Emerging Contaminants Sampling
Scope of Work
for the
Kesselring Site

Knolls Atomic Power Laboratory
Kesselring Site
West Milton, New York

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Table of Contents

List of Tables

List of Figures

List of Attachments

List of Acronyms and Abbreviations

amsl	Above Mean Sea Level
ASP	Analytical Service Protocol
AFFF	Aqueous Film-Forming Foam
bgs	Below Ground Surface
CA	Corrective Action
CVOC	Chlorinated Volatile Organic Compound
EC	Emerging Contaminants
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Approval Program
EMR	Environmental Monitoring Report
FRB	Field Reagent Blank
HDPE	High Density Polyethylene
IDW	Investigation-Derived Waste
KAPL	Knolls Atomic Power Laboratory
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCE	Tetrachloroethene
PFAS	Per- and Polyfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppb	Parts Per Billion
ppt	Parts Per Trillion
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
SDG	Sample Delivery Group
SIM	Selected Ion Monitoring
SOW	Scope of Work
SV	Sampling Visit

SVIE	Soil Vapor Intrusion Evaluation
SWMU	Solid Waste Management Unit
TCA	Trichloroethane
TCE	Trichloroethene
UCMR3	Third Unregulated Contaminant Monitoring Rule
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This Scope of Work (SOW) has been developed to evaluate the groundwater at the Knolls Atomic Power Laboratory (KAPL) – Kesselring Site (Site) for the presence of emerging contaminants (EC), per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane, as identified by the United States Environmental Protection Agency (USEPA) and New York State Department of Environmental Conservation (NYSDEC).

This SOW was prepared in accordance with the reference (1) NYSDEC Guidance for Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances and includes the sampling objectives, methods, analytical parameters, and quality assurance/quality control (QA/QC) elements for completion of the sampling. The SOW objective, a Site description, evaluation of onsite EC usage, the selection of representative groundwater sampling locations, and SOW steps are provided herein.

1.1 SOW Objective

The objective of the SOW is to evaluate for the presence of EC in groundwater at the Site. In order to achieve the SOW objective and determine representative groundwater sampling locations, a Site evaluation was performed that consisted of a review of:

(1) past uses of potential EC containing items;
(2) available groundwater chlorinated volatile organic compound (CVOC) analytical results for potential 1,4-dioxane indicator CVOCs (as described in reference (2) and Section 3.0); and
(3) local groundwater flow patterns.

2.0 SITE DESCRIPTION

As shown on Figure 1, the Site is approximately 3,900 acres of undeveloped land with a centrally located developed area that is approximately 65 acres. The Site is located near West Milton, New York, approximately 17 miles north of the city of Schenectady and 9 miles southwest of Saratoga Springs. The Site is an industrial setting that is predominantly paved with two pressurized-water naval nuclear propulsion plants and support facilities that include administrative offices, machine shops, waste storage facilities, oil storage facilities, training facilities, equipment service buildings, chemistry laboratories, a boiler house, a cooling tower, and wastewater treatment facilities. The Site is dedicated primarily to the training of personnel in the operation of naval nuclear propulsion plants. The Site is owned by the United States Department of Energy and is currently operated by Fluor Marine Propulsion, LLC.

2.1 Environmental Setting

The Site is located within the undulating transition zone between the Adirondack Mountains and the Hudson-Mohawk Valley lowlands. Ground elevations in the vicinity of the Site generally range from 400 to 900 feet above mean sea level (amsl) as shown on Figure 1. The developed area of the Site is essentially flat with ground elevations averaging approximately 480 to 490 feet amsl.

2.2 Geology

Within the Site, overburden deposits consist of lake-bottom deposits (lacustrine silts) and glacial till. Fluvial deposits have been observed in some isolated areas of the Site. Coarse backfill materials consisting of sand, gravel, and crushed stone have also been added during construction activities.

2.3 Groundwater

There are no groundwater aquifers in the vicinity of the Site that are designated as sole source aquifers by the USEPA or as primary or principal aquifers by NYSDEC. Primarily, the glacial till and lacustrine silt deposits produce very low volumes of groundwater. However, localized areas of saturated coarse-grained deposits have been observed at the Site.

Depths to groundwater are approximately 2 to 3 feet below ground surface (bgs) on the western portion of the Site’s developed area and gradually reach approximately 9 to 11 feet bgs on the eastern portion of the Site’s developed area. The water table generally conforms to the ground surface topography. As shown on Figure 2, the groundwater flow in the southwestern portion of the Site has been altered by the Building 28 foundation that extends down to bedrock, and groundwater flow patterns are also altered by the continuous operation of the Building 102 foundation dewatering system.

3.0 EMERGING CONTAMINANTS EVALUATION

This section includes an EC chemical background and the Site EC evaluation that was performed to determine representative EC groundwater sampling locations.

3.1 EC Chemical Background

PFAS are a large group of highly soluble, stable, synthetic chemicals that have been used since the 1940s in a wide variety of industrial and consumer products, such as carpet and clothing treatments, industrial surfactants, emulsifiers, and fire-fighting aqueous film-forming foam (AFFF) as described in reference (3). Two PFAS, perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) have been produced in the largest amounts within the United States and are the most widely studied of the PFAS chemicals. In industry, PFAS were released to the air, water, and soil in and around manufacturing facilities. PFAS can readily move through soil and into groundwater. They are resistant to typical natural degradation processes and as a result are often found in the environment.

1,4-dioxane is often found at sites contaminated with certain CVOCs, primarily 1,1,1-trichloroethane (TCA), because of its wide use as a stabilizer for this solvent as described in reference (2). 1,4-dioxane has also been found at sites contaminated with other CVOCs such as tetrachloroethene (PCE) and trichloroethene (TCE), although no definitive connection with these CVOCs has been established. 1,4-dioxane typically migrates rapidly in groundwater, is resistant to biodegradation, and is therefore often detected ahead of other contaminants in groundwater plumes.

3.2 Site EC Background

The Site EC evaluation consisted of a review of usage of potential EC containing items, specifically AFFF, the occurrence of certain indicator CVOCs (e.g.,1,1,1-TCA, PCE, and TCE) in Site groundwater, and local groundwater flow patterns to determine representative groundwater sampling locations in the Site’s developed area. Also, based on discussions with NYSDEC, the Site’s closed Hogback Road landfill will be included in follow-on groundwater sampling for EC.

For completeness, EC groundwater sampling will consist of both PFAS and 1,4-dioxane analysis. The Site evaluation is described below.

The presence of PFAS in groundwater has not been previously assessed at the Site, and with the exception of the recent Building 93 Sampling Visit (SV), 1,4-dioxane in groundwater has not been evaluated. The principal potential PFAS containing item evaluated for usage at the Site is AFFF. A review of historical operations and interviews with Site personnel indicate that fire-fighting training with AFFF was conducted onsite, proximal to former Building 31 (i.e., Farmhouse) and Building 3 (i.e., Site Firehouse) as shown on Figure 2. These two structures were located near one another; however, the Farmhouse was demolished in 2014 and office trailers currently exist at this location. Fire-fighting training with AFFF, containing PFAS, is no longer conducted on-site. An alternative, PFAS-free, training foam product is now used in training exercises conducted at the Site.

