DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
1322 PATTERSON AVENUE, SE SUITE 1000
WASHINGTON NAVY YARD DC 20374-5065

5090
Ser EV3/012
24 November 2020

From: Commander, Naval Facilities Engineering Command Systems Command

Subj: INTERIM PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) SITE GUIDANCE FOR NAVFAC REMEDIAL PROJECT MANAGERS (RPMs)/NOVEMBER 2020 UPDATE

Ref: (a) DASN (E) Perfluorinated Compounds/Perfluoroalkyl Substances (PFC/PFAS) – Identification of Potential Areas of Concern (AOCs) Memorandum, 20 June 2016

Encl: (1) Interim Per- and Polyfluoroalkyl Substances (PFAS) Site Guidance for NAVFAC Remedial Project Managers (RPMs)/November 2020 Update

1. In accordance with reference (a), the guidance and procedures for addressing Perfluoroalkyl Substances (PFAS) under the Environmental Restoration, Navy (ER,N) Program and Navy Base Realignment and Closure (BRAC) Program are provided in Enclosure (1), which are organized as Frequently Asked Questions (FAQs). As many Policies and Guidance documents have been revised and updated, and Navy installations have been receiving requests to adopt those changes at cleanup sites, this PFAS Site Guidance assists with identifying sampling methodologies and promoting a consistent approach for dealing with PFAS at Navy Environmental Restoration (ER) sites.

2. This Guidance supersedes and replaces previous Interim PFAS Site Guidance/FAQs issued on 28 September 2017.

3. The main objective of the PFAS Site Guidance is to assist Remedial Project Managers (RPMs) with programmatic and technical issues related to PFAS at Naval ER sites. These issues include: eligibility and funding responsibilities, sampling and analysis scenarios, investigation procedures, risk assessment methodology, applicable or relevant and appropriate requirements, remedial action considerations, land use controls and five year review issues.

4. The Headquarters point of contact is Ms. Kim P. Brown, who can be reached at kim.brown@navy.mil or (202) 685-0096. Technical questions can also be directed to Mr. Tim Reisch at timothy.reisch@navy.mil or (757) 322-4130 and Ms. Jennifer Corack at jennifer.corack@navy.mil or (757) 322-4335.

Larry E. Douchand

LARRY E. DOUCHAND
Assistant Commander for Environmental Programs

Distribution:

NAVFAC ATLANTIC

NAVFAC PACIFIC

NAVFAC SOUTHEAST

NAVFAC SOUTHWEST

NAVFAC NORTHWEST

NAVFAC WASHINGTON

NAVFAC MID-ATLANTIC

NAVFAC HAWAII

NAVFAC MARIANAS

NAVFAC EXWC

NAVFAC BRAC PMO

Interim Per- and Polyfluoroalkyl Substances (PFAS) Site Guidance for NAVFAC Remedial Project Managers (RPMs) November 2020 Update

Objective/Purpose

The objective of this document is to assist Remedial Project Managers (RPMs) with programmatic and technical issues related to a group of chemicals called per- and polyfluoroalkyl substances (PFAS) at Department of the Navy (DON) Environmental Restoration (ER) sites. These issues include: funding responsibilities, risk assessment, and regulatory requirements. The "Frequently Asked Questions" are presented to give general guidance. However, RPMs are encouraged to discuss site-specific conditions with their respective ER Manager or Base Closure Manager to determine if circumstances allow for Environmental Restoration, Navy (ER,N) or Base Realignment and Closure (BRAC) eligibility.

Applicability

The guidance and procedures in this document apply to actions taken under the ER,N and BRAC funded Defense Environmental Restoration Program (DERP). This update supersedes and replaces the previous *Interim Per- and Polyfluoroalkyl Substances (PFAS) Site Guidance for NAVFAC Remedial Project Managers (RPMs)/September 2017 Update*.

Background

Certain PFAS have been identified as emerging chemicals (ECs) of concern[1] for the DERP. These compounds are environmentally persistent, and have been detected in environmental samples long after a release was reported. This environmental persistence and the tendency to bioaccumulate in living organisms and some demonstrated toxicity in laboratory animals, have increased interest in these compounds.

