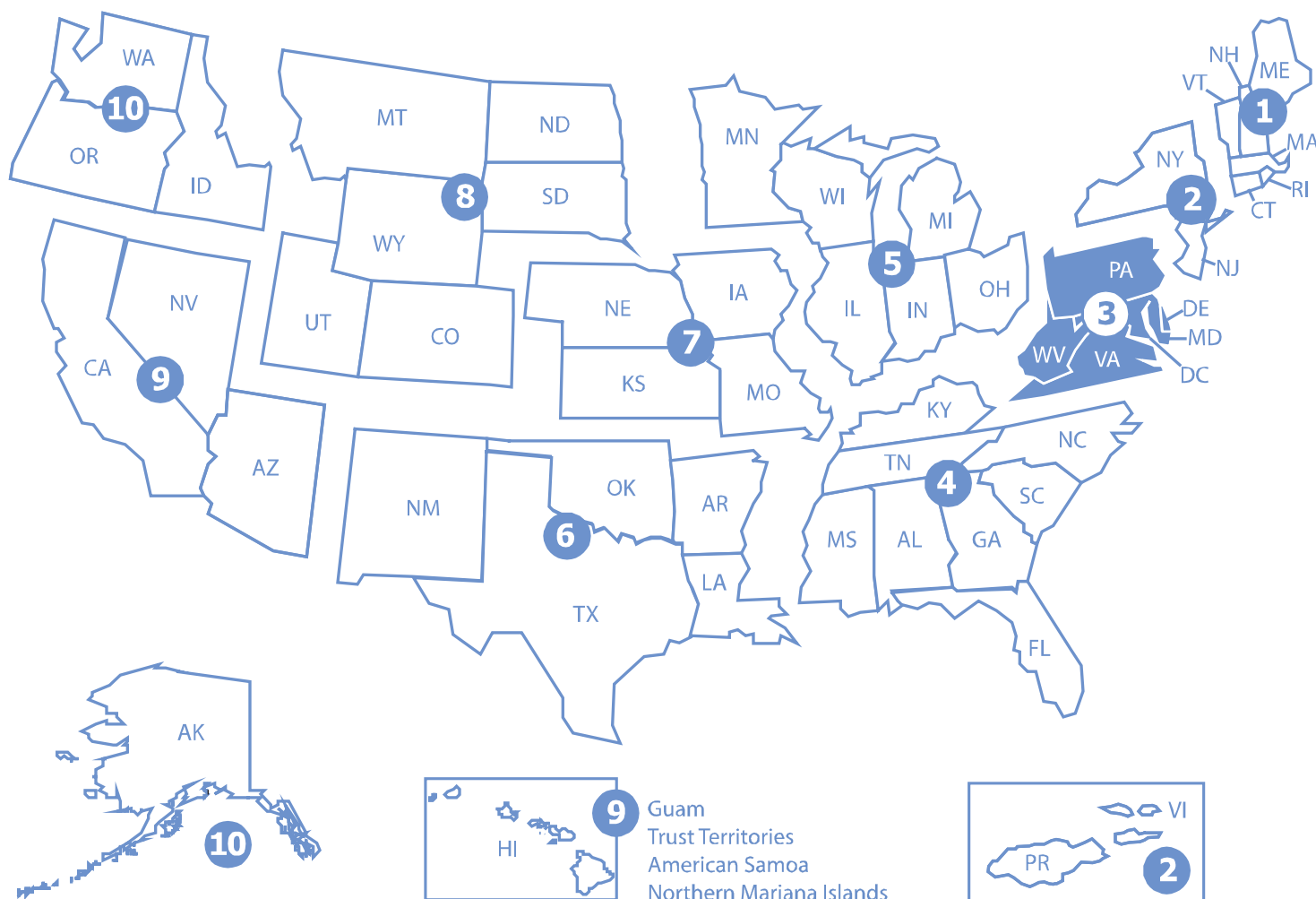




Support Document for the Revised National Priorities List Final Rule – East Basin Road Groundwater



**Support Document for the
Revised National Priorities List
Final Rule
East Basin Road Groundwater
March 2023**

**Site Assessment and Remedy Decisions Branch
Office of Superfund Remediation and Technology Innovation
Office of Land and Emergency Management
U.S. Environmental Protection Agency
Washington, DC 20460**

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Attachment 1 - Excerpt from EA Engineering, Science, and Technology, Inc., Sampling and Analysis Plan, Site Inspection New Castle Public Wells Groundwater Plume Site (aka 0 East Basin Road New Castle PFOS-PFOA Site) DE-0363 New Castle, Delaware, June 2020.

Attachment 2 - Excerpt from EA Engineering, Science, and Technology, Inc., Sampling and Analysis Plan Addendum Expanded Site Inspection New Castle Public Wells Groundwater Plume Site (DE-0363) New Castle, Delaware, August 2021.

Attachment 3 - Excerpt from Delaware Department of Natural Resources and Environmental Control (DNREC), New Castle Public Wells Groundwater Plume (aka Zero (0) E. Basin Road New Castle PFOA-PFOA) Site Inspection Work Plan, New Castle, Delaware, May 2017.

Executive Summary

Section 105(a)(8)(B) of CERCLA, as amended by SARA, requires that the EPA prepare a list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States. An original National Priorities List (NPL) was promulgated on September 8, 1983 (48 FR 40658). CERCLA requires that EPA update the list at least annually.

This document provides responses to public comments received on East Basin Road Groundwater site, proposed on September 9, 2022 (87 FR 55342). This site is being added to the NPL based on an evaluation under EPA's Hazard Ranking System (HRS) in a final rule published in the *Federal Register* in March 2023.

Introduction

This document explains the rationale for adding the East Basin Road Groundwater site in New Castle, Delaware to the National Priorities List (NPL) of uncontrolled hazardous waste sites and provides responses to public comments received on this site listing proposal. The EPA proposed this site to the NPL on September 9, 2022 (87 FR 55342). This site is being added to the NPL based on an evaluation under the Hazard Ranking System (HRS) in a final rule published in the *Federal Register* in March 2023.

Background of the NPL

In 1980, Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. Sections 9601 *et seq.* in response to the dangers of uncontrolled hazardous waste sites. CERCLA was amended on October 17, 1986, by the Superfund Amendments and Reauthorization Act (SARA), Public Law No. 99-499, stat., 1613 *et seq.* To implement CERCLA, EPA promulgated the revised National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, on July 16, 1982 (47 FR 31180), pursuant to CERCLA Section 105 and Executive Order 12316 (46 FR 42237, August 20, 1981). The NCP, further revised by EPA on September 16, 1985 (50 FR 37624) and November 20, 1985 (50 FR 47912), sets forth guidelines and procedures needed to respond under CERCLA to releases and threatened releases of hazardous substances, pollutants, or contaminants. On March 8, 1990 (55 FR 8666), EPA further revised the NCP in response to SARA.

Section 105(a)(8)(A) of CERCLA, as amended by SARA, requires that the NCP include:

criteria for determining priorities among releases or threatened releases throughout the United States for the purpose of taking remedial action and, to the extent practicable, taking into account the potential urgency of such action, for the purpose of taking removal action.

Removal action involves cleanup or other actions that are taken in response to emergency conditions or on a short-term or temporary basis (CERCLA Section 101). Remedial action is generally long-term in nature and involves response actions that are consistent with a permanent remedy for a release (CERCLA Section 101). Criteria for placing sites on the NPL, which makes them eligible for remedial actions financed by the Trust Fund established under CERCLA, were included in the HRS. EPA promulgated the HRS as Appendix A of the NCP (47 FR 31219, July 16, 1982). On December 14, 1990 (56 FR 51532), EPA promulgated revisions to the HRS in response to SARA, and established the effective date for the HRS revisions as March 15, 1991. On January 9, 2017, EPA promulgated a further revision to the HRS that added a component for evaluating the threats posed by the intrusion of subsurface contamination into regularly occupied structures. These changes are consistent with, and comply with, the statutory requirements of SARA.

Section 105(a)(8)(B) of CERCLA, as amended, requires that the statutory criteria provided by the HRS be used to prepare a list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States. The list, which is Appendix B of the NCP, is the NPL.

An original NPL of 406 sites was promulgated on September 8, 1983 (48 FR 40658). At that time, an HRS score of 28.5 was established as the cutoff for listing because it yielded an initial NPL of at least 400 sites, as suggested by CERCLA. The NPL has been expanded several times since then, most recently on December 22, 2022 (87 FR 78568). The Agency also has published a number of proposed rulemakings to add sites to the NPL. The most recent proposal was on September 9, 2022 (87 FR 55342).

Development of the NPL

The primary purpose of the NPL is stated in the legislative history of CERCLA (Report of the Committee on Environment and Public Works, Senate Report No. 96-848, 96th Cong., 2d Sess. 60 [1980]).

The priority list serves primarily informational purposes, identifying for the States and the public those facilities and sites or other releases which appear to warrant remedial actions. Inclusion of a facility or site on the list does not in itself reflect a judgment of the activities of its owner or operator, it does not require those persons to undertake any action, nor does it assign liability to any person. Subsequent government actions will be necessary in order to do so, and these actions will be attended by all appropriate procedural safeguards.

The NPL, therefore, is primarily an informational and management tool. The identification of a site for the NPL is intended primarily to guide EPA in determining which sites warrant further investigation to assess the nature and extent of the human health and environmental risks associated with the site and to determine what CERCLA-financed remedial action(s), if any, may be appropriate. The NPL also serves to notify the public of sites EPA believes warrant further investigation. Finally, listing a site may, to the extent potentially responsible parties are identifiable at the time of listing, serve as notice to such parties that the Agency may initiate CERCLA-financed remedial action.

CERCLA Section 105(a)(8)(B) directs EPA to list priority sites among the known releases or threatened release of hazardous substances, pollutants, or contaminants, and Section 105(a)(8)(A) directs EPA to consider certain enumerated and other appropriate factors in doing so. Thus, as a matter of policy, EPA has the discretion not to use CERCLA to respond to certain types of releases. Where other authorities exist, placing sites on the NPL for possible remedial action under CERCLA may not be appropriate. Therefore, EPA has chosen not to place certain types of sites on the NPL even though CERCLA does not exclude such action. If, however, the Agency later determines that sites not listed as a matter of policy are not being properly responded to, the Agency may consider placing them on the NPL.

Hazard Ranking System

The HRS is the principal mechanism EPA uses to place uncontrolled waste sites on the NPL. It is a numerically based screening system that uses information from initial, limited investigations -- the preliminary assessment and site inspection -- to assess the relative potential of sites to pose a threat to human health or the environment. HRS scores, however, do not determine the sequence in which EPA funds remedial response actions, because the information collected to develop HRS scores is not sufficient in itself to determine either the extent of contamination or the appropriate response for a particular site. Moreover, the sites with the highest scores do not necessarily come to the Agency's attention first, so that addressing sites strictly on the basis of ranking would in some cases require stopping work at sites where it was already underway. Thus, EPA relies on further, more detailed studies in the remedial investigation/feasibility study that typically follows listing.

The HRS uses a structured value analysis approach to scoring sites. This approach assigns numerical values to factors that relate to or indicate risk, based on conditions at the site. The factors are grouped into three categories. Each category has a maximum value. The categories are:

- likelihood that a site has released or has the potential to release hazardous substances into the environment;
- characteristics of the waste (e.g., toxicity and waste quantity); and
- targets (e.g., people or sensitive environments) affected by the release.

Under the HRS, four pathways can be scored for one or more components and threats as identified below:

- Ground Water Migration (S_{gw})
 - population

- Surface Water Migration (S_{sw})
The following threats are evaluated for two separate migration components, overland/flood migration and ground water to surface water.
 - drinking water
 - human food chain
 - sensitive environments
- Soil Exposure and Subsurface Intrusion (S_{sessi})
 - Soil Exposure Component:
 - resident population
 - nearby population
 - Subsurface Intrusion Component
 - population
- Air Migration (S_a)
 - population

After scores are calculated for one or more pathways according to prescribed guidelines, they are combined using the following root-mean-square equation to determine the overall site score (S), which ranges from 0 to 100:

$$S = \sqrt{\frac{S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2}{4}}$$

If all pathway scores are low, the HRS score is low. However, the HRS score can be relatively high even if only one pathway score is high. This is an important requirement for HRS scoring because some extremely dangerous sites pose threats through only one pathway. For example, buried leaking drums of hazardous substances can contaminate drinking water wells, but -- if the drums are buried deep enough and the substances not very volatile -- not surface water or air.

Other Mechanisms for Listing

There are two mechanisms other than the HRS by which sites can be placed on the NPL. The first of these mechanisms, authorized by the NCP at 40 CFR 300.425(c)(2), allows each State and Territory to designate one site as its highest priority regardless of score. The last mechanism, authorized by the NCP at 40 CFR 300.425(c)(3), allows listing a site if it meets the following three requirements:

- Agency for Toxic Substances and Disease Registry (ATSDR) of the U.S. Public Health Service has issued a health advisory that recommends dissociation of individuals from the release;
- EPA determines the site poses a significant threat to public health; and
- EPA anticipates it will be more cost-effective to use its remedial authority than to use its emergency removal authority to respond to the site.

Organization of this Document

The following section contains EPA responses to site-specific public comments received on the proposal of the East Basin Road Groundwater site on September 9, 2022 (87 FR 55342). The site discussion begins with a list of commenters, followed by a site description, a summary of comments, and Agency responses to each comment. A concluding statement indicates the effect of the comments on the HRS score for the site.

Glossary

The following acronyms and abbreviations are used throughout the text:

AFFF	Aqueous Film Forming Foam
Agency	U.S. Environmental Protection Agency
AOPCs	Areas of Potential Concern
ATSDR	Agency for Toxic Substances and Disease Registry
AWC	Artesian Water Company
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. Sections 9601 <i>et seq.</i> , also known as Superfund
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-dichloroethylene
CLP	EPA Contract Laboratory Program
CRQL	Contract-required quantitation limit
CVOCs	Chlorinated Volatile Organic Compounds
DANG	Delaware Air National Guard
1,2-DCA	1,2-dichloroethane
DEARNG	Delaware Army National Guard
DNREC	Delaware Department of Natural Resources and Environmental Control
DGS	Delaware Geological Survey
DL	Detection Limit
EPA	U.S. Environmental Protection Agency
ESI	Expanded Site Inspection
FR	Federal Register
FS	Feasibility Study
HDPE	High-density polyethylene
HRS	Hazard Ranking System, Appendix A of the NCP
HRS score	Overall site score calculated using the Hazard Ranking System; ranges from 0 to 100
MCL	Maximum contaminant level
MCLG	Maximum Contaminant Level Goal
µg/L	Microgram per liter
mg/kg	Milligram per kilogram
MRL	Minimum reporting limit
MW	Monitoring Well
MSC	Municipal Services Corporation

NCCA	New Castle County Airport
NCMSC	New Castle Municipal Services Commission
NCP	National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Part 300
NPL	National Priorities List
NTU	Nephelometric Turbidity Unit
OLEM	EPA Office of Land and Emergency Management
PA	Preliminary Assessment
PACA	Penn Acres Civic Association
PCE	Tetrachloroethene
PFAS	Per- and polyfluoroalkyl substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PRP	Potentially responsible party
RfD	Reference Dose
RI	Remedial investigation
RI/FS	Remedial investigation/feasibility study
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SQL	Sample quantitation limit
SI	Site Inspection
STRIDE	Science, Technology and Research Institute of Delaware
TCE	Trichloroethylene
TDL	Target Distance Limit
trans-1,2-DCE	trans-1,2-dichloroethylene
USGS	United States Geological Survey
VOC	Volatile organic compound

1. List of Commenters and Correspondence

EPA-HQ-OLEM-2022-0679-0004	Correspondence, dated August 1, 2022, submitted by John C. Carney, Governor, State of Delaware.
EPA-HQ-OLEM-2022-0679-0005	Comment, dated September 16, 2022, submitted by Lesley Merkel.
EPA-HQ-OLEM-2022-0679-0006	Comment, dated September 22, 2022, submitted by Pierre Kpanougou.
EPA-HQ-OLEM-2022-0679-0007	Comment, dated September 26, 2022, submitted by an anonymous commenter.
EPA-HQ-OLEM-2022-0679-0008	Comment, dated October 5, 2022, submitted by Sandy Mayer.
EPA-HQ-OLEM-2022-0679-0009	Comment, dated October 1, 2022, submitted by Russell P. Smith.
EPA-HQ-OLEM-2022-0679-0010	Comment, dated October 12, 2022, submitted by Kenneth and Mary Lagowski.
EPA-HQ-OLEM-2022-0679-0011	Comment with attachment, dated October 19, 2022, submitted by Rebecca Koshi.
EPA-HQ-OLEM-2022-0679-0012	Comment, dated October 21, 2022, submitted by an anonymous commenter.
EPA-HQ-OLEM-2022-0679-0013	Comment with attachment, dated October 24, 2022, submitted by John Hendrix, on behalf of the Penn Acres Civic Association.
EPA-HQ-OLEM-2022-0679-0014	Comment, dated October 24, 2022, submitted by an anonymous commenter.
EPA-HQ-OLEM-2022-0679-0015	Comment with attachment, dated October 25, 2022, submitted by John Hendrix, on behalf of the Penn Acres Civic Association.
EPA-HQ-OLEM-2022-0679-0016	Comment with attachment, dated November 7, 2022, submitted by Jessica Anton.
EPA-HQ-OLEM-2022-0679-0017	Comment, dated November 7, 2022, submitted by Seetha Coleman-Kammula, on behalf of the Center for PFAS Solutions at the Science, Technology and Research Institute of DE (STRIDE).
EPA-HQ-OLEM-2022-0679-0018	Comment with attachment, dated November 7, 2022, submitted by Nicole Yakovlev.
EPA-HQ-OLEM-2022-0679-0019	Comment, dated November 7, 2022, submitted by Karen Igou.

EPA-HQ-OLEM-2022-0679-0020	Comment with attachment, dated November 8, 2022, submitted by Robert D. Fox, Manko, Gold, Katcher & Fox, LLP, on behalf of New Castle County.
EPA-HQ-OLEM-2022-0679-0021	Comment, dated November 8, 2022, submitted by Kristin Zumar.
EPA-HQ-OLEM-2022-0679-0022	Comment with attachment, dated November 8, 2022, submitted by Jay Guyer, Water Utility Manager, Municipal Services Commission (MSC), City of New Castle.
EPA-HQ-OLEM-2022-0679-0023	Comment, dated November 8, 2022, submitted by Lily Walker.

2. Site Description

The East Basin Road Groundwater site (the Site) consists of a groundwater plume with no identified source contaminated with per- and polyfluoroalkyl substances (PFAS) (i.e., perfluorooctanoic acid [PFOA] and perfluorooctanesulfonic acid [PFOS]) and chlorinated volatile organic compounds (CVOCs) (i.e., tetrachloroethylene [PCE], trichloroethylene [TCE], cis-1,2-dichloroethylene [cis-1,2-DCE], trans-1,2-dichloroethylene [trans-1,2-DCE], and 1,2-dichloroethane [1,2-DCA]) as identified by groundwater samples collected from municipal and monitoring wells that meet the criteria for an observed release. The Site is located in New Castle, Delaware. The Delaware River is located approximately 1 mile east-southeast from the eastern edge of known extent of the plume. See Figure 2 of Reference 5 of the HRS documentation record at proposal.

The Site is evaluated in the HRS documentation record at proposal as a groundwater plume with no identified source because there are too many known or possible sources for the PFAS and CVOC contamination in groundwater to reasonably attribute the significant increase in groundwater contamination to a specific source(s). Numerous facilities in New Castle, Delaware are identified in the EPA Envirofacts database as facilities that may have used, produced, dispensed, or disposed of compounds and products that may contain PFAS or CVOCs. A Preliminary Assessment (PA) was conducted in 2015 to identify the likely source(s) of PFAS contamination in public supply wells in New Castle, Delaware. The PA identified 16 Areas of Potential Concern (AOPCs) that may have used, produced, dispensed, or disposed of compounds or products that may contain PFAS. In 2017, 2018, and 2020, the Delaware Department of Natural Resources and Environmental Control (DNREC) conducted a Site Inspection (SI), and in 2021, DNREC conducted an Expanded Site Inspection (ESI). Analytical results of the groundwater samples collected from monitoring wells during the SI and ESI showed the presence of PFOA, PFOS, and volatile organic compounds (VOCs). Releases of PFAS and CVOCs from multiple possible sources likely have come along over time, due to complex changes in local groundwater flow direction likely resulting from, in part, municipal well pumping.

The Columbia and Potomac aquifers are present in the subsurface at the Site. The Columbia aquifer functions as a water table aquifer. Underlying the Columbia aquifer is the Potomac aquifer. The Potomac aquifer is considered a single stratigraphic unit in Delaware, but regionally it has been subdivided into an upper, middle, and lower aquifer units separated by discontinuous layers of fine-grained sediments. Underlying the Columbia aquifer in the vicinity of the Site in New Castle is the discontinuous upper Potomac confining unit. The upper Potomac aquifer units are not laterally continuous, and to the northeast of the New Castle County/Wilmington airport much of the Potomac formation has been eroded and filled with Columbia sediments of the Pleistocene Age. Boreholes Dc14-3, Dc14-42, Cd43-4, and Cd43-16 (located south and northeast of the plume) establish that the Columbia Aquifer is in direct contact with portions of the Potomac Aquifer. Boreholes (Dc14-3 and Dc14-42) establish that the Columbia Aquifer is in direct contact with the sands of the Upper Potomac Aquifer. There is also evidence that sand of the Columbia formation is also in direct contact with sand of the middle Potomac as shown in boreholes

Cd43-4 and Cd43-16. (Reference 19 of the HRS documentation record at proposal¹.) Boreholes logs for wells NCPW-MW18 and NCPW-MW21 (See Figure 2 of Reference 5² and page 81 of Reference 7 of the HRS documentation record at proposal) indicate that no HRS qualifying confining unit is present down to a depth of approximately 90 feet below mean sea level (msl). The absence of discernible continuous clay layers, both locally and regionally, demonstrates that a continuous (greater than 2 miles) confining layer is not present in the formations that comprise the Columbia/Potomac Aquifer System in the vicinity of the groundwater plume. As a result, the Columbia and Potomac aquifers were evaluated as interconnected for HRS scoring purposes. (See Figure 1 of this support document.)

Contaminated groundwater samples collected from the plume were withdrawn from the interconnected Columbia and Potomac aquifers. Samples from nine public supply wells contain concentrations of PFOS, PFOA, and tetrachloroethylene (PCE) meeting HRS Level I concentration criteria. These nine public wells supply drinking water to an apportioned population of approximately 25,648 persons. Two of these public supply wells have exceeded the maximum contaminant level (MCL) for PCE, and eight of these public supply wells have exceeded the non-cancer risk screening concentration for PFOS and/or PFOA.

¹ A redacted copy of Reference 19 of the HRS documentation record at proposal is available on the site progress profile for the site at the following location <https://semspub.epa.gov/src/document/03/2335529>.

² A redacted copy of Reference 5 of the HRS documentation record at proposal is available on the site progress profile for the site at the following location <https://semspub.epa.gov/src/document/03/2335517>.

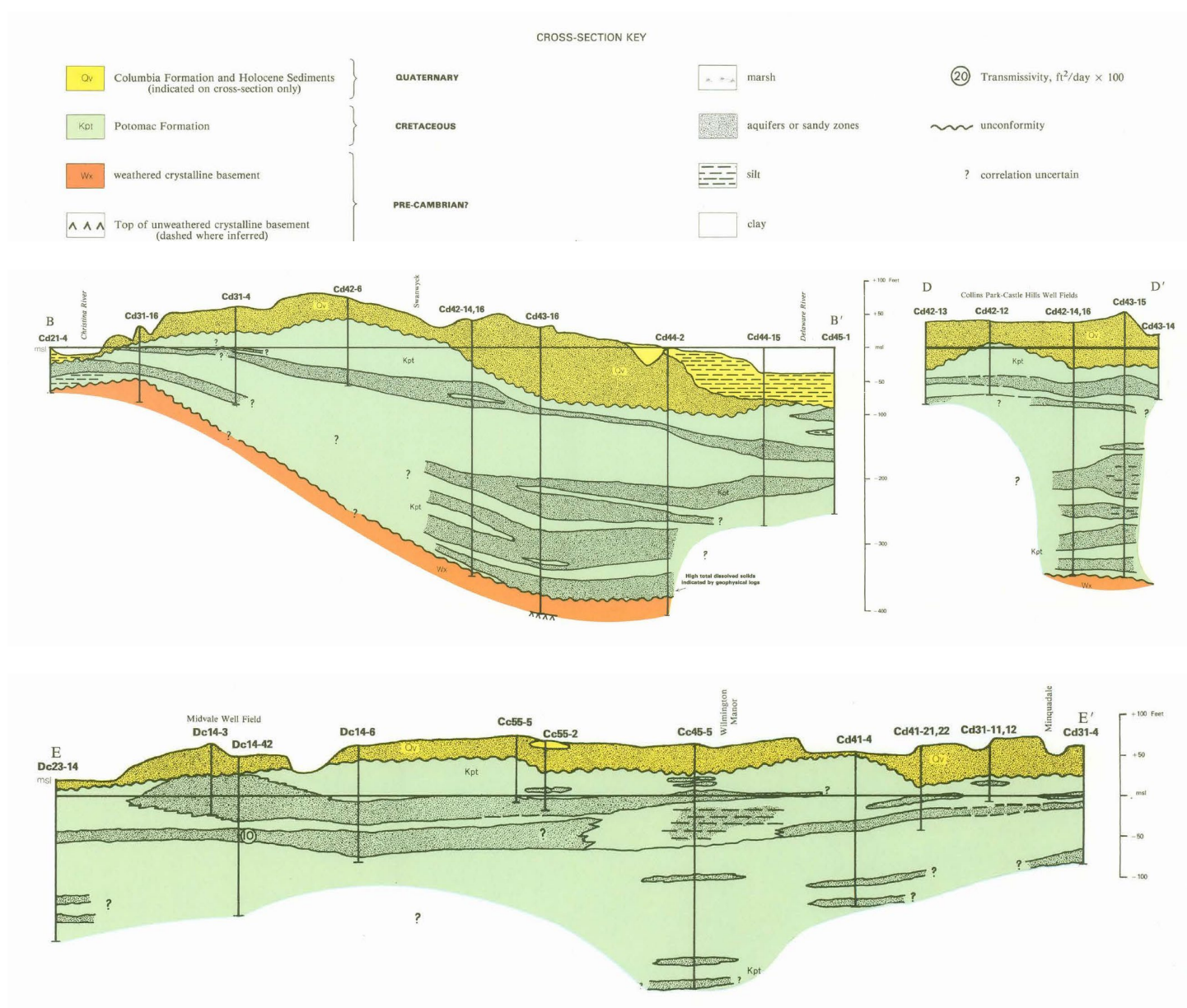


Figure 1. Excerpted from Delaware Geological Survey (DGS). 1987. Geohydrology of the Wilmington Area, Delaware. Hydrologic Map Series No. 3, Sheet 1, Basic Geology. University of Delaware, Newark. (Reference 19 of the HRS documentation record at proposal). This figure depicts the general subsurface geology in the vicinity of the Site and illustrates that the Columbia aquifer is in direct connect with the Potomac aquifer. Refer to Reference 19 of the HRS documentation record at proposal for the accompanying map and additional regional cross sections. A redacted version of Reference 19 of the HRS documentation record at proposal is available online at the following location: <https://semspub.epa.gov/src/document/03/2335529>.

3. Summary of Comments

The State of Delaware, two organizations, the Municipal Services Corporation (MSC), and 15 private citizens expressed support for or did not oppose the proposed listing of the Site on the NPL. These commenters expressed concerns for, among other things, human health, timely and effective remediation of the contamination, the lack of PFAS drinking water standards, the impact on property values, and financial assistance to address the contamination.

Robert D. Fox, Manko, Gold, Katcher & Fox, LLP, on behalf of New Castle County (herein referred to as New Castle County) submitted comments questioning the appropriateness of the proposed listing. New Castle County commented that the boundaries of the Site are not well defined. It asserted that it is unclear whether the risk posed by Site is accurately estimated in the proposed listing. New Castle County stated that the extent to which CVOCs may currently exceed screening levels is unclear. New Castle County also stated that it is unclear on how the Site will be monitored and evaluated since regulatory limits are not available for PFAS compounds.

New Castle County submitted comments questioning aspects of the HRS evaluation. It stated that the list of possible sources in the HRS documentation record at proposal is incomplete. It commented that additional possible sources of the groundwater contamination may be present. New Castle County also asserted that the effects of geologic features on contaminant migration in the vicinity of the Site were not fully discussed in the HRS documentation record at proposal and barriers to groundwater flow, such as surface water bodies, may be present between background and observed release wells. In commenting on the observed release, New Castle County stated that there may be possible errors in the observed release asserting that:

- The appropriateness of the selected background levels cannot be determined due to the site-specific geologic conditions.
- The groundwater flow conditions at the Site affect the background well selection and impairs the ability to attribute the groundwater contamination in the release.
- The method used for the analysis of some PFAS samples was not an approved method.
- Inconsistent sampling procedures were utilized to collect the groundwater samples used in the HRS scoring.
- The presence of high and varying turbidity calls into question the appropriateness of using some of the PFAS analytical results included in the HRS evaluation.
- It is unclear in the HRS documentation record at proposal whether CVOCs would independently support the NPL placement of the Site.

New Castle County also commented that the benchmarks used to determine the level of PFOA and PFOS contamination were not consistent with EPA's Health Advisory Levels for these substances, and it is unclear how the EPA will assess these compounds without established drinking water criteria for them. Finally, New Castle County asserted that the New Castle County airport is not within a wellhead protection area.

3.1 Support for Listing and Other Non-opposition Comments

The EPA received 18 comments (totaling 19 commenters) that either expressed support or did not express opposition for the proposed listing. Those commenters in support (or non-opposition) of placing the Site on the NPL include: the State of Delaware, MSC, Penn Acres Civic Association (PACA), Science, Technology and Research Institute of DE (STRIDE), and 15 individual commenters.

3.1.1 General Support

John Carney, Governor, State of Delaware, MSC, PACA, STRIDE, Ms. Walker, Ms. Merkel, Ms. Mayer, Mr. Smith, Ms. Koshi, Ms. Anton, Ms. Yakovlev, Ms. Igou, Ms. Zumar, and an anonymous commenter provided support for adding the Site to the NPL. John Carney, Governor, State of Delaware stated that the Delaware Department of Natural Resources and Environmental Control (DNREC) concurs with the placing the Site on the NPL.

Ms. Merkel, Ms. Mayer, Ms. Walker, Ms. Anton, Ms. Koshi, Mr. and Ms. Lagowski, Mr. Kpanougou, and an anonymous commenter submitted comments expressing general concerns regarding the impact of the Site. Ms. Merkel and Ms. Mayer commented that the site may pose a risk to human health and/or the environment. Ms. Walker commented that listing is warranted due to the long-standing presence of contamination impacting human health and the environment, and the contamination at the Site achieving an HRS score above the NPL threshold. PACA, Ms. Anton, Mr. and Ms. Lagowski, and Mr. Kpanougou commented that remedial actions to address the contaminated groundwater should occur promptly to avoid negative impacts to the community. Mr. Kpanougou expressed concern over the quality of the water and commented that the Penn Acres community is interested in timely and efficient remediation and monitoring of the contamination. Ms. Koshi commented that clean water should be available for the community. An anonymous commenter provided support for NPL designation if alternatives to listing were unavailable.

Response: The EPA has added the East Basin Road Groundwater site to the NPL. Listing makes a site eligible for remedial action funding under CERCLA, and the EPA will examine the site to determine what response, if any, is appropriate. Actual funding may not necessarily be undertaken in the precise order of HRS scores, however, and upon more detailed investigation may not be necessary at all in some cases. The EPA will determine the need for using Superfund funding for remedial activities on a site-by-site basis, taking into account the NPL ranking, State priorities, further site investigation, other response alternatives, and other factors as appropriate.

3.1.2 Support with Requests for Further Actions

Comment: Several commenters that either supported or did not oppose listing the Site on the NPL also provided comments with requests for additional actions related to the Site.

MSC and Ms. Anton inquired about how the past investigations will be incorporated following NPL placement. MSC commented on the use of prior studies, questioning whether past studies into the origin of the contamination would be incorporated into the new investigations. MSC requested information about when the long-term cleanup and groundwater remediation would commence. MSC also inquired about whether Superfund resources would be used to evaluate possible facilities that may be the origin of the PFAS contamination.

Ms. Anton and Ms. Walker expressed concern about future remediation and the risk associated with the Site. Ms. Anton commented that the timing of remediation is unclear and requested timely cleanup of drinking water at the Site. Ms. Anton also commented that due to the lack of drinking water standards for PFAS, the risk posed to the public is not clear and not well communicated. Ms. Walker expressed concern over whether remediation of NPL sites will become mandatory and over the lack of legal requirements to ensure sites are addressed. In discussing the risk associated with the Site, Ms. Walker expressed concern that the Sites in the NPL proposal, including the East Basin Road Groundwater site, may be withdrawn from proposal. Ms. Walker and Ms. Anton commented that the Site should be a priority due to the extent of the contamination. An anonymous commenter stated that concern over the risk posed by the Site is a possible health impact. The anonymous commenter stated that the EPA should attempt to mitigate citizen concerns about the potential risk posed by the Site including mental stress and financial impacts when selecting remedial actions.

STRIDE and Ms. Anton provided comments regarding approaches to remediating PFAS contamination, noting that NPL designation of the Site will provide resources for investigation, biomonitoring, and remediation of PFAS groundwater and air contamination. STRIDE commented that shorter chain PFAS are not regulated and may need

to be removed through methods other than filtration methods that remove PFOA and PFOS. Ms. Anton commented that remediation should include:

- Installation of water filters
- Assessment and consideration of air quality
- Consideration of the impact of aeration on the volatilization of some PFAS compounds.

MSC inquired about possible financial assistance for addressing the impact of Site related PFAS contamination on its operations. MSC and Ms. Igou commented that treatment costs to address Site contamination should be reimbursable until the Site has been remediated. Ms. Igou commented that the Site should be added to NPL to enable the use of federal funding to address the Site. Ms. Zumar commented that a timeline should be established for reimbursement and ongoing funding for utilities that have installed treatment systems for PFAS removal.

PACA, Mr. and Ms. Lagowski, and Mr. Smith requested updates about the Site. Ms. Yakovlev commented that adding the Site to the NPL would inform the community and allow for community engagement and participation in the remediation process. PACA requested timely updates regarding the status of the Site and a presentation about the Site at one of its association meetings. PACA commented that updating its community would provide the EPA with an additional source of community comments about the Site. Mr. Smith expressed interest in obtaining additional information about the Site due to health concerns.

MSC, STRIDE, and Ms. Anton commented on the extent of the Site. MSC commented that the impact of the groundwater contamination on MSC operations extends beyond the boundaries of the 5,000-acre investigation area. STRIDE stated that other nearby sites “could be subject to ‘reopener’ clauses and subject to PFAS” evaluation. Ms. Anton also expressed concern regarding contamination that may extend beyond the Site as presented at proposal, inquiring about the criteria for identifying the boundary of the Site and the approach to address private wells in the area. Ms. Anton submitted comments suggesting that other areas may be of concern due to contamination, commenting that:

- Artificial turf may be a possible contributor to the PFAS contamination in groundwater because PFOS was historically used in the production of artificial turf and other PFAS compounds may be associated with the current production of artificial turf.
- Army Creek is a possible area of concern and signage should be posted to inform the public about Army Creek.

An anonymous commenter stated that while the positive impact of remediation is welcomed, there is concern that the Superfund designation and long timeframe associated with remediation may result in negative economic impacts, may affect property values, and may affect economic development. The anonymous commenter also requested that a factsheet for property owners, property appraisers, and mortgage lenders be created to explain that properties within the Site boundary are not restricted or that the status of restricted properties is subject to change. The anonymous commenter also stated that properties within the Site should be evaluated for withdrawal regularly with notification of withdrawal provided to the property owner.

Ms. Walker and Ms. Yakovlev provided comments regarding potentially responsible parties (PRPs) and liability. Ms. Yakovlev asserted that NPL placement would allow for continued PRP identification. Related to liability and the role of PRPs, Ms. Walker expressed concern regarding:

- The lack of liability and mandatory action for owners to remediate sites.
- The lack of legal requirements to address sites.
- The possibility that funding for remediation may come from the EPA as opposed to property owners or operators.

- The timeliness of action to address the Site.
- The perceived prioritization of source identification over remediation.

Response: The EPA has added the East Basin Road Groundwater site to the NPL. Listing makes a site eligible for remedial action funding under CERCLA, and the EPA will examine the site to determine what response, if any, is appropriate.

Regarding comments expressing concern about previous investigations, the long-term cleanup and the remediation process, the EPA has procedures in place, consistent with CERCLA, for identifying sites where releases of substances addressed under CERCLA have occurred or may occur, placing such sites on the NPL, evaluating the nature and extent of the threats at such sites, responding to those threats, and deleting sites from the NPL. The purpose of the initial two steps is to develop the NPL, which identifies for the States and the public those sites that appear to warrant remedial action (56 FR 35842, July 29, 1991). The evaluation or remedial investigation/feasibility study (RI/FS) phase involves on-site testing to assess the nature and extent of the public health and environmental risks associated with the site and to determine what alternatives for remedial action, if any, may be appropriate. After a period of public comment, following the RI/FS and the identification of a preferred alternative, the EPA responds to the identified threats by issuing a Record of Decision which selects the most appropriate alternative. The selected remedy is implemented during the remedial design/remedial action phase. Finally, the site may be deleted from the NPL when the EPA determines that no further response is appropriate.

Regarding comments requesting additional information about the extent of the Site and specific remedial actions, as explained in detail in section 3.2, Site Boundaries/Extent of Site, of this support document, HRS scoring and subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under CERCLA and warrants further investigation. The extent of contamination related to the Site as well as appropriate remedial actions, if any, will be investigated in later steps of the Superfund process, particularly during the Remedial Investigation/Feasibility Study (RI/FS) stage. Following further investigation, the EPA may find that contamination has spread further than previously estimated and the site definition may be correspondingly expanded. General information about the Site may be found on the Site progress profile available online at: <https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0304044&msspp=med>. To date, the EPA has held two information sessions, an in-person session on October 4, 2022, at the Route 9 Library & Innovation Center in New Castle and a virtual session on October 6, 2022. The presentation slides are available at the following link: <https://semspub.epa.gov/src/document/03/2335659>.

Regarding PACA's request for a presentation from the EPA regarding the Site, the EPA contacted the Penn Acres Civic Association and invited them to attend the EPA public availability sessions held in October of 2022, discussed above. The EPA held both an in-person and a virtual meeting. Representatives from the Penn Acres neighborhood attended both of those sessions and were provided the materials, and the recording, for the virtual meeting.

Regarding concerns about perceived stigma, economic impacts as the result of NPL designation, and requests for financial assistance, the EPA will determine the need for using Superfund funding for remedial activities on a site-by-site basis. While neither cost recovery nor liability is addressed at this stage of the NPL process, listing sites as national priorities can give States increased support for funding responses. In addition, economic factors such as those raised by the commenters are generally not considered in the assessment of whether a site belongs on the NPL. Inclusion of a site or facility on the NPL reflects the EPA's judgment that a significant release or threat of release has occurred and that the site is a priority for further investigation under CERCLA. The EPA notes that there are both costs and benefits that can be associated with listing a site. Among the benefits are increased health and environmental protection as a result of increased public awareness of potential hazards. In addition to the potential for Federally financed remedial actions, the addition of a site to the NPL could accelerate privately financed, voluntary cleanup efforts. As a result of the additional CERCLA remedies, there will be lower human exposure to high-risk chemicals, and higher quality surface water, groundwater, soil, and air. Therefore, it

is possible that any perceived or actual negative fluctuations in property values or development opportunities that may result from contamination may also be countered by positive fluctuations when a CERCLA investigation and any necessary cleanup are completed. Moreover, drinking water grants may be available for eligible groups to apply for through alternate programs.³

Regarding comments discussing liability for the contamination at the Site, liability is not considered in evaluating a site under the HRS. Liability is also not assigned at the listing stage of the Superfund process. The NPL serves primarily as an informational tool for use by the EPA in identifying those sites that appear to present a significant risk to public health or the environment. As explained above, the purpose of the initial two steps of Superfund process is to develop the NPL and identify for the public those sites that appear to warrant remedial action and further investigation.

3.2 Site Boundaries/Extent of Site

Comment: New Castle County submitted comments questioning what constituted the Site boundaries and the overall extent of the Site. New Castle County commented that the Site should be assessed and defined accurately to the extent possible, and asserted that the Site boundaries had not been well defined at proposal. New Castle County commented that the list of possible sources of contamination at the Site in the HRS documentation record at proposal is a not a complete list of possible sources associated with the contamination at the Site.

New Castle County stated that the Site appears to include the Llangollen public wells, which have been connected to contamination associated with two other NPL sites and two other state Superfund Sites. It asserted that the reason for including the Llangollen wells as part of the Site is not clear.

In commenting on the extent of the contamination at the Site, New Castle County asserted that the extent of Site appears to be based on the 2015 PA, which assessed CVOC and PFAS contamination exceeding applicable regulatory levels or health advisory levels within an approximately seven square mile area. New Castle County commented that it is unclear how the extent of PFAS contamination in groundwater will be evaluated because PFOA and PFOS do not have regulatory standards.

Response: The Site was properly described and defined for the purpose of HRS scoring as a groundwater plume with no identified source consisting of groundwater contaminated with PFAS and CVOCs documented in municipal and monitoring well samples meeting observed release criteria. As explained on page 1 of the HRS documentation record at proposal, the contaminant locations in the HRS documentation record “represent one or more locations EPA considers to be part of the Site based on the screening information EPA used to evaluate the site for NPL listing,” and the initial description of the Site boundary presented at proposal may be modified following further investigation into the contamination. A more complete evaluation of the extent of the contamination at the Site will occur at a later stage in the Superfund process as warranted.

Placing a site on the NPL is based on an evaluation, in accordance with the HRS, of a release or threatened release of hazardous substances, pollutants, or contaminants. However, the fact that the EPA initially identifies and lists the release based on a review of contamination at a certain parcel of property does not necessarily mean that the site boundaries are limited to that parcel.

³ Possible examples of alternative funding sources for eligible groups include state or EPA programs outside of the Superfund program. DNREC maintains the Delaware Water Pollution Control Revolving Fund which, as explained on its webpage, “provides low-interest loans and grants to municipalities, private organizations, nonprofit organizations and private individuals for projects that will improve water quality.” Additional information about this fund is available online: <https://dnrec.alpha.delaware.gov/environmental-finance/revolving-fund/>. Additional funding for eligible groups may be available via the EPA’s Emerging Contaminants in Small or Disadvantaged Communities grant program. Through this program, the EPA provides “states and territories with grants to public water systems in small or disadvantaged communities to address emerging contaminants, including PFAS.” Additional information about the EPA’s Emerging Contaminants in Small or Disadvantaged Communities grant program is available online: <https://www.epa.gov/dwcapacity/emerging-contaminants-ec-small-or-disadvantaged-communities-grant-sdc#Imp>

CERCLA Section 105(a)(8)(A) requires the EPA to list national priorities among the known “releases or threatened releases” of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. Further, CERCLA Section 101(a) defines a “facility” as the “site” where a hazardous substance has been “deposited, stored, placed, or otherwise come to be located.” The “come to be located” language gives the EPA broad authority to clean up contamination when it has spread from the original source. On March 31, 1989 (54 FR 13298), the EPA stated:

HRS scoring and the subsequent listing of a release merely represent the initial [emphasis added] determination that a certain area may need to be addressed under CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will need to be refined and improved as more information is developed as to where the contamination has come to be located; this refining step generally comes during the RI/FS [remedial investigation/feasibility study] stage.

The 1990 revised HRS (55 FR 51587, December 14, 1990) elaborates on the “come to be located” language, defining “site” as “area(s) where a hazardous substance has been deposited, stored, disposed, or placed, or has otherwise come to be located. Such areas may include multiple sources and may include the area between the sources.”

Until the site investigation process has been completed and a remedial action (if any) selected, the EPA can neither estimate the extent of contamination at the NPL site, nor describe the ultimate dimensions of the site. Even during a remedial action (e.g., the removal of buried waste) the EPA may find that the contamination has spread further than previously estimated, and the site definition may be correspondingly expanded. In addition, if another, unrelated area of contamination is discovered elsewhere on the property, the EPA may decide to evaluate that release for the NPL.

As explained above, the Site was evaluated as a groundwater plume with no identified source. In defining eligible sources for HRS scoring purposes, HRS Section 1.1, *Definitions*, states that a “ground water plume with no identified source...may be considered a source.” Page 12 of the HRS documentation record at proposal defines the Site and states that the Site “consists of a groundwater plume with no identified source located in the City of New Castle, New Castle County, Delaware.” Page 12 of the HRS documentation record at proposal elaborates that the Site “consists of groundwater contaminated with per- and polyfluoroalkyl substances (PFAS) and chlorinated volatile organic compounds (CVOCs) as identified by groundwater samples collected from municipal and monitoring wells that meet the criteria for an observed release.” In providing the rationale for the Site definition, page 14 of the HRS documentation record at proposal states that “there are too many known or possible sources for the PFAS and CVOCs in groundwater to reasonably attribute the groundwater contamination to one or more specific source(s).” Consistent with the HRS, the Site for HRS scoring purposes, was evaluated as a groundwater plume with no identified source due to commingled contamination, and was described as the locations of samples with CVOC and/or PFAS concentrations meeting observed release criteria.

Regarding comments discussing that the Site is not well defined, the full extent of the Site and Site related contamination, including the extent of PFAS contamination, is not determined at the listing stage of the Superfund process. Page 1 of the HRS documentation record at proposal, quoted above, notes that the locations presented “represent one or more locations EPA considers to be part of the Site based on the screening information.” Page 1 of the HRS documentation record at proposal also explains that the site boundaries are not fully determined at the listing stage, stating that “the focus is on the release, not precisely delineated boundaries” and “listing of a release merely represent the initial determination that a certain area may need to be addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).” Placement of a site on the NPL identifies for the States and the public those sites that appear to warrant remedial action (56 FR 35842, July 29, 1991). The evaluation or remedial investigation/feasibility study (RI/FS) stage of the Superfund process involves on-site testing to assess the nature and extent of the public health and environmental risks associated with the site and to determine what CERCLA-funded remedial actions, if any, may be appropriate. After a period of public

comment, the Agency responds to those threats by issuing a Record of Decision, which selects the most appropriate alternative. The selected remedy is implemented during the remedial design/remedial action stage and is implemented until the remedy has reached the cleanup goals defined in the Record of Decision. Finally, the site may be deleted from the NPL when the Agency determines that no further response is appropriate. Further investigation into the extent of Site-related contamination, such as PFAS, occurs at a later stage of the Superfund process, as warranted. Other stages of the Superfund process will consider the need for remediation and the specific mechanism for remediation, if any. Comments discussing future remediation are discussed in detail in section 3.5, Evaluation and Future Remediation of Hazardous Substances, Pollutants, and Contaminants, of this support document.

Regarding assertions that the Llangollen public wells were included in the Site, Llangollen public wells were used to establish a background level for HRS scoring purposes and were not scored as part of the observed release in the HRS documentation record at proposal. Table 21 on page 45 of the HRS documentation record at proposal lists background deep public well concentrations and includes samples from Llangollen Well 6R, Llangollen Well 2, Llangollen Well G3R, and Llangollen Well 7. Samples from the four Llangollen wells, as well as a sample from Wilmington Airport well 3R presented in Table 21 of the HRS documentation record at proposal, were used to determine an appropriate background level for PFOS and PFOA in deep public wells. Samples from these wells are not listed as observed releases for deep public wells in Table 23 on page 47 of the HRS documentation record at proposal. As these comments may relate to the determination of an appropriate background level, please see section 3.8.1, Background Levels, of this support document.

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

3.3 Risk to Human Health or the Environment

Comment: New Castle County commented that the analytical results in the HRS documentation record at proposal may not accurately reflect the risk associated with the Site due to possible issues with the sampling and data collection completed. New Castle County asserted that the high turbidity associated with the samples used for PFAS analysis may produce an inaccurate assessment of the risk associated with the Site.

Response: The HRS documentation record at proposal establishes that the Site poses a sufficient relative risk to human health or the environment as compared to other candidate sites evaluated using the HRS to warrant inclusion on the NPL and further investigation. As discussed in detail in section 3.8.2, Groundwater Sampling and Analysis, of this support document, the samples used for HRS scoring were properly collected and analyzed for HRS purposes. The analytical results from these samples were appropriate for HRS scoring purposes and to assess whether the relative risk posed by the Site warrants NPL placement.

Regarding New Castle County's comments that the HRS documentation record at proposal may not accurately reflect the risk posed by the Site, the HRS is not a site-specific risk assessment. A site-specific risk assessment quantifies the risk to receptors actually posed by releases at a site. The HRS is a numerically based screening tool that the EPA uses to assess the relative degree of risk to human health and the environment posed by a site compared to other sites subject to review based on a screening-level knowledge of site conditions. The HRS score is used to determine whether a site is eligible for placement on the NPL. The NPL is intended primarily to guide EPA in determining which sites warrant further investigation to assess the nature and extent of public health and environmental risks associated with a release of hazardous substances, pollutants, or contaminants. See 87 FR 55342 (Proposed Rule, East Basin Road Groundwater site, September 9, 2022); see also 55 FR 51532 (Final Rule, Hazard Ranking System, December 14, 1990). CERCLA § 105(a)(8)(a) requires EPA to determine NPL priorities based on the "relative risk or danger to public health or welfare, or the environment." The criteria the EPA applies to determine this relative risk or danger is codified in the HRS, and is the EPA's primary tool for deriving a site score based on the factors identified in CERCLA. The HRS evaluation and score at or above 28.50 represents EPA's determination that the Site may pose a relative risk or danger to human health and the environment and warrants further investigation under CERCLA. Determination of site-specific risk posed to human health or the environment is made at a later stage of the Superfund process following listing. During this later stage, sufficient

information will be collected to completely evaluate the site-specific risk associated with the Site. Based on this information, the EPA will determine if further response actions are warranted at the Site.

Regarding the specific sampling and analysis used to evaluate the Site, these comments are discussed in section 3.8.2, Groundwater Sampling and Analysis, of this support document.

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

3.4 Regulatory Limits and Screening Levels

Comment: New Castle County provided comments discussing the concentrations of CVOCs and PFAS in groundwater relative to screening levels. New Castle County commented that it is unclear the extent that CVOCs currently exceed drinking water screening levels in public wells based on the HRS documentation record at proposal. It also stated that the lack of information on CVOC contamination in public wells exceeding screening levels questions the ability of the CVOC contamination to independently support NPL listing. New Castle County asserted that the extent of Site appears to be based on the 2015 Preliminary Assessment (PA) and based on wells with concentrations of CVOCs exceeding regulatory drinking water limits and/or PFAS exceeding provisional health advisory levels.

New Castle County commented that regulatory standards are not established for PFOA and PFOS making it unclear how PFAS contamination in groundwater at the Site will be evaluated and monitored. New Castle County stated that the PFOA and PFOS benchmarks in the HRS documentation record at proposal were inconsistent with both the June 2022 Health Advisory Levels and the 2016 Health Advisory Levels.

Response: The concentrations of hazardous substances, pollutants, and/or contaminants evaluated in the HRS documentation record at proposal were eligible for consideration consistent with the HRS. The HRS does not require that a hazardous substance, pollutant, and/or contaminant meet or exceed a regulatory limit or screening level; rather the HRS requires that observed releases of those substances are established. Concentrations of a hazardous substance and/or pollutant or contaminant may be eligible for consideration in an HRS evaluation even if they are below a regulatory limit or screening level. As discussed in detail in section 3.8, Observed Release, and subsections of this support document, the concentrations of PFAS and CVOCs were documented in the HRS documentation record at proposal to meet observed release by chemical analysis criteria. HRS eligible benchmarks (e.g., screening concentrations) are discussed in section 3.9, Level of Contamination, of this support document.

On July 16, 1982, when responding to public comments on the proposed (original) HRS (47 FR 31188), and again on September 8, 1983 (48 FR 40665), the EPA rejected the idea that releases within regulatory limits should not be considered “observed releases” under the HRS. As the EPA noted in 1982:

[E]mission or effluent limits do not necessarily represent levels which cause no harm to public health or the environment. These limitations are frequently established on the basis of economic impacts or achievability.

By contrast, an observed release represents a 100 percent likelihood that substances can migrate from the site (47 FR 31188, July 16, 1982).

Section 2.3 of the revised HRS (55 FR 51589, December 14, 1990) states that an observed release can be established either by direct observation or by chemical analysis. An observed release by chemical analysis has occurred when a contaminant is measured significantly above background level if some portion of the release is attributable to the site. Although contaminant levels may be lower than regulatory limits, an observed release has nevertheless occurred if the measured levels are significantly higher than background levels. The HRS does, however, consider whether releases are above regulatory limits in evaluating target populations, increasing by a factor of 10 the weight assigned populations exposed to contaminants above regulatory limits.

Of course, the observed release factor alone is not intended to reflect the hazard presented by the particular release. Instead, the hazard of the site is approximated by the total HRS score, which incorporates the observed release factors with other factors such as waste characteristics (including waste quantity, toxicity, and mobility) and targets. This total HRS score reflects the hazard of the site relative only to the other sites that have been scored. The actual degree of contamination and its effects are more fully determined during the remedial investigation that typically follows listing.

The fact that the release may have been “Federally-permitted” also does not preclude listing. CERCLA Section 105(a)(8)(B) directs the EPA to list on the NPL “releases” of hazardous substances, pollutants, and contaminants according to specific criteria set out in CERCLA Section 105(a)(8)(A). The definition of “release” in CERCLA Section 101(22) exempts certain releases from its scope, but it does not exempt “Federally-permitted releases”; thus, even if discharges occur within the regulatory limits set by those Federal laws enumerated in CERCLA Section 101(10), so as to constitute “Federally-permitted releases,” the discharges may be considered releases under CERCLA and, if appropriate under the HRS, placed on the NPL. CERCLA exempts “Federally-permitted releases” only from the notification (Section 103(a) and cost-recovery (107(j)) sections of the statute; such releases remain subject to the other sections of the statute.

Regarding comments questioning the approach to remediation due to the absence of regulatory standards for PFAS, the approach for remediation is not determined at the listing stage of the Superfund process. As discussed in section 3.3, Risk to Human Health or the Environment, of this support document, NPL listing identifies sites that appear to warrant further investigation and possible remediation. A subsequent stage of the superfund process investigates the Site further, and determines which remedial actions, if any, are appropriate, and what cleanup criteria should be used.

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

3.5 Evaluation and Future Remediation of Hazardous Substances, Pollutants, and Contaminants

Comment: New Castle County commented that as PFOA and PFOS are not CERCLA designated hazardous substances, it is unclear how the extent of PFOS contamination in groundwater will be determined and remediated. New Castle County also asserted that the approach for evaluating PFOA and PFOS contamination in impacted wells is unclear due to the lack of drinking water standards for PFOA and PFOS.

In discussing future remediation, STRIDE commented that “‘reopener’ clauses” could apply to other NPL and State superfund sites near the East Basin Road Groundwater “because the EPA has given a Notice of Federal Rulemaking to begin listing two PFAS (PFOA and PFOS) as hazardous substances under CERCLA,” allowing for PFAS testing and remediation. STRIDE also stated that this Site should be investigated and remediated for PFAS following NPL placement.

Response: Decisions regarding whether remedial actions will occur and which approach should be employed to remediate the Site are not determined at the listing stage of the Superfund process. Specific remedial actions and site-specific cleanup criteria are developed at a later stage in the Superfund process, after NPL listing. Consistent with CERCLA, the EPA has in place a procedure for identifying sites where releases of substances addressed under CERCLA have occurred or may occur, placing such sites on the NPL, evaluating the nature and extent of the threats at such sites, responding to those threats, and deleting sites from the NPL. The purpose of the initial two steps is to develop the NPL, which identifies for the States and the public those sites that appear to warrant remedial action. The evaluation or RI/FS phase involves on-site testing to define the nature and extent of the threat posed by the contamination and to identify alternatives for remedial action, if needed.

Regarding the commenter’s concern that other nearby sites should be evaluated for PFAS because it is an emerging contaminant that may be present in the vicinity of the East Basin Road Groundwater site, emerging

contaminants are evaluated during the 5-year review process at NPL sites. For information about the status of other NPL sites, including NPL sites in the vicinity of the East Basin Road Groundwater site, please refer to the site's progress profile on the EPA's website for more information about site-specific remedial actions.⁴

Moreover, the HRS evaluation and subsequent NPL placement of a site can be based on one hazardous substance or on multiple hazardous substances; the HRS does not include any requirements for calculating multiple site scores to score contaminants individually. In discussing which hazardous substances to score in the ground water migration pathway, HRS Section 2.2.3, *Identify hazardous substances available to a pathway*, states to consider “[h]azardous substances that meet the criteria for an observed release... to ground water” and “[a]ll hazardous substances associated with a source” with a containment factor value of greater than zero for the ground water migration pathway. Hence, the HRS score for a site can be based on a single hazardous substance or multiple hazardous substances depending on their presence at the site and their eligibility for scoring. Here, the HRS scoring of the Site evaluated the observed release to groundwater of PFOA, PFOS, TCE, PCE, cis-1,2-DCE, 1,2-DCA, and trans-1,2-DCE and properly calculated an HRS site score of 50.00 as a result. (See section 3.8, Observed Release, and subsections of this support document for a discussion of the scoring of the observed release and page 3 of the HRS documentation record at proposal for the ground water migration pathway scoresheet.)

In discussing which hazardous substance to consider for the calculation of the ground water migration pathway toxicity/mobility factor value as part of the ground water pathway migration scoring, HRS section 3.2.1.3, *Calculation of toxicity/mobility factor value*, states to “[u]se the hazardous substance with the highest toxicity/mobility factor value for the aquifer being evaluated to assign the value to the toxicity/mobility factor value for that aquifer.” As shown in Table 24 on page 56 of the HRS documentation record at proposal, PFOA and PFOS were assigned the highest toxicity/mobility factor value for the site (i.e., 10,000). The HRS documentation record at proposal properly considered all the hazardous substances associated with the source and observed release and then selected the highest calculated toxicity/mobility factor value among these substances. Separate site scores considering each substance individually, combined with the other factor value components used in calculating an HRS site score (i.e., likelihood of release factor value, waste characteristics factor value [which includes the toxicity/mobility factor value], and targets factor value) are not a requirement of the HRS. (See page 3 of the HRS documentation record at proposal.)

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

3.6 Evaluation of Other Possible Sources

Comment: New Castle County challenged the list of possible sources presented in the HRS documentation record at proposal. New Castle County asserted that the list of possible sources of contamination is both incomplete and unsupported. New Castle County asserted that the contamination in public wells may have been caused by other possible sources than what are identified in the HRS documentation record at proposal. It commented that other possible contributors not identified in the HRS documentation record at proposal appear to be located nearby based on information available in public databases, including “properties where aqueous film forming foam (“AFFF”) containing PFAS may have been used.” New Castle County asserted that commercial laundry facilities, which are possible sources of PFAS, were not included in the HRS documentation record at proposal and should be identified as a possible source. It stated that while the HRS documentation record at proposal relied on the 2015 PA to identify possible sources, a connection to the contamination in the public wells evaluated is not provided for the 16 areas that may have been associated with contaminants identified in the HRS documentation record at proposal.

⁴ The site progress profile for East Basin Road Groundwater is available online at the following location <https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0304044&msspp=med>. The site progress profiles for the Army Creek Landfill and Delaware Sand & Gravel Landfill sites are available online at the following locations <https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0300086> and <https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0300034&msspp=med>.

New Castle County asserted that insufficient support was included to support evaluating the New Castle County Airport as a possible source. Contesting the inclusion of the airport as a possible source, New Castle County commented that:

- “[L]inks between certain contaminants” and activities at the airport property were not established.
- A CVOC source was not identified on the airport property.
- Analysis of soil samples from the airport property did not detect CVOCs.
- Groundwater analytical results for PFOA concentrations at the airport property were similar in magnitude to the PFOA background concentrations presented in the HRS documentation record at proposal.

Response: The possible sources discussed in the HRS documentation record at proposal were appropriately identified as possible sources of the commingled contamination evaluated based on either known or suspected use of PFAS or CVOCs and/or documented CVOCs and/or PFAS in soil and/or groundwater samples from the properties. Multiple investigations were completed to evaluate the contamination including a PA in 2015, an SI in 2017, 2018, and 2020, and an ESI in 2021 (see page 13 of the HRS documentation record at proposal). As the Site was scored as a groundwater plume with no identified source, the HRS documentation record at proposal did not attribute the contamination to a specific source or sources. These possible sources identified in the HRS documentation record at proposal were identified as only possible sources. As discussed in section 3.2, Site Boundaries/Extent of Site, of this support document, additional investigation will occur at a subsequent stage in the Superfund process to further investigate the contamination at the Site.

The HRS definition of a source includes a contaminated groundwater plume as a source. HRS Section 1.1, *Definitions*, states:

Any area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance. Sources do not include those volumes of air, ground water, surface water, or surface water sediments that have become contaminated by migration, except: **in the case of either a ground water plume with no identified source or contaminated surface water sediments with no identified source, the plume or contaminated sediments may be considered a source.** [emphasis added]

Page 13 of the HRS documentation record at proposal states:

In 2015, DNREC conducted a PA to identify the likely source(s) of PFAS (formerly referred to as perfluorinated compounds [PFCs]) groundwater contamination of the public supply wells in New Castle, Delaware (Ref. 8, pp. 1, 2)...

In 2017, 2018, and 2020, DNREC conducted a Site Inspection (SI) that included the installation and sampling of monitoring wells at six of the 16 AOPC, as well as at locations throughout the AOI, to investigate the presence of hazardous substances in groundwater (Ref. 7, pp. 25, 70, 71, 87)....

In 2021, DNREC conducted an Expanded Site Inspection (ESI) that included the installation and sampling of monitoring wells in the northeast portion of the AOI, the sampling of select existing monitoring wells, and the sampling of two Artesian public supply wells and two NCMSC public supply wells (Ref. 9, pp. 26, 28, 29, 121, 124).

Page 51 of the HRS documentation record at proposal states:

In an effort to identify the source(s) of PFAS and CVOCs in groundwater in New Castle, Delaware, DNREC has conducted or overseen investigations at the following locations:

- NCCA [New Castle County Airport]
- DANG [Delaware Air National Guard {Tenant} Wilmington Airport Site]
- DEARNG [Delaware Army National Guard, Duncan Readiness Center and Army Aviation Support Facility]
- BMX Fire Training Area
- 600 Dupont Highway/Jackson Ave. and North Dupont Highway
- Community Plaza

Regarding the NCCA, pages 51 and 52 of the HRS documentation record at proposal state:

From 1941 to 1946, the NCCA was occupied and operated as the U.S. Army, New Castle Army Airfield (EPA ID: DEN000305948) under the War Department (known today as the Department of Defense) (Refs. 47, p. 17; 97, p. 6). The U.S. Army utilized the property as an airbase and training facility from 1941 to 1946 (Refs. 47, pp. 17, 18; 97, pp. 6, 9). After World War II, from 1946 to 1949, the War Department transitioned the airfield back to New Castle County as a civilian airport... However, the military, including the Delaware Air National Guard (DANG) and the Delaware Army National Guard (DEARNG), has continued to maintain a presence at the airport (Ref. 47, p. 18; 97, pp. 9, 10). The Site remains an active airport facility... **The EPA PA indicates that materials and fuels containing hazardous substances had been managed at the Site during World War II under the DOD and following the development of the municipal airport thereafter (post-1946). The materials listed in the EPA PA included solvents, paints, and paint strippers composing of unknown constituents. Past tenants were also reported to have used cleaning solvents and paint removers that potentially contained hazardous substances....**

In addition to the use and possible releases of chlorinated solvents at the NCCA, **many of the airport buildings and hangars contain foam fire suppressant systems** (Ref. 8, pp. 12, 48, 77, 210, 211, 223, 232, 237). Since the properties use as a military airbase, there have been several plane and helicopter crashes at the airport. **The last crash occurred in 2007, which showed the use of foam** (Ref. 8, pp. 12, 48, 92, 93). Additionally, there is a fire training area located on the north end of Runway #19 that airport personnel have confirmed this area was **used by the airport for fire training activities and that aqueous film forming foam (AFFF) may have been used** (Ref. 8, pp. 11, 41).

As presented in **Additional Supporting Information, CVOCs and PFOS and PFOA have been detected in groundwater samples collected from monitoring wells located at the NCCA**. However, shallow and deep soil samples collected in 2013 (34 samples) and 2016 (two samples) did not contain concentrations of CVOCs (Refs. 46, pp. 45-47, 67; 47, pp. 80, 96). Collected soil samples have not been analyzed for PFAS (Refs. 46, p. 16; 47, pp. 44, 45). [emphasis added]

Pages 52-54 of the HRS documentation record at proposal describe the DANG, the DEARNG, the BMX Fire Training Area, 600 Dupont Highway/Jackson Ave. and North Dupont Highway, and Community Plaza. These pages state:

DANG occupies approximately 57 acres at the northeast corner of the NCCA (Ref. 7, p. 70). A PA conducted by DNREC in 2015 indicated a possible fire training area located on the DANG property (Ref. 8, pp. 11, 16). However, in 2016, DANG conducted a separate PA that indicated there is no evidence that a fire training area is, or was located, within the current footprint of the

DANG property boundary and that DANG utilized the fire training area located on NCCA property, north of the runway (Ref. 73, p. 13). A SI conducted by DEARNG indicates that DANG uses an area to the south of the DEARNG property for fire training (Ref. 53, pp. 32, 35). The DANG PA did indicate several areas where AFFF has been stored or released and may include crash sites, hangars, fuel spill areas, hazardous waste storage facilities, firefighting equipment testing areas, and others (Ref. 73, pp. 15, 16, 33). Of particular note is the Wash Rack area which is a concrete area, approximately 175 feet by 120 feet. The area is not sheltered and there is a central drain. According to fire station personnel, annual nozzle testing using AFFF was conducted at the Wash Rack until approximately two years ago. The Wash Rack has one drain that is equipped with a valve that can divert drainage to either the storm water system or the sanitary sewer. AFFF was likely diverted into the sanitary system; however, had the potential to drain to the South Stormwater Retention Basin (Outfall 2) if the valve in the drain was not diverted.... Soil samples collected in 2017, contained concentrations of PFOS and PFOA at several areas (Ref. 52, pp. 70, 71, 85, 86, 87). As presented in **Additional Supporting Information**, PFOS, and PFOA have been detected in groundwater samples collected from monitoring wells located at DANG....

DEARNG encompasses approximately 17.3 acres adjacent to the NCCA (Ref. 53, pp. 9, 23). Soil samples collected on the property as part of a SI conducted by DEARNG in 2021, showed concentrations of PFOS and PFOA (Ref. 53, pp. 55, 64). Soil samples were not analyzed for VOCs as part of the SI (Ref. 53, pp. 45). The PFOS and PFOA detected in soil on the DEARNG property are possibly associated with a helicopter crash that occurred in the 1970s and the fire suppression system in the hangar, which was discharged in 2011 when it was retrofitted with Jet-X 2 percent high expansion foam...

The BMX Fire Training Area (referred to as Area 9) is owned by New Castle County (Ref. 8, p. 10). Local fire fighters confirmed that the area was used as a fire training area but could not confirm whether AFFF containing PFAS was used during fire training exercises.... Soil samples, primarily surface soil (0 to 2 feet bgs), collected from the BMX fire training area did not contain concentrations of CVOCs (Ref. 7, pp. 46, 69, 73, 89, 90, 94, 95). Soil samples collected by DNREC as part of the SI were not analyzed for PFAS (Ref. 7, p. 26). As presented in **Section 3.1**, PFOS and PFOA were also detected in groundwater samples collected from monitoring wells located at the BMX Fire Training Area as part of the DNREC SI....

The 600 Dupont Highway property has been used as an automobile service station, gas station, and towing facility since the early 1960s (Ref. 54, p. 9). In 2014, as part of a Brownfields investigation, soil samples were collected from the property; two of the collected samples showed detections of PCE at 0.04 milligrams per kilogram (mg/kg) and 0.011 mg/kg (Ref. 54, pp. 83, 91, 104, and 105). A dry cleaners is across Jackson Ave from the property (Ref. 54, p. 83)....

As presented in **Additional Supporting Information**, CVOCs, such as PCE, TCE, and cis-1,2-DCE have been detected in groundwater samples collected from monitoring wells located on these properties in the vicinity of the dry cleaners....