The developed area of the Site contains a network of monitoring wells for the Voluntary Monitoring Program and monitoring wells installed to support Resource Conservation and Recovery Act (RCRA) Corrective Action (CA) Program investigations. A significant amount of groundwater volatile organic compound (VOC) analytical results have been generated from groundwater sampling conducted in the Site's developed area as part of past RCRA CA Program investigations (e.g., Building 29 SV, MW-3 Assessment, and Building 93 SV) and as part of the ongoing annual Site Voluntary Monitoring Program. Indicator CVOCs have been historically detected in Site groundwater VOC analytical results from sampling performed in the developed area. A detailed assessment of Site groundwater quality was performed in 2011 as described in the reference (4) KS Soil Vapor Intrusion Evaluation (SVIE) Work Plan. Additional groundwater VOC analytical results were generated as part of the Solid Waste Management Unit (SWMU) #55 SV for Building 93 as described in the reference (5) Building 93 SV Report. The results of the Site's Voluntary Monitoring Program have been reported annually in Knolls Laboratory and Kesselring Site Environmental Monitoring Reports (EMRs) since 1990. Developed area monitoring wells associated with RCRA CA Program investigations and the Site's Voluntary Monitoring Program are shown on Figure 2.

The Closed Hogback Road Landfill (landfill), SWMU #35, is located south-southeast of the developed area as shown on Figure 1. The landfill was closed in 1994 in accordance with 6 New York Codes, Rules and Regulations Part 360 Solid Waste Management regulations and groundwater is monitored annually per the requirements of the reference (6) Hogback Road Landfill Post-Closure Monitoring and Maintenance Operations Manual. The landfill is monitored annually for VOCs and the monitoring results are reported to NYSDEC in an annual report and in annual EMRs. Indicator CVOCs (primarily indicator CVOC breakdown products) have been historically detected in landfill groundwater VOC analytical results from past monitoring. Landfill monitoring wells are shown on Figure 3.

The EC evaluation and proposed groundwater sampling locations in the Site's developed area and the landfill are further described below and on Table 1. Well locations and local groundwater flow patterns/direction are also shown on Figures 2 and 3 to provide perspective on monitoring well selection rationale. Representative downgradient sampling locations and a companion upgradient well location were selected for EC groundwater sampling. Certain downgradient locations were selected based on the presence of CVOCs in past groundwater monitoring events.

3.3 EC Evaluation and Sampling Location Rationale

3.3.1 Developed Area

The groundwater flow in the developed area is predominantly west to east and is influenced by deep foundations (e.g., Building 28) and the Building 102 foundation dewatering system as described in Section 2.3 and as shown on Figure 2. The Site's Voluntary Monitoring Program currently consists of annual groundwater sampling of 18 monitoring wells (MW-1 through MW-4 and MW-6 through MW-19) for a focused list of analytical parameters including VOCs. EC sampling locations determined based on the occurrence of CVOCs and the past usage of EC containing AFFF are summarized below.

PCE, TCE, and 1,1,1-TCA have been historically detected in Voluntary Monitoring Program samples collected from developed area groundwater monitoring wells. PCE has been historically detected in samples collected from MW-6 which is located in the southwestern portion of the developed area. TCE has been detected in MW-4, MW-6, and MW-16. MW-4 is located in the central portion of the developed area and MW-16 is located on the eastern and downgradient portion of the developed area. 1,1,1-TCA has been detected historically in wells MW-4 and MW-6. 1,1,1-TCA was detected on one occasion in a sample collected from MW-7, which is located in the central portion of the developed area; this CVOC has not been detected in nearby downgradient well MW-8. Over the last three years of voluntary groundwater monitoring, VOCs have not been detected in any of the voluntary monitoring wells.

For RCRA CA Program monitoring wells, TCE has been historically detected in MW-3 assessment well TW-5 and in Building 93 SV well TMW-5.

While CVOCs have been detected in various monitoring wells across the Site’s developed area, the wells that have had the highest frequency of CVOC detections have been selected for EC sampling. Consideration to their location and the overall groundwater flow pattern has also been factored into the determination. Wells selected for EC sampling based on historical CVOC detections and location are MW-4, MW-6, and MW-16. MW-16 also serves as a representative downgradient location. Based on the past usage of AFFF for fire-fighting training as described in Section 3.2, Site monitoring well MW-10 is selected for EC groundwater sampling based on its location immediately north of (side/downgradient of) and adjacent to the fire-fighting training area as shown on Figure 2. Additionally, for completeness, MW-15, MW-17, and MW-18, all located on the east side of the developed area will also serve as representative downgradient EC sampling locations. Well MW-1, located on the west side of the developed area, has been selected for EC sampling and will serve as an upgradient monitoring location to wells with historical detections of CVOCs. Furthermore, indicator CVOCs have not been detected in samples collected from MW-1. Monitoring well locations are shown on Figure 2 and described on Table 1.

3.3.2 Hogback Road Landfill

Overall, groundwater flows radially from west to east across the landfill. The landfill monitoring program consists of annual groundwater sampling of five shallow overburden wells (HB-1A, LMW-4, HB-5A2, LMW-6, and HB-11A) and one bedrock well (HB-5B) for a focused list of analytical parameters which includes VOCs. Indicator CVOCs (primarily breakdown products) have been detected in samples collected from landfill monitoring wells. TCE was detected historically in HB-11A. Historically, low levels of other indicator CVOC breakdown products such as 1,1-dichloroethane and cis-1, 2-dichloroethene have been detected in LMW-4 and HB-5A2. No VOCs were detected in the landfill wells during the 2018 and 2019 monitoring events.

Based on its upgradient location, HB-1A is selected for EC groundwater sampling. Due to historical detections of CVOCs in groundwater and the radial groundwater flow pattern, LMW-4, HB-5A2, and HB-11A are selected for EC groundwater sampling. LMW-4 has a history of drying out; therefore, downgradient landfill monitoring well HB-4A, has been selected as an alternate EC sampling location should LMW-4 dry out and not recharge sufficiently to allow for sample collection. Monitoring well locations are shown on Figure 3 and described on Table 1.

4.0 SCOPE OF WORK

The SOW will consist of the collection of groundwater samples across the Site from the identified eight developed area Voluntary Monitoring Program wells and four landfill wells (one alternate well) as described in Section 3 (Figures 2 and 3) and on Table 1. Groundwater samples will be submitted to the Eurofins TestAmerica Laboratory in Sacramento, California for the analysis of PFAS in accordance with modified USEPA Method 537 and to the Eurofins TestAmerica Laboratory in Edison, New Jersey for analysis of 1,4-dioxane by USEPA Method 8270 selected ion monitoring (SIM). Both analytical laboratories are New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified for the methods and analytes subject to this SOW. In the event these laboratories are unavailable for sample analysis, equivalent NYSDOH ELAP certified laboratories will be selected for this SOW. The sample collection, handling, analysis, validation and investigation-derived waste (IDW) management procedures for the SOW are provided below.