The U.S. Department of Defense (DoD) works with the U.S. Environmental Protection Agency (EPA) and state agencies to reach consensus on how to address ECs, such as PFAS. ECs may have insufficient or limited health and science data. Additionally, the science and technology necessary to address them may still be under development as scientific understanding evolves. Naval Facilities Engineering Systems Command (NAVFAC) has prepared this interim guidance to provide support to RPMs regarding the management of potential PFAS releases at their sites. Due to the ever-evolving science related to these compounds, it is possible that portions of this guidance could become 'outdated' before another update is issued. RPMs should check with their ER Manager or a representative from the NAVFAC EC Workgroup regarding updates.

PFAS are a class of man-made chemicals that have been used for many years to make products that resist heat, stains, grease and water. PFAS have been used to make carpets, clothing, fabrics for furniture, paper packaging for food and other materials (e.g., cookware) that are resistant to water, grease or stains. Additionally PFAS are also used in a variety of other industries, including aerospace, chrome plating, automotive, building and construction, and electronics. PFAS were also used in a variety of military applications, including as a component in certain aqueous film forming foam (AFFF), routinely used in the past at airfields and firefighting training areas (FTAs).

Currently, there are no Safe Drinking Water Act (SDWA) federal regulations or Clean Water Act (CWA) Ambient Water Quality Human Health Criteria for any PFAS. For chemical constituents not subject to

[1] DoD Instruction 4715.18 defines ECs and establishes policy, assigns responsibilities, and provides procedures for an enterprise-wide approach to the identification, assessment, and management of "DoD ECs" (DoD 2019).

any national primary drinking water regulation, the SDWA authorizes the EPA to publish non-regulatory health advisories or take other appropriate actions. The EPA created these health advisories to assist state and local officials in evaluating risks from these chemical constituents in drinking water (EPA 2016a). In May of 2016, the EPA issued a lifetime health advisory for two PFAS, specifically perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). Each health advisory was set at 70 nanograms per liter (ng/L) or parts per trillion (ppt). In addition, when both PFOA and PFOS are detected in drinking water, their combined total should be compared to 70 ng/L.

The Deputy Assistant Secretary of the Navy (Environment) [DASN (E)] Policy Memo, 20 Jun 2016 [*Perfluorinated Compounds/Perfluoroalkyl Substances (PFC/PFAS) - Identification of Potential Areas of Concern (AOCs)*], required all Navy and Marine Corps installations to identify and prioritize sites for investigation if drinking water resources, on- or off-installation, were thought to be vulnerable to PFOA/PFOS impacts from past Navy/Marine Corps PFAS releases. Initially the primary mechanism to identify potential PFAS release sites was review of existing Navy environmental restoration databases. Sites with drinking water sources within 1-mile downgradient from known or potential releases of PFAS were assigned the highest priority. This policy directed the sampling of off-base drinking water at these high priority sites, and appropriate mitigation measures to address exposure of PFOS/PFOA above the EPA health advisory levels, if present, be implemented.

In the continued implementation of this policy, the DON initiated "installation-wide" Preliminary Assessments (PAs) of Navy and Marine Corps installations, including special areas and non-contiguous properties, to identify additional potential PFAS releases. These evaluations are being conducted under the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). If at any time during the CERCLA investigation process a potential for drinking water exposure to any on-base or off-base human receptor is identified, the RPM shall notify their respective ER Manager (for ER,N) or Base Closure Manager (for BRAC), and implement the drinking water sampling process for potentially affected properties. If PFAS are confirmed in drinking water above the EPA drinking water health advisories, then immediate actions must be taken to notify affected individuals and reduce/eliminate the exposure. For immediate response, this typically involves providing alternate (e.g., bottled) water for drinking and cooking until a long term solution is implemented. RPMs should coordinate with, and report all sampling of private drinking water to NAVFAC Headquarters (HQ).

For additional information and policy memorandum from ASN and Chief of Naval Operations (CNO) related to PFOA and PFOS, see the Navy's website at https://www.secnav.navy.mil/eie/pages/pfc-pfas.aspx. For additional information about the chemicals, see EPA's web site at https://www.epa.gov/pfas/basic-information-pfas

Please Note: Previous DON policies and guidance used the term perfluorinated compounds (PFC), which are a subset of PFAS. The term PFC is limited to fluorinated compounds having a certain structure. The broader term PFAS is used in the remainder of this document to include all analytes of potential concern of the PFAS group.