An RI was conducted at Community Plaza, a strip mall that contains a dry cleaners, at 287 Christiana Road in New Castle, Delaware in 2014 (Ref. 59, pp. 8, 111). Three soil samples collected from two soil borings closest to the dry cleaners contained concentrations of PCE (0.14 mg/kg), TCE (0.075 mg/kg), cis-1,2-DCE (up to 0.074 mg/kg), and trans-1,2-DCE (0.75 mg/kg) (Ref. 59, pp. 120, 139). As presented in **Additional Supporting Information**, CVOCs, such as PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride have been detected in groundwater samples collected from monitoring wells located on this property.

In discussing additional possible sources, page 54 of the HRS documentation record at proposal states:

As shown in Reference 5, there are too many known or possible sources within the vicinity of the Site to reasonably attribute the significant increase in the PFAS and CVOCs in the groundwater to one or more specific source(s).

Industrial facilities that manufacture organic chemicals, plastics, and synthetic fibers may have PFAS at the facility for numerous reasons such as: to specifically manufacture PFAS through electrochemical fluorination, telomerization, or other processes in production of such products; as a polymerization processing aid; for the production of plastic, rubber, and resin; and in the manufacturing of commercial chemical products (e.g., carpet cleaning sprays, cleaning agents, protective coatings) (Ref. 62, pp. 13, 32). **Twenty seven facilities in the vicinity of the Site are identified in the EPA Enviromapper database as plastics or resin manufacturing facilities, or chemical plants or manufacturers** (Ref. 5 p. 2; 11)....

Eight facilities in the vicinity of the Site are identified in the EPA Enviromapper database as metal coating, fabrication, or smelting facilities, or as electronic manufacturers (Ref. 5, p. 2; 11)....

Two facilities in the vicinity of the Site are identified in the EPA Enviromapper databased as textile facilities (Refs. 5, p. 2; 11)....

Approximately 15 car washes are located within New Castle Delaware (Ref. 72, p. 2)....

PCE, which breaks down into TCE, cis/trans-1,2-DCE, DCE, and vinyl chloride, is a commercially important chlorinated hydrocarbon solvent and chemical intermediate. It is used as a dry cleaning and textile-processing solvent and for vapor degreasing in metal-cleaning operations (Ref. 65, pp. 279, 302; 95 p. 39).... **The EPA Enviromapper databased identified a total of 26 facilities that fell into the category of metal coating and fabrication, dry cleaning, auto repair, chemical plants or manufacturers, and textiles facilities** (Refs. 5, p. 2; 11). [emphasis added]

The HRS evaluation of the Site was unable to reasonably attribute the commingled groundwater contamination to a single source or sources based on the numerous possible sources of contamination in the area as explained on pages 52-54 of the HRS documentation record at proposal. Page 13 of the HRS documentation record at proposal, quoted above, summarizes the investigations that were performed and indicates that a PA, an SI, and an ESI were conducted to investigate the contamination identified in monitoring and public supply wells. Pages 52-54 of the HRS documentation record at proposal identify possible sources of contamination based on investigations identifying possible past uses of related compounds, and on detections of CVOCs and/or PFAS in soil and/or groundwater at some properties. However, the significant increase in contamination could not be reasonably attributed to one or more of these facilities; therefore, the Site was scored as a groundwater plume with no identified source consistent with the HRS. The EPA also noted that in addition to the facilities listed on pages 52-54 of the HRS documentation record at proposal, numerous other industries and facilities are present in the area of the Site that may also be possible sources of the contamination, such as dry cleaners, car washes, and numerous industrial facilities. The origin of the contamination was not limited to the six areas discussed in detail on pages 52-54 of the HRS documentation record at proposal. Following NPL placement, further investigation will occur to attempt to determine the source or sources of the contamination. (See section 3.5, Evaluation and Future Remediation of Hazardous Substances, Pollutants, and/or Contaminants, of this support document.)

Regarding the consideration of the NCCA as a possible source, the HRS documentation record at proposal provided a link between past potential activities and past uses of materials that likely contain hazardous substances, such as solvents, that may have contributed to contamination at the Site. Neither NCCA nor any other identified property was scored as an HRS source in the HRS evaluation; the NCCA and other properties were only identified as possible sources. Page 51 of the HRS documentation record at proposal indicated that cleaning

solvents and paint removers were used at the facility and may have contained hazardous substances, and page 52 of the HRS documentation record at proposal indicates that firefighting foam, which likely contains hazardous substances, also may have been used at the property. The HRS documentation record at proposal, on page 52 quoted above, also noted that groundwater samples collected from monitoring wells on the NCCA property contained hazardous substances. Due to the possible uses of hazardous substances at the property and the detections of hazardous substances in groundwater at the property, the HRS evaluation of the Site indicated that the NCCA may be a “possible source.” However, the Site is scored as a groundwater plume with no identified source because the source or sources of contamination could not be reasonably identified and found to be attributable for the significant increase in contamination. Therefore, the NCCA is properly discussed as a possible source in the HRS documentation record at proposal; further investigation into the origin of the contamination will occur at a subsequent stage in the Superfund process.

Insomuch as these comments are expressing concern for liability of the contamination at the Site, liability is not assessed at the listing stage of the Superfund process, and liability is not considered in determining whether NPL placement of a site is warranted.

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

3.7 Aquifer Interconnection and Groundwater Flow

Comment: New Castle County asserted that the Site-specific geology is complex and expressed concern that the impacts of the complex geology on contaminant migration is not well known. New Castle County commented that although the HRS documentation record at proposal identifies a possible groundwater divide and a groundwater mound at a nearby facility (both possibly impacting the surficial aquifer), the impact of these features on groundwater migration is not fully discussed as it relates to the nearby airport. It asserted that while not defined in the HRS documentation record at proposal, information about recharge to the aquifers, and possible differences in contaminants and contaminant ratios between the Potomac and Columbia aquifers, could clarify migration pathways and possible sources.

New Castle County commented that hydraulic barriers may be present, separating some background wells from the Site. It asserted that surface water bodies may be possible barriers to groundwater migration between some background wells and the Site.

New Castle County commented that the groundwater flow direction in the area is complex, impacting the ability to determine background levels for groundwater. It asserted that the HRS documentation record at proposal does not explain whether groundwater flow is changing due to the many active wells pumping groundwater in the vicinity of the Site. New Castle County also stated that the complex nature of groundwater flow in the area impacts the ability to determine the possible contamination migration from sources to public wells.

Response: Sufficient information about the Site-specific geology was presented in the HRS documentation record at proposal for HRS scoring purposes and to evaluate the aquifer interconnections and discontinuities scoring factors. The Columbia and Potomac aquifers were properly shown to be interconnected within two miles of the Site, and no HRS qualifying aquifer discontinuities were identified at the Site (i.e., no aquifer discontinuities were identified between the background and observed release wells scored in the HRS documentation record at proposal). It is beyond the scope of the HRS to assess differences in contaminants and contaminant ratios between the Potomac and Columbia aquifers and to determine routes of migration from source(s) to contaminated wells; the HRS doesn’t require that migration routes be identified. The EPA acknowledges the complex flow of groundwater in the area including the impact of pumping from public wells; however, this complex groundwater flow does not impact the EPA’s decision to add the Site to the NPL or the HRS scoring of the Site as further discussed in section 3.8.1, Background Levels, of this support document.

In evaluating aquifers for HRS scoring purposes, HRS Section 3.0.1.2, *Aquifer boundaries*, directs to “[c]ombine multiple aquifers into a single hydrologic unit for scoring purposes if aquifer interconnections can be established for these aquifers. In contrast, restrict aquifer boundaries if aquifer discontinuities can be established.”

HRS Section 3.0.1.2.1, *Aquifer interconnections*, directs how aquifers should be evaluated for interconnections. It states:

Evaluate whether aquifer interconnections occur within 2 miles of the sources at the site. If they occur within this 2-mile distance, combine the aquifers having interconnections in scoring the site. In addition, if observed ground water contamination attributable to the sources at the site extends beyond 2 miles from the sources, use any locations within the limits of this observed ground water contamination in evaluating aquifer interconnections. If data are not adequate to establish aquifer interconnections, evaluate the aquifers as separate aquifers.

HRS Section 3.0.1.2.2, *Aquifer discontinuities*, directs how to evaluate potential discontinuities at the site being evaluated. It states:

Evaluate whether aquifer discontinuities occur within the 4-mile target distance limit. An aquifer discontinuity occurs for scoring purposes only when a geologic, topographic, or other structure or feature entirely transects an aquifer within the 4-mile target distance limit, thereby creating a continuous boundary to ground water flow within this limit. If two or more aquifers can be combined into a single hydrologic unit for scoring purposes, an aquifer discontinuity occurs only when the structure or feature entirely transects the boundaries of this single hydrologic unit.

In addition, Section L, *Ground Water Migration Pathway*, of the preamble to the 1990 HRS in the Federal Register (55 FR 51551-51554) provides the following examples of information that can be used to identify aquifer interconnections for the purposes of scoring a site; page 51553 states:

In practice, EPA has found that studies in the field to determine whether aquifers are interconnected in the vicinity of a site will generally require resources more consistent with remedial investigations than SIs, especially where installation of deep wells is necessary to conduct aquifer testing. Thus, EPA has in the past relied largely on existing information to make such determinations and the Agency finds it necessary to continue that approach. Examples of the types of information useful in identifying aquifer interconnections were given in the proposed rule. This information includes literature or well logs indicating that no lower relative hydraulic conductivity layer or confining layer separates the aquifers being assessed (e.g., presence of a layer with a hydraulic conductivity lower by two or more orders of magnitude); literature or well logs indicating that a lower relative hydraulic conductivity layer or confining layer separating the aquifers is not continuous through the two-mile radius (i.e., hydrogeologic interconnections between the aquifers are identified); evidence that withdrawals of water from one aquifer (e.g., pumping tests, aquifer tests, well tests) affect water levels in another aquifer; **and observed migration of any constituents from one aquifer to another within two miles**. For this last type of information, **the mechanism of vertical migration does not have to be defined**, and the constituents do not have to be attributable to the site being evaluated. Other mechanisms that can cause interconnection (e.g., boreholes, mining activities, faults, etc.) will also be considered. [emphasis added]

Regarding groundwater flow direction, Section L, *Ground Water Migration Pathway*, page 51553, of the preamble to the 1990 HRS in the Federal Register (55 FR 51551-51554), states:

EPA reviewed a range of options for considering ground water flow direction in evaluating targets. For the reasons discussed above under “Use of Available Data,” the Agency decided that it was not feasible to adopt a tiered approach in the targets factors for evaluating ground water

flow direction. EPA does not agree that increased accuracy warrants the increased complexity of accounting for groundwater flow direction, because this level of accuracy is not required for a screening tool that is intended to assess relative risk. This level of accuracy, however, is needed to determine the extent of remedial action and, therefore, is appropriate at the time of the RI.

... ground water flow direction can be influenced by factors such as seasonal flows and pumping from well fields. In addition, the ground water flow direction may be different in each aquifer at the site, and the direction of hazardous substance migration is not always the same as the direction of ground water flow. ...

Although the final rule does not consider ground water flow direction directly in evaluating targets, it does consider flow direction indirectly in the method used to evaluate target populations. If wells have not been contaminated by the site, as the commenters assume upgradient wells would not be, the population drawing from those wells is distance weighted and, thus, populations drawing from the wells would have to be substantial before a large number of points could be assigned.

Page 27 of the HRS documentation record at proposal describes the interconnection of the Columbia and Potomac aquifers based on the site-specific geologic conditions. It states:

3.0.1.2.1 Aquifer Interconnections

The absence of discernible continuous clay layers, both locally and regionally, demonstrates that a continuous (greater than 2 miles) confining layer is not present in the formations that comprise the Columbia/Potomac Aquifer System in the vicinity of the groundwater plume (Refs. 9, 129-131; 19, p. 1; 47, p. 100). The upper Potomac aquifer units are not laterally continuous, and to the northeast of the airport much of the Potomac formation has been eroded and filled with Columbia sediments of the Pleistocene Age (Refs. 21, p. 1; 22, p. 1). **Boreholes (Dc14-3 and Dc14-42) establish that the Columbia Aquifer is in direct contact with the sands of the Upper Potomac Aquifer (Ref. 19, p. 1). Monitoring wells located within the boundaries of the groundwater plume further demonstrate that there is no continuous confining unit; boreholes logs for wells NCPW-MW18 and NCPW-MW21 indicate that no HRS qualifying confining unit is present down to a depth of approximately 90 feet below msl (Ref. 7, pp. 299-303, 316-321; 9, p. 130).** There is also evidence that sand of the Columbia formation are also in direct contact with sand of the middle Potomac where a paleochannel eroded the Potomac formation and created a paleochannel with deposited sands of the Pleistocene Age Columbia Group as shown in boreholes Cd43-4 and Cd-43-16 (Ref. 18, pp. 18, 25, 26). The Pleistocene erosion removed the overlying Potomac confining unit which resulted in deposition of more permeable sediment and provided a conduit for water to leak out of or into the Potomac aquifers (Ref. 18, p. 33).

The migration of non-naturally occurring contaminants through the fine-grained sediments and the subsequent presence of contamination throughout the Columbia/Potomac Aquifer System to a depth of at least -103 feet in elevation demonstrates that the interbedded fine-grained units do not act as a local barrier to groundwater flow within the Columbia/Potomac Aquifer System. Site contaminants, such as PFOS, PFOA, and CVOCs, have been detected in groundwater monitoring and public supply wells screened within sands of the Columbia and Upper Potomac Aquifers as documented in Section 3.1.1 (wells screened at depths ranging from an elevation of 5.2 feet to elevation of -103.25 feet as shown on **Figure 2** in Reference 5 and **Tables 4 through 23** of this HRS documentation record). [emphasis added]

Page 28 of the HRS documentation record at proposal describes the assessment of aquifer discontinuities. It states:

3.0.1.2.2 Aquifer Discontinuities

For HRS scoring purposes, an aquifer discontinuity occurs when a geologic, topographic, or other structure or feature entirely transects an aquifer within the 4-mile target distance limit, thereby creating a continuous boundary to groundwater flow within this limit (Ref. 1, Section 3.0.1.2.2).

As shown on the Geologic Map for the New Castle County, Delaware, there are no aquifer boundaries, such as mountain ranges, deep rivers, continuous HRS qualifying confining units, or faults, within 4 miles from the Site that entirely transects any portion of the aquifer within the 4-mile TDL [target distance limit] and would constitute an aquifer discontinuity (Ref. 15, p. 1; **Figure 4** in Reference 5 of this HRS documentation record). The Christina River is relatively shallow and does not form a hydrological divide (Refs. 16, pp. 19 and 20; 19, p. 1).

Pages 23 to 25 of the HRS documentation record at proposal discuss recharge to the aquifer as well as the complexity of the aquifer as it pertains to the paleochannels which may act as conduits for water:

The saturated part of the Columbia Formation forms a surficial aquifer. Groundwater in the surficial aquifer is recharged by direct infiltration of precipitation. Flow is generally from higher to lower land-surface elevations, resulting in groundwater discharge to small streams and creeks (Ref. 16, pp. 18, 20). The Columbia aquifer is recharged from the surficial aquifer and is Delaware's most important ground water resource (Ref. 20, pp. 8, 46). ...

Underlying the Columbia aquifer is the Potomac aquifer (Ref. 18, pp. 15, 18, 19, 21-25). The source of groundwater for the Potomac aquifers is recharge from the overlying Columbia aquifer. Most of the recharge occurs near the updip extent of the aquifers where sandy zones of the Potomac Formation crop out at, or near, the land surface and from the Columbia aquifer where confining units are thin or absent (Refs. 16, p. 18; 18, p. 36). During pre-pumping conditions, much of the water in the Columbia aquifer discharges as base flow into local streams or lakes. The remainder of the groundwater flows into the deeper Potomac aquifers (Ref. 18, p. 36). Reported recharge into the Potomac aquifers from the Columbia aquifer was from 0.1 to 2.0 inches per year (in/yr), including in the confined Potomac aquifers in northern Delaware (Ref. 18, p. 36). Reported transmissivity values of the Potomac Formation range from 454 to 8,480 ft²/d (Ref. 18, p. 26).

...

The downward erosion of river channels during Pleistocene era resulted in the removal of underlying Cretaceous sediments. The channel-fill sediments deposited after the erosional episodes consisted of sand and gravel of the Columbia Group and Holocene sediments. These sediments have a greater permeability than the Potomac confining unit that had overlain the Potomac aquifers. Therefore, the paleochannels will influence groundwater in the Potomac aquifer and may act as a conduit for water to leak out of or into the Potomac aquifer units (Refs. 18, pp. 33, 34; 19, p. 1). The sediments of the Columbia Formation fill that eroded surfaces within the underlying Potomac Formation formed a paleochannel that trends northeast to southwest with a thickness of approximately 70 ft. within the vicinity of the Site (Ref. 7, pp. 13, 68). Due to erosion, the Upper Potomac clay may be discontinuous or missing entirely within the paleochannels. As presented below, the Upper Potomac clay is absent in places from the NCCA, as documented in boring logs from select monitoring wells (Ref. 7, p. 13). Groundwater in the Columbia Formation (with public supply wells located in the paleo-channel filled with Columbia Formation sediments) is rapid and expected to be in the hundreds of feet per year based on a fate and transport assessment of PFAS compounds in groundwater at NCCA and DANG and at the public supply wells located in and around the paleochannel (Ref. 9, pp. 58, 132).

Consistent with the HRS, the HRS evaluation of the Site properly combined the Columbia and Potomac aquifers into a single hydrologic unit for scoring purposes because aquifer interconnections were established through the absence of confining units and documented migration of non-naturally occurring contaminants. The HRS evaluation then evaluated whether any features were present that would be barriers to groundwater flow and entirely transected the hydrologic unit within the 4-mile target distance limit (TDL). The presence of a possible groundwater divide, and a groundwater mound, at the Site do not constitute an aquifer discontinuity in the 4-mile TDL such that contaminant migration from the overlying surfaces to the underlying Columbia and Potomac aquifers would not occur. Additionally, page 27 of the HRS documentation record at proposal explained that the Christina River, a surface water body present within the 4-mile TDL, did not constitute an aquifer discontinuity because its shallow depth did not create a barrier to groundwater flow. Because barriers to groundwater flow entirely transecting the combined Columbia and Potomac aquifers within the 4-mile TDL were not identified based, in part, on the information in References 15⁵, 16⁶, and 19⁷ of the HRS documentation record at proposal, the HRS scoring of the Site did not limit the 4-mile TDL. Thus, sufficient geologic information was provided to properly evaluate the aquifer interconnections and aquifer discontinuities scoring factors for HRS scoring purposes.

Moreover, aquifer discontinuities were not identified between the background wells and the release wells as the commenter suggests. As the background wells are located near the edges of the plume, and within 4-miles of the approximate center of the plume, the assessment of aquifer discontinuities within the 4-mile TDL for identifying eligible targets also indicates whether barriers to groundwater flow are present between the release and background wells. (See Figures 2 and 4 in Reference 5 of the HRS documentation record at proposal and References 15 and 19 of the HRS documentation record at proposal.) The lack of aquifer discontinuities within the 4-mile TDL also indicates that there are no barriers to groundwater flow, such as deep surface water bodies entirely transecting the hydrologic unit, scored between the release and background wells.

Regarding the spatial relationship of the Delaware River to the release and background wells, aquifer discontinuities were not identified in the HRS documentation record at proposal, as discussed above, and References 15 and 19 of the HRS documentation record at proposal were cited to support the absence of aquifer discontinuities. The HRS documentation record at proposal did not identify the Delaware River as an aquifer discontinuity. Even if the Delaware River were an aquifer discontinuity, it would not impact the HRS scoring of the Site because it is not present between the background and release wells; background, release, and target wells are all located west of the Delaware River as indicated on Figures 2 and 4 in Reference 5 of the HRS documentation record at proposal.

Regarding comments discussing the groundwater flow direction, the HRS documentation record at proposal contained sufficient information to establish an observed release in the scored public supply wells and monitoring wells at the Site, and, as shown in HRS language quoted above, the HRS does not contain any specific requirements for establishing the groundwater flow at a site; however, the preamble to the 1990 HRS discusses⁸ the consideration of evaluating groundwater flow direction. The preamble to the 1990 HRS explains that accounting for groundwater flow direction is an increased level of complexity that is not required for a screening tool such as the HRS; therefore, determining a more accurate understanding of the groundwater flow at a site is appropriate during a remedial investigation that follows this step in the Superfund process. Thus, sufficient data are not available at this stage in the listing process to accurately assess the groundwater flow directions

⁵ Reference 15 of the HRS documentation record at proposal: Delaware Geological Survey (DGS). 2005. *Geologic Map of New Castle County, Delaware*. University of Delaware, Newark. 1 Page.

⁶ Reference 16 of the HRS documentation record at proposal: U.S. Geological Survey (USGS). 2015. *Hydrogeologic Framework, Hydrology, and Refined Conceptual Model of Groundwater Flow for Coastal Plain Aquifers at the Standard Chlorine of Delaware, Inc. Superfund Site, New Castle County, Delaware, 2005–12*. Scientific Investigations Report 2014–5224. 74 Pages.

⁷ Reference 19 of the HRS documentation record at proposal: Delaware Geological Survey (DGS). 1987. *Geohydrology of the Wilmington Area, Delaware. Hydrologic Map Series No. 3, Sheet 1, Basic Geology*. University of Delaware, Newark. 1 Page.

⁸ December 14, 1990, Federal Register Volume 55, Number 241, page 51553

throughout the TDL or to present a complete groundwater flow model at the site, and such a process is not part of the HRS evaluation.

As these comments relate to the consideration of groundwater flow direction in determining background sample locations, the determination of background levels for the Site is discussed in section 3.8.1, Background Levels, of this support document.

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

3.8 Observed Release

Comment: New Castle County commented that it is unclear whether the concentrations of CVOCs alone would support the placement of the Site on the NPL. It asserted that the information in the HRS documentation record at proposal did not clearly explain the extent the CVOC contamination in public wells at the Site and whether the contamination exceeded applicable screening levels. New Castle County asserted that CVOC concentrations, specifically tetrachloroethylene (PCE), only exceeded screening levels in two public wells, AIP #1 and AIP #2. It commented that the highest PCE concentrations detected in these two wells were from an almost 30-year-old sample from AIP #1 and a more than 10 year old sample from AIP #2.

New Castle County commented that the complexity of groundwater flow in the vicinity of the Site could affect contamination migration to the public wells from possible sources. It stated that shifts in groundwater flow over time could affect the background level determination and the ability to attribute the contamination.

Response: An observed release by chemical analysis was properly documented in the HRS documentation record at proposal. A significant increase in the concentrations of PFOA, PFOS, TCE, PCE, cis-1,2-DCE, 1,2-DCA, and trans-1,2-DCE in groundwater above site-specific background levels was appropriately established as part of the HRS scoring of the Site.

In establishing an observed release for the ground water migration pathway, HRS Section 3.1.1, *Observed release*, directs:

Establish an observed release to an aquifer by demonstrating that the site has released a hazardous substance to the aquifer. Base this demonstration on either:

- Direct observation—a material that contains one or more hazardous substances has been deposited into or has been observed entering the aquifer.
- Chemical analysis—**an analysis of ground water samples from the aquifer indicates that the concentration of hazardous substance(s) has increased significantly above the background concentration for the site (see section 2.3). Some portion of the significant increase must be attributable to the site to establish the observed release, except: when the source itself consists of a ground water plume with no identified source, no separate attribution is required.** [emphasis added]

HRS Section 3.1.1 quoted above refers to HRS Section 2.3, *Likelihood of release*, which further directs:

Establish an observed release either by direct observation of the release of a hazardous substance into the media being evaluated (for example, surface water) or by chemical analysis of samples appropriate to the pathway being evaluated (see sections 3, 4, and 6). **The minimum standard to establish an observed release by chemical analysis is analytical evidence of a hazardous substance in the media significantly above the background level.** Further, some portion of the release must be attributable to the site. Use the criteria in Table 2–3 as the standard for determining analytical significance. [emphasis added]

The observed release criteria are explained in HRS Section 2.3, *Likelihood of release*, and HRS Table 2-3. HRS Table 2-3 explains:

TABLE 2-3—OBSERVED RELEASE CRITERIA FOR CHEMICAL ANALYSIS

Sample Measurement < Sample Quantitation Limit^a No observed release is established. Sample Measurement ≥ Sample Quantitation Limit^a An observed release is established as follows: • If the background concentration is not detected (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds the sample quantitation limit.^a • If the background concentration equals or exceeds the detection limit, an observed release is established when the sample measurement is 3 times or more above the background concentration.

^aIf the sample quantitation limit (SQL) cannot be established, determine if there is an observed release as follows:

- If the sample analysis was performed under the EPA Contract Laboratory Program, use the EPA contract-required quantitation limit (CRQL) in place of the SQL.
- If the sample analysis is not performed under the EPA Contract Laboratory Program, use the detection limit (DL) in place of the SQL.

In discussing the scoring of an observed release by chemical analysis, pages 29-47 of the HRS documentation record at proposal state, in part:

As discussed in **Section 3.0.1**, the Columbia Formation ranges in depth from 10 to 100 feet below ground surface (bgs), below which is the Potomac Formation that has a maximum thickness of 1,600 feet. As shown on **Tables 6, 7, 10, 11, 14, 15, 18, 19, 22, and 23** of this HRS documentation record, samples containing PCE, and PCE breakdown products, as well as PFOS and PFOA, were collected from monitoring and public supply wells to a maximum depth of 137 feet bgs (-110 feet elevation); therefore, an observed release in the Columbia/Potomac Aquifer System is documented....

Background levels for each analyte in each well category are identified in **bold**.

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TABLE 5 BACKGROUND SHALLOW MONITORING WELL CONCENTRATIONS					
Well ID (Sample ID)	Sample Date	Hazardous Substance	Concentration (ng/l or µg/l) ¹	RL (ng/l or µg/l) ¹	Reference(s)
NCPW-MW24 (NCPW-MW24-11032021)	11/03/21	PFOS	0.52U	1.91	9, pp. 157, 190; 30, pp. 1656, 3185; 33, pp. 176-182, 219
		PFOA	4.33	1.91	9, pp. 157, 190; 30, pp. 1656, 3185; 33, pp. 176-182, 219

TABLE 5 BACKGROUND SHALLOW MONITORING WELL CONCENTRATIONS					
Well ID (Sample ID)	Sample Date	Hazardous Substance	Concentration (ng/l or µg/l) ¹	RL (ng/l or µg/l) ¹	Reference(s)
		trans-1,2-DCE	0.24U	1.0	9, pp. 157, 190; 30, pp. 461, 3173; 33, pp. 223-230, 271
		cis-1,2-DCE	0.22U	1.0	9, pp. 157, 190; 30, pp. 461, 3173; 33, pp. 223-230, 271
		TCE	0.31U	1.0	9, pp. 157, 190; 30, pp. 461, 3173; 33, pp. 223-230, 271
		PCE	0.25U	1.0	9, pp. 157, 190; 30, pp. 461, 3173; 33, pp. 223-230, 271

Notes:¹Units for PFOS and PFOA are ng/l and for VOCs are µg/l.

RL = Reporting limit. The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence (Refs. 32, p. 24; 34, p. 2).

The samples were analyzed by a non-CLP laboratory. RLs presented above are most equivalent to the SQL as defined by HRS Section 1.1 (Ref. 1, Sections 1.1 and 2.3).

U = Indicates the analyte was analyzed for but not detected (Ref. 9, p. 242).

µg/l = micrograms per liter

ng/l = nanograms per liter

1,1-DCA = 1,1-dichloroethane

cis-1,2-DCE = cis-1,2-dichloroethylene

trans-1,2-DCE = cis-1,2-dichloroethylene

PCE = Tetrachloroethylene

TCE = Trichloroethylene

PFOS = Perfluorooctanesulfonic acid

PFOA = Perfluorooctanoic acid

CLP = Contract Laboratory Program

ID = Identifier

MW = Monitoring well

NCPW = New Castle Public Wells

VOC = Volatile organic compound

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TABLE 7 OBSERVED RELEASE SHALLOW MONITORING WELL CONCENTRATIONS					
Well ID (Sample ID)	Sample Date	Hazardous Substance	Concentration (ng/l or µg/l) ¹	RL (ng/l or µg/l) ¹	Reference(s)
NCPW-A9-MW05 (NCPW-A09GW-05)	9/17/18	PFOS	262	1.68	26, pp. 338, 821; 33, pp. 113-119, 123
		PFOA	162	1.68	26, pp. 338, 821; 33, pp. 113-119, 123

TABLE 7 OBSERVED RELEASE SHALLOW MONITORING WELL CONCENTRATIONS					
Well ID (Sample ID)	Sample Date	Hazardous Substance	Concentration (ng/l or µg/l) ¹	RL (ng/l or µg/l) ¹	Reference(s)
NCPW-A11-MW06 (NCPW-A11GW-06)	8/9/17	PFOS	15.4	1.94	25, pp. 270, 652; 33, pp. 79-85, 87
		PFOA	24.1	1.94	25, pp. 270, 652; 33, pp. 79-85, 87
NCPW-A13-MW12 (AREA13-MW12-11012021)	11/01/21	PFOS	18	1.80	30, pp. 1189, 3182; 33, pp. 176-184, 189
		PFOA	71.1	1.80	30, pp. 1189, 3182; 33, pp. 176-184, 189
		trans-1,2-DCE	2.9	1.0	30, pp. 326, 3171; 33 pp. 223-232, 237
		cis-1,2-DCE	2.3	1.0	30, pp. 326, 3171; 33 pp. 223-232, 237
		TCE	19	1.0	30, pp. 326, 3171; 33, 223-232, 237
		PCE	2.8	1.0	30, pp. 326, 3171; 33, 223-232, 237
NCPW-A13-MW13 (NCPW-A13GW-13)	9/19/18	PFOA	71.3	1.73	27, pp. 270, 761; 33, pp. 143-149, 151
NCPW-A13-MW14 (AREA13-MW14-11022021)	11/2/21	PFOS	28.3	1.94	30, pp. 1447, 3183; 33, pp. 176-184, 206
		PFOA	107	1.94	30, pp. 1447, 3183; 33, pp. 176-184, 206
NCPW-A14-MW16 (NCPW-A14GW-16)	9/17/18	PFOS	111	1.76	26, pp. 316, 821; 33, pp. 113-119, 121
		PFOA	67.6	1.76	26, pp. 316, 821; 33, pp. 113-119, 121
NCPW-MW23 (NCPW-MW23-11032021)	11/03/21	PFOS	8.35	1.87	30, pp. 1696, 3185; 33, pp. 177-184, 222
		PFOA	39.1	1.87	30, pp. 1696, 3185; 33, pp. 177-184, 222

Notes:¹Units for PFOS and PFOA are ng/l and for VOCs are µg/l.

Data was validated in accordance with EPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Superfund Methods Data Review, OLEM 9240.0-51, EPA-540-R-20-005, November 2020 (Ref. 33, pp. 125, 132, 137).

RL = Reporting limit. The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence (Refs. 32, p. 24 34. 2).

The samples were analyzed by a non-CLP laboratory. RLs presented above are most equivalent to the SQL as defined by HRS Section 1.1 (Ref. 1, Sections 1.1 and 2.3).

µg/l = micrograms per liter

ng/l = nanograms per liter

cis-1,2-DCE = cis-1,2-dichloroethylene

trans-1,2-DCE = cis-1,2-dichloroethylene

PCE = Tetrachloroethylene

TCE = Trichloroethylene

PFOS = Perfluorooctanesulfonic acid

PFOA = Perfluorooctanoic acid

CLP = Contract Laboratory Program

ID = Identifier

MW = Monitoring well

NCPW = New Castle Public Wells

VOC = Volatile organic compound

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TABLE 9 BACKGROUND INTERMEDIATE MONITORING WELL CONCENTRATIONS					
Well ID (Sample ID)	Sample Date	Hazardous Substance	Concentration (ng/l or µg/l) ¹	RL (ng/l or µg/l) ¹	Reference(s)
NCPW- MW22 (NCPW- MW22- 11032021)	11/03/21	PFOS	0.51U	1.90	9, pp. 157, 188; 30, pp. 1625, 3185; 33, pp. 176-182, 217
		PFOA	41.5	1.90	9, pp. 157, 188; 30, pp. 1625, 3185; 33, pp. 176-182, 217
		1,2-DCA	0.43U	1.0	9, pp. 157, 188; 30, pp. 455, 3173; 33, pp. 223-230, 269
		cis-1,2-DCE	0.22U	1.0	9, pp. 157, 188; 30, pp. 455, 3173; 33, pp. 223-230, 269
		TCE	0.31U	1.0	9, pp. 157, 188; 30, pp. 455, 3173; 33, pp. 223-230, 269

Notes:

¹Units for PFOS and PFOA are ng/l and for VOCs are µg/l.

RL = Reporting limit. The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence (Refs. 32, p. 24; 34, p. 2).

The samples were analyzed by a non-CLP laboratory. RLs presented above are most equivalent to the SQL as defined by HRS Section 1.1 (Ref. 1, Sections 1.1 and 2.3).

U = Indicates the analyte was analyzed for but not detected (Ref. 9, p. 242).

µg/l = micrograms per liter

ng/l = nanograms per liter

1,2-DCA = 1,2-dichloroethane

cis-1,2-DCE = cis-1,2-dichloroethylene

trans-1,2-DCE = cis-1,2-dichloroethylene

PCE = Tetrachloroethylene

TCE = Trichloroethylene

PFOS = Perfluorooctanesulfonic acid

PFOA = Perfluorooctanoic acid

CLP = Contract Laboratory Program

ID = Identifier

MW = Monitoring well

NCPW = New Castle Public Wells

VOC = Volatile organic compound

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TABLE 11 OBSERVED RELEASE INTERMEDIATE MONITORING WELL CONCENTRATIONS					
Well ID (Sample ID)	Sample Date	Hazardous Substance	Concentration (ng/l or µg/l) ¹	RL (ng/l or µg/l) ¹	Reference(s)
NCPW-A8-MW01 (NCPW-A08GW-01)	8/8/17	PFOS	97.8	2.68	7, p. 351; 24, pp. 421, 1831; 33, pp. 45-51, 53
		PFOA	177	2.68	7, p. 351; 24, pp. 421, 1831; 33, pp. 45-51, 53
NCPW-A8-MW02 (NCPW-A08GW-02 DL for PFOS and PFOA; NCPW-A08GW-02 for CVOCs)	8/8/17	PFOS	3400	47.8	7, p. 352; 24, pp. 448, 1831; 33, pp. 45-51, 55
		PFOA	560	47.8	7, p. 352; 24, pp. 448, 1831; 33, pp. 45-51, 55
		cis-1,2-DCE	2.7	1.0	7, p. 352; 24, pp. 105, 1831; 33, pp. 59-66, 69
		TCE	5.7	1.0	7, p. 352; 24, pp. 105, 1831; 33, pp. 59-66, 69
NCPW-A8-MW03 (NCPW-A08GW-03)	8/8/17	PFOS	34.5	2.5	7, p. 353; 24, pp. 459, 1831; 33, pp. 45-51, 56
NCPW-A9-MW04 (AREA09-MW04-11012021)	11/1/21	PFOS	729	17.77	9, pp. 154, 183; 30, pp. 14, 3182; 33, pp. 176-182, 192
		PFOA	170	1.77	9, pp. 154, 183; 30, pp. 1218, 3182; 33, pp. 176-182, 191
NCPW-MW19s (NCPW-MW19S-081720201450)	8/17/20	PFOS	59	1.7	7, pp. 232, 362; 28, pp. 435, 1465; 33, pp. 2-7, 20
NCPW-MW20s (NCPW-MW20S-11022021)	11/2/21	PFOS	152	1.90	9, pp. 155, 187; 30, pp. 1493, 3184; 33, pp. 176-184, 209
		1,2-DCA	4.7	1.0	9, pp. 155, 187; 30, pp. 395, 3172; 33, pp. 223-332, 257

Notes:¹Units for PFOS and PFOA are ng/l and for VOCs are µg/l.

Data was validated in accordance with EPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Superfund Methods Data Review, OLEM 9240.0-51, EPA-540-R-20-005, November 2020 (Ref. 33, pp. 59, 223).

RL = Reporting limit. The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence (Refs. 32, p. 24; 34, p. 2).

The samples were analyzed by a non-CLP laboratory. RLs presented above are most equivalent to the SQL as defined by HRS Section 1.1 (Ref. 1, Sections 1.1 and 2.3).

MDL = Method detection Limit. This is the minimum measured quantity of a substance that can be reported with 99 percent confidence that the concentration is distinguishable from method blank results, consistent with 40 CFR Part 136 Appendix B, August 2017 (Ref. 34, p. 2).

µg/l = micrograms per liter
 ng/l = nanograms per liter
 1,2-DCA = 1,2-dichloroethane
 cis-1,2-DCE = cis-1,2-dichloroethylene
 trans-1,2-DCE = cis-1,2-dichloroethylene
 PCE = Tetrachloroethylene
 TCE = Trichloroethylene
 PFOS = Perfluorooctanesulfonic acid
 PFOA = Perfluorooctanoic acid
 CLP = Contract Laboratory Program
 ID = Identifier
 MW = Monitoring well
 NCPW = New Castle Public Wells
 QAPP = Quality Assurance Project Plan
 VOC = Volatile organic compound

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TABLE 13 BACKGROUND DEEP MONITORING WELL CONCENTRATIONS					
Well ID (Sample ID)	Sample Date	Hazardous Substance	Concentration (ng/l)	RL (ng/l)	Reference(s)
NCPW-MW18 (NCPW-MW18-11022021)	11/2/21	PFOS	7.14	1.82	30, pp. 1288, 3182; 33, pp. 176-184, 196

Notes:

RL = Reporting limit. The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence (Refs. 32, p. 24; 34, p. 2).

The samples were analyzed by a non-CLP laboratory. RLs presented above are most equivalent to the SQL as defined by HRS Section 1.1 (Ref. 1, Sections 1.1 and 2.3).

ng/l = nanograms per liter

CLP=Contract Laboratory Program

ID = Identifier

MW = Monitoring well

NCPW = New Castle Public Wells

PFOS = Perfluorooctanesulfonic acid

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TABLE 15 OBSERVED RELEASE DEEP MONITORING WELL CONCENTRATIONS					
Well ID (Sample ID)	Sample Date	Hazardous Substance	Concentration (ng/l)	RL (ng/l)	Reference(s)
NCPW-MW21 (NCPW-MW21-081720200933)	8/17/20	PFOS	99	1.9	7, p. 364; 28, pp. 309, 1465; 33, pp. 2-7, 12

Notes:

RL = Reporting limit. The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence (Refs. 32, p. 24; 34, p. 2).

The samples were analyzed by a non-CLP laboratory. RL presented above is most equivalent to the SQL as defined by HRS Section 1.1 (Ref. 1, Sections 1.1 and 2.3).

ng/l = nanograms per liter

CLP=Contract Laboratory Program

ID = Identifier

MW = Monitoring well

NCPW = New Castle Public Wells

PFOS = Perfluorooctanesulfonic acid

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TABLE 17 BACKGROUND INTERMEDIATE PUBLIC WELL CONCENTRATIONS					
Well ID (Sample ID)	Sample Date	Hazardous Substance	Concentration (ng/l or µg/l) ¹	MRL/RL ² (ng/l or µg/l) ¹	Reference(s)
Collins Park (4427323 for PFOS and PFOA; 9094439-01 for CVOCs)	9/18/19	PFOS	24	2	31, pp. 56, 58
		PFOA	72	2	31, pp. 56, 58
	9/30/19	TCE	< 0.5	0.5	31, pp. 62, 65, 66, 67
		PCE	0.6	0.5	31, pp. 62, 65, 66, 67
Midvale 1R (7121398-01)	10/15/19	PFOS	11	2	31, pp. 144, 145
		PFOA	53	2	31, pp. 144, 145
	12/13/17	TCE	< 0.5	0.5	31, pp. 124, 130, 131, 132
		PCE	< 0.5	0.5	31, pp. 124, 130, 131, 132
Midvale 2R (10038 Well 2 for PFOS and PFOA; 8014661-01 for CVOCs)	10/15/19	PFOS	14	2	31, pp. 144, 145
		PFOA	46	2	31, pp. 144, 145
	1/30/18	TCE	< 0.5	0.5	31, pp. 136, 138, 139, 140
		PCE	< 0.5	0.5	31, pp. 136, 138, 139, 140

Notes:¹Units for PFOS and PFOA are ng/l and for VOCs are µg/l.²MRLs are associated with the PFOS and PFOA data and RLs are associated with the VOC data.

The MRLs and RLs presented above are most equivalent to the SQL as defined by HRS Section 1.1 (Ref. 1, Sections 1.1 and 2.3). However, it cannot be documented with available information whether the above noted MRLs and RLs are sample-specific.

MRL = Minimum reporting limit - The minimum concentration that can be reported as a quantitated value for a method analyte in a sample following analysis. This defined concentration can be no lower than the concentration of the lowest calibration standard for that analyte and can only be used if acceptable QC criteria for this standard are met. (Ref. 38, p. 6). In accordance with EPA Method 537, laboratories are required to demonstrate they can meet the MRL (Refs. 31, pp. 55, 143; 38, pp. 3, 18, 19).

RL = Reporting limit – The concentrations of a compound below which results are reported as nondetect or less than for this sample set (Ref. 91, p. 1).

< = less than

µg/l = micrograms per liter

ng/l = nanograms per liter

cis-1,2-DCE = cis-1,2-dichloroethylene

PCE = Tetrachloroethylene

TCE = Trichloroethylene

PFOS = Perfluorooctanesulfonic acid

PFOA = Perfluorooctanoic acid

CLP=Contract Laboratory Program

ID = Identifier

QC = Quality criteria

SQL = Sample Quantitation Limit

VOC = Volatile organic compound

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TABLE 19 OBSERVED RELEASE INTERMEDIATE PUBLIC WELL CONCENTRATIONS					
Well ID (Sample ID)	Sample Date	Hazardous Substance	Concentration (ng/l or µg/l) ¹	MRL/RL ² (ng/l or µg/l) ¹	Reference(s)
Airport Industrial Park 1 (NCPW-AIPW1- 11032021)	11/3/21	PCE	7.5	1.0	30, pp. 426, 3172; 33, 223- 232, 261
Airport Industrial Park 2 (52445 Well 2 for PFOS; 9042776-01 for CVOCs)	10/29/19	PFOS	90	2	31, pp. 5, 7
	4/25/19	PCE	20.7	0.5	31, pp. 19, 21, 22, 23
		TCE	1.1	0.5	31, pp. 19, 21, 22, 23
Jefferson Farms 2R (NCPW-JF2R- 11032021)	11/3/21	PFOS	203	1.88	30, pp. 1590, 3184; 33, pp. 176-184, 215
Wilmington Manor 3 (00552/10041 Well 3 for PFOS. 0034348-03 for CVOCs)	4/16/20	PFOS	1,700	2	31, pp. 158, 160
	4/3/20	PCE	2.2	0.5	31, pp. 150, 152, 153
Basin Road (NCPW-BASIN- 11022021)	11/2/21	PFOS	3,240	32.3	30, pp. 1413, 3183; 33, pp. 176-184, 204
		PFOA	269	1.62	30, pp. 1396, 3183; 33, pp. 176-184, 203

Notes:¹Units for PFOS and PFOA are ng/l and for VOCs are µg/l.²MRLs are associated with the PFOS and PFOA data and RLs are associated with the VOC data.

Data was validated in accordance with EPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Superfund Methods Data Review, OLEM 9240.0-51, EPA-540-R-20-005, November 2020 (Ref. 33, p. 223).

Qualified data were used in accordance with EPA's fact sheet "Using Qualified Data to Document an Observed Release and Observed Contamination". No adjustment factor for J qualified data was needed or used (Ref. 37, pp. 4, 8).

MRL = Minimum reporting limit. The minimum concentration that can be reported as a quantitated value for a method analyte in a sample following analysis. This defined concentration can be no lower than the concentration of the lowest calibration standard for that analyte and can only be used if acceptable QC criteria for this standard are met (Ref. 38, p. 6). In accordance with EPA Method 537, laboratories are required to demonstrate they can meet the MRL (Refs. 31, pp. 4, 157; 38, pp. 3, 18, 19).

RL = Reporting limit – The concentrations of a compound below which results are reported as nondetect or less than in this Suburban laboratories analysis (Ref. 91, p. 1). In the Eurofins laboratories analyses, reporting limits are the minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence (Refs. 32, p. 24; 34, p. 2). The samples were analyzed by a non-CLP laboratory. The MRLs and RLs presented above are most equivalent to the SQL as defined by HRS Section 1.1 (Ref. 1, Sections 1.1 and 2.3). However, it cannot be documented with available information whether the above noted MRLs and RLs are sample-specific.

µg/l = micrograms per liter

ng/l = nanograms per liter

PCE = tetrachloroethylene

TCE = trichloroethylene

PFOS = Perfluorooctanesulfonic acid

PFOA = Perfluorooctanoic acid

CLP=Contract Laboratory Program

ID = Identifier

QC = Quality criteria

SQL = Sample Quantitation Limit

VOC = Volatile organic compound

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TABLE 21 BACKGROUND DEEP PUBLIC WELL CONCENTRATIONS					
Well ID (Sample ID)	Sample Date	Hazardous Substance	Concentration (ng/l or µg/l) ¹	MRL (ng/l)	Reference(s)
Llangollen Well 6R (3838226)	12/12/17	PFOS	5	2	31, pp. 104, 106
		PFOA	33	2	31, pp. 104, 106
Llangollen Well 2 (4147747)	12/10/18	PFOS	4.4	2	31, pp. 87, 89
		PFOA	24	2	31, pp. 87, 89
Llangollen Well 7 (4104888)	10/29/18	PFOS	6.3	2	31, pp. 110, 112
		PFOA	40	2	31, pp. 110, 112
Wilmington Airport 3R (4427334)	9/18/19	PFOS	< 2	2	31, pp. 170, 172
		PFOA	5.9	2	31, pp. 170, 172
Llangollen Well G3R (4147746)	12/10/18	PFOS	17	2	31, pp. 87, 89
		PFOA	79	2	31, pp. 87, 89
Wilmington Airport 1 (4427332)	9/18/19	PFOS	< 2	2	31, pp. 169, 172
		PFOA	< 2	2	31, pp. 169, 172

Notes:

MRL = Minimum reporting limit - The minimum concentration that can be reported as a quantitated value for a method analyte in a sample following analysis. This defined concentration can be no lower than the concentration of the lowest calibration standard for that analyte and can only be used if acceptable QC criteria for this standard are met (Ref. 38, p. 6). In accordance with EPA Method 537, laboratories are required to demonstrate they can meet the MRL (Refs. 31, pp. 86, 103, 109, 168, 169; 38, pp. 3, 18, 19).

The samples were analyzed by a non-CLP laboratory. RLs presented above are most equivalent to the SQL as defined by HRS Section 1.1 (Ref. 1, Sections 1.1 and 2.3). However, it cannot be documented with available information whether the above noted MRLs and RLs are sample-specific.

< = less than

µg/l = micrograms per liter

ng/l = nanograms per liter

PFOS = Perfluorooctanesulfonic acid

PFOA = Perfluorooctanoic acid

CLP=Contract Laboratory Program

ID = Identifier

QC = Quality criteria

SQL = Sample Quantitation Limit

VOC = Volatile organic compound

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TABLE 23 OBSERVED RELEASE DEEP PUBLIC WELL CONCENTRATIONS					
Sample ID	Sample Date	Hazardous Substance	Concentration (ng/ or µg/l) ¹	MRL/RL/ LOQ (ng/l)	Reference(s)
Jefferson Farm 1R (3044531)	6/18/14	PFOS	200	40 ¹	31, pp. 175, 177

TABLE 23 OBSERVED RELEASE DEEP PUBLIC WELL CONCENTRATIONS					
Sample ID	Sample Date	Hazardous Substance	Concentration (ng/ or µg/l) ¹	MRL/RL/LOQ (ng/l)	Reference(s)
Frenchtown Road (GW 9975950)	1/28/19	PFOS	520	18 ²	32, pp. 11, 15
Schoolhouse Lane (NCPW-SCHOOL-11022021 DL)	11/2/21	PFOS	878	8.49 ³	30, pp. 1369, 3183; 33, pp. 176-184, 201
Crossroads	1/28/19	PFOS	680	17 ²	32, pp. 10, 15
		PFOA	290	87 ²	32, pp. 10, 15

Notes:¹ Indicates the value is an MRL.² Indicates the value is a limit of quantitation.³ Indicates the value is an RL.

The samples were analyzed by a non-CLP laboratory. The MRLs, LOQs, and RLs presented above are most equivalent to the SQL as defined by HRS Section 1.1 (Ref. 1, Sections 1.1 and 2.3). However, it cannot be documented with available information whether the above noted MRLs, LOQs, and RLs are sample-specific (Ref. 1, Sections 1.1 and 2.3).

LOQ = Limit(s) of quantitation Reporting Limit: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence (Ref. 34, p.2).

MRL = Minimum reporting limit - The minimum concentration that can be reported as a quantitated value for a method analyte in a sample following analysis. This defined concentration can be no lower than the concentration of the lowest calibration standard for that analyte and can only be used if acceptable QC criteria for this standard are met (Ref. 38, p. 6). In accordance with EPA Method 537, laboratories are required to demonstrate they can meet the MRL (Refs. 31, p. 174; 38, pp. 3, 18, 19).

RL = Reporting limit. The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence (Refs. 32, p. 24; 34, p. 2).

µg/l = micrograms per liter

ng/l = nanograms per liter

CLP=Contract Laboratory Program

ID = Identifier

PFOS = Perfluorooctanesulfonic acid

PFOA = Perfluorooctanoic acid

QC = Quality criteria

SQL = Sample Quantitation Limit

VOC = Volatile organic compound

The HRS evaluation of the Site properly documented an observed release by chemical analysis of PFOA, PFOS, TCE, PCE, cis-1,2-DCE, 1,2-DCA, and trans-1,2-DCE in monitoring wells and public supply wells. Concentrations from monitoring wells and public supply wells were documented to be significantly above the substance-specific, well type specific, and well depth specific background levels and meet the criteria in HRS Section 2.3. The HRS evaluation documented a substance-specific, well type-specific, and depth specific background level for each hazardous substance. Tables 5, 7, 9, 11, 13, and 15 of the HRS documentation record at proposal, quoted above, show that analytical results for release samples collected from monitoring wells were compared to background samples from monitoring wells collected from similar depths (i.e., shallow, intermediate, or deep depth ranges). The data in these tables document that for each monitoring well depth range, an observed release was established based on comparison of analytical results for PFOA, PFOS, trans-1,2-DCE, cis-1,2-DCE, 1,2-DCA, TCE, and PCE consistent with the criteria for analytical significance as outlined in HRS Table 2-3. Similarly, Tables 17, 19, 21, and 23 of the HRS documentation record at proposal quoted above, indicate that analytical results for release samples collected from public supply wells were compared to analytical results from background samples from public supply wells collected from similar depths (i.e., intermediate or deep depth ranges). The data in these tables document that for each public supply well depth range, an observed release was documented based on comparison of analytical results for PFOA, PFOS, TCE, and PCE consistent with the criteria for analytical significance as outlined in HRS Table 2-3. Separate attribution was not required to establish an observed release by chemical analysis per HRS Section 3.1.1, quoted above, because the Site was scored as a

groundwater plume with no identified source. Thus, the HRS evaluation appropriately documented an observed release by chemical analysis consistent with the criteria in HRS Sections 2.3 and 3.1.1 by establishing that concentrations of PFOA, PFOS, trans-1,2-DCE, cis-1,2-DCE, 1,2-DCA, TCE, and PCE were significantly above the applicable background levels.

Additional specific comments on documenting the aspects of the observed release are discussed in the following subsections:

- 3.8.1 Background Levels
- 3.8.2 Groundwater Sampling and Analysis
- 3.8.3 Analytical Significance
- 3.8.4 Attribution

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

3.8.1 Background Levels

Comment: New Castle County asserted that it is unclear whether background groundwater conditions were adequately represented by the locations of the wells used to establish background conditions at the Site in the HRS documentation record at proposal. New Castle County commented that the complex groundwater flow in the vicinity of the Site makes it difficult to determine the appropriate background concentrations for groundwater in the Site area.

In discussing the impact of site-specific geology on background levels, New Castle County asserted that insufficient information about the geology at the Site was presented in the HRS documentation record at proposal to determine whether the monitoring wells selected to represent background concentrations are appropriate. New Castle County commented that groundwater elevations, concentration contours, and detailed information on groundwater flow were not provided to support the selection of monitoring wells used to represent background levels, noting that the absence of this information impacted the ability to assess the background well selection. It also stated that a groundwater divide and localized mounding may be present in the vicinity of the Site making the selection of background wells difficult. New Castle County asserted that surface water bodies such as Army Creek may separate some of the background wells from the Site and could possibly act as a barrier to groundwater migration.

Response: The locations of wells used to collect background samples were appropriate for establishing background levels for HRS scoring purposes. As explained above in section 3.8, Observed Release, of this support document, the observed release evaluation was established consistently with the criteria in HRS Sections 2.3 and 3.1.1. The background samples used to establish background levels were collected from similar portions of the aquifer and from wells with sufficiently similar well characteristics to document that the significant increase in contamination is due to a release from the Site and not from differences in sample characteristics.

The HRS does not identify requirements for establishing background levels. The observed release by chemical analysis requirements in the HRS present the discussion of background concentrations only in the context of identifying an observed release.

HRS Section 3.1.1, *Observed release*, explains how to establish an observed release to an aquifer:

Establish an observed release to an aquifer by demonstrating that the site has released a hazardous substance to the aquifer. Base this demonstration on either:

- ...
- **Chemical analysis-an analysis of ground water samples from the aquifer indicates that the concentration of hazardous substance(s) has increased significantly above the background**

concentration for the site (see section 2.3). Some portion of the significant increase must be attributable to the site to establish the observed release, except: when the source itself consists of a ground water plume with no identified source, no separate attribution is required. [emphasis added]

HRS Section 3.1.1 refers a scorer to HRS Section 2.3. HRS Section 2.3, *Likelihood of release*, quoted above in full, states in relevant part:

The minimum standard to establish an observed release by chemical analysis is analytical **evidence of a hazardous substance in the media significantly above the background level**. Further, some portion of the release must be attributable to the site. Use the criteria in Table 2-3 as the standard for determining analytical significance. [emphasis added]

The background well selection discussion on page 30 of the HRS documentation record at proposal states:

Wells chosen to document background conditions are wells located on the farthest edges of the plume and show that groundwater samples collected to document an observed release are greater than three times (or more) the concentrations detected in the background sample locations. Therefore, the observed release wells delineate an area of significant increase. For background similarity, and to meet the criteria for establishing an observed release, wells are separated into five categories, as described below. This ensures that background wells are screened within the same relative depth within the Columbia/Potomac Aquifer and have similar construction as the contaminated wells with which they are being compared:

- Shallow monitoring wells are screened at depths ranging from 50.84 to 10.97 feet elevation (**Tables 4 and 6**)
- Intermediate monitoring wells are screened at depths from 5.2 feet msl to -23.38 feet elevation (**Tables 8 and 10**)
- Deep monitoring wells are screened at depths ranging from -45.34 to -87.91 feet elevation (**Tables 12 and 14**)
- Public supply wells are only compared with other public supply wells, due to longer screen lengths and larger casing diameters than the monitoring wells; however, to ensure similar screened intervals within the aquifer, public supply wells are evaluated as:
 - Intermediate public supply wells, screened at depths from ranging from -15 to -69.75 feet elevation (**Tables 16 and 18**)
 - Deep public supply wells, screened at depths ranging from -50.5 to -141.2 feet elevation (**Tables 20 and 22**)

Tables 5, 9, 13, 17, and 21 of the HRS documentation record at proposal on pages 31, 35, 39, 41, and 45 quoted above in section 3.8, Observed Release, present the background sample concentrations for each well type. Figure 2 in Reference 5 of the HRS documentation record at proposal presents the location of background and release wells.

The HRS scoring identified background levels for PFOA, PFOS, trans-1,2-DCE, cis-1,2-DCE, 1,2-DCA, TCE and/or PCE based on well type and well depth range, as explained on page 30 of the HRS documentation record at proposal. The substance-specific, well type specific, and well depth specific background levels were used for comparison against analytical results from similar samples to establish an observed release by chemical analysis as indicated on page 30 of the HRS documentation record at proposal, quoted above.

Regarding New Castle County's comments asserting that the appropriateness of the background well locations is unclear, the background well locations were appropriate for establishing a background level for HRS scoring purposes. As discussed above, the HRS does not include specific requirements or instructions for the selection of appropriate background sample locations. And, a separate background level was determined for each substance depending on the specific well type and depth. Page 30 of the HRS documentation record at proposal explains that "[w]ells chosen to document background conditions are wells located on the farthest edges of the plume." For the public supply wells, the background intermediate depth public wells and the background deep depth public wells are located north and south of the plume. For background intermediate depth public wells, the Collins Park well is located north to northeast of the groundwater plume, and Midvale 1R and Midvale 2R are located south to southwest of the groundwater plume. For the background deep depth public wells, the two Wilmington Airport wells are located north to northwest of the plume, and the four Llangollen wells are located south to southeast of the groundwater plume. Hence, the wells used to establish background levels for the public supply wells are located both north and south of the plume and represent conditions from more than one location to identify concentrations outside of the influence of the plume. These wells establish that groundwater contamination significantly above the background level is present between the locations of these wells, and the background samples collected from these wells were sufficiently similar to the observed release wells to document background levels for HRS scoring purposes.

Regarding the groundwater flow direction, the HRS documentation record at proposal on page 25 acknowledges that the groundwater direction varies in the vicinity of the plume and can be influenced by the pumping of wells in the area. Background levels were determined for each well type and well depth range, and were collected from multiple locations surrounding the groundwater plume. The HRS requires a background level be established, but it does not provide specific requirements for establishing this background. As contamination significantly above the background level for public wells are determined using multiple samples from various locations surrounding the plume, the HRS scoring of the Site documented that a significant increase is present based on a comparison of similar sample types.

Regarding comments concerning local surface water bodies acting as possible barriers to groundwater flow and being located between background wells and the groundwater plume, as discussed in section 3.7, Aquifer Interconnection and Groundwater Flow, of this support document, there were no HRS qualifying discontinuities within the 4-mile TDL (nor between the background and release wells that would constitute an aquifer discontinuity). Therefore, the background and release wells are located in the same aquifer and all background well locations are appropriately selected as background locations.

Regarding comments on the possible groundwater divide at the site, although page 25 of the HRS documentation record at proposal acknowledges a groundwater divide in the *shallow* aquifer in the vicinity of the New Castle County Airport and a groundwater mound in the DANG facility located in the northeast portion of the airport, these features do not qualify as an HRS discontinuity, and they do not inhibit flow in the interconnected aquifer beneath the Site. Even if an aquifer divide were considered at the Site, observed release samples in shallow monitoring wells documented on the east, west, and north sides of the New Castle County Airport; observed release samples in intermediate depth monitoring wells north and east of the airport; and observed release samples in deep monitoring wells south of the airport would document observed releases on both sides of the possible shallow divide (see page 25 of the HRS documentation record at proposal; Figure 2 in Reference 5 of the HRS documentation record at proposal; pages 55 and 77 of Reference 7 of the HRS documentation record at proposal; and pages 8, 16, 30, 31, and 47 of Reference 8 of the HRS documentation record at proposal).

Finally, inasmuch as these comments are expressing concern for liability of the contamination at the Site, liability is not assessed at the listing stage of the Superfund process, and liability is not considered in determining whether NPL placement of a site is warranted.

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

3.8.2 Groundwater Sampling and Analysis

Comment: New Castle County challenged the groundwater sampling and data used in the HRS evaluation of the Site. New Castle County asserted that the sampling and data collection methods used for some of the samples may not result in an accurate assessment of the groundwater. It stated that several samples for which PFAS concentrations were presented “were analyzed using Method 537 instead of an approved methodology for groundwater analysis.” It also commented that as a result of varying “well developing/purging and sample filtration,” the turbidity of samples is inconsistent and the higher turbidity samples are associated with the higher PFAS concentrations. New Castle County asserted that the high turbidity could indicate that the PFAS concentrations used for HRS scoring purposes are potentially inaccurate due to possible sampling inconsistencies.

Response: The samples used to establish an observed release were properly collected and analyzed for the purpose of evaluating an observed release by chemical analysis for HRS scoring.

HRS Sections 2.3 and 3.1.1, quoted above in section 3.8, Observed Release, of this support document, present the requirements for documenting an observed release by chemical analysis. The HRS does not include specific requirements for a particular method for analysis of samples. The HRS does not include any specific instructions for sampling, but instructions in HRS Section 3.1.1 state to use “ground water samples from the aquifer” in establishing an observed release by chemical analysis in the ground water migration pathway.

In describing the analysis completed, page 29 of the HRS documentation record at proposal states, “[s]amples were analyzed for VOCs by EPA Method SW846 8260 and for PFAS by modified version of EPA Method 537 (for monitoring well samples), and by EPA Method 537.1 (for drinking water samples) (Refs. 7, p. 35; 9, p. 31).”

Page 29 of the HRS documentation record at proposal discusses the collection of groundwater samples and states:

Groundwater samples from monitoring wells were collected by EA, under contract with DNREC, as part of the SI in 2017, 2018, and 2020 (Ref. 7, pp. 28, 33, 232, 351-364). EA, under contract with DNREC, collected additional groundwater samples from monitoring wells and four public supply wells in 2021 as part of the ESI (Ref. 9, pp. 28, 29, 154-158, 182-190). Sample collection included the collection of quality assurance (QA) and quality control (QC) samples which consisted of field duplicates, matrix spike (MS)/matrix spike duplicates (MSDs), field blanks, rinsate blanks, and trip blanks (Refs. 7, p. 35; 9, p. 29)....

Water samples were collected from the public supply wells by the respective public supply facilities, Artesian, and NCMSC for PFAS and VOCs by EPA Methods 537 (and 537.1) and 524.2, respectively, (Refs. 31, p. 1; 32, p. 1).

Page 11 of Reference 7 of the HRS documentation record at proposal, the 2021 SI, states:

SI activities included the installation of monitoring wells and the collection of groundwater, surface water, soil, and sediment samples. This SI Report has been prepared to provide a summary of the SI activities, which were performed in accordance with the SI Work Plan (DNREC 2017), and the subsequent 2020 Sampling and Analysis Plan (SAP) (EA 2020).

Pages 28 and 29 of Reference 7 of the HRS documentation record at proposal state:

On 8 and 9 August 2017, groundwater samples were collected from monitoring wells Area08-MW01, Area08-MW02, Area08-MW03, Area11-MW06, Area13-MW12, and Area13-MW14. On 17 and 19 September 2018, groundwater samples were collected from monitoring wells Area09-MW04, Area09-MW05, Area13-MW13, and Area14-MW16....

The groundwater samples were collected using a disposable high-density polyethylene (HDPE) bailer. Groundwater samples were collected when at least three well volumes were removed and/or the water quality parameters, as measured by a portable water quality meter, were stable over three consecutive readings.... Stabilization was defined as:...

- ± 10 percent for turbidity, with a goal of 10 nephelometric turbidity units.

During the 2017 groundwater sampling event, turbidity was not measured while purging prior to groundwater sample collection. However, DNREC-RS staff attempted to purge the wells until the groundwater was visibly clear, to the extent possible. Turbidity was measured during the 2018 groundwater sampling event.

Following stabilization of water quality parameters, groundwater collected directly from the bailers was placed into laboratory supplied bottle ware. The purge water was drummed and disposed of in accordance with the SI Work Plan (DNREC 2017). Precautions were taken to prevent introduction of PFAS to the groundwater samples from sampling equipment and other common consumer products as outlined in the SI Work Plan (DNREC 2017).

Page 33 of Reference 7 of the HRS documentation record at proposal states:

On 17 August 2020, groundwater samples were collected from monitoring wells NCPW-MW18, NCPW-MW19S, NCPW-MW20S, and NCPW-MW21....

The groundwater samples were collected using a low-flow purging and sampling methodology via dedicated HDPE tubing and a PFAS-free bladder pump. The bladder pump was decontaminated in accordance with the SAP (EA 2020) prior to and between sample collection. During purging, the groundwater discharged from the pump was passed through a portable water quality meter flow-through cell to facilitate the monitoring of groundwater field parameters at 5-minute intervals.

Groundwater samples were collected when the water quality parameters were stable over three consecutive readings. The water quality data for each groundwater sample are presented on the monitoring well purge logs included in Appendix F. Stabilization was defined as:

...

- ± 10 percent for turbidity, with a goal of 10 nephelometric turbidity units.

Pages 351-364 of Reference 7 of the HRS documentation record at proposal present the well purging and sampling records for wells sampled during the SI. Pages 357-364 include limited turbidity measurements for monitoring well samples collected between 2017 and 2020 from the following monitoring wells: MW-4, Area09-GW-05, MW-13, Area 14-MW16, NCPW-MW18, NCPW-MW19S, NCPW-MW20S, and NCPW-MW21.

Page 13 of Reference 9 of the HRS documentation record at proposal, the 2022 ESI, states:

ESI activities included the installation of monitoring wells and the collection of groundwater and public supply well water samples. This ESI Report has been prepared to provide a summary of the ESI activities, which were performed in accordance with the 2020 Sampling and Analysis Plan (SAP) (EA 2020) and the subsequent 2021 SAP Addendum (EA 2021b).

Pages 28 and 29 of Reference 9 of the HRS documentation record at proposal state:

On 1-3 November 2021, groundwater samples were collected from monitoring wells Area08-MW02, Area09-MW04, Area13-MW12, Area13-MW14, NCPW-MW18, NCPW-MW20S, NCPW-MW22, NCPW-MW23, and NCPW-MW24. Prior to sampling each monitoring well, EA

field-screened the headspace within the monitoring well with a PID. The PID headspace readings are included in Table 1 and concentrations ranged from 0.0 to 1.2 parts per million.

The groundwater samples were collected using a low-flow purging and sampling methodology via dedicated high-density polyethylene (HDPE) tubing and a PFAS-free bladder pump. The bladder pump was decontaminated in accordance with the SAP Addendum (EA 2021b) prior to and between sample collection. During purging, the groundwater discharged from the pump was passed through a portable water quality meter flow-through cell to facilitate the monitoring of groundwater field parameters at 5-minute intervals.

The groundwater samples from monitoring wells Area08-MW02 and Area09-MW04 were collected using a low-flow purging and sampling methodology via dedicated HDPE tubing and a peristaltic pump due to the narrow diameter of the monitoring wells. When the groundwater depth was deeper than that of which a peristaltic pump could operate in narrow-diameter monitoring wells (Area13-MW12 and Area13-MW14), groundwater was purged and collected using a disposable HDPE bailer. ...

Groundwater samples were collected when at least three well volumes were removed and/or the water quality parameters, as measured by a portable water quality meter, were stable over three consecutive readings. The water quality data for each groundwater sample are presented on the monitoring well purge logs included in Appendix E. Stabilization was defined as: ...

- ± 10 percent for turbidity, with a goal of 10 nephelometric turbidity units.

....

On 2-3 November 2021, raw water samples were collected from designated sample ports at select Artesian (Airport Industrial Park Well 1 and Jefferson Farms Well #2R) and City of New Castle Municipal Services Commission (School Lane Well and Basin Road Well) public supply wells. Additionally, a finished water sample was collected from the City of New Castle Municipal Services Commission's School Lane Water Treatment Facility. Prior to sampling, each sample port was opened and allowed to flush for at least 5 minutes, when possible. The public supply well samples were collected while the water was flowing, taking care not to flush out any preservatives in the laboratory supplied bottle ware.

Pages 156 and 158 of Reference 9 of the HRS documentation record at proposal present field sampling notes for the four public supply well samples collected during the ESI. Pages 182-190 of Reference 9 present available well purging and sampling records for samples collected in 2021. Limited turbidity data are presented for monitoring well samples from Area08-MW02, Area09-MW04, Area 13-MW12, Area 13-MW14, NCPW-MW18, NCPW-MW20S, NCPW-MW22, NCPW-MW23, and NCPW-MW24.

Sample Analysis

Samples used to evaluate the observed release were analyzed appropriately for HRS scoring purposes. The HRS requirements for establishing an observed release by chemical analysis are quoted above in section 3.8, Observed Release, of this support document. The HRS does not specify methods for use in determining results for HRS scoring. Page 29 of the HRS documentation record at proposal, quoted above, explains that a modified version of EPA Method 537 was used for PFAS analysis of monitoring well samples, EPA Method 537.1 was used for drinking water samples, and EPA Method SW846 8260 was used for VOCs. These are common EPA methods for the analysis of these substances in waters. Additionally, the commenter did not point to specific reasons these methods would be inappropriate for use, or would indicate that the analytical results are inaccurate. Finally, if it is the commenter's intent to question these methods based on their approval for regulatory reporting, there is no HRS requirement that analytical methods used in generating data used for HRS scoring purposes be methods that are specified/approved for regulatory reporting purposes.