4.1 Groundwater Sampling

Groundwater samples will be collected from the selected monitoring wells using the process detailed below. Existing dedicated groundwater sampling equipment that is within the selected wells will be removed prior to the start of the EC groundwater sampling event. Persons involved with the sampling program will be technically competent and familiar with the sampling procedures described herein.

4.1.1 Water Level Measurements

Prior to conducting groundwater sampling activities, the depth to groundwater will be measured in the monitoring well and compared to a previously determined well depth to calculate the volume of water to be purged during sampling activities. The water level measurements will be obtained in accordance with the procedures below.

Carefully remove the protective well cover and well cap to avoid having any foreign material enter the well. Screen for organic vapors with a photoionization detector (PID) at the well head.

The depth to groundwater levels will be measured using an electronic water level indicator probe graduated in 0.01 feet increments. Read the depth to groundwater, to the nearest 0.01 feet, from the graduated cable using the marked measuring point on the monitoring well casing as a reference. Remove the probe from the monitoring well and clean the probe and cable as described in Section 4.6. Information to record on the field form should include the monitoring well identification, date and time of the water level measurement, depth to water, and PID reading.

4.1.2 Purging Procedures

Groundwater monitoring wells will be purged prior to sample collection. In rapidly recharging monitoring wells, purging will be accomplished by removal of a minimum of three well volumes of water. In slowly recharging monitoring wells, the well should be purged to dryness for a minimum of one well volume. Monitoring well purging and sampling will be conducted while wearing appropriate personal protective equipment (PPE) and using sampling equipment as outlined in Attachment 1. Additional PFAS-related precautions will be taken during the sampling to minimize sample contamination, as also outlined in Attachment 1 and in the PFAS Pre-Sampling Checklist provided as Attachment 2.

Prior to purging the well, calculate the volume of water to be purged from the well. The selected monitoring wells may be purged using peristaltic pump (e.g., Geotech Geopump^{TM}, or equivalent) with dedicated, HDPE tubing. The tubing will be connected to the pump and a discharge hose directed into a container.

Water quality parameters will be measured after each well volume is purged using a groundwater multi-parameter device equipped with an in-line flow through cell equipped with temperature, conductivity, pH, oxidation-reduction potential and dissolved oxygen probes (e.g., YSI® Model 8260 with flow through cell and accessories or equivalent). Groundwater turbidity will also be measured prior to the flow through cell via an in-line bypass valve. Visual observations will also be noted at the start and end of purging.

Purging information will be recorded on the field form and should include well identification, date and time of purging, type of purging equipment, depth to water, well diameter, computed volume of water in well, appearance of purge water, volume of water purged, and field parameter readings.

4.2 Groundwater Sample Collection

Subsequent to purging activities, groundwater samples will be collected and submitted for laboratory analysis. If possible, groundwater samples will be collected within three hours after purging is completed. If recharge is sufficient, then samples will be collected immediately following well purging. For slowly recharging wells, groundwater samples will be collected after a sufficient volume of water for sampling is available in the well. During sampling, take care to prevent the tubing from coming in contact with any objects other than the riser of the well. Prior to sample collection, a new pair of nitrile gloves will be donned by sampling personnel. The groundwater sample for PFAS analysis will be collected first by direct filling the polypropylene or HDPE laboratory-provided containers. The sample for 1,4-dioxane analysis will be collected after the PFAS sample collection has been completed (including collection of any QC samples for PFAS analysis). The 1,4-dioxane samples will also be direct-filled into laboratory-provided containers. The sample container type, preservation and relative hold time are provided on Table 2. After collecting the sample, record the sample identification, project name, date and time of sample collection and sample analysis required onto the sample containers and on the field form. Record the sample information on a laboratory provided chain of custody and place the sample containers in a cooler containing regular ice for transportation to the laboratory. Close and lock (if applicable) the monitoring well.

Groundwater sampling information will be recorded on the field form. Information to record should include date and time of sampling, well identification, sample identification, method of sample collection, appearance of sample, type of sample container, analytical method requested, and identification of QC samples.

4.3 Quality Assurance/Quality Control Samples

Field duplicate samples will be collected at a rate of one per 19 environmental samples (not including the field duplicate) or, if less than 19 samples and practical, one per sample delivery group (SDG) per analysis (i.e., PFAS, 1,4-dioxane). Matrix spike/matrix spike duplicate (MS/MSD) sample pairs will also be collected at a rate of one per 19 environmental samples or, if less than 19 samples and practical, one per SDG per analysis. Equipment blanks will be collected for each SDG or 20 field samples, whichever occurs first. Equipment blanks will include each type of sampling equipment used including single use, pre-cleaned sampling equipment. Equipment blanks will be collected by pouring laboratory provided water over sampling equipment and into laboratory provided containers. Equipment blanks will be subject to the same analyses as the associated environmental samples.

In addition, one field reagent blank (FRB) will be collected on each day samples for PFAS analysis are collected and/or at least one FRB per sample area. FRBs are collected in the field by transferring laboratory supplied PFAS-free water in one sample container into an empty laboratory-supplied container at the same general location and time as the collection of the environmental samples. FRBs are for PFAS analysis only and are not applicable to samples collected for 1,4-dioxane analysis.

Table 1 provides a summary of the QC samples and analytical methods.

4.4 Sample Identification and Labeling

Sample labels should be prepared at the time of sample collection with the information described above. The collected samples will be assigned a unique sample identification code based on the sampling location. Generally, for groundwater samples, the sample identification code will include the field location number and date of collection. MS/MSD samples will be identified as MS/MSD samples on the chain-of-custody.

Blind field duplicate samples will be labeled X-1, X-2, etc. The field notes will identify the blind field duplicate samples, as well as where they were obtained.

4.5 Laboratory Analysis and Data Validation

The groundwater and QC samples will be analyzed for 21 PFAS by modified USEPA Method 537. This method was originally developed for use with the Third Unregulated Contaminant Monitoring Rule (UCMR3), which included six PFAS. The UCMR3 list of six PFAS and NYSDEC's current list of 21 PFAS analytes both include PFOS and PFOA, which are currently the only two PFAS for which USEPA has drinking water health advisories and for which NYSDOH recently established drinking water standards. The groundwater and QC samples will be analyzed for 1,4-dioxane by USEPA SW-846 Method 8270 with SIM which also has a NYSDOH established drinking water standard. Table 3 lists the analytical laboratory method detection limits and practical quantitation limits for the 21 PFAS and 1,4-dioxane.

The analytical laboratories will provide Analytical Service Protocol (ASP) Category B analytical data packages that document sample preparation, extraction, and analysis for the samples. EQuIS^{TM} 4-file electronic data deliverables (EDDs) will also be provided by the analytical laboratory.