Organization of this Document

The remainder of this document is presented as Frequently Asked Questions (FAQs), as follows.

FAQ – General

G1. What are emerging chemicals (ECs) of concern?
G2. Is it reasonable to assume that PFAS will be present at my site?
G3. What are the similarities and differences between AFFF formulations that I need to know about for my site?
G4. Is it important to differentiate between PFAS and PFOA and PFOS?

FAQ - Eligibility and Funding

E1. Are PFAS considered CERCLA hazardous substances?
E2. Can ER,N or BRAC funding be used to respond to potential PFAS releases?
a. What if the property has been transferred outside of the Navy?
b. What if the release originated off-site (e.g., mutual aid) to an off-base incident in coordination and support of a local fire department)?
E3. What if the site has achieved site closure (SC)?
E4. Are recent releases or spills of AFFF eligible for ERP response actions?

FAQ – Sampling and Analysis

S1. Are there special concerns when sampling for these chemicals?
S2. What analytical method and target analyte list should be used for PFAS in drinking water samples?
S3. What analytical methods are currently available for PFAS in other environmental media?
S4. Are there any DoD-ELAP accredited laboratories that can perform PFAS analysis?
S5. Is there a standard target analyte list for PFAS investigations?
S6. Are proficiency testing (PT) samples recommended for PFAS drinking water investigations?

FAQ – Investigation

INV1. What should an installation-wide PA include?
INV2. When should a Site Inspection (SI) for PFAS be initiated?
INV3. Should a PFAS SI be carried out at a site where AFFF was released but there are no records supporting that the formulation contained PFAS?
INV4. Are there special considerations for PFAS investigations on operational ranges (i.e., Major Range and Test Facility Base and Test and Evaluation ranges)?
INV5. What is needed in an SI to support initiating a remedial investigation/feasibility study (RI/FS)?
INV6. What should be expected regarding fate and transport of PFAS?
INV7. What if PFAS may have reached a drinking water source?
INV8. During the implementation of the RI/FS, to what concentrations is the nature and extent of PFAS delineated?
INV9. What if a release is suspected to have migrated offsite?
INV10. How should investigation-derived waste (IDW) at PFAS sites be disposed?

FAQ - Risk Assessment

R1. What human health risk assessment screening levels are available?
R2. What human health toxicity values are available?
R3. Do PFAS need to be considered in the ecological risk assessment?

R4. What ecological risk assessment screening levels are available?

FAQ – Applicable or Relevant and Appropriate Requirements (ARARs) and/or To Be Considered (TBCs) Values

ARAR1. Are there Federal ARARs or TBCs for any PFAS?
ARAR2. Are there state ARARs for any PFAS?

FAQ – Remedial Action Considerations

RA1. If sampling indicates presence of PFAS, is remedial action warranted?
RA2. How should cleanup levels be established for PFAS?
RA3. What treatment technologies are available for PFAS?

FAQ – Land Use Controls (LUCs)

LUC1. Should LUCs be considered when PFAS are present?

FAQ - Five-Year Review (FYR) Issues

FY1. Should PFAS be considered during a FYR?
FY2. When are PFAS an issue that affects protectiveness?
FY3. How should I address the Navy program for conducting installation-wide PFAS PA/SIs in the FYR?

Appendices

A. Approved Per- and Polyfluoroalkyl Substances (PFAS) Analytical Methods and Analyte Lists
B. Talking Points: Awareness Regarding Potential PFAS Releases from Off-Base Fire Response Actions by Navy and Marine Corps First Responders
C. Acronyms

FAQ – General

G1. What are emerging chemicals (ECs) of concern?

There is no single, consensus definition across agencies; different organizations (e.g., DoD, EPA, state agencies) have different definitions for ECs, and thus, possibly different chemicals. For DoD, they are defined in the DoD Instruction 4715.18 as substances that:

- Have a perceived or real threat to human health or the environment; and
- Have new or changing toxicity values, or
- Have new or changing human health or environmental regulatory standards (DoD 2019).

These changes may be due to new science discoveries, detection capabilities, or exposure pathways.

For reference, EPA's definition is: "a chemical or material that is characterized by a perceived, potential or real threat to human health or the environment or by a lack of published health standards" (EPA 2014a).

G2. Is it reasonable to assume that PFAS will be present at my site?