Sampling Procedures

Regarding sampling procedures, such as filtration, the monitoring well samples were collected with similar sampling and handling procedures (such as well purging and water quality parameters stabilization prior to sample collection) as explained on pages 11, 28, 29, and 33 of Reference 7 and pages 13, 28 and 29 of Reference 9 of the HRS documentation record at proposal, quoted above. Reference 7 of the HRS documentation record at proposal, the SI report, quoted above, states that the 2020 Sampling and Analysis plan was followed in collecting samples. Similarly, Reference 9 of the HRS documentation record at proposal, the ESI report, quoted above, states that the 2020 Sampling and Analysis Plan and the Sampling and Analysis Plan Addendum were followed during field activities, including sampling. The use of similar sampling and handling procedures for monitoring well samples suggests that these samples are sufficiently similar for comparison of analytical results for HRS scoring purposes.

Regarding the collection of public supply well samples, page 29 of the HRS documentation record at proposal notes that some of the public supply wells were sampled by the respective public supply facilities, and page 29 of Reference 9 of the HRS documentation record at proposal notes that the Airport Industrial Park Well 1, Jefferson Farms Well #2R, School Lane Well, and Basin Road Well were sampled as part of the ESI. Page 29 of Reference 9 of the HRS documentation record at proposal, quoted above, explains that for the four public supply wells sampled during the ESI “raw water samples were collected from designated sample ports” and that “[p]rior to sampling, each sample port was opened and allowed to flush for at least 5 minutes, when possible.” Reference 9 of the HRS documentation record at proposal, the ESI report, quoted above, states that the 2020 Sampling and Analysis Plan and the Sampling and Analysis Plan Addendum were followed during field activities, including sampling. Hence, the four public supply samples collected during the ESI were collected using similar sampling procedures when possible. Further, the EPA notes that all of the public supply wells sampled and included in the HRS scoring are active supply wells and are continuously flushed while in use.

Additionally, the Sampling and Analysis Plan, the Sampling and Analysis Plan Addendum, and the SI Work Plan referred to in the SI, Reference 7 of the HRS documentation record at proposal, and the ESI, Reference 9 of the HRS documentation record at proposal, include additional information regarding sampling recommendations. The Standard Operating Procedure No. 073 for Sampling for Per- and Polyfluorinated Alkyl Substances included as Appendix C of the Sampling and Analysis Plan for the Site Inspection⁹ states on page 168 that for groundwater sampling “[f]iltration is not recommended because the filter may sorb PFAS or be a source of PFAS” contamination. Similarly, the Standard Operating Procedure No. 073 for Sampling for Per- and Polyfluorinated Alkyl Substances included as Appendix C of the Sampling and Analysis Plan Addendum for the Expanded Site Inspection¹⁰ states on page 165 that for groundwater sampling “[f]iltration is not recommended because the filter may sorb PFAS or be a source of PFAS.” Thus, accompanying Sampling and Analysis plans for the SI and ESI sampling events did not recommend the use of filtration. Further, the EPA has concluded that the samples in question are appropriate for use in evaluating this site. Because commenter has failed to provide specific information to the contrary, the EPA considers unfiltered sample results to be acceptable. The 2020 Sampling and Analysis Plan (SAP) (EA 2020), the 2021 SAP Addendum (EA 2021), and the SI Work Plan¹¹ (DNREC 2017) mentioned in References 7 and 9 of the HRS documentation record were not included as references in the HRS documentation record at proposal, but excerpted versions are included as Attachments 1, 2, and 3 to the support document.

⁹ Attachment 1 to this support document is an excerpt from the EA Engineering, Science, and Technology, Inc., *Sampling and Analysis Plan Site, Inspection New Castle Public Wells Groundwater Plume Site (aka 0 East Basin Road New Castle PFOS-PFOA Site) DE-0363 New Castle, Delaware*, June 2020.

¹⁰ Attachment 2 to this support document is an excerpt from the EA Engineering, Science, and Technology, Inc., *Sampling and Analysis Plan Addendum Expanded Site Inspection New Castle Public Wells Groundwater Plume Site (DE-0363) New Castle, Delaware*, August 2021.

¹¹ Attachment 3 to this support document is an excerpt from the DNREC, *New Castle Public Wells Groundwater Plume (aka Zero (0) E. Basin Road New Castle PFOA-PFOA) Site Inspection Work Plan, New Castle, Delaware*, May 2017.

Sample Turbidity

Regarding comments that turbidity levels may vary between samples and that higher turbidity is associated with higher concentrations of PFAS, the commenter did not specify to which results it is referring. The information provided by the commenter did not indicate the samples and data used to establish the commenter's assertion of a correlation between turbidity in samples and PFAS concentrations. As for the available data, turbidity was not recorded for all samples. Where recorded, the turbidity data vary between the available samples from monitoring wells, and, overall, insufficient data are available to determine a clear pattern. (See pages 29 and 357-364 of Reference 7, and pages 182-190 of Reference 9 of the HRS documentation record at proposal.) Only limited turbidity data for monitoring well samples are available; turbidity data are available for only 10 out of 14 monitoring well samples used to document release concentrations and are available for three background monitoring well samples used to document background concentrations. Final field measurements of turbidity data for background shallow monitoring wells, background intermediate monitoring well, and background deep monitoring well samples are >1000 nephelometric turbidity unit (NTU)¹², 131 NTU, and 3.4 NTU, respectively, as indicated on pages 186, 188, and 190 of Reference 9 of the HRS documentation record at proposal. Available final field turbidity data for release monitoring wells are as follows:

- Shallow release monitoring well samples range from 181.7 NTU to >1000 NTU.
- Intermediate release monitoring well samples range from 36.8 NTU to 518 NTU.
- Deep release monitoring well sample is 5.93 NTU.

(See pages 357-364 of Reference 7 and pages 182-190 of Reference 9 of the HRS documentation record at proposal for limited release monitoring well sample turbidity data, and Tables 5, 7, 9, 11, 13, and 15 of the HRS documentation record at proposal, quoted above, in section 3.8, Observed Release, of this support document for monitoring well sample PFAS concentration data.)

Further, on the alleged effects of sample turbidity, although there are only limited direct turbidity measurements¹³, the EPA agrees that turbidity may be present in some groundwater release samples collected from monitoring wells. However, such particulates are likely representative of groundwater conditions at the Site, and hazardous substances associated with that turbidity would represent a release from the Site (as there is no indication particulate was incorrectly introduced in groundwater samples by sampling techniques).

If the commenter is specifically discussing results used to establish an observed release, then it does not appear that turbidity affected the identification of a significant increase in PFOA and PFOS concentrations in release samples relative to background samples. Where turbidity and PFOA/PFOS concentrations were available, no correlation could be made to conclude that higher turbidity resulted in higher PFOA/PFOS concentrations. As explained above, samples from similar well types and well depth ranges were used for comparison to help ensure that samples were sufficiently similar for comparison, and field activities for the SI and ESI were conducted in accordance with the relevant sampling and analysis plans. PFOA was detected in the background samples from shallow and intermediate monitoring wells, as indicated in Tables 5 and 9 of the HRS documentation record at proposal, and PFOS was detected in the background deep monitoring well sample as indicated in Table 13 of the HRS documentation record at proposal.

Also, hazardous substances other than PFOA and PFOS (i.e., PCE, TCE, cis-1,2-DCE, 1,2-DCA, and trans-1,2-DCE) were documented to be present at concentrations meeting observed release criteria, as discussed in section 3.8, Observed Release, of this support document. The commenter has not pointed to specific reasons why the concentrations of the CVOCs scored would be inappropriate for establishing an observed release. The documentation of an observed release is discussed in section 3.8, Observed Release, of this support document.

¹² Per References 7 and 9 of the HRS documentation record at proposal, >1000 NTU reflects value recorded on well purging and sampling record sheet.

¹³ As explained above, turbidity measurements are available for some monitoring wells on pages 357-364 of Reference 7 and pages 182-190 of Reference 9 of the HRS documentation record at proposal.

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

3.8.3 Analytical Significance

Comment: New Castle County stated that in the HRS documentation record at proposal, “it is not clear whether and to what extent CVOCs may currently exceed drinking water standards in the public wells within the proposed Site and therefore whether the CVOCs [would] provide an independent basis for listing the Site on the NPL.” It asserted that only PCE concentrations exceeded CVOC drinking water standards and stated that only two public wells at the Site had PCE concentrations above drinking water standards.

In commenting on the data presented in the HRS documentation record at proposal, New Castle County stated that some of the CVOC data used for scoring in the HRS documentation record at proposal are more than a decade old. New Castle County asserted that the highest PCE concentrations were detected nearly 30 years ago in AIP #1 and more than 10 years ago in AIP #2.

Response: The HRS documentation record at proposal appropriately evaluated the concentrations of hazardous substances in groundwater consistent with the criteria for an observed release by chemical analysis presented in HRS Section 2.3. Consistent with the HRS and as explained in section 3.4, Regulatory Limits and Screening Levels, of this support document, there is no requirement for releases or benchmark exceedances to be ongoing. The Site was scored based both on the PFAS substances and CVOCs in the observed release and not based solely on CVOCs. While PFAS are not designated CERCLA hazardous substances, they are scored as CERCLA pollutant and contaminants. Although regulatory standards such as MCLs may be used for HRS purposes, they are not needed to evaluate an observed release; see section 3.5, Evaluation and Future Remediation of Hazardous Substances, Pollutants and Contaminants, of this support document for a discussion. As explained in section 3.9, Level I Contamination, of this support document, PFOA and PFOS were established to be at Level I concentrations by comparison to the non-cancer screening concentrations for these substances, per HRS Table 3-10, *Health-Based Benchmarks for Hazardous Substances in Drinking Water*.

In discussing analytical significance, HRS Section 3.1.1, *Observed Release*, quoted above, states

- Chemical analysis—**an analysis of ground water samples from the aquifer indicates that the concentration of hazardous substance(s) has increased significantly above the background concentration for the site** (see section 2.3). [emphasis added]

The observed release criteria are explained in HRS Section 2.3, *Likelihood of release*, and HRS Table 2-3. HRS Table 2-3 explains:

TABLE 2-3—OBSERVED RELEASE CRITERIA FOR CHEMICAL ANALYSIS

Sample Measurement < Sample Quantitation Limit^a

No observed release is established.

Sample Measurement ≥ Sample Quantitation Limit^a

An observed release is established as follows:

- If the background concentration is not detected (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds the sample quantitation limit.^a
- If the background concentration equals or exceeds the detection limit, an observed release is established when the sample measurement is 3 times or more above the background concentration.

^aIf the sample quantitation limit (SQL) cannot be established, determine if there is an observed release as follows:

- If the sample analysis was performed under the EPA Contract Laboratory Program, use the EPA contract-required quantitation limit (CRQL) in place of the SQL.
- If the sample analysis is not performed under the EPA Contract Laboratory Program, use the detection limit (DL) in place of the SQL.

Tables 5, 7, 9, 11, 13, 15, 17, 19, 21, and 23 of the HRS documentation record at proposal are quoted above in section 3.8, Observed Release, of this support document. These tables present analytical results from monitoring and public supply well samples that meet observed release criteria.

As explained above in section 3.8, Observed Release, of this support document, the HRS evaluation of the Site properly documented the analytical significance component of observed release by chemical analysis criteria for samples from monitoring wells and public supply wells. To establish analytical significance, concentrations of PFOA, PFOS, TCE, PCE, cis-1,2-DCE, 1,2-DCA, and trans-1,2-DCE from monitoring well samples and public supply well samples were documented to be significantly above the substance-specific, well type specific, and well depth specific background level and met the criteria for analytical significance outlined in HRS Table 2-3. Tables 5, 7, 9, 11, 13, 15, 17, 19, 21, and 23 of the HRS documentation record at proposal, quoted above, document that analytical results for release samples collected from monitoring wells were compared to background samples from monitoring wells collected from similar depths (i.e., shallow, intermediate, or deep depth ranges). The data in these tables document that for each monitoring well depth range and public supply well depth range, the analytical significance criteria of either equaling or exceeding three times the background concentration, or exceeding the sample quantitation limit when the background concentration is not detected, was met based on comparison of analytical results for PFOA, PFOS, TCE, PCE, cis-1,2-DCE, 1,2-DCA, and trans-1,2-DCE in monitoring well samples and PFOA, PFOS, TCE, and PCE in public supply well samples.

On the commenter's assertion that data greater than 10 years old were used, the data used for HRS scoring (i.e., to determine background levels and document an observed release) are less than 10 years old, including the samples from the two wells pointed to by the commenter. As quoted above in section 3.8, Observed Release, of this support document, the samples presented in Tables 5, 7, 9, 11, 13, 15, 17, 19, 21, and 23 of the HRS documentation record at proposal used to document either background levels or observed release concentrations were collected between 2017 and 2021 except for one sample. As presented in Table 23 of the HRS documentation record at proposal, one deep public supply well sample (i.e., Sample ID: Jefferson Farm 1R [3044531]) was collected in 2014. This date range includes the data from samples from Airport Industrial Park 1 and Airport Industrial Park 2 which were collected in 2021 and 2019, respectively, as presented in Table 19 of the HRS documentation record at proposal. Additional groundwater data are discussed in the HRS documentation record at proposal to provide context, background, or supporting information about the Site in the Site Summary section, the Additional Supporting Data discussion, and the Attribution section, but are not used to establish either background levels or document concentrations significantly above background levels. (See pages 12-14 and 48-55 of the HRS documentation record at proposal.) Therefore, recent analytical results, primarily from samples collection between 2017 and 2021, were used to establish background levels and document an observed release to evaluate conditions at the Site.

In addition, the concentration data from Airport Industrial Park 1 and Airport Industrial Park 2 that are greater than 10 years old pointed to by the commenter were specifically not used to establish an observed release as explained above. Page 12 of the HRS documentation record at proposal provides general background of the Site. Page 12 of the HRS documentation record at proposal discusses that the "PA provides analytical history... that show AIP Well #1 had its highest detection of PCE in 1999 at 21 µg/l and had its highest detection of TCE in 1993 at 9.4 µg/l." Page 12 of the HRS documentation record at proposal also states that "AIP Well #2 had its highest detection of PCE in 2009 at 21 µg/l and had its highest detection of TCE in 1984 at 2.7 µg/l." These data are not included in the observed release tables as discussed above. Hence, the observed release by chemical analysis used more recent concentrations to establish conditions at the Site. See Table 19 of the HRS documentation record at proposal for 2019 and 2021 data for Airport Industrial Park 1 and 2 wells.

Regarding the New Castle County's comment discussing the ability of CVOCs to support NPL listing, the Site achieved an NPL eligible HRS site score of 50.00 and scored an observed release by chemical analysis of PFOA, PFOS, trans-1,2-DCE, cis-1,2-DCE, 1,2-DCA, TCE, and PCE. The commenter has not challenged the eligibility of PFOA and/or PFOS for use in HRS scoring. PFOA and PFOS were evaluated as CERCLA pollutants and contaminants. (See Reference 88¹⁴ of the HRS documentation record at proposal.) As PFOA and PFOS are eligible for use in HRS scoring, whether PCE independently supports the HRS score has no impact on the overall listing decision or HRS scoring. However, CVOCs were detected in both monitoring and public supply well samples. As quoted above in section 3.8, Observed Release, Tables 7, 11, 13, 19, and 23 indicate that CVOCs (i.e., trans-1,2-DCE, cis-1,2-DCE, 1,2-DCA, TCE and/or PCE) were detected at concentrations meeting observed release criteria in three monitoring well samples and three public supply well samples. CVOCs, specifically TCE and/or PCE, were detected in three public supply well samples meeting observed release criteria. The three intermediate public well samples containing PCE and/or TCE at observed release levels were Airport Industrial Park 1 well, Airport Industrial Park 2 well, and Wilmington Manor 3 well. Hence, PCE and/or TCE were detected in three public supply well samples at concentrations meeting observed release criteria, and trans-1,2-DCE, cis-1,2-DCE, 1,2-DCA, TCE, and/or PCE were detected in three monitoring well samples at concentrations meeting observed release criteria. The EPA notes however that even if the EPA were to consider just the contamination of VOCs in scoring, the Site would still score sufficiently for NPL listing because PCE was detected at Level I concentrations in Airport Industrial Park wells 1 and 2, and at Level II concentrations in Wilmington Manor well 3 (see pages 1, 3, 33, 37, 43, 55 to 57, 59-62, and 64 of the HRS documentation record at proposal).

As these comments relate to concentrations exceeding health-based benchmarks, the level of contamination is discussed in detail in section 3.9, Level of Contamination, of this support document.

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

3.8.4 Attribution

Comment: New Castle County submitted comments discussing the ability to attribute contamination based on the Site-specific geology. It asserted that fluctuations in groundwater flow could affect the ability to attribute contamination to a source and also could affect the background level determination. New Castle County commented that although the HRS documentation record at proposal identifies 16 areas of potential concern that may have a connection to compounds that may have contributed to the groundwater contamination, the HRS documentation record at proposal did not present connections between these areas and the observed releases in the public wells. It added that it is possible that "different and distinct sources are contributing to contamination in the individual public wells."

Response: The HRS documentation record at proposal appropriately established the inability to reasonably attribute the significant increase in contamination evaluated in groundwater at the Site to a source or sources for HRS scoring purposes, and the Site was properly evaluated as a groundwater plume with no identified source due to the inability to attribute contamination. As the Site was scored as a groundwater plume with no identified source, separate attribution was not required. As these comments relate to the comparison of background and release samples, background and release samples are discussed in sections 3.8, Observed Release, and section 3.8.1, Background Levels. Groundwater flow is discussed in section 3.7, Aquifer Interconnection and Groundwater Flow, of this support document. Other possible sources are discussed in section 3.6, Evaluation of Other Possible Sources, of this support document.

¹⁴ Reference 88 of the HRS documentation record at proposal: EPA. 2020. Memo Regarding Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) as a CERCLA Pollutant or Contaminant from Lorie Baker, HRS Coordinator, Region 3 to East Basin Road Groundwater site Hazard Ranking System documentation record. June 20. 4 Pages

HRS Section 3.1.1, *Observed release*, in the groundwater migration pathway explains the criteria for documenting an observed release to the aquifer and has specific directions for evaluating an observed release by chemicals analysis, including when determining attribution is not applicable:

Establish an observed release to an aquifer by demonstrating that the site has released a hazardous substance to the aquifer. Base this demonstration on either:

- Direct observation-a material that contains one or more hazardous substances has been deposited into or has been observed entering the aquifer.
- Chemical analysis-an analysis of ground water samples from the aquifer indicates that the concentration of hazardous substance(s) has increased significantly above the background concentration for the site (see section 2.3). Some portion of the significant increase must be attributable to the site to establish the observed release, except: **when the source itself consists of a ground water plume with no identified source, no separate attribution is required.** [emphasis added]

Page 51 of the HRS documentation record at proposal states:

The East Basin Road Groundwater Site is a documented release of PFOA, PFOS, and CVOCs that include PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, 1,2-DCA, and vinyl chloride.^[15] Observed releases to groundwater have been established resulting in the contamination of nine active municipal wells (**Section 3.1.1 Tables 19 and 23** of this HRS documentation record). The specific source(s) causing the significant increase of the contamination at the East Basin Road Groundwater Site cannot reasonably be attributed at this time because of the presence of multiple known and possible sources of PFAS and CVOCs and the mixing of groundwater.

Separate attribution was not required for the HRS scoring of the Site because the Site was scored as a groundwater plume with no identified source in the HRS documentation record at proposal. HRS Section 3.1.1, quoted above, indicates that no separate attribution is required when scoring a groundwater plume with no identified source. The HRS scoring of the Site properly evaluated the Site as groundwater plume with no identified source, which is not challenged by the commenter, and the HRS documentation record at proposal provided support for why attribution could not be reasonably established through the evaluation of multiple possible contributors and facilities in the area, such as dry cleaners, car washes, manufacturers, and/or industrial facilities, that may have used CVOC containing substances, such as solvents, or PFAS containing materials. As explained in detail in section 3.6, Evaluation of Other Possible Sources, of this support document, pages 51-54 of the HRS documentation record at proposal explain that there are numerous facilities that may have been possible users of CVOCs or PFAS in addition to the six properties that were investigated in more detail. Page 51 of the HRS documentation record at proposal, quoted above, discussed that the mixing of groundwater also impacted the ability to attribute contamination in groundwater. As a result of the numerous potential contributors to the contamination and the complexity of the geology at the Site, the HRS documentation record at proposal properly established the inability to reasonably attribute the contamination. Due to the inability to determine the source, the HRS documentation record at proposal properly evaluated the Site consistent with the HRS, and separate attribution of the contamination was not required per HRS Section 3.1.1.

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

3.9 Level of Contamination

Comment: New Castle County submitted comments questioning the extent to which CVOCs, PFOA, and PFOS contamination exceeded drinking water screening levels. It stated that it is unclear if the groundwater

¹⁵ Vinyl chloride was not documented as an observed release substance in the monitoring and public supply wells analytical data used to score the site. The EPA notes this error has no impact on the site scoring sufficiently for NPL listing.

concentrations of CVOCs presently exceed screening levels in the public wells. New Castle County asserted that only PCE concentrations exceeded CVOC drinking water standards. It also stated that only two public wells at the Site had concentrations of PCE above drinking water standards. Regarding the PFOA and PFOS benchmarks used to evaluate targets in the HRS documentation record at proposal, New Castle County stated:

the benchmarks... for assessing PFOA and PFOS groundwater concentrations (60.2 ng/L and 40.1 ng/L, respectively, Table 26) do not match the interim updated Health Advisory levels issued by EPA in June 2022 (0.004 ng/L for PFOA, 0.02 ng/L for PFOS) nor the previous Health Advisory level issued by EPA in 2016 (70 ng/L for PFOA and PFOS combined).

Response: The HRS evaluation of the Site utilized appropriate substance specific benchmarks for PFOA, PFOS, PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and 1,2-DCA consistent with HRS Table 3-10, *Health-Based Benchmarks for Hazardous Substances in Drinking Water*. The analytical results meeting observed release criteria from public supply wells samples were appropriately compared to HRS substance-specific benchmarks to determine the level of contamination associated with the well. Eight of the public wells evaluated at the Site were found to be above the PFOA and/or PFOS cancer risk benchmark. Two of the public wells were found to be above the PCE maximum contaminant level. The EPA's Health Advisory Levels were not used as HRS drinking water benchmark concentrations as they are not listed in HRS Table 3-10.

HRS Table 3-10 presents the HRS eligible health-based benchmarks for drinking water in the ground water migration pathway and states:

TABLE 3-10 – HEALTH-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN DRINKING WATER

- Concentration corresponding to Maximum Contaminant Level (MCL).
- Concentration corresponding to a nonzero Maximum Contaminant Level Goal (MCLG).
- Screening concentration for cancer corresponding to that concentration that corresponds to the 10^{-6} individual cancer risk for oral exposures.
- Screening concentration for noncancer toxicological responses corresponding to the Reference Dose (RfD) for oral exposures.

In identifying the level of contamination, HRS Section 3.3.2.1, *Level of contamination*, in relevant part, states:

However, if one or more samples meet the criteria for an observed release for the point of withdrawal, determine which factor (Level I or Level II concentrations) applies to that point of withdrawal as specified in sections 2.5.1 and 2.5.2. Use the health-based benchmarks from table 3-10 in determining the level of contamination. Evaluate the point of withdrawal using the Level I concentrations factor in section 3.3.2.2 or the Level II concentrations factor in section 3.3.2.3, as appropriate.

HRS Section 3.3.2.1 refers to HRS Section 2.5.2, *Comparison to benchmarks*. HRS Section 2.5.2, in relevant part, states:

If the concentration of any applicable hazardous substance from any sample equals or exceeds its benchmark concentration, consider the sampling location to be subject to Level I concentrations for that pathway (or threat). If more than one benchmark applies to the hazardous substance, assign Level I if the concentration of the hazardous substance equals or exceeds the **lowest** applicable benchmark concentration. [emphasis added]

Page 59 of the HRS documentation record at proposal presents the identified benchmarks and states:

Table 26 lists the applicable benchmarks against which analytical results of the observed release samples were compared.

TABLE 26 BENCHMARKS				
Substance	MCL/MCLG (µg/l)¹	CRSC (µg/l or ng/l)²	NCRSC (µg/l or ng/l)	Reference(s)
PCE	5	37.1	120	2, p. 17
TCE	5	1.19	10	2, p. 20
Cis-1,2-DCE	70	NA	40.1	2, p. 5
Trans-1,2-DCE	100	NA	401	2, p. 8
1,2-DCA	5	0.856	120	2, p. 2
Vinyl Chloride	2	0.0214	60.2	2, p. 23
PFOS	NA	NA	40.1	2, p. 11
PFOA	NA	1,110	60.2	2, p. 14

Notes:

¹ Units are presented in µg/l for consistency with reported data.

² Units are in µg/l for VOCs and ng/l for PFAS.

µg/l = micrograms per liter

ng/l = nanograms per liter

CRSC = Cancer Risk Screening Concentration

MCL = Maximum Contaminant Level

MCLG = Maximum Contaminant Level Goal

NCRSC = Non-cancer Risk Screening Concentration

1,2-DCA = 1,2-Dichloroethane

cis-1,2-DCE = cis-1,2-dichloroethylene

PCE = Tetrachloroethylene

PFOA = Perfluorooctanoic acid (PFOA)

PFOS = Perfluorooctanesulfonic acid (PFOS)

TCE = Trichloroethylene

trans-1,2-DC = Trans-1,2-dichloroethylene

VOC = Volatile organic compound

Page 60 of the HRS documentation record at proposal states:

The following public supply wells are subject to Level I and each is assigned a population as calculated above. Per HRS Section 2.5.2, if more than one benchmark applies to a hazardous substance, Level I is assigned if the concentration of the hazardous substance equals or exceeds the lowest applicable benchmark concentration. The benchmarks listed below in **Table 27** represent the lowest applicable benchmark for PFOS, PFOA and PCE (see **Table 26** of this HRS documentation record).

TABLE 27 LEVEL I CONCENTRATIONS				
Well	Substance	Concentration (µg/l or ng/l)¹	Benchmark (µg/l or ng/l)¹	Reference(s)
Jefferson Farm 1R	PFOS	200	40.1 (NCRSC)	2, p. 11; 31, p. 175
Jefferson Farm 2R	PFOS	203	40.1 (NCRSC)	2, p. 11; 30, p. 1590
Airport Industrial Park 1	PCE	7.5	5 (MCL)	2, p. 17; 30, p. 426
	PFOS	90	40.1 (NCRSC)	2, p. 11; 31, pp. 5, 7

TABLE 27 LEVEL I CONCENTRATIONS				
Well	Substance	Concentration (µg/l or ng/l) ¹	Benchmark (µg/l or ng/l) ¹	Reference(s)
Airport Industrial Park 2	PCE	20.7	5 (MCL)	2, p. 17; 31, p. 19, 21
Wilmington Manor 3	PFOS	1,700	40.1 (NCRSC)	2, p. 11; 31, pp. 158, 160
	PFOA	180	60.2 (NCRSC)	2, p. 14; 31, pp. 158, 160
Basin Road	PFOS	3,240	40.1 (NCRSC)	2, p. 11; 30, p. 1413
	PFOA	269	60.2 (NCRSC)	2, p. 14; 30, p. 1396
Schoolhouse Lane	PFOS	878	40.1 (NCRSC)	2, p. 11; 30, p. 1369
Crossroad	PFOS	680	40.1 (NCRSC)	2, p. 11; 32, p. 10
	PFOA	290	60.2 (NCRSC)	2, p. 14; 32, p. 10
Frenchtown Road	PFOS	520	40.1 (NCRSC)	2, p. 11; 32, p. 11

Notes:

¹ Units are in µg/l for VOCs and ng/l for PFAS.

µg/l = micrograms per liter

ng/l = nanograms per liter

MCL = EPA Maximum Contaminant Level.

NCRSC = Non cancer risk screening concentration

PCE = tetrachloroethylene

PFOA = Perfluorooctanoic acid

PFOS = Perfluorooctanesulfonic acid

The HRS documentation record at proposal presented appropriate benchmarks in Table 26 and cited Reference 2 of the HRS documentation record at proposal to support the benchmarks. Page 11 of Reference 2¹⁶ of the HRS documentation record at proposal lists the non-cancer risk benchmark for PFOS as 4.01E-05 mg/L, and page 12 of Reference 2 of the HRS documentation record at proposal lists the RfD as 2.00E-06 mg/kg/day. Similarly, for PFOA, page 14 of Reference 2 of the HRS documentation record at proposal lists the non-cancer risk benchmark for PFOA as 6.02E-05 mg/L and the cancer risk benchmark as 1.11E-03 mg/L. Page 15 of Reference 2 of the HRS documentation record at proposal lists the RfD as 3.0E-06 mg/kg/day and the cancer slope factor as 7.00E-02 (mg/kg/day)⁻¹.

Consistent with HRS Table 3-10, quoted above, the HRS evaluation of the Site compared the concentrations of samples meeting observed release criteria to the lowest available benchmark for that substance which is the non-cancer screening risk benchmarks for PFOA and PFOS (i.e., 60.2 and 40.1 ng/l, respectively) and the MCL for PCE (i.e., 5 µg/l). As presented in Tables 26 and 27 of the HRS documentation record at proposal, quoted above, the HRS evaluation compared concentrations from samples meeting observed release criteria in the public supply wells to the benchmarks and determined that concentrations of at least one hazardous substance exceeded the applicable benchmark for PFOS, PFOA, and/or PCE for nine public supply wells. The HRS documentation record at proposal properly assigned the nine public supply wells Level I concentrations due to an exceedance of the PFOS, PFOA, and/or PCE benchmark.

¹⁶ Reference 2 of the HRS documentation record at proposal: EPA. Superfund Chemical Data Matrix (SCDM) Query. Last Update, January 2022. A complete copy of SCDM is available at <http://www.epa.gov/superfund/superfund-chemical-data-matrixscdm>. Accessed on July 20, 2022. 27 pages. [The SCDM Methodology report explaining the sources of the RfD and cancer slope factors as well as the calculations used to derive the cancer and non-cancer risk benchmarks is available online at: <https://semspub.epa.gov/src/document/HQ/402800>.]

Regarding New Castle County's assertion that the benchmarks presented in the HRS documentation record at proposal did not match EPA's Health Advisory Levels for these PFOA and PFOS, the HRS documentation record at proposal properly used the non-cancer risk screening concentration for PFOA and PFOS (i.e., 60.2 and 40.1 ng/l, respectively), consistently with the HRS. HRS Table 3-10, quoted above, identifies the drinking water health-based benchmarks that are eligible for use in scoring the ground water migration pathway. The eligible benchmarks in HRS Table 3-10 include the "[s]creening concentration for noncancer toxicological responses corresponding to the Reference Dose (RfD) for oral exposures," the MCL, the MCLG, and the screening concentration for cancer risk "that corresponds to the 10^{-6} individual cancer risk for oral exposures." HRS Table 3-10 does not identify EPA's Health Advisory Levels as an eligible HRS drinking water benchmark. As EPA's Health Advisory Levels are not eligible HRS drinking water benchmarks, they were not used as benchmark concentrations for PFOA and PFOS. Consistent with the eligible benchmarks listed in HRS Table 3-10, the HRS evaluation of the Site compared the concentrations of PFOA and PFOS to the substance-specific non-cancer risk screening concentration.

Regarding wells that contain CVOCs exceeding a benchmark, two public supply wells, Airport Industrial Park 1 and Airport Industrial Park 2, were documented to contain Level I concentrations of PCE (Table 27 of the HRS documentation record at proposal). As explained above, HRS Section 2.5.2 directs to assign Level I concentrations to a location "[i]f the concentration of any applicable hazardous substance from any sample equals or exceeds its benchmark concentration." As listed in Table 27 of the HRS documentation record at proposal, the concentrations of PCE in samples from Airport Industrial Park 1 and Airport Industrial Park 2 wells, which met observed release by chemical analysis criteria, were 7.5 µg/l and 20.7 µg/l, respectively. The concentrations of PCE in samples from Airport Industrial Park 1 and Airport Industrial Park 2 wells exceeded the MCL of 5 µg/l for PCE. Thus, Airport Industrial Park 1 and Airport Industrial Park 2 wells were properly documented to contain PCE at Level I concentrations.

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

3.10 Wellhead Protection Area

Comment: New Castle County commented that a 2013 SI report for the New Castle County Airport indicated that the New Castle County Airport is not within a wellhead protection area.

Response: The wellhead protection area factor value was appropriately assigned a value of 20 in the HRS documentation record at proposal based on the groundwater plume with no identified source physically overlapping boundaries with at least part of a documented wellhead protection area. The Site overlaps a portion of the City of New Castle Municipal Services Commission (NCMSC) and Artesian Water Company (AWC) wellhead protection areas as discussed in the HRS documentation record at proposal; therefore the scoring of the wellhead protection area factor is correctly evaluated at the Site.

HRS Section 3.3.4, *Wellhead Protection Area*, states:

Evaluate the Wellhead Protection Area factor based on Wellhead Protection Areas designated according to section 1428 of the Safe Drinking Water Act, as amended. Consider only those Wellhead Protection Areas applicable to the aquifer being evaluated or overlying aquifers (as specified in section 3.0). Select the highest value below that applies. Assign it as the value for the Wellhead Protection Area factor for the aquifer being evaluated....

Assign a value of 20 if either of the following criteria applies for the aquifer being evaluated or overlying aquifers:

- A source with a ground water containment factor value greater than 0 lies either partially or fully, within or above the designated Wellhead Protection Area.
- Observed ground water contamination attributable to the source at the site lies, either partially or fully, within the designated Wellhead Protection Area.

If neither criterion applies, assign a value of 5, if, within the target distance limit, there is a designated Wellhead Protection Area applicable to the aquifer being evaluated or overlying aquifers.

Assign a value of 0 if none of the above applies.

Page 64 of the HRS documentation record at proposal states:

3.3.4 Wellhead Protection Area

The contaminated groundwater plume lies within AWC and NCMSC Well head Protection Areas (Ref. 86, pp. 1, 2; **Figure 2** in Reference 5 of this HRS documentation record). Wellhead protection areas in Delaware are designated by EPA in accordance with Section 1428 of the Safe Drinking Water Act (Ref. 85, pp. 1, 2). Therefore, the Wellhead Protection Area Factor Value of 20 is assigned (Ref. 1, Section 3.3.4).

Wellhead Protection Area Factor Value: 20

The wellhead protection area discussion in the HRS documentation record at proposal cites pages 1 and 2 of Reference 86¹⁷ of the HRS documentation record at proposal. Page 2 of Reference 86 of the HRS documentation record at proposal presents a map from the Delaware Geologic Information Resource outlining wellhead protection areas in the vicinity of the Site. This map includes AWC and NCMSC wellhead protection areas which are within the groundwater plume with no identified at this Site.

The wellhead protection areas for NCMSC and AWC overlap with part of the eastern edge of the groundwater plume as indicated in References 5¹⁸ and 86 of the HRS documentation record at proposal. As quoted above, HRS Section 3.3.4 instructs to assign a value of 20 if “[o]bserved ground water contamination attributable to the source at the site lies, either partially or fully, within the designated Wellhead Protection Area.” Therefore, the HRS scoring of the Site properly assigned a value of 20 to the wellhead protection area because the groundwater plume overlaps with a portion of a wellhead protection area.

Regarding the scoring of a wellhead protection area in relation to the New Castle County airport, the commenter is correct that the New Castle County airport is not located in a wellhead protection area. Page 2 of Reference 86 of the HRS documentation record at proposal does not present a wellhead protection area at the New Castle County airport. The scoring of the wellhead protection area factor for HRS purposes, however, is not dependent on whether the entire Site is within a wellhead protection area; it can be scored based on a portion of the Site falling within a wellhead protection area. As quoted above, HRS Section 3.3.4 directs to assign a value to the wellhead protection area factor based on the site being partially within the wellhead protection area. Accordingly, the absence of a wellhead protection area at the New Castle County Airport does not impact the appropriateness of assigning a value of 20 to the wellhead protection area factor value based on a different portion of the groundwater plume overlapping with a portion of a wellhead protection area.

This comment results in no change to the HRS score and no change in the decision to place the Site on the NPL.

¹⁷ Reference 86 of the HRS documentation record at proposal: DGS. 2022. *Delaware Geologic Information Resource (DGIR) Map Viewer*. Information Available: <https://www.dgs.udel.edu/projects/delaware-geologic-information-resource-dgir-webapplication>. Accessed June 8. 2 Pages.

¹⁸ Reference 5 of the HRS documentation record at proposal: Tetra Tech, Inc. (Tetra Tech). 2022. *Project Note to East Basin Road Groundwater Site File. Subject: Figures. 4* Pages. June 30.

4. Conclusion

The original HRS score for this site was 50.00. Based on the above responses to public comments, the score remains unchanged. The final scores for the East Basin Road Groundwater site are:

Ground Water:	100.00
Surface Water:	NS
Soil Exposure:	NS
Air Pathway:	NS
 HRS Score:	 50.00

Attachment 1:

**Excerpt from EA Engineering, Science, and Technology, Inc.,
Sampling and Analysis Plan, Site Inspection New Castle Public
Wells Groundwater Plume Site (aka 0 East Basin Road New
Castle PFOS-PFOA Site) DE-0363 New Castle, Delaware, June
2020. Excerpted for file accessibility.**



**Sampling and Analysis Plan
Site Inspection
New Castle Public Wells Groundwater Plume Site
(aka 0 East Basin Road New Castle PFOS-PFOA Site)
DE-0363
New Castle, Delaware**

Prepared for

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LIST OF ACRONYMS AND ABBREVIATIONS

AWC	Artesian Water Company, Inc.
bgs	Below ground surface
CONC	City of New Castle
DANG	Delaware Air National Guard
DNREC-RS	Department of Natural Resources and Environmental Control-Remediation Section
EA	EA Engineering, Science, and Technology, Inc., PBC
EDD	Electronic data deliverable
EPA	U.S. Environmental Protection Agency
Eurofins	Eurofins Lancaster Laboratories Environmental
ft	Foot (feet)
HAL	Health advisory level
HDPE	High density polyethylene
HSCA	Hazardous Substance Cleanup Act
IDW	Investigation-derived waste
in.	Inch(es)
MS	Matrix spike
MSD	Matrix spike duplicate
NCPW	New Castle Public Wells
No.	Number
ntu	Nephelometric turbidity units
PA	Preliminary Assessment
PFAS	Per- and Polyfluoroalkyl substance
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PVC	Polyvinyl chloride poly
SI	Site Inspection
Site	New Castle Public Wells Groundwater Plume Site
SOP	Standard Operating Procedure
VOC	Volatile organic compound

1. INTRODUCTION

1.1 PROJECT DESCRIPTION

EA Engineering, Science, and Technology, Inc., PBC (EA) has been tasked by the Delaware Department of Natural Resources and Environmental Control – Division of Waste and Hazardous Substances, Remediation Section (DNREC-RS; formerly Site Investigation and Restoration Section), under the authority of the Delaware Hazardous Substance Cleanup Act (HSCA) (7 Delaware Code, Chapter 91) and Environmental Investigation and Remediation Services Contract Number (No.) NAT-15374, to complete a Site Inspection (SI). Activities will include well installations followed by groundwater, sediment, and surface water sampling at the New Castle Public Wells (NCPW) Groundwater Plume Site (the Site) to evaluate per- and polyfluoroalkyl substances (PFAS) and volatile organic compounds (VOCs).

This Sampling and Analysis Plan includes the tasks and procedures associated with well installation and the sampling of the newly installed monitoring wells as well as sediment and surface water sampling. Sampling will be completed in accordance with the Site-Specific Health and Safety Plan drafted by EA (**Appendix A**).

1.2 SAMPLING AND ANALYSIS PLAN ORGANIZATION

This Sampling and Analysis Plan is organized into the following sections:

- **Section 1**—Provides a brief project description and report organization.
- **Section 2**—Provides background on site history, site geology, and hydrogeology, and summarizes the characterization completed to date.
- **Section 3**—Provides an overview of the project scope and objectives.
- **Section 4**—Summarizes pre-field activities.
- **Section 5**—Summarizes well installation and development.
- **Section 6**—Summarizes sampling procedures, including field and analytical procedures.
- **Section 7**—Presents the field operation documentation.
- **Section 8**—Provides an overview of the report requirements.
- **Section 9**—Identifies the project team and schedule.
- **Section 10**—Provides the references cited within this document.

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2. BACKGROUND INFORMATION

2.1 LOCATION AND DESCRIPTION

The Site is located at (0) East Basin Road, New Castle, New Castle County, Delaware as shown on **Figure 1** (DNREC 2020) and is approximately a 7-square mile area surrounding public wells. The Site includes areas of potential concern as identified by DNREC-RS on **Figure 2** (DNREC 2017). The Site is approximately bounded by Interstate 295 to the north, the Delaware River to the east, Route 273/Frenchtown Road to the south, and New Castle County Airport to the west. The Site is a mixture of residential and commercial areas including housing developments, the New Castle County Airport, retail and commercial centers, and industrial parks.

2.2 HISTORY

In 2014, samples from five public water supply wells in New Castle as shown on **Figure 3** (DNREC 2017) exceeded the U.S. Environmental Protection Agency (EPA) preliminary health advisory levels (HALs) for perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS). PFOA was detected at a maximum concentration of 440 parts per trillion and PFOS was detected at a maximum concentration of 2,300 parts per trillion. Since that time, EPA established a more stringent lifetime HAL of 70 parts per trillion in 2016. These public water supply wells, as well as others in the area, exceed the lifetime HAL. Artesian Water Company, Inc. (AWC) and the City of New Castle (CONC) Municipal Services Commission have been treating the public drinking water to remove PFOS and PFOA to assure concentrations do not exceed the HAL.

The Site includes 16 areas of potential concern (**Figure 2**) identified during a Preliminary Assessment (PA) by DNREC-RS in March 2015 as follows:

- Area 1: Quigley Boulevard Industrial Park (32 parcels)
- Area 2: Harry Wood Landfill (DNREC-RS Site)
- Area 3: Centerpoint Industrial Park (23 parcels)
- Area 4: Boulden Interchange Park (12 parcels – Boulden Boulevard Southside)
- Area 5: Southgate Center Industrial Park (39 parcels – Boulden Boulevard Northside)
- Area 6: Matassino Road (18 parcels – North and South of Boulden Boulevard west of Railroad)
- Area 7: East Commons Blvd Industrial Complex (17 parcels – East of West Basin Road)
- Area 8: BMX fire training area at track off Commons Boulevard on Speedway Drive

- Area 9: New Castle County Airport fire training area at the north end of runway #19
- Area 10: Delaware Air National Guard (DANG) fire training area
- Area 11: Route 141 Basin Road Carpet Warehouse across from DANG
- Area 12: Route 13 Carpet Warehouse just north of Route 141 Basin Road overpass
- Area 13: Wilmington Manor Fire Company on Route 13
- Area 14: New Castle County Airport (crash sites and fire systems in hangers)
- Area 15: Route 13 Commercial District
- Area 16: Old Airport Road Commercial District.

The 2015 PA discusses each of the 16 areas in detail. The purpose of the PA was to identify potential sources of PFAS that were detected in five New Castle public drinking water supply wells, which included AWC's Wilmington Manor Well #3, Jefferson Farm Well #1, and the CONC's Basin Road Well, Schoolhouse Lane Well, and Frenchtown Road Well as shown on **Figure 3** (DNREC 2017). The wells were taken off-line or required carbon treatment due to exceedances of EPA's preliminary HALs for PFAS in 2015. As of 2020, water from additional AWC and CONC wells in this area exceed the lifetime HAL for PFOS, PFOA, and/or combined PFOS/PFOA. However, AWC and CONC have been treating the public drinking water to remove PFOS and PFOA so that the water does not exceed the lifetime HAL.

The initial phase of the SI for the NCPW Groundwater Plume Site was completed in Summer 2017 and Fall 2018 by DNREC-RS and focused on potential groundwater contamination at Areas 8, 9, 11, 12, 13, and 14 and potential soil contamination at Area 8. These areas were listed as high priority due to operational history and proximity to existing exceedances of PFAS.

A summary of the PFAS results from the 2017 and 2018 SI are provided on **Figure 4**. The results were provided to EA by DNREC-RS. In addition to PFAS, VOCs including tetrachloroethene, trichloroethene, and vinyl chloride are associated with the areas of potential concern, are present in the area, and have been sampled in the past.

DANG (Area 10) and the Harry Wood Landfill (Area 2) were not evaluated further as part of the NCPW Groundwater Plume Site. The DANG is currently investigating and monitoring PFAS contamination on the base facility. At the Harry Wood Landfill, groundwater has already been sampled and analyzed for PFAS from monitoring wells onsite. Both facilities will continue to be addressed as their own sites and were not included in the initial phase of the SI.

2.3 GEOLOGY

The following information is summarized from the March 2015 PA (DNREC 2015).

New Castle County includes the Appalachian Piedmont Province and the Atlantic Coastal Plain Province. The border between these two provinces is marked by a fall zone. The Site lies within the northern edge of the Atlantic Coastal Plain Province, which consists of unconsolidated and semi consolidated fluvial deposited sediments. The area of the Site where monitoring wells are proposed by DNREC-RS is underlain by yellowish to reddish brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel with scattered beds of tan to reddish- gray clayey silt common. In places, the upper 5-25 feet (ft) consist of grayish to reddish brown silt to very fine sand overlaying medium to coarse sand of the Middle Pleistocene Columbia Formation. The base of the Columbia Formation is characterized by cobble to boulder size clasts found in gravel beds ranging from a few inches to 3 ft thick. The thickness of the Columbia Formation in New Castle County ranges from less than 10 ft to over 130 ft (DNREC 2015).

The sediments of the Columbia Formation fill the eroded surfaces within the underlying Potomac Formation forming paleo-channels that trend northeast to southwest with a thickness of approximately 70 ft. The underlying Potomac Formation is believed to be 400 ft thick in the area of the Site based on the boring log for AWC Wilmington Manor (AWC-WM) MW-1 (Permit No. 190370-W) drilled in 2003 (DNREC 2015). The Potomac Formation consists of dark-red, gray, pink, and white silty clay to clayey silt and fine to medium sand. Beds of gray clayey silt to very fine sand containing charcoal and lignite are common.

The Potomac Formation in the area of the Site is underlain by the Lower Paleozoic Wilmington Complex, which consists of felsic and mafic gneiss and minor schist and the Brandywine Blue Gneiss, which consists of granulite facies felsic gneisses. The unit is a medium to coarse-grained, lineated, two pyroxene, gneiss with variable quartz content and thin, discontinuous mafic layers. The well log from the AWC Wilmington manor MW-1 indicated that the basement rocks were encountered at a depth of 440 ft below ground surface (bgs) at this well's location.

2.4 HYDROGEOLOGY

The following information is summarized from the March 2015 PA (DNREC 2015).

The Columbia and Potomac formations serve as aquifers within the area (DNREC 2015). The saturated thickness of the Columbia aquifer is variable and is unconfined. The Potomac aquifer is confined to semiconfined.

Groundwater flow direction in the area is influenced by withdrawals from public supply wells as well as the presence of the surface water and groundwater divide at the New Castle County Airport. The surface elevations in the area range from 85 ft above sea level at the New Castle Airport to sea level both at the Delaware River to the southeast, and at Nonesuch Creek and the Christina River to the northwest. Along the east side of the New Castle County Airport, the surficial aquifer flows to the east-southeast toward the Delaware River while the west side of the

airport flows to the west-northwest toward the Christina River. Groundwater flow velocities in the Columbia aquifer are on the order of 100s of feet per year while those in the Potomac aquifer are 10s of feet per year (DNREC 2015).

3. PROJECT SCOPE AND OBJECTIVES

The installation of 2 shallow wells and 5 deeper wells is anticipated along with sampling of the newly installed wells, 5 sediment, and 5 surface water locations for the analysis of VOCs and PFAS. The estimated well locations provided by DNREC-RS through discussions with EPA as well as the sediment and surface water locations are shown on **Figure 5** (DNREC 2020) and are subject to change based on property access. Shallow wells are estimated to be installed to a depth of 50 ft bgs while deeper wells are estimated to be installed to 110 ft bgs. Deeper wells are estimated to be cased off by temporary sonic casing method at an estimated depth of 50 ft bgs depending on lithology encountered. Depths are subject to change depending on DNREC-RS direction, which will be based on screened formations of the surrounding public wells.

Sampling of the newly installed wells along with the sediment and surface water samples will occur no sooner than 2 weeks following development of the newly installed wells.

The objective of this SI is to further investigate if PFAS and VOCs are present and migrating to the environment in the area surrounding the public wells. The SI is not intended to be a detailed extent-of-contamination assessment or risk assessment. The purpose of this Sampling and Analysis Plan is to document the well installation as well as the sampling and analysis procedures.

Samples are proposed to be analyzed by a DNREC-HSCA certified laboratory, Eurofins Lancaster Laboratories Environmental (Eurofins) for analysis as requested by DNREC-RS. Data validation is currently not scoped, as requested by DNREC-RS.

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4. PRE-FIELD ACTIVITIES

4.1 RIGHT-OF-ENTRIES

DNREC–RS will maintain the right-of-entries and contact property owners prior to commencement of the well installation and subsequent sampling event. DNREC-RS will coordinate with the property owners to determine an area to store drums while waiting for disposal parameter results.

4.2 SITE VISIT

A site visit with EA, DNREC–RS, and potentially with property owners is proposed prior to commencement of the well installation phase to mark locations as well as coordinate the sampling effort logistics.

4.3 UTILITY CLEARANCE

Intrusive activities will commence following the mark-out and clearance of utilities by Miss Utility as well as a third-party utility locator company. Locations will also be soft dug by the drilling contractor prior to the commencement of sonic drilling.

The following information will be considered when planning any intrusive activities:

- ***Time between locate requests and site marking***—Excavators in Delaware are to give notice 2 full working days prior to the day they plan to start work. The day of the call is not counted as one of these days.
- ***Ticket life***—10 business days after the call date.
- ***Required hand-digging distance***—24 inches (in.).

Following the Miss Utility mark-out, a third-party utility locator will be contacted to mark and clear each private property and/or location proposed for intrusive work. It is anticipated that some of the investigative work will be performed on commercial, industrial, and public properties. The third-party utility locator will include a ground penetrating radar component to the utility mark-out.

The EA Site Manager will confirm with the EA Project Manager that the clearance has been performed.

Locations will be vacuum excavated/air knifed as needed and cleared of utilities to at least 5 ft bgs prior to any intrusive activities.

4.4 PERMITS

In order to perform the field investigations, applicable permit applications will be drafted. Prior to commencement of intrusive activities, the proper permits will be obtained by a Delaware-licensed driller required to extract continuous soil cores, penetrate the water table, and install monitoring wells.

Safety permits, if drilling is anticipated to be completed in the right-of-way, may be needed through the Delaware Department of Transportation. Safety permits may include traffic control requirements including the proper use of signage and safety drums/barrels due to pedestrian traffic in accordance with the Delaware Department of Transportation.

5. WELL INSTALLATION AND DEVELOPMENT

It is anticipated that 7 monitoring wells will be installed at the Site by a Delaware-licensed driller using roto sonic drilling methods. These 7 wells will include 2 shallow wells to 50 ft bgs and 5 deep wells to 110 ft bgs with approximately 10 ft of screen at each well. The deep wells are anticipated to be temporarily cased-off using isolation casing in the Potomac clay to a maximum depth of 55 ft bgs.

Continuous soil will be collected to document lithology to determine well screen intervals. Soil samples are not proposed to be submitted for laboratory analysis except for disposal parameters. Following installation, the monitoring wells will be developed by a Delaware-licensed driller in accordance with applicable DNREC Division of Water regulations. The monitoring wells will be surveyed by a Delaware-licensed surveyor to determine the lateral coordinates, top of inner casing elevation, and ground surface elevation.

The 2020 Proposed Sample Location Map (**Figure 5**) illustrates the proposed well locations provided by DNREC-RS, although locations may change depending on access.

5.1 DRILLING

Water from a PFAS-free source will be brought onsite by the drilling subcontractor to be used during drilling. The water source quality report was provided to DNREC-RS and was approved by DNREC-RS and EPA. During monitoring well borehole advancement, continuous soil cores will be collected to characterize lithology, determine screen intervals, and the extent of the confining unit in order to case off for deeper wells prior to drilling further. Target depths and approximate screening depths for monitoring wells are 50 ft for the 2 shallow wells and 110 ft for the deeper wells. The following summarizes the general steps for drilling the anticipated monitoring wells:

- Advance a nominal 4-in. diameter sample barrel using roto sonic drilling methods to 10 ft. Drilling will be conducted using a minimal amount of water and a mixture of water and bentonite (such as Bentonite Quik-Gel® and/or Bentonite Super-GEL-X®) as well as required to lubricate and prevent overheating of the casing and control heaving sands.
- A nominal 6-in. override casing will be then be drilled over the 4-in. sample barrel to a depth of 10 ft. The 6-in. override casing will remain in place and the 4-in. sample barrel will be removed from the borehole. The soil core will be extruded from the 4-in. sample barrel. The barrel will be returned to the borehole to 10 ft and then vibrated to a depth of 20 ft. The 6-in. over-ride casing will be drilled to 20 ft. This process will continue until the targeted depth or clay confining unit.
- Continuous soil will be collected to document lithology to determine well screen intervals and where to case off for the deeper wells. Photoionization detector readings will be collected and documented along with lithology. The Boring Log (**Appendix B**) will be completed for each location.

- In reference to deeper wells, once the clay confining unit is encountered, an 8-in. work casing will be seated into the confining unit to approximately 3-5 ft to case-off and will be left in place until drilling is complete.
 - The 8-in. working casing will be seated into the confining unit with the 6-in. override casing.
 - The falling head test is proposed to be completed for 15 minutes. The water will be pumped between the 6-in. override casing and the 8-in. working casing to fill the entire annular space for the falling head test. The water will be monitored for 5 minutes to assure there is no loss of water. If the falling head test fails, the process will be repeated. If the falling head test fails during the 2nd attempt, work will stop, EPA and DNREC will be contacted, and the drilling method will be evaluated and modified in accordance with site conditions.
 - Once the test is complete, the 6-in. override casing will be lowered back down to the bottom of the hole and drilling will commence.
 - The 4-in. sample barrel and 6-in. override casing will continue to total depth.
 - In the event that a second confining layer is encountered in a boring, the following steps are proposed. A 10-in. working casing will be utilized as a 2nd isolation casing.
 - The 10-in. working casing will be drilled to the depth of the 8-in. (first confining unit) and a falling head test would be completed in accordance with the above text.
 - Once the test is complete, the 8-in. working casing will be lowered over the 6-in. override casing and a falling head test would be completed.
 - Once the test is complete, the 6-in. override will be drilled to total depth for well installation.
- Once sampling is complete and well screen depth has been approved, the 4-in. sample barrel will be removed from the boring prior to well installation. The 2-in. well will be set inside the 6-in. override casing, sand packed and bentonite seal in accordance with Delaware regulations. Grout will be placed in between the 2-in. well and the 6-in. override casing and the 6-in. will be extracted from the borehole. The driller will then ensure the borehole is full of grout and will then remove the working casing(s). This will leave a 2-in. well in place with a continuous grout column above the screened zone to the surface.

5.2 WELL INSTALLATION

The wells will be installed inside the 6-in. override casing. Grout will be placed by a tremie-pipe between the 2-in. well and the 6-in. override casing. The borehole will be full of grout prior to removing the working casing(s).

These wells will be constructed with a 2-in. diameter, flush threaded, Schedule 40 polyvinyl chloride (PVC) riser with 0.010-in. slot screen with an anticipated screen length of 10 ft. Well installation will include type #0 fine-grained sand filter pack at a minimum of 2 ft above the screen, followed by 1-2 ft of bentonite followed by a bentonite-cement grout. The bentonite seal will be hydrated with water and allowed to set for a sufficient time to ensure a proper seal. A bentonite grout will be placed with a tremie pipe from the bentonite seal to within 2 ft of the ground surface. A concrete surface seal, approximately 1- to 2-ft thick, will be placed on top of the bentonite grout to the surface level. A protective steel flush mount curb box with lockable cap will be installed in the concrete surface seal, which will be constructed with a slight slope away from the well casing to divert runoff water from the well casing.

The Record of Monitoring Well Construction (**Appendix B**) will be completed for each location.

5.3 WELL DEVELOPMENT

Following installation, the monitoring wells will be developed by a Delaware-licensed driller in accordance with applicable DNREC Division of Water regulations. Wells will be developed by surging and pumping to remove silt and fines to ensure that representative groundwater samples will be obtained. The new wells will be developed approximately 48 hours after placement, but no sooner than 24 hours after grouting is completed, per Delaware regulations. The depth to static water level and total well depth will be measured from the top of the inner PVC casing prior to developing each well. The wells will be continuously surged and pumped until turbidity is below 10 nephelometric turbidity units (ntu). At a minimum, well development will remove 3-5 well volumes of water.

Water quality parameters will be monitored by EA for turbidity, pH, conductivity, oxidation reduction potential, dissolved oxygen, and temperature before beginning development procedures and after removing 2, 2.5, and 3 well volumes of water, per Delaware regulations. It is anticipated that each well will be developed for a maximum of 2 hours each. Physical characteristics of the purged groundwater during well development will be noted as applicable such as odor and color. Well development will be recorded on the Record of Well Development provided in **Appendix B**. Well development water will be drummed and disposed of in accordance with Section 6.8.

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6. SAMPLING PROCEDURES

Sampling will be completed in accordance with the Site-Specific Health and Safety Plan (**Appendix A**) and EA's Standard Operating Procedures (SOPs) for Field Logbooks and PFAS Sampling (**Appendix C**). EA's SOP for Sampling PFAS lists the prohibited and acceptable items in a table. In addition to following EA's SOP for Sampling PFAS, this section includes additional requirements that will be followed by the field crew. The 2020 Proposed Sample Location Map (**Figure 5**) illustrates the locations of the proposed monitoring wells and the sediment and surface water locations (NCPW-SED/SW01 through NCPW-SED/SW05) to be sampled.

6.1 SAMPLE REQUIREMENTS

Clean nitrile gloves will be donned immediately as noted below during the following activities:

- Following the contact of any non-dedicated sampling equipment
- Following contact of non-decontaminated surfaces and when needed
- Prior to contacting sample bottles or laboratory-grade PFAS-free water
- Prior to and following the decontamination of equipment
- Prior to placing downhole/intrusive equipment such as pumps in wells
- Following groundwater purging, prior to collecting any sample.

Sampling will not occur during persistent rainfall since rain gear is not permitted during sampling.

High density polyethylene (HDPE) lids on sample containers are not typically considered water-tight; therefore, the HDPE sample containers will be individually placed in water-tight bags prior to placement in coolers. Containers for collection of PFAS samples shall never be left uncapped, either before or after sample collection, and the lid/cap shall be kept in a gloved hand and not be set down while removed from the container. Labels will be completed in ballpoint pens and no Sharpies® or other markers will be used during field activities.

Samples will be iced immediately upon sample collection and blue ice is prohibited. Ice will be double-bagged (polyethylene plastic) and sealed to avoid contact of ice or meltwater during sample delivery. The table of prohibited and acceptable alternatives in EA's SOP for Sampling PFAS (**Appendix C**) will be followed even while sampling for other analytes to minimize cross contamination to PFAS samples.

PFAS are located in a number of household products including nonstick cookware, fabric waterproofing/stain-proofing, Post-It® notes, foam coolers, and food packaging (i.e., aluminum foil, sandwich paper wrapping, and disposable coffee cups). PFAS are also located in vehicle materials such as stain resistant vehicle seats, wiring and insulation, and anti-reflective coatings. If feasible, vehicle seats will be covered in a well-laundered cotton blanket to avoid contact between clothes and the seats.

The sample team will not wear new clothing, clothing with fabric softener, stain-resistant, treated clothing, or garments including polytetrafluoroethylene (e.g., Teflon[®], Gore-Tex[®], Tyvek[®]) as noted in the table of prohibited and acceptable items in EA's SOP for Sampling PFAS (**Appendix C**). They will refrain from using cosmetics, moisturizers, lotions, hand creams, non-approved sunscreens, and non-approved insect repellent (table in EA's SOP for Sampling PFAS [**Appendix C**]).

Snacks and lunch are not to be eaten in the immediate sampling area and shall be eaten at least 33 ft away from any sampling area. As a result, the sampling team will use appropriate hand washing procedures (Liquinox, Alconox, or Citranox and laboratory-grade PFAS-free water) and will don clean nitrile gloves immediately prior to collecting a sample.

Visitors to the sampling area shall remain at least 33 ft at a distance.

6.2 EQUIPMENT CALIBRATION, OPERATION, AND MAINTENANCE

Proper calibration, operation, and maintenance of each instrument will be followed in accordance with the manufacturer's instructions. Equipment to be calibrated includes, but is not limited to, water quality meters, combustible gas indicators/oxygen meters, and photoionization detectors.

Instruments and equipment used during sampling activities will be calibrated, operated, and maintained according to the manufacturer's guidelines and recommendations. Instruments will be inspected and calibrated prior to the beginning of each sampling day, at the end of each sampling day, and additionally as needed, as indicated by changes in instrument performance or weather conditions that could affect instrument performance. In addition to the manufacturer's calibration solutions, each piece of field equipment that is calibrated will be required to pass a quality control sample from a source different than that used to calibrate the device (pH, turbidity, and conductivity). The acceptance criteria for the quality control sample will be that the recovery does not deviate from the true value. Standard verification will be confirmed against the requirements provided by the standard manufacturer. This will demonstrate that all field instruments have held calibration throughout the sample screening and collection sequence. The equipment calibration will be recorded in the field logbook.

6.3 GROUNDWATER MONITORING PROCEDURE

Groundwater sampling will be completed at a minimum of 14 days following well development.

6.3.1 Groundwater Level Measurements

Water levels and depth to bottom of well will be measured with a water level indicator from each well following sampling in lieu of prior to the commencement of sampling due to the low detection limits for PFAS analysis and to help mitigate the possibility of cross-contamination. Measurements will be recorded to the nearest 0.01 ft and will be taken from a clearly marked reference point at the top of the PVC casing. Water level indicators will not be placed in wells during purging. Well headspace will be measured by a photoionization detector when initially

opening the well lid. Data will be recorded in the field logbook. A table will be provided to the sampling crew that summarizes the newly installed monitoring well permit numbers, elevations, coordinates, and screened intervals prior to mobilization onsite.

6.3.2 Groundwater Sampling via Low Flow

Dedicated HDPE tubing and PFAS-free bladder pumps are proposed to purge the monitoring wells during low flow sampling. Purged water will be drummed and disposed of in accordance with Section 6.8. Water quality data will be recorded every 5 minutes until the water quality parameters have stabilized over three consecutive readings. Stabilization is proposed to be defined as:

- ± 0.1 pH units
- ± 3 percent for temperature
- ± 3 percent for conductivity
- ± 10 percent for dissolved oxygen
- ± 10 millivolts for redox potential
- ± 10 percent for turbidity
- Steady or rising water level.

If these parameters have not stabilized after 2 hours, purging will be terminated, and sampling will commence. If a low yielding well de-waters, the well will be sampled upon adequate recovery and will be noted in field documents. The EA Project Manager and DNREC-RS will be notified.

Parameters will be recorded in the Purging and Sampling Record (**Appendix B**).

Any foaming observed in the sample during collection should be documented on the chain-of-custody form as well as the Purging and Sampling Record (**Appendix B**).

6.4 SEDIMENT AND SURFACE WATER SAMPLING PROCEDURE

Surface water and sediment samples will be collected from locations NCPW-SED/SW01 through NCPW-SED/SW05, which are shown on the 2020 Proposed Sample Location Map (**Figure 5**). When sampling on a surface water body, associated gear such as waders will be PFAS-free.

6.4.1 Surface Water Sampling

Surface water samples will be collected before sediment samples are collected to minimize siltation. The sampler will be located downstream of where the sample is being collected to minimize cross contamination. Samples downstream will be collected prior to samples upstream.

Capped surface water sample containers (outside portion of container) will be rinsed multiple times with surface water prior to sampling. Surface water will be collected by inserting a capped

(not Teflon-lined) polypropylene or HDPE sampling container with the opening pointing down to avoid the collection of surface film since PFAS tend to accumulate at the air/water interface. The container will be opened more than 4 in. from the sediment bed and more than 4 in. below the surface water level where possible and within the center of the channel. Upon opening, the container will be pointed up so that the sampler and container are downstream of the sample collection point.

Water quality parameters will be measured following sample collection to minimize cross-contamination; pH, conductivity, temperature, and total dissolved solids will be measured at each location following sediment collection.

6.4.2 Sediment Sampling

Sediment samples will be collected by using stainless steel tools such as a trowel, ponar sampler, or corer. If needed for sediment collection through corers, single-use PVC, HDPE, or acetate liners are proposed to be used. The trowel and corer will be decontaminated onsite in accordance with Section 6.7 prior to and between sample collection.

Sediment samples are proposed to be collected at 0-6 in. bgs. The sediment samples should be undisturbed and free of vegetation.

6.5 ANALYTICAL PROCEDURES

Samples will be iced immediately upon sample collection, and blue ice is prohibited. The bottleware, preservative requirements, and holding times for each analyte are listed in **Table 1**. The samples will either be picked up by the laboratory from the Site or at the EA–Abingdon, Maryland office. Samples will be analyzed by Eurofins, an approved DNREC–HSCA laboratory on a 15-day standard turnaround time. Preliminary results will be available on a 10-day turnaround time. Eurofins will provide a Level IV data package including a DNREC–HSCA electronic data deliverable (EDD).

6.5.1 Analytical Methods and Quality Assurance Samples

The analytical methods and quality assurance samples for each media are provided in **Table 2**. Eurofin’s list of analytes, method detection limits, and limit of quantification for VOCs and PFAS are provided in **Appendix D** (Eurofins 2019 and 2020). As directed, PFAS will be analyzed by Modified 537 (Method 537 Version 1.1 Modified/SW-846 8321B Using LC/MS/MS, version 10).

Quality assurance will include field blanks (ambient sample), rinsate blanks, duplicates, and matrix spike (MS)/matrix spike duplicates (MSDs), and trip blanks. A field blank will be collected to represent each parent sample in reference to PFAS analysis for each media and one field blank per day will be collected to represent each media for VOC analysis. A rinsate blank will be collected to represent each type of downhole/intrusive equipment following decontamination per day. The rinsate blank for each set of equipment utilized will be sampled

for PFAS and VOC analyses per media. Rinsate samples will be collected for each type of equipment but not collected more than once on the same pump in between locations. A duplicate and MS/MSD will be collected per 20 parent samples per day to be analyzed for PFAS and VOC analysis per media. A trip blank per cooler for VOC analysis will be analyzed in addition to the above quality assurance samples.

The equipment representing each rinsate blank collected, as well as where that piece of equipment was utilized in reference to sample identification number and location will be documented. The parent sample represented by each field blank will be documented as well. The parent sample representing each duplicate and MS/MSD will be documented.

6.6 SAMPLE DESIGNATION

Each sample identification number will commence with NCPW to represent New Castle Public Wells.

Groundwater samples will be identified by the Well Identification Number-date of collection (e.g., NCPW-MW19-A-09242019).

Surface water samples will be identified with SW for surface water immediately followed by the identification number such as SW01 – date of collection (e.g., NCPW-SW01-09252019).

Sediment samples will be identified as SED for sediment immediately followed by the identification number-beginning sample depth in inches bgs-ending sample depth in inches bgs-date of collection (NCPW-SED01-0-6-09252019).

Quality assurance sample identification will commence with NCPW followed by the matrix code (MW, SW, or SED) in the sample designation. Field blanks and rinsate blanks will also be identified by number in sequence of collection.

- Field blank will be identified as MW, SW, or SED followed by FB-sequential number-date (e.g., MW-FB-01-09242019).
- Rinsate blank will be identified as MW, SW, or SED followed by RB-sequential number-date (e.g., MW-RB-01-09242019).
- Duplicate will be identified as MW, SW, or SED-DUP-date (e.g., SW-DUP-09252019).
- Trip blank will be identified as TRIP-date (e.g., TRIP-09252019).

MS/MSD samples will be identified in relation to the parent sample on the chain-of-custody in the Notes section.

Samples collected for investigation-derived waste (IDW) analyses will be labeled as IDW-AQ for aqueous or S for solid-date of collection (i.e., IDW-AQ-09122019).

6.7 EQUIPMENT DECONTAMINATION

6.7.1 Drilling Phase

Decontamination of larger equipment (e.g., drill rigs and large downhole drilling and sampling equipment) will be completed between boring locations with an approved potable water source using a high-pressure washer or steam within a decontamination pad or container. The 4-in. sample barrel interior will be rinsed with an approved potable water source.

6.7.2 Sampling Phase

Whenever possible, equipment will be rinsed with PFAS-free water immediately prior to use at each sample location during groundwater, surface water, and sediment sampling.