Following receipt of the analytical data packages, the analytical data will be validated by an independent data validator in accordance with this SOW and with guidance from the following documents as appropriate:

- NYSDEC. 2021. Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs, January 2021, reference (1).
- USEPA. 2018. USEPA Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537, EPA 910-R-18-001, November 2018, reference (7).
- USEPA. 2017. USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Superfund Methods Data Review, January 2017, reference (8).

The validated analytical data will be evaluated by comparison of the detected PFAS concentrations to the lifetime health advisories issued by USEPA in May 2016 [70 parts per trillion (ppt)] for PFOA and PFOS, individually and combined and the drinking water standards established by NYSDOH in August 2020 [10 ppt for PFOA, 10 ppt for PFOS, and 1 part per billion (ppb) for 1,4-dioxane]. With the exception of the above water standards, there are no federal or state ambient groundwater quality standards for 1,4-dioxane or any PFAS (including PFOA and PFOS). Further assessment may be warranted if either of the following additional NYSDEC screening levels are met:

- Any other individual PFAS (excluding PFOA or PFOS) is detected in water at or above 100 ppt; or
- Total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ppt.

4.6 Equipment Cleaning

All non-dedicated sampling equipment will be cleaned between each use. Equipment will be cleaned using a spray bottle with laboratory provided water, followed by a 1,4-dioxane free soap (e.g., Seventh Generation ™)/laboratory provided water mix. A secondary rinse with the laboratory provided water should then be used and the equipment wiped with paper towels. Cleaning fluids will be returned to ground surface near each sampling location, absent of any visual or olfactory evidence of contamination.

4.7 IDW Management

IDW may include, but not necessarily be limited to, PPE and disposable sampling materials (e.g., tubing, paper towels), and purged groundwater.

PPE and sampling materials will be appropriately containerized and disposed of in accordance with KAPL waste management procedures. At this time, it is assumed that PPE and purged groundwater will be non-hazardous.

Purge water will be returned to the ground within the same general area from which it was generated, absent of any visual or olfactory evidence of gross contamination.

5.0 IMPLEMENTATION SCHEDULE AND REPORTING

This SOW will be implemented by a subcontractor experienced in PFAS and 1,4-dioxane sampling, under KAPL-Environmental Remediation oversight during the 2nd Quarter 2021. NYSDEC will be kept apprised of the fieldwork schedule as it develops.

Results of the PFAS and 1,4-dioxane analyses will be provided to NYSDEC in a report that will include the data validation report. The ASP Category B data packages will be uploaded to NYSDEC's File Transfer Service, and the validated analytical data will also be submitted to NYSDEC in an EDD-format compliant with NYSDEC's Environmental Information Management System requirements. A schedule for submitting the monitoring report to NYSDEC will be provided within 30 days of receiving the final validated data.

6.0 REFERENCES

1) NYSDEC. 2021. Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs, January 2021
2) USEPA. 2017. USEPA Technical Fact Sheet – 1,4-Dioxane, EPA 505-F-17-011, November 2017
3) USEPA. 2017. USEPA Technical Fact Sheet – Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA), EPA 505-F-17-001, November 2017
4) KAPL. 2011. Soil Vapor Intrusion Evaluation Work Plan, Knolls Atomic Power Laboratory - Kesselring Site, November 2011
5) KAPL. 2020. Stormwater Drain System (SWMU #55) Current Industrial Sewer Conditions RCRA Facility Assessment Sampling Visit Report for Building 93, Knolls Atomic Power Laboratory - Kesselring Site, September 2020
6) KAPL. 1998. Hogback Road Landfill Post-Closure Monitoring and Maintenance Operations Manual, Knolls Atomic Power Laboratory, Kesselring Site, September 1998, Revised March 2014
7) USEPA. 2018. USEPA Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537, EPA 910-R-18-001, November 2018
8) USEPA. 2017. USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Superfund Methods Data Review, January 2017

Tables

Table 1

Sample Schedule and
Analytical Methods/Quality Control Summary

Knolls Atomic Power Laboratory
Kesselring Site
Emerging Contaminants Sampling Scope of Work

		Analytical Method	
Well ID	***Location/Comment***	***21 PFAS by modified EPA Method 537***	***1,4-Dioxane by EPA Method 8270 SIM***
Hogback Rd. Landfill Wells:			
HB-1A	Upgradient of landfill	1	1
LMW-4	Downgradient well and historical detections of CVOCs	1	1
HB-5A2	Downgradient well and historical detections of CVOCs	1	1
HB-4A[1]	Downgradient of landfill	---	---
HB-11A	Downgradient well and historical detections of CVOCs	1	1
Facility Area Wells:			
MW-1	Upgradient well	1	1
MW-4	Downgradient well and historical detections of CVOCs	1	1
MW-6	Downgradient well and historical detections of CVOCs	1	1
MW-10	Monitoring well proximal to historical fire fighting training area.	1	1
MW-15	Downgradient well	1	1
MW-16	Downgradient well and historical detections of CVOCs	1	1
MW-17	Downgradient well	1	1
MW-18	Downgradient well	1	1
	Estimated Environmental Samples	12	12
	Field Duplicate	1	1
	MS	1	1
	MSD	1	1
	Equipment Blank	1	1
	Field Reagent Blank*	3	0
	Total	**19**	**16**

Notes:

PFAS = Per and polyfluoroalkyl substances; EPA = United States Environmental Protection Agency;
SIM = selected ion monitoring; MS = matrix spike; MSD matrix spike duplicate
CVOC - chlorinated volatile organic compound
* Field reagent blanks will be collected for PFAS analysis only.

[1] Monitoring well HB-4A is listed as an alternative well should LMW-4 be dry.

Table 2

Sample Container, Preservation, and Holding Times

Knolls Atomic Power Laboratory
Kesselring Site
Emerging Contaminants Sampling Scope of Work

Matrix	Parameter	Sample Containers	Preservation	Holding Time
Water	PFAS	2 x 250 mL HDPE containers	$\leq$ 6 °C	14 days
	1,4-dioxane	2 x 250 mL amber glass containers	$\leq$ 6 °C	7 days

Notes:

PFAS = Per- and polyfluoroalkyl substances; mL = milliliters; HDPE = High Density Polyethylene

°C = degrees Celsius

Holding times begin from the date of sample collection.

Extra sample volume will be collected for matrix spike/matrix spike duplicate samples, as needed.

Source of information: Eurofins Test America Laboratories in Sacramento, California (PFAS) and Edison, New Jersey (1,4-dioxane).