At DON facilities, the most common activity that could have resulted in the historical release of PFAS to the environment is the use of certain AFFF for testing, training, firefighting, and other life-saving emergency responses. Therefore, areas where AFFF was used for these activities (e.g., fire training areas, runways, crash sites, hangars, fuel farms, where fires or accidental releases of AFFF occurred, equipment testing and washout areas, oil-water separators or other piping systems where released AFFF may have flowed), it is possible that PFAS is present at the site.

AFFF may be found in sludge from oil-water separators at hangars and sludge from sewage treatment at air bases after a discharge or release occurs into the local drainage system. PFAS may have been used in mist suppression at hard chrome plating shops and other industrial operations; as such, disposal areas receiving wastes from these operations and sludge and effluent from waste water treatment plants may contain PFAS. For these operational and waste areas, it is important to develop a conceptual site model (CSM) that considers the following to determine if a reasonable basis exists for PFAS use, and if there is potential for the PFAS to have been released into the environment:

- type of operations,
- timeline of operational activity,
- material/product development and usage,
- material storage and management practices,
- quantities of material used, and
- historical information/data from similar operations in the assessment.

G3. What are the similarities and differences between AFFF formulations that I need to know about for my site?

AFFF is the name on the Military Specification (MIL-SPEC) (where the MIL-SPEC is owned by the Navy) for the fire-fighting foam commonly used for hydrocarbon (e.g., fuel) fires. However,

fluorinated foams by any name should be noted in the investigations and their ingredients identified, if known.

AFFF formulations used at DoD facilities differ in their chemical composition. Additional information on AFFF formulations is available from the Interstate Technology and Regulatory Council (ITRC) Aqueous Film Forming Foam (AFFF) fact sheet. Each formulation is comprised of various individual PFAS at varying individual concentrations. Formulations used at DoD facilities are similar in that they have to be listed on the Qualified Products List (QPL). To be listed on the QPL, formulations must meet the requirements of the Navy MIL-SPEC for AFFF. One of the key property requirements is compatibility. Every formulation listed on the QPL must be compatible with all other formulations that are currently listed on the QPL. This allows for the mixing of different formulations without introducing performance issues.

G4. Is it important to differentiate between PFAS and PFOA and PFOS?

Yes, because the Navy will only take action on PFAS that have vetted (i.e., Tier 1, 2, or 3 toxicity value per DoDI 4715.18) toxicity values. Currently there are only three PFAS with DoD-endorsed toxicity values: PFOA, PFOS, and perfluorobutane sulfonate (PFBS) (ASD 2019b).

FAQ - Eligibility and Funding

E1. Are PFAS considered CERCLA hazardous substances?

PFAS, including PFOA and PFOS, do not currently meet the definition of a CERCLA hazardous substance. PFAS fall within the definition of ECs contained in DOD Instruction 4715.18 (DoD 2019), and can be included in a DERP investigation if a reasonable basis exists to suspect a release may have occurred.

The EPA is considering designating PFOA and PFOS as CERCLA hazardous substances (EPA 2019a); when such action is complete, the DON will comply with all resulting requirements thereof.

E2. Can ER,N or BRAC funding be used to respond to potential PFAS releases?

If the CSM indicates the use or release of PFAS, from firefighting or other industrial activities for which PFAS are associated, then ER,N or BRAC funds can be used to investigate, and if necessary, perform remedial and removal actions of PFAS if the exposure would pose an unacceptable risk to human health or the environment. However, ER,N or BRAC funds can only be used to address past releases of PFAS (ER,N or BRAC funds cannot be used to investigate/remediate potential ongoing releases at active operations).

a. What if the property has been transferred outside of the Navy?

For transferred installations, or installations where there are transferred properties, these evaluations are part of the Preliminary Assessment (PA). If the PA recommends an SI, before the SI is initiated, the ER Manager (ER,N) or Base Closure Manager (BRAC) should coordinate with HQ. Site-specific coordination with the ER Manager (ER,N) or the Base Closure Manager (BRAC) is needed to identify the appropriate lead agency for the SI (Navy may not always be the appropriate lead), review existing deed language, and coordinate interaction with and obtain access from property owners if needed, etc. This

is especially important where current property owners may also be potentially responsible parties (PRPs) (e.g., current property owner is a civilian airport with