Intrusive field equipment utilized during the groundwater, surface water, and sediment sampling phase (such as the water level meter, trowel, etc.) that will contact media will be properly decontaminated before use and between uses. Proper decontamination procedures will consist of the following steps upon donning a new pair of nitrile gloves:

- Wash with an approved detergent washing solution (e.g., Alconox, Liquinox, or Citranox) and laboratory-grade PFAS-free water using an appropriate brush
- Rinse with laboratory-grade PFAS-free water
- Rinse with methanol
- Triple rinse with laboratory-grade PFAS-free water
- Air dry in a clean HDPE container or bucket; aluminum foil will not be used to wrap air dry equipment since this is a prohibited item as noted in the EA SOP for Sampling PFAS (**Appendix C**).

6.8 INVESTIGATION-DERIVED WASTES

IDW that will be generated as part of the drilling and subsequent sampling event may include personal protective equipment, soil, groundwater, and decontamination water. IDW will be drummed and stored on pallets in a DNREC–RS-approved area while awaiting analytical results for offsite disposal. The drums will be labeled as IDW pending analysis, sample or well location as well as the site identification, media, DNREC–RS Project Manager contact information, and dates generated will be listed.

Other wastes generated during Site activities are expected to include disposable gloves, plastic tubing, paper towels, etc. These materials will be placed into plastic garbage bags and disposed of as municipal waste.

6.8.1 Sample Collection and Analysis of Investigation-Derived Waste

One composite sample will be collected from every 10 to 20 drums depending on facility requirements at the time to represent each media. Media suspected to be classified as hazardous per DNREC will be drummed and sampled separate from suspected nonhazardous waste per media. IDW parameter analyses for each media are listed in **Table 2** and are in accordance with the disposal facility at the time of the drafting of this document. It is anticipated that there will be approximately 25 drums of cuttings and 29 drums of water produced during well installation, which may change in number depending on Site conditions. Seven drums of purged groundwater are anticipated to be produced from groundwater sampling activities.

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7. FIELD OPERATION DOCUMENTATION

7.1 SAMPLE LABEL AND CUSTODY DOCUMENTATION

7.1.1 Sample Label

Each sample bottle will be labeled with the client's name, project number, location, sample designation, requested analyses, date, time of collection, Site name, and name of sampler on a label that will not float/soak off. Sample label and custody documents will be filled out in ballpoint pens and no Sharpies®, water-proof pens, or markers will be used during sampling activities in accordance with the table in **Appendix C**.

HDPE lids on sample containers are not typically considered watertight; the HDPE sample containers will be individually placed in water-tight bags prior to placement in shipping containers loaded with ice.

7.1.2 Sample Custody and Documentation

Chain-of-custody forms will be completed in ballpoint pens at the time samples are collected for analysis. The NCPW Groundwater Plume Site is a DNREC-HSCA Site, which will be noted on the chain-of custody. DNREC-HSCA EDD will be noted as well. Foaming of sample during sample location will be noted on the chain-of custody.

The chain-of-custody will be transported with the samples to the laboratory where the sample custodian will accept custody of the samples by signing the chain-of-custody. A copy of the chain-of-custody will be retained by EA.

7.2 FIELD LOGBOOK AND SAMPLE FIELD SHEETS

Dedicated field logbooks (loose non-waterproof paper on aluminum or Masonite clipboards) will be completed in accordance with EA's SOP for Field Logbooks (**Appendix C**). Loose papers in lieu of field logbooks will be utilized to avoid PFAS cross-contamination and loose papers will be numbered in sequence and dated. Field logbooks, spiral hard cover books, or plastic binders will not be used to minimize cross-contamination to PFAS samples. The table in the EA SOP for Sampling PFAS provided in **Appendix C** lists the appropriate field documentation items that can be utilized onsite. Loose, non-waterproof paper will be kept and scanned to record field operations. Field documentation will be maintained by field personnel and will become part of the permanent project file. Field logbook entries will be completed in ballpoint pen and will be legible and factual, providing sufficient detailed information so that field operations could be recreated. Corrections will be made by crossing out an incorrect entry (with one line) and initialing the correction. When custody of the notebook is transferred to another field team member, an entry will indicate this transfer. Examples of entries are as follows:

- Date and weather description

- Date and number each page
- Name and location of site
- Personnel onsite and list of visitors
- Time onsite and offsite
- Name and title of individual maintaining logbook/loose paper
- Change in custody of logbook/loose paper
- Date and time beginning each onsite activity
- Details of daily activities
- Sampling information including listing all samples including sample times along with details for each sample and observations.
- Field forms completed will be referenced
- Accident information
- Field instruments used and readings
- Calibration of equipment and equipment problems
- Type of waste generated and number of drums for each media
- Location of stored drums
- Decontamination procedures.

The equipment representing each rinsate blank will be documented as well as where that piece of equipment was utilized in reference to sample identification number and location. The parent sample represented by each field blank will be documented. The parent sample representing each duplicate and MS/MSD will be documented as well. Foaming of sample during sample location will be noted in logbook/loose paper as well as chain-of custody.

8. REPORT AND ELECTRONIC DATA DELIVERABLE REQUIREMENTS

8.1 REPORT REQUIREMENTS

A letter report will be drafted following receipt of the analytical results and will summarize field procedures and include an evaluation of the analytical results as well as field observations. Data will be evaluated to determine current conditions as well as recommendations, as needed. The report will include the use of tables and figures. Field documentation will be submitted as an attachment to the report.

8.2 ELECTRONIC DATA DELIVERABLE REQUIREMENTS

The laboratory will provide full laboratory DNREC–HSCA EDDs. The EA Data Management team will then revise the EDD before submitting it to DNREC (DNREC_Equis@delaware.gov) and a copy will be sent to the DNREC–RS Project Manager, as per the current DNREC Environmental Quality Information System EDD Format.

EA will modify the DNREC–HSCA EDD to include the following, if applicable:

- **Location**—Identifies the sampling locations and their coordinates.
- **Lithology**—Contains lithological data collected from soil cores generated during drilling of borings.
- **Well**—Contains data regarding wells including installation date, well permit number, top of casing elevation, and depth of well.
- **Sample**—Contains data for the samples collected at the Site and sent to a fixed laboratory for analysis. Fields include sample date, location, type, matrix, source, start and end depths, etc.
- **Test Result Quality Control**—Contains data regarding the laboratory tests performed on samples, the results of those tests, and the associated quality control data.
- **Batch**—Contains data associating samples with the laboratory batch identifier.
- **Water Level**—Contains data regarding water level measurements collected during sampling activities, including water level depth and water level elevation.

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9. PROJECT TEAM AND SCHEDULE

9.1 PROJECT TEAM

The project organization chart is provided in **Figure 6**.

9.2 PROJECT SCHEDULE

The project schedule is provided in **Figure 7**. The project schedule is estimated by detailing the number of days since access to properties is forthcoming. Exact dates will be added to the schedule once DNREC-RS can estimate when access will be granted. It is anticipated that field activities will commence on 1 July. The schedule will be subject to change and field activities are dependent on review of planning documents and access agreements. The letter report will be drafted within 30 days (or earlier) of receiving analytical data depending on schedule requirements. Final planning documents and the letter report will be submitted within 7-14 days of receiving comments on the drafts.

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10. REFERENCES

Delaware Department of Natural Resources and Environmental Control (DNREC)-Remediation Section. 2015. *Preliminary Assessment of 0. E Basin Road Site, PFOS & PFOA Impacted Public Wells in New Castle County, Delaware*. March.

———. 2017. *DE-0363 New Castle Public Wells Groundwater Plume (AKA Zero (0) E. Basin Road New Castle PFOS-PFOA) Site Inspection Work Plan*. May.

———. 2020. *2020 Site Location Map and Proposed Sample Location Map, New Castle Public Wells, Groundwater Plume Site*. May.

Eurofins Lancaster Laboratories Environmental. 2019. *TCL 4.3 VOCs 8260C LOQ and MDLS Table*. July.

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Figures

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Tables

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Table 1. Bottleware, Preservative Requirements, and Sample Holding Times

Matrix	Analytical Group /Method	No. of Sample Containers per Sample	Type of Container	Preservative Requirements	Holding Time
Aqueous	PFAS Modified 537	2	250-mL HDPE	Potable water and chlorinated Non-potable water-Trizma, non-potable without chlorination-no preservative, cool 6°C	14 days to extraction/28 days for analysis
Soil/Sediment	PFAS Modified 537	1	5-ounce plastic	Non, cool 6°C	28 days
Aqueous	Target Compound List 4.3 Volatile Organic Compounds SW846 8260C	3	40-mL glass vial	Hydrochloric acid to pH<2 (no headspace), cool 6°C	14 days
Solid	Target Compound List 4.3 Volatile Organic Compounds SW846 8260C/5035A (TerraCore)	1	40-mL glass vial	Methanol	14 days
Solid	Percent Moisture with above sample analysis	1	5-ounce plastic cup	Cool 6°C	14 days
Aqueous	TCLP Metals SW846 6010C/7470A ¹	1	1, 000-mL round amber glass	None, cool 6°C	14 days leachate extraction or filtration/28 days analysis
Solid	TCLP Metals SW846 6010C/7470A ¹	1	500-mL glass jar	None, cool 6°C	14 days leachate extraction or filtration/28 days analysis

Matrix	Analytical Group /Method	No. of Sample Containers per Sample	Type of Container	Preservative Requirements	Holding Time
Aqueous	TCLP Volatiles SW846 8260C ¹	3	40-mL glass vial	None, cool 6°C	14 days leachate extraction or filtration/14 days analysis
Solid	TCLP Volatiles SW846 8260C ¹	1	60-mL glass jar, no headspace	None, Cool 6°C	14 days leachate extraction/14 days analysis
Aqueous	Total Polychlorinated Biphenyls (8082A) ¹	2	250-mL round amber glass	None, Cool 6°C	7 days extraction/40 days analysis
Solid	Total Polychlorinated Biphenyls (8082A) ¹	1	500-mL glass jar	None, Cool 6°C	14 days extraction/40 days analysis
Aqueous	Sulfide, Cyanide, Flashpoint ¹	2	250-mL plastic	None, Cool 6°C	Not applicable for reactivity, 30 days for flashpoint
Solid	Sulfide, Cyanide, Flashpoint ¹	2	125-mL glass jar, no headspace (reactivity), 250-mL glass jar (flashpoint)	None, Cool 6°C	Not applicable for reactivity, 30 days for flashpoint
1. Disposal facility's requirements for investigation-derived waste analysis. Investigation-derived waste will also include analysis of PFAS and TCL VOCs. NOTES: °C = Degree Celsius. HDPE = High density polyethylene. mL = Milliliter(s). PFAS = Polyfluoroalkyl substance. TCLP = Toxicity Characteristic Leaching Procedure.					

Table 2. Laboratory Analytical Summary

Matrix	Analytical Group and Method	No. of Parent Samples per Event	No. of Field Duplicate Pairs	No. of MS/MSD pairs	No. of Field Blanks	No. of Rinsate	No. of Trip Blanks¹
Surface Water	PFAS Modified 537	5	1	1 MS/1 MSD	1 to represent each parent	1 to represent each type of downhole/intrusive equipment per day ²	Not applicable
Surface Water	TCL VOCs SW846 8260C	5	1	1 MS/1MSD	1 per day	1 to represent each type of downhole/intrusive equipment per day ²	1 per cooler
Sediment	PFAS Modified 537	5	1	1 MS/1 MSD	1 to represent each parent	1 to represent each type of downhole/intrusive equipment per day ²	Not applicable
Sediment	TCL VOCs SW846 8260C	5	1	1 MS/1MSD	1 per day	1 to represent each type of downhole/intrusive equipment per day ²	1 per cooler
Groundwater	PFAS Modified 537	7	1	1 MS/1MSD	1 to represent each parent	1 to represent each type of downhole/intrusive equipment per day ²	Not applicable
Groundwater	TCL VOCs SW846 8260C	7	1	1 MS/1MSD	1 per day	1 to represent each type of downhole/intrusive equipment per day ²	1 per cooler

Matrix	Analytical Group and Method	No. of Parent Samples per Event	No. of Field Duplicate Pairs	No. of MS/MSD pairs	No. of Field Blanks	No. of Rinsate	No. of Trip Blanks ¹
Water and Soil Investigation-Derived Waste	TCL VOCs PFAS TCLP Metals TCLP Volatiles Total Polychlorinated Biphenyls Sulfide, Cyanide, and Flash Point	3 soil and 3 water (1 sample per 10 drums or 20 drums per media)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
1. Only 1 trip blank for each applicable analysis is needed per cooler shipment. 2. A rinsate blank will be collected to represent each type of downhole/intrusive equipment following decontamination. Each rinsate blank will be analyzed for PFAS and VOC analyses per media per day. Rinsate samples will be collected for each type of equipment but not collected more than once on same pump in between locations. PFAS Modified 537 is Method 537 Version 1.1 Modified/SW-846 8321B Using LC/MS/MS, version 10. List of analytes, method detection limits, and limits of quantification are provided in Appendix D. NOTES: MS = Matrix spike. MSD = Matrix spike duplicate. PFAS = Per- and Polyfluoroalkyl substance. TCL = Target Compound List. TCLP = Toxicity Characteristic Leaching Procedure. VOC = Volatile organic compound.							

Appendix A

Site-Specific Health and Safety Plan

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**HEALTH AND SAFETY PLAN
NEW CASTLE PUBLIC WELLS
GROUNDWATER PLUME SITE
SITE INSPECTION
NEW CASTLE, DELAWARE**



May 2020



**EA Engineering, Science,
and Technology, Inc., PBC**

HEALTH AND SAFETY PLAN

NEW CASTLE PUBLIC WELLS GROUNDWATER PLUME SITE, NEW CASTLE, DELAWARE (AKA 0 E. BASIN ROAD NEW CASTLE PFOS-PFOA SITE) SITE INSPECTION DE-0363

Prepared for:

Delaware Department of Natural Resources and Environmental Control
Division of Waste and Hazardous Substances Remediation Section
391 Lukens Drive
New Castle , Delaware 19720

Prepared by:

EA Engineering, Science, and Technology, Inc., PBC
1311 Continental Drive, Suite K
Abingdon, Maryland 21009
(410) 671-6051

May 2020

CERTIFICATION

This Health and Safety Plan has been prepared under the supervision of, and has been reviewed by, a Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene.

A handwritten signature in black ink, reading "Peter Garger". The signature is written in a cursive style with a horizontal line extending from the end of the name.

Peter Garger, CIH
ABIH No. 3118

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LIST OF ACRONYMS AND ABBREVIATIONS

°F	Degrees Fahrenheit
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CPR	Cardio-pulmonary resuscitation
dBa	Decibels on the A-weighted scale
EA	EA Engineering, Science, and Technology, Inc., PBC
ft	Foot/feet
HASP	Health and safety plan
HEPA	High efficiency particulate air
kV	Kilo-volt
OSHA	Occupational Safety and Health Administration
OU-2	Operable Unit - 2
PPE	Personal protective equipment
SDS	Safety data sheet
SSHO	Site Safety and Health Officer
WBGT	Wet-bulb globe temperature

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1. INTRODUCTION

The following is a Health and Safety Plan (HASP) for field activities at New Castle Public Wells Groundwater Plume Site performed by EA Engineering, Science, and Technology, Inc., PBC (EA). This HASP provides overall health and safety guidance to EA employees and subcontractors that are conducting the field activities. A site-specific HASP will stand as an addendum to this HASP, as required.

1.1 PURPOSE, SCOPE, AND APPLICABILITY

This HASP has been developed to designate and define general health and safety protocols. The HASP also addresses potential hazards to site workers during field activities.

Each EA employee has been provided with a copy of this HASP and it is the responsibility of each EA employee to possess their copy of the HASP and site-specific HASP addendum when conducting EA field procedures. It is also recommended that EA employees carry onsite copies of their certifications for Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1926.65 requirements, (Section 3).

Prior to commencement of field activities, site workers will be briefed by the Site Safety and Health Officer (SSHO) on emergency procedures and potential hazards of site operations. These briefings will include, at a minimum, the following information:

- Disclosure of potential hazards
- Procedures for obtaining clearances/access to restricted areas
- Emergency response
- Vehicle rules/requirements
- Equipment to be used
- Restrictions on handling of materials to be encountered in work areas
- Rules for transporting/storing hazardous materials
- Guidelines for personal protective equipment (PPE)
- Clearance/restricted areas procedures
- Standard operating procedures
- Demarcation of the exclusion, contaminant reduction, and support zones (as necessary).

Field staff will be familiar with the HASP and the site-specific HASP addendum for project activities in which they are involved. The site-specific HASP addendum will include the following information, at a minimum, and appropriate to site conditions:

- Client name, project name/number, site location/address
- Site description and a description of the work

- Site-specific HASP addendum approvals – Project Manager and Manager of Health and Safety
- Hazards of concern, including pathways and overall hazard evaluation
- Justification or narrative of how work activities may encounter hazards, and their controls, including known or anticipated contaminant concentrations
- Fire explosion potential and the nature of the surrounding population
- Chemical hazards – condensed from Table 6-1 of the HASP
- Anticipated level of chemical exposure – approximate concentrations of anticipated contaminants of concern in environmental media
- Contingency plans, including evacuation procedures, assembly points and contingency leader
- Deviations/variations from HASP
- Location of site workers' documentation of required training
- Protective equipment – primary and contingency
- Monitoring equipment
- Decontamination procedures
- Emergency telephone numbers (subcontractor contact, fire, ambulance, poison control, police, etc.)
- Medical emergency information, including detail and route to the nearest hospital.

Prior to entering the site, the HASP and site-specific HASP addendum will be reviewed and an agreement to comply with the requirements will be signed by personnel, including contractors, subcontractors, and visitors. This form is presented in Appendix A. In signing this agreement, the personnel acknowledge their responsibility for compliance with the HASP requirements. Personnel onsite will be informed of the site emergency response plan and potential safety or health hazards of the operations. A copy of the Site Entry and Exit Log, presented in each site-specific HASP addendum, must be signed by personnel before entering and upon exiting the site. An example of this form is presented as Appendix B.

Both the HASP and site-specific HASP will be readily available onsite.

This HASP and the appropriate site-specific HASP addenda were designed to satisfy the OSHA Standards for Construction, 29 CFR 1926.65, *Hazardous Waste Operations and Emergency Response and including Hazard Communication*. Additional regulations have been cited throughout this report in situations where specific health and safety regulations exist for various tasks.

2. ORGANIZATION

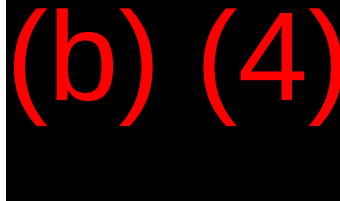
2.1 PROJECT PERSONNEL

Program Manager:

Project Manager:

Manager, Health and Safety:

Field Team Leader(s)/SSHOs:



2.2 RESPONSIBILITIES

The core of the technical organization is the Project Manager and the assigned Project Team. Additional individuals will be made available if warranted. The chain of command for safety and health related issues for EA projects is as follows:

2.2.1 Project Manager

The responsibilities of the Project Manager include the following:

- Approving the HASP and each amendment to the HASP
- Providing overall supervisory control for safety and health protocols in effect for the project
- Assigning the Field Team Manager and SSHO and ensuring that the assigned onsite staff will enforce provisions of the approved HASP.

2.2.2 Manager, Health and Safety

The responsibilities of the Manager, Health and Safety, include the following:

- Reviewing the HASP and the site-specific HASP addendum
- Providing technical support to the SSHO, particularly in the modification for site safety and health requirements or work plans.

2.2.3 Field Team Leader

The Field Team Leader will be responsible for the following duties:

- Working with the SSHO to identify and evaluate hazards to prepare the Site-specific HASP addendum.
- Working with the SSHO to identify safe and secure locations for drummed waste

- Coordinating utilities location prior to subsurface investigations.

2.2.4 Site Safety and Health Officer

The SSHO will be onsite throughout the project and will be responsible for daily compliance with site safety and health requirements. The SSHO's responsibilities include the following:

- Implementing the HASP and the site-specific HASP addendum.
- Ensuring that anyone who enters the site has reviewed the HASP and the site-specific HASP addendum and signs the HASP review record in Appendix A.
- Stopping work when unacceptable safety or health risks exist.
- Providing an initial safety and health briefing to site workers and visitors and providing weekly safety and health meetings during the project performance. Daily meetings will be conducted during intrusive activities.
- Conducting necessary monitoring.
- Initiating the evacuation of the work site when needed, communicating with offsite emergency responders, and coordinating activities of onsite and offsite emergency responders.
- Determining if the abatement of hazardous conditions is sufficient prior to allowing resumption of work operations after an emergency.
- Establishing and ensuring compliance with site control areas and procedures.
- Supervising decontamination to ensure complete decontamination of personnel, tools, and equipment.
- Supervising the distribution, use, maintenance, and disposal of personal protective clothing and equipment.
- Coordinating with client safety officers.
- Investigating incidents/accidents and preparing any incident reports, as necessary.

2.2.5 Employees

Employees (including subcontractors) will be responsible for:

- Following the HASP, site-specific HASP addendum, and applicable safety and health rules, regulations, and procedures. Using required controls and safety devices, including PPE.
- Notifying their supervisor of safety and health hazards.
- Complying with training and medical requirements.

2.3 SUBCONTRACTORS

EA's subcontractors will be required to follow this HASP and the site-specific HASP addendum, as well as their own company's safety and health program and applicable regulations.

2.4 VISITORS

Visitors will remain in the support zone and will not be permitted to enter a contaminant reduction zone or an exclusion zone unless they have current and appropriate OSHA training and medical monitoring, and permission of the Field Team Leader and the SSHO.

3. EMPLOYEE TRAINING AND MEDICAL SURVEILLANCE

3.1 EMPLOYEE TRAINING

Hazardous waste workers will be trained to meet 29 CFR 1926.65 and other workers will be trained to meet other applicable OSHA regulations. Personnel who do not meet the following training requirements are prohibited from engaging in hazardous waste site operations within the contaminant reduction and/or exclusion zone. Documentation (certificates) of training will be onsite for each hazardous waste worker and will be checked for completeness by the Field Team Leader or SSHO. It is recommended that EA employees keep a copy of their training documentation with this HASP.

3.1.1 Site Workers

- Forty hours of Initial Offsite Hazardous Waste Operations Training and 3 days of onsite training under the direct supervision of a more experienced site worker.
- If more than 12 months have passed since initial training, an 8-hour Annual Refresher Training must be completed.

3.1.2 Field Team Leader

The same requirements stated above for site workers, plus an 8-hour Supervisor's Hazardous Waste Operations Training Course.

3.1.3 First Aid/CPR

At least one onsite worker will be currently certified in both first aid and cardiopulmonary resuscitation (CPR) by the American Red Cross or equivalent organization. First-aid training will be updated every 3 years and will include bloodborne pathogen training; CPR training will be updated annually. Documentation of certifications will be onsite.

3.2 MEDICAL SURVEILLANCE

Site workers will satisfactorily complete a comprehensive medical examination by or under the supervision of a licensed physician, preferably by one knowledgeable in occupational medicine prior to the initiation of field work. Medical examinations and consultations will comply with the protocols of 29 CFR 1926.65 and 29 CFR 1910.134 and will be provided according to the following schedule:

- Prior to fieldwork assignment.
- At least annually for employees covered by the program (biennially with the approval of the occupational physician).

- At termination of employment or reassignment to an area where the employee had not been examined within the past 6 months.
- As soon as possible after the development of signs or symptoms that may indicate an overexposure to hazardous substances or health hazards.
- More frequently if the physician deems such examination necessary to maintain employee health.

Documentation for compliance with 29 CFR 1926.65 will be onsite. Further documentation is maintained in EA's Office of Human Resources (410-584-7000). The records shall be complete and accurate and be kept on file for at least 30 years after termination of employment. A minimum of the following information shall be kept:

- Name and social security number
- Physician's written opinions, recommendations, limitations, and test results
- Employee medical complaints related to hazardous waste operations
- Information provided to the physician by the employee concerning possible exposures, accidents, etc.

4. SAFETY MEETINGS

4.1 PRE-ENTRY BRIEFING

The SSHO will brief workers and visitors on the potential hazards of the site and the protective measures to be implemented. Site-specific training will include the site monitoring equipment, emergency procedures, areas of restricted access, methods of decontamination, responsibilities for safety of personnel and property, physical, chemical and biological hazards and controls, PPE, and Safety Data Sheets (SDSs). Pre-entry briefings will be held prior to commencement of field activities, prior to initiating new or modified site activity, and at other times as necessary to ensure workers are knowledgeable of the HASP, the site-specific HASP addendum, and activity hazards.

4.2 WEEKLY SAFETY MEETINGS

The SSHO is responsible for conducting safety meetings at least weekly, and daily for intrusive work, to discuss status of site health and safety. These meetings shall also address employees' concerns regarding safety and hazard control practices and procedures implemented at the work site.

5. SITE CONTROL AND SECURITY

No unauthorized personnel will be permitted within the work zones at EA sites. Only personnel assigned to the specific work tasks (or supervision of) will be permitted to enter the work zones. Training and medical certificates required by this HASP and OSHA requirements will be maintained onsite by the Field Team Leader or SSHO.

5.1 WORK ZONES

Work zones are designed to prevent employees, visitors, and the surrounding environment from exposure to contamination during intrusive site activities. Work zones will be divided into three different areas by EA: the Exclusion Zone, Contaminant Reduction Zone, and Support Zone. Movement of personnel and equipment between zones and on and off the site will be controlled by means of designated access points. Minimum PPE for work in each zone is Level D, as described in Section 7.3.1. The SSHO will determine the need for and boundary/location of each work zone. As applicable, the SSHO may delineate work zones by means of caution tape, stakes or traffic cones.

Exclusion Zone

This zone will be determined by the SSHO after evaluating the potential for exposure to hazardous substances and presence of potential safety hazards. An Exclusion Zone typically includes the area no less than 25 feet (ft) around field-investigation activities. When the potential exists for unauthorized access, it is recommended that this zone will be clearly delineated with caution tape and stakes to prohibit unauthorized access from unauthorized persons. The area within the Exclusion Zone has the highest potential for exposure to hazardous chemicals. Therefore, proper PPE will be worn in this area. Entry into the Exclusion Zone will require donning the required PPE prior to entry. An entry and exit log will be maintained (Appendix B).

Contaminant Reduction Zone

This zone will be determined by the SSHO after evaluating potential for exposure to hazardous substances and presence of potential safety hazards. A Contaminant Reduction Zone is the area where decontamination procedures will take place before entering the support zone and will completely surround the exclusion zone. As applicable, this zone may be clearly delineated with caution tape and stakes to prohibit access from unauthorized persons. No area of the site should allow access from the Support Zone directly into the Exclusion Zone – one must first travel through the Contaminant Reduction Zone. The following rules apply:

- Entry into the Contaminant Reduction Zone will require the appropriate level of PPE necessary to protect against hazards involved in assisting in the decontamination process.
- Leaving the Contaminant Reduction Zone without following decontamination procedures is prohibited.

- Entering the Exclusion Zone without donning the appropriate PPE is prohibited.

Support Zone

The Support Zone is an area not designated as the Exclusion or Contaminant Reduction Zone and shall completely surround the Contaminant Reduction Zone. No area of the site should allow access from the Support Zone directly into the Exclusion Zone. Activities not permitted in the Contaminant Reduction Zone or the Exclusion Zone are likely permitted in the Support Zone, such as eating, drinking and taking necessary medication as approved by the SSHO.

5.2 SITE ENTRY AND EXIT

Persons entering the Exclusion Zone will be required to wear the PPE assigned by the SSHO as specified in Section 7.3. The following protocols will be followed when leaving the Exclusion Zone and Contaminant Reduction Zone:

- Personnel will exit through the designated exit points
- Personnel will proceed through appropriate decontamination, as specified in Section 11.

Potentially contaminated PPE will be removed in the Contaminant Reduction Zone.

5.3 BUDDY SYSTEM

During field activities that require more than one person, all site personnel will remain in verbal, radio, or mobile phone contact with each other. The Field Team Leader will have a mobile telephone and will be responsible for handling communications during emergencies that may arise.

5.4 SAFE WORK PRACTICES

Safe work practices that will be followed by site workers include, but are not limited to, the following rules:

- Working before or after daylight hours without special permission is prohibited.
- Eating and drinking, chewing gum or tobacco, and smoking in the Exclusion Zone and Contaminant Reduction Zone is prohibited.
- Possessing, using, purchasing, distributing, or having controlled substances in their system throughout the day or during meal breaks is prohibited.
- Consuming or possessing alcoholic beverages is prohibited.
- Good housekeeping—employees will be instructed about housekeeping throughout field activities.

- Sitting or kneeling in areas of obvious contamination while in the Exclusion Zone or Contaminant Reduction Zone is prohibited.
- Wash hands and face thoroughly upon leaving the work area in the Contaminant Reduction Zone.
- Immediately repair or replace defective PPE, but not while in the Exclusion Zone.
- Prescription drugs will not be taken by personnel unless specifically approved by a qualified occupational physician and then only within the Support Zone.
- When respirators are required, facial hair that interferes with the face-to-facepiece fit of the respirator will not be permitted and must be removed prior to arrival onsite or at an appropriate location within the Support Zone.
- Personnel onsite will use the buddy system; visual contact will be maintained between team members while in the Exclusion Zone.
- Dust suppression, such as wetting soil, shall be used to prevent dust generation at or near work areas when deemed appropriate and necessary by the SSHO or Field Team Leader.

5.5 DAILY STARTUP AND SHUTDOWN PROCEDURES

The following protocols will be followed daily prior to start of work activities:

- The SSHO will review site conditions to establish if modification of work and safety plans is needed.
- Personnel will be briefed and updated on new safety procedures as appropriate.
- Safety equipment will be checked for proper function.
- The SSHO will ensure that first aid equipment is readily available.
- The SSHO will initiate appropriate monitoring.

Personnel will proceed through appropriate decontamination procedures and facilities at the end of daily operations and before breaks.

6. HAZARD IDENTIFICATION AND HAZARD CONTROL

6.1 HAZARD COMMUNICATION

OSHA Hazardous Waste Operations, 29 CFR 1910.1200, requires a written hazard communication program and training on the contents for exposed field personnel. These regulations require review of the following items that will be discussed in the Pre-Entry Briefing by the SSHO and Field Team Leader:

- Specific requirements of the law and regulation
- Nature of hazardous substances in the workplace
- Protection from hazards
- Access to information through SDSs and labels
- Employees rights under the law.

An SDS will be kept onsite by the SSHO for chemicals brought onsite during field activities. Field personnel will be informed of the location of SDS by the SSHO. Subcontractors will inform the Field Team Leader and SSHO about hazardous substances brought onsite and provide appropriate SDSs to the SSHO. Chemicals brought onsite will be labeled in accordance with OSHA Hazard Communication Requirements, 29 CFR 1920.1200.

6.2 CHEMICAL HAZARDS

Table 6-1 presents the exposure limits, routes of exposure, and symptoms of exposure for chemicals of potential concern that may be present at the New Castle Public Wells Groundwater Plume Site.

Dermal contact with these chemical hazards is possible at the New Castle Public Wells Groundwater Plume Site. Many hazardous chemicals are readily absorbed through the skin. Therefore, appropriate dermal protection for the chemical will be worn when handling or contacting contaminated environmental media.

Proper respiratory protection will be worn when levels of organic vapors in the breathing zone exceed proposed action levels. If dust suppression with a water spray is not effective in controlling dust in the breathing zone, Level C PPE will be used, including respirators equipped with high efficiency particulate air (HEPA) cartridges.

6.3 PHYSICAL HAZARDS

Various physical hazards will potentially be present at the sites during field activities. These physical hazards may include, but may not be limited to:

- General Physical Hazards
- Fire/Explosion Hazards
- Heavy Equipment Hazards

- Vehicle and Pedestrian Hazards
- Noise Hazards
- Electrical Hazards
- Utilities
- Weather Hazards, including Heat or Cold Stress
- Material Handling/Moving/Lifting
- Drilling
- Trenching and Excavation
- Entry into Excavations.

6.3.1 General Physical Hazards

Hazardous waste and other field operation sites include many basic safety hazards, such as:

- Holes, ditches, etc., posing fall, cave-in, and other hazards.
- Precariously positioned objects, which may cause crushing or other injuries.
- Sharp objects (e.g., nails, metal shards, glass), which may cause cuts, injection, or other injuries.
- Slippery surfaces, posing slip and fall hazards.
- Steep grades and/or uneven terrain, posing slip, trip, and fall hazards.
- Unstable surfaces (e.g., walls that may cave-in, unstable underground structures), which may pose fall, crushing, or other injuries.

Basic safety hazards can directly injure workers and create additional hazards. For example, a person may trip due to uneven terrain, fall and be cut on rusty metal shards, and become inoculated with contaminants adhering to the metal.

Site personnel will look constantly, closely, and carefully for these basic safety hazards and immediately inform the SSHO of conditions that they feel may be hazardous. If hazards are present, these hazards will be recorded by the SSHO and precautionary measures will be taken to prevent injury.

6.3.2 Fire/Explosion Hazards

Explosion and fire hazards may be present at various sites due to ignition of chemicals, agitation of shock-sensitive compounds, the sudden release of materials under pressure, etc. Site operations will be conducted in accordance with local fire codes and regulations. The potential for fire and/or explosion emergencies is possible at the site in situations involving underground

storage tanks, confined space entry (i.e., manholes), landfills or in excavations or locations where hazardous vapors have accumulated.

If a potential for fire and/or explosion emergencies is present, workers will continuously monitor the work area for combustible or explosive gases when operations have the potential to generate sparks (such as the cutting of an underground storage tank for removal). Employees shall always be on the alert for unexpected events, such as ignition of chemicals or sudden release of materials under pressure, and be prepared to act in these emergencies.

Field vehicles and heavy equipment will be equipped with fire extinguishers. Employees will be trained in the proper use of fire suppression equipment. Large fires, not able to be controlled with a fire extinguisher, will be handled by the professionals of the local fire department. The SSHO will notify site workers during the pre-entry briefing of the availability of “911” service in the area. This information will be provided in the site-specific HASP addendum. In the event of a fire, employees will report to the pre-determined rally point unless this location has become dangerous due to the existing emergency. Persons directly involved in the emergency along with the SSHO will then complete an accident report. Further discussion is presented in Chapter 12.

6.3.3 Heavy Equipment Hazards

The use of heavy equipment (e.g., drill rigs, generators, compressors, etc.) may pose safety hazards to site workers. Heavy equipment work will be conducted only by trained, licensed, and experienced personnel. Site workers will remain outside the turning radius of large, moving equipment. At a minimum, personnel will maintain visual contact with the equipment operator.

No personnel are permitted to work underneath heavy equipment or hoisted loads because this practice poses a serious crushing hazard.

Belts, pulleys, sheaves, gears, chains, shafts, clutches, drums, flywheels, and other moving parts of equipment can pose injury hazards. No guard, safety appliance, or other device will be removed or made ineffective unless repairs or maintenance are required and then only after power has been shut off and locked out. Safety devices will be replaced once repair/maintenance are complete.

Exhaust from equipment powered by steam or combustion engines will be properly located so that release of exhaust does not endanger workers or obstruct the view of the operator. Gasoline-operated equipment will be re-fueled properly to prevent fire hazards; power will be off, no smoking allowed, and proper dispensing equipment will be used.

When not operational, equipment will be set and locked so that it cannot be activated, released, dropped, etc.

6.3.4 Vehicle and Pedestrian Hazards

Traffic at certain sites, particularly active sites in busy areas, presents a hazard to site personnel. Equipment will be located in an area that does not present hazards to bystanders. Barriers will be used to separate the work areas from both vehicle and pedestrian traffic areas and to prevent inadvertent entry of either type of traffic into the work area. The demarcated area will include adequate buffer zones between the actual work area and traffic areas. Standard traffic cones are not considered adequate for these situations, due to their low vertical profile. Taller, 28-inch cones can be effectively modified with warning flags and barricade tape. Safety pennants and plastic or steel “A” frame type barricades may also be used in high traffic areas. Flashing warning lights may also be necessary. Barriers demarcating the work area and buffer zone are required even if the site is inactive during work operations.

Employees exposed to public vehicular traffic will be provided with and will wear warning vests or other suitable garments marked with or made of reflectorized or high-visibility material. In addition, EA will coordinate with the local authorities on and/or near common roadways, private roads, etc.

6.3.5 Noise Hazards

The equipment at the treatment facilities often creates excessive noise. Noise can cause workers to be startled, annoyed, or distracted; it can cause physical damage to the ear, pain, and temporary and/or permanent hearing loss; and it can interfere with communication. If workers are subjected to noise exceeding an 8-hour time-weighted average sound level of 85 decibels on the A-weighted scale (dBA), hearing protection will be provided with an appropriate noise reduction rating to comply with 29 CFR 1910.95 and reduce noise levels to or below 85 dBA. Workers involved in drilling or heavy machinery operation activities are likely to be subjected to noise exceeding sound levels of 85 dBA peak sound pressure. At this level, hearing protection will be selected by the SSHO with an appropriate Noise Reduction Rating to reduce noise levels to or below these values.

6.3.6 Electrical Hazards

Overhead power lines, electrical wiring, electrical equipment, and buried cables pose risks to workers of electric shock, burns, muscle twitches, heart fibrillation, and other physical injuries, as well as fire and explosion hazards. Prior to bringing drilling and/or direct push equipment on the job site, a survey will be done by the SSHO to identify overhead electrical hazards and potential ground hazards, such as underground utilities. The SSHO will be responsible for ensuring that the utility locating service has completed a utility marking for the site prior to intrusive site work. Employees will be aware of the risk of electric shock, burns, muscle twitches, heart fibrillation, and other physical injuries, as well as fire and explosion hazards, associated with overhead power lines, electrical wiring, electrical equipment, and buried cables.

If overhead lines are encountered and cannot be de-energized prior to the start of work, a 10 ft distance will be maintained between overhead energized power lines with a voltage of 50 kilo-

volts (kV) and elevated equipment parts. Operating procedures will be in accordance with minimum clearance distances from energized overhead electric lines as follows:

<u>Nominal System Voltage</u>	<u>Minimum Required Clearance</u>
0 - 50 kV	3 m (10 ft)
51 - 200 kV	4.5 m (15 ft)
201 - 300 kV	6 m (20 ft)
301 - 500 kV	7.5 m (25 ft)
501 - 750 kV	10.5m (35 ft)
751 - 1000 kV	13.5 m (45 ft)

In accordance with OSHA's standard for Electrical Safety-Related Work Practices (29 CFR 1910.331-.335), protective measures will be taken when working near live electrical parts, including but not limited to:

- Insulation and guarding of live parts
- Grounding
- De-energizing live parts followed by lockout/tag-out to prevent inadvertent re-activation of the parts
- Electric protective devices (e.g., insulated tools)
- Safe work practices, including:
 - Inspection of the work area to identify potential spark sources
 - Maintenance of a safe distance from live electrical parts
 - Proper illumination of work areas
 - No "blind reaching" around live electrical equipment
 - Provision of barriers, shields, or insulation to prevent inadvertent contact with live parts
 - Use of nonconductive, intrinsically safe equipment near live parts.

EA personnel will not be permitted to work on electric parts of equipment that have not been de-energized, locked out, and tagged by personnel trained to work with electrical equipment. No EA employee will work near energized exposed live parts without the use of protective measures. PPE designed to protect against electrical hazards may be specified for certain work operations. The Project Manager is responsible for ensuring that appropriate safety measures are implemented to protect against electrical safety hazards on their sites.

Lightning is an electrical hazard during outdoor operations, particularly for workers in open areas and handling metal equipment. Weather conditions will be monitored, and work will be

suspended at the discretion of the SSHO during electrical storms. The Field Team Leader will relay an order to suspend work due to weather to site workers.

6.3.7 Utilities

The SSHO will be responsible for ensuring that the utility locating service has completed a utility marking for the site prior to site intrusive work. These markings show an estimated location of underground installations, including sewer, telephone, fuel, electric, water lines or other underground installations that reasonably may be expected to be encountered during invasive work. Site maps will also be utilized when available to note underground hazards. Using a pipe and cable locator or metal detector may also be necessary to accomplish locating these hazards. The following is the Delaware utility clearance phone number: Miss Utility of Delaware 800-282-8555.

Underground utilities pose hazards to workers involved in invasive operations such as excavating, drilling and direct-push sampling. These hazards include electrical hazards, explosion, and asphyxiation, as well as costly and annoying hazards associated with damaging communication, sewer, and water lines. Prior to commencement of invasive operations, underground utilities, including buried wires, pipes, tanks, etc., will be visibly marked with flags or marking paint to alert workers to areas unsafe for digging/excavating. Personnel will be aware that although an area may be 'cleared', unanticipated hazards may occur.

Workers will be alert for unanticipated events such as snapping cables, drilling into unmarked underground utilities, drilling into a heavily contaminated zone, etc. Such occurrences will prompt involved individuals to halt work immediately and take appropriate corrective measures to gain control of the situation.

6.3.8 Weather Hazards

Weather conditions will be taken into consideration. Heavy rains or snowfall, electrical storms, high winds, and extreme temperatures, for example, may create extremely dangerous situations for employees. Inclement weather may also impair equipment performance. Whenever unfavorable conditions arise, the Field Team Leader and SSHO will evaluate both the safety hazards and the ability of the employees to effectively perform given tasks under such conditions. Activities will be halted at the discretion of the SSHO and initiated by the Field Team Leader.

When site activities involve drilling or the operation of heavy equipment, site activities will cease when lightning has been sighted in an approaching storm. The danger of electrocution exists if a piece of machinery (i.e., a drill rig) is struck by lightning.

Wind direction will be considered when positioning for sampling or conducting intrusive work. If exposure to contaminated emissions is anticipated, workers will locate upwind. Wind direction often changes abruptly and without warning, so personnel will be prepared to reposition, if necessary.

6.3.9 Temperature-Induced Stresses

6.3.9.1 Heat Stress

Heat stress hazards can occur even in temperatures not commonly considered “hot” due to the level of physical activity, the level of PPE the worker is wearing, or the physical condition of the worker. Illness resulting from exposure to extreme heat is possible during field operations. Personnel, especially those in impermeable clothing (i.e., chemical suits), will be familiar with the signs and symptoms of heat stress, including:

- **Heat Cramps:** Muscle spasms in the abdomen or limbs. Frequent rest periods and fluid intake are appropriate measures to prevent or reduce heat cramps.
- **Heat exhaustion:** Severe dehydration; pale, clammy skin; profuse sweating; dizziness, light-headedness; slurred speech; rapid pulse; confusion; fainting; fatigue; cool skin; nausea. Affected personnel will be escorted from the site, decontaminated promptly, set in cool, shaded area, and given fluids slowly.
- **Heat stroke:** Life-threatening condition occurring when the body’s temperature-regulating system improperly functions. Hot dry skin; rapid, deep breathing; lack of perspiration; delirium; high fever (often 106 degrees Fahrenheit [°F] or more), nausea; unconsciousness. Brain damage and/or death may occur, if body temperature is not reduced. Provide fluids, use cooling devices (hose-down or shower), call emergency medical services or transport to hospital immediately.

Some preventive measures to avoid heat stress include:

- Frequent resting in cool or shaded areas
- Prevent heat stress by resting frequently in a shaded area and consuming large quantities of fresh potable water (more than amount needed to simply “quench thirst”). Drink at least 8 ounces of water or diluted Gatorade every 2 hours when temperatures exceed 75°F. Do not consume alcoholic beverages to combat dehydration or heat stress.

Heat stress monitoring will be conducted in a manner that anticipates and prevents the onset of heat stress symptoms (i.e., wet-bulb globe temperature [WBGT] monitoring coupled with OSHA work-rest regimens). If the WBGT Index is used and semi-impermeable or impermeable clothing is worn, the WBGT Index will be lowered, as appropriate.

Non-acclimated workers and workers wearing full body impermeable chemical protective clothing shall be monitored when the work area temperature is greater than 70°F. The worker’s heart rate and blood pressure will be measured at the start of a rest break, and the work period will be decreased so that after 1 minute of rest, a worker’s heart rate does not exceed 110 beats per minute.

A suggested work-rest regimen is:

<u>Ambient Temperature</u>	<u>Work</u>	<u>Rest</u>
70°F	3 hours	15 min
75°F	2-1/2 hours	15 min
80°F	2 hours	15 min
85°F	1-1/2 hours	15 min
90°F	1 hour	15 min
95°F	½ hour	15 min

If a worker's heart rate is greater than 110 beats per minute, the next work period will be shortened by 33 percent, while the length of the rest period stays the same. If the heart rate is 110 beats per minute at the beginning of the next rest period, the following work cycle will be shortened by 33 percent. When ambient temperatures are expected to exceed 75°F, the resting heart rate of each worker will be measured prior to the start of onsite activities.

Other factors, such as a worker's level of acclimation, level of physical fitness, and age, may increase or decrease his susceptibility to heat stress. Before assigning a task to an individual worker, these factors will be taken into account to ensure that the task will not endanger the worker's health.

If a heat-related illness is suspected or observed, the affected person will be moved to a cool or shaded area and given plenty of liquids to consume. If symptoms of a heat stroke are observed, the victim will be cooled and immediately and call 911.

6.3.9.2 Cold Stress

Cold stress hazards are most likely to occur at low temperatures or low wind chill factors, with wet, windy conditions contributing to risk. Workers will be familiar with the signs and symptoms of cold stress, which include:

- **Hypothermia:** Cold-induced decreasing of the core body temperature that produces shivering, numbness, drowsiness, and muscular weakness. If severe enough, it can lead to unconsciousness and death.
- **Frostbite:** Constriction of blood vessels in the extremities and decreasing the supply of warming blood. This may result in formation of ice crystals in the tissues, causing tissue damage. Condition may range from frostnip, which is a numbing of extremities, to deep-freezing tissue beneath the skin. Symptoms include white or grayish skin, blisters, numbness, mental confusion, failing eyesight, fainting, shock, and cessation of breathing. Death may occur from heart failure.

Pain in the extremities may be the first warning of cold stress, and precautions will be taken to reduce exposure. Maximum severe shivering will be taken as a sign of immediate danger to the worker, and exposure to cold will be immediately terminated. Personnel exhibiting signs and

symptoms of cold stress will be removed from the site, decontaminated, and given appropriate first aid. Emergency medical services will be contacted if symptoms are severe (e.g., more than numbness of the extremities or shivering). When air temperatures are less than 36°F (including wind chill), workers who become immersed in water or whose clothing becomes wet will be immediately provided a change of clothing and be treated for hypothermia.

As a precautionary measure, employees will wear layers of loose-fitting clothing including insulated coveralls, head cover (perhaps a liner beneath a hard hat), and boots when temperatures fall below 40°F, including wind chill. Protection of the hands, feet, and head is particularly important because these are likely to be injured first by cold. However, actual injury to hands, feet, and head is not likely to occur without prior development of early signs of hypothermia such as numbing and shivering. Bare skin contact with cold surfaces (below 32°F) will be avoided. Table 6-2 presents the cooling power of wind on exposed flesh expressed as equivalent temperature. Personnel will wear wind-resistant outer shell to decrease wind chill effects. No continuous exposure to cold is permitted when the air speed and temperature results in an equivalent chill temperature of 26°F or less.

A temperature-dependent work regimen limiting lengthy periods of outdoor activity may be necessary. Table 6-3 gives the threshold limit values work/warm-up schedule for a 4-hour shift. Workers entering heated shelters will remove the outer layer of clothing and loosen remaining clothing to permit the evaporation of perspiration. Workers will avoid dehydration by drinking water or other decaffeinated beverages, including warm drinks and soups; excludes alcoholic beverages.

6.3.10 Material Handling/Moving/Lifting

Materials handling at hazardous waste sites can vary from heavy equipment handling to manually moving/lifting items. Hazards associated with materials handling include physical injury, detonation, fire, explosion, and vapor generation among others.

Injuries to back and abdominal muscles from improperly lifting of loads are the most common occupational injuries reported. Such injuries can range from relatively mild strains to major, permanently disabling injuries. Before lifting a load, personnel will consider the overall weight, distribution of weight, unwieldiness or awkwardness of the load, distance to be carried, obstacles to be negotiated, site conditions, and visibility.

When using equipment to move materials; proper work practices will be followed. Equipment used will be designed for the task to be performed. Equipment will be inspected regularly by the SSHO and the Field Team Leader, and damaged or defective equipment will be removed from service. Planning is critical when handling materials. The Field Team Leader, in conjunction with the Project Manager, will plan where the materials are to be moved, taking into consideration the current location of such materials and hazards associated with moving them. Routes for moving materials will be clearly outlined, with paths cleaned of obstructions so materials may be transported.

Loads will be lifted using the power of the leg muscles rather than the back, stomach, or arm muscles. The item will be approached to balance the load evenly. Backs will be kept straight and the arms nearly parallel with the body. The knees will be bent to grasp the load. Lifting will be done by straightening the legs without bending the body, holding the load as close to the body as possible and the back remaining as straight as possible.

Bulky, heavy loads will be handled by at least two people, ensuring that the load is level and evenly distributed between personnel helping to carry it. Carriers will know the destination and path for the load.

6.3.11 Drilling/Well Installation

The selection of locations for each drilling/well installation site will take into account buried utility pipes, wires, conduits, tanks, or other potentially dangerous structures. Overhead power lines and obstructions will also be surveyed when using drill rigs with elevated parts. Prior to raising the mast of rigs, the area immediately overhead and surrounding the rig will be checked by the drilling foreman and the SSHO.

If overhead lines cannot be de-energized prior to the start of work, the following minimum distances will be maintained between the lines and both site workers and the longest conductive object present (including vehicles with elevated structural parts):

<u>Nominal System Voltage (kV)</u>	<u>Minimum Required Clearance</u>
0-50	3 m (10 ft)
51-200	4.5 (15 ft)
201-300	6 (20 ft)
301-500	7.5 (25 ft)
501-750	10.5 (35 ft)
751-1000	13.5 (45 ft)

When the drill rig is in transit, with boom lowered and no load, the equipment clearance will be at least 4 ft for voltages less than 50 kV, 10 ft for voltages of 50 kV or greater (up to and including 345 kV), and 16 ft for voltages above 345 kV.

During drilling/well installation operations, setup, and takedown, persons who enter the Exclusion Zone will wear hard hats (when overhead hazards are present), safety shoes/boots, and safety glasses/face shields to protect personnel from the physical hazards.

If during drilling operations there is indication that buried drums, underground storage tanks, or other anomalies are being encountered, the drilling will be halted immediately and the SSHO will notify the Field Team Leader. Indications that an anomaly may have been encountered include:

- Change in the speed or momentum of the rig
- Visual examination of drill cuttings

- Direct-push refusal on hard object
- Odor noted in the cuttings or exiting borehole
- The presence of airborne total volatile organics (as measured with a direct-reading instrument).

Drilling/well installation equipment also involves basic safety hazards (e.g., snapping cables, slings, ropes, moving heavy equipment, slip and trip hazards, etc.). Accidents may include head injuries from falling tools and equipment, hand and foot injuries due to moving equipment, and crushing injuries from unstable equipment or careless moving of equipment. If possible, EA personnel will remain outside the turning radius of moving parts. If this is not feasible then, at a minimum, EA personnel will maintain visual contact with the equipment operator when equipment is active.

6.4 BIOLOGICAL HAZARDS

Workers will be encouraged to wear protective clothing to protect against insects, and for added protection, specialized sprays or lotions may be applied to the clothing and skin to protect against fleas, ticks, mosquitoes, and poisonous plants. Contact will be avoided with syringes and medical or biohazard waste encountered in an uncontrolled setting and will be reported immediately to the SSHO.

6.4.1 Poisonous Plants

Poisonous plants, such as poison ivy, poison oak, or poison sumac may be present at various sites. Personnel are expected to know how to recognize these plants and avoid them. If these plants need to be removed to obtain a work area free of hazards, gloves will be worn to protect against the poisonous oils of the plant, and the plant will be placed in a trash bag and disposed of in a proper receptacle. Never burn a poisonous plant; smoke and vapors are also poisonous when inhaled. If dermal contact occurs, the affected areas will be washed with soap and water immediately.

6.4.2 Insect Bites/Stings

Protective outer clothing such as gloves, hard hats, and coveralls can reduce the potential for insect bites and stings. Avoid disturbing insect nests encountered on the job site if possible, otherwise an insect swarm may develop. If an insect nest (i.e., a beehive) is encountered in an area that is likely to be disturbed during site activities, the nest will be eradicated prior to site activities to ensure employee safety.

Insect bite symptoms may include redness, rash, swelling, chills, fever, diarrhea, and vomiting. A worker who has been bitten or stung and shows symptoms of a severe reaction will seek medical assistance immediately. Workers with allergies to insects (i.e., bees) should advise their employer prior to field activities and should carry an antidote kit, if necessary.

To prevent contact with fleas or disease-carrying ticks (deer ticks), workers will ideally wear long-sleeved shirts, long pants, and boots that extend above the ankle with pants cuffs taped to boots, especially when working in wooded, overgrown, or high grass areas. Workers will thoroughly check clothing, skin, and hair for the presence of ticks at the end of each workday. If a tick attaches to the body, it will be removed by gently tugging with tweezers where the mouth-parts enter the skin. The tick should not be killed prior to removal. A deer tick is as small as the area of a pinhead and often has a white or red dot on its head. A wood tick is larger, and typically is not a carrier of Lyme disease. If a worker suspects he has been bitten by a tick, the area shall be monitored for several days/weeks by the individual for the development of a noticeable bulls-eye shaped skin rash at the affected area. If this develops, seek immediate medical attention for a possible infection of Lyme disease. Insect repellent containing DEET® is also an effective means of tick control.

Mosquitoes may also carry disease; therefore, workers will ideally wear long-sleeved shirts, long pants, and boots that extend above the ankle with pant cuffs taped to the boots, especially when working in wooded, overgrown, or high grass areas.

6.4.3 Animal Bites

Rodents, snakes, stray dogs, stray cats, raccoons or other animals may be encountered on job sites. The only effective measure to preclude animal bites is avoidance. Contact with wild animals will be avoided. Do not reach into an object such as a pipe that may contain a rodent or other animal or attempt to remove the animal. If possible, delay activity in this area until the animal leaves or has been removed by an animal control unit. If it is necessary to use or move an object where an animal is hiding, the SSHO may have to notify the local animal control agency to subdue an animal that may cause a risk to workers (i.e., a raccoon). Do not approach an animal under any circumstance as this may cause the animal to be in an aggressive state. Persons bitten by an animal will seek medical assistance immediately, especially if it is suspected that the animal may be rabid. Aggressive or disoriented behavior, as well as foaming at the mouth, can be signs of rabid animals. Until medical assistance can be reached, persons will watch for symptoms of severe swelling, nausea, and shock. The local animal control agency will be contacted if a stray dog is observed on the property, especially if its presence will obstruct work activity or endanger the animal's safety. Do not attempt to leash a stray dog (no matter how harmless it may appear); doing so would greatly increase the risk of an animal bite.

Table 6-1. Potential Chemicals of Concern at New Castle Public Wells Groundwater Plume Site.

Compound	PEL or TLV/STEL ^(a)	IDLH ^(a)	Route of Exposure	Symptoms
Perfluorocarbons	No data	No data	Inhalation, Ingestion, Skin/Eye Contact	Potential changes in cholesterol and sex hormones; animals irritation of the eyes and nose, liver damage and weight loss
Tetrachloroethylene (PCE)	25 ppm/100 ppm C 200 ppm	1,000 ppm	Inhalation, Ingestion, Skin/Eye Contact	Irritated eyes, respiratory system; CNS depressant.
1,2-Dichloroethylene (<i>cis</i> - and <i>trans</i> -)	200 ppm / 200 ppm	Ca 1,000 ppm	Inhalation, Ingestion, Absorption, Skin/Eye Contact	Irritated eyes, skin; headache, dizziness, vertigo, visual distortion, fatigue, giddiness, vomiting, dermatitis, nausea.
Trichloroethylene (TCE)	50 ppm/100 ppm	Ca	Inhalation, Skin/Eye Contact (with liquid)	Weakness, abdominal pain, GI bleeding, enlarged liver.
Vinyl chloride	1 ppm/C 5 ppm	Ca	Inhalation, Skin/Eye Contact (with liquid)	Weakness, abdominal pain, GI bleeding, enlarged liver.

Table 6-2. Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature (Under Calm Conditions)^(a)

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect)	LITTLE DANGER In <1hr with dry skin, maximum danger of false sense of security				INCREASING DANGER Danger from freezing of exposed flesh within one minute			GREAT DANGER Flesh may freeze within 30 seconds				
(a) Developed by U.S. Army Research Institute of Environmental Medicine, Natick, Massachusetts.												
NOTE: Trenchfoot and immersion foot may occur at any point on this chart.												

Table 6-3. Threshold Limit Values Work/Warm-Up Schedule for 4-Hour Shift^(a)

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26 to -28	-15 to -19	(NB)	1	(NB)	1	75 min	2	55 min	3	40 min	4
-29 to -31	-20 to -24	(NB)	1	75 min	2	55 min	3	40 min	4	30 min	5
-32 to -34	-25 to -29	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35 to -37	-30 to -34	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38 to -39	-35 to -39	40 min	4	30 min	5	Non-emergency work should cease					
-40 to -42	-40 to -44	30 min	5	Non-emergency work should cease							
-43 and below	-45 and below	Non-emergency work should cease									

(a) Adopted from Occupational Health and Safety Division, Saskatchewan Department of Labor.

NOTES:

- Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods of 10 minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For light-to-moderate work (limited physical movement), apply the schedule one step lower. For example, at -35°C (-30°F) with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with four breaks in a 4-hour period (Step 5).
- The following is suggested as a guide for estimating wind velocity if accurate information is not available: 5 mph-light flag moves; 10 mph-light flag fully extended; 15 mph-raises newspaper sheet; 20 mph-blowing and drifting snow.
- If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given would be: (1) special warm-up breaks should be initiated at a wind chill cooling rate of about 1,750 W/m²; (2) all non-emergency work should have ceased at or before a wind chill of 2,250 W/m². In general, the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges because windy conditions rarely prevail at extremely low temperatures.
- Threshold Limit Values apply only for workers in dry clothing.

°C = Degrees Celsius.
°F = Degrees Fahrenheit.
min = Minutes.
mph = Miles per hour.
NB = Normal breaks.

7. PERSONAL PROTECTIVE EQUIPMENT

7.1 GENERAL PPE REQUIREMENTS

Personnel will be equipped with proper PPE for the tasks they are asked to perform. The SSHO will distribute PPE to employees and will also train employees in proper use and disposal of PPE. Subcontractors are responsible for providing proper PPE for their own employees.

Respiratory fit-tests will be performed as necessary prior to the start of field activities. Adequate records of results, including size and brand of respirators in which employees passed fit-test requirements, will be kept.

Should PPE fail during use, the affected person will leave the Exclusion Zone immediately and replace or repair failed PPE in the Contaminant Reduction Zone. This person is not permitted to re-enter the Exclusion Zone until the problem has been rectified.

7.2 INITIAL REQUIREMENTS/UPGRADE OR DOWNGRADE OF PPE LEVELS

Based on an evaluation of the potential safety and health hazards, the required initial levels of PPE will be presented in the site-specific HASP. During field operations, the SSHO will evaluate environmental monitoring results and potential for exposure to hazards. The SSHO can authorize an upgrade or downgrade of the PPE level worn onsite, using the criteria presented in Table 8-1 or the site-specific HASP. Changes in PPE level, including the rationale for the changes, will be documented on the site health and safety activity report (Appendix C). Respirator cartridges will be changed daily or more frequently if required by manufacturer's recommendations.

7.3 LEVELS OF PPE

Engineering controls and work practices will be used where feasible to minimize potential hazards. The components of each level of PPE anticipated to be donned during field activities are listed below.

7.3.1 Level D PPE

Level D protection will be the minimum protection used for field operations. The following are the minimum requirements for Level D:

- Steel-toe, steel-shank safety shoes/boots
- Chemical resistant boot covers (optional)
- Hard hat that meets American National Standards Institute (ANSI) Standard Z89.1-1986 (when overhead hazards are present, or as required by SSHO)

- Chemical-resistant gloves (nitrile gloves when water sampling)
- Leather work gloves (as appropriate)
- Safety glasses (as appropriate)
- Hearing protectors (when noise hazards are present or as required by SSHO)
- Face shield (when operating steam cleaner or pressure washer)
- Coveralls (as appropriate)
- Poly-coated coveralls (when splash hazards are present or contact with heavily contaminated soil/water is expected).

7.3.2 Level C PPE

Level C protection will be used when the concentrations and types of airborne substances are known and criteria for the use of air-purifying respirators are met. The following are the minimum requirements for Level C:

- Full-facepiece, air-purifying respirator equipped with combination organic vapor and HEPA used in accordance with 29 CFR 1910.134
- Filters will be changed per established change schedule and/or daily even if the cartridge is not suspected to be at its capacity
- Steel-toe, steel-shank safety shoes/boots
- Chemical-resistant boot covers (as appropriate)
- Hard hat that meets ANSI Standard Z89.1-1986 (when overhead hazards are present or required by SSHO)
- Chemical-resistant inner and outer gloves
- Chemical-resistant coveralls with ankle and wrist openings taped
- Hearing protection (when noise hazards are present, or as required by SSHO).

7.3.3 Level B PPE

Level B protection will be used when the highest level of respiratory protection is required but the highest level of skin protection is not required. The following are the minimum requirements for Level B:

- Positive-pressure, supplied air breathing apparatus with full-facepiece mask and 5-minute escape bottle
- Steel-toe, steel-shank safety shoes/boots
- Chemical-resistant boot covers taped to coveralls
- Hard hat (when overhead hazards are present, or as required by SSHO) that meets ANSI Standard Z89.1-1986
- Chemical-resistant inner and outer gloves taped to coveralls
- Chemical-resistant suit complete with a chemical-resistant hood
- Hearing protectors (when noise hazards are present, or as required by SSHO).

No Level A work is to be conducted under this HASP.

7.4 HEARING PROTECTION

The groundwater treatment system equipment gives off a significant amount of noise (often exceeding 85 dBA). Hearing protection will be available to workers and should be worn at all times. Muffs and/or foam ear plugs will be available for hearing protection. Hearing protection that best suits the workers' needs without restricting or impairing their abilities will be chosen.

7.5 INSPECTION AND MAINTENANCE OF PROTECTIVE EQUIPMENT

Effective use of protective equipment requires that the equipment be properly used, maintained, and inspected periodically during the day. Site-specific issues and standard procedures will be reiterated during pre-entry training.

Gloves/Coveralls

Gloves and coveralls will be regularly inspected and replaced promptly if torn while in the Contaminant Reduction Zone. Disposable coveralls will be replaced daily at a minimum. Reusable gloves will be decontaminated whenever exiting the Exclusion Zone or Contaminant Reduction Zone.

7.6 COMMUNICATIONS

Should the use of PPE interfere with verbal communication, standardized hand/body signals will be used to maintain communications between personnel in the various work zones throughout the duration of each specific operation. These hand/body signals are:

- Hand clutching throat = “Out of air, can’t breathe.”
- Hands on top of head = “Need assistance.”
- Thumbs up = “OK,” “I’m alright,” or “I understand.”
- Thumbs down = “No,” or “negative.”
- Grip partner’s wrist or both hands around partners waist = Leave area immediately.

Communications also will be established between personnel in the Support Zone and emergency response personnel via the mobile telephone located in field vehicle. Emergency response procedures are discussed in more detail in Chapter 12.

8. ENVIRONMENTAL MONITORING

8.1 GENERAL

The following monitoring program is to be instituted during operations at the site. The monitoring program may be modified by the Manager, Health and Safety, based on site conditions and monitoring results. Monitoring will be accomplished under the direction of the SSHO who will interpret the results. The results will be recorded on an environmental monitoring record (Appendix D). Environmental monitoring requirements are presented on Table 8-1, which is to be included in the site-specific HASP addendum. Table 8-1 represents a worst-case scenario and presents monitoring requirements and exposure limits for sites with unknown contaminants and unknown concentrations. Where general site contaminants and concentrations are known, Table 8-1 can be modified in the site-specific HASP to represent known site conditions.

When oxygen levels are monitored, the oxygen level should be 20.8% (background). Readings above or below 20.8% oxygen should be further evaluated to determine the cause and if controls are needed.

8.2 REAL-TIME AIR MONITORING

The air monitoring program will include sufficient monitoring of air quality in work zones and other onsite areas to assess levels of employee exposure, establish that the work zone designations are valid, and verify that the respiratory protection being worn by personnel is adequate. The air monitoring program is also designed to ensure that contaminants are not migrating offsite to minimize exposure of nearby populations and/or workers. Air monitoring will be conducted:

- Periodically during the site field investigations
- When work begins on a different portion of the site
- When contaminants other than those previously identified are being handled or encountered
- When a different type of field investigation is initiated
- If personnel are working in areas with obvious liquid contamination
- If a sufficient reasonable interval has passed so that exposures may have significantly increased

Measurements will be taken at the anticipated source and in the breathing zone of site personnel during field activities utilizing the instruments specified in Table 8-1. Response action levels are also presented in this table.

8.3 PERIMETER MONITORING

If real-time air monitoring in the Exclusion Zone indicates readings above action levels, monitoring for contaminant concentrations will be conducted during operations at least two times each day at the perimeter of the site as specified by the aforementioned tables. If airborne levels of contaminants exceed established action levels for a sustained period of time beyond the perimeter of the site, the work will be stopped, the suspected source of the contamination will be covered to eliminate emissions, and the Manager, Health and Safety, and Project Manager will be notified. A decision will then be made as to how to proceed with the work and how to more fully characterize the airborne emissions. Work zones may need to be modified as a result of air monitoring readings in the Exclusion Zone and during perimeter monitoring.

8.4 CALIBRATION AND MAINTENANCE

Direct-reading instruments will be calibrated initially, and instructions in the manufacturers' operations manuals regarding calibration, cleaning, and maintenance of the instruments will be followed (Appendix D). A calibration and maintenance log for each instrument will also be maintained (Appendix D). The log should contain detailed descriptions of problems encountered with the instrument along with any records of factory calibration and repair.

8.5 HEAT STRESS MONITORING

Ambient temperatures at the site combined with the requirements for PPE use may contribute to heat stress. While using impermeable PPE when ambient temperatures reach or exceed 70°F, heart rates will be monitored when heat stress conditions may occur. Work-rest regimens will be adjusted accordingly.

Table 8-1. Environmental Monitoring Requirements

Instrument	Location of Monitoring	Frequency	General Action Level	Site-Specific Action Level	Response
Total Volatile Organics Detector (Photoionization detector)	Breathing Zone	Initially and every 30 minutes	Above background	_____ Same or Specify	Begin perimeter monitoring. Upgrade to Level C personal protective equipment
			>5 parts per million	_____ Same or Specify	Withdraw from site, prepare to upgrade to Level B
	Perimeter monitoring	2 times per day	Above action level established in site specific HASP	Above action level established in site-specific Health and Safety Plan	Shut down operations and identify source of contamination and cover.

General Action Levels represent worst-case conditions for unknown contaminants/concentrations. Table 8-1 can be modified in HASP addenda to reflect site-specific conditions

The readings must remain <10% of the Lower Exposure Limit in order to enter an excavation or other area containing combustible gas.

Action levels represent concentrations or percentages that are sustained for the monitoring period specified under “Frequency” and do not reflect peak levels.

9. CONFINED SPACE ENTRY PROCEDURES

Confined spaces present unique hazards due to their configuration and/or contents. If air circulation is restricted within a confined space, a hazardous atmosphere may accumulate quickly. Confined spaces may present entrapment hazards. The limited space can increase the risk of injury or death by making employees work closer to hazards. Workplace hazards encountered elsewhere, such as electrical shock and contact with machinery and chemicals, may also be encountered in confined spaces, but may be intensified by the conditions of confined space work. Asphyxiation, fire(s) and explosion, toxic atmosphere, engulfment, and mechanical hazards have been identified as causes of fatalities in confined space entries. Historically, the largest numbers of fatalities have been untrained rescuers.

Confined spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces more than 4 ft in depth, such as pits, tubs, vaults, and vessels.

EA does not anticipate confined space entries at the Site but if needed, we will provide additional procedures as necessary.

10. SPILL CONTAINMENT PROCEDURES

Small incidental spills that do not cause injury to personnel or the environment will be cleaned as quickly as possible. Waste will be disposed of properly and labeled accordingly.

Large spills that may harm personnel or the environment will be dealt with at once. First aid will be of primary importance. Spill containment procedures will follow, and emergency contacts can then be made. The Field Team Leader or SSHO will notify the EA Project Manager. Many hazardous chemicals are listed by the United States Environmental Protection Agency as having Reportable Quantities. Spills involving these chemicals in amounts of the Reportable Quantity or greater will require reporting to the appropriate federal, state, and local agencies. It is the client's responsibility to report to other government agencies. Emergency telephone numbers are provided in Section 12.