Table 3

Laboratory Method Detection Limits and Practical Quantitation Limits

Knolls Atomic Power Laboratory
Kesselring Site
Emerging Contaminants Sampling Scope of Work

		Groundwater	
PFAS Chemical Name	**CASRN**	**MDL (ng/L)**	**PQL (ng/L)**
Perfluorobutane sulfonic acid	375-73-5	0.200	2.00
Perfluorohexane sulfonic acid	355-46-4	0.570	2.00
Perfluoroheptane sulfonic acid	375-92-8	0.190	2.00
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.540	2.00
Perfluorodecane sulfonic acid	335-77-3	0.320	2.00
Perfluorobutanoic acid	375-22-4	2.40	5.00
Perfluoropentanoic acid	2706-90-3	0.490	2.00
Perfluorohexanoic acid	307-24-4	0.580	2.00
Perfluoroheptanoic acid	375-85-9	0.250	2.00
Perfluorooctanoic acid (PFOA)	335-67-1	0.850	2.00
Perfluorononanoic acid	375-95-1	0.270	2.00
Perfluorodecanoic acid	335-76-2	0.310	2.00
Perfluoroundecanoic acid	2058-94-8	1.10	2.00
Perfluorododecanoic acid	307-55-1	0.550	2.00
Perfluorotridecanoic acid	72629-94-8	1.30	2.00
Perfluorotetradecanoic acid	376-06-7	0.730	2.00
1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	2.50	5.00
1H, 1H, 2H, 2H-Perfluorodecanesulfonic acid	39108-34-4	0.460	2.00
Perfluorooctane sulfonamide	754-91-6	0.980	2.00
N-Methylperfluorooctane sulfonamido acetic acid	2355-31-9	1.20	5.00
N-Ethylperfluorooctane sulfonamido acetic acid	2991-50-6	1.30	2.00
Chemical Name	**CASRN**	**MDL (µg/L)**	**PQL (µg/L)**
1,4-Dioxane	123-91-1	0.0160	0.200

Notes:

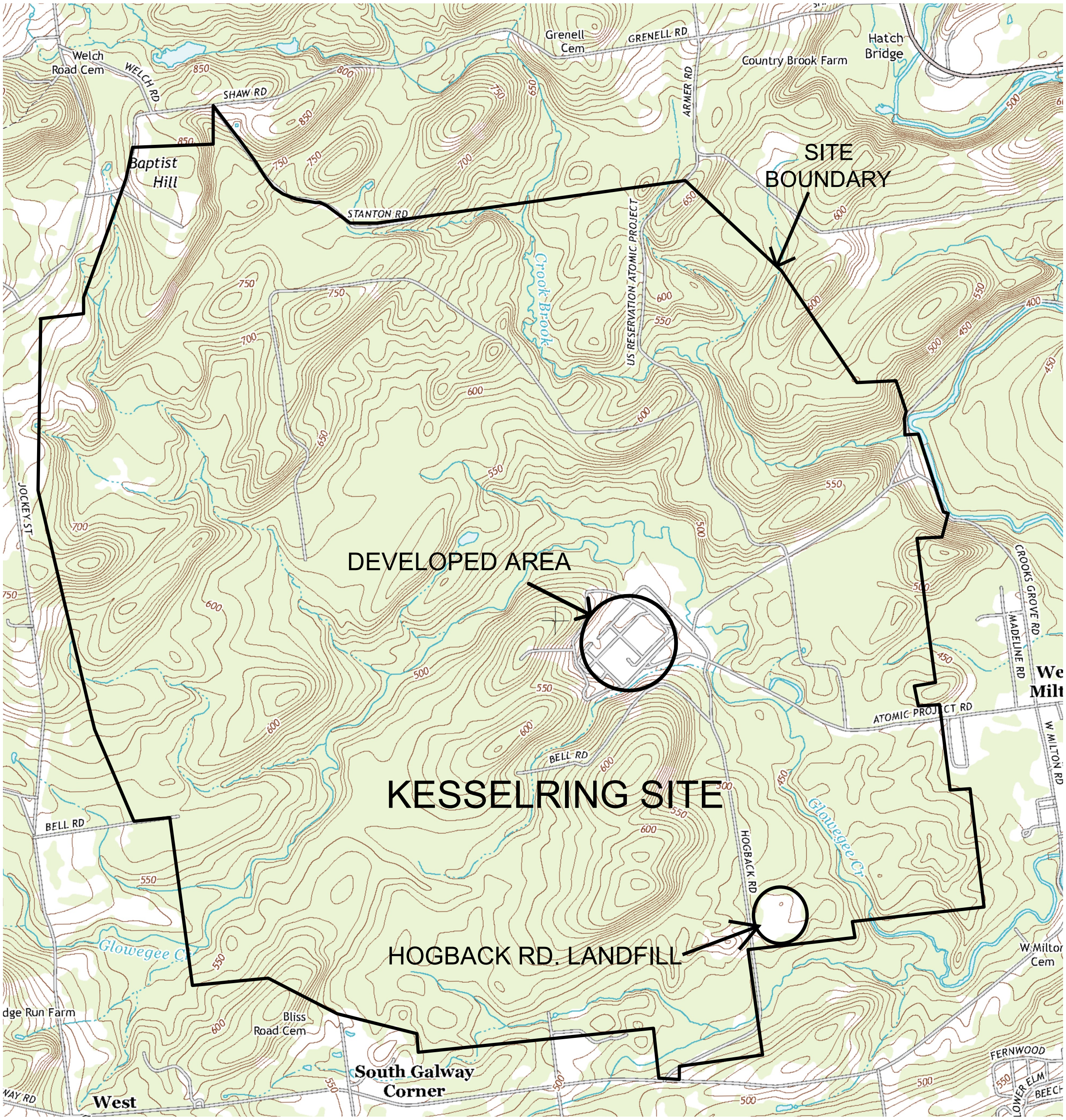
PFAS = Per- and polyfluoroalkyl substances; CASRN = Chemical Abstracts Service Registry Number; MDL = method detection limit; PQL = practical quantitation limit; ng/L = nanograms per liter or parts per trillion; µg/L - micrograms per liter or parts per billion.

Source of PFAS analytes list: New York State Department of Environmental Conservation. Sampling, Analysis, and Assessment of PFAS, Appendix G, January 2021.

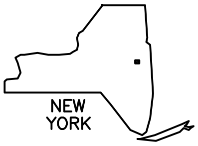
Source of MDLs and PQLs: Eurofins Test America Laboratories in Sacramento, California (PFAS) and Edison, New Jersey (1,4-dioxane). MDL and PQL values may vary based on the overall analyte concentration in the sample and potential matrix interferences.

