The equipment used, procedures followed, and analytical results are presented below.

Materials of Construction

This bulletin describes testing of the HPT logging system for PFAS contaminants. The HPT logging system includes a variety of components in series that act to deliver water to the HPT screen at the probe and measure the flow and pressure of water injection. Geoprobe Systems has made every effort to eliminate any materials from the HPT system which could contribute PFAS compounds to the injection stream. The use of Teflon tape as a sealant in threaded fittings on the HPT system was discontinued in April 2019. Materials of construction in contact with injected water in an HPT system include: nylon, polyacetal (POM), brass, stainless steel, ceramic, polyurethane, and polyethylene.

Equipment and Setup

The equipment used in this PFAS rinsate test (Table 1) includes all components used in field operation of the HPT system with the exception of probe rods and connection tube that do not have contact with the injected water. All components, including the HPT Flow Module, were taken from new stock ready for commercial sale. The equipment was setup on a bench to perform the rinsate test (Photo 1). A schematic of the bench set up (Figure 1) reveals that all components of the system that contact water during the injection logging process were assembled as used in the field. The HPT probe (MN 226553) was assembled with the HPT pressure sensor (MN 210091) and trunkline connections made as for field logging procedure. The HPT probe was placed in a horizontal position so that the injection screen faced downward. This allowed for free flow of injection water from the system for purging and sampling.

Table 1

Water Contact HPT Components Assembled for PFAS Rinsate Testing

Item No.	Material Number	Description
1	214091	HPT Flow Module, 120V AC, FI Based: Serial No. HPT10060 (This includes water intake hose assembly)
2	214095	HPT Trunkline, 150 ft (45.7 m)
3	226553	1.75-inch HPT Probe (K6052)
4	205558	HPT Screen Assy.
5	107963	Brass Coupling, HPT trunkline to HPT sensor
6	210091	HPT Pressure Sensor Assy, 100psi (Serial No. XD31313A)

PFAS Rinsate Procedure

After the HPT system was assembled on the bench as described above the following steps were performed to complete the PFAS rinsate test of the system.

- 1) The RV antifreeze used to protect the system plumbing during shipping and storage was purged from the HPT Flow Module.
- 2) Ten liters of de-ionized (DI) water were pumped through the assembled HPT system at a rate of approximately 250ml/min (typical injection flow rate for logging). The DI water was allowed to



Photograph 1: Bench setup of the HPT system for PFAS rinsate testing. Components include:

- (1) HPT Flow Module, includes pump, flow meter, valves, internal plumbing, pressure meter, pressure gauge, water inlet line, bypass valve, bypass line, etc.*
- (2) 150 ft HPT Trunkline*
- (3) Carboy of PFAS free water provided by Alpha Labs.*
- (4) HPT Probe with screened injection port.*
- (5) HPT Pressure Sensor*

Inset photo: Collecting sample for PFAS analysis.

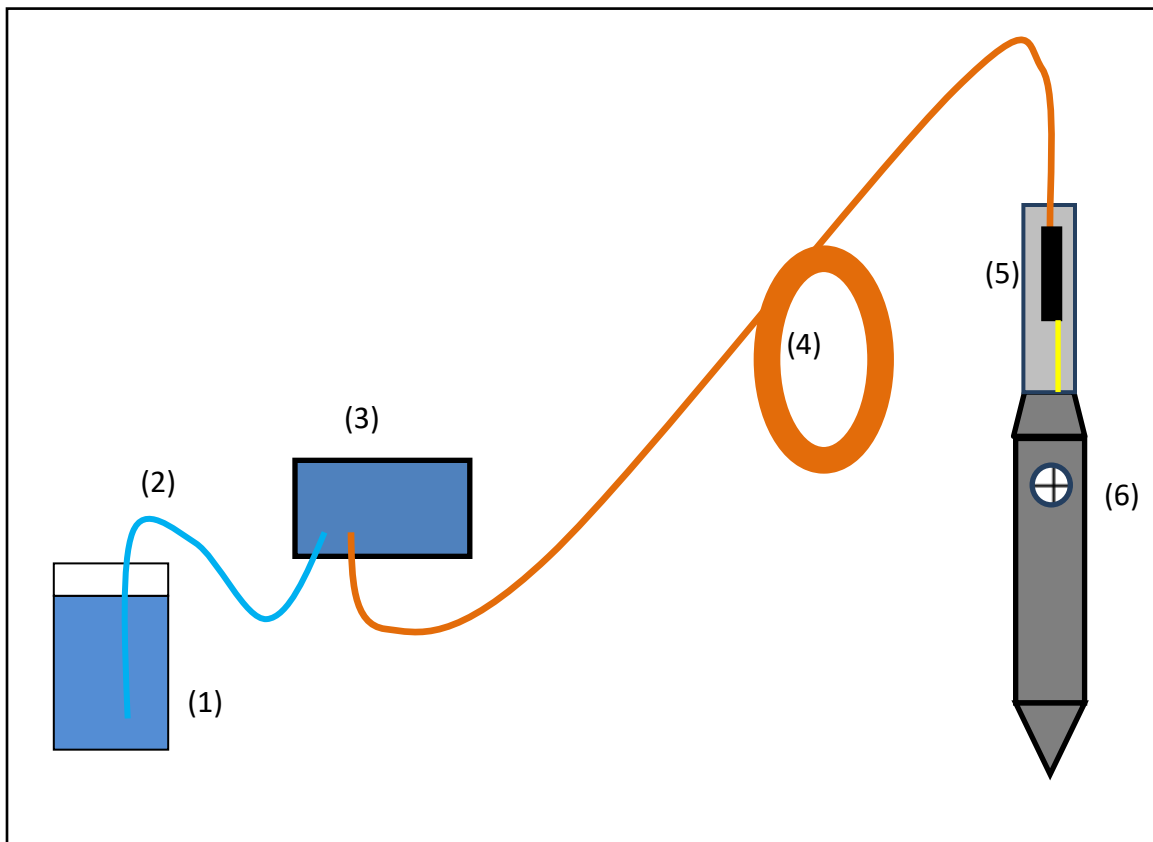


Figure 1: Schematic of HPT system setup for PFAS rinsate test (not to scale). Components are (1) container of DI water then PFAS free water (2) water supply line (3) HPT Flow Module (4) 150 ft HPT trunkline (5) HPT pressure sensor (black) and (6) 1.75" HPT probe with screened injection port.