11. DECONTAMINATION PROCEDURES

Personnel and equipment that enter an Exclusion Zone (i.e., personnel, drill rigs, monitoring equipment, field sample collection equipment, etc.) will be decontaminated prior to exit. Decontamination will be supervised by the SSHO. The decontamination supplies and equipment will be maintained by the SSHO. The decontamination procedure described herein assumes the contaminating substances are particulate matter and soils containing heavy metals and leachate. The decontamination procedure will be modified in the site-specific HASP addendum if the type of contaminating substance or its hazard potential is altered.

11.1 PERSONNEL DECONTAMINATION

Remove and discard boot covers, if worn. Wash boots with detergent and water; rinse. Remove and discard disposable coveralls. Wash outer gloves and remove, and then remove the respirator, if worn. Discard inner gloves if worn. Place non-disposable coveralls in plastic bags prior to leaving the site and prior to entering any vehicle. Launder non-disposable clothing prior to reuse, separately from other laundry items. Hands and face, and other exposed skin must be washed with soap and water prior to leaving the site. Shower and shampoo as soon as possible at the end of the workday.

11.2 EQUIPMENT DECONTAMINATION

It is imperative that equipment and vehicles used on site are thoroughly decontaminated before allowing the items to leave the work area. A decontamination station will be established within the Contaminant Reduction Zone to wash off treads, tracks, and excessive soil and debris when equipment must exit the Exclusion Zone.

Instruments used onsite must be wet-wiped with clean water prior to leaving the site. Wet-wipe respirator exteriors whenever exiting the work areas. Clean respirators with a manufacturer-recommended sanitizer, then hang to drip dry and place in plastic bags for protection against dust. Change respirator cartridges at least daily or earlier if breakthrough occurs, or when breathing resistance becomes high, whichever occurs first. Damage used cartridges to prevent accidental reuse.

Drilling equipment will be steam cleaned or pressure washed onsite at a designated decontamination area. Non-dedicated field equipment (e.g., downhole equipment and submersible pumps) will be properly decontaminated before use and in between locations. Decontamination of downhole equipment will not be completed between intervals associated with one location. All drilling equipment will be steam cleaned or pressure washed prior to the start and in between drilling activities. Downhole drilling equipment will be steam cleaned or pressure washed prior to initiation of drilling activities, between each boring, and at the conclusion of drilling activities.

Discolorations, stains, corrosion, and substances adhering to objects may indicate that contaminants have not been removed.

11.3 WASTE DISPOSAL PROCEDURES

PPE that cannot be decontaminated (i.e., chemical resistant suits, gloves, boot covers, respirator cartridges, etc.) will be placed in plastic trash bags and discarded as municipal waste.

Investigation-derived waste consisting of drill cuttings from well installations will be containerized in 55-gallon drums and temporarily stored in an approved area while awaiting analysis for transportation to an offsite disposal facility.

Water generated from decontamination, well development, and well purging activities will be containerized in 55-gallon drums and temporarily stored in an approved area while waiting analysis for transportation to an offsite disposal facility.

Each drum will be properly marked as to the drum contents. Composite samples will be collected from a set number of drums based on contents and media and submitted to the designated laboratory for hazardous waste disposal characterization in accordance with the proposed disposal facility.

Drums will be removed offsite for disposal following the receipt of analytical results.

12. EMERGENCY RESPONSE PLAN

12.1 EMERGENCY RECOGNITION

An emergency is defined as a situation that requires calling outside help onto a job site. Field personnel will immediately stop work and report to the Field Team Leader and SSHO under the following situations:

- Medical emergency
- Fire emergency
- Discovery of unanticipated hazards (e.g., drums, heavily contaminated materials, etc.)
- Heavy equipment accident
- Overexposure of personnel to onsite contaminants requiring emergency medical services support
- Heat/cold-related injury or heat/cold stress requiring emergency medical services support.

Prior to work startup, personnel will be familiar with this Emergency Response Plan. The Field Team Leader and/or the SSHO will make this plan available for review and photocopying. Emergency telephone numbers and directions to the nearest hospital are presented in each site-specific HASP addendum in the corresponding work plan. Figures in the site-specific HASP addendum will present a map with directions to the nearest hospital.

Onsite emergencies will ultimately be handled by offsite emergency support personnel such as the local fire department, ambulance squad, or police dependent based on the nature of the emergency. Initial response and first aid treatment, however, will be available through trained onsite personnel.

Workers will be quickly decontaminated in the Contaminant Reduction Zone prior to transport to a hospital to avoid refusal of treatment at the local hospital. If a neck or back injury is suspected, do not move the victim without medical personnel stabilizing the neck and back in accordance with first aid procedures. Then workers trained in first aid and wearing PPE should move the injured worker to the Contaminant Reduction Zone for decontamination so that it is safe for emergency personnel to administer medical help to the injured worker. As the situation allows, emergency personnel should not be allowed to enter the Exclusion Zone without the proper PPE. Local hospital requirements for accepting contaminated workers should be investigated in the site-specific HASP addendum.

In case of a hazardous materials emergency, the Field Team Leader will assume control and direction of the emergency until arrival of the emergency response Incident Commander. The Incident Commander will work with the Manager, Health and Safety, or the SSHO to identify and evaluate hazards. Emergency responders and communications will be coordinated and controlled through the Incident Commander.

12.2 PROCEDURES FOR HANDLING EMERGENCY INCIDENTS

In the event of an emergency, the information available at that time will be properly evaluated and the appropriate steps taken to implement the Emergency Response Procedures. The Field Team Leader (or SSHO if the Field Team Leader is part of the emergency) will assume command of the situation. He or she will call the appropriate emergency services, evacuate personnel to the pre-designated evacuation location as needed, and take other steps necessary to gain control over the emergency. If a hazardous materials emergency takes place, the Field Team Leader will assume control of the situation until the emergency response incident commander arrives.

Give the following information when reporting an emergency:

- Name and location of person reporting
- Location of accident/incident
- Name and affiliation of injured party
- Description of injuries, fire, spill, or explosion
- Status of medical aid and/or other emergency control efforts
- Details of chemicals involved
- Summary of accident, including suspected cause and time it occurred
- Temporary control measures taken to minimize further risk

This information is not to be released to parties other than those listed in this section and emergency response team members. Once emergency response agencies have been notified, the Project Manager will be immediately notified.

12.3 MEDICAL EMERGENCIES

Personnel will be alert for signs and symptoms of illnesses related to chemical, physical, and disease factors onsite. Severe injuries resulting from accidents will be recognized as emergencies and treated as such. At least one person currently trained in first aid/CPR will be present onsite.

Personnel currently trained in first aid will evaluate the nature of the injury, decontaminate the victim if the victim can be moved safely, and initiate first aid assistance immediately. First aid will be administered to limit further injury and stabilize the victim. The local Emergency Medical Services will be notified immediately if needed. Personnel will not transport victims to emergency medical facilities unless the injury does not pose an immediate threat to life and transport to the emergency medical facility can be accomplished without the risk of further injury.

First aid equipment will be available at locations specified in the site-specific HASP addendum as well as in company vehicles.

The Field Team Leader will complete an Accident Investigation Report (Appendix E) and submit it to the Project Manager within 24 hours of the following types of incidents:

- Job-related injuries and illnesses
- Accidents resulting in loss or damage to property
- Accidents involving vehicles and/or vessels, whether or not they result in damage to property or personnel
- Accidents in which there may have been no injury or property damage, but which have a high probability of recurring with at least a moderate risk to personnel or property.

An accident that results in a fatality will be reported within 8 hours to the U.S. Department of Labor through the Project Manager. An accident that results in the hospitalization of one or more employees or involves and amputation or loss of an eye will be reported within 24 hours to the U.S. Department of Labor through the Project Manager. In addition to the written accident investigation report discussed above, the Field Team Leader will be responsible for contacting the Health and Safety Manager or the Director of Human Resources as soon as possible after the incident for determination of whether a drug and/or alcohol test will need to be taken by the affected parties.

First aid/emergency equipment is available at the following locations:

- First Aid Kit: Field Vehicle
- Eye Wash: Onsite.

The eye wash kit will be portable and capable of supplying at least a 15-minute supply of potable water to the eyes.

12.4 FIRE/EXPLOSION EMERGENCIES

A fire and/or explosion will be immediately recognized as an emergency. Emergency services (fire, police, and ambulance) will be notified. Only persons properly trained in fire suppression and other emergency response procedures will attempt to deal with these situations. Employees will not attempt to handle a fire/explosion emergency. Other than small fires or spills, local emergency response services will be notified to handle the emergency. The Field Team Leader will take measures to reduce injury and illness, primarily by evacuating personnel as quickly as possible. He or she will then notify the Project Manager. Cleanup after such events may require specialized services. The Project Manager will establish proper cleanup actions. Site personnel will not resume work during or after a fire/explosion incident until the emergency coordinator has directed that the incident is over, and work may resume. During the incident, site personnel will remain outside the incident area and obey the instructions of the emergency coordinator.

12.5 EMERGENCY PHONE NUMBERS

Communications will be by a mobile telephone provided to field personnel. Additional emergency numbers will be included in the site-specific HASP addendum, as they will change per locality.

Poison Control Center: 1-800-552-6337.

National Response Center: 1-800-424-8802.

EA Emergency Contacts

- Manager, Health and Safety: [REDACTED], Certified Industrial Hygienist (CIH)
 - Work: (410) 527-2425
 - Cell: (410) 410 790-6338.
- SSHO/Field Team Leader: (b) (4) [REDACTED]
 - Work: (410) 671-6051 x1410
 - Cell: (443) 207-3716.
- Field Team Leader/SSHO: [REDACTED]
 - Work: (410) 584-7000 x5257
 - Cell: 704-576-5948.

In Case of Spill, Contact:

(b) (4) [REDACTED]

- Work: (410) 671-6051 x1408
- Cell: (302) 540-1284.

EA Occupational Physician:

- Health Resources: (800) 350-4511.

12.6 EMERGENCY EQUIPMENT AVAILABLE ONSITE

Medical Equipment

First Aid Kits

EA company vehicle

Fire-Fighting Equipment

Fire Extinguishers

EA company vehicles

13. REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH). *Threshold Limit Values and Biological Exposure Indices*. Cincinnati: ACGIH, current edition.

Federal Acquisition Regulation (F.A.R.), Clause 52.236.13: *Accident Prevention*.

National Institute of Occupational Safety and Health/Occupational Safety and Health Administration (OSHA)/U.S. Coast Guard/U.S. Environmental Protection Agency. 1985. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*. October.

National Institute of Occupational Safety and Health. *Pocket Guide to Chemical Hazards*. U.S. Department of Health and Human Services, current online edition.

———. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985.

Occupational Safety and Health Administration (OSHA). Standards for General Industry, 29 CFR 1910.1000, *Air Contaminants*.

———. Standards for Construction Industry, 29 CFR 1926, including 29 CFR 1926.65, *Hazardous Waste Operations and Emergency Response* and 29 CFR 1926.59, *Hazard Communication*.

———. Standards for General Industry, 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response*.

———. Standards for General Industry, 29 CFR 1910, including 29 CFR 1910.1030, *Occupational Exposure to Bloodborne Pathogens*.

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**HEALTH AND SAFETY PLAN
APPENDIX A**

HEALTH AND SAFETY PLAN REVIEW RECORD

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HEALTH AND SAFETY PLAN REVIEW RECORD

SITE: _____

EA Project No. _____

I have read the Health and Safety Plan (s) and have been briefed on the nature, level, and degree of exposure likely as a result of participation of field activities. I agree to conform to all the requirements of this Plan.

[illegible]

HEALTH AND SAFETY PLAN
APPENDIX B
SITE ENTRY AND EXIT LOG

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SITE ENTRY AND EXIT LOG

Site : _____

EA Project No.: _____

[illegible]

**HEALTH AND SAFETY PLAN
APPENDIX C**

HEALTH AND SAFETY ACTIVITY REPORT

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HEALTH AND SAFETY ACTIVITY REPORT

Site: _____

Location: _____

EA Project No. _____

Date: _____

Weather Cond.: _____

Onsite Hours: From _____ To _____

Changes in PPE Levels*

Work Operations

Reasons for Change

Site Safety and Health Plan
Violations

Corrective Action
Specified

Corrective Action
Taken (yes/no)

Observations and Comments:

Completed by: _____
Site Health and Safety Supervisor

Date: _____

*Only SSHO may change PPE levels, using only criteria specified in GHASP.

**HEALTH AND SAFETY PLAN
APPENDIX D**

ENVIRONMENTAL MONITORING RECORD

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ENVIRONMENTAL MONITORING RECORD

SITE: _____

EA PROJECT NO.: _____

INSTRUMENT: _____

CALIBRATION: Gas: _____ Conc: _____ Span: _____

Time	Monitoring Location	Reading	Corrective Action Taken ^(a)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Comments: _____

(a) Corrective actions taken must be documented whenever readings at or above action levels are reached. Monitoring equipment and action levels should be specified in the site-specific GHASP addendum

Recorded By: _____
Site Health & Safety Supervisor

Date: _____

**HEALTH AND SAFETY PLAN
APPENDIX E**

ACCIDENT/LOSS AND INCIDENT REPORT

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ACCIDENT/LOSS REPORT

THIS REPORT MUST BE COMPLETED BY THE INJURED EMPLOYEES SUPERVISOR AND FAXED TO EA CORPORATE HUMAN RESOURCES WITHIN 24 HOURS OF ANY ACCIDENT. THE FAX NUMBER IS (410) 771-1780.

NOTE WHENEVER AN EMPLOYEE IS SENT FOR MEDICAL TREATMENT FOR A WORK RELATED INJURY OR ILLNESS, PAGE 4 OF THIS REPORT MUST ACCOMPANY THAT INDIVIDUAL TO ENSURE THAT ALL INVOICES/BILLS/CORRESPONDENCE ARE SENT TO CORPORATE CENTER FOR TIMELY RESPONSE.

DATE OF ACCIDENT: _____ TIME OF ACCIDENT: _____

EXACT LOCATION WHERE ACCIDENT OCCURRED (including street, city and state):

NAME OF INJURED EMPLOYEE: _____

HOME ADDRESS: _____

HOME PHONE: _____ DATE OF BIRTH: _____

AGE: _____ SEX: M F MARITAL STATUS: _____

SOCIAL SECURITY NUMBER: _____ DATE OF HIRE: _____

NUMBER OF DEPENDENTS: _____

EMPLOYEES JOB TITLE: _____

DEPT. REGULARLY EMPLOYED: _____

EXPLAIN WHAT HAPPENED (include what the employee was doing at the time of the accident and how the accident occurred):

DESCRIBE THE INJURY AND THE SPECIFIC PART OF THE BODY AFFECTED (i.e. laceration, right hand, third finger, second joint):

OBJECT OR SUBSTANCE THAT DIRECTLY INJURED EMPLOYEE:



NAME AND ADDRESS OF THE PHYSICIAN (if medical attention was administered):

PLEASE ATTACH THE PHYSICIANS WRITTEN RETURN TO WORK SLIP

NOTE A PHYSICIANS RETURN TO WORK SLIP IS REQUIRED PRIOR TO ALLOWING THE WORKER TO RETURN TO WORK

IS THE EMPLOYEE EXPECTED TO LOSE AT LEAST ONE FULL DAY OF WORK? _____

WAS THE EMPLOYEE ASSIGNED TO RESTRICTED DUTY? _____

NUMBER OF DAYS AND HOURS EMPLOYEE USUALLY WORKS PER WEEK: _____

LIST ALL PPE EMPLOYEE WAS WEARING AND ALL SAFETY DEVICES IN USE AT THE TIME OF THE ACCIDENT:

DESCRIBE THE PREVENTIVE MEASURES TAKEN TO AVERT A RECURRENCE OF THIS TYPE OF INCIDENT: _____

DATE WHEN MEASURES WERE IMPLEMENTED AND BY WHOM: _____



AUTOMOBILE ACCIDENT INFORMATION

AUTHORITY CONTACTED AND REPORT # _____

EA EMPLOYEE VEHICLE YEAR, MAKE AND MODEL _____

V.I.N. _____ PLATE/TAG # _____

OWNER'S NAME AND ADDRESS: _____

DRIVER'S NAME AND ADDRESS: _____

RELATION TO INSURED: _____ DRIVER'S LICENSE # _____

DESCRIBE DAMAGE TO YOUR PROPERTY: _____

DESCRIBE DAMAGE TO OTHER VEHICLE OR PROPERTY: _____

OTHER DRIVER'S NAME AND ADDRESS: _____

OTHER DRIVER'S PHONE: _____

OTHER DRIVER'S INSURANCE COMPANY AND PHONE: _____

LOCATION OF OTHER VEHICLE: _____

NAME, ADDRESS AND PHONE OF OTHER INJURED PARTIES: _____

WITNESSES

NAME: _____ PHONE: _____

ADDRESS: _____

STATEMENT: _____

SIGNATURE: _____

NAME: _____ PHONE: _____

ADDRESS: _____

STATEMENT: _____

SIGNATURE: _____



NAME OF SUPERVISOR: _____

DATE OF THIS REPORT: _____ REPORT PREPARED BY: _____

I have read this report and the contents as to how the accident/loss occurred is accurate to the best of my knowledge.

Signature: _____

Injured Employee

Date: _____



I am seeking medical treatment for a work related injury/illness.

Please forward all bills/invoices/correspondence to:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

CORPORATE OFFICE

11019 MCCORMICK ROAD

HUNT VALLEY, MD 21031

ATTENTION: Human Resources

(410) 584-7000

**HEALTH AND SAFETY PLAN
APPENDIX F
SITE-SPECIFIC ADDENDUM**

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SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

This document shall be maintained on site with the *Sampling and Analysis Plan (SAP)* and the *Health & Safety Plan (HASP)* for the New Castle Public Wells Groundwater Plume Site conducted by EA Engineering, Science, and Technology, Inc., PBC (EA).

Client: Delaware Department of Natural Resources and Environmental Control (DNREC)

Project Name/Number: New Castle Public Wells Groundwater Plume Site (DE-0363) / 1531814

Site Location/Address: 0. East Basin Road, New Castle, New Castle County, Delaware

Site Description/History: In 2014, five public water supply wells in New Castle exceeded the EPA preliminary health advisory levels for perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS). PFOA was detected at a maximum concentration of 440 parts per trillion and PFOS was detected at a maximum concentration of 2300 parts per trillion. Since that time, EPA established a more stringent lifetime health advisory level (HAL) of 70 parts per trillion in 2016. These public water supply wells as well as others in the area exceed the lifetime HAL. Artesian Water Company, Inc. and the City of New Castle Municipal Services Commission have been treating the public drinking water to remove PFOS and PFOA to assure concentrations do not exceed the health advisory level.

In addition to per- and polyfluoroalkyl substances (PFAS), volatile organic compounds (VOCs) which included tetrachloroethene (PCE), trichloroethene (TCE) and vinyl chloride were detected in the area wells.

The objective of the upcoming Site Inspection is to further investigate if PFAS and VOCs are present and migrating in the surrounding area of the public wells.

Work Description: Site work will include utility marking and clearing to include soft dig/vacuum, drilling/well installation, well development and groundwater sampling as well as sediment and surface water sampling.

APPROVALS:

This Addendum to the May 2020 HASP has been prepared under the supervision and review of a Certified Industrial Hygienist certified by the American Board of Industrial Hygiene

Program Health and Safety Manager: _____ 5-27-2020
_____, CIH (ABIH No. 3118) Date

Project Manager: _____ 5-27-2020
_____, P.G. Date

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

EMERGENCY CONTACT INFORMATION:

Contacts	Name	Phone Number(s) work/cell
Project Manager	(b) (4), P.G.	302-540-1284 (cell)
Program Health and Safety Manager	(b) (4) CIH	410-527-2425 / 410-790-6338
Task Manager, Site Manager, and/or Site Safety and Health Officer	(b) (4)	443-528-8338 (Lazzeri's cell)
		443-207-3716 (Phillips cell)
		704-576-5948 (Thornton cell)
Client/ Regulatory Contact	S. Gordon, DNREC Project Manager	302-395-2654 (direct office line)
Poison Control		800-222-1222
National Response Center		800-424-8802
EA Medical Services	Health Resources	800-350-4511
Corporate Health and Safety Director	(b) (4), CIH	410-527-2425 / 410-790-6338
Fire/Rescue/Emergency Medical Services/Ambulance-Medical Transport		911 Give Site address to 911
Police		302-322-9800 (non-emergency) 911 (emergency)
Others		

MEDICAL EMERGENCY:

Distance to Nearest Hospital (with emergency room): 7.9 miles, 16 minutes

Hospital Name: Christiana Hospital

Hospital Phone: (302) 733-1000

Hospital Address: 4755 Ogletown Stanton Rd, Newark, DE 19718

Route to Hospital:

Start: New Castle Airport Area

End: 4755 Ogletown Stanton Rd, Newark, DE 19718

Route to Hospital (See Map Below)

- Head southwest on N Dupont Hwy/US-40 W/US-13 S towards Traders Lane – 0.8 miles
- Turn right onto DE-273W/Christiana Rd/Frenchtown Rd – 0.3 miles
- Turn right (first right) onto DE-58 W/Churchmans Rd – 3.6 miles
- Turn left into Hospital (at light across from Best Buy/Bugaboo Creek Steakhouse) – 0.1 miles

Route to Christiana Hospital

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

HAZARDS OF CONCERN: Check as many as are applicable. See Section 6 of SCR GHASP for Chemical, Physical, and Biological Hazards.

(X) Heat Stress	() Reactive Chemicals	() Oxygen Deficient	(X) Insect Bite
() Cold Stress	(X) Noise	() Corrosive	(X) Snake Bite
(X) Explosion/Fire	() Inorganics	() Toxic Chemicals	(X) Heavy Equipment
(X) Biological	(X) Organic Vapors	() Inert Atmosphere	(X) Vegetation
() Radiological	(X) Utilities	() Excavations	() Electrical
() Pressure or Vacuum	(X) Lifting	(X) General Physical	() Boating
() Confined Space (see Section 9 of GHASP)	() UXO		
() Other, specify: _____			

CONTROLS OR PROTECTIVE MEASURES: Check as many as are applicable.

(X) Pre-entry Briefing/Safety Meetings (X) PPE (X) Site control
(X) Operator Training Drilling equipment, licensed well driller
(X) Permits Well installation
(X) Engineering Controls cones, flags, etc. to demarcate work area
(X) Work Practices Standard Operating Procedures
(X) Other Miss Utility of Delaware (800-282-8555)

EXPOSURE PATHWAYS: (X) Inhalation (X) Ingestion (X) Dermal () Injection

POTENTIALLY IMPACTED MEDIA:

(X) Air (X) Dust/Soil (X) Surface Water (X) Sediment (X) Groundwater () Other

FIRE/EXPLOSION POTENTIAL: () High () Medium (X) Low

SURROUNDING POPULATION: () Residential () Industrial () Rural (X) Commercial

ANTICIPATED LEVEL OF CHEMICAL EXPOSURE: (List potential contaminants of concern, media, and concentration levels if known. Include previous air sampling if any):

() High () Medium (X) Low

Contaminants found in the public water include PFAS as wells as VOCs, primarily PCE, TCE, and DCE.

OVERALL HAZARD RANKING: () High () Medium (X) Low

JUSTIFICATION OF HAZARD RANKING: (brief narrative of how work activities may encounter hazards and their controls):

With properly trained EA employees and subcontractors performing the site work, Safety Meeting participation, site control, proper PPE (Level D), and awareness of surroundings will be sufficient to keep the overall hazard ranking low. Organic vapors, contact with potentially contaminated soil and groundwater may be encountered during activities. Organic vapors will be monitored in the breathing zone during drilling including soft digging/vacuum and sampling activities.

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

CHEMICAL HAZARDS (condensed from Table 6-1 of SCR GHASP, add/delete as required):

Compound	PEL or TLV/STEL	IDLH	Route of Exposure	Symptoms
Perfluorocarbons	No Data	No Data	Inhalation, Ingestion, Skin/Eye Contact	Potential changes in cholesterol and sex hormones; animals irritation of the eyes and nose, liver damage and weight loss
Tetrachloroethylene (PCE)	25 ppm/100 ppm C 200 ppm	Ca 150 ppm	Inhalation, Ingestion, Absorption, Skin/Eye Contact	Irritated eyes, skin, throat; dizziness, headache, nausea, face flush, liver damage.
1,2-Dichloroethylene (<i>cis</i> - and <i>trans</i> -)	200 ppm / 200 ppm	1,000 ppm	Inhalation, Ingestion, Skin/Eye Contact	Irritated eyes, respiratory system; CNS depressant.
Trichloroethylene (TCE)	50 ppm/100 ppm	Ca 1,000 ppm	Inhalation, Ingestion, Absorption, Skin/Eye Contact	Irritated eyes, skin; headache, dizziness, vertigo, visual distortion, fatigue, giddiness, vomiting, dermatitis, nausea.
Vinyl chloride	1 ppm/C 5 ppm	Ca	Inhalation, Skin/Eye Contact (with liquid)	Weakness, abdominal pain, GI bleeding, enlarged liver.
IDLH	Immediately Dangerous to Life and Health			
PEL	Permissible Exposure Limit			
TLV	Threshold Limit Value			
STEL	Short Term Exposure Limit (15 min)			
C	Ceiling Limit			
Ca	Carcinogen			
CNS	Central Nervous System			
GI	Gastrointestinal			
N.D.	Not determined			
Skin	Skin absorption can contribute to overall body dose			
[a]	The PEL and IDLH are representative of coal tar pitch volatiles.			

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

WORKING ALONE: (X) No () Yes, explain precautions _____

UTILITY CLEARANCE:

One-Call Utility Services () Not Required (X) Required, explain Miss Utility of Delaware will be called
prior to soft dig/vacuum and drilling activities.

Facility-Provided Clearance or Permit (X) Not Required () Required, explain _____

Geophysical, Pipe Locator, or Other Contractor () Not Required (X) Required, explain locating utility
lines

CONTINGENCY PLANS: Summarize below (Evacuation, assembly point, contingency leader)

If evacuation is deemed necessary by the Site Manager, assemble in the designated support zone and
contact the Program Safety and Health Officer before continuing to work.

DEVIATIONS/VARIATIONS FROM GHASP:

MEDICAL SURVEILLANCE:

Do hazardous waste site workers and supervisor (s) have documentation of required medical exams?

(X) Yes () No, Explain _____

TRAINING REQUIRED:

(X) HAZWOPER Worker () HAZWOPER Supervisor (X) First Aid/CPR

() Confined Space (X) Other, explain Well drilling will be conducted by DE-licensed
driller

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

PROTECTIVE EQUIPMENT: Protective equipment should be specified by the type of task and site (e.g., soil boring and sampling at landfill). Indicate type and/or material, as necessary. Use additional pages as necessary.

TASK 1: Soft dig for utility clearance.

INITIAL LEVEL: A - B - C - (D) - Modified (Circle applicable)

Respiratory: (X) Not needed

() SCBA, Airline: _____

() APR: _____

() Cartridge: _____

() Escape Mask: _____

() Other: _____

Head and Eye: () Not needed

(X) Safety Glasses: _____

() Face Shield: _____

() Goggles: _____

(X) Hard Hat: soft dig

Hearing Protection: () Not needed

(X) Plugs: soft dig

() Muffs: _____

Boots: () Not needed

(X) Safety Boots: steel toe/shank

() Overboots: _____

Protective Clothing: (X) Not needed

() Encapsulating Suit: _____

() Splash Suit: _____

() Apron: _____

() Tyvek Coverall

() Saranex Coverall

() Coverall: _____

() Other: _____

Gloves: () Not needed

() Undergloves: _____

(X) Gloves: nitriles

() Overgloves: _____

(X) Other: leather

TASK 2: Drilling to include continuous soil cores, installation of monitoring wells, well development and groundwater sampling as well as sediment and surface water sampling.

LEVEL: A - B - C - (D) - Modified (Circle applicable)

UPGRADE CRITERIA: _____

Respiratory: (X) Not needed

() SCBA, Airline: _____

() APR: _____

() Cartridge: _____

() Escape Mask: _____

() Other: _____

Head and Eye: () Not needed

(X) Safety Glasses: _____

() Face Shield: _____

() Goggles: _____

(X) Hard Hat: drilling activities

Hearing Protection: () Not needed

(X) Plugs: drilling activities

() Muffs: _____

Boots: () Not needed

(X) Safety Boots: steel toe/shank

() Overboots: _____

Protective Clothing: (X) Not needed

() Encapsulating Suit: _____

() Splash Suit: _____

() Apron: _____

() Tyvek Coverall

() Saranex Coverall

() Coverall: _____

() Other: _____

Gloves: () Not needed

() Undergloves: _____

(X) Gloves: nitriles

() Overgloves: _____

(X) Other: leather

MONITORING EQUIPMENT: Monitoring equipment should be specified by task and type of site. Indicate type, as necessary. Attach additional sheets, as necessary.

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

TASKS: Soft dig/vacuum, drilling, soil and groundwater sampling.

See HASP for Calibration Procedures or attach if different. Attached table specifies monitoring requirements and action levels

<u>INSTRUMENT</u>	<u>ACTION GUIDELINES</u>
Combustible Gas Indicator/O ₂ () Not needed	0-10% LEL Continue. 10-20% LEL Potential explosion hazard, continuous monitoring. >20% LEL Explosion hazard; interrupt task/evacuate.
Oxygen (O ₂) Percentage:	20.8% - O ₂ normal. <20.8% - O ₂ deficient, investigate cause. <19.5% O ₂ Interrupt task/evacuate.
Type: <u>MultiRae or CGI/O₂</u>	

Photoionization Detector Specify: (COCs)
() 11.7 ev (X) 10.6 ev () 09.8 ev () __ ev
Type: Photovac or MiniRAE (circle applicable or list other):
() Not needed
Flame Ionization Detector Specify: (COCs)
Type Photovac or OVA (circle applicable or list other):
(X) Not needed

Detector Tubes Or Chemical Detector Specify: (COCs, Range, Interferences)
Type _____
(X) Not needed

Dust Monitor Specify: (COCs, Nuisance)
Type _____
(X) Not needed

Radiation Survey Meter Specify: (Radioisotopes; alpha, beta, gamma, x-ray)
> Background Contact RSO/SSHO and PM
3 x Background Notify CIH and stop work
2.5mR/hr Interrupt task/evacuate
(X) Not needed Note: Annual Exposure not to exceed 100 mrem/yr or 50 urem/hr average

Other Instruments Specify:

DECONTAMINATION PROCEDURES:

Summarize personnel decontamination/containment and disposal method
() Not needed

PPE that cannot be decontaminated (i.e., gloves, respirator cartridges, etc.) will be placed in plastic trash bags and discarded as municipal waste. Personnel will wash hands and other exposed body areas prior to leaving the site.

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

Summarize equipment decontamination/containment and disposal method

() Not needed

Whenever possible, equipment will be rinsed with "PFAS-free" water immediately prior to use at each sample location during groundwater, surface water and sediment sampling.

Intrusive field equipment utilized during the groundwater, surface water and sediment sampling phase (interface probe, water level meter, trowel, and hand auger) that will contact media will be properly decontaminated before use and between uses. Proper decontamination procedures will consist of the following steps upon donning a new pair of nitrile gloves:

- Wash with an approved detergent washing solution (e.g., Alconox, Liquinox or Citranox®) and laboratory grade PFAS-free water using an appropriate brush
- Rinse with laboratory grade PFAS-free water
- Rinse with methanol
- Triple rinse with laboratory grade PFAS-free water

Air dry in a clean high-density polyethylene container or bucket; aluminum foil will not be used to wrap air dry equipment since this is a prohibited item in reference to PFAS sampling.

Summarize heavy equipment decontamination/containment and disposal method

() Not needed

Decontamination of larger equipment (for example, drill rigs and large downhole drilling and sampling equipment) will be completed between boring locations with potable water using a high-pressure washer or steam.

Investigation Derived Waste (IDW) and Waste Disposal

() Not needed

Investigation-derived waste (IDW) that will be generated as part of the drilling and subsequent sampling event may include personal protective equipment, soil, groundwater and decontamination water. IDW will be drummed and stored on pallets in a DNREC-approved area while awaiting analytical results for offsite disposal. The drums will be labeled as investigation-derived waste pending analysis, sample or well location as well as the site identification, media, DNREC Project Manager contact information, and dates generated will be listed.

Other wastes generated during site activities are expected to include disposable gloves, plastic tubing, paper towels, etc. These materials will be placed into plastic garbage bags and disposed of as municipal waste.

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

ENVIRONMENTAL MONITORING REQUIREMENTS

Instrument	Location of Monitoring	Frequency	General Action Level	Site-Specific Action Level	Response
Total Volatile Organics Detector (Photoionization detector)	Breathing Zone	Initially and every 30 minutes	Above background	Same or Specify	Begin perimeter monitoring. Upgrade to Level C PPE
			>5 ppm	Same or Specify	Withdraw from site, prepare to upgrade to Level B
	Perimeter monitoring	2 times per day	Above background	Same or Specify	Shut down operations and identify source of contamination and cover.
Combustible Gas Indicator	Borehole, excavation or well opening at ground surface	For each sample, initially and every 10 minutes	0-10% of LEL*	0-10% of LEL*	Continue monitoring
			10-20% of LEL	10-20% of LEL	Monitor continuously, prepare to shutdown
			>20% of LEL	>20% of LEL	Shutdown immediately, evacuate

Modify to reflect site-specific conditions.

*The readings must remain <10% of LEL in order to enter an excavation or other area containing combustible gas.

Action levels represent concentrations or percentages that are sustained for the monitoring period specified under "Frequency" and do not reflect peak levels.

Appendix B

Field Forms

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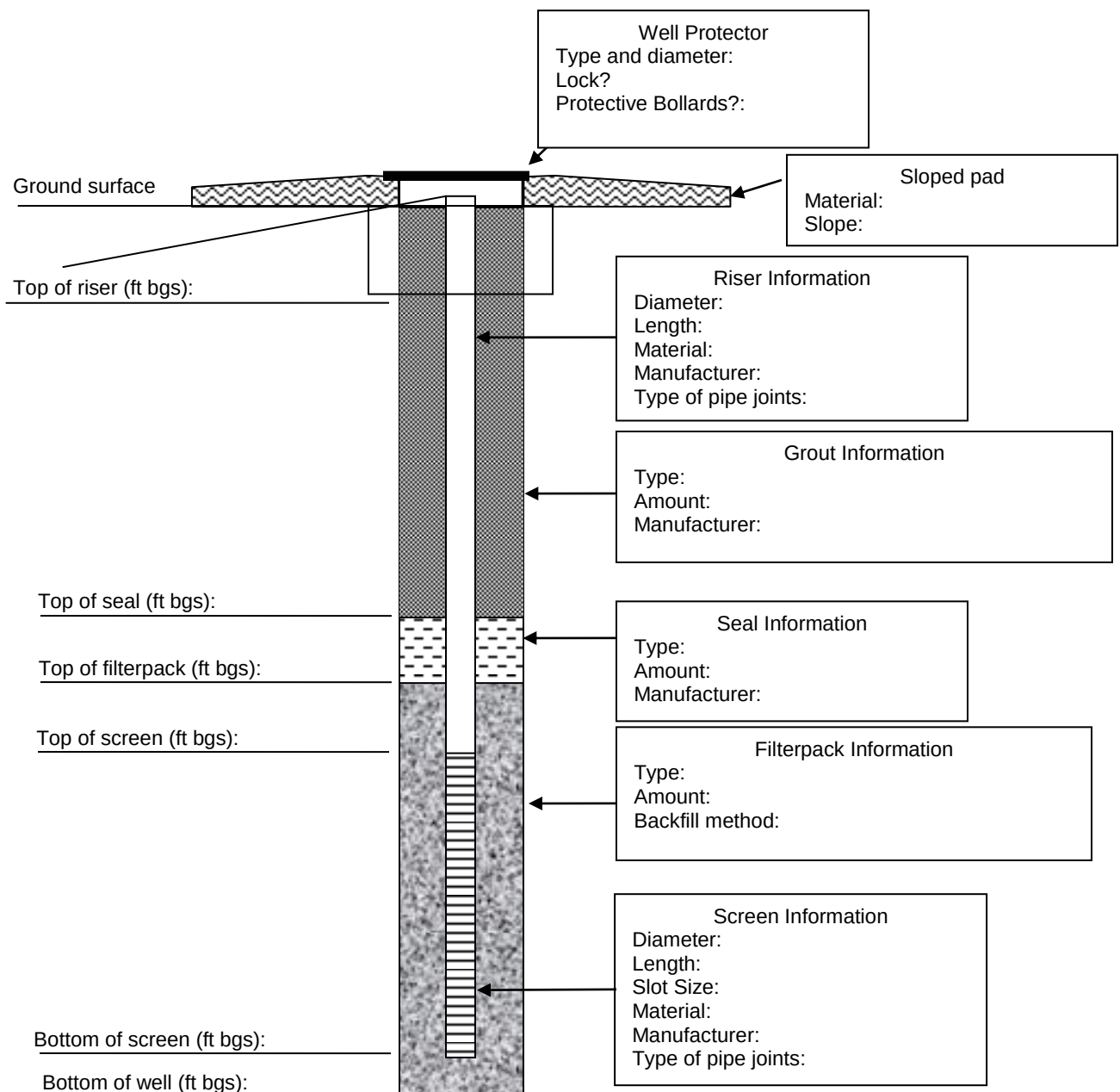
BORING LOG			Client DNREC		HOLE NUMBER AND PERMIT NUMBER				
1. COMPANY NAME EA Engineering, Science, and Technology, Inc., PBC			2. DRILL SUBCONTRACTOR			SHEET 1		SHEETS OF	
3. PROJECT ID/ OPERABLE UNIT ID:		4. GEOLOGIST		5. Coordinates:					
6. NAME OF DRILLER				7. MANUFACTURER'S DESIGNATION OF DRILL					
8. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT TYPE OF LINER USED, IF APPLICABLE				9. SURFACE ELEVATION AND CONDITIONS					
10. DIRECT READING PARAMETERS: PID (ppm)				11. DATE STARTED		12. DATE COMPLETED			
13. OVERBURDEN THICKNESS				14. DEPTH GROUNDWATER ENCOUNTERED					
15. DEPTH DRILLED INTO ROCK				16. DEPTH TO WATER AND ELAPSED TIME ATFER DRILLING COMPLETED					
17. TOTAL DEPTH OF HOLE				18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
19. WELL INSTALLED?		IF SO COMPLETE CONSTRUCTION DIAGRAM		20. SAMPLE TYPE:					
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS			22. SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS			23. SCREENING ANALYSIS			
24. DISPOSITION OF HOLE				25. IF NOT A WELL, BACKFILLED WITH:					
USCS LOG	DEPTH (FT)	DESCRIPTION OF MATERIALS	READINGS		ANALYTICAL SAMPLE DESIGNATION AND INTERVAL	DEPTH (FT)	RECOVERY (IN.)	REMARKS	
			VOC (ppm)	Blow Counts					

EA PROJECT NUMBER: 1531804			HOLE NO.:						

RECORD OF MONITORING WELL CONSTRUCTION

(FLUSH MOUNT)

	Monitoring Well/Soil Boring ID No.: Permit No.:
Coordinates:	Top of Inner Casing Elevation (ft msl): Ground surface Elevation (ft msl):
Project Name/ EA Project No:	Date Installed: Time Finished:
Location:	Depth to Water (ft bgs):
Site Geologist:	Drilling Method:
Borehole Diameter (inches):	Outer Casing Diameter (inches): Outer Casing Depth (ft bgs):



Not to scale

RECORD OF WELL DEVELOPMENT

Well Designation	_____	Project Name	_____
Condition	_____		
		Project Location	_____
Well Grout Date	_____	Developer Initials	_____
Well Installation Date	_____	Well Development Date	_____
Gauge Date	_____	Gauge Time	_____
Sounding Method	_____	Measurement Ref.	TOC
Stick up/down (ft)	_____	Well Diameter	_____
Static Water Level	_____	Screen Length	_____
Development Time	_____		
Surge Device	_____		
Weather	_____		

Well Volume Determination:

- A. Well Depth _____
- B. Depth to Water _____
- C. Liquid Depth (A-B) (ft) _____
- D. Well Volume/ft _____
- E. Liquid screen length (ft) _____

	Beginning	1	2	3	4	5
Time (min)						
Pump Rate (gpm)						
Volume purged						
Turbidity (NTU)						
Conductivity (uS/cm)						
pH						
ORP (mV)						
Dissolved Oxygen (mg/L)						
Temperature (°C)						

Total volume of water removed (gal): _____

Estimated Recharge Rate: _____

Depth to sediment before development: _____ Depth to sediment after development: _____

Final Well Depth: _____

Final Water Level: _____

Total Time: _____

Development Description: _____

WELL PURGING AND SAMPLING RECORD

PROJECT NAME: _____ EA PROJECT NO. _____
 WELL ID _____ SAMPLE NO. _____
 WELL/SITE DESCRIPTION _____
 PID HEADSPACE _____ (ppm)

DATE ____/____/____ TIME _____ AIR TEMP. _____

WELL DEPTH _____ ft CASING HEIGHT _____ ft
 WATER DEPTH _____ ft WELL DIAMETER _____ in
 WATER COL. HEIGHT _____ ft SANDPACK DIAM. _____ in
 EQUIVALENT VOLUME OF STANDING WATER _____ (gal) (L)
 PUMP RATE _____ (gpm) (LPM)
 PUMP TIME _____ min
 WELL WENT DRY? () Yes () No PUMP TIME _____ min
 VOL. REMOVED _____ (gal) (L) RECOVERY TIME _____ min
 PURGE AGAIN? () Yes () No TOTAL VOL. REMOVED _____ (gal) (L)

Date	Time	Volume Removed	pH	Cond.	Temp.	ORP	Turb.	DO	Depth to Water	Pump Rate
		Unit:							from TOC	

COMMENTS _____

Any Foaming of Sample Observed: yes or no _____

PID: _____

SIGNATURE _____

Appendix C

EA Standard Operating Procedures

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Standard Operating Procedure No. 059 for Field Logbook

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 1
December 2014

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1. SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for recording field survey and sampling information in the Field Logbook.

2. MATERIALS

The following materials may be required:

- Field Logbook (Teledyne 415 Level Book, or equivalent)¹
- Indelible ink pen (e.g., ~~Sharpie~~[®]).

3. PROCEDURE

All information pertinent to a field survey or sampling effort will be recorded in a bound logbook. Each page/form will be consecutively numbered, dated, and signed. All entries will be made in indelible ink, and all corrections will consist of line-out deletions that are initialed and dated. The person making the correction will provide a brief explanation for the change. Entries are factual only. No personal opinions should be entered.

There should be no blank lines on a page. A single blank line or a partial blank line (i.e., at the end of a paragraph) should be lined to the end of the page. If only part of a page is used, the remainder of the page should have an “X” drawn across it. The bottom of each page must be signed and dated by the field personnel entering the information.

At a minimum, entries in the Field Logbook will include but not be limited to the following:

- Date.
- Project number and project name.
- Name and address of field contact.
- Identification of sample crew members.
- Documentation should include model numbers of equipment used (e.g., drilling rigs) and calibration (if applicable). Each day’s entry should begin with time onsite, who is onsite (including observers other than the sampling crew), brief description of what work will be performed that day and how, and the weather.

¹ Pre-printed, bound forms are approved as well. See SOP No. 016 for recommended content and format.

- If samples are being taken in or near tidal waters, the time of high and low tide for the site should be determined from local gauges or tables and recorded.
- References such as maps of the sampling site.
- Times of key daily milestones should be entered (e.g., time borings began, times personnel arrived and left site, times subcontractors arrived and left site, etc.). Time should be recorded in the left-hand margin on the page in military time.
- Sample-specific information:
 - Unique, sequential field sample number
 - Purpose of sampling
 - Location, description, and log of photographs of each sampling point
 - Details of the sample site (e.g., elevation of the casing, casing diameter and depth, integrity of the casing, etc.)
 - Documentation of procedures for preparation of reagents or supplies which become an integral part of the sample (e.g., filters and absorbing reagents)
 - Type of media of sample (e.g., groundwater, surface water, soil, sediment, and product)
 - Suspected waste composition
 - Number and volume of sample taken
 - Sampling methodology, including distinction between grab and composite sample
 - Sample preservation
 - Date and time of collection
 - Collector's sample identification number(s)
 - Sample shipment (e.g., name of the laboratory and cartage agent: Federal Express, United Parcel Service, etc.)
 - Field observations (e.g., oily sheen on groundwater sample, incidental odors, soil color, grain size, plasticity, moisture content, layering, Unified Soil Classification System classification, etc.)

- Any field measurements made (e.g., pH, conductivity, explosivity, water depth, organic vapor analyzer readings, etc.)
- Signature and date by the personnel responsible for observations
- Decontamination procedures.

Sampling situations vary widely. No general rules can specify the extent of information that must be entered in a Field Logbook. However, records should contain sufficient information so that someone can reconstruct the sampling activity without relying on the sampler's memory. Further, the project work plan or field sampling plan should be reviewed to identify additional specific information or requirements that should be included in the Field Logbook.

The Project Manager will keep a master list of all Field Logbooks assigned to the Sampling Team Leaders. One Field Logbook kept by the Project Manager will be a master site log of daily activities and will contain the list of Field Logbooks assigned to Sampling Team Leaders.

Project name and number should be clearly marked on the outside cover using indelible ink. If more than one Field Logbook exists for the project, then the number of the Field Logbook should also be clearly marked on the outside cover.

4. MAINTENANCE

At the end of the field sampling effort, the Field Logbook should be scanned and filed in the electronic file for the project and maintained according to the EA Records Retention Policy or contract requirements.

5. PRECAUTIONS

None.

6. REFERENCES

EA Engineering, Science, and Technology, Inc., PBC. 2014. Standard Operating Procedure No. 016 for Surface Water, Groundwater, and Soil/Sediment Field Logbooks. December.

U.S. Environmental Protection Agency. 1980. *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, QAMS-005/80.

- . 1990. *Sampler's Guide to the Contract Laboratory Program*. EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C. December.
- . 1991. *User's Guide to the Contract Laboratory Program*. EPA/540/O-91/002, Directive 9240.0-01D. Office of Emergency and Remedial Response. January.



Standard Operating Procedure No. 073 for Sampling for Per- and Polyfluorinated Alkyl Substances

Prepared by

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Hunt Valley, Maryland 21031

Revision 1
June 2019

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PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**check Box A**), or if this SOP is being used with no changes (**check Box B**). This form should be archived with the project files.

	A. Variances required; cite section(s) of the SOP to which there is a variance
X	

B. No variances

[illegible]

Project Manager (Name)

Project Manager (Signature)

Date _____

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DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	Revision Date	Revision Summary	Revised By	Reviewed By
1	June 2019	Note regarding water-tight lids	F. Barranco	F. Barranco

1. SCOPE AND APPLICATION

The objective of this Standard Operating Procedure (SOP) is to delineate protocols for collecting environmental samples for analysis of per- and polyfluorinated alkyl substances (PFAS), also known generally as perfluoroalkyl compounds or chemicals (PFCs).

This SOP includes sampling procedures and requirements specific to analysis of PFAS, which are ubiquitous and have a high potential for cross-contamination from common consumer products and sampling materials, even when new and clean. This SOP should be used in combination with appropriate SOPs applicable to the target medium and sampling methodology (e.g., but not limited to SOP No. 007 Surface Water Sampling, SOP No. 013 Collection of Monitoring Well Samples, SOP No. 21 Sediment Sampling, SOP No. 25 Soil Sampling, or SOP No. 047 Direct-Push Technology Sampling).

This SOP was developed primarily based on guidance from the U.S. Army Corps of Engineers (2016) and the Interstate Technology Regulatory Council (ITRC 2018).

2. ACCEPTABLE MATERIALS

Table 1 provides a summary of Prohibited Items that should NOT be used or present during sampling for PFAS because they may contain PFAS, along with Acceptable (PFAS-free) Alternatives that may be used if appropriate for project requirements. In general, in the context of sampling events, PFAS are commonly found in waterproof and nonstick materials (including food packaging, rain gear, and anything containing Teflon®), personal care products, and certain plastics (e.g., low-density polyethylene [LDPE]) and synthetic fibers.

Table 1. Prohibited Items and Acceptable Alternatives for Use during PFAS Sampling

Prohibited Items	Acceptable Alternatives
Field Equipment	
Teflon-containing or LDPE materials (including tubing, bailers, tape)	HDPE or silicone materials
Waterproof field books, plastic clipboards, binders, or spiral hard cover notebooks	Loose paper (non-waterproof) on aluminum or Masonite clipboards
Sharpies®/markers, waterproof pens	Non-waterproof pens or pencils
Sticky notes (e.g., Post-It®) and glues	Not applicable
Re-usable chemical (blue) ice packs	Regular ice in polyethylene bags (double bagged)
Aluminum foil	Thin HDPE sheeting
Plastic spoons used in soil/sediment sampling	Stainless steel trowels/spoons
Reusable core liners	Single-use PVC or acetate liners
LDPE HydraSleeve	HDPE HydraSleeve
Field Clothing and Personal Protective Equipment	
New cotton clothing; synthetic water resistant, waterproof, or stain- treated clothing; clothing containing Gore-Tex™	Well-laundered clothing, defined as clothing that has been washed 6 or more times after purchase, made of natural fibers (preferably cotton)
Clothing laundered using fabric softener	No fabric softener
Boots (e.g., steel-toed or waders) containing Gore-Tex™ or waterproof coatings	Boots made with polyurethane or PVC with no waterproof coating

Prohibited Items	Acceptable Alternatives
Coated Tyvek® suits	Uncoated/plain Tyvek suits not containing PFAS
Cosmetics, shampoo, conditioner, body gel, moisturizers, hand cream, waxed dental floss, or other personal care products used <u>on the day of sampling</u> .	Use bar soap not containing moisturizers and rinse well on the day of sampling (including for hand washing). Use any other required products the night before (rather than the day of) sampling.
Paper towels	Air dryers (for hand drying)
No sunscreens or insect repellents except approved 100% natural products such as those noted in the Alternatives column.	Acceptable Sunscreens: Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss My Face, “free” or “natural” sunscreens for babies Acceptable Insect Repellents: Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect Repellent, Herbal Armor, California Baby
Sample Containers	
LDPE or glass containers	HDPE containers (or polypropylene if required)
Teflon-lined caps	Unlined HDPE (or polypropylene if required) caps
Rain Events	
Rain gear that has been treated to make it waterproof/resistant and breathable (e.g., Gore-Tex™ treated)	PVC or polyurethane- or wax-coated rain gear that is confirmed not to contain PFAS, or utilize a gazebo tent that is only touched or moved prior to and following sampling activities.
Equipment Decontamination	
Decon 90	Alconox®, Liquinox®, and/or Citranox®
Water from an onsite well	Potable water from municipal drinking water supply (not containing PFAS), and “PFAS-free” deionized water for final rinse
Food Considerations	
All food and drink, with exceptions noted in the Alternatives column. Paper food packaging (e.g., fast food wrappers, drink cups, paper bags) and foil, in particular, often contain PFAS.	Bottled water and hydration drinks (i.e., Gatorade® and Powerade®) to be brought and consumed only in the staging area
NOTES: HDPE = High-density polyethylene. PVC = Polyvinyl chloride.	

If a plastic product or chemical not included in the Acceptable Alternatives column of Table 1 is proposed for use, it is recommended that Safety Data Sheets and other references be reviewed prior to use to confirm that the material does not contain PFAS. Indications of potential PFAS ingredients, in addition to the items listed in Table 1, include the following materials (ITRC 2018):

- Polytetrafluoroethylene (fluorocarbon solids such as Teflon)
- Fluorinated ethylene propylene
- Ethylene tetrafluoroethylene
- Polyvinylidene fluoride
- Generally, any other ingredient names containing the prefix “fluoro.”

Specific to the use of HDPE sample containers, note that the associated lids are not typically “water-tight.” Therefore, HDPE sample containers should be individually placed in water-tight bags prior to placement in shipping containers loaded with ice.

3. PROCEDURES

As stated above, this SOP includes procedures specific to analysis of PFAS, and should be used in combination with the appropriate SOPs applicable to the target medium and sampling methodology.

3.1 GENERAL CONSIDERATIONS

Materials listed in the Prohibited Items column of Table 1 and other materials containing PFAS ingredients should not be used. However, in some cases, these materials must be used due to factors outside the control of the scope of the work or utility of the project team (e.g., health and safety requirements where other hazardous chemicals are present, or where the sampling requirements are prescriptive, unexpected, or time-sensitive). In these cases, the sampling team should purge/rinse equipment adequately with PFAS-free water where available, and collect additional quality control samples (Section 3.7) to assess the degree of cross-contamination associated with the use of known or suspected PFAS-containing materials during sampling.

NOTE: Most steel-toed boots are made from coated leather and synthetic fibers. PVC or polyurethane are preferred PFAS-free materials for boots. If not possible to obtain PFAS-free footwear that comply with specified health and safety requirements for personal protective equipment, then field personnel should minimize contact with footwear while in the sampling area, and always change gloves after touching footwear.

Disposable nitrile gloves shall be worn at all times during PFAS sampling activities. A new pair of nitrile gloves shall be donned after contacting potential contaminants including all non-decontaminated surfaces. New gloves shall also be donned before touching containers used for storage of PFAS samples, decontaminating re-usable sampling equipment, or handling quality control samples (Section 3.7).

Food shall not be eaten within 10 meters of any sampling area. Before eating or drinking, sampling personnel shall remove their gloves and any outer garments (e.g., coveralls) and leave the work area. When finished, sampling personnel shall wash their hands, remove any visible residue, and put new gloves and any outer garments back on prior to returning to the work area.

PFAS-containing stain resistant products are often applied to vehicle seats that have fabric upholstery. Therefore, if no outer garments (e.g., coveralls) will be worn, or if the outer garments will be worn in the field vehicle then, if feasible, the seats of the vehicle should be covered in a well-laundered cotton blanket to avoid contact between clothing and the seats.

Visitors to the sampling area shall remain at least 10 meters at a distance.



As indicated in Table 1, sampling personnel shall not use the personal care products or cosmetics (other than bar soap) prior to or during sample collection on any day. Additionally, clothes worn during sampling should be well-washed natural fibers.

Other personnel who come within 2-3 meters of the sample collection area should follow the guidelines above and in Table 1.

Fluids used during laboratory- or fieldwork (e.g., drilling for monitoring well installation or for deep soil sampling) should be confirmed PFAS-free.

When sampling on a surface water body, associated gear (e.g., waders, life preservers) should be confirmed PFAS-free.

3.2 EQUIPMENT DECONTAMINATION

Wherever possible, dedicated or disposable equipment shall be used to avoid the need for decontamination, which introduces additional potential for cross-contamination.

Large field equipment (e.g., drill rigs) should be decontaminated with potable water using steam or high-pressure water. Laboratory-certified “PFAS-free” water should be used to perform a final rinse of portions of the sampling equipment that will be in direct contact with samples, wherever practical.

Hand-held, non-dedicated sampling equipment, which is used at multiple field sampling locations, shall be decontaminated using the following procedure:

- Rinse with a non-PFAS-containing detergent (e.g., Alconox, Liquinox, or Citranox)
- Rinse with laboratory-provided, “PFAS-free” water (Grade 3 distilled, Millipore deionized)
- Rinse with methanol
- Rinse with laboratory-provided, “PFAS-free” deionized water.

The Safety Data Sheet for the selected detergent should be reviewed to ensure that it does not contain fluoro-surfactant ingredients.

Wherever possible, equipment should be rinsed with “PFAS-free” water immediately prior to use at each sampling location.

3.3 SAMPLE COLLECTION AND PRESERVATION

The sampling team shall coordinate with the analyzing laboratory regarding requirements for sample bottle, volume, and preservation requirements for samples for PFAS analysis, and the laboratory should provide certified “PFAS-free” containers. HDPE bottles with unlined caps are



typically used for collection of samples for PFAS analyses. Polypropylene may also be used for specific applications (e.g., collection of drinking water samples to be analyzed for the short list of PFASs by Method 537) (Department of Defense Environmental Data Quality Workgroup 2017).

Containers for collection of PFAS samples shall never be left uncapped, either before or after sample collection, and the lid/cap shall be kept in a gloved hand and not be set down while removed from the container.

Sampling personnel shall put on a clean pair of nitrile gloves immediately prior to collection of each sample for PFAS analyses, prior to removing the lid from the sampling container. After the sample is collected and the container is closed, pens or pencils, but not markers, shall be used in completing sample labels or in the vicinity of samples during collection.

Following sample collection and addition of preservative (if required), sample containers for PFAS analyses shall be placed in coolers with new, double-bagged ice and not re-usable chemical ice packs unless confirmed PFAS-free and regulatorily accepted, such that meltwater does not contact sample containers during transport.

3.4 SOIL/SEDIMENT SAMPLING CONSIDERATIONS

Surface soil and sediment samples for PFAS analyses should be collected using a clean, stainless-steel tool (e.g., a trowel or Ponar grab sampler).

For field collection of soil and sediment cores, single-use PVC, HDPE, or acetate liners shall be used, and samples for PFAS analysis should be collected from the cores directly or using a stainless-steel tool.

3.5 GROUNDWATER SAMPLING CONSIDERATIONS

It is recommended that, where feasible, measurements of monitoring well water levels and well depths be performed after sampling for PFAS to avoid possible cross-contamination.

HDPE or silicone tubing shall be used for purging and sample collection, where applicable. Teflon and LDPE shall NOT be used. During sampling, sampling personnel shall ensure that no tubing or other equipment contacts the inside or rim of the sample bottle. Any foaming observed in the sample during collection should be noted on the chain-of-custody form that accompanies the samples to the analytical laboratory.

If analyses to be performed by the laboratory include less common PFAS chemicals that have relatively high volatility (including fluorotelomers and sulfonamide/alcohols such as fluorotelomer alcohols, fluorotelomer acrylates, and methyl/ethyl fluorosulfonamides and sulfonamidoethanols), then precautions should be taken during sample collection to minimize loss of volatiles (e.g., minimizing turbulence in water as it flows into the sample container).

If use of passive/no-purge sample collection technology is to be utilized, it is critical to confirm that the sampling device does not contain LDPE (e.g., HydraSleeves made of HDPE rather than LDPE may be requested for PFAS sampling).

Filtration is not recommended because the filter may sorb PFAS or be a source of PFAS contamination.

3.6 SURFACE WATER AND POREWATER SAMPLING CONSIDERATIONS

Capped surface water sample containers shall be rinsed multiple times with site surface water prior to sampling.

Because PFAS tend to accumulate at the air/water interface, specific procedures for surface water sampling shall be followed. After rinsing, the capped container shall be lowered into the surface water, with the top pointed down. The container shall then be reoriented with the top pointed upward and opened under water at the depth targeted for sampling, ideally at least 10 centimeters from both the sediment surface and the water surface. During sample collection, the sample collection point shall be positioned upstream of the sampler, gloves, etc. If an extension rod must be used due to the depth of sampling, the rod shall be made of clean, PFAS-free material.

For porewater sampling, the common stainless-steel and PVC samplers, with HDPE and silicone tubing, are acceptable. The samplers should not be reused at multiple sampling locations.

As for groundwater samples, filtration is not recommended.

3.7 FIELD QUALITY CONTROL SAMPLES

It is recommended that field blanks and equipment (i.e., rinsate) blanks be collected at least daily, using laboratory supplied “PFAS-free” water, to detect any cross-contamination that occurred despite precautions taken during sampling. If a peristaltic pump is used for sample collection, then at least one equipment blank should be collected by pumping “PFAS-free” water through the pump with clean HDPE tubing.

Field duplicates should also be collected to assess the precision of the results.

Analysis of trip blanks may be advisable on a project-specific basis, particularly if relatively volatile PFAS chemicals will be analyzed.

The same precautions taken during collection of specified samples should be taken during the collection of quality control samples (Section 3.7).

4. MAINTENANCE

Not applicable.



5. PRECAUTIONS

See detailed precautions noted above.

6. REFERENCES

Department of Defense Environmental Data Quality Workgroup. 2017. *Bottle Selection and other Sampling Considerations When Sampling for Per- and Poly-Fluoroalkyl Substances (PFAS)*. Revision 1.2. July.

Interstate Technology Regulatory Council (ITRC). 2018. *Fact Sheet: Site Characterization Considerations, Sampling Precautions, and Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances (PFAS)*. March.

U.S. Army Corps of Engineers. 2016. *Standard Operating Procedure 047: Per/Poly Fluorinated Alkyl Substances (PFAS) Field Sampling*. March.

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Appendix D

Eurofin's List of Analytes, Method Detection Limits, and Limits of Quantification (Eurofins 2019 and 2020)

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**PFAS Modified 537 (Method 537 Version 1.1 Modified/SW-846 8321B Using LC/MS/MS, version 10)-
Solids**

<u>Compound</u>	<u>CAS Number</u>	<u>MDL</u>	<u>LOQ</u>	<u>Units</u>
10:2Fluorotelomersulfonic acid	120226-60-0	0.60	2.0	ng/g
4:2-Fluorotelomersulfonic acid	757124-72-4	0.60	2.0	ng/g
6:2-Fluorotelomersulfonic acid	27619-97-2	0.60	2.0	ng/g
8:2-Fluorotelomersulfonic acid	39108-34-4	0.60	3.0	ng/g
NEtFOSAA	2991-50-6	0.20	2.0	ng/g
NMeFOSAA	2355-31-9	0.20	2.0	ng/g
Perfluorobutanesulfonic acid	375-73-5	0.40	2.0	ng/g
Perfluorobutanoic acid	375-22-4	0.80	2.0	ng/g
Perfluorodecanesulfonic acid	335-77-3	0.20	0.60	ng/g
Perfluorodecanoic acid	335-76-2	0.20	0.60	ng/g
Perfluorododecanesulfonic acid	79780-39-5	0.20	2.0	ng/g
Perfluorododecanoic acid	307-55-1	0.20	0.60	ng/g
Perfluoroheptanesulfonic acid	375-92-8	0.20	0.60	ng/g
Perfluoroheptanoic acid	375-85-9	0.20	0.60	ng/g
Perfluorohexadecanoic acid	67905-19-5	0.20	0.60	ng/g
Perfluorohexanesulfonic acid	355-46-4	0.20	0.60	ng/g
Perfluorohexanoic acid	307-24-4	0.20	0.60	ng/g
Perfluorononanesulfonic acid	68259-12-1	0.20	0.60	ng/g
Perfluorononanoic acid	375-95-1	0.20	0.60	ng/g
Perfluorooctadecanoic acid	16517-11-6	0.20	0.60	ng/g
Perfluorooctanesulfonamide	754-91-6	0.20	0.60	ng/g
Perfluorooctanesulfonic acid	1763-23-1	0.20	0.60	ng/g
Perfluorooctanoic acid	335-67-1	0.20	0.60	ng/g
Perfluoropentanesulfonate	2706-91-4	0.20	0.60	ng/g
Perfluoropentanoic acid	2706-90-3	0.20	0.60	ng/g
Perfluorotetradecanoic acid	376-06-7	0.20	0.60	ng/g
Perfluorotridecanoic acid	72629-94-8	0.20	0.60	ng/g
Perfluoroundecanoic acid	2058-94-8	0.20	0.60	ng/g

Reporting limits and statistical QC windows are evaluated periodically and are subject to change.

**PFAS Modified 537 (Method 537 Version 1.1 Modified/SW-846 8321B Using LC/MS/MS, version 10)-
Aqueous**

<u>Compound</u>	<u>CAS Number</u>	<u>MDL</u>	<u>LOQ</u>	<u>Units</u>
11CI-PF3OUdS	763051-92-9	0.50	2.0	ng/l
4:2-Fluorotelomersulfonic acid	757124-72-4	0.50	2.0	ng/l
6:2-Fluorotelomersulfonic acid	27619-97-2	2.0	5.0	ng/l
8:2-Fluorotelomersulfonic acid	39108-34-4	1.0	3.0	ng/l
9CI-PF3ONS	756426-58-1	0.50	2.0	ng/l
DONA	919005-14-4	0.50	2.0	ng/l
HFPODA	13252-13-6	0.50	3.0	ng/l
NEtFOSAA	2991-50-6	0.50	3.0	ng/l
NMeFOSAA	2355-31-9	0.60	2.0	ng/l
Perfluorobutanesulfonic acid	375-73-5	0.50	2.0	ng/l
Perfluorobutanoic acid	375-22-4	2.0	5.0	ng/l
Perfluorodecanesulfonic acid	335-77-3	0.50	2.0	ng/l
Perfluorodecanoic acid	335-76-2	0.50	2.0	ng/l
Perfluorododecanoic acid	307-55-1	0.50	2.0	ng/l
Perfluoroheptanesulfonic acid	375-92-8	0.50	2.0	ng/l
Perfluoroheptanoic acid	375-85-9	0.50	2.0	ng/l
Perfluorohexanesulfonic acid	355-46-4	0.50	2.0	ng/l
Perfluorohexanoic acid	307-24-4	0.50	2.0	ng/l
Perfluorononanesulfonic acid	68259-12-1	0.50	2.0	ng/l
Perfluorononanoic acid	375-95-1	0.50	2.0	ng/l
Perfluorooctanesulfonamide	754-91-6	0.50	2.0	ng/l
Perfluorooctanesulfonic acid	1763-23-1	0.50	2.0	ng/l
Perfluorooctanoic acid	335-67-1	0.50	2.0	ng/l
Perfluoropentanesulfonate	2706-91-4	0.50	2.0	ng/l
Perfluoropentanoic acid	2706-90-3	0.50	2.0	ng/l
Perfluorotetradecanoic acid	376-06-7	0.50	2.0	ng/l
Perfluorotridecanoic acid	72629-94-8	0.50	2.0	ng/l
Perfluoroundecanoic acid	2058-94-8	0.50	2.0	ng/l

Reporting limits and statistical QC windows are evaluated periodically and are subject to change.

July 2019
L12374

TCL 4.3 VOCs 8260C

<u>Compound</u>	<u>LOQ</u>	<u>MDL</u>	<u>Units</u>
1,1,1-Trichloroethane	1	0.3	ug/l
1,1,2,2-Tetrachloroethane	1	0.2	ug/l
1,1,2-Trichloroethane	1	0.2	ug/l
1,1-Dichloroethane	1	0.2	ug/l
1,1-Dichloroethene	1	0.2	ug/l
1,2,4-Trichlorobenzene	5	0.3	ug/l
1,2-Dibromo-3-chloropropane	5	0.3	ug/l
1,2-Dibromoethane	1	0.2	ug/l
1,2-Dichlorobenzene	5	0.2	ug/l
1,2-Dichloroethane	1	0.3	ug/l
1,2-Dichloropropane	1	0.2	ug/l
1,3-Dichlorobenzene	5	0.2	ug/l
1,4-Dichlorobenzene	5	0.2	ug/l
2-Butanone	10	0.3	ug/l
2-Hexanone	10	0.3	ug/l
4-Methyl-2-pentanone	10	0.5	ug/l
Acetone	20	0.7	ug/l
Benzene	1	0.2	ug/l
Bromodichloromethane	1	0.2	ug/l
Bromoform	4	0.2	ug/l
Bromomethane	1	0.3	ug/l
Carbon Disulfide	5	0.2	ug/l
Carbon Tetrachloride	1	0.2	ug/l
Chlorobenzene	1	0.2	ug/l
Chloroethane	1	0.2	ug/l
Chloroform	1	0.2	ug/l
Chloromethane	1	0.2	ug/l
cis-1,2-Dichloroethene	1	0.2	ug/l
cis-1,3-Dichloropropene	1	0.2	ug/l
Cyclohexane	5	0.2	ug/l
Dibromochloromethane	1	0.2	ug/l
Dichlorodifluoromethane	1	0.2	ug/l
Ethylbenzene	1	0.4	ug/l
Freon 113	10	0.2	ug/l
Isopropylbenzene	5	0.2	ug/l
Methyl Acetate	5	0.2	ug/l
Methyl Tertiary Butyl Ether	1	0.2	ug/l
Methylcyclohexane	5	0.2	ug/l
Methylene Chloride	1	0.3	ug/l
Styrene	5	0.2	ug/l
Tetrachloroethene	1	0.2	ug/l
Toluene	1	0.2	ug/l
trans-1,2-Dichloroethene	1	0.2	ug/l
trans-1,3-Dichloropropene	1	0.2	ug/l
Trichloroethene	1	0.2	ug/l
Trichlorofluoromethane	1	0.2	ug/l
Vinyl Chloride	1	0.2	ug/l



July 2019
L12374

TCL 4.3 VOCs 8260C

<u>Compound</u>	<u>LOQ</u>	<u>MDL</u>	<u>Units</u>
Xylene (Total)	5	1	ug/l

Reporting limits are evaluated periodically and are subject to change.