Figures

FIGURE 1



ADAPTED FROM: MIDDLE GROVE, NEW YORK U.S.G.S. 7.5 MIN. QUAD (2013)

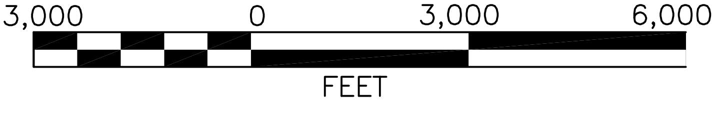


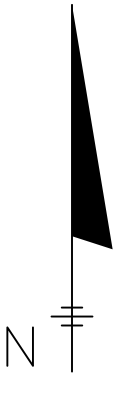
QUADRANGLE LOCATIO

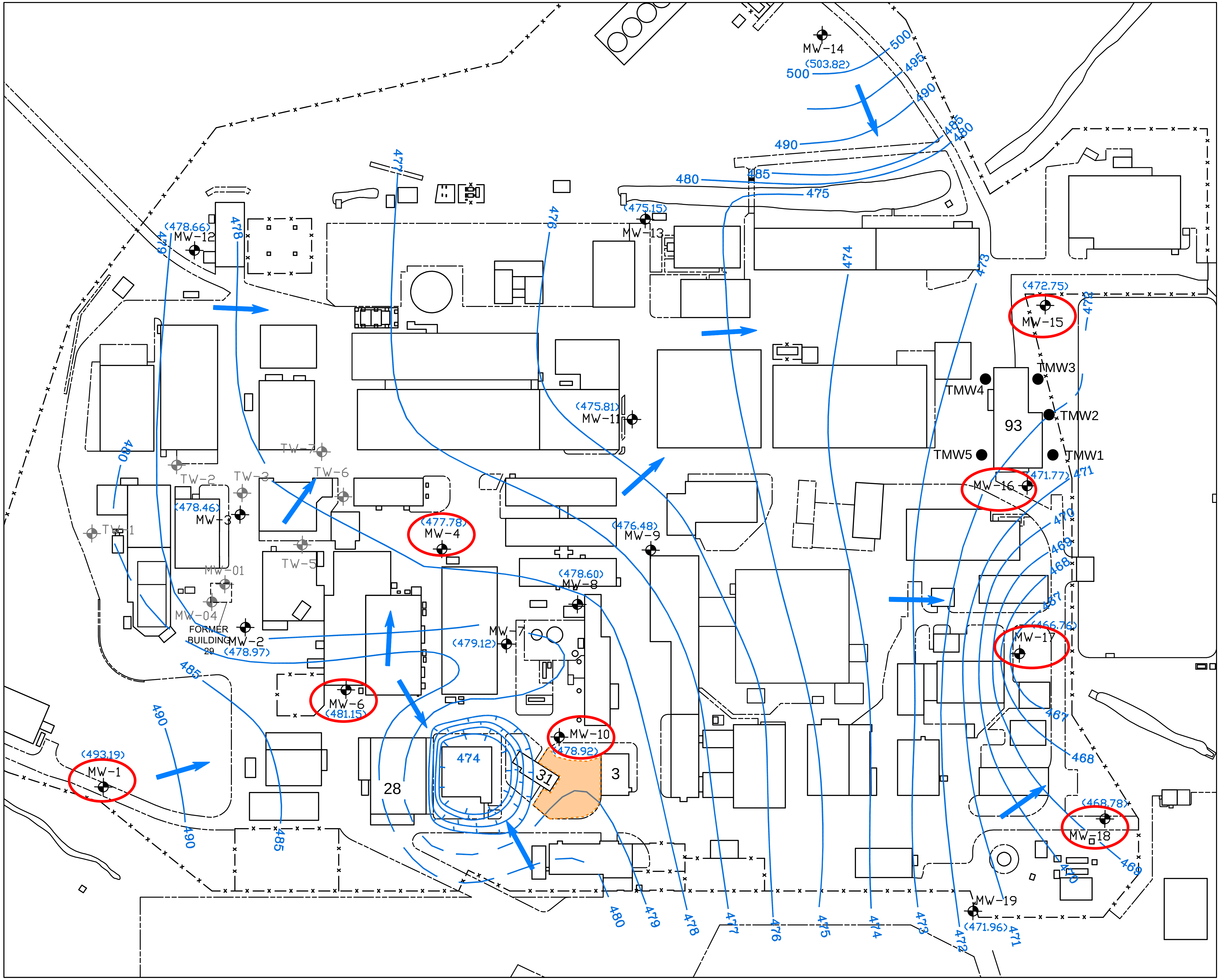
KNOLLS ATOMIC POWER LABORATORY – KESSELRING SITE
WEST MILTON, NEW YORK

EMERGING CONTAMINANTS SAMPLING SCOPE OF WORK

SITE LOCATION MAP







CALLED NORTH

TRUE NORTH

Legend

● Bld. 93 Monitoring Well Location (Approximate)

MW-2 (478.97) Monitoring Well Location with Groundwater Elevation Measured on August 26, 2019

TW-7 Monitoring Well Not Measured

Groundwater Elevation Contour (Dashed where inferred)

Groundwater Flow Direction

▨ Possible fire fighting training area

Note:
1. Monitoring wells surveyed in February 2010.
2. Groundwater elevations and contours presented in feet above mean sea level.
3. Contour interval = 1 foot when <480 and 5 feet when >480.
4. Groundwater measurements obtained August 25, 2019.

○ Groundwater Monitoring Well and Identification Number selected for EC Sampling

KNOLLS ATOMIC POWER
LABORATORY - KESSELRING SITE
WEST MILTON, NEW YORK

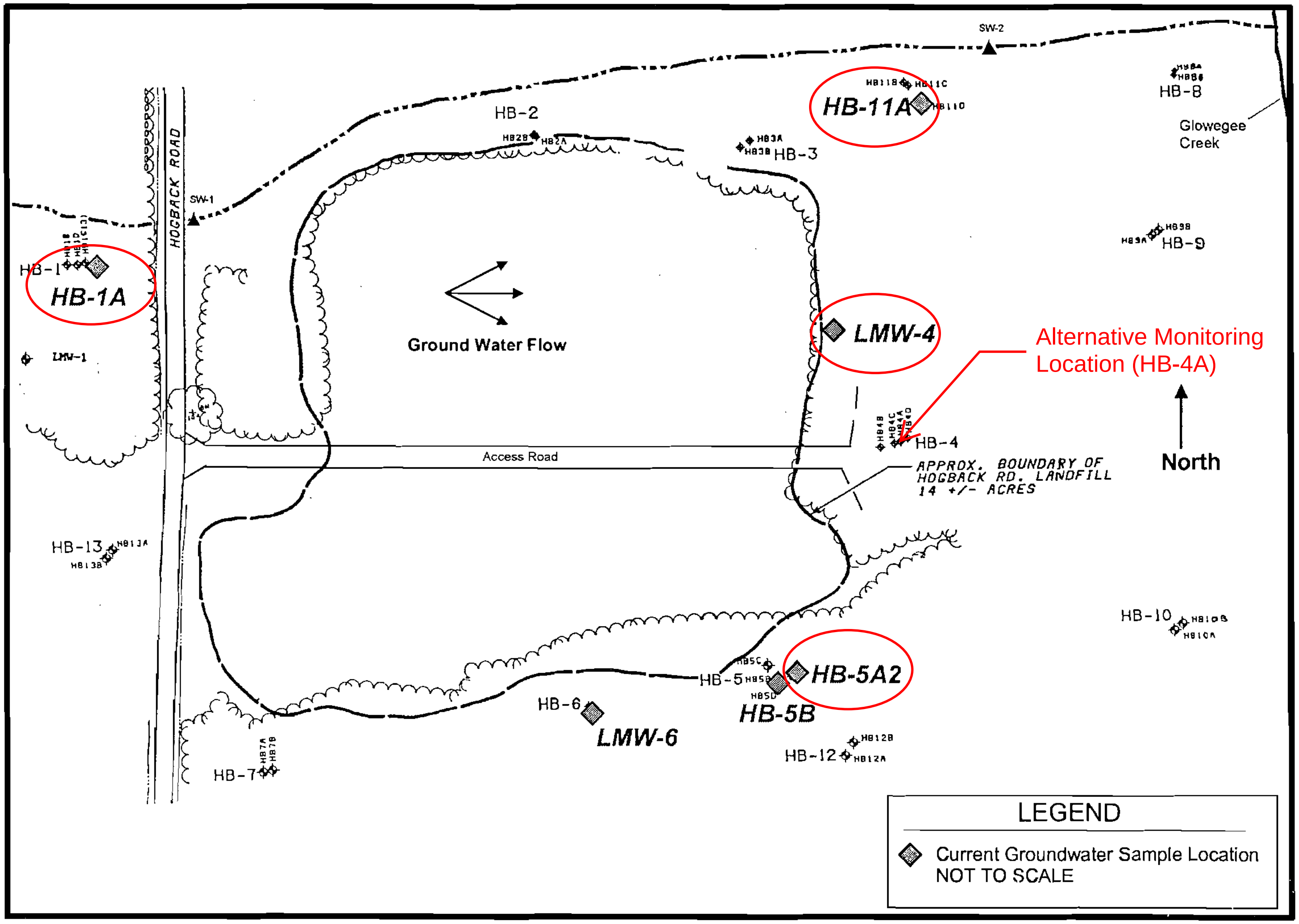
EMERGING CONTAMINANTS
SAMPLING SCOPE OF WORK