flow out of the screen into a bucket. Intermittently, a nitrile gloved thumb was placed over the screened port to elevate line and HPT pressure to a range of 30psi to 40psi (200kPa to 300kPa). This pressure pulsing helped to remove any air bubbles from the trunkline and further simulate actual logging conditions.

- 3) After the DI purge was completed the water intake tube was removed from the DI water supply. Ambient air was pumped through the system to purge out the DI water. Air was purged through the trunkline and probe until air bubbles were observed at the injection screen.
- 4) The HPT intake tube was then placed in a carboy of PFAS Free water supplied by ALPHA ANALYTICAL, Inc. (Westborough, MA). A total of 5 liters of PFAS free water was purged through the HPT system and out of the injection screen. HPT flow rate for this step was again set at 250 ml/min.
- 5) After 5 liters of PFAS free water were purged two 250ml HDPE sample bottles were filled with water flowing out of the HPT screen as the probe laid in horizontal position (Photo 1, inset). 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.

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 DHS 2019) using Alpha Labs proprietary isotope dilution LC/MS/MS method. The HPT rinsate sample (HPT1) was 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 report for the HPT1 sample are attached (Appendix I).

This PFAS rinsate test is a point-in-time test of one HPT 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 HPT systems that have been previously used at other sites. If needed, each HPT system could be rinsate tested prior to use onsite to verify its current status relative to the presence/absence of PFAS compounds. 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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Appendix I
Analytical Report Alpha Laboratory
HPT1 PFAS Rinsate Test

Serial_No:03302016:12

Project Name: GEOPROBE PFAS TEST
 Project Number: Not Specified

Lab Number: L2012905
 Report Date: 03/30/20

SAMPLE RESULTS

Lab ID: L2012905-01
 Client ID: HPT-1
 Sample Location: SALINA, KS

Date Collected: 03/18/20 15:53
 Date Received: 03/23/20
 Field Prep: Not Specified

Sample Depth:
 Matrix: Water
 Analytical Method: 134,LCMSMS-ID
 Analytical Date: 03/26/20 19:47
 Analyst: JW

Extraction Method: ALPHA 23528
 Extraction Date: 03/26/20 09:29

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorobutanoic Acid (PFBA)	ND		ng/l	1.88	-	1
Perfluoropentanoic Acid (PFPeA)	ND		ng/l	1.88	-	1
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	1.88	-	1
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	ND		ng/l	1.88	-	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	1.88	-	1
Perfluoropentanesulfonic Acid (PFPeS)	ND		ng/l	1.88	-	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	1.88	-	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	1.88	-	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.88	-	1
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND		ng/l	1.88	-	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		ng/l	1.88	-	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	1.88	-	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.88	-	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	1.88	-	1
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND		ng/l	1.88	-	1
Perfluoronanesulfonic Acid (PFNS)	ND		ng/l	1.88	-	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOGAA)	ND		ng/l	1.88	-	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	1.88	-	1
Perfluorodecanesulfonic Acid (PFDS)	ND		ng/l	1.88	-	1
Perfluorooctanesulfonamide (FOGA)	ND		ng/l	1.88	-	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEFOGAA)	ND		ng/l	1.88	-	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	1.88	-	1
Perfluorotridecanoic Acid (PFTriDA)	ND		ng/l	1.88	-	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	1.88	-	1
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND		ng/l	47.0	-	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	1.88	-	1
Perfluorohexadecanoic Acid (PFHxDA)	ND		ng/l	3.76	-	1



Project Name: GEOPROBE PFAS TEST
 Project Number: Not Specified

Serial_No:03302016:12
 Lab Number: L2012905
 Report Date: 03/30/20

SAMPLE RESULTS

Lab ID: L2012905-01
 Client ID: HPT-1
 Sample Location: SALINA, KS

Date Collected: 03/18/20 15:53
 Date Received: 03/23/20
 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	3.76	–	1
Perfluorododecane Sulfonic Acid (PFDoDS)	ND		ng/l	1.88	–	1
1H,1H,2H,2H-Perfluorododecanesulfonic Acid (10:2FTS)	ND		ng/l	4.70	–	1
9-Chlorohexadecafluoro-3-Oxanon-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	1.88	–	1
11-Chloroicosasfluoro-3-Oxundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	1.88	–	1
N-Methyl Perfluorooctane Sulfonamide (NMeFOSA)	ND		ng/l	18.8	–	1
N-Ethyl Perfluorooctane Sulfonamide (NEFOSA)	ND		ng/l	18.8	–	1
N-Methyl Perfluorooctanesulfonamido Ethanol (NMeFOSE)	ND		ng/l	47.0	–	1
N-Ethyl Perfluorooctanesulfonamido Ethanol (NEFOSE)	ND		ng/l	47.0	–	1
PFOA/PFOS, Total	ND		ng/l	1.88	–	1
PFAS, Total (5)	ND		ng/l	1.88	–	1

For additional information about the sample preparation and analytical method used please see this link: <https://alphalab.com/analytical-services/emerging-contaminants/per-and-polyfluorinated-alkyl-substances-pfas>