Attachment 2:
Excerpt from EA Engineering, Science, and Technology, Inc.,
Sampling and Analysis Plan Addendum Expanded Site
Inspection New Castle Public Wells Groundwater Plume Site
(DE-0363) New Castle, Delaware, August 2021. Excerpted for file
accessibility.



**Sampling and Analysis Plan Addendum
Expanded Site Inspection
New Castle Public Wells Groundwater Plume Site
(DE-0363)
New Castle, Delaware**

Prepared for

Delaware Department of Natural Resources and Environmental Control
Division of Waste and Hazardous Substances
Remediation Section
391 Lukens Drive
New Castle, Delaware 19720

Prepared by

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August 2021
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LIST OF ACRONYMS AND ABBREVIATIONS

AOPC	Area of potential concern
Artesian	Artesian Water Company, Inc.
bgs	Below ground surface
DNREC-RS	Department of Natural Resources and Environmental Control-Remediation Section
EA	EA Engineering, Science, and Technology, Inc., PBC
EDD	Electronic data deliverable
EPA	U.S. Environmental Protection Agency
ESI	Expanded Site Inspection
ft.	Foot (feet)
HAL	Health advisory level
HDPE	High density polyethylene
HSCA	Hazardous Substance Cleanup Act
IDW	Investigation-derived waste
in.	Inch(es)
MS	Matrix spike
MSD	Matrix spike duplicate
NCCA	New Castle County Airport
ng/L	Nanograms per liter
No.	Number
PA	Preliminary Assessment
PFAS	Per- and Polyfluoroalkyl substance
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
PID	Photoionization detector
PVC	Polyvinyl chloride poly
SI	Site Inspection
Site	New Castle Public Wells Groundwater Plume Site
SOP	Standard Operating Procedure
SVOC	Semi-volatile organic compound
TAL	Target Analyte List
TestAmerica	TestAmerica Laboratories, Inc.

UCMR 3 Third Unregulated Contaminant Monitoring Rule

VOC Volatile organic compound

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1. INTRODUCTION

1.1 PROJECT DESCRIPTION

EA Engineering, Science, and Technology, Inc., PBC (EA) has been tasked by the Delaware Department of Natural Resources and Environmental Control – Division of Waste and Hazardous Substances, Remediation Section (DNREC-RS), under the authority of the Delaware Hazardous Substance Cleanup Act (HSCA) (7 Delaware Code, Chapter 91) and Environmental Investigation and Remediation Services Contract Number (No.) NAT-20374, to complete an Expanded Site Inspection (ESI). Activities will include well installations followed by groundwater and potable water sampling at the New Castle Public Wells Groundwater Plume Site (DE-0363) in New Castle, Delaware (the “Site”) to evaluate potential constituents of concern and to identify the nature and extent of per- and polyfluoroalkyl substances (PFAS) in groundwater in the vicinity of areas of potential concern (AOPCs) 4, 5, and 6 and the Jefferson Farms public supply wells.

This Sampling and Analysis Plan Addendum includes the tasks and procedures associated with well installation and the sampling of select monitoring and public supply wells. The following sections document the revision to the 2020 Final Sampling and Analysis Plan (EA 2020). Sampling will be completed in accordance with the Site-Specific Health and Safety Plan drafted by EA (**Appendix A**).

1.2 SAMPLING AND ANALYSIS PLAN ADDENDUM ORGANIZATION

This Sampling and Analysis Plan is organized into the following sections:

- **Section 1**—Provides a brief project description and report organization.
- **Section 2**—Provides background on site history, site geology, and hydrogeology, and summarizes the characterization completed to date.
- **Section 3**—Provides an overview of the project scope and objectives.
- **Section 4**—Summarizes pre-field activities.
- **Section 5**—Summarizes well installation and development.
- **Section 6**—Summarizes sampling procedures, including field and analytical procedures.
- **Section 7**—Presents the field operation documentation.
- **Section 8**—Provides an overview of the report requirements.
- **Section 9**—Identifies the project team.

- **Section 10**—Provides the references cited within this document.

2. BACKGROUND INFORMATION

2.1 LOCATION AND DESCRIPTION

The Site is located at (0) East Basin Road, New Castle, New Castle County, Delaware as shown on **Figure 1** and is an approximately 7-square mile area surrounding several public supply wells. The Site includes 16 AOPCs, otherwise referred to as Areas, as identified by DNREC-RS on **Figure 2**. The Site is approximately bounded by Interstate 295 to the north, the Delaware River to the east, State Route 273 (Frenchtown Road) to the south, and the New Castle County Airport (NCCA) to the west. The Site is a mixture of residential and commercial areas including housing developments, the NCCA, retail and commercial centers, and industrial parks.

2.2 HISTORY

In 2013 and 2014, as part of the federal Third Unregulated Contaminant Monitoring Rule (UCMR 3), drinking water samples were collected from multiple public supply wells in the city of New Castle, Delaware. Concentrations of perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) exceeded the U.S. Environmental Protection Agency (EPA) provisional health advisory levels (HALs) (EPA 2009) of 200 nanograms per liter (ng/L) and 400 ng/L, respectively, in five of the public supply wells: Artesian Water Company, Inc.'s (Artesian) Wilmington Manor Well #3 and Jefferson Farms Well #1, and the City of New Castle Municipal Services Commission's Basin Road Well, Schoolhouse Lane Well, and Frenchtown Road Well. PFOA was detected at a maximum concentration of 440 ng/L and PFOS was detected at a maximum concentration of 2,300 ng/L (Delaware Division of Public Health 2014a and 2014b) during the UCMR 3 sampling of the aforementioned public supply wells.

Since that time, EPA has established a more stringent lifetime HAL of 70 ng/L in drinking water for PFOS and PFOA and recommend this same level for combined PFOS and PFOA concentrations when both compounds are detected (EPA 2016a and 2016b). Concentrations in these public water supply wells, as well as others in the area, have exceeded the lifetime HAL during subsequent sampling events in 2019 and 2020 (**Figure 3**). Artesian and the City of New Castle's Municipal Services Commission have been treating the public drinking water with carbon to remove PFOS and PFOA to assure concentrations do not exceed the lifetime HAL.

A Preliminary Assessment (PA) was conducted by DNREC-RS in March 2015 to identify potential sources of PFAS in the area of the impacted public supply wells (DNREC 2015b). The PA identified 16 AOPCs based on the presence of businesses that either use, produce, dispense, or dispose of compounds and products that may contain PFAS either directly or inadvertently. The AOPCs were also selected based on their proximity to the impacted public supply wells and the NCCA. The 16 AOPCs are displayed on **Figure 2** and are summarized in further detail in the Comprehensive Site Inspection Report (EA 2021) and are as follows:

- Area 1: Quigley Boulevard Industrial Park
- Area 2: Harry Wood Landfill
- Area 3: Centerpoint Industrial Park

- Area 4: Boulden Interchange Park
- Area 5: Southgate Center Industrial Park
- Area 6: Matassino Road
- Area 7: East Commons Boulevard Industrial Complex
- Area 8: BMX Fire Training Area at Track Off Commons Boulevard on Speedway Drive
- Area 9: New Castle County Airport Fire Training Area at the North End of Runway #19
- Area 10: New Castle Air National Guard Base
- Area 11: Route 141 Basin Road Carpet Warehouse Across from Delaware Air National Guard
- Area 12: Route 13 Carpet Warehouse North of Route 141 Basin Road Overpass
- Area 13: Wilmington Manor Fire Company on Route 13
- Area 14: NCCA (Crash Sites and Fire Systems in Hangars)
- Area 15: Route 13 Dupont Highway Commercial District
- Area 16: Old Airport Road Commercial District.

A Site Inspection (SI) was completed from 2017-2020 by DNREC-RS and EA that focused on potential groundwater contamination at Areas 1, 8, 9, 11, 13, and 14 and potential soil contamination at Area 8 (EA 2021). These areas were listed as high priority due to operational history and proximity to existing exceedances of PFAS. The SI was conducted to determine whether substances, primarily PFAS, are present and migrating to the environment at the Site. During the SI, PFAS was detected in groundwater, surface water, and sediment collected at the Site. Although soil was not sampled for PFAS during the SI, PFAS has been detected in soil within Area 10 during an independent SI (Amec Foster Wheeler 2019).

Based on the groundwater data collected thus far, the lateral extent of PFAS contamination is widespread throughout the Site. The Comprehensive Site Inspection Report recommended that additional monitoring wells should be installed in the vicinity of the Jefferson Farms public supply wells to fill data gaps and identify the nature and extent of PFAS in groundwater at the Site (EA 2021). Currently, there is limited groundwater data available for the area surrounding the Jefferson Farms Wells (Jefferson Farms Well #1R and Jefferson Farms Well #2R) and the proximity of these wells to a groundwater divide could be valuable in determining contaminant migration direction(s). Jefferson Farms Well #2R had a combined PFOS and PFOA concentration of 196 ng/L in 2019 (**Figure 2**). Additionally, the list of potential constituents of concern at the Site should be expanded to include PFAS, volatile organic compounds (VOCs), semi-volatile organic compound (SVOCs), Target Analyte List (TAL) metals, and dioxin/furans for all AOPCs (EA 2021).

2.3 GEOLOGY

New Castle County includes the Appalachian Piedmont Province and the Atlantic Coastal Plain Province. The border between these two provinces is marked by a fall zone. Physiographically, the Site lies within the northern edge of the Atlantic Coastal Plain Province, which consists of unconsolidated and semi consolidated fluvial deposited sediments. The Pleistocene Columbia

Formation unconformably overlies the older Cretaceous Potomac Formation at the Site and dips easterly. These formations were deposited in non-marine fluvial environments.

The Columbia Formation is typically composed of yellowish to reddish brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel with scattered beds of tan to reddish-gray clayey silt. In places, the upper 5 to 25 feet (ft.) consist of grayish to reddish brown silt to very fine sand overlaying medium to coarse sand of the Middle Pleistocene Columbia Formation. The base of the Columbia Formation is characterized by cobble- to boulder-sized clasts found in gravel beds ranging from a few inches to 3 ft. thick. The thickness of the Columbia Formation in New Castle County ranges from less than 10 ft. to over 130 ft. where it occurs in channel deposits (Delaware Geological Survey 1982).

The sediments of the Columbia Formation fill the eroded surfaces within the underlying Potomac Formation forming paleo-channels that trend northeast to southwest with a thickness of approximately 70 ft. (Delaware Geological Survey 1957; Spoljaric 1967). One of these paleochannels is located within the Site (**Figure 4**). Due to erosion, the Upper Potomac clay may be discontinuous or missing entirely within the paleochannels. Additionally, the Upper Potomac clay is absent in places from the NCCA, as documented in boring logs from select monitoring wells. The underlying Potomac Formation is believed to be 400 ft. thick in the area of the Site based on the boring log for Artesian's Wilmington Manor MW-1 drilled in 2003 (DNREC 2015b). The Potomac Formation consists of interbedded dark-red, gray, pink, and white silty clay to clayey silt and fine to medium sand. Beds of gray clayey silt to very fine sand containing charcoal and lignite are common.

The Potomac Formation in the area of the Site is underlain by the Lower Paleozoic Wilmington Complex, which consists of felsic and mafic gneiss and minor schist and the Brandywine Blue Gneiss, which consists of granulite facies felsic gneisses. The unit is a medium to coarse grained, lineated, two pyroxene, gneiss with variable quartz content and thin, discontinuous mafic layers. The well log from Artesian's Wilmington Manor MW-1 indicated that the basement rocks were encountered at a depth of 440 ft. below ground surface (bgs) at this well's location.

2.4 HYDROGEOLOGY

The Columbia and Potomac Formations serve as aquifers within the area (DNREC 2015b). The saturated thickness of the Columbia Aquifer is variable and is unconfined. The sands of the Potomac Aquifer are confined to semiconfined by the clays of the Potomac Formation. The hydrogeologic conditions of both the Columbia and Potomac Aquifers are variable due to the lenticular and discontinuous nature of units of permeable sands interbedded with units of silts and clays. Direct recharge from the surficial Columbia Aquifer is only to the youngest aquifer sands of the Potomac with limited or no recharge to lower Potomac Aquifer sands. The Potomac Formation has historically been considered as two aquifers, the Upper Potomac and Middle Potomac, separated by an aquitard that is not always present (AECOM 2016a and BB&E, Inc. 2016). The aquitard, if present, is a very stiff to hard lean clay or soft to medium stiff fat clay

that does not appear to transmit water vertically. The clay layer has been observed to be up to 60 to 80 ft. thick within the Site (BB&E, Inc. 2016).

Regionally, groundwater flow within the Columbia Aquifer is influenced by topography and the presence of surface water bodies. The Potomac Aquifer regionally flows east-southeast and discharges to the Delaware River. Groundwater flow direction within the Site is influenced by withdrawals from public supply wells as well as the presence of the surface water and groundwater divide at the NCCA. The City of New Castle and Artesian public supply wells have all been installed to the north, east, and south of the of the NCCA in areas where the sands of the Columbia Aquifer are thickest and have filled eroded surfaces within the underlying Potomac Formation.

The surface elevations in the area range from 85 ft. above sea level at the NCCA to sea level both at the Delaware River to the southeast, and at Nonesuch Creek and the Christina River to the northwest. Along the east side of the NCCA, the surficial aquifer flows to the east-southeast toward the Delaware River while on the west side of the NCCA it flows to the west-northwest toward the Christina River. The presence of the groundwater divide may be related to the thinning of the Columbia Aquifer at the NCCA. Groundwater flow velocities in the Columbia Aquifer are on the order of hundreds of ft. per year while those in the Potomac Aquifer are tens of ft. per year (DNREC 2015b).

3. PROJECT SCOPE AND OBJECTIVES

The project includes the installation of 3 monitoring wells along with sampling of up to 9 monitoring wells (6 existing and 3 newly installed monitoring wells) and up to 4 public supply wells (pre- and post-treatment samples) for the analysis of PFAS, VOCs, SVOCs, TAL metals (total and dissolved), and dioxins/furans. The existing monitoring wells to be sampled (Area08-MW02, Area09-MW04, Area13-MW12, Area13-MW14, NCPW-MW18, and NCPW-MW20S) were installed by DNREC-RS and EA during the SI (EA 2021). The estimated proposed monitoring well locations provided by DNREC-RS through discussions with EPA are shown on **Figure 5** and are subject to change based on property access. The monitoring wells will be screened in the first encountered groundwater and are not anticipated to exceed a total depth of 50 ft. bgs.

Sampling of the newly installed wells will occur no sooner than 2 weeks following development of the newly installed wells.

Potable water sampling will be conducted at Artesian's Airport Industrial Park Well #1 or #2 (pre- and post-treatment samples), City of New Castle's School House Lane Well (pre- and post-treatment samples), City of New Castle's Basin Road Well (pre-treatment sample), and Artesian's Jefferson Farms Well #2R (pre- and post-treatment samples).

The objective of this ESI is to further investigate if PFAS and additional potential constituents of concern are present and migrating to the environment in the area surrounding the public wells. Additionally, the ESI will attempt to fill data gaps and identify the nature and extent of PFAS in groundwater in the vicinity of the Jefferson Farms public supply wells. The ESI is not intended to be a detailed extent-of-contamination assessment or risk assessment. The purpose of this Sampling and Analysis Plan Addendum is to document the well installation and the sampling and analysis procedures.

Samples will be analyzed by a DNREC-HSCA-approved laboratory, TestAmerica Laboratories, Inc. (TestAmerica), for analysis, as requested by DNREC-RS. Data validation will not occur, as requested by DNREC-RS.

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4. PRE-FIELD ACTIVITIES

4.1 RIGHT-OF-ENTRIES

DNREC-RS will maintain the right-of-entries and contact property owners prior to commencement of the well installation and subsequent sampling event. DNREC-RS will coordinate with the property owners to determine an area to store drums while waiting for disposal parameter results.

4.2 SITE VISIT

A site visit with EA, DNREC-RS, and potentially with property owners will occur prior to commencement of the well installation phase to mark locations as well as coordinate the sampling effort logistics.

4.3 UTILITY CLEARANCE

Intrusive activities will commence following the mark-out and clearance of utilities by Miss Utility as well as a third-party utility locator company, Geo-Graf, Inc. Locations will also be soft dug by the drilling contractor, Summit Drilling, prior to the commencement of sonic drilling.

The following information will be considered when planning any intrusive activities:

- ***Time between locate requests and site marking***—Excavators in Delaware are to give notice 2 full working days prior to the day they plan to start work. The day of the call is not counted as one of these days.
- ***Ticket life***—10 business days after the call date.
- ***Required hand-digging distance***—24 inches (in.).

Following the Miss Utility mark-out, a third-party utility locator, Geo-Graf, Inc., will be contacted to mark and clear each private property and/or location proposed for intrusive work. It is anticipated that some of the investigative work will be performed on public properties. The third-party utility locator will include a ground penetrating radar component to the utility mark-out.

The EA Geologist will confirm with the EA Project Manager that the clearance has been performed.

Locations will be vacuum excavated/air knifed as needed and cleared of utilities to at least 5 ft. bgs prior to any intrusive activities.

4.4 PERMITS

Prior to the start of field work the drilling subcontractor, Summit Drilling, will submit the required well permit forms electronically to DNREC Division of Water. It is anticipated that DNREC-RS will provide the fee waiver notifications for each boring and well locations to EA. Summit Drilling will upload the fee waiver notifications with the well permits to avoid the permit fees.

Safety permits, if drilling is to be completed in the right-of-way, may be needed through the Delaware Department of Transportation. Safety permits may include traffic control requirements including the proper use of signage and safety drums/barrels due to pedestrian traffic in accordance with the Delaware Department of Transportation.

5. WELL INSTALLATION AND DEVELOPMENT

Three monitoring wells will be installed at the Site by a Delaware-licensed driller, Summit Drilling, using rotosonic drilling methods. These 3 wells will be screened in the first encountered groundwater and are not anticipated to exceed a total depth of 50 ft. bgs.

Continuous soil will be collected to document lithology to determine well screen intervals. Soil samples will not be submitted for laboratory analysis except for disposal parameters. Following installation, the monitoring wells will be developed by Summit Drilling in accordance with applicable DNREC Division of Water regulations. The monitoring wells will be surveyed by a Delaware-licensed surveyor, Apex Engineering Incorporated, to determine the lateral coordinates, top of inner casing elevation, and ground surface elevation.

The 2021 Proposed Sample Location Map (**Figure 5**) illustrates the proposed well locations provided by DNREC-RS, although locations may change depending on access.

5.1 DRILLING

Water from a PFAS-free source will be brought onsite by Summit Drilling to be used during drilling. The water source quality report will be provided to and approved by DNREC-RS and EPA. During monitoring well borehole advancement, continuous soil cores will be collected to characterize lithology. Target depths and approximate screening depths for monitoring wells are in the first encountered groundwater. The following summarizes the general steps for drilling the monitoring wells:

- Advance a nominal 4-in. diameter sample barrel using rotosonic drilling methods to 10 ft. bgs. Drilling will be conducted using a minimal amount of water and a mixture of water and bentonite (such as Bentonite Quik-Gel[®] and/or Bentonite Super-GEL-X[®]), as required, to lubricate and prevent overheating of the casing and control heaving sands.
- A nominal 6-in. override casing will then be drilled over the 4-in. sample barrel to a depth of 10 ft. bgs. The 6-in. override casing will remain in place and the 4-in. sample barrel will be removed from the borehole. The soil core will be extruded from the 4-in. sample barrel. The barrel will be returned to the borehole to 10 ft. bgs and then vibrated to a depth of 20 ft. bgs. The 6-in. override casing will be drilled to 20 ft. bgs. This process will continue until the targeted depth is reached.
- Continuous soil will be collected to document lithology. Photoionization detector (PID) readings will be collected and documented along with lithology. Boring logs (**Appendix B**) will be completed for each boring.
- Once groundwater is encountered and the well screen depth is determined, the 4-in. sample barrel will be removed from the boring prior to well installation. The 2-in. well will be set inside the 6-in. override casing, sand packed and bentonite seal in accordance with Delaware regulations. Grout will be placed in between the 2-in. well and the 6-in.

override casing and the 6-in. will be extracted from the borehole. The driller will then ensure the borehole is full of grout and will then remove the working casing. This will leave a 2-in. well in place with a continuous grout column above the screened zone to the surface.

5.2 WELL INSTALLATION

The wells will be installed inside the 6-in. override casing. Grout will be placed by a tremie-pipe between the 2-in. well and the 6-in. override casing. The borehole will be full of grout prior to removing the working casing.

These wells will be constructed with a 2-in. diameter, flush threaded, Schedule 40 polyvinyl chloride (PVC) riser with 0.010-in. slot screen with a well screen length of 10 ft. Well installation will include Type #1 fine-grained sand filter pack at a minimum of 2 ft. above the screen, followed by a minimum of 2 ft. of bentonite, followed by a bentonite-cement grout. The bentonite seal will be hydrated with potable water and allowed to set for a sufficient time to ensure a proper seal. A bentonite grout will be placed with a tremie pipe from the bentonite seal to within 2 ft. of the ground surface. A concrete surface seal, approximately 1- to 2-ft. thick, will be placed on top of the bentonite grout to the surface level. A protective steel flush mount manhole with lockable cap will be seated in the concrete surface seal, which will be constructed with a slight slope so that surface water will run off the pad.

The Record of Monitoring Well Construction (**Appendix B**) will be completed for each monitoring well.

5.3 WELL DEVELOPMENT

The new wells will be developed by Summit Drilling approximately 48 hours after placement, but no sooner than 24 hours after grouting is completed, per Delaware regulations. The depth to static water level and total well depth will be measured from the top of the inner PVC casing prior to developing each well. The wells will be continuously surged and pumped until turbidity is below 10 nephelometric turbidity units. At a minimum, well development will remove 3-5 well volumes of water.

Water quality parameters will be monitored by EA for turbidity, pH, conductivity, oxidation reduction potential, dissolved oxygen, and temperature before beginning development procedures and after removing 2, 2.5, and 3 well volumes of water, per Delaware regulations. It is anticipated that each well will be developed for a maximum of 2 hours each. Physical characteristics of the purged groundwater during well development will be noted as applicable such as odor and color. Well development will be recorded on the Record of Well Development provided in **Appendix B**. Well development water will be drummed and disposed of in accordance with Section 6.8.

6. SAMPLING PROCEDURES

Sampling will be completed in accordance with the Site-Specific Health and Safety Plan (**Appendix A**) and EA's Standard Operating Procedures (SOPs) for Field Logbooks and PFAS Sampling (**Appendix C**). EA's SOP for Sampling PFAS lists the prohibited and acceptable items in a table. In addition to following EA's SOP for Sampling PFAS, this section includes additional requirements that will be followed by the field crew. The 2021 Proposed Sample Location Map (**Figure 5**) illustrates the locations of the proposed monitoring wells and additional monitoring well locations to be sampled. Potable water sampling will be conducted at four public supply wells operated by Artesian and the City of New Castle.

6.1 SAMPLE REQUIREMENTS

Clean nitrile gloves will be donned immediately as noted below during the following activities:

- Following the contact of any non-dedicated sampling equipment
- Following contact of non-decontaminated surfaces and when needed
- Prior to contacting sample bottles or laboratory-grade PFAS-free water
- Prior to and following the decontamination of equipment
- Prior to placing downhole/intrusive equipment such as pumps in wells
- Following groundwater purging, prior to collecting any sample.

Sampling will not occur during persistent rainfall since rain gear is not permitted during sampling.

High density polyethylene (HDPE) lids on sample containers are not typically considered water-tight; therefore, the HDPE sample containers will be individually placed in water-tight bags prior to placement in coolers. Containers for collection of PFAS samples shall never be left uncapped, either before or after sample collection, and the lid/cap shall be kept in a gloved hand and not be set down while removed from the container. Labels will be completed in ballpoint pens and no Sharpies® or other markers will be used during field activities.

Samples will be iced immediately upon sample collection and blue ice is prohibited. Ice will be double bagged (polyethylene plastic) and sealed to avoid contact of ice or meltwater during sample delivery. The table of prohibited and acceptable alternatives in EA's SOP for Sampling PFAS (**Appendix C**) will be followed even while sampling for other analytes to minimize cross contamination to PFAS samples.

PFAS are located in a number of household products including nonstick cookware, fabric waterproofing/stain-proofing, Post-It® notes, foam coolers, and food packaging (i.e., aluminum foil, sandwich paper wrapping, and disposable coffee cups). PFAS are also located in vehicle materials such as stain resistant vehicle seats, wiring and insulation, and anti-reflective coatings. If feasible, vehicle seats will be covered in a well-laundered cotton blanket to avoid contact between clothes and the seats.

The sample team will not wear new clothing, clothing with fabric softener, stain-resistant, treated clothing, or garments including polytetrafluoroethylene (e.g., Teflon[®], Gore-Tex[®], Tyvek[®]) as noted in the table of prohibited and acceptable items in EA's SOP for Sampling PFAS (**Appendix C**). They will refrain from using cosmetics, moisturizers, lotions, hand creams, non-approved sunscreens, and non-approved insect repellent (table in EA's SOP for Sampling PFAS [**Appendix C**]).

Snacks and lunch are not to be eaten in the immediate sampling area and shall be eaten at least 33 ft. away from any sampling area. As a result, the sampling team will use appropriate hand washing procedures (Liquinox, Alconox, or Citranox and laboratory-grade PFAS-free water) and will don clean nitrile gloves immediately prior to collecting a sample.

Visitors to the sampling area shall remain at least 33 ft. at a distance.

6.2 EQUIPMENT CALIBRATION, OPERATION, AND MAINTENANCE

Proper calibration, operation, and maintenance of each instrument will be followed in accordance with the manufacturer's instructions. Equipment to be calibrated includes, but is not limited to, water quality meters, combustible gas indicators/oxygen meters, and photoionization detectors.

Instruments and equipment used during sampling activities will be calibrated, operated, and maintained according to the manufacturer's guidelines and recommendations. Instruments will be inspected and calibrated prior to the beginning of each sampling day, at the end of each sampling day, and additionally as needed, as indicated by changes in instrument performance or weather conditions that could affect instrument performance. In addition to the manufacturer's calibration solutions, each piece of field equipment that is calibrated will be required to pass a quality control sample from a source different than that used to calibrate the device (pH, turbidity, and conductivity). The acceptance criteria for the quality control sample will be that the recovery does not deviate from the true value. Standard verification will be confirmed against the requirements provided by the standard manufacturer. This will demonstrate that all field instruments have held calibration throughout the sample screening and collection sequence. The equipment calibration will be recorded in field notes.

6.3 GROUNDWATER MONITORING PROCEDURE

Groundwater sampling will be completed at a minimum of 14 days following well development of the newly installed monitoring wells.

6.3.1 Groundwater Level Measurements

Water levels and depth to bottom of well will be measured with a water level indicator from each well following sampling in lieu of prior to the commencement of sampling due to the low detection limits for PFAS analysis and to help mitigate the possibility of cross-contamination. Measurements will be recorded to the nearest 0.01 ft. and will be taken from a clearly marked reference point at the top of the PVC casing. Water level indicators will not be placed in wells

during purging. Well headspace will be measured by a photoionization detector when initially opening the well lid. Data will be recorded in field notes. A table will be provided to the sampling crew that summarizes the newly installed monitoring well permit numbers, elevations, coordinates, and screened intervals prior to mobilization onsite.

6.3.2 Groundwater Sampling via Low Flow

Dedicated HDPE tubing and PFAS-free bladder pumps, or equivalent, are proposed to purge the monitoring wells during low flow sampling. Purged water will be drummed and disposed of in accordance with Section 6.8. Water quality data will be recorded every 5 minutes until the water quality parameters have stabilized over three consecutive readings. Stabilization is proposed to be defined as:

- ± 0.1 pH units
- ± 3 percent for temperature
- ± 3 percent for conductivity
- ± 10 percent for dissolved oxygen
- ± 10 millivolts for redox potential
- ± 10 percent for turbidity
- Steady or rising water level.

If these parameters have not stabilized after 2 hours, purging will be terminated, and sampling will commence. If a low yielding well de-waters, the well will be sampled upon adequate recovery and will be noted in field documents. The EA Project Manager and DNREC-RS will be notified.

Parameters will be recorded in the Purging and Sampling Record (**Appendix B**).

Any foaming observed in the sample during collection should be documented on the chain-of-custody form as well as the Purging and Sampling Record (**Appendix B**).

6.4 POTABLE WELL SAMPLING PROCEDURE

Potable water will be collected from designated sample ports from select Artesian and City of New Castle public supply wells. Unless otherwise noted, pre- and post-treatment samples will be collected at each public supply well. Each sample port will be opened and allowed to flush for at least 5 minutes, when possible, to obtain a “fresh” sample. However, when sampling from a public supply well that is not in regular use, purge the water until water quality parameters (pH, temperature, conductivity, dissolved oxygen, redox potential, and turbidity) have stabilized, to ensure formation water (as opposed to stagnant well column water) will be sampled. Potable water samples should be collected while the water is flowing, taking care not to flush out any preservatives in the bottle ware.

Potable water sampling will be conducted at Artesian’s Airport Industrial Park Well #1 or #2 (pre- and post-treatment samples), City of New Castle’s School House Lane Well (pre- and post-

treatment samples), City of New Castle's Basin Road Well (pre-treatment sample), and Artesian's Jefferson Farms Well #2R (pre- and post-treatment samples).

6.5 ANALYTICAL PROCEDURES

Samples will be placed in a cooler on ice (blue ice is prohibited) after collection and the samples will be transported to either the DNREC-RS New Castle office or EA's Newark, Delaware office for pickup by a HSCA-approved laboratory, TestAmerica (under contract with DNREC-RS). The bottle ware, preservative requirements, and holding times for each analyte are listed in **Table 1**. The laboratory will provide a Level IV data package including a DNREC-HSCA electronic data deliverable (EDD).

6.5.1 Analytical Methods and Quality Assurance Samples

The analytical methods and quality assurance samples for each media are provided in **Table 2**. As directed, PFAS will be analyzed by Modified 537 (Method 537 Version 1.1 Modified/SW-846 8321B Using LC/MS/MS, version 10).

Quality assurance will include field blanks (ambient sample), rinsate blanks, duplicates, and matrix spike (MS)/matrix spike duplicates (MSDs), and trip blanks. A field blank will be collected at each sampling location to represent each parent sample for PFAS analysis and one field blank per day will be collected for analysis of VOCs, SVOCs, TAL metals (total and dissolved), and dioxins/furans. A rinsate blank will be collected to represent each type of downhole/intrusive equipment following decontamination per day. The rinsate blank for each set of equipment utilized will be sampled for PFAS, VOCs, SVOCs, TAL metals (total and dissolved), and dioxins/furans. Rinsate samples will be collected for each type of equipment but not collected more than once on the same pump in between locations. A duplicate and MS/MSD will be collected per 20 parent samples per day to be analyzed for PFAS, VOCs, SVOCs, TAL metals (total and dissolved), and dioxins/furans. A trip blank per cooler for VOC analysis will be analyzed in addition to the above quality assurance samples.

The equipment representing each rinsate blank collected, as well as where that piece of equipment was utilized in reference to sample identification number and location will be documented. The parent sample represented by each field blank will be documented as well. The parent sample representing each duplicate and MS/MSD will be documented.

6.6 SAMPLE DESIGNATION

Each sample identification number will commence with NCPW to represent New Castle Public Wells.

Groundwater samples will be identified by the Well Identification Number-date of collection (e.g., NCPW-MW18-09132021).

Potable water samples will be identified by the Public Supply Well Identification-date of collection (e.g., NCPW-AIPW2-09132021).

Quality assurance sample identification will commence with NCPW followed by the quality assurance code (FB, RB, DUP, or TRIP) in the sample designation. Field blanks and rinsate blanks will also be identified by number in sequence of collection.

- Field blank will be identified as NCPW followed by FB-sequential number-date (e.g., NCPW-FB-01-09132021).
- Rinsate blank will be identified as NCPW followed by RB-sequential number-date (e.g., NCPW-RB-01-09132021).
- Duplicate will be identified as NCPW-DUP-date (e.g., NCPW-DUP-09132021).
- Trip blank will be identified as NCPW-TRIP-date (e.g., NCPW-TRIP-09132021).

MS/MSD samples will be identified in relation to the parent sample on the chain-of-custody in the Notes section.

Samples collected for investigation-derived waste (IDW) analyses will be labeled as NCPW-IDW-AQ for aqueous or S for solid-date of collection (i.e., NCPW-IDW-AQ-09132021).

6.7 EQUIPMENT DECONTAMINATION

6.7.1 Drilling Phase

Decontamination of larger equipment (e.g., drill rigs and large downhole drilling and sampling equipment) will be completed between boring locations with an approved potable water source using a high-pressure washer or steam within a decontamination pad or container. The 4-in. sample barrel interior will be rinsed with an approved potable water source.

6.7.2 Sampling Phase

Whenever possible, equipment will be rinsed with PFAS-free water immediately prior to use at each sample location during groundwater sampling.

Intrusive field equipment utilized during the groundwater sampling phase (such as the water level meter, etc.) that will contact media will be properly decontaminated before use and between uses. Proper decontamination procedures will consist of the following steps upon donning a new pair of nitrile gloves:

- Wash with an approved detergent washing solution (e.g., Alconox, Liquinox, or Citranox) and laboratory-grade PFAS-free water using an appropriate brush

- Rinse with laboratory-grade PFAS-free water
- Rinse with methanol
- Triple rinse with laboratory-grade PFAS-free water
- Air dry in a clean HDPE container or bucket; aluminum foil will not be used to wrap air dry equipment since this is a prohibited item as noted in the EA SOP for Sampling PFAS (**Appendix C**).

6.8 INVESTIGATION-DERIVED WASTES

IDW that will be generated as part of the drilling and subsequent sampling event may include personal protective equipment, soil, groundwater, and decontamination water. IDW will be drummed and stored on pallets in a DNREC-RS-approved area while awaiting analytical results for offsite disposal. The drums will be labeled as IDW pending analysis, sample or well location as well as the site identification, media, DNREC-RS Project Manager contact information, and dates generated will be listed.

Other wastes generated during Site activities are expected to include disposable gloves, plastic tubing, paper towels, etc. These materials will be placed into plastic garbage bags and disposed of as municipal waste.

6.8.1 Sample Collection and Analysis of Investigation-Derived Waste

One composite sample will be collected from every 10 to 20 drums depending on facility requirements at the time to represent each media. Media suspected to be classified as hazardous per DNREC will be drummed and sampled separate from suspected nonhazardous waste per media. IDW parameter analyses for each media are listed in **Table 2** and are in accordance with the disposal facility at the time of the drafting of this document. It is anticipated that there will be approximately 10 drums of cuttings and 29 drums of water produced during well installation and development, which may change in number depending on Site conditions. One drum of purged groundwater is anticipated to be produced from groundwater sampling activities.

7. FIELD OPERATION DOCUMENTATION

7.1 SAMPLE LABEL AND CUSTODY DOCUMENTATION

7.1.1 Sample Label

Each sample bottle will be labeled with the client's name, project number, location, sample designation, requested analyses, date, time of collection, Site name, and name of sampler on a label that will not float/soak off. Sample label and custody documents will be filled out in ballpoint pens and no Sharpies®, water-proof pens, or markers will be used during sampling activities in accordance with the table in **Appendix C**.

HDPE lids on sample containers are not typically considered watertight; the HDPE sample containers will be individually placed in water-tight bags prior to placement in shipping containers loaded with ice.

7.1.2 Sample Custody and Documentation

Chain-of-custody forms will be completed in ballpoint pens at the time samples are collected for analysis. The New Castle Public Wells Groundwater Plume Site is a DNREC-HSCA Site, which will be noted on the chain-of custody. Foaming of sample during sample location will be noted on the chain-of custody.

The chain-of-custody will be transported with the samples to the laboratory where the sample custodian will accept custody of the samples by signing the chain-of-custody. A copy of the chain-of-custody will be retained by EA.

7.2 FIELD NOTES AND SAMPLE FIELD SHEETS

Field notes (loose non-waterproof paper on aluminum or Masonite clipboards) will be completed in accordance with EA's SOP for Field Logbooks (**Appendix C**). Loose-paper field notes in lieu of field logbooks will be utilized to avoid PFAS cross-contamination and loose papers will be numbered in sequence and dated. Field logbooks, spiral hard cover books, or plastic binders will not be used to minimize cross-contamination to PFAS samples. The table in the EA SOP for Sampling PFAS provided in **Appendix C** lists the appropriate field documentation items that can be utilized onsite. Loose, non-waterproof paper will be kept and scanned to record field operations. Field documentation will be maintained by field personnel and will become part of the permanent project file. Field note entries will be completed in ink and will be legible and factual, providing sufficient detailed information so that field operations could be recreated. Corrections will be made by crossing out an incorrect entry (with one line), initialing the correction, and entering the date the correction was made. Examples of entries are as follows:

- Name and location of Site.
- Date and time beginning onsite activities.
- Weather description

- Daily activities.
- Sampling information.
- Accident information.
- Field instruments used and readings.
- Type and quantity of waste generated.
- Description of equipment problems.
- Decontamination procedures.
- Date and number each page

The equipment representing each rinsate blank will be documented as well as where that piece of equipment was utilized in reference to sample identification number and location. The parent sample represented by each field blank will be documented. The parent sample representing each duplicate and MS/MSD will be documented as well. Foaming of sample during sample location will be noted in field notes as well as chain-of custody.

8. REPORT AND ELECTRONIC DATA DELIVERABLE REQUIREMENTS

8.1 REPORT REQUIREMENTS

A letter report will be drafted following receipt of the analytical results and will summarize field procedures and include an evaluation of the analytical results as well as field observations. Data will be evaluated to determine current conditions as well as recommendations, as needed. The report will include the use of tables and figures. Field documentation will be submitted as an attachment to the report.

8.2 ELECTRONIC DATA DELIVERABLE REQUIREMENTS

The laboratory will provide full laboratory DNREC-HSCA EDDs. The EA Data Management team will then revise the EDD before submitting it to DNREC (DNREC_Equis@delaware.gov) and a copy will be sent to the DNREC-RS Project Manager, as per the current DNREC Environmental Quality Information System EDD Format.

EA will modify the DNREC-HSCA EDD to include the following, if applicable:

- **Location**—Identifies the sampling locations and their coordinates.
- **Lithology**—Contains lithological data collected from soil cores generated during drilling of borings.
- **Well**—Contains data regarding wells including installation date, well permit number, top of casing elevation, and depth of well.
- **Sample**—Contains data for the samples collected at the Site and sent to a fixed laboratory for analysis. Fields include sample date, location, type, matrix, source, start and end depths, etc.
- **Test Result Quality Control**—Contains data regarding the laboratory tests performed on samples, the results of those tests, and the associated quality control data.
- **Batch**—Contains data associating samples with the laboratory batch identifier.
- **Water Level**—Contains data regarding water level measurements collected during sampling activities, including water level depth and water level elevation.

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9. PROJECT TEAM

The project organizational chart is provided in **Figure 6**.

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Figures

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Tables

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Table 1. Bottle Ware, Preservative Requirements, and Sample Holding Times

Analytical Group	Analytical Method	Container	Preservative Requirements and Hold Times
Groundwater and Potable Water			
PFAS	EPA Method 537 (Modified)	Two 250-mL HDPE	Potable with chlorination – Trizma Groundwater and potable without chlorination – No preservative Cool 4°C; 14 days to extraction/28 days for analysis
TCL VOCs	SW846 8260B	Three 40-mL vials with Teflon-faced silicone septum	Hydrochloric acid to pH<2, zero headspace; Cool to 4°C; 14 days (7 days if not preserved)
TCL SVOCs	SW846 8270C	Two 250-mL amber glass	None; Cool to 4°C; extracted within 7 days, analyzed within 40 days following extraction
TAL Metals (Total and dissolved) ¹	SW846 6020B/7471B	250-mL HDPE	Nitric acid to pH<2; Cool to 4°C; 6 months (28 days for mercury)
Dioxins/furans	EPA 1613B	Two 250-mL amber glass	None, Cool 4°C; 7 days extraction/40 days analysis
Aqueous IDW			
PFAS	EPA Method 537 (Modified)	Two 250-mL HDPE	None; Cool 4°C; 14 days to extraction/28 days for analysis
TCL VOCs	SW846 8260B	Three 40-mL vials with Teflon-faced silicone septum	Hydrochloric acid to pH<2, zero headspace; Cool to 4°C; 14 days (7 days if not preserved)
TCL SVOCs	SW846 8270C	Two 250-mL amber glass	None; Cool to 4°C; extracted within 7 days, analyzed within 40 days following extraction
TAL Metals	SW846 6020B/7471B	250-mL HDPE	Nitric acid to pH<2; Cool to 4°C; 6 months (28 days for mercury)
Dioxins/furans	EPA 1613B	Two 250-mL amber glass	None, Cool 4°C; 7 days extraction/40 days analysis
Total PCBs	SW846 8082A	Two 250-mL amber glass	None, Cool 4°C; 7 days extraction/40 days analysis
Solid IDW			
PFAS	EPA Method 537 (Modified)	5-oz plastic cup	None; Cool 6°C; 28 days
TCL VOCs	SW846 8260B	Three 40-mL vials with Teflon-faced silicone septum (Terra Core sample kit)	Two vials with 5 mL sodium bisulfite solution and magnetic stir bar and one vial with 5 mL methanol; Cool to 4°C; 14 days
TCLP Metals	SW846 6020B/7470A	4-oz glass jar	None; Cool to 4°C; 14 days
Total PCBs	SW846 8082A	4-oz glass jar	None; None; Cool to 4°C; 14 days
Percent Moisture	-	5-oz plastic cup	None; Cool 6°C; 28 days
NOTES:			
1. Potable water samples will be collected for total metals only. Collect volume in triplicate for matrix spike/matrix spike duplicate analyses.			

Table 1. Bottle Ware, Preservative Requirements, and Sample Holding Times (Continued)

NOTES:

°C = Degrees Celsius.

EPA = U.S. Environmental Protection Agency.

HDPE = High density polyethylene.

IDW = Investigation-derived waste.

mL = Milliliter(s).

oz = Ounce(s).

PCB = Polychlorinated biphenyl.

PFAS = Per- and polyfluoroalkyl substance.

SVOC = Semi-volatile organic compound.

TAL = Target analyte list.

TCL = Target compound list.

TCLP = Toxicity Characteristic Leaching Procedure.

VOC = Volatile organic compound.

Table 2. Laboratory Analytical Summary

Matrix	Analytical Group and Method	No. of Parent Samples per Event	No. of Field Duplicate Pairs	No. of MS/MSD pairs	No. of Field Blanks	No. of Rinsate Blanks	No. of Trip Blanks¹
Groundwater / Potable Water	PFAS ²	16	1	1 MS/1MSD	1 for each parent sample	1 to represent each type of downhole/ intrusive equipment per day ³	Not applicable
Groundwater / Potable Water	TCL VOCs	16	1	1 MS/1MSD	1 per day	1 to represent each type of downhole/ intrusive equipment per day ³	1 per cooler
Groundwater / Potable Water	TCL SVOCs	16	1	1 MS/1MSD	1 per day	1 to represent each type of downhole/ intrusive equipment per day ³	Not applicable
Groundwater / Potable Water	TAL Metals (Total and dissolved)	16	1	1 MS/1MSD	1 per day	1 to represent each type of downhole/ intrusive equipment per day ³	Not applicable
Groundwater / Potable Water	Dioxins/furans	16	1	1 MS/1MSD	1 per day	1 to represent each type of downhole/ intrusive equipment per day ³	Not applicable
IDW (Aqueous and Soil)	PFAS TCL VOCs Total/TCLP Metals PCBs	1 soil and 3 water (1 sample per 10 drums or 20 drums per media)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
NOTES: 1. Only 1 trip blank for each applicable analysis is needed per cooler shipment. 2. PFAS Modified 537 is Method 537 Version 1.1 Modified/SW-846 8321B Using LC/MS/MS, version 10. 3. A rinsate blank will be collected to represent each type of downhole/intrusive equipment following decontamination per day. Rinsate samples will be collected for each type of equipment but not collected more than once on same pump in between locations. IDW = Investigation-derived waste. SVOC = Semi-volatile organic compound. MS = Matrix spike. TAL = Target analyte list. MSD = Matrix spike duplicate. TCL = Target compound list. PCB = Polychlorinated biphenyl. TCLP = Toxicity Characteristic Leaching Procedure. PFAS = Per- and Polyfluoroalkyl substance. VOC = Volatile organic compound.							

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Appendix A

Site-Specific Health and Safety Plan

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HEALTH AND SAFETY PLAN

NEW CASTLE PUBLIC WELLS GROUNDWATER PLUME SITE, NEW CASTLE, DELAWARE (AKA 0 E. BASIN ROAD NEW CASTLE PFOS-PFOA SITE) SITE INSPECTION DE-0363

Prepared for:

Delaware Department of Natural Resources and Environmental Control
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July 2021

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CERTIFICATION

This Health and Safety Plan has been prepared under the supervision of, and has been reviewed by, a Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene.

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CIH, CSP

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LIST OF ACRONYMS AND ABBREVIATIONS

°F	Degrees Fahrenheit
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CPR	Cardio-pulmonary resuscitation
dBA	Decibels on the A-weighted scale
EA	EA Engineering, Science, and Technology, Inc., PBC
ft	Foot/feet
HASP	Health and safety plan
HEPA	High efficiency particulate air
kV	Kilo-volt
OSHA	Occupational Safety and Health Administration
OU-2	Operable Unit - 2
PPE	Personal protective equipment
SDS	Safety data sheet
SSHO	Site Safety and Health Officer
WBGT	Wet-bulb globe temperature

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1. INTRODUCTION

The following is a Health and Safety Plan (HASP) for field activities at the New Castle Public Wells Groundwater Plume Site performed by EA Engineering, Science, and Technology, Inc., PBC (EA). This HASP provides overall health and safety guidance to EA employees and subcontractors that are conducting the field activities. A site-specific HASP will stand as an addendum to this HASP, as required.

1.1 PURPOSE, SCOPE, AND APPLICABILITY

This HASP has been developed to designate and define general health and safety protocols. The HASP also addresses potential hazards to site workers during field activities.

Each EA employee has been provided with a copy of this HASP and it is the responsibility of each EA employee to possess their copy of the HASP and site-specific HASP addendum when conducting EA field procedures. It is also recommended that EA employees carry onsite copies of their certifications for Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1926.65 requirements, (Section 3).

Prior to commencement of field activities, site workers will be briefed by the Site Safety and Health Officer (SSHO) on emergency procedures and potential hazards of site operations. These briefings will include, at a minimum, the following information:

- Disclosure of potential hazards
- Procedures for obtaining clearances/access to restricted areas
- Emergency response
- Vehicle rules/requirements
- Equipment to be used
- Restrictions on handling of materials to be encountered in work areas
- Rules for transporting/storing hazardous materials
- Guidelines for personal protective equipment (PPE)
- Clearance/restricted areas procedures
- Standard operating procedures
- Demarcation of the exclusion, contaminant reduction, and support zones (as necessary).

Field staff will be familiar with the HASP and the site-specific HASP addendum for project activities in which they are involved. The site-specific HASP addendum will include the following information, at a minimum, and appropriate to site conditions:

- Client name, project name/number, site location/address
- Site description and a description of the work

- Site-specific HASP addendum approvals – Project Manager and Manager of Health and Safety
- Hazards of concern, including pathways and overall hazard evaluation
- Justification or narrative of how work activities may encounter hazards, and their controls, including known or anticipated contaminant concentrations
- Fire explosion potential and the nature of the surrounding population
- Chemical hazards – condensed from Table 6-1 of the HASP
- Anticipated level of chemical exposure – approximate concentrations of anticipated contaminants of concern in environmental media
- Contingency plans, including evacuation procedures, assembly points and contingency leader
- Deviations/variations from HASP
- Location of site workers' documentation of required training
- Protective equipment – primary and contingency
- Monitoring equipment
- Decontamination procedures
- Emergency telephone numbers (subcontractor contact, fire, ambulance, poison control, police, etc.)
- Medical emergency information, including detail and route to the nearest hospital.

Prior to entering the site, the HASP and site-specific HASP addendum will be reviewed and an agreement to comply with the requirements will be signed by personnel, including contractors, subcontractors, and visitors. This form is presented in Appendix A. In signing this agreement, the personnel acknowledge their responsibility for compliance with the HASP requirements. Personnel onsite will be informed of the site emergency response plan and potential safety or health hazards of the operations. A copy of the Site Entry and Exit Log, presented in each site-specific HASP addendum, must be signed by personnel before entering and upon exiting the site. An example of this form is presented as Appendix B.

Both the HASP and site-specific HASP will be readily available onsite.

This HASP and the appropriate site-specific HASP addenda were designed to satisfy the OSHA Standards for Construction, 29 CFR 1926.65, *Hazardous Waste Operations and Emergency Response and including Hazard Communication*. Additional regulations have been cited throughout this report in situations where specific health and safety regulations exist for various tasks.

2. ORGANIZATION

2.1 PROJECT PERSONNEL

Program Manager: (b) (4), P.G.
Project Manager: (b) (4)
Manager, Health and Safety: (b) (4) CIH, CSP
Field Team Leader(s)/SSHOs: (b) (4)

2.2 RESPONSIBILITIES

The core of the technical organization is the Project Manager and the assigned Project Team. Additional individuals will be made available if warranted. The chain of command for safety and health related issues for EA projects is as follows:

2.2.1 Project Manager

The responsibilities of the Project Manager include the following:

- Approving the HASP and each amendment to the HASP
- Providing overall supervisory control for safety and health protocols in effect for the project
- Assigning the Field Team Manager and SSHO and ensuring that the assigned onsite staff will enforce provisions of the approved HASP.

2.2.2 Manager, Health and Safety

The responsibilities of the Manager, Health and Safety, include the following:

- Reviewing the HASP and the site-specific HASP addendum
- Providing technical support to the SSHO, particularly in the modification for site safety and health requirements or work plans.

2.2.3 Field Team Leader

The Field Team Leader will be responsible for the following duties:

- Working with the SSHO to identify and evaluate hazards to prepare the Site-specific HASP addendum.
- Working with the SSHO to identify safe and secure locations for drummed waste

- Coordinating utilities location prior to subsurface investigations.

2.2.4 Site Safety and Health Officer

The SSHO will be onsite throughout the project and will be responsible for daily compliance with site safety and health requirements. The SSHO's responsibilities include the following:

- Implementing the HASP and the site-specific HASP addendum.
- Ensuring that anyone who enters the site has reviewed the HASP and the site-specific HASP addendum and signs the HASP review record in Appendix A.
- Stopping work when unacceptable safety or health risks exist.
- Providing an initial safety and health briefing to site workers and visitors and providing weekly safety and health meetings during the project performance. Daily meetings will be conducted during intrusive activities.
- Conducting necessary monitoring.
- Initiating the evacuation of the work site when needed, communicating with offsite emergency responders, and coordinating activities of onsite and offsite emergency responders.
- Determining if the abatement of hazardous conditions is sufficient prior to allowing resumption of work operations after an emergency.
- Establishing and ensuring compliance with site control areas and procedures.
- Supervising decontamination to ensure complete decontamination of personnel, tools, and equipment.
- Supervising the distribution, use, maintenance, and disposal of personal protective clothing and equipment.
- Coordinating with client safety officers.
- Investigating incidents/accidents and preparing any incident reports, as necessary.

2.2.5 Employees

Employees (including subcontractors) will be responsible for:

- Following the HASP, site-specific HASP addendum, and applicable safety and health rules, regulations, and procedures. Using required controls and safety devices, including PPE.
- Notifying their supervisor of safety and health hazards.
- Complying with training and medical requirements.

2.3 SUBCONTRACTORS

EA's subcontractors will be required to follow this HASP and the site-specific HASP addendum, as well as their own company's safety and health program and applicable regulations.

2.4 VISITORS

Visitors will remain in the support zone and will not be permitted to enter a contaminant reduction zone or an exclusion zone unless they have current and appropriate OSHA training and medical monitoring, and permission of the Field Team Leader and the SSHO.

3. EMPLOYEE TRAINING AND MEDICAL SURVEILLANCE

3.1 EMPLOYEE TRAINING

Hazardous waste workers will be trained to meet 29 CFR 1926.65 and other workers will be trained to meet other applicable OSHA regulations. Personnel who do not meet the following training requirements are prohibited from engaging in hazardous waste site operations within the contaminant reduction and/or exclusion zone. Documentation (certificates) of training will be onsite for each hazardous waste worker and will be checked for completeness by the Field Team Leader or SSHO. It is recommended that EA employees keep a copy of their training documentation with this HASP.

3.1.1 Site Workers

- Forty hours of Initial Offsite Hazardous Waste Operations Training and 3 days of onsite training under the direct supervision of a more experienced site worker.
- If more than 12 months have passed since initial training, an 8-hour Annual Refresher Training must be completed.

3.1.2 Field Team Leader

The same requirements stated above for site workers, plus an 8-hour Supervisor's Hazardous Waste Operations Training Course.

3.1.3 First Aid/CPR

At least one onsite worker will be currently certified in both first aid and cardiopulmonary resuscitation (CPR) by the American Red Cross or equivalent organization. First-aid training will be updated every 3 years and will include bloodborne pathogen training; CPR training will be updated annually. Documentation of certifications will be onsite.

3.2 MEDICAL SURVEILLANCE

Site workers will satisfactorily complete a comprehensive medical examination by or under the supervision of a licensed physician, preferably by one knowledgeable in occupational medicine prior to the initiation of field work. Medical examinations and consultations will comply with the protocols of 29 CFR 1926.65 and 29 CFR 1910.134 and will be provided according to the following schedule:

- Prior to fieldwork assignment.
- At least annually for employees covered by the program (biennially with the approval of the occupational physician).

- At termination of employment or reassignment to an area where the employee had not been examined within the past 6 months.
- As soon as possible after the development of signs or symptoms that may indicate an overexposure to hazardous substances or health hazards.
- More frequently if the physician deems such examination necessary to maintain employee health.

Documentation for compliance with 29 CFR 1926.65 will be onsite. Further documentation is maintained in EA's Office of Human Resources (410-584-7000). The records shall be complete and accurate and be kept on file for at least 30 years after termination of employment. A minimum of the following information shall be kept:

- Name and social security number
- Physician's written opinions, recommendations, limitations, and test results
- Employee medical complaints related to hazardous waste operations
- Information provided to the physician by the employee concerning possible exposures, accidents, etc.

4. SAFETY MEETINGS

4.1 PRE-ENTRY BRIEFING

The SSHO will brief workers and visitors on the potential hazards of the site and the protective measures to be implemented. Site-specific training will include the site monitoring equipment, emergency procedures, areas of restricted access, methods of decontamination, responsibilities for safety of personnel and property, physical, chemical and biological hazards and controls, PPE, and Safety Data Sheets (SDSs). Pre-entry briefings will be held prior to commencement of field activities, prior to initiating new or modified site activity, and at other times as necessary to ensure workers are knowledgeable of the HASP, the site-specific HASP addendum, and activity hazards.

4.2 WEEKLY SAFETY MEETINGS

The SSHO is responsible for conducting safety meetings at least weekly, and daily for intrusive work, to discuss status of site health and safety. These meetings shall also address employees' concerns regarding safety and hazard control practices and procedures implemented at the work site.

5. SITE CONTROL AND SECURITY

No unauthorized personnel will be permitted within the work zones at EA sites. Only personnel assigned to the specific work tasks (or supervision of) will be permitted to enter the work zones. Training and medical certificates required by this HASP and OSHA requirements will be maintained onsite by the Field Team Leader or SSHO.

5.1 WORK ZONES

Work zones are designed to prevent employees, visitors, and the surrounding environment from exposure to contamination during intrusive site activities. Work zones will be divided into three different areas by EA: the Exclusion Zone, Contaminant Reduction Zone, and Support Zone. Movement of personnel and equipment between zones and on and off the site will be controlled by means of designated access points. Minimum PPE for work in each zone is Level D, as described in Section 7.3.1. The SSHO will determine the need for and boundary/location of each work zone. As applicable, the SSHO may delineate work zones by means of caution tape, stakes or traffic cones.

Exclusion Zone

This zone will be determined by the SSHO after evaluating the potential for exposure to hazardous substances and presence of potential safety hazards. An Exclusion Zone typically includes the area no less than 25 feet (ft) around field-investigation activities. When the potential exists for unauthorized access, it is recommended that this zone will be clearly delineated with caution tape and stakes to prohibit unauthorized access from unauthorized persons. The area within the Exclusion Zone has the highest potential for exposure to hazardous chemicals. Therefore, proper PPE will be worn in this area. Entry into the Exclusion Zone will require donning the required PPE prior to entry. An entry and exit log will be maintained (Appendix B).

Contaminant Reduction Zone

This zone will be determined by the SSHO after evaluating potential for exposure to hazardous substances and presence of potential safety hazards. A Contaminant Reduction Zone is the area where decontamination procedures will take place before entering the support zone and will completely surround the exclusion zone. As applicable, this zone may be clearly delineated with caution tape and stakes to prohibit access from unauthorized persons. No area of the site should allow access from the Support Zone directly into the Exclusion Zone – one must first travel through the Contaminant Reduction Zone. The following rules apply:

- Entry into the Contaminant Reduction Zone will require the appropriate level of PPE necessary to protect against hazards involved in assisting in the decontamination process.
- Leaving the Contaminant Reduction Zone without following decontamination procedures is prohibited.

- Entering the Exclusion Zone without donning the appropriate PPE is prohibited.

Support Zone

The Support Zone is an area not designated as the Exclusion or Contaminant Reduction Zone and shall completely surround the Contaminant Reduction Zone. No area of the site should allow access from the Support Zone directly into the Exclusion Zone. Activities not permitted in the Contaminant Reduction Zone or the Exclusion Zone are likely permitted in the Support Zone, such as eating, drinking and taking necessary medication as approved by the SSHO.

5.2 SITE ENTRY AND EXIT

Persons entering the Exclusion Zone will be required to wear the PPE assigned by the SSHO as specified in Section 7.3. The following protocols will be followed when leaving the Exclusion Zone and Contaminant Reduction Zone:

- Personnel will exit through the designated exit points
- Personnel will proceed through appropriate decontamination, as specified in Section 11.

Potentially contaminated PPE will be removed in the Contaminant Reduction Zone.

5.3 BUDDY SYSTEM

During field activities that require more than one person, all site personnel will remain in verbal, radio, or mobile phone contact with each other. The Field Team Leader will have a mobile telephone and will be responsible for handling communications during emergencies that may arise.

5.4 SAFE WORK PRACTICES

Safe work practices that will be followed by site workers include, but are not limited to, the following rules:

- Working before or after daylight hours without special permission is prohibited.
- Eating and drinking, chewing gum or tobacco, and smoking in the Exclusion Zone and Contaminant Reduction Zone is prohibited.
- Possessing, using, purchasing, distributing, or having controlled substances in their system throughout the day or during meal breaks is prohibited.
- Consuming or possessing alcoholic beverages is prohibited.

- Good housekeeping—employees will be instructed about housekeeping throughout field activities.
- Sitting or kneeling in areas of obvious contamination while in the Exclusion Zone or Contaminant Reduction Zone is prohibited.
- Wash hands and face thoroughly upon leaving the work area in the Contaminant Reduction Zone.
- Immediately repair or replace defective PPE, but not while in the Exclusion Zone.
- Prescription drugs will not be taken by personnel unless specifically approved by a qualified occupational physician and then only within the Support Zone.
- When respirators are required, facial hair that interferes with the face-to-facepiece fit of the respirator will not be permitted and must be removed prior to arrival onsite or at an appropriate location within the Support Zone.
- Personnel onsite will use the buddy system; visual contact will be maintained between team members while in the Exclusion Zone.
- Dust suppression, such as wetting soil, shall be used to prevent dust generation at or near work areas when deemed appropriate and necessary by the SSHO or Field Team Leader.

5.5 DAILY STARTUP AND SHUTDOWN PROCEDURES

The following protocols will be followed daily prior to start of work activities:

- The SSHO will review site conditions to establish if modification of work and safety plans is needed.
- Personnel will be briefed and updated on new safety procedures as appropriate.
- Safety equipment will be checked for proper function.
- The SSHO will ensure that first aid equipment is readily available.
- The SSHO will initiate appropriate monitoring.

Personnel will proceed through appropriate decontamination procedures and facilities at the end of daily operations and before breaks.

6. HAZARD IDENTIFICATION AND HAZARD CONTROL

6.1 HAZARD COMMUNICATION

OSHA Hazardous Waste Operations, 29 CFR 1910.1200, requires a written hazard communication program and training on the contents for exposed field personnel. These regulations require review of the following items that will be discussed in the Pre-Entry Briefing by the SSHO and Field Team Leader:

- Specific requirements of the law and regulation
- Nature of hazardous substances in the workplace
- Protection from hazards
- Access to information through SDSs and labels
- Employees rights under the law.

An SDS will be kept onsite by the SSHO for chemicals brought onsite during field activities. Field personnel will be informed of the location of SDS by the SSHO. Subcontractors will inform the Field Team Leader and SSHO about hazardous substances brought onsite and provide appropriate SDSs to the SSHO. Chemicals brought onsite will be labeled in accordance with OSHA Hazard Communication Requirements, 29 CFR 1920.1200.

6.2 CHEMICAL HAZARDS

Table 6-1 presents the exposure limits, routes of exposure, and symptoms of exposure for chemicals of potential concern that may be present at the New Castle Public Wells Groundwater Plume Site.

Dermal contact with these chemical hazards is possible at the New Castle Public Wells Groundwater Plume Site. Many hazardous chemicals are readily absorbed through the skin. Therefore, appropriate dermal protection for the chemical will be worn when handling or contacting contaminated environmental media.

Proper respiratory protection will be worn when levels of organic vapors in the breathing zone exceed proposed action levels. If dust suppression with a water spray is not effective in controlling dust in the breathing zone, Level C PPE will be used, including respirators equipped with high efficiency particulate air (HEPA) cartridges.

6.3 PHYSICAL HAZARDS

Various physical hazards will potentially be present at the sites during field activities. These physical hazards may include, but may not be limited to:

- General Physical Hazards
- Fire/Explosion Hazards
- Heavy Equipment Hazards

- Vehicle and Pedestrian Hazards
- Noise Hazards
- Electrical Hazards
- Utilities
- Weather Hazards, including Heat or Cold Stress
- Material Handling/Moving/Lifting
- Drilling
- Trenching and Excavation
- Entry into Excavations.

6.3.1 General Physical Hazards

Hazardous waste and other field operation sites include many basic safety hazards, such as:

- Holes, ditches, etc., posing fall, cave-in, and other hazards.
- Precariously positioned objects, which may cause crushing or other injuries.
- Sharp objects (e.g., nails, metal shards, glass), which may cause cuts, injection, or other injuries.
- Slippery surfaces, posing slip and fall hazards.
- Steep grades and/or uneven terrain, posing slip, trip, and fall hazards.
- Unstable surfaces (e.g., walls that may cave-in, unstable underground structures), which may pose fall, crushing, or other injuries.

Basic safety hazards can directly injure workers and create additional hazards. For example, a person may trip due to uneven terrain, fall and be cut on rusty metal shards, and become inoculated with contaminants adhering to the metal.

Site personnel will look constantly, closely, and carefully for these basic safety hazards and immediately inform the SSHO of conditions that they feel may be hazardous. If hazards are present, these hazards will be recorded by the SSHO and precautionary measures will be taken to prevent injury.

6.3.2 Fire/Explosion Hazards

Explosion and fire hazards may be present at various sites due to ignition of chemicals, agitation of shock-sensitive compounds, the sudden release of materials under pressure, etc. Site operations will be conducted in accordance with local fire codes and regulations. The potential for fire and/or explosion emergencies is possible at the site in situations involving underground

storage tanks, confined space entry (i.e., manholes), landfills or in excavations or locations where hazardous vapors have accumulated.

If a potential for fire and/or explosion emergencies is present, workers will continuously monitor the work area for combustible or explosive gases when operations have the potential to generate sparks (such as the cutting of an underground storage tank for removal). Employees shall always be on the alert for unexpected events, such as ignition of chemicals or sudden release of materials under pressure, and be prepared to act in these emergencies.

Field vehicles and heavy equipment will be equipped with fire extinguishers. Employees will be trained in the proper use of fire suppression equipment. Large fires, not able to be controlled with a fire extinguisher, will be handled by the professionals of the local fire department. The SSHO will notify site workers during the pre-entry briefing of the availability of “911” service in the area. This information will be provided in the site-specific HASP addendum. In the event of a fire, employees will report to the pre-determined rally point unless this location has become dangerous due to the existing emergency. Persons directly involved in the emergency along with the SSHO will then complete an accident report. Further discussion is presented in Chapter 12.

6.3.3 Heavy Equipment Hazards

The use of heavy equipment (e.g., drill rigs, generators, compressors, etc.) may pose safety hazards to site workers. Heavy equipment work will be conducted only by trained, licensed, and experienced personnel. Site workers will remain outside the turning radius of large, moving equipment. At a minimum, personnel will maintain visual contact with the equipment operator.

No personnel are permitted to work underneath heavy equipment or hoisted loads because this practice poses a serious crushing hazard.

Belts, pulleys, sheaves, gears, chains, shafts, clutches, drums, flywheels, and other moving parts of equipment can pose injury hazards. No guard, safety appliance, or other device will be removed or made ineffective unless repairs or maintenance are required and then only after power has been shut off and locked out. Safety devices will be replaced once repair/maintenance are complete.

Exhaust from equipment powered by steam or combustion engines will be properly located so that release of exhaust does not endanger workers or obstruct the view of the operator. Gasoline-operated equipment will be re-fueled properly to prevent fire hazards; power will be off, no smoking allowed, and proper dispensing equipment will be used.

When not operational, equipment will be set and locked so that it cannot be activated, released, dropped, etc.

6.3.4 Vehicle and Pedestrian Hazards

Traffic at certain sites, particularly active sites in busy areas, presents a hazard to site personnel. Equipment will be located in an area that does not present hazards to bystanders. Barriers will be used to separate the work areas from both vehicle and pedestrian traffic areas and to prevent inadvertent entry of either type of traffic into the work area. The demarcated area will include adequate buffer zones between the actual work area and traffic areas. Standard traffic cones are not considered adequate for these situations, due to their low vertical profile. Taller, 28-inch cones can be effectively modified with warning flags and barricade tape. Safety pennants and plastic or steel “A” frame type barricades may also be used in high traffic areas. Flashing warning lights may also be necessary. Barriers demarcating the work area and buffer zone are required even if the site is inactive during work operations.

Employees exposed to public vehicular traffic will be provided with and will wear warning vests or other suitable garments marked with or made of reflectorized or high-visibility material. In addition, EA will coordinate with the local authorities on and/or near common roadways, private roads, etc.

6.3.5 Noise Hazards

The equipment at the treatment facilities often creates excessive noise. Noise can cause workers to be startled, annoyed, or distracted; it can cause physical damage to the ear, pain, and temporary and/or permanent hearing loss; and it can interfere with communication. If workers are subjected to noise exceeding an 8-hour time-weighted average sound level of 85 decibels on the A-weighted scale (dBA), hearing protection will be provided with an appropriate noise reduction rating to comply with 29 CFR 1910.95 and reduce noise levels to or below 85 dBA. Workers involved in drilling or heavy machinery operation activities are likely to be subjected to noise exceeding sound levels of 85 dBA peak sound pressure. At this level, hearing protection will be selected by the SSHO with an appropriate Noise Reduction Rating to reduce noise levels to or below these values.

6.3.6 Electrical Hazards

Overhead power lines, electrical wiring, electrical equipment, and buried cables pose risks to workers of electric shock, burns, muscle twitches, heart fibrillation, and other physical injuries, as well as fire and explosion hazards. Prior to bringing drilling and/or direct push equipment on the job site, a survey will be done by the SSHO to identify overhead electrical hazards and potential ground hazards, such as underground utilities. The SSHO will be responsible for ensuring that the utility locating service has completed a utility marking for the site prior to intrusive site work. Employees will be aware of the risk of electric shock, burns, muscle twitches, heart fibrillation, and other physical injuries, as well as fire and explosion hazards, associated with overhead power lines, electrical wiring, electrical equipment, and buried cables.

If overhead lines are encountered and cannot be de-energized prior to the start of work, a 10 ft distance will be maintained between overhead energized power lines with a voltage of 50 kilo-

volts (kV) and elevated equipment parts. Operating procedures will be in accordance with minimum clearance distances from energized overhead electric lines as follows:

<u>Nominal System Voltage</u>	<u>Minimum Required Clearance</u>
0 - 50 kV	3 m (10 ft)
51 - 200 kV	4.5 m (15 ft)
201 - 300 kV	6 m (20 ft)
301 - 500 kV	7.5 m (25 ft)
501 - 750 kV	10.5m (35 ft)
751 - 1000 kV	13.5 m (45 ft)

In accordance with OSHA's standard for Electrical Safety-Related Work Practices (29 CFR 1910.331-.335), protective measures will be taken when working near live electrical parts, including but not limited to:

- Insulation and guarding of live parts
- Grounding
- De-energizing live parts followed by lockout/tag-out to prevent inadvertent re-activation of the parts
- Electric protective devices (e.g., insulated tools)
- Safe work practices, including:
 - Inspection of the work area to identify potential spark sources
 - Maintenance of a safe distance from live electrical parts
 - Proper illumination of work areas
 - No "blind reaching" around live electrical equipment
 - Provision of barriers, shields, or insulation to prevent inadvertent contact with live parts
 - Use of nonconductive, intrinsically safe equipment near live parts.