FIGURE 2
PROPOSED DEVELOPED AREA SAMPLE LOCATION MAP

75 0 75

Source: Stormwater Drain System (SWMU#55) CISC RCRA Facility Assessment SV Report for Building 93, September 2020

HOGBACK RD. LANDFILL - GROUNDWATER MONITORING WELLS



KNOLLS ATOMIC POWER
LABORATORY -
KESSELRING SITE
WEST MILTON, NEW YORK

EMERGING
CONTAMINANTS
SAMPLING SCOPE OF
WORK

FIGURE 3
PROPOSED CLOSED
HOGBACK RD. LANDFILL
SAMPLE
LOCATION MAP

Source: Knolls Laboratory and Kesselring Site,
Environmental Monitoring Report
Calendar Year 2019, Figure 7

◇ **HB-1A** Groundwater Monitoring Well and Identification Number selected for EC Sampling

Attachment 1

Attachment 1. Summary of Prohibited and Acceptable Items for PFAS Sampling

Prohibited	Acceptable
Field Equipment	
Materials and equipment containing the following: - Polytetrafluoroethylene (PTFE), including the trademarks Teflon® and Hostaflon® - Fluorinated ethylene propylene (FEP), including the trademarks Teflon® FEP, Hostaflon® FEP, and Neoflon® - Polyvinylidene fluoride (PVDF), including the trademark Kynar® - Polychlorotrifluoroethylene (PCTFE), including the trademark Neoflon® - Ethylene-tetrafluoroethylene (ETFE), including the trademark Tefzel® - Trademarks Viton®, Gore-Tex®, and Decon 90®	Materials and equipment containing the following: - Silicone - Acetate - Stainless steel - Polypropylene - Polyurethane - Polyvinylchloride (PVC) - Neoprene - Nylon
Low density polyethylene (LDPE) materials, unless certified by the manufacturer as PFAS-free	High density polyethylene (HDPE) materials
Waterproof field books, waterproof paper and waterproof sample bottle labels	Loose-leaf, non-waterproof paper and non-waterproof sample labels
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
Waterproof/permanent markers, including the trademark Sharpies®	Ball point pens or pencils
Aluminum foil	LDPE storage bags, including Ziploc®, that do not come into direct contact with sample media
Post-It Notes®, or similar	
Chemical (blue) ice packs	Double-bagged water ice
Field Clothing and PPE	
New cotton clothing or synthetic water resistant, waterproof, or stain-treated clothing, including: - Any Teflon® fabric protectors (e.g., Gore-Tex™, Repel Teflon® and Ultra Release Teflon®) - Any Scotchgard™ fabric protectors - Bionic Finish® - GreenShield® - High-Performance Release Teflon® and Ultra Release Teflon® - Lurotex Protector FL ECO® - Resists Spills™ and Releases Stains™ - RUCO®, RUCO-COAT®, RUCO-GUARD®, RUCO-PROTECT®, RUCOSTAR®, RUCOTEC®, and Rucostar® EEE6 - NK Guard S series - Oleophobol CP® - Repellan KFC® - Unidyne™	Clothing made from: - Fabric made of synthetic or natural fibers (preferably cotton) that are well-laundered (more than six times with no fabric softener) - Fabric made from or treated with neoprene, polyurethane, or PVC - Wax-coated fabrics - PVC-coated fabrics
Clothing laundered using fabric softener	No fabric softener
Clothing chemically treated for insect resistance or ultraviolet (UV) protection	
Boots containing Gore-Tex™ or treated with water-resistant spray	Boots made with polyurethane and PVC
Coated (i.e., yellow) Tyvek®	Non-coated (i.e., white)Tyvek®

Attachment 1. Summary of Prohibited and Acceptable Items for PFAS Sampling

Prohibited	Acceptable
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	
Sunscreens or insecticides, except as noted on right	Sunscreens - Alba Organics Natural Sunscreen - Aubrey Organics - Banana Boat for Men Triple Defense Continuous Spray SPF 30 - Banana Boat Sport Performance Coolzone Broad Spectrum SPF 30 - Banana Boat Sport Performance Sunscreen Stick SPF 50 and Lotion Broad Spectrum SPF 30 - Coppertone Sport High-Performance AccuSpray Sunscreen SPF 30 - Coppertone Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50 - Coppertone Sunscreen Stick Kids SPF 55 - Jason Natural Sun Block - Kiss My Face - L'Oréal Silky Sheer Face Lotion 50+ - Meijer Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50 - Meijer Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70 - Neutrogena Beach Defense Water + Sun Barrier Lotion SPF 70 and Broad Spectrum SPF 30 - Neutrogena Pure & Free Baby Sunscreen Broad Spectrum SPF 60+ - Neutrogena Ultra-Sheer Dry-Touch Sunscreen Broad Spectrum SPF 30 - Yes To Cucumbers Insect Repellents - Baby Ganics - California Baby Natural Bug Spray - Jason Natural Quit Bugging Me - Herbal Armor - Repel Lemon Eucalyptus Insect repellant - Sawyer Permethrin Sunscreen and insect repellant - Avon Skin So Soft Bug Guard Plus - SPF 30
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Unlined polypropylene caps
Rain Events	
Waterproof or resistant rain gear	Wet weather gear made of polyurethane and PVC only; field tents that are only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90®	Alconox®, Liquinox®, Seventh Generation ™ and Citranox® branded products
Water from an on-site well	
Potable water from untested public water supply	Laboratory supplied PFAS-free water