EA personnel will not be permitted to work on electric parts of equipment that have not been de-energized, locked out, and tagged by personnel trained to work with electrical equipment. No EA employee will work near energized exposed live parts without the use of protective measures. PPE designed to protect against electrical hazards may be specified for certain work operations. The Project Manager is responsible for ensuring that appropriate safety measures are implemented to protect against electrical safety hazards on their sites.

Lightning is an electrical hazard during outdoor operations, particularly for workers in open areas and handling metal equipment. Weather conditions will be monitored, and work will be

suspended at the discretion of the SSHO during electrical storms. The Field Team Leader will relay an order to suspend work due to weather to site workers.

6.3.7 Utilities

The SSHO will be responsible for ensuring that the utility locating service has completed a utility marking for the site prior to site intrusive work. These markings show an estimated location of underground installations, including sewer, telephone, fuel, electric, water lines or other underground installations that reasonably may be expected to be encountered during invasive work. Site maps will also be utilized when available to note underground hazards. Using a pipe and cable locator or metal detector may also be necessary to accomplish locating these hazards. The following is the Delaware utility clearance phone number: Miss Utility of Delaware 800-282-8555.

Underground utilities pose hazards to workers involved in invasive operations such as excavating, drilling and direct-push sampling. These hazards include electrical hazards, explosion, and asphyxiation, as well as costly and annoying hazards associated with damaging communication, sewer, and water lines. Prior to commencement of invasive operations, underground utilities, including buried wires, pipes, tanks, etc., will be visibly marked with flags or marking paint to alert workers to areas unsafe for digging/excavating. Personnel will be aware that although an area may be 'cleared', unanticipated hazards may occur.

Workers will be alert for unanticipated events such as snapping cables, drilling into unmarked underground utilities, drilling into a heavily contaminated zone, etc. Such occurrences will prompt involved individuals to halt work immediately and take appropriate corrective measures to gain control of the situation.

6.3.8 Weather Hazards

Weather conditions will be taken into consideration. Heavy rains or snowfall, electrical storms, high winds, and extreme temperatures, for example, may create extremely dangerous situations for employees. Inclement weather may also impair equipment performance. Whenever unfavorable conditions arise, the Field Team Leader and SSHO will evaluate both the safety hazards and the ability of the employees to effectively perform given tasks under such conditions. Activities will be halted at the discretion of the SSHO and initiated by the Field Team Leader.

When site activities involve drilling or the operation of heavy equipment, site activities will cease when lightning has been sighted in an approaching storm. The danger of electrocution exists if a piece of machinery (i.e., a drill rig) is struck by lightning.

Wind direction will be considered when positioning for sampling or conducting intrusive work. If exposure to contaminated emissions is anticipated, workers will locate upwind. Wind direction often changes abruptly and without warning, so personnel will be prepared to reposition, if necessary.

6.3.9 Temperature-Induced Stresses

6.3.9.1 Heat Stress

Heat stress hazards can occur even in temperatures not commonly considered “hot” due to the level of physical activity, the level of PPE the worker is wearing, or the physical condition of the worker. Illness resulting from exposure to extreme heat is possible during field operations. Personnel, especially those in impermeable clothing (i.e., chemical suits), will be familiar with the signs and symptoms of heat stress, including:

- **Heat Cramps:** Muscle spasms in the abdomen or limbs. Frequent rest periods and fluid intake are appropriate measures to prevent or reduce heat cramps.
- **Heat exhaustion:** Severe dehydration; pale, clammy skin; profuse sweating; dizziness, light-headedness; slurred speech; rapid pulse; confusion; fainting; fatigue; cool skin; nausea. Affected personnel will be escorted from the site, decontaminated promptly, set in cool, shaded area, and given fluids slowly.
- **Heat stroke:** Life-threatening condition occurring when the body’s temperature-regulating system improperly functions. Hot dry skin; rapid, deep breathing; lack of perspiration; delirium; high fever (often 106 degrees Fahrenheit [°F] or more), nausea; unconsciousness. Brain damage and/or death may occur, if body temperature is not reduced. Provide fluids, use cooling devices (hose-down or shower), call emergency medical services or transport to hospital immediately.

Some preventive measures to avoid heat stress include:

- Frequent resting in cool or shaded areas
- Prevent heat stress by resting frequently in a shaded area and consuming large quantities of fresh potable water (more than amount needed to simply “quench thirst”). Drink at least 8 ounces of water or diluted Gatorade every 2 hours when temperatures exceed 75°F. Do not consume alcoholic beverages to combat dehydration or heat stress.

Heat stress monitoring will be conducted in a manner that anticipates and prevents the onset of heat stress symptoms (i.e., wet-bulb globe temperature [WBGT] monitoring coupled with OSHA work-rest regimens). If the WBGT Index is used and semi-impermeable or impermeable clothing is worn, the WBGT Index will be lowered, as appropriate.

Non-acclimated workers and workers wearing full body impermeable chemical protective clothing shall be monitored when the work area temperature is greater than 70°F. The worker’s heart rate and blood pressure will be measured at the start of a rest break, and the work period will be decreased so that after 1 minute of rest, a worker’s heart rate does not exceed 110 beats per minute.

A suggested work-rest regimen is:

<u>Ambient Temperature</u>	<u>Work</u>	<u>Rest</u>
70°F	3 hours	15 min
75°F	2-1/2 hours	15 min
80°F	2 hours	15 min
85°F	1-1/2 hours	15 min
90°F	1 hour	15 min
95°F	½ hour	15 min

If a worker's heart rate is greater than 110 beats per minute, the next work period will be shortened by 33 percent, while the length of the rest period stays the same. If the heart rate is 110 beats per minute at the beginning of the next rest period, the following work cycle will be shortened by 33 percent. When ambient temperatures are expected to exceed 75°F, the resting heart rate of each worker will be measured prior to the start of onsite activities.

Other factors, such as a worker's level of acclimation, level of physical fitness, and age, may increase or decrease his susceptibility to heat stress. Before assigning a task to an individual worker, these factors will be taken into account to ensure that the task will not endanger the worker's health.

If a heat-related illness is suspected or observed, the affected person will be moved to a cool or shaded area and given plenty of liquids to consume. If symptoms of a heat stroke are observed, the victim will be cooled and immediately and call 911.

6.3.9.2 Cold Stress

Cold stress hazards are most likely to occur at low temperatures or low wind chill factors, with wet, windy conditions contributing to risk. Workers will be familiar with the signs and symptoms of cold stress, which include:

- **Hypothermia:** Cold-induced decreasing of the core body temperature that produces shivering, numbness, drowsiness, and muscular weakness. If severe enough, it can lead to unconsciousness and death.
- **Frostbite:** Constriction of blood vessels in the extremities and decreasing the supply of warming blood. This may result in formation of ice crystals in the tissues, causing tissue damage. Condition may range from frostnip, which is a numbing of extremities, to deep-freezing tissue beneath the skin. Symptoms include white or grayish skin, blisters, numbness, mental confusion, failing eyesight, fainting, shock, and cessation of breathing. Death may occur from heart failure.

Pain in the extremities may be the first warning of cold stress, and precautions will be taken to reduce exposure. Maximum severe shivering will be taken as a sign of immediate danger to the

worker, and exposure to cold will be immediately terminated. Personnel exhibiting signs and symptoms of cold stress will be removed from the site, decontaminated, and given appropriate first aid. Emergency medical services will be contacted if symptoms are severe (e.g., more than numbness of the extremities or shivering). When air temperatures are less than 36°F (including wind chill), workers who become immersed in water or whose clothing becomes wet will be immediately provided a change of clothing and be treated for hypothermia.

As a precautionary measure, employees will wear layers of loose-fitting clothing including insulated coveralls, head cover (perhaps a liner beneath a hard hat), and boots when temperatures fall below 40°F, including wind chill. Protection of the hands, feet, and head is particularly important because these are likely to be injured first by cold. However, actual injury to hands, feet, and head is not likely to occur without prior development of early signs of hypothermia such as numbing and shivering. Bare skin contact with cold surfaces (below 32°F) will be avoided. Table 6-2 presents the cooling power of wind on exposed flesh expressed as equivalent temperature. Personnel will wear wind-resistant outer shell to decrease wind chill effects. No continuous exposure to cold is permitted when the air speed and temperature results in an equivalent chill temperature of 26°F or less.

A temperature-dependent work regimen limiting lengthy periods of outdoor activity may be necessary. Table 6-3 gives the threshold limit values work/warm-up schedule for a 4-hour shift. Workers entering heated shelters will remove the outer layer of clothing and loosen remaining clothing to permit the evaporation of perspiration. Workers will avoid dehydration by drinking water or other decaffeinated beverages, including warm drinks and soups; excludes alcoholic beverages.

6.3.10 Material Handling/Moving/Lifting

Materials handling at hazardous waste sites can vary from heavy equipment handling to manually moving/lifting items. Hazards associated with materials handling include physical injury, detonation, fire, explosion, and vapor generation among others.

Injuries to back and abdominal muscles from improperly lifting of loads are the most common occupational injuries reported. Such injuries can range from relatively mild strains to major, permanently disabling injuries. Before lifting a load, personnel will consider the overall weight, distribution of weight, unwieldiness or awkwardness of the load, distance to be carried, obstacles to be negotiated, site conditions, and visibility.

When using equipment to move materials; proper work practices will be followed. Equipment used will be designed for the task to be performed. Equipment will be inspected regularly by the SSHO and the Field Team Leader, and damaged or defective equipment will be removed from service. Planning is critical when handling materials. The Field Team Leader, in conjunction with the Project Manager, will plan where the materials are to be moved, taking into consideration the current location of such materials and hazards associated with moving them. Routes for moving materials will be clearly outlined, with paths cleaned of obstructions so materials may be transported.

Loads will be lifted using the power of the leg muscles rather than the back, stomach, or arm muscles. The item will be approached to balance the load evenly. Backs will be kept straight and the arms nearly parallel with the body. The knees will be bent to grasp the load. Lifting will be done by straightening the legs without bending the body, holding the load as close to the body as possible and the back remaining as straight as possible.

Bulky, heavy loads will be handled by at least two people, ensuring that the load is level and evenly distributed between personnel helping to carry it. Carriers will know the destination and path for the load.

6.3.11 Drilling/Well Installation

The selection of locations for each drilling/well installation site will take into account buried utility pipes, wires, conduits, tanks, or other potentially dangerous structures. Overhead power lines and obstructions will also be surveyed when using drill rigs with elevated parts. Prior to raising the mast of rigs, the area immediately overhead and surrounding the rig will be checked by the drilling foreman and the SSHO.

If overhead lines cannot be de-energized prior to the start of work, the following minimum distances will be maintained between the lines and both site workers and the longest conductive object present (including vehicles with elevated structural parts):

<u>Nominal System Voltage (kV)</u>	<u>Minimum Required Clearance</u>
0-50	3 m (10 ft)
51-200	4.5 (15 ft)
201-300	6 (20 ft)
301-500	7.5 (25 ft)
501-750	10.5 (35 ft)
751-1000	13.5 (45 ft)

When the drill rig is in transit, with boom lowered and no load, the equipment clearance will be at least 4 ft for voltages less than 50 kV, 10 ft for voltages of 50 kV or greater (up to and including 345 kV), and 16 ft for voltages above 345 kV.

During drilling/well installation operations, setup, and takedown, persons who enter the Exclusion Zone will wear hard hats (when overhead hazards are present), safety shoes/boots, and safety glasses/face shields to protect personnel from the physical hazards.

If during drilling operations there is indication that buried drums, underground storage tanks, or other anomalies are being encountered, the drilling will be halted immediately and the SSHO will notify the Field Team Leader. Indications that an anomaly may have been encountered include:

- Change in the speed or momentum of the rig

- Visual examination of drill cuttings
- Direct-push refusal on hard object
- Odor noted in the cuttings or exiting borehole
- The presence of airborne total volatile organics (as measured with a direct-reading instrument).

Drilling/well installation equipment also involves basic safety hazards (e.g., snapping cables, slings, ropes, moving heavy equipment, slip and trip hazards, etc.). Accidents may include head injuries from falling tools and equipment, hand and foot injuries due to moving equipment, and crushing injuries from unstable equipment or careless moving of equipment. If possible, EA personnel will remain outside the turning radius of moving parts. If this is not feasible then, at a minimum, EA personnel will maintain visual contact with the equipment operator when equipment is active.

6.4 BIOLOGICAL HAZARDS

Workers will be encouraged to wear protective clothing to protect against insects, and for added protection, specialized sprays or lotions may be applied to the clothing and skin to protect against fleas, ticks, mosquitoes, and poisonous plants. Contact will be avoided with syringes and medical or biohazard waste encountered in an uncontrolled setting and will be reported immediately to the SSHO.

6.4.1 Poisonous Plants

Poisonous plants, such as poison ivy, poison oak, or poison sumac may be present at various sites. Personnel are expected to know how to recognize these plants and avoid them. If these plants need to be removed to obtain a work area free of hazards, gloves will be worn to protect against the poisonous oils of the plant, and the plant will be placed in a trash bag and disposed of in a proper receptacle. Never burn a poisonous plant; smoke and vapors are also poisonous when inhaled. If dermal contact occurs, the affected areas will be washed with soap and water immediately.

6.4.2 Insect Bites/Stings

Protective outer clothing such as gloves, hard hats, and coveralls can reduce the potential for insect bites and stings. Avoid disturbing insect nests encountered on the job site if possible, otherwise an insect swarm may develop. If an insect nest (i.e., a beehive) is encountered in an area that is likely to be disturbed during site activities, the nest will be eradicated prior to site activities to ensure employee safety.

Insect bite symptoms may include redness, rash, swelling, chills, fever, diarrhea, and vomiting. A worker who has been bitten or stung and shows symptoms of a severe reaction will seek medical assistance immediately. Workers with allergies to insects (i.e., bees) should advise their employer prior to field activities and should carry an antidote kit, if necessary.

To prevent contact with fleas or disease-carrying ticks (deer ticks), workers will ideally wear long-sleeved shirts, long pants, and boots that extend above the ankle with pants cuffs taped to boots, especially when working in wooded, overgrown, or high grass areas. Workers will thoroughly check clothing, skin, and hair for the presence of ticks at the end of each workday. If a tick attaches to the body, it will be removed by gently tugging with tweezers where the mouth-parts enter the skin. The tick should not be killed prior to removal. A deer tick is as small as the area of a pinhead and often has a white or red dot on its head. A wood tick is larger, and typically is not a carrier of Lyme disease. If a worker suspects he has been bitten by a tick, the area shall be monitored for several days/weeks by the individual for the development of a noticeable bulls-eye shaped skin rash at the affected area. If this develops, seek immediate medical attention for a possible infection of Lyme disease. Insect repellent containing DEET® is also an effective means of tick control.

Mosquitoes may also carry disease; therefore, workers will ideally wear long-sleeved shirts, long pants, and boots that extend above the ankle with pant cuffs taped to the boots, especially when working in wooded, overgrown, or high grass areas.

6.4.3 Animal Bites

Rodents, snakes, stray dogs, stray cats, raccoons or other animals may be encountered on job sites. The only effective measure to preclude animal bites is avoidance. Contact with wild animals will be avoided. Do not reach into an object such as a pipe that may contain a rodent or other animal or attempt to remove the animal. If possible, delay activity in this area until the animal leaves or has been removed by an animal control unit. If it is necessary to use or move an object where an animal is hiding, the SSHO may have to notify the local animal control agency to subdue an animal that may cause a risk to workers (i.e., a raccoon). Do not approach an animal under any circumstance as this may cause the animal to be in an aggressive state. Persons bitten by an animal will seek medical assistance immediately, especially if it is suspected that the animal may be rabid. Aggressive or disoriented behavior, as well as foaming at the mouth, can be signs of rabid animals. Until medical assistance can be reached, persons will watch for symptoms of severe swelling, nausea, and shock. The local animal control agency will be contacted if a stray dog is observed on the property, especially if its presence will obstruct work activity or endanger the animal's safety. Do not attempt to leash a stray dog (no matter how harmless it may appear); doing so would greatly increase the risk of an animal bite.

Table 6-1. Potential Chemicals of Concern at New Castle Public Wells Groundwater Plume Site.

Compound	PEL or TLV/STEL ^(a)	IDLH ^(a)	Route of Exposure	Symptoms
Perfluorocarbons	No data	No data	Inhalation, Ingestion, Skin/Eye Contact	Potential changes in cholesterol and sex hormones; animals irritation of the eyes and nose, liver damage and weight loss
Tetrachloroethylene (PCE)	25 ppm/100 ppm C 200 ppm	1,000 ppm	Inhalation, Ingestion, Skin/Eye Contact	Irritated eyes, respiratory system; CNS depressant.
1,2-Dichloroethylene (<i>cis</i> - and <i>trans</i> -)	200 ppm / 200 ppm	Ca 1,000 ppm	Inhalation, Ingestion, Absorption, Skin/Eye Contact	Irritated eyes, skin; headache, dizziness, vertigo, visual distortion, fatigue, giddiness, vomiting, dermatitis, nausea.
Trichloroethylene (TCE)	50 ppm/100 ppm	Ca	Inhalation, Skin/Eye Contact (with liquid)	Weakness, abdominal pain, GI bleeding, enlarged liver.
Vinyl chloride	1 ppm/C 5 ppm	Ca	Inhalation, Skin/Eye Contact (with liquid)	Weakness, abdominal pain, GI bleeding, enlarged liver.

Table 6-2. Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature (Under Calm Conditions)^(a)

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect)	LITTLE DANGER In <hr with dry skin, maximum danger of false sense of security				INCREASING DANGER Danger from freezing of exposed flesh within one minute			GREAT DANGER Flesh may freeze within 30 seconds				
(a) Developed by U.S. Army Research Institute of Environmental Medicine, Natick, Massachusetts.												
NOTE: Trenchfoot and immersion foot may occur at any point on this chart.												

Table 6-3. Threshold Limit Values Work/Warm-Up Schedule for 4-Hour Shift^(a)

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26 to -28	-15 to -19	(NB)	1	(NB)	1	75 min	2	55 min	3	40 min	4
-29 to -31	-20 to -24	(NB)	1	75 min	2	55 min	3	40 min	4	30 min	5
-32 to -34	-25 to -29	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35 to -37	-30 to -34	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38 to -39	-35 to -39	40 min	4	30 min	5	Non-emergency work should cease					
-40 to -42	-40 to -44	30 min	5	Non-emergency work should cease							
-43 and below	-45 and below	Non-emergency work should cease									

(a) Adopted from Occupational Health and Safety Division, Saskatchewan Department of Labor.

NOTES:

- Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods of 10 minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For light-to-moderate work (limited physical movement), apply the schedule one step lower. For example, at -35°C (-30°F) with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with four breaks in a 4-hour period (Step 5).
- The following is suggested as a guide for estimating wind velocity if accurate information is not available: 5 mph-light flag moves; 10 mph-light flag fully extended; 15 mph-raises newspaper sheet; 20 mph-blowing and drifting snow.
- If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given would be: (1) special warm-up breaks should be initiated at a wind chill cooling rate of about 1,750 W/m²; (2) all non-emergency work should have ceased at or before a wind chill of 2,250 W/m². In general, the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges because windy conditions rarely prevail at extremely low temperatures.
- Threshold Limit Values apply only for workers in dry clothing.

°C = Degrees Celsius.
°F = Degrees Fahrenheit.
min = Minutes.
mph = Miles per hour.
NB = Normal breaks.

7. PERSONAL PROTECTIVE EQUIPMENT

7.1 GENERAL PPE REQUIREMENTS

Personnel will be equipped with proper PPE for the tasks they are asked to perform. The SSHO will distribute PPE to employees and will also train employees in proper use and disposal of PPE. Subcontractors are responsible for providing proper PPE for their own employees.

Respiratory fit-tests will be performed as necessary prior to the start of field activities. Adequate records of results, including size and brand of respirators in which employees passed fit-test requirements, will be kept.

Should PPE fail during use, the affected person will leave the Exclusion Zone immediately and replace or repair failed PPE in the Contaminant Reduction Zone. This person is not permitted to re-enter the Exclusion Zone until the problem has been rectified.

7.2 INITIAL REQUIREMENTS/UPGRADE OR DOWNGRADE OF PPE LEVELS

Based on an evaluation of the potential safety and health hazards, the required initial levels of PPE will be presented in the site-specific HASP. During field operations, the SSHO will evaluate environmental monitoring results and potential for exposure to hazards. The SSHO can authorize an upgrade or downgrade of the PPE level worn onsite, using the criteria presented in Table 8-1 or the site-specific HASP. Changes in PPE level, including the rationale for the changes, will be documented on the site health and safety activity report (Appendix C). Respirator cartridges will be changed daily or more frequently if required by manufacturer's recommendations.

7.3 LEVELS OF PPE

Engineering controls and work practices will be used where feasible to minimize potential hazards. The components of each level of PPE anticipated to be donned during field activities are listed below.

7.3.1 Level D PPE

Level D protection will be the minimum protection used for field operations. The following are the minimum requirements for Level D:

- Steel-toe, steel-shank safety shoes/boots
- Chemical resistant boot covers (optional)
- Hard hat that meets American National Standards Institute (ANSI) Standard Z89.1-1986 (when overhead hazards are present, or as required by SSHO)

- Chemical-resistant gloves (nitrile gloves when water sampling)
- Leather work gloves (as appropriate)
- Safety glasses (as appropriate)
- Hearing protectors (when noise hazards are present or as required by SSHO)
- Face shield (when operating steam cleaner or pressure washer)
- Coveralls (as appropriate)
- Poly-coated coveralls (when splash hazards are present or contact with heavily contaminated soil/water is expected).

7.3.2 Level C PPE

Level C protection will be used when the concentrations and types of airborne substances are known and criteria for the use of air-purifying respirators are met. The following are the minimum requirements for Level C:

- Full-facepiece, air-purifying respirator equipped with combination organic vapor and HEPA used in accordance with 29 CFR 1910.134
- Filters will be changed per established change schedule and/or daily even if the cartridge is not suspected to be at its capacity
- Steel-toe, steel-shank safety shoes/boots
- Chemical-resistant boot covers (as appropriate)
- Hard hat that meets ANSI Standard Z89.1-1986 (when overhead hazards are present or required by SSHO)
- Chemical-resistant inner and outer gloves
- Chemical-resistant coveralls with ankle and wrist openings taped
- Hearing protection (when noise hazards are present, or as required by SSHO).

7.3.3 Level B PPE

Level B protection will be used when the highest level of respiratory protection is required but the highest level of skin protection is not required. The following are the minimum requirements for Level B:

- Positive-pressure, supplied air breathing apparatus with full-facepiece mask and 5-minute escape bottle
- Steel-toe, steel-shank safety shoes/boots
- Chemical-resistant boot covers taped to coveralls
- Hard hat (when overhead hazards are present, or as required by SSHO) that meets ANSI Standard Z89.1-1986
- Chemical-resistant inner and outer gloves taped to coveralls
- Chemical-resistant suit complete with a chemical-resistant hood
- Hearing protectors (when noise hazards are present, or as required by SSHO).

No Level A work is to be conducted under this HASP.

7.4 HEARING PROTECTION

The groundwater treatment system equipment gives off a significant amount of noise (often exceeding 85 dBA). Hearing protection will be available to workers and should be worn at all times. Muffs and/or foam ear plugs will be available for hearing protection. Hearing protection that best suits the workers' needs without restricting or impairing their abilities will be chosen.

7.5 INSPECTION AND MAINTENANCE OF PROTECTIVE EQUIPMENT

Effective use of protective equipment requires that the equipment be properly used, maintained, and inspected periodically during the day. Site-specific issues and standard procedures will be reiterated during pre-entry training.

Gloves/Coveralls

Gloves and coveralls will be regularly inspected and replaced promptly if torn while in the Contaminant Reduction Zone. Disposable coveralls will be replaced daily at a minimum. Reusable gloves will be decontaminated whenever exiting the Exclusion Zone or Contaminant Reduction Zone.

7.6 COMMUNICATIONS

Should the use of PPE interfere with verbal communication, standardized hand/body signals will be used to maintain communications between personnel in the various work zones throughout the duration of each specific operation. These hand/body signals are:

- Hand clutching throat = “Out of air, can’t breathe.”
- Hands on top of head = “Need assistance.”
- Thumbs up = “OK,” “I’m alright,” or “I understand.”
- Thumbs down = “No,” or “negative.”
- Grip partner’s wrist or both hands around partners waist = Leave area immediately.

Communications also will be established between personnel in the Support Zone and emergency response personnel via the mobile telephone located in field vehicle. Emergency response procedures are discussed in more detail in Chapter 12.

8. ENVIRONMENTAL MONITORING

8.1 GENERAL

The following monitoring program is to be instituted during operations at the site. The monitoring program may be modified by the Manager, Health and Safety, based on site conditions and monitoring results. Monitoring will be accomplished under the direction of the SSHO who will interpret the results. The results will be recorded on an environmental monitoring record (Appendix D). Environmental monitoring requirements are presented on Table 8-1, which is to be included in the site-specific HASP addendum. Table 8-1 represents a worst-case scenario and presents monitoring requirements and exposure limits for sites with unknown contaminants and unknown concentrations. Where general site contaminants and concentrations are known, Table 8-1 can be modified in the site-specific HASP to represent known site conditions.

When oxygen levels are monitored, the oxygen level should be 20.8% (background). Readings above or below 20.8% oxygen should be further evaluated to determine the cause and if controls are needed.

8.2 REAL-TIME AIR MONITORING

The air monitoring program will include sufficient monitoring of air quality in work zones and other onsite areas to assess levels of employee exposure, establish that the work zone designations are valid, and verify that the respiratory protection being worn by personnel is adequate. The air monitoring program is also designed to ensure that contaminants are not migrating offsite to minimize exposure of nearby populations and/or workers. Air monitoring will be conducted:

- Periodically during the site field investigations
- When work begins on a different portion of the site
- When contaminants other than those previously identified are being handled or encountered
- When a different type of field investigation is initiated
- If personnel are working in areas with obvious liquid contamination
- If a sufficient reasonable interval has passed so that exposures may have significantly increased

Measurements will be taken at the anticipated source and in the breathing zone of site personnel during field activities utilizing the instruments specified in Table 8-1. Response action levels are also presented in this table.

8.3 PERIMETER MONITORING

If real-time air monitoring in the Exclusion Zone indicates readings above action levels, monitoring for contaminant concentrations will be conducted during operations at least two times each day at the perimeter of the site as specified by the aforementioned tables. If airborne levels of contaminants exceed established action levels for a sustained period of time beyond the perimeter of the site, the work will be stopped, the suspected source of the contamination will be covered to eliminate emissions, and the Manager, Health and Safety, and Project Manager will be notified. A decision will then be made as to how to proceed with the work and how to more fully characterize the airborne emissions. Work zones may need to be modified as a result of air monitoring readings in the Exclusion Zone and during perimeter monitoring.

8.4 CALIBRATION AND MAINTENANCE

Direct-reading instruments will be calibrated initially, and instructions in the manufacturers' operations manuals regarding calibration, cleaning, and maintenance of the instruments will be followed (Appendix D). A calibration and maintenance log for each instrument will also be maintained (Appendix D). The log should contain detailed descriptions of problems encountered with the instrument along with any records of factory calibration and repair.

8.5 HEAT STRESS MONITORING

Ambient temperatures at the site combined with the requirements for PPE use may contribute to heat stress. While using impermeable PPE when ambient temperatures reach or exceed 70°F, heart rates will be monitored when heat stress conditions may occur. Work-rest regimens will be adjusted accordingly.

Table 8-1. Environmental Monitoring Requirements

Instrument	Location of Monitoring	Frequency	General Action Level	Site-Specific Action Level	Response
Total Volatile Organics Detector (Photoionization detector)	Breathing Zone	Initially and every 30 minutes	Above background	_____ Same or Specify	Begin perimeter monitoring. Upgrade to Level C personal protective equipment
			>5 parts per million	_____ Same or Specify	Withdraw from site, prepare to upgrade to Level B
	Perimeter monitoring	2 times per day	Above action level established in site specific HASP	Above action level established in site-specific Health and Safety Plan	Shut down operations and identify source of contamination and cover.

General Action Levels represent worst-case conditions for unknown contaminants/concentrations. Table 8-1 can be modified in HASP addenda to reflect site-specific conditions

The readings must remain <10% of the Lower Exposure Limit in order to enter an excavation or other area containing combustible gas.

Action levels represent concentrations or percentages that are sustained for the monitoring period specified under “Frequency” and do not reflect peak levels.

9. CONFINED SPACE ENTRY PROCEDURES

Confined spaces present unique hazards due to their configuration and/or contents. If air circulation is restricted within a confined space, a hazardous atmosphere may accumulate quickly. Confined spaces may present entrapment hazards. The limited space can increase the risk of injury or death by making employees work closer to hazards. Workplace hazards encountered elsewhere, such as electrical shock and contact with machinery and chemicals, may also be encountered in confined spaces, but may be intensified by the conditions of confined space work. Asphyxiation, fire(s) and explosion, toxic atmosphere, engulfment, and mechanical hazards have been identified as causes of fatalities in confined space entries. Historically, the largest numbers of fatalities have been untrained rescuers.

Confined spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces more than 4 ft in depth, such as pits, tubs, vaults, and vessels.

EA does not anticipate confined space entries at the Site but if needed, we will provide additional procedures as necessary.

10. SPILL CONTAINMENT PROCEDURES

Small incidental spills that do not cause injury to personnel or the environment will be cleaned as quickly as possible. Waste will be disposed of properly and labeled accordingly.

Large spills that may harm personnel or the environment will be dealt with at once. First aid will be of primary importance. Spill containment procedures will follow, and emergency contacts can then be made. The Field Team Leader or SSHO will notify the EA Project Manager. Many hazardous chemicals are listed by the United States Environmental Protection Agency as having Reportable Quantities. Spills involving these chemicals in amounts of the Reportable Quantity or greater will require reporting to the appropriate federal, state, and local agencies. It is the client's responsibility to report to other government agencies. Emergency telephone numbers are provided in Section 12.

11. DECONTAMINATION PROCEDURES

Personnel and equipment that enter an Exclusion Zone (i.e., personnel, drill rigs, monitoring equipment, field sample collection equipment, etc.) will be decontaminated prior to exit. Decontamination will be supervised by the SSHO. The decontamination supplies and equipment will be maintained by the SSHO. The decontamination procedure described herein assumes the contaminating substances are particulate matter and soils containing heavy metals and leachate. The decontamination procedure will be modified in the site-specific HASP addendum if the type of contaminating substance or its hazard potential is altered.

11.1 PERSONNEL DECONTAMINATION

Remove and discard boot covers, if worn. Wash boots with detergent and water; rinse. Remove and discard disposable coveralls. Wash outer gloves and remove, and then remove the respirator, if worn. Discard inner gloves if worn. Place non-disposable coveralls in plastic bags prior to leaving the site and prior to entering any vehicle. Launder non-disposable clothing prior to reuse, separately from other laundry items. Hands and face, and other exposed skin must be washed with soap and water prior to leaving the site. Shower and shampoo as soon as possible at the end of the workday.

11.2 EQUIPMENT DECONTAMINATION

It is imperative that equipment and vehicles used on site are thoroughly decontaminated before allowing the items to leave the work area. A decontamination station will be established within the Contaminant Reduction Zone to wash off treads, tracks, and excessive soil and debris when equipment must exit the Exclusion Zone.

Instruments used onsite must be wet-wiped with clean water prior to leaving the site. Wet-wipe respirator exteriors whenever exiting the work areas. Clean respirators with a manufacturer-recommended sanitizer, then hang to drip dry and place in plastic bags for protection against dust. Change respirator cartridges at least daily or earlier if breakthrough occurs, or when breathing resistance becomes high, whichever occurs first. Damage used cartridges to prevent accidental reuse.

Drilling equipment will be steam cleaned or pressure washed onsite at a designated decontamination area. Non-dedicated field equipment (e.g., downhole equipment and submersible pumps) will be properly decontaminated before use and in between locations. Decontamination of downhole equipment will not be completed between intervals associated with one location. All drilling equipment will be steam cleaned or pressure washed prior to the start and in between drilling activities. Downhole drilling equipment will be steam cleaned or pressure washed prior to initiation of drilling activities, between each boring, and at the conclusion of drilling activities.

Discolorations, stains, corrosion, and substances adhering to objects may indicate that contaminants have not been removed.

11.3 WASTE DISPOSAL PROCEDURES

PPE that cannot be decontaminated (i.e., chemical resistant suits, gloves, boot covers, respirator cartridges, etc.) will be placed in plastic trash bags and discarded as municipal waste.

Investigation-derived waste consisting of drill cuttings from well installations will be containerized in 55-gallon drums and temporarily stored in an approved area while awaiting analysis for transportation to an offsite disposal facility.

Water generated from decontamination, well development, and well purging activities will be containerized in 55-gallon drums and temporarily stored in an approved area while waiting analysis for transportation to an offsite disposal facility.

Each drum will be properly marked as to the drum contents. Composite samples will be collected from a set number of drums based on contents and media and submitted to the designated laboratory for hazardous waste disposal characterization in accordance with the proposed disposal facility.

Drums will be removed offsite for disposal following the receipt of analytical results.

12. EMERGENCY RESPONSE PLAN

12.1 EMERGENCY RECOGNITION

An emergency is defined as a situation that requires calling outside help onto a job site. Field personnel will immediately stop work and report to the Field Team Leader and SSHO under the following situations:

- Medical emergency
- Fire emergency
- Discovery of unanticipated hazards (e.g., drums, heavily contaminated materials, etc.)
- Heavy equipment accident
- Overexposure of personnel to onsite contaminants requiring emergency medical services support
- Heat/cold-related injury or heat/cold stress requiring emergency medical services support.

Prior to work startup, personnel will be familiar with this Emergency Response Plan. The Field Team Leader and/or the SSHO will make this plan available for review and photocopying. Emergency telephone numbers and directions to the nearest hospital are presented in each site-specific HASP addendum in the corresponding work plan. Figures in the site-specific HASP addendum will present a map with directions to the nearest hospital.

Onsite emergencies will ultimately be handled by offsite emergency support personnel such as the local fire department, ambulance squad, or police dependent based on the nature of the emergency. Initial response and first aid treatment, however, will be available through trained onsite personnel.

Workers will be quickly decontaminated in the Contaminant Reduction Zone prior to transport to a hospital to avoid refusal of treatment at the local hospital. If a neck or back injury is suspected, do not move the victim without medical personnel stabilizing the neck and back in accordance with first aid procedures. Then workers trained in first aid and wearing PPE should move the injured worker to the Contaminant Reduction Zone for decontamination so that it is safe for emergency personnel to administer medical help to the injured worker. As the situation allows, emergency personnel should not be allowed to enter the Exclusion Zone without the proper PPE. Local hospital requirements for accepting contaminated workers should be investigated in the site-specific HASP addendum.

In case of a hazardous materials emergency, the Field Team Leader will assume control and direction of the emergency until arrival of the emergency response Incident Commander. The Incident Commander will work with the Manager, Health and Safety, or the SSHO to identify and evaluate hazards. Emergency responders and communications will be coordinated and controlled through the Incident Commander.

12.2 PROCEDURES FOR HANDLING EMERGENCY INCIDENTS

In the event of an emergency, the information available at that time will be properly evaluated and the appropriate steps taken to implement the Emergency Response Procedures. The Field Team Leader (or SSHO if the Field Team Leader is part of the emergency) will assume command of the situation. He or she will call the appropriate emergency services, evacuate personnel to the pre-designated evacuation location as needed, and take other steps necessary to gain control over the emergency. If a hazardous materials emergency takes place, the Field Team Leader will assume control of the situation until the emergency response incident commander arrives.

Give the following information when reporting an emergency:

- Name and location of person reporting
- Location of accident/incident
- Name and affiliation of injured party
- Description of injuries, fire, spill, or explosion
- Status of medical aid and/or other emergency control efforts
- Details of chemicals involved
- Summary of accident, including suspected cause and time it occurred
- Temporary control measures taken to minimize further risk

This information is not to be released to parties other than those listed in this section and emergency response team members. Once emergency response agencies have been notified, the Project Manager will be immediately notified.

12.3 MEDICAL EMERGENCIES

Personnel will be alert for signs and symptoms of illnesses related to chemical, physical, and disease factors onsite. Severe injuries resulting from accidents will be recognized as emergencies and treated as such. At least one person currently trained in first aid/CPR will be present onsite.

Personnel currently trained in first aid will evaluate the nature of the injury, decontaminate the victim if the victim can be moved safely, and initiate first aid assistance immediately. First aid will be administered to limit further injury and stabilize the victim. The local Emergency Medical Services will be notified immediately if needed. Personnel will not transport victims to emergency medical facilities unless the injury does not pose an immediate threat to life and transport to the emergency medical facility can be accomplished without the risk of further injury.

First aid equipment will be available at locations specified in the site-specific HASP addendum as well as in company vehicles.

The Field Team Leader will complete an Accident Investigation Report (Appendix E) and submit it to the Project Manager within 24 hours of the following types of incidents:

- Job-related injuries and illnesses
- Accidents resulting in loss or damage to property
- Accidents involving vehicles and/or vessels, whether or not they result in damage to property or personnel
- Accidents in which there may have been no injury or property damage, but which have a high probability of recurring with at least a moderate risk to personnel or property.

An accident that results in a fatality will be reported within 8 hours to the U.S. Department of Labor through the Project Manager. An accident that results in the hospitalization of one or more employees or involves and amputation or loss of an eye will be reported within 24 hours to the U.S. Department of Labor through the Project Manager. In addition to the written accident investigation report discussed above, the Field Team Leader will be responsible for contacting the Health and Safety Manager or the Director of Human Resources as soon as possible after the incident for determination of whether a drug and/or alcohol test will need to be taken by the affected parties.

First aid/emergency equipment is available at the following locations:

- First Aid Kit: Field Vehicle
- Eye Wash: Onsite.

The eye wash kit will be portable and capable of supplying at least a 15-minute supply of potable water to the eyes.

12.4 FIRE/EXPLOSION EMERGENCIES

A fire and/or explosion will be immediately recognized as an emergency. Emergency services (fire, police, and ambulance) will be notified. Only persons properly trained in fire suppression and other emergency response procedures will attempt to deal with these situations. Employees will not attempt to handle a fire/explosion emergency. Other than small fires or spills, local emergency response services will be notified to handle the emergency. The Field Team Leader will take measures to reduce injury and illness, primarily by evacuating personnel as quickly as possible. He or she will then notify the Project Manager. Cleanup after such events may require specialized services. The Project Manager will establish proper cleanup actions. Site personnel will not resume work during or after a fire/explosion incident until the emergency coordinator has directed that the incident is over, and work may resume. During the incident, site personnel will remain outside the incident area and obey the instructions of the emergency coordinator.

12.5 EMERGENCY PHONE NUMBERS

Communications will be by a mobile telephone provided to field personnel. Additional emergency numbers will be included in the site-specific HASP addendum, as they will change per locality.

Poison Control Center: 1-800-552-6337.

National Response Center: 1-800-424-8802.

EA Emergency Contacts:

- Manager, Health and Safety: (b) (4), Certified Industrial Hygienist (CIH)
 - Work: (410) 329-5192
 - Cell: (717) 586-9878
- SSHO/Field Team Leader: (b) (4)
 - Work: (410) 671-6051 x1410
 - Cell: (410) 670-7304

In Case of Spill, Contact:

(b) (4)

- Work: (302) 485-0114
- Cell: (443) 257-4277.

EA Occupational Physician:

- Health Resources: (800) 350-4511.

12.6 EMERGENCY EQUIPMENT AVAILABLE ONSITE

<u>Medical Equipment</u>	First Aid Kits	EA company vehicle
<u>Fire-Fighting Equipment</u>	Fire Extinguishers	EA company vehicles

13. REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH). *Threshold Limit Values and Biological Exposure Indices*. Cincinnati: ACGIH, current edition.

Federal Acquisition Regulation (F.A.R.), Clause 52.236.13: *Accident Prevention*.

National Institute of Occupational Safety and Health/Occupational Safety and Health Administration (OSHA)/U.S. Coast Guard/U.S. Environmental Protection Agency. 1985. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*. October.

National Institute of Occupational Safety and Health. *Pocket Guide to Chemical Hazards*. U.S. Department of Health and Human Services, current online edition.

———. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985.

Occupational Safety and Health Administration (OSHA). Standards for General Industry, 29 CFR 1910.1000, *Air Contaminants*.

———. Standards for Construction Industry, 29 CFR 1926, including 29 CFR 1926.65, *Hazardous Waste Operations and Emergency Response* and 29 CFR 1926.59, *Hazard Communication*.

———. Standards for General Industry, 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response*.

———. Standards for General Industry, 29 CFR 1910, including 29 CFR 1910.1030, *Occupational Exposure to Bloodborne Pathogens*.

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**HEALTH AND SAFETY PLAN
APPENDIX A**

HEALTH AND SAFETY PLAN REVIEW RECORD

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HEALTH AND SAFETY PLAN REVIEW RECORD

SITE: _____

EA Project No. _____

I have read the Health and Safety Plan (s) and have been briefed on the nature, level, and degree of exposure likely as a result of participation of field activities. I agree to conform to all the requirements of this Plan.

[illegible]

HEALTH AND SAFETY PLAN
APPENDIX B
SITE ENTRY AND EXIT LOG

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SITE ENTRY AND EXIT LOG

Site : _____

EA Project No.: _____

[illegible]

**HEALTH AND SAFETY PLAN
APPENDIX C**

HEALTH AND SAFETY ACTIVITY REPORT

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HEALTH AND SAFETY ACTIVITY REPORT

Site: _____

Location: _____

EA Project No. _____

Date: _____

Weather Cond.: _____

Onsite Hours: From _____ To _____

Changes in PPE Levels*

Work Operations

Reasons for Change

Site Safety and Health Plan
Violations

Corrective Action
Specified

Corrective Action
Taken (yes/no)

Observations and Comments:

Completed by: _____
Site Health and Safety Supervisor

Date: _____

*Only SSHO may change PPE levels, using only criteria specified in GHASP.

**HEALTH AND SAFETY PLAN
APPENDIX D**

ENVIRONMENTAL MONITORING RECORD

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ENVIRONMENTAL MONITORING RECORD

SITE: _____

EA PROJECT NO.: _____

INSTRUMENT: _____

CALIBRATION: Gas: _____ Conc: _____ Span: _____

Time	Monitoring Location	Reading	Corrective Action Taken ^(a)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Comments: _____

(a) Corrective actions taken must be documented whenever readings at or above action levels are reached. Monitoring equipment and action levels should be specified in the site-specific GHASP addendum

Recorded By: _____
Site Health & Safety Supervisor

Date: _____

**HEALTH AND SAFETY PLAN
APPENDIX E**

ACCIDENT/LOSS AND INCIDENT REPORT

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ACCIDENT/LOSS REPORT

THIS REPORT MUST BE COMPLETED BY THE INJURED EMPLOYEES SUPERVISOR AND FAXED TO EA CORPORATE HUMAN RESOURCES WITHIN 24 HOURS OF ANY ACCIDENT. THE FAX NUMBER IS (410) 771-1780.

NOTE WHENEVER AN EMPLOYEE IS SENT FOR MEDICAL TREATMENT FOR A WORK RELATED INJURY OR ILLNESS, PAGE 4 OF THIS REPORT MUST ACCOMPANY THAT INDIVIDUAL TO ENSURE THAT ALL INVOICES/BILLS/CORRESPONDENCE ARE SENT TO CORPORATE CENTER FOR TIMELY RESPONSE.

DATE OF ACCIDENT: _____ TIME OF ACCIDENT: _____

EXACT LOCATION WHERE ACCIDENT OCCURRED (including street, city and state):

NAME OF INJURED EMPLOYEE: _____

HOME ADDRESS: _____

HOME PHONE: _____ DATE OF BIRTH: _____

AGE: _____ SEX: M F MARITAL STATUS: _____

SOCIAL SECURITY NUMBER: _____ DATE OF HIRE: _____

NUMBER OF DEPENDENTS: _____

EMPLOYEES JOB TITLE: _____

DEPT. REGULARLY EMPLOYED: _____

EXPLAIN WHAT HAPPENED (include what the employee was doing at the time of the accident and how the accident occurred):

DESCRIBE THE INJURY AND THE SPECIFIC PART OF THE BODY AFFECTED (i.e. laceration, right hand, third finger, second joint):

OBJECT OR SUBSTANCE THAT DIRECTLY INJURED EMPLOYEE:



NAME AND ADDRESS OF THE PHYSICIAN (if medical attention was administered):

PLEASE ATTACH THE PHYSICIANS WRITTEN RETURN TO WORK SLIP

NOTE A PHYSICIANS RETURN TO WORK SLIP IS REQUIRED PRIOR TO ALLOWING THE WORKER TO RETURN TO WORK

IS THE EMPLOYEE EXPECTED TO LOSE AT LEAST ONE FULL DAY OF WORK? _____

WAS THE EMPLOYEE ASSIGNED TO RESTRICTED DUTY? _____

NUMBER OF DAYS AND HOURS EMPLOYEE USUALLY WORKS PER WEEK: _____

LIST ALL PPE EMPLOYEE WAS WEARING AND ALL SAFETY DEVICES IN USE AT THE TIME OF THE ACCIDENT:

DESCRIBE THE PREVENTIVE MEASURES TAKEN TO AVERT A RECURRENCE OF THIS TYPE OF INCIDENT: _____

DATE WHEN MEASURES WERE IMPLEMENTED AND BY WHOM: _____



AUTOMOBILE ACCIDENT INFORMATION

AUTHORITY CONTACTED AND REPORT # _____

EA EMPLOYEE VEHICLE YEAR, MAKE AND MODEL _____

V.I.N. _____ PLATE/TAG # _____

OWNER'S NAME AND ADDRESS: _____

DRIVER'S NAME AND ADDRESS: _____

RELATION TO INSURED: _____ DRIVER'S LICENSE # _____

DESCRIBE DAMAGE TO YOUR PROPERTY: _____

DESCRIBE DAMAGE TO OTHER VEHICLE OR PROPERTY: _____

OTHER DRIVER'S NAME AND ADDRESS: _____

OTHER DRIVER'S PHONE: _____

OTHER DRIVER'S INSURANCE COMPANY AND PHONE: _____

LOCATION OF OTHER VEHICLE: _____

NAME, ADDRESS AND PHONE OF OTHER INJURED PARTIES: _____

WITNESSES

NAME: _____ PHONE: _____

ADDRESS: _____

STATEMENT: _____

SIGNATURE: _____

NAME: _____ PHONE: _____

ADDRESS: _____

STATEMENT: _____

SIGNATURE: _____



NAME OF SUPERVISOR: _____

DATE OF THIS REPORT: _____ REPORT PREPARED BY: _____

I have read this report and the contents as to how the accident/loss occurred is accurate to the best of my knowledge.

Signature: _____

Injured Employee

Date: _____



I am seeking medical treatment for a work related injury/illness.

Please forward all bills/invoices/correspondence to:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

CORPORATE OFFICE

11019 MCCORMICK ROAD

HUNT VALLEY, MD 21031

ATTENTION: Human Resources

(410) 584-7000

**HEALTH AND SAFETY PLAN
APPENDIX F
SITE-SPECIFIC ADDENDUM**

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SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

This document shall be maintained on site with the *Sampling and Analysis Plan (SAP) Addendum* and the *Health & Safety Plan (HASP) for the New Castle Public Wells Groundwater Plume Site* conducted by EA Engineering, Science, and Technology, Inc., PBC (EA).

Client: Delaware Department of Natural Resources and Environmental Control (DNREC)

Project Name/Number: New Castle Public Wells Groundwater Plume Site (DE-0363) / 1613105

Site Location/Address: 0. East Basin Road, New Castle, New Castle County, Delaware

Site Description/History: In 2014, five public water supply wells in New Castle exceeded the U.S. Environmental Protection Agency (EPA) preliminary health advisory levels for perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS). PFOA was detected at a maximum concentration of 440 parts per trillion and PFOS was detected at a maximum concentration of 2300 parts per trillion. Since that time, EPA established a more stringent lifetime health advisory level (HAL) of 70 parts per trillion in 2016. These public water supply wells as well as others in the area exceed the lifetime HAL. Artesian Water Company, Inc. and the City of New Castle Municipal Services Commission have been treating the public drinking water to remove PFOS and PFOA to assure concentrations do not exceed the health advisory level.

In addition to per- and polyfluoroalkyl substances (PFAS), volatile organic compounds (VOCs) which included tetrachloroethene (PCE), trichloroethene (TCE) and vinyl chloride were detected in the area wells.

A Site Inspection was conducted in 2017, 2018, and 2020 to determine whether substances, primarily PFAS, are present and migrating to the environment at the Site. PFAS was detected in groundwater, surface water, and sediment collected at the Site.

The objective of the upcoming Expanded Site Inspection is to further investigate if PFAS and VOCs are present and migrating in the surrounding area of the public wells.

Work Description: Site work will include utility marking and clearing to include soft dig/vacuum, drilling/well Installation, well development, and groundwater sampling.

APPROVALS:

This Addendum to the July 2021 HASP has been prepared under the supervision and review of a Certified Industrial Hygienist certified by the American Board of Industrial Hygiene

Program Health and Safety Manager: _____ 30 July 2021
Role _____ Date

Project Manager: Kristin Lazzeri 30 July 2021
Kristin Lazzeri . Date

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

EMERGENCY CONTACT INFORMATION:

Contacts	Name	Phone Number(s) work/cell
Project Manager	(b) (4)	302-485-0116 / 443-528-8338
Program Health and Safety Manager	(b) (4)	410-329-5192 / 717-586-9878
Task Manager, Site Manager, and/or Site Safety and Health Officer	(b) (4)	302-485-0114 / 443-257-4277
	(b) (4)	410-671-6051 / 410-670-7304
Client/ Regulatory Contact	Stephanie Gordon, DNREC Project Manager	302-395-2654 (office)
Poison Control		800-222-1222
National Response Center		800-424-8802
EA Medical Services	Health Resources	800-350-4511
Corporate Health and Safety Director	(b) (4)	410-329-5192 / 717-586-9878
Fire/Rescue/Emergency Medical Services/Ambulance-Medical Transport		911 Give Site address to 911
Police		302-322-9800 (non-emergency) 911 (emergency)
Others		

MEDICAL EMERGENCY:

Distance to Nearest Hospital (with emergency room): 7.9 miles, 16 minutes

Hospital Name: ChristianaCare Hospital

Hospital Phone: (302) 733-1000

Hospital Address: 4755 Ogletown Stanton Rd, Newark, DE 19718

Route to Hospital:

Start: New Castle Airport Area

End: 4755 Ogletown Stanton Rd, Newark, DE 19718

Route to Hospital (See Map Below)

- Head southwest on N Dupont Hwy/US-40 W/US-13 S towards Traders Lane – 0.8 miles
- Turn right onto DE-273W/Christiana Rd/Frenchtown Rd – 0.3 miles
- Turn right (first right) onto DE-58 W/Churchmans Rd – 3.6 miles
- Turn left into Hospital (at light across from Best Buy/Bugaboo Creek Steakhouse) – 0.1 miles

Route to Christiana Hospital

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

HAZARDS OF CONCERN: Check as many as are applicable. See Section 6 of SCR GHASP for Chemical, Physical, and Biological Hazards.

☒ Heat Stress	☐ Reactive Chemicals	☐ Oxygen Deficient	☒ Insect Bite
☐ Cold Stress	☒ Noise	☐ Corrosive	☒ Snake Bite
☒ Explosion/Fire	☐ Inorganics	☐ Toxic Chemicals	☒ Heavy Equipment
☒ Biological	☒ Organic Vapors	☐ Inert Atmosphere	☒ Vegetation
☐ Radiological	☒ Utilities	☐ Excavations	☐ Electrical
☐ Pressure or Vacuum	☒ Lifting	☒ General Physical	☐ Boating
☐ Confined Space (see Section 9 of GHASP)	☐ UXO		
☐ Other, specify: _____			

CONTROLS OR PROTECTIVE MEASURES: Check as many as are applicable.

☒ Pre-entry Briefing/Safety Meetings	☒ PPE	☒ Site control
☒ Operator Training	<u>Drilling equipment, licensed well driller</u>	
☒ Permits	<u>Well installation</u>	
☒ Engineering Controls	<u>cones, flags, etc. to demarcate work area</u>	
☒ Work Practices	<u>Standard Operating Procedures</u>	
☒ Other	<u>Miss Utility of Delaware (800-282-8555)</u>	

EXPOSURE PATHWAYS: ☒ Inhalation ☒ Ingestion ☒ Dermal ☐ Injection

POTENTIALLY IMPACTED MEDIA:

☒ Air ☒ Dust/Soil ☒ Surface Water ☒ Sediment ☒ Groundwater ☐ Other

FIRE/EXPLOSION POTENTIAL: ☐ High ☐ Medium ☒ Low

SURROUNDING POPULATION: ☐ Residential ☐ Industrial ☐ Rural ☒ Commercial

ANTICIPATED LEVEL OF CHEMICAL EXPOSURE: (List potential contaminants of concern, media, and concentration levels if known. Include previous air sampling if any):

☐ High ☐ Medium ☒ Low

Contaminants found in the public water include PFAS as wells as VOCs, primarily PCE, TCE, and DCE.

OVERALL HAZARD RANKING: ☐ High ☐ Medium ☒ Low

JUSTIFICATION OF HAZARD RANKING: (brief narrative of how work activities may encounter hazards and their controls):

With properly trained EA employees and subcontractors performing the site work, Safety Meeting participation, site control, proper PPE (Level D), and awareness of surroundings will be sufficient to keep the overall hazard ranking low. Organic vapors, contact with potentially contaminated soil and groundwater may be encountered during activities. Organic vapors will be monitored in the breathing zone during drilling including soft digging/vacuum and sampling activities.

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

CHEMICAL HAZARDS (condensed from Table 6-1 of SCR GHASP, add/delete as required):

Compound	PEL or TLV/STEL	IDLH	Route of Exposure	Symptoms
Perfluorocarbons	No Data	No Data	Inhalation, Ingestion, Skin/Eye Contact	Potential changes in cholesterol and sex hormones; animals irritation of the eyes and nose, liver damage and weight loss
Tetrachloroethylene (PCE)	25 ppm/100 ppm C 200 ppm	Ca 150 ppm	Inhalation, Ingestion, Absorption, Skin/Eye Contact	Irritated eyes, skin, throat; dizziness, headache, nausea, face flush, liver damage.
1,2-Dichloroethylene (<i>cis</i> - and <i>trans</i> -)	200 ppm / 200 ppm	1,000 ppm	Inhalation, Ingestion, Skin/Eye Contact	Irritated eyes, respiratory system; CNS depressant.
Trichloroethylene (TCE)	50 ppm/100 ppm	Ca 1,000 ppm	Inhalation, Ingestion, Absorption, Skin/Eye Contact	Irritated eyes, skin; headache, dizziness, vertigo, visual distortion, fatigue, giddiness, vomiting, dermatitis, nausea.
Vinyl chloride	1 ppm/C 5 ppm	Ca	Inhalation, Skin/Eye Contact (with liquid)	Weakness, abdominal pain, GI bleeding, enlarged liver.
IDLH	Immediately Dangerous to Life and Health			
PEL	Permissible Exposure Limit			
TLV	Threshold Limit Value			
STEL	Short Term Exposure Limit (15 min)			
C	Ceiling Limit			
Ca	Carcinogen			
CNS	Central Nervous System			
GI	Gastrointestinal			
N.D.	Not determined			
Skin	Skin absorption can contribute to overall body dose			
[a]	The PEL and IDLH are representative of coal tar pitch volatiles.			

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

WORKING ALONE: (X) No () Yes, explain precautions _____

UTILITY CLEARANCE:

One-Call Utility Services () Not Required (X) Required, explain Miss Utility of Delaware will be called
prior to soft dig/vacuum and drilling activities.

Facility-Provided Clearance or Permit (X) Not Required () Required, explain _____

Geophysical, Pipe Locator, or Other Contractor () Not Required (X) Required, explain locating utility
lines

CONTINGENCY PLANS: Summarize below (Evacuation, assembly point, contingency leader)

If evacuation is deemed necessary by the Site Manager, assemble in the designated support zone and
contact the Program Safety and Health Officer before continuing to work.

DEVIATIONS/VARIATIONS FROM GHASP:

MEDICAL SURVEILLANCE:

Do hazardous waste site workers and supervisor (s) have documentation of required medical exams?

(X) Yes () No, Explain _____

TRAINING REQUIRED:

(X) HAZWOPER Worker () HAZWOPER Supervisor (X) First Aid/CPR

() Confined Space (X) Other, explain Well drilling will be conducted by DE-licensed
driller

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

PROTECTIVE EQUIPMENT: Protective equipment should be specified by the type of task and site (e.g., soil boring and sampling at landfill). Indicate type and/or material, as necessary. Use additional pages as necessary.

TASK 1: Soft dig for utility clearance.

INITIAL LEVEL: A - B - C - (D) - Modified (Circle applicable)

Respiratory: (X) Not needed

() SCBA, Airline: _____

() APR: _____

() Cartridge: _____

() Escape Mask: _____

() Other: _____

Head and Eye: () Not needed

(X) Safety Glasses: _____

() Face Shield: _____

() Goggles: _____

(X) Hard Hat: soft dig

Hearing Protection: () Not needed

(X) Plugs: soft dig

() Muffs: _____

Boots: () Not needed

(X) Safety Boots: steel toe/shank

() Overboots: _____

Protective Clothing: (X) Not needed

() Encapsulating Suit: _____

() Splash Suit: _____

() Apron: _____

() Tyvek Coverall

() Saranex Coverall

() Coverall: _____

() Other: _____

Gloves: () Not needed

() Undergloves: _____

(X) Gloves: nitriles

() Overgloves: _____

(X) Other: leather

TASK 2: Drilling to include continuous soil cores, installation of monitoring wells, well development and groundwater sampling.

LEVEL: A - B - C - (D) - Modified (Circle applicable)

UPGRADE CRITERIA: _____

Respiratory: (X) Not needed

() SCBA, Airline: _____

() APR: _____

() Cartridge: _____

() Escape Mask: _____

() Other: _____

Head and Eye: () Not needed

(X) Safety Glasses: _____

() Face Shield: _____

() Goggles: _____

(X) Hard Hat: drilling activities

Hearing Protection: () Not needed

(X) Plugs: drilling activities

() Muffs: _____

Boots: () Not needed

(X) Safety Boots: steel toe/shank

() Overboots: _____

Protective Clothing: (X) Not needed

() Encapsulating Suit: _____

() Splash Suit: _____

() Apron: _____

() Tyvek Coverall

() Saranex Coverall

() Coverall: _____

() Other: _____

Gloves: () Not needed

() Undergloves: _____

(X) Gloves: nitriles

() Overgloves: _____

(X) Other: leather

MONITORING EQUIPMENT: Monitoring equipment should be specified by task and type of site. Indicate type, as necessary. Attach additional sheets, as necessary.

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

TASKS: Soft dig/vacuum, drilling, soil and groundwater sampling.

See HASP for Calibration Procedures or attach if different. Attached table specifies monitoring requirements and action levels

<u>INSTRUMENT</u>	<u>ACTION GUIDELINES</u>
Combustible Gas Indicator/O ₂ () Not needed	0-10% LEL Continue. 10-20% LEL Potential explosion hazard, continuous monitoring. >20% LEL Explosion hazard; interrupt task/evacuate.
Oxygen (O ₂) Percentage:	20.8% - O ₂ normal. <20.8% - O ₂ deficient, investigate cause. <19.5% O ₂ Interrupt task/evacuate.
Type: <u>MultiRae or CGI/O₂</u>	

Photoionization Detector Specify: (COCs)
() 11.7 ev (X) 10.6 ev () 09.8 ev () __ ev
Type: Photovac or MiniRAE (circle applicable or list other):
() Not needed
Flame Ionization Detector Specify: (COCs)
Type Photovac or OVA (circle applicable or list other):
(X) Not needed

Detector Tubes Or Chemical Detector Specify: (COCs, Range, Interferences)
Type _____
(X) Not needed

Dust Monitor Specify: (COCs, Nuisance)
Type _____
(X) Not needed

Radiation Survey Meter Specify: (Radioisotopes; alpha, beta, gamma, x-ray)
> Background Contact RSO/SSHO and PM
3 x Background Notify CIH and stop work
2.5mR/hr Interrupt task/evacuate
(X) Not needed Note: Annual Exposure not to exceed 100 mrem/yr or 50 urem/hr average

Other Instruments Specify:

DECONTAMINATION PROCEDURES:

Summarize personnel decontamination/containment and disposal method
() Not needed

PPE that cannot be decontaminated (i.e., gloves, respirator cartridges, etc.) will be placed in plastic trash bags and discarded as municipal waste. Personnel will wash hands and other exposed body areas prior to leaving the site.

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

Summarize equipment decontamination/containment and disposal method
() Not needed

Whenever possible, equipment will be rinsed with "PFAS-free" water immediately prior to use at each sample location during groundwater, surface water and sediment sampling.

Intrusive field equipment utilized during the groundwater sampling phase (interface probe and water level meter) that will contact media will be properly decontaminated before use and between uses. Proper decontamination procedures will consist of the following steps upon donning a new pair of nitrile gloves:

- Wash with an approved detergent washing solution (e.g., Alconox, Liquinox or Citranox®) and laboratory grade PFAS-free water using an appropriate brush
- Rinse with laboratory grade PFAS-free water
- Rinse with methanol
- Triple rinse with laboratory grade PFAS-free water

Air dry in a clean high-density polyethylene container or bucket; aluminum foil will not be used to wrap air dry equipment since this is a prohibited item in reference to PFAS sampling.

Summarize heavy equipment decontamination/containment and disposal method
() Not needed

Decontamination of larger equipment (for example, drill rigs and large downhole drilling and sampling equipment) will be completed between boring locations with potable water using a high-pressure washer or steam.

Investigation Derived Waste (IDW) and Waste Disposal
() Not needed

Investigation-derived waste (IDW) that will be generated as part of the drilling and subsequent sampling event may include personal protective equipment, soil, groundwater and decontamination water. IDW will be drummed and stored on pallets in a DNREC-approved area while awaiting analytical results for offsite disposal. The drums will be labeled as investigation-derived waste pending analysis, sample or well location as well as the site identification, media, DNREC Project Manager contact information, and dates generated will be listed.

Other wastes generated during site activities are expected to include disposable gloves, plastic tubing, paper towels, etc. These materials will be placed into plastic garbage bags and disposed of as municipal waste.

SITE SPECIFIC ADDENDUM TO GENERAL HEALTH AND SAFETY PLAN FOR
HAZARDOUS WASTE & ENVIRONMENTAL SERVICES

ENVIRONMENTAL MONITORING REQUIREMENTS

Instrument	Location of Monitoring	Frequency	General Action Level	Site-Specific Action Level	Response
Total Volatile Organics Detector (Photoionization detector)	Breathing Zone	Initially and every 30 minutes	Above background	_____ Same or Specify	Begin perimeter monitoring. Upgrade to Level C PPE
			>5 ppm	_____ Same or Specify	Withdraw from site, prepare to upgrade to Level B
	Perimeter monitoring	2 times per day	Above background	_____ Same or Specify	Shut down operations and identify source of contamination and cover.
Combustible Gas Indicator	Borehole, excavation or well opening at ground surface	For each sample, initially and every 10 minutes	0-10% of LEL*	0-10% of LEL*	Continue monitoring
			10-20% of LEL	10-20% of LEL	Monitor continuously, prepare to shutdown
			>20% of LEL	>20% of LEL	Shutdown immediately, evacuate

Modify to reflect site-specific conditions.

*The readings must remain <10% of LEL in order to enter an excavation or other area containing combustible gas.

Action levels represent concentrations or percentages that are sustained for the monitoring period specified under "Frequency" and do not reflect peak levels.

Appendix B

Field Forms

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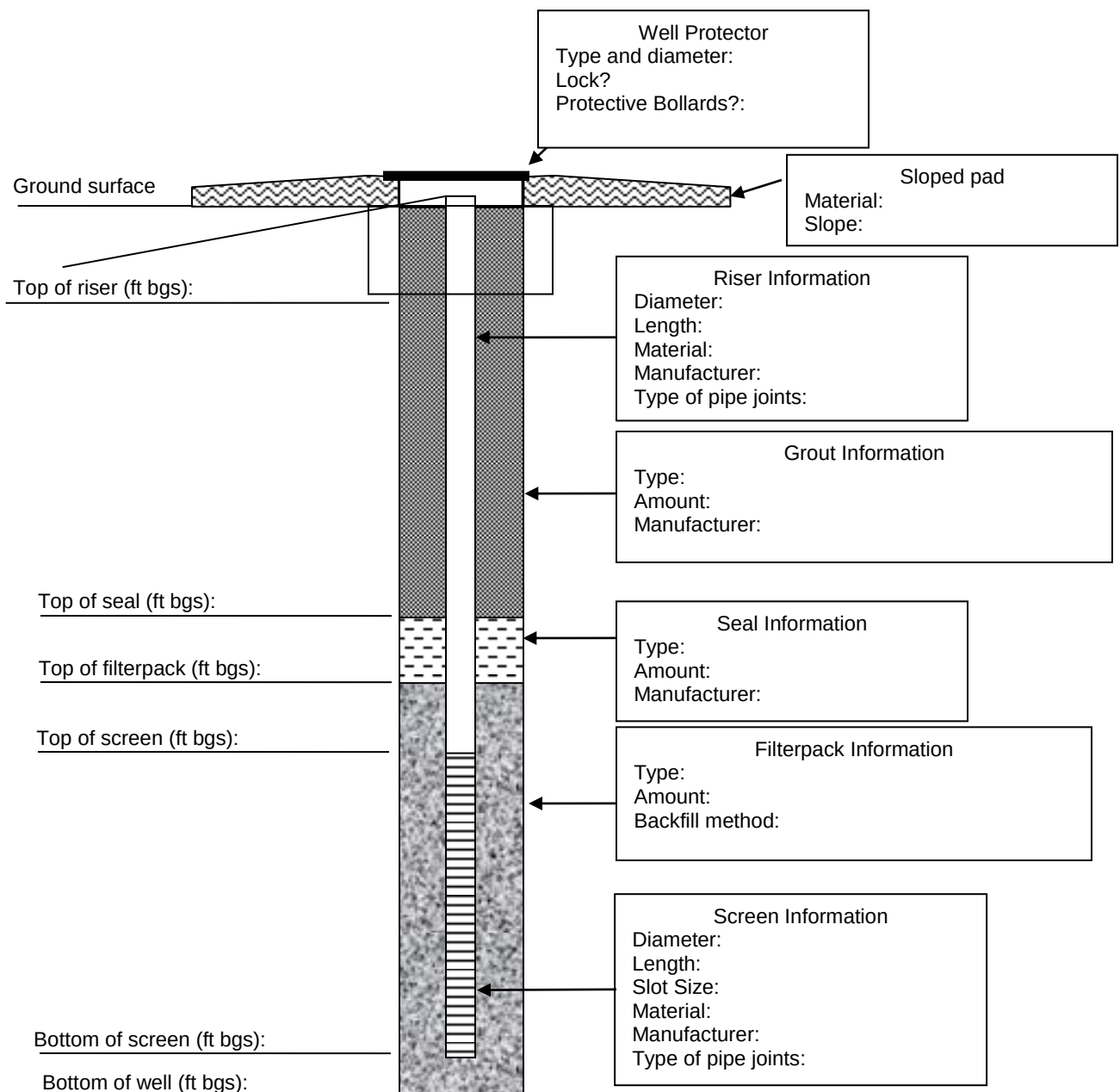
BORING LOG				Client DNREC		HOLE NUMBER AND PERMIT NUMBER			
1. COMPANY NAME EA Engineering, Science, and Technology, Inc., PBC				2. DRILL SUBCONTRACTOR			SHEET 1 OF SHEETS		
3. PROJECT ID/ OPERABLE UNIT ID:		4. GEOLOGIST		5. Coordinates:					
6. NAME OF DRILLER				7. MANUFACTURER'S DESIGNATION OF DRILL					
8. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT TYPE OF LINER USED, IF APPLICABLE				9. SURFACE ELEVATION AND CONDITIONS					
10. DIRECT READING PARAMETERS: PID (ppm)				11. DATE STARTED			12. DATE COMPLETED		
13. OVERBURDEN THICKNESS				14. DEPTH GROUNDWATER ENCOUNTERED					
15. DEPTH DRILLED INTO ROCK				16. DEPTH TO WATER AND ELAPSED TIME ATFER DRILLING COMPLETED					
17. TOTAL DEPTH OF HOLE				18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)					
19. WELL INSTALLED?		IF SO COMPLETE CONSTRUCTION DIAGRAM		20. SAMPLE TYPE:					
21. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS			22. SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS			23. SCREENING ANALYSIS			
24. DISPOSITION OF HOLE				25. IF NOT A WELL, BACKFILLED WITH:					
USCS LOG	DEPTH (FT)	DESCRIPTION OF MATERIALS	READINGS		ANALYTICAL SAMPLE DESIGNATION AND INTERVAL	DEPTH (FT)	RECOVERY (IN.)	REMARKS	
			VOC (ppm)	Blow Counts					

EA PROJECT NUMBER: 1531804				HOLE NO.:					

RECORD OF MONITORING WELL CONSTRUCTION

(FLUSH MOUNT)

 EA Engineering, Science, and Technology, Inc., PBC	Monitoring Well/Soil Boring ID No.: Permit No.:
Coordinates:	Top of Inner Casing Elevation (ft msl): Ground surface Elevation (ft msl):
Project Name/ EA Project No:	Date Installed: Time Finished:
Location:	Depth to Water (ft bgs):
Site Geologist:	Drilling Method:
Borehole Diameter (inches):	Outer Casing Diameter (inches): Outer Casing Depth (ft bgs):



Not to scale

RECORD OF WELL DEVELOPMENT

Well Designation _____	Project Name _____
Condition _____	
	Project Location _____
Well Grout Date _____	Developer Initials _____
Well Installation Date _____	Well Development Date _____
Gauge Date _____	Gauge Time _____
Sounding Method _____	Measurement Ref. <u>TOC</u>
Stick up/down (ft) _____	Well Diameter _____
Static Water Level _____	Screen Length _____
Development Time _____	
Surge Device _____	
Weather _____	

Well Volume Determination:

- A. Well Depth _____
- B. Depth to Water _____
- C. Liquid Depth (A-B) (ft) _____
- D. Well Volume/ft _____
- E. Liquid screen length (ft) _____

	Beginning	1	2	3	4	5
Time (min)						
Pump Rate (gpm)						
Volume purged						
Turbidity (NTU)						
Conductivity (uS/cm)						
pH						
ORP (mV)						
Dissolved Oxygen (mg/L)						
Temperature (°C)						

Total volume of water removed (gal): _____

Estimated Recharge Rate: _____

Depth to sediment before development: _____ Depth to sediment after development: _____

Final Well Depth: _____

Final Water Level: _____

Total Time: _____

Development Description: _____

WELL PURGING AND SAMPLING RECORD

PROJECT NAME: _____ EA PROJECT NO. _____
 WELL ID _____ SAMPLE NO. _____
 WELL/SITE DESCRIPTION _____
 PID HEADSPACE _____ (ppm)

DATE ____/____/____ TIME _____ AIR TEMP. _____

WELL DEPTH _____ ft CASING HEIGHT _____ ft
 WATER DEPTH _____ ft WELL DIAMETER _____ in
 WATER COL. HEIGHT _____ ft SANDPACK DIAM. _____ in
 EQUIVALENT VOLUME OF STANDING WATER _____ (gal) (L)
 PUMP RATE _____ (gpm) (LPM)
 PUMP TIME _____ min
 WELL WENT DRY? () Yes () No PUMP TIME _____ min
 VOL. REMOVED _____ (gal) (L) RECOVERY TIME _____ min
 PURGE AGAIN? () Yes () No TOTAL VOL. REMOVED _____ (gal) (L)

Date	Time	Volume Removed	pH	Cond.	Temp.	ORP	Turb.	DO	Depth to Water	Pump Rate
		Unit:							from TOC	

COMMENTS _____

Any Foaming of Sample Observed: yes or no _____

PID: _____

SIGNATURE _____

Appendix C

EA Standard Operating Procedures

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Standard Operating Procedure No. 059 for Field Logbook

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 1
December 2014

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1. SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for recording field survey and sampling information in the Field Logbook.

2. MATERIALS

The following materials may be required:

- Field Logbook (Teledyne 415 Level Book, or equivalent)¹
- Indelible ink pen (~~e.g., Sharpie®~~).

3. PROCEDURE

All information pertinent to a field survey or sampling effort will be recorded in a bound logbook. Each page/form will be consecutively numbered, dated, and signed. All entries will be made in indelible ink, and all corrections will consist of line-out deletions that are initialed and dated. The person making the correction will provide a brief explanation for the change. Entries are factual only. No personal opinions should be entered.

There should be no blank lines on a page. A single blank line or a partial blank line (i.e., at the end of a paragraph) should be lined to the end of the page. If only part of a page is used, the remainder of the page should have an “X” drawn across it. The bottom of each page must be signed and dated by the field personnel entering the information.

At a minimum, entries in the Field Logbook will include but not be limited to the following:

- Date.
- Project number and project name.
- Name and address of field contact.
- Identification of sample crew members.
- Documentation should include model numbers of equipment used (e.g., drilling rigs) and calibration (if applicable). Each day’s entry should begin with time onsite, who is onsite (including observers other than the sampling crew), brief description of what work will be performed that day and how, and the weather.

¹ Pre-printed, bound forms are approved as well. See SOP No. 016 for recommended content and format.

- If samples are being taken in or near tidal waters, the time of high and low tide for the site should be determined from local gauges or tables and recorded.
- References such as maps of the sampling site.
- Times of key daily milestones should be entered (e.g., time borings began, times personnel arrived and left site, times subcontractors arrived and left site, etc.). Time should be recorded in the left-hand margin on the page in military time.
- Sample-specific information:
 - Unique, sequential field sample number
 - Purpose of sampling
 - Location, description, and log of photographs of each sampling point
 - Details of the sample site (e.g., elevation of the casing, casing diameter and depth, integrity of the casing, etc.)
 - Documentation of procedures for preparation of reagents or supplies which become an integral part of the sample (e.g., filters and absorbing reagents)
 - Type of media of sample (e.g., groundwater, surface water, soil, sediment, and product)
 - Suspected waste composition
 - Number and volume of sample taken
 - Sampling methodology, including distinction between grab and composite sample
 - Sample preservation
 - Date and time of collection
 - Collector's sample identification number(s)
 - Sample shipment (e.g., name of the laboratory and cartage agent: Federal Express, United Parcel Service, etc.)
 - Field observations (e.g., oily sheen on groundwater sample, incidental odors, soil color, grain size, plasticity, moisture content, layering, Unified Soil Classification System classification, etc.)

- Any field measurements made (e.g., pH, conductivity, explosivity, water depth, organic vapor analyzer readings, etc.)
- Signature and date by the personnel responsible for observations
- Decontamination procedures.

Sampling situations vary widely. No general rules can specify the extent of information that must be entered in a Field Logbook. However, records should contain sufficient information so that someone can reconstruct the sampling activity without relying on the sampler's memory. Further, the project work plan or field sampling plan should be reviewed to identify additional specific information or requirements that should be included in the Field Logbook.

The Project Manager will keep a master list of all Field Logbooks assigned to the Sampling Team Leaders. One Field Logbook kept by the Project Manager will be a master site log of daily activities and will contain the list of Field Logbooks assigned to Sampling Team Leaders.

Project name and number should be clearly marked on the outside cover using indelible ink. If more than one Field Logbook exists for the project, then the number of the Field Logbook should also be clearly marked on the outside cover.

4. MAINTENANCE

At the end of the field sampling effort, the Field Logbook should be scanned and filed in the electronic file for the project and maintained according to the EA Records Retention Policy or contract requirements.

5. PRECAUTIONS

None.

6. REFERENCES

EA Engineering, Science, and Technology, Inc., PBC. 2014. Standard Operating Procedure No. 016 for Surface Water, Groundwater, and Soil/Sediment Field Logbooks. December.

U.S. Environmental Protection Agency. 1980. *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, QAMS-005/80.

- . 1990. *Sampler's Guide to the Contract Laboratory Program*. EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C. December.
- . 1991. *User's Guide to the Contract Laboratory Program*. EPA/540/O-91/002, Directive 9240.0-01D. Office of Emergency and Remedial Response. January.



Standard Operating Procedure No. 073 for Sampling for Per- and Polyfluorinated Alkyl Substances

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision 1
June 2019

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PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**check Box A**), or if this SOP is being used with no changes (**check Box B**). This form should be archived with the project files.



A. Variances required; cite section(s) of the SOP to which there is a variance



B. No variances

[illegible]

Project Manager (Name)

Project Manager (Signature)

Date _____

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DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	Revision Date	Revision Summary	Revised By	Reviewed By
1	June 2019	Note regarding water-tight lids	F. Barranco	F. Barranco

1. SCOPE AND APPLICATION

The objective of this Standard Operating Procedure (SOP) is to delineate protocols for collecting environmental samples for analysis of per- and polyfluorinated alkyl substances (PFAS), also known generally as perfluoroalkyl compounds or chemicals (PFCs).

This SOP includes sampling procedures and requirements specific to analysis of PFAS, which are ubiquitous and have a high potential for cross-contamination from common consumer products and sampling materials, even when new and clean. This SOP should be used in combination with appropriate SOPs applicable to the target medium and sampling methodology (e.g., but not limited to SOP No. 007 Surface Water Sampling, SOP No. 013 Collection of Monitoring Well Samples, SOP No. 21 Sediment Sampling, SOP No. 25 Soil Sampling, or SOP No. 047 Direct-Push Technology Sampling).

This SOP was developed primarily based on guidance from the U.S. Army Corps of Engineers (2016) and the Interstate Technology Regulatory Council (ITRC 2018).

2. ACCEPTABLE MATERIALS

Table 1 provides a summary of Prohibited Items that should NOT be used or present during sampling for PFAS because they may contain PFAS, along with Acceptable (PFAS-free) Alternatives that may be used if appropriate for project requirements. In general, in the context of sampling events, PFAS are commonly found in waterproof and nonstick materials (including food packaging, rain gear, and anything containing Teflon®), personal care products, and certain plastics (e.g., low-density polyethylene [LDPE]) and synthetic fibers.

Table 1. Prohibited Items and Acceptable Alternatives for Use during PFAS Sampling

Prohibited Items	Acceptable Alternatives
Field Equipment	
Teflon-containing or LDPE materials (including tubing, bailers, tape)	HDPE or silicone materials
Waterproof field books, plastic clipboards, binders, or spiral hard cover notebooks	Loose paper (non-waterproof) on aluminum or Masonite clipboards
Sharpies®/markers, waterproof pens	Non-waterproof pens or pencils
Sticky notes (e.g., Post-It®) and glues	Not applicable
Re-usable chemical (blue) ice packs	Regular ice in polyethylene bags (double bagged)
Aluminum foil	Thin HDPE sheeting
Plastic spoons used in soil/sediment sampling	Stainless steel trowels/spoons
Reusable core liners	Single-use PVC or acetate liners
LDPE HydraSleeve	HDPE HydraSleeve
Field Clothing and Personal Protective Equipment	
New cotton clothing; synthetic water resistant, waterproof, or stain- treated clothing; clothing containing Gore-Tex™	Well-laundered clothing, defined as clothing that has been washed 6 or more times after purchase, made of natural fibers (preferably cotton)
Clothing laundered using fabric softener	No fabric softener
Boots (e.g., steel-toed or waders) containing Gore-Tex™ or waterproof coatings	Boots made with polyurethane or PVC with no waterproof coating

Prohibited Items	Acceptable Alternatives
Coated Tyvek® suits	Uncoated/plain Tyvek suits not containing PFAS
Cosmetics, shampoo, conditioner, body gel, moisturizers, hand cream, waxed dental floss, or other personal care products used <u>on the day of sampling</u> .	Use bar soap not containing moisturizers and rinse well on the day of sampling (including for hand washing). Use any other required products the night before (rather than the day of) sampling.
Paper towels	Air dryers (for hand drying)
No sunscreens or insect repellents except approved 100% natural products such as those noted in the Alternatives column.	Acceptable Sunscreens: Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss My Face, “free” or “natural” sunscreens for babies Acceptable Insect Repellents: Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect Repellent, Herbal Armor, California Baby
Sample Containers	
LDPE or glass containers	HDPE containers (or polypropylene if required)
Teflon-lined caps	Unlined HDPE (or polypropylene if required) caps
Rain Events	
Rain gear that has been treated to make it waterproof/resistant and breathable (e.g., Gore-Tex™ treated)	PVC or polyurethane- or wax-coated rain gear that is confirmed not to contain PFAS, or utilize a gazebo tent that is only touched or moved prior to and following sampling activities.
Equipment Decontamination	
Decon 90	Alconox®, Liquinox®, and/or Citranox®
Water from an onsite well	Potable water from municipal drinking water supply (not containing PFAS), and “PFAS-free” deionized water for final rinse
Food Considerations	
All food and drink, with exceptions noted in the Alternatives column. Paper food packaging (e.g., fast food wrappers, drink cups, paper bags) and foil, in particular, often contain PFAS.	Bottled water and hydration drinks (i.e., Gatorade® and Powerade®) to be brought and consumed only in the staging area
NOTES: HDPE = High-density polyethylene. PVC = Polyvinyl chloride.	

If a plastic product or chemical not included in the Acceptable Alternatives column of Table 1 is proposed for use, it is recommended that Safety Data Sheets and other references be reviewed prior to use to confirm that the material does not contain PFAS. Indications of potential PFAS ingredients, in addition to the items listed in Table 1, include the following materials (ITRC 2018):

- Polytetrafluoroethylene (fluorocarbon solids such as Teflon)
- Fluorinated ethylene propylene
- Ethylene tetrafluoroethylene
- Polyvinylidene fluoride
- Generally, any other ingredient names containing the prefix “fluoro.”

Specific to the use of HDPE sample containers, note that the associated lids are not typically “water-tight.” Therefore, HDPE sample containers should be individually placed in water-tight bags prior to placement in shipping containers loaded with ice.

3. PROCEDURES

As stated above, this SOP includes procedures specific to analysis of PFAS, and should be used in combination with the appropriate SOPs applicable to the target medium and sampling methodology.

3.1 GENERAL CONSIDERATIONS

Materials listed in the Prohibited Items column of Table 1 and other materials containing PFAS ingredients should not be used. However, in some cases, these materials must be used due to factors outside the control of the scope of the work or utility of the project team (e.g., health and safety requirements where other hazardous chemicals are present, or where the sampling requirements are prescriptive, unexpected, or time-sensitive). In these cases, the sampling team should purge/rinse equipment adequately with PFAS-free water where available, and collect additional quality control samples (Section 3.7) to assess the degree of cross-contamination associated with the use of known or suspected PFAS-containing materials during sampling.

NOTE: Most steel-toed boots are made from coated leather and synthetic fibers. PVC or polyurethane are preferred PFAS-free materials for boots. If not possible to obtain PFAS-free footwear that comply with specified health and safety requirements for personal protective equipment, then field personnel should minimize contact with footwear while in the sampling area, and always change gloves after touching footwear.

Disposable nitrile gloves shall be worn at all times during PFAS sampling activities. A new pair of nitrile gloves shall be donned after contacting potential contaminants including all non-decontaminated surfaces. New gloves shall also be donned before touching containers used for storage of PFAS samples, decontaminating re-usable sampling equipment, or handling quality control samples (Section 3.7).

Food shall not be eaten within 10 meters of any sampling area. Before eating or drinking, sampling personnel shall remove their gloves and any outer garments (e.g., coveralls) and leave the work area. When finished, sampling personnel shall wash their hands, remove any visible residue, and put new gloves and any outer garments back on prior to returning to the work area.

PFAS-containing stain resistant products are often applied to vehicle seats that have fabric upholstery. Therefore, if no outer garments (e.g., coveralls) will be worn, or if the outer garments will be worn in the field vehicle then, if feasible, the seats of the vehicle should be covered in a well-laundered cotton blanket to avoid contact between clothing and the seats.

Visitors to the sampling area shall remain at least 10 meters at a distance.



As indicated in Table 1, sampling personnel shall not use the personal care products or cosmetics (other than bar soap) prior to or during sample collection on any day. Additionally, clothes worn during sampling should be well-washed natural fibers.

Other personnel who come within 2-3 meters of the sample collection area should follow the guidelines above and in Table 1.

Fluids used during laboratory- or fieldwork (e.g., drilling for monitoring well installation or for deep soil sampling) should be confirmed PFAS-free.

When sampling on a surface water body, associated gear (e.g., waders, life preservers) should be confirmed PFAS-free.

3.2 EQUIPMENT DECONTAMINATION

Wherever possible, dedicated or disposable equipment shall be used to avoid the need for decontamination, which introduces additional potential for cross-contamination.

Large field equipment (e.g., drill rigs) should be decontaminated with potable water using steam or high-pressure water. Laboratory-certified “PFAS-free” water should be used to perform a final rinse of portions of the sampling equipment that will be in direct contact with samples, wherever practical.

Hand-held, non-dedicated sampling equipment, which is used at multiple field sampling locations, shall be decontaminated using the following procedure:

- Rinse with a non-PFAS-containing detergent (e.g., Alconox, Liquinox, or Citranox)
- Rinse with laboratory-provided, “PFAS-free” water (Grade 3 distilled, Millipore deionized)
- Rinse with methanol
- Rinse with laboratory-provided, “PFAS-free” deionized water.

The Safety Data Sheet for the selected detergent should be reviewed to ensure that it does not contain fluoro-surfactant ingredients.

Wherever possible, equipment should be rinsed with “PFAS-free” water immediately prior to use at each sampling location.

3.3 SAMPLE COLLECTION AND PRESERVATION

The sampling team shall coordinate with the analyzing laboratory regarding requirements for sample bottle, volume, and preservation requirements for samples for PFAS analysis, and the laboratory should provide certified “PFAS-free” containers. HDPE bottles with unlined caps are



typically used for collection of samples for PFAS analyses. Polypropylene may also be used for specific applications (e.g., collection of drinking water samples to be analyzed for the short list of PFASs by Method 537) (Department of Defense Environmental Data Quality Workgroup 2017).

Containers for collection of PFAS samples shall never be left uncapped, either before or after sample collection, and the lid/cap shall be kept in a gloved hand and not be set down while removed from the container.

Sampling personnel shall put on a clean pair of nitrile gloves immediately prior to collection of each sample for PFAS analyses, prior to removing the lid from the sampling container. After the sample is collected and the container is closed, pens or pencils, but not markers, shall be used in completing sample labels or in the vicinity of samples during collection.

Following sample collection and addition of preservative (if required), sample containers for PFAS analyses shall be placed in coolers with new, double-bagged ice and not re-usable chemical ice packs unless confirmed PFAS-free and regulatorily accepted, such that meltwater does not contact sample containers during transport.

3.4 SOIL/SEDIMENT SAMPLING CONSIDERATIONS

Surface soil and sediment samples for PFAS analyses should be collected using a clean, stainless-steel tool (e.g., a trowel or Ponar grab sampler).

For field collection of soil and sediment cores, single-use PVC, HDPE, or acetate liners shall be used, and samples for PFAS analysis should be collected from the cores directly or using a stainless-steel tool.

3.5 GROUNDWATER SAMPLING CONSIDERATIONS

It is recommended that, where feasible, measurements of monitoring well water levels and well depths be performed after sampling for PFAS to avoid possible cross-contamination.

HDPE or silicone tubing shall be used for purging and sample collection, where applicable. Teflon and LDPE shall NOT be used. During sampling, sampling personnel shall ensure that no tubing or other equipment contacts the inside or rim of the sample bottle. Any foaming observed in the sample during collection should be noted on the chain-of-custody form that accompanies the samples to the analytical laboratory.

If analyses to be performed by the laboratory include less common PFAS chemicals that have relatively high volatility (including fluorotelomers and sulfonamide/alcohols such as fluorotelomer alcohols, fluorotelomer acrylates, and methyl/ethyl fluorosulfonamides and sulfonamidoethanols), then precautions should be taken during sample collection to minimize loss of volatiles (e.g., minimizing turbulence in water as it flows into the sample container).

If use of passive/no-purge sample collection technology is to be utilized, it is critical to confirm that the sampling device does not contain LDPE (e.g., HydraSleeves made of HDPE rather than LDPE may be requested for PFAS sampling).

Filtration is not recommended because the filter may sorb PFAS or be a source of PFAS contamination.

3.6 SURFACE WATER AND POREWATER SAMPLING CONSIDERATIONS

Capped surface water sample containers shall be rinsed multiple times with site surface water prior to sampling.

Because PFAS tend to accumulate at the air/water interface, specific procedures for surface water sampling shall be followed. After rinsing, the capped container shall be lowered into the surface water, with the top pointed down. The container shall then be reoriented with the top pointed upward and opened under water at the depth targeted for sampling, ideally at least 10 centimeters from both the sediment surface and the water surface. During sample collection, the sample collection point shall be positioned upstream of the sampler, gloves, etc. If an extension rod must be used due to the depth of sampling, the rod shall be made of clean, PFAS-free material.

For porewater sampling, the common stainless-steel and PVC samplers, with HDPE and silicone tubing, are acceptable. The samplers should not be reused at multiple sampling locations.

As for groundwater samples, filtration is not recommended.

3.7 FIELD QUALITY CONTROL SAMPLES

It is recommended that field blanks and equipment (i.e., rinsate) blanks be collected at least daily, using laboratory supplied “PFAS-free” water, to detect any cross-contamination that occurred despite precautions taken during sampling. If a peristaltic pump is used for sample collection, then at least one equipment blank should be collected by pumping “PFAS-free” water through the pump with clean HDPE tubing.

Field duplicates should also be collected to assess the precision of the results.

Analysis of trip blanks may be advisable on a project-specific basis, particularly if relatively volatile PFAS chemicals will be analyzed.

The same precautions taken during collection of specified samples should be taken during the collection of quality control samples (Section 3.7).

4. MAINTENANCE

Not applicable.



5. PRECAUTIONS

See detailed precautions noted above.

6. REFERENCES

Department of Defense Environmental Data Quality Workgroup. 2017. *Bottle Selection and other Sampling Considerations When Sampling for Per- and Poly-Fluoroalkyl Substances (PFAS)*. Revision 1.2. July.

Interstate Technology Regulatory Council (ITRC). 2018. *Fact Sheet: Site Characterization Considerations, Sampling Precautions, and Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances (PFAS)*. March.

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Attachment 3:

**Excerpt from Delaware Department of Natural Resources and
Environmental Control (DNREC), New Castle Public Wells
Groundwater Plume (aka Zero (0) E. Basin Road New Castle
PFOA-PFOA) Site Inspection Work Plan, New Castle, Delaware,
May 2017. Excerpted for file accessibility.**

DE-0363
NEW CASTLE PUBLIC WELLS GROUNDWATER PLUME
(AKA ZERO (0) E. BASIN ROAD NEW CASTLE PFOS-PFOA)
SITE INSPECTION WORK PLAN
New Castle, Delaware

Prepared For
USEPA Region 3
1650 Arch Street
Philadelphia, PA 19109-2029



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May 2017

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1.0 INTRODUCTION

The Delaware Department of Natural Resources and Environmental Control - Site Investigation and Restoration Section (DNREC-SIRS), under a cooperative agreement with the United States Environmental Protection Agency (EPA), has developed this Site Inspection (SI) work plan for the New Castle Public Wells Groundwater Plume Site ("Site"), also known as the Zero (0) E. Basin Road New Castle PFOS-PFOA Site, located in New Castle, New Castle County, Delaware (Figure 1).

2.0 PURPOSE

The SI is intended to determine whether hazardous substances, particularly poly- and perfluoroalkyl substances (PFASs), are present and are migrating to the environment, especially to the public wells in New Castle, by collecting and evaluating environmental samples. The SI is not intended to be a detailed extent-of-contamination assessment or risk assessment. The purpose of this SI work plan is to document the sampling and analysis plan for the Site and to describe the sampling procedures.

Based on the conclusions drawn in the SI report, EPA and DNREC will decide whether the Site should undergo further investigation or obtain a "No Further Action" (NFA) designation under the Federal Superfund and/or State Site Investigation & Restoration Section Programs.

3.0 SITE DESCRIPTION

The New Castle Public Wells Groundwater Plume Site, also known as the Zero (0) E. Basin Road New Castle PFOS-PFOA Site, is an approximately seven square mile area surrounding contaminated public wells located in New Castle, New Castle County, Delaware (Figure 2). The Site includes sixteen areas of potential concern (AOPCs) identified during a Preliminary Assessment (PA) by DNREC-SIRS in March 2015. The purpose of the PA was to identify potential sources of perfluorinated compounds (PFCs), including perfluorooctanoic acid (PFOA) and perfluorooctanoic sulfonate (PFOS), which were detected in five New Castle public drinking water supply wells. PFCs have more recently been referred to as poly- and perfluoroalkyl substances (PFASs). The five wells impacted by PFASs included Artesian Water Company's Wilmington Manor Well #3 and Jefferson Farm Well #1 and the City of New Castle's Basin Road Well, Schoolhouse Lane Well, and Frenchtown Road Well (Figure 3). The wells were taken off-line or required carbon treatment due to exceedances of EPA's preliminary health advisory levels for PFOS (0.2 micrograms per liter (ug/l)) and/or PFOA (0.4 ug/l). In May 2016, EPA established a lifetime health advisory level (HAL) of 0.07 micrograms per liter (ug/l) for PFOS, PFOA, or combined PFOS/PFOA. At present, additional Artesian and City of New Castle wells in this area exceed the HAL for PFOS, PFOA, and/or combined PFOS/PFOA.

The Site is approximately bound by I-295 to the north, the Delaware River to the east, Route 273/Frenchtown Road to the south, and Route 13/DuPont Highway and New Castle County Airport to the west. The impacted public drinking water supply wells are located in residential and commercial areas. The western half of the Site includes the New Castle County Airport (NCCA), retail and commercial centers along Route 13, large tracks of open land, and several industrial parks. The eastern half of the Site is primarily housing developments intermixed with strip malls and industrial parks and a rails-to-trails pathway.



The sixteen areas of potential concern (Figure 4) were identified in the March 2015 Preliminary Assessment. Starting at the southern extent of the Site on Frenchtown Rd and moving counter clockwise the AOPCs are:

- Area 1: Quigley Blvd Industrial Park (32 parcels)
- Area 2: Harry Wood LF (DNREC-SIRS Site)
- Area 3: Centerpoint Industrial Park (23 parcels)
- Area 4: Boulden Interchange Park (12 parcels - Boulden Blvd Southside),
- Area 5: Southgate Center Industrial Park (39 parcels - Boulden Blvd Northside)
- Area 6: Matassino Rd (18 parcels - North and South of Boulden Blvd. west of RR)
- Area 7: E. Commons Blvd Industrial Complex (17 parcels - East of W. Basin Rd)
- Area 8: BMX fire training area at track off Commons Blvd on Speedway Dr.
- Area 9: NCCA fire training area at the north end of runway #19
- Area 10: Delaware Air National Guard (DANG) fire training area
- Area 11: Rt141 Basin Rd Carpet Warehouse across from the DANG
- Area 12: Rt13 Carpet Warehouse just north of Rt141 Basin Rd overpass
- Area 13: Wilmington Manor Fire Company on Rt13
- Area 14: NCC airport (crash sites & fire systems in hangers)
- Area 15: Rt13 Commercial District
- Area 16: Old Airport Road Commercial District

This initial phase of the Site Inspection for New Castle Public Wells Groundwater Plume Site will focus on potential groundwater contamination at Areas 8, 9, 11, 12, 13, and 14 (Figures 5 – 10) and potential soil contamination at Area 8. After review of the Preliminary Assessment, these areas were identified by EPA and DNREC as high priority and the focus of this initial phase of the Site Inspection due to operational history and proximity to existing exceedances of EPA's HAL for PFOS, PFOA, or combined PFOS/PFOA. The Delaware Air National Guard (DANG/Area 10) and the Harry Wood Landfill (Area 2) will not be evaluated further as part of the New Castle Public Wells Groundwater Plume Site. The DANG is currently investigating and monitoring PFAS contamination on the base facility. At the Harry Wood Landfill, groundwater has already been sampled and analyzed for PFAS from monitoring wells on-site. Both facilities will continue to be addressed as their own sites, and will not be included in this SI.

4.0 SAMPLING

DNREC-SIRS proposes to collect groundwater samples from approximately 17 monitoring wells at Areas 8, 9, 11, 12, 13, and 14 and soil samples from approximately 6 boreholes at Area 8 only. The proposed locations are shown on Figure 11. **The locations are subject to change based on field conditions.** During sampling activities, DNREC-SIRS will follow the Health and Safety Plan included in Appendix A.

DNREC will coordinate with Miss Utility and, as needed, a private utility mark-out company to clear the area around the monitor well locations.

The sample locations will be drilled by a State of Delaware licensed water well driller. All locations will be drilled to meet the requirements of the Delaware Regulations Governing the Construction and Use of



Wells, April 6, 1997.

4.1 Soils

Twelve (12) soil samples are proposed to be collected from six (6) boreholes at Area 8 only. A monitoring well will also be installed at three of these boreholes. DNREC proposes to sample both shallow and deep soil from each borehole. No soil samples are proposed to be collected at Areas 9, 11, 12, 13, or 14. However, if soil at these areas exhibits elevated PID readings, significant odor, or visible contamination then a soil sample will be collected and screened, at minimum, by the DNREC-SIRS screening laboratory. Figure 11, the proposed sample location map, shows the approximate soil sample locations. Actual sampling locations will depend on site conditions and utility clearances.

Soil borings will be advanced using a direct push Geoprobe®-type drilling rig and logged by a DNREC-SIRS Hydrologist. The shallow soil sample will be collected from the top 24 inches of the first sampling sleeve in each borehole. The deep soil sample will generally be collected from the two foot interval immediately above the groundwater table.

The volatile samples will be collected from the sampling sleeve using a 10mm syringe, and then the soil will be placed into a 40ml VOA vial containing 25ml of methanol. The remaining soil will be homogenized with disposable plastic scoops in a disposable food-grade aluminum pan and put into sterilized 8oz (or smaller) wide mouth glass jars for semi-volatile organic compound (SVOC), dioxin, metals, pesticide, and/or polychlorinated biphenyl (PCB) analysis. The jars will be placed in zip-lock bags and stored in coolers with ice for transportation. The boreholes will be subsequently backfilled with the remaining excavated material and topped with either bentonite chips or concrete/asphalt patch.

4.2 Groundwater

Monitoring wells (with an inner diameter of 1.5") are planned to be installed at 17 locations at depths up to 45 feet below ground surface. Prepacked well screens will be utilized. The wells will be screened in either the Columbia Aquifer or Upper Potomac Aquifer but will not penetrate the confining clay of the Upper Potomac Formation (if encountered). Groundwater samples, including QA/QC samples, are expected to be collected from the 17 newly installed monitoring wells at a minimum of 48 – 72 hours after the wells are installed and developed. The wells will be developed by the driller in accordance with DNREC regulations. Exact well locations will be approved by a DNREC-SIRS Hydrologist based on the geology, terrain and past activities at the Site and surrounding area. The monitoring wells will be surveyed in order to establish relative groundwater elevation and groundwater flow direction.

Groundwater will be collected from the wells using a disposable high density polyethylene (HDPE) bailer. Each well will be purged using a bailer of at least three well volumes and/or until certain groundwater parameters stabilize. The groundwater parameters to be monitored and recorded are temperature, pH, conductivity, dissolved oxygen, and turbidity every five minutes until the values are relatively unchanged for three consecutive intervals.

At Areas 9, 11, 12, 13, and 14:

Groundwater collection will start with the volatile sample. Three or four VOA vials (depending on the lab) preserved with hydrochloric acid (HCl) will be filled first. Due to the potential for cross-contamination, a



new disposable bailer will be used to collect the PFAS sample. The PFAS groundwater sample will be collected second in pre-cleaned 250 mL HDPE containers. All bottles will be placed in coolers with ice for transportation to the laboratory.

Since PFASs may be present in sampling equipment and other common consumer products, extra precaution must be taken to prevent introduction of these contaminants to the groundwater samples. Refer to Table 1 for a list of prohibited and acceptable items to be used during sampling of PFASs.

At Area 8 only:

Groundwater collection will start with the volatile sample. Three or four VOA vials (depending on the lab) preserved with hydrochloric acid (HCl) will be filled first. Due to the potential for cross-contamination, a new disposable bailer will be used to collect the PFAS sample. The PFAS groundwater sample will be collected second in pre-cleaned 250 mL HDPE containers.

Since PFASs may be present in sampling equipment and other common consumer products, extra precaution must be taken to prevent introduction of these contaminants to the groundwater samples. Refer to Table 1 for a list of prohibited and acceptable items to be used during sampling of PFASs.

Next, 1-liter to 2-liter unpreserved amber jars will be filled for semi-volatiles analysis and then dioxin analysis. Finally, 1-liter polyurethane containers preserved with nitric acid (HNO₃) are filled for total metals and dissolved metals. The sample collected for dissolved metals analysis will be filtered by the laboratory to remove the solids that are suspended within the water column. All bottles will be placed in coolers with ice for transportation to the laboratory.

4.3 Sediment and Surface Water

No sediment or surface water samples are proposed to be collected at this time.

5.0 ANALYSIS

From the environmental samples collected and screened, approximately 15-20% of the soil samples and all of the water samples collected from wells including the QA/QC samples may be submitted to the DNREC Division of Water laboratory and/or Test America, Inc. for confirmatory analysis of chemicals of potential concern.

Chemicals of potential concern for soil and/or groundwater consist of all or part of the USEPA Target Analyte List (Inorganics) and Target Compound List (Organics) (TAL/TCL) in addition to poly- and perfluoroalkyl substances (PFASs) and dioxins.

All soil samples delivered to the analytical laboratory will have been screened in the DNREC-SIRS' Laboratory for the following classes of compounds: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH) and metals. Screening will be performed in the DNREC-SIRS' Laboratory using a portable GC/MS and an X-Ray Fluorescence instrument (XRF). Partial and/or full TAL/TCL analysis may be conducted on samples based upon the results of the screening analysis. Soil samples collected from Area 8 will be analyzed for dioxins as well based on the site operational history and as recommended by EPA. Screened



samples identified as having elevated concentrations of contaminants for a particular chemical suite shall be sent to the DNREC Division of Water Laboratory for confirmatory analysis. In the event that the DNREC lab needs to out-source some of the analytical processes, the samples will be sent to Test America, Inc., a DNREC-SIRS qualified laboratory.

At the analytical lab, the Gas Chromatography/Mass Spectroscopy (GC/MS) System will be used to analyze soil for VOCs, SVOCs, dioxins, pesticides and/or PCBs. Metals will be analyzed using an Atomic Absorption Unit and an Inductively Coupled Plasma Unit (AA and ICP). These constituents are analyzed at sites with environmental and health impact concerns because they are commonly found in industrial areas. The above constituent groups, with the exception of dioxins and PFASs, comprise the TAL/TCL list. Analysis using the GC/MS system and AA and ICP provides a good cursory tool by which to determine the presence or absence of compounds and analytes at sites under investigation. Soil samples will not be analyzed for PFASs during this phase of the SI.

At the analytical lab, the GC/MS System will also be used to analyze all groundwater samples for VOCs and groundwater samples from Area 8 only for SVOCs and dioxins. AA and ICP will also be used to analyze groundwater samples from Area 8 only for total and dissolved metals.

All of the groundwater samples collected from monitoring wells, including the QA/QC samples, will be submitted to Test America-Sacramento for analysis of PFAS by USEPA Method 537 Modified. Method 537 Modified utilizes liquid chromatography/tandem mass spectrometry (LC/MS/MS) to analyze water samples for PFASs. Water samples must be extracted within 14 days of collection and analyzed within 40 days from extraction. A list of analytes, reporting limits, and method detection limits associated with this method are provided in Table 2.

Table 3 provides a summary of the analysis by matrix and area of potential concern.

6.0 QUALITY ASSURANCE / QUALITY CONTROL

Field sampling and sample handling will adhere to the procedures as specified in the State of Delaware Site Inspection Quality Assurance Project Plan (QAPP) and as described in this site-specific work plan. A copy of the Quality Assurance Project Plan is available for review at the office of the Department of Natural Resources and Environmental Control, 391 Lukens Drive, New Castle, Delaware, 19720.

Sampling equipment will be decontaminated between sampling locations using procedures outlined in the Quality Assurance Project Plan. Sterile disposable sampling equipment, such as disposable HDPE bailers and soil scoops, will be utilized where applicable.

The QA/QC sample program also requires that samples be collected to evaluate the quality of field sampling practices and equipment decontamination practices. The following samples will be collected during the sampling period:

Trip Blanks
Field Duplicates
Laboratory Duplicates



Field Rinsate Blanks

Trip Blanks consist of four-forty milliliter glass vials filled with distilled water and sealed with a Teflon lined cap. Trip blanks are used to evaluate the potential for cross contamination of site samples from contamination sources outside the sampling area. Trip blanks are filled with distilled water prior to sampling, sealed, transported to the sampling site and returned to the laboratory without reopening for analysis. Trip blanks are analyzed for volatile organic compounds (VOC) only. One trip blank will be included with each cooler containing VOC samples.

Field duplicates consist of an actual sample for which twice as much volume as necessary has been collected. Aliquots of this volume are then distributed in two sets of sample containers and submitted to the laboratory as two separate samples. Field duplicates are used to assess the consistency of sampling homogeneity and laboratory analytical consistency. One field duplicate will be collected per 20 samples or per day for each media.

Laboratory duplicates (also referred to as Matrix Spike/Matrix Spike Duplicate [MS/MSD]) represent a sample location in which twice the normal sample volume is collected. The purpose of the laboratory duplicate is to provide the analytical laboratory with a sample which can also serve to calibrate analytical machinery. The laboratory duplicate is normally spiked with a known concentration of chemical and this sample is used to calibrate the instrument. One MS/MSD will be collected per 20 samples or per day for each media.

Field Rinsate blanks consist of pouring demonstrated Analyte-free distilled water over decontaminated sampling equipment as a check that the decontamination procedure was adequately performed and that there was no cross contamination of samples. Analysis of Rinsate blanks is performed for all analytes of interest. One field rinsate blank will be collected per 20 samples or per day.

Validation of the analytical data results will be performed by DNREC's Analytical Chemist, Robert Schulte.



7.0 PROJECT SCHEDULE

DNREC has established a project schedule for the New Castle Public Wells Groundwater Plume Site. The schedule establishes a timeframe for completion of each activity, and is included below. Once the sampling, analysis, and data validation have been completed, the draft report will be prepared. Following EPA review and comment, the final report is anticipated to be available in September 2017.

Project Time Line:

<u>Action</u>	<u>Date</u>
Finalize Work Plan	April 2017
Monitor Well Installation	June 2017
Soil Sampling	June 2017
Groundwater Sampling	June 2017
Final Report to EPA	September 2017



TABLES



Table 1. List of Prohibited and Acceptable Items during Sampling of PFASs

Prohibited Items	Acceptable Items
Sampling Equipment containing the following materials:	
Polytetrafluoroethylene (PTFE)	Stainless steel
Teflon ®	Acetate
Low-density polyethylene (LDPE)	Silicone
	High-density polyethylene (HDPE)
	Polypropylene
Non-Sampling Field Equipment	
Waterproof field books	Non-waterproof loose-leaf paper
Plastic clipboards, binders, or spiral hard cover notebooks which may be coated	Masonite or aluminum clipboards
Sharpies ® or similar indelible markers	Ball-point pens or pencils
Post-it ® notes	
Field Clothing and Protective Gear	
New clothing and clothes treated for stain resistance	Wash clothes several times before use during sampling
Avoid using fabric softener	Wear clothes made from natural fibers such as cotton
Water-resistant clothing and shoes	Rain gear made from polyurethane or wax-coated materials
Avoid using cosmetics, shampoos, moisturizers or similar items on the morning of sampling	Sunscreen and insect repellent with 100% natural ingredients
Tyvek ®	Wear nitrile gloves at all times and change gloves often during sampling
Avoid contact with car upholstery treated with PFASs	
Sample Containers and Shipping	
Glass sample containers	Lab-supplied plastic containers, such as polypropylene or HDPE
Teflon ®-lined caps	Unlined polypropylene screw caps
Blue Ice ®	Regular Ice
Shipping tape used to secure coolers may contain PFASs. Avoid touching samples with tape.	
Decontamination	
Decon 90	Alconox ®
Food and Drink	
Do not handle pre-wrapped food, such as candy bars, granola bars, microwave popcorn, etc., in sampling area	Wash hands thoroughly after handling fast food, snacks, or other items that may contain PFASs



Table 2. Analyte List and Limits for PFAS by Method 537 Modified - Water

Analyte	CAS Number	Reporting Limit (ng/L)	Method Detection Limit (ng/L)
Perfluorobutanoic acid (PFBA)	375-22-4	2.00	0.458
Perfluoropentanoic acid (PFPeA)	2706-90-3	2.00	0.989
Perfluorohexanoic acid (PFHxA)	307-24-4	2.00	0.786
Perfluoroheptanoic acid (PFHpA)	375-85-9	2.00	0.802
Perfluorooctanoic acid (PFOA)	335-67-1	2.00	0.748
Perfluorononanoic acid (PFNA)	375-95-1	2.00	0.654
Perfluorodecanoic acid (PFDA)	335-76-2	2.00	0.440
Perfluoroundecanoic acid (PFUnA)	2058-94-8	2.00	0.748
Perfluorododecanoic acid (PFDoA)	307-55-1	2.00	0.584
Perfluorotridecanoic Acid (PFTriA)	72629-94-8	2.00	0.551
Perfluorotetradecanoic acid (PFTeA)	376-06-7	2.00	0.199
Perfluorobutanesulfonic acid (PFBS)	375-73-5	2.00	0.918
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	2.00	0.870
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	2.00	0.713
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	2.00	1.28
Perfluorodecanesulfonic acid (PFDS)	335-77-3	2.00	1.21
Perfluorooctane Sulfonamide (FOSA)	754-91-6	2.00	0.638



Table 3. Summary of Analysis by Matrix and Area of Potential Concern

Area of Potential Concern	Analysis by Matrix	
	Soil	Groundwater
Area 8	VOC,SVOC, Metals, Dioxins	VOC, PFAS, SVOC, Metals, Dioxins
Area 9	None*	VOC, PFAS
Area 11	None*	VOC, PFAS
Area 12	None*	VOC, PFAS
Area 13	None*	VOC, PFAS
Area 14	None*	VOC, PFAS

*No soil samples are proposed to be collected at Areas 9, 11, 12, 13, or 14. However, if soil at these areas exhibits elevated PID readings, significant odor, or visible contamination then a soil sample will be collected and screened, at minimum, by the DNREC-SIRS screening laboratory. Additional soil analysis will be determined based on the soil screening results.



FIGURES

APPENDIX A

HEALTH AND SAFETY PLAN



SITE HEALTH AND SAFETY PLAN

FOR THE

**NEW CASTLE PUBLIC WELLS GROUNDWATER PLUME
(AKA ZERO (0) E. BASIN ROAD NEW CASTLE PFOS-PFOA)
(DE-0363)**

FIELD ACTIVITIES

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**SITE SAFETY PLAN FOR
NEW CASTLE PUBLIC WELLS GROUNDWATER PLUME (DE-0363)
FIELD ACTIVITIES**

SCHEDULED FIELD DATE: Spring/Summer 2017

1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been developed for DNREC personnel for the field activities at the New Castle Public Wells Groundwater Plume (aka Zero (0) E. Basin Road New Castle PFOS-PFOA) Site. This HASP is not applicable to any activities not specifically addressed in this HASP. Provisions for air monitoring and air sample collection are addressed in case the need arises.

This HASP establishes guidelines and requirements for the safety of DNREC personnel and is based on a review of available data and an evaluation of potential hazards associated with the site.

DNREC has developed this HASP in accordance with all applicable federal and state standards and regulations. The key regulations which govern the proposed field operation activities as mandated by the Occupational Safety and Health Administration (OSHA) area listed below:

<u>REGULATION</u>	<u>SUBJECT</u>
29 CFR 1910.20	Employee Exposure and Medical Records
29 CFR 1910.120	Hazardous Waste Operations
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1000	Toxic and Hazardous Substances

1.1 *HASP Management*

Due to the varying degree and type of hazards encountered by field personnel, certain administrative policies and procedures must be implemented. These include the use of: 1) properly trained personnel; 2) specific criteria for field team organization and size; 3) proper selection, use and maintenance of personal protective equipment; and 4) basic safety procedures. To ensure each field team is properly staffed to complete the task objective, while also providing for its own safety, DNREC has assigned specific employees to enforce the health and safety program. These employees, along with their major responsibilities, are listed below:

<u>DNREC EMPLOYEE</u>	<u>RESPONSIBILITY</u>
Stephanie Gordon	Project Team Leader
Karissa Hendershot	Health and Safety Officer

1.2 Project Team Leader Responsibilities

The Project Team Leader is responsible for, and has authority over, all work performed by DNREC personnel assigned to the project. The Project Team Leader establishes project policies and procedures, monitors cost and performance, and resolves conflicts and problems in the HASP, principally through the Site Health and Safety Officer.

The Project Team Leader, with the assistance of the Site Health and Safety Officer, is responsible for the job-related health and safety of on-site personnel, and for managing the risks associated with equipment and facilities under his/her control. The responsibilities of the Project Team Leader include the following:

- Furnish complete and approved project work plans to the Site Health and Safety Officer that define the work tasks and objectives and identify the procedures/methods to accomplish those tasks and objectives;
- Provide for obtaining safe and functional facilities, equipment, and vehicles under his/her control during the project;
- Coordinate the attendance of each field team member in a health and safety meeting prior to performing site work;
- Take or cause to be taken, prudent measures to reduce hazards and to correct unsafe conditions or actions when made aware of such unsafe or potentially unsafe conditions; and
- Participate in the completion of investigation and corrective action reports.

1.3 Health and Safety Officer Responsibilities

The Health and Safety Officer has the primary enforcement authority on project sites for the policies and provisions of the site-specific HASP. The responsibilities of the Health and Safety Officer include the following:

- Ensure that all DNREC personnel comply with the HASP;
- Serve as the initial contact for all site-specific health and safety activities;
- Prepare a site-specific HASP with assistance from the Project Team Leader;
- Assist the Project Team Leader in documenting compliance with the Health and Safety Program and site-specific HASP;
- Obtain documentation from all DNREC site personnel that they have received the proper training and medical certification as per 29 CFR 1910.120;

- Document and conduct briefing sessions for on-site personnel concerning site-specific hazards, emergency procedures, and symptoms associated with exposure;
- Determine the required level of personal protective equipment based on guidance given in the site-specific HASP and based on actual on-site operations;
- Seek guidance from the Project Team Leader when unanticipated conditions develop and obtain and approved site-specific HASP amendment before continuing;
- Ensure proper operation, calibration, and storage of monitoring equipment;
- Enforce the "buddy system" as defined in 29 CFR 1910.120;
- Set up, enforce, and document decontamination procedures;
- Inspect and maintain the first aid kit and other emergency equipment;
- Act as Emergency Coordinator with the assistance of the Project Team Leader;
- Assume DNREC's lead role during medical emergencies;
- Monitor personnel for heat/cold stress; and
- Prepare accident reports with assistance from the Project Team Leader.

2.0 SITE DESCRIPTION

See appropriate Section of Site Work Plan.

3.0 FIELD ACTIVITIES

DNREC personnel will be overseeing the construction of boreholes with a direct push Geoprobe®-type drilling rig across the Site for the purpose of sampling soils and installing and sampling monitoring wells. Refer to the site Work Plan and/or Standard Operating Procedures for a detailed description of the tasks to be performed.

If at any time during this activity, DNREC personnel observe any unanticipated hazards which are not adequately addressed in this HASP they will, if safely possible, attempt to control the situation, and/or immediately leave the Site.

Under No Circumstances will Confined Space Entry be permitted during Field Activities.

4.0 SAFETY AND HEALTH HAZARD ANALYSIS

The primary hazards which may be present during the sampling of the monitor wells include: potential exposure to chemical contaminants; noise; trips and falls; heavy equipment concerns; and precipitation and temperature dependent injuries.

4.1 Chemical Hazards

Site chemical hazards may include metals, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), pesticides, polychlorinated biphenyls (PCBs), dioxins, and poly- and perfluoroalkyl substances (PFASs).

4.2 Operational Hazards and Protective Measures

A variety of potential physical hazards may be encountered on-site. These include the following: 1) injury resulting from contact with equipment; 2) tripping and falling; and 3) precipitation and hot/cold temperatures.

4.2.1 Slips/Trips/Falls

The Site may present a potential for trip and fall hazards. DNREC personnel should pay particular attention to uneven terrain, ditches, debris, partially buried drums, and any other Site characteristics that may present trip and fall hazards.

4.2.2 Precipitation

Precipitation may cause slippery conditions, impair vision, create hidden hazards, and increase the risk of electrical shock. Individuals working during these conditions may encounter the following:

- Vehicle operation may be hampered by window fogging/frosting or slippery driving conditions.
- These conditions will increase the chance of slipping when walking, climbing steps and ladders, and working at elevation.
- Use of electric equipment in these conditions will increase the risk of electrical shock.
- Fog may hamper vehicle operation or visual communication among workers.
- These conditions may cause slippage on braking devices on augers, drills, etc.

To ensure safe working conditions during rainy weather the Site Health and Safety Officer should be aware of changing weather conditions and instruct workers to stop work or proceed cautiously when these conditions are encountered.

4.2.3 Air Monitoring

General hazards frequently encountered during air sampling and monitoring include:

- Placing sampling pumps in elevated areas or areas where slip/trip and fall hazards exist.
- Hazards associated with ambient environment being sampled. Readings indicating non-explosive atmospheres, low concentrations of toxic substances, or other conditions may increase or decrease suddenly, changing the associated risks.
- Electrical hazards as a result of power sources to run sampling pumps.

These hazards can be prevented with the following measures:

- Grounded plugs should be used when a power source is needed to reduce the hazard of electric shock.
- Personnel should be thoroughly familiar with the use, limitations and operating characteristics of the monitoring instruments.
- Perform continuous monitoring in variable atmospheres.
- Use intrinsically safe instruments until the absence of combustible gases or vapors is anticipated.

4.2.4 Groundwater Sampling

Hazards generally encountered during groundwater sampling include the following:

- Exposure to vapors of volatile organics when the well is initially opened.
- Back strain due to lifting bailers or pumps from down-well depths and moving equipment (generators) to well locations.
- Slipping on wet, muddy surfaces created by spilled water.
- Electrical hazards associated with use of electrical equipment around water or wet surfaces.
- Possible water splashing in eyes during sampling.
- The hazards involved with groundwater sampling can be prevented using the following measures:
 - To minimize exposure to volatiles when the well head is initially opened, a monitoring instrument (HNU, OVA) should be placed near the opening to monitor organic levels.

The breathing zone should also be monitored. The action levels on the instruments should be chosen before site work begins, and should be outlined in the safety plan. To prevent contact with contaminated groundwater, or product material, provide adequate protective equipment.

- Back strain can be prevented by employing proper lifting and bailing techniques. Heavy equipment, such as pumps and generators, should only be lifted with the legs, preferably using two or three personnel.
- Slipping on wet surfaces can be prevented by placing all purged water in drums for removal. Also, if the area is wet wear boots with good treads and be alert of where personnel are walking to decrease the chance of slipping.
- Ground fault interrupter should be used in the absence of properly grounded circuitry or when pumps are used around wet conditions.
- Electrical extension cords should be protected or guarded from damage (i.e., cuts from other machinery) and be maintained in good condition.
- Eye protection should be worn as appropriate to prevent splashing into eyes.

4.2.5 Site Survey

General hazards associated with site walk-throughs, site surveys, and sampling grid layout include the following:

- Exposure to irritant and toxic plants such as poison ivy and sticker bushes may cause allergic reactions to personnel.
- Surfaces covered with heavy vegetation and under growth create a tripping hazard.
- Back strain due to carrying instruments.
- Native wildlife such as rodents, ticks, and snakes present the possibility of insect bites and associated diseases such as Lyme disease.
- Driving vehicles on uneven or unsafe surfaces can result in accidents such as overturned vehicles or flat tires.
- Electrical hazard due to fallen lines.
- Heat stress/cold stress exposure.
- On-site chemical hazards depending on contaminant location and contact or disturbances of contaminated areas.

HAZARD PREVENTION

- Wear long sleeved clothing and slacks to minimize contact with irritant and toxic plants and to protect against insect bites. Appropriate first aid for personnel with known allergic reactions.
- Be alert and observe terrain while walking to minimize slips and falls. Steel-toed boots provide additional support and stability.
- Use proper lifting techniques to prevent back strain.
- Avoid wildlife when possible. In case of an animal bite, perform first aid and capture the animal, if possible, for rabies testing. Perform a tick check after leaving a wooded or vegetated area.
- Ensure all maintenance is performed on vehicles before going to the field. A site surveillance on foot might be required to choose clear driving paths.
- Ensure fallen power lines are not energized.
- Avoid buildings which are not structurally sound.
- Implement heat stress management techniques such as shifting work hours, electrolyte fluid intake, and monitoring employees, especially high risk workers.

4.2.6 Perimeter Monitoring (if needed)

These site boundaries clearly mark off the “clean” off-site areas, from the “contaminated” on-site areas, and so chemical contamination from the site should not be a hazard associated with perimeter and off-site monitoring.

Perimeter monitoring and off-site monitoring are performed once the site boundaries have been established. Hazards specific to perimeter and off-site monitoring include encounters with residents and non-project personnel. This is a unique hazard, in that untrained personnel prove to be a risk when performing any type of site work. Inquisitive and/or hostile persons may interfere with the monitoring/sampling effort, jeopardizing the safety of themselves as well as the safety of the field team.

HAZARD PREVENTION

To minimize public involvement in perimeter monitoring/off-site monitoring, the most effective preventative measure is to inform all interested parties. Notifying state and local police, the fire department, and any local/state governmental officials of the projects purpose and scope will allow those authorities to answer questions posed to them by local residents and the media by preparing statements

on the projects purpose or by informing the public where to call for further information. This will alleviate the problem of work stoppage due to field personnel answering questions.

4.2.7 Surface Soil Sampling

For the purposes of this hazard identification section, surface soil sampling will be considered any soil sampling completed by hand using a trowel, split spoon, shovel, auger, or other type of handheld tool. Hazards generally associated with soil and tailings/soils sampling include:

- Contact with or inhalation of contaminants, potentially in high concentrations in sampling media.
- Back strain and muscle fatigue due to lifting, shoveling and augering techniques.
- Contact with or inhalation of decontamination solutions.

HAZARD PREVENTION

To minimize exposure to chemical contaminants, a thorough review of suspected contaminants should be completed and implementation of an adequate protection program.

Proper lifting (pre-lift weight assessment, use of legs, multiple personnel) techniques will prevent back strain. Use slow easy motions when shoveling, auguring, and digging to decrease muscle strain.

Material Safety Data Sheets for all field solutions should be included with each Site Health and Safety Plan.

First aid equipment should be available based on MSDS requirements.

4.2.8 Subsurface Soil Sampling

For the purposes of this hazard identification section, subsurface soil sampling will be considered any soil sampling completed by hand using a trowel, split spoon, shovel, auger, or other type of handheld tool. Hazards generally associated with soil and tailings/spoils sampling include:

- Contact with or inhalation of contaminants, potentially in high concentrations in sampling media.
- Back strain and muscle fatigue due to lifting, shoveling and augering techniques.
- Contact with or inhalation of decontamination solutions.

HAZARD PREVENTION

To minimize exposure to chemical contaminants, a thorough review of suspected contaminants should be completed and implementation of an adequate protection program.

Proper lifting (pre-lift weight assessment, use of legs, multiple personnel) techniques will prevent back strain. Use slow easy motions when shoveling, augering, and digging to decrease muscle strain.

Material Safety Data Sheets for all decon solutions should be included with each Site Health and Safety Plan.

First aid equipment should be available based on MSDS requirements.

4.2.9 Groundwater Well Installation

Hazards generally associated with drilling operations include the following:

- Noise levels exceeding the OSHA PEL of 90 dBA are both a hazard and a hinderance to communication.
- Fumes (carbon monoxide) from the drill rig.
- Overhead utility wires, i.e., electrical and telephone, can be hazardous when the drill rig boom is in the upright position.
- Underground pipelines and utility lines can be ruptured or damaged during active drilling operations.
- Moving parts, i.e. augers, on the drill rig may catch clothing. Free or falling parts from the cat head may cause injury.
- Moving the drill rig over uneven terrain may cause the vehicle to roll over or get stuck in a rut or mud. Be aware of hazards associated with moving heavy machinery and other associated injury.
- High pressure hydraulic lines and air lines used on drill rigs are hazardous when they are in ill repair or incorrectly assembled.

HAZARD PREVENTION

Review the contaminants suspected to be onsite and perform air monitoring as required. Shut down drill rig and/or divert exhaust fumes.

All chains, lines, cables should be inspected daily for weak spots, frays, etc.

Ear muffs and ear plugs effectively reduce noise levels.

Hard hats should be worn at all times when working around a drill rig. Secure loose clothing. Check boom prior to approaching drill rig.

To avoid contact with any overhead lines, the drill rig boom should be lowered prior to moving the rig. Overhead utilities should be considered "live" until determined otherwise.

The rig mast should not be erected within 10 feet of an overhead electrical line until the line is de-energized, grounded, or shielded and an electrician has certified that arcing cannot occur.

Minimum working distances around "live" overhead power lines are:

Minimum working voltage range [(phase to phase) kilovolt] and clear hot stick distance

2.1 to 15	2ft. 0 in.
15.1 to 35	2ft. 4 in.
35.1 to 46	2 ft. 6 in.
46.1 to 72.5	3 ft. 0 in.
72.6 to 121	3 ft. 0 in.
138 to 145	3 ft. 6 in.
161 to 169	3 ft. 8 in.
230 to 242	5 ft. 0 in.
345 to 362	7 ft. 0 in.
500 to 552	11 ft. 0 in.
700 to 765	15 ft. 0 in.

A thorough underground utilities search should be conducted before the commencement of a drilling project.

All high pressure lines should be checked prior to and during use.

4.2.10 Surface Water, Lagoon and Sediment Sampling

Hazards generally encountered during sampling include the following:

Drowning due to slipping, tripping, or falling. Drowning can occur as a result of falling into the lagoon while sampling, or by falling out of a boat. The use of personal protective clothing will increase the chance of drowning and accidents, due to the added weight and cumbersome nature of PPE.

Contact with contaminated water and possibly splashing water into eyes during sampling procedures.

HAZARD PREVENTION

Sampling should be done on the lagoon bank, and the sampler should be secured with a safety line. The sampler should wear chemical resistant hip waders, and should not stand in lagoon water.

If a boat must be used, a row boat in good condition and complete with floating oars should be employed. (NOTE: Some metals found in boats may be reactive with contaminants in the water, such as aluminum). Two samplers should be in the boat, seated on opposite ends, and each should wear a life preserver. Samplers should remain seated while in the boat, and if feasible, the boat should be connected to the shore by a rope. A safety watch should be posted on shore.

The buddy system should be used at all times.

5.0 PERSONAL PROTECTIVE EQUIPMENT

The level of personal protective equipment required for this activity is a modification of Level D, as outlined in the DNREC Division of Waste and Hazardous Substances Health and Safety Manual (revised March 2016), and includes: protective clothing, steel-toed footwear, hard hats, gloves, and over boots. Each person on-site will possess an air purifying respirator if the protection level is needed to be upgraded to include air purifying respiratory protection.

Each sampling team will have a cellular phone to be able to contact, or be contacted, by the remaining sampling crews and/or the DNREC office.

6.0 HAZARD MONITORING

DNREC will conduct air monitoring using a direct reading Photoionization Detector (PID) instrument equipped with a 10.2 eV lamp source or a dual PID/FID vapor analyzer. Prior to entering the Site, DNREC personnel will ensure that the direct reading instrument has been properly calibrated according to the manufacturer's instructions.

After proper calibration, DNREC personnel will determine the wind direction at the Site and take an organic vapor concentration reading from upwind of the Site. Combustible Gas readings will also be taken. These readings will be recorded in the field logbook as the background reading. While sampling of the monitor wells is occurring, DNREC personnel will continue to measure organic vapors and combustible gas concentrations. Recording of monitoring the organic vapor concentrations will be done on a half-hourly basis, or more frequently based upon the readings registered on the PID of CGI. PID readings will be taken at the opening of the well and in the breathing zone, or at the discretion of the DNREC Health and Safety Officer. If PID readings of greater than five (5) ppm over the background level are encountered, PID monitoring will be continuous, and readings will be recorded at least every fifteen minutes. All instrument readings will be recorded in the field logbook for future documentation.

If at any time, the instrument meter sustains a reading, for fifteen minutes or more, of five (5) ppm or more above the background measurement, DNREC personnel will immediately don respirators (if available) or leave the vicinity. If PID readings exceed 500 ppm all personnel will leave the vicinity until readings reduce. If a reduction in readings is not achieved, the boring will be backfilled and abandoned, unless under supplied air. If at any time, the CGI indicates a level of 5% LEL work will stop until dissipation of the gas.

CONDITIONS WARRANTING EVACUATIONS OF DNREC PERSONNEL FROM SITE

PID/FID readings elevated to 500 ppm or more above background readings for fifteen minutes.

Observation of symptoms of chemical contaminant exposure.

Visible dust emissions on-site.

LEL of 10% or greater.

Oxygen less than 19% (if not on supplied air).

7.0 DECONTAMINATION

DNREC personnel will follow a standard decontamination procedure based on the assessed exposures to contaminants at the site. If contaminated, personnel must decontaminate boots and wash hands and face prior to leaving the Site. Personnel will dispose of any disposable personal protective equipment as necessary in a plastic garbage bag. All garbage bags will be disposed of in an appropriate manner.

To help reduce potential for spread of contaminants, all personnel shall avoid walking through standing or running water or leachate seeps. In addition, personnel shall take all precautions to avoid contact with any potentially contaminated materials, unless wearing appropriate PPE. All decon water will be returned to the ground surface upon completion of the activities.

7.1 *Work Limitations*

During all field activities, DNREC personnel will adhere to the following:

- A complete first aid kit will be easily accessible;
- Work will be restricted to daylight hours only;
- A buddy system will be employed at all times on-Site;
- Outdoor work will stop during storms or electrical storms;
- Minimize contact with excavated, purged, and contaminated materials;
- Maintaining safety equipment; and
- Maintaining an emergency contact and telephone number list and area maps or directions to the nearest medical facility.

Personnel from the DNREC will be performing air quality monitoring in the immediate area of the field operation with a PID.

7.2 *Site Control Measures*

No unauthorized personnel will be allowed on site within 60 feet of the sampling operation. The Project Team Leader will be in charge of controlling access into and out of the site in the immediate area of the monitor well sampling operation. The location of the decontamination and support zone will be determined in the field.

All equipment will be decontaminated by either wiping down with soap and water or washing with soap and water. All equipment, after decontamination, will need to be rinse wiped or rinsed.

All disposable equipment will be doffed and put in two 6 mil. drum liner bags and sealed with duct tape.

8.0 EMERGENCY RECOGNITION AND PREVENTION

In case of an immediate hazard to employees or the public, all employees on the Site will take all practicable steps to eliminate or neutralize the hazard; this may include leaving the Site. Follow-up consultation with the Project Team Leader and the Site Health and Safety Officer must then be made at the first opportunity. In such circumstances, the Project Team Leader will take, or cause to be taken, the necessary steps to ensure that the drilling of monitor wells can be completed safely. Such steps may include changes in procedure, removal or neutralization of a hazard, consultation with appropriate experts or specialists; and modifications to this HASP. In cases where the hazard is not immediate, the employee will consult the Project Team Leader or the Site Health and Safety Officer regarding appropriate corrective measures.

Prevention of accidents requires exercising good judgment and common sense by all employees.

In the event that any member of the field team is overcome, incapacitated, or traumatically injured while on-Site, the remaining members will immediately call for assistance and then don appropriate protective equipment and make a reasonable effort to rescue the affected person.

At least one person should remain out of the problem area until help arrives. Once removed from the problem area, the affected person will not be left unattended. If possible, limited personal decontamination should be conducted, but not if time is critical to get the injured person to medical aid. If it is determined that the problem was due to chemical exposure, all field team members will proceed expeditiously, in a group to the nearest medical facility. In those cases where personal contamination has occurred, all persons involved shall make every reasonable effort to decontaminate themselves, so there will be minimal spreading of contaminants.

Non-Verbal Communications

The following standardized non-verbal communications signals will be used when necessary on-site:

Thumbs-up = "OK/Affirmative, I am alright, I understand"

Thumbs-down = "No, Negative"

Hands on top of head = "Need Assistance"

Gripping partners wrist or gripping both hands or wrists = "Leave Site Immediately"

These signals are to be reviewed by the Site Health and Safety Officer and all personnel covered under this plan immediately prior to site entry.

9.0 ACTION LEVELS

These action levels have been established in consideration of the entire list of Potential Contaminants of Concern for the site and as such are adequately protective of personal health and safety at any given location on site. Dependent upon the specific areas proposed for field work on any given site visit, the

specific activities to be performed, and the documented contaminants for that location, the Project Team Leader or Site Health and Safety Officer may alter these action levels to more accurately reflect specific chemical hazards presented by that specific area or areas.

ACTION LEVELS

INSTRUMENT	READING	ACTION
PID or FID (for organic vapors)	Background to <1 ppm above background	Continue activities (Level D)
	> or = 1 ppm to <5 above background (sustained for 15 minutes or more)	Continue activities (Level D)
	> or =5 ppm above background (sustained for 15 minutes or more) (exceeds STEL for benzene)	Consult Health & Safety Officer Evacuate Area Immediately Notify Health & Safety Officer
N/A	Visible dust emissions	- evacuate area immediately - immediately notify SHSO

9.1 Emergency Notification

In the event of an on-Site emergency requiring notification to personnel off-Site, the Emergency Coordinator is responsible for immediately notifying the appropriate contacts in this section. The Emergency Coordinator will notify the Project Team Leader as soon as practicable after any emergency. The Emergency Coordinator will provide a report to the Project Team Leader and Site Health and Safety Officer describing the following:

- The event including date and time, that necessitated the notification and the basis for that decision;
- Date, time, and names of all persons/agencies notified and their response; and
- Resolution of the incident, including duration and corrective action involved.

9.2 Sanitary Facilities

Location of the nearest Sanitary facility: Nearby gas stations and fast food restaurants.

10.0 EMERGENCY CONTACTS AND TELEPHONE NUMBERS

The following numbers are listed for use in an emergency.

DIAL 911 TO CONTACT AMBULANCE, FIRE, OR POLICE OFFICIALS

Location of nearest telephone: Any personal or DNREC-SIRS cell phone that personnel is carrying

Christiana Hospital, Newark (302) 733-1000	5.3 miles
St. Francis Hospital, Wilmington (302) 421-4333	7.8 miles
<u>Directions attached.</u>	

(To be filled in by the Site Health and Safety Officer)

EMERGENCY 911 SERVICE ☒ Established ☐ Not Established

AMBULANCE.....	911
FIRE DEPARTMENT.....	911
POLICE DEPARTMENT.....	911
STATE POLICE.....	911
POISON CONTROL CENTER	1-800-222-1222
NATIONAL RESPONSE CENTER	1-800-424-8802
DNREC EMERGENCY RESPONSE	1-800-662-8802

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

Tim Ratsep, Environmental Program Administrator.....	w) 302.395.2600
.....	c) 302.383.5759
Qazi Salahuddin, Program Manager II.....	w) 302.395.2600

11.0 SIGNATURES

All site personnel have read the above plan and are familiar with its provisions.

Title
Site Safety Officer

Printed Name
Karissa Hendershot

Signature

Project Team Leader

Stephanie Gordon

Team Personnel

Rick Galloway

Site Safety Officer signs last and dates it
Karissa Hendershot

-  5. Use the left lane to merge onto I-95 N via the ramp to I-495 N/Wilmington/Philadelphia 1.3 mi
-  6. Keep left to stay on I-95 N 2.4 mi
-  7. Take exit 6 for DE-4/Maryland Ave toward M.L King Jr Blvd 0.3 mi

Take W 2nd St to N Clayton St

-  8. Continue onto S Adams St (signs for Frawley Stadium Alt Ent) 6 min (1.1 mi)
 -  9. Turn left onto W 2nd St 0.2 mi
 -  10. Turn right onto N Clayton St 0.5 mi
-  Destination will be on the left
- 0.3 mi

Saint Francis Hospital

701 N Clayton St Wilmington DE 19805

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Drive to your destination

4 min (0.6 mi)

 5. Use the left lane to turn left

0.1 mi

 6. Turn left

.351 ft

 7. Turn left

0.3 mi

 8. Turn right

377 ft

 9. Turn right

226 ft

Christiana Hospital

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.