Attachment 1. Summary of Prohibited and Acceptable Items for PFAS Sampling

Prohibited	Acceptable
Food Considerations	
All food and drink, with exceptions noted on right	Bottled water and hydration fluids (i.e., Gatorade® and Powerade®) to be brought and consumed only in the staging areas
Vehicle Considerations	
Vehicle fabrics, carpets and mats may contain PFAS	Avoid utilizing areas inside vehicle as sample staging areas

Attachment 2

RAMBOLL

ENVIRONMENT
& HEALTH

PFAS Pre-Sampling Checklist

Site Name: ______________________ Task: ______________________

Weather (temp/precip): ______________________ Date: ______________________

Pre-Mobilization:

☐ The QAPP or other site-specific field guidance has been consulted for sample locations, QC sampling requirements, and sample nomenclature

Field Clothing and PPE:

☐ Using white Tyvek®; not using yellow Tyvek®

☐ Clothing has not been most recently washed with fabric softeners or other treatments

☐ Clothing has not been permanently chemically treated for insect resistance or UV protection

☐ Clothing has not been treated with materials or formulations potentially containing PTFE or other PFAS products listed named in this checklist

☐ Any personal care products, if used, have been applied outside sampling zone, hands have been washed, and new nitrile gloves are being used

☐ Any use of sunscreens or insect repellants is consistent with the commercial products named in this checklist

Field Equipment:

☐ Subcontractor (e.g., driller) materials and equipment conform to the requirements of this checklist (as applicable)

☐ Sampling equipment is free of PTFE and other potentially PFAS-containing components listed in this checklist

☐ Sampling equipment is made from stainless steel, HDPE, acetate, silicon, HDPE, or nylon

☐ Waterproof field books, waterproof paper, and Post-It Notes® are not used

☐ Markers (e.g., Sharpies®) are used only in the staging area or are not used

Sample Containers:

☐ Water ice is in use only, not chemical (blue) ice packs

☐ Sample containers have been received and are made of HDPE or polypropylene

☐ Bottleware for non-drinking water samples do not contain preservative

☐ Caps are unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

☐ Wet weather gear made of polyurethane and PVC only, or is being worn under white Tyvek® covering

Equipment Decontamination (as applicable):

☐ On-site or off-site public or private water, if to be used for equipment decontamination, has been analyzed and is "PFAS-free" (water that does not contain any site-specific target PFAS analytes above laboratory detection limits).

☐ Alconox®, Liquinox®, Seventh Generation™, and Citranox® are being used as decontamination cleaning agents; Decon 90® is not being used.

Food Considerations:

☐ Any pre-wrapped food or snacks, carry-out food, fast food, or other food items will remain in the staging area

☐ Any food items, will be consumed outside the sampling zone, hands will be washed, and new PPE and nitrile gloves will be used

Work Area and Vehicle Considerations:

☐ Work areas, including vehicle interiors if used for sample handling, are covered with HDPE or LDPE plastic to prevent contact with potentially PFAS-containing materials and surfaces

If any applicable boxes cannot be checked, describe deviations below and work with field personnel to address issues prior to commencement of that day's work. Materials present and identified as potentially containing PFAS through use of this checklist should be relocated to the support area or other area of the site away from the sampling locations and noted below.

______________________________ ______________

Field Team Leader Name and Signature Time

Field clothing and PPE to be **avoided** include:

- Clothing that has recently been washed with fabric softener.
- Coated (i.e., yellow) Tyvek®.
- Clothing chemically treated for insect resistance and ultraviolet protection.
- Clothing that has been treated with water and/or stain resistant coatings such as:
    - Any Teflon® fabric protectors (e.g., Gore Tex)
    - Any Scotchgard™ fabric protectors
    - Bionic Finish®
    - GreenShield®
    - High-Performance Release Teflon®
    - Lurotex Protector RL ECO®
    - Resists Spills™ and Releases Stains™
    - RUCO®
    - RUCO-COAT®
    - RUCO-GUARD®
    - RUCO-PROTECT®
    - RUCOSTAR®
    - NK Guard S series
    - Oleophobol CP®
    - Repel Teflon® fabric protector
    - Repellan KFC®
    - Rucostar® EEE6
    - RUCOTEC®
    - Ultra Release Teflon®
    - Unidyne™

If required, sun and biological protection products **preferred for use** (however, care should be taken to use these exact products because similar products from the same brand may contain PFAS) include:

- Alba Organics Natural Sunscreen
- Aubrey Organics
- Avon Skin So Soft Bug Guard-SPF 30
- Baby Ganics
- Banana Boat for Men Triple Defense Continuous Spray Sunscreen SPF 30
- Banana Boat Sport Performance Coolzone Broad Spectrum SPF 30
- Banana Boat Sport Performance Sunscreen Lotion Broad Spectrum SPF 30
- Banana Boat Sport Performance Sunscreen Stick SPF 50
- California Baby Natural Bug Spray

- Coppertone Sport High-Performance AccuSpray Sunscreen SPF 30
- Coppertone Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50
- Coppertone Sunscreen Stick Kids SPF 55
- Herbal Armor
- Jason Natural Quit Bugging Me
- Jason Natural Sun Block
- Kiss My Face
- L'Oréal Silky Sheer Face Lotion 50+
- Meijer Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50
- Meijer Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70
- Neutrogena Beach Defense Water + Sun Barrier Lotion SPF 70
- Neutrogena Beach Defense Water + Sun Barrier Spray Broad Spectrum SPF 30
- Neutrogena Pure & Free Baby Sunscreen Broad Spectrum SPF 60+
- Neutrogena Ultra-Sheer Dry-Touch Sunscreen Broad Spectrum SPF 30
- Repel Lemon Eucalyptus
- Sawyer Permethrin
- Yes To Cucumbers

Sampling equipment and materials to be **avoided**, which include:

- Polytetrafluoroethylene (PTFE), including the trademarks Teflon® and Hostaflon®.
- Fluorinated ethylene propylene (FEP), including the trademarks Teflon® FEP, Hostaflon® FEP, and Neoflon®.
- Polyvinylidene fluoride (PVDF), including the trademark Kynar®.
- Polychlorotrifluoroethylene (PCTFE), including the trademark Neoflon®.
- Ethylene-tetrafluoroethylene (ETFE), including the trademark Tefzel®.
- Trademarks Viton®, Gore-Tex® and Decon 90® products with the term "fluoro" in the product name.
- Waterproof field notebooks.
- New clothing, as it may have fabric treatment applied.
- Post-It® notes or similar.
- Decon 90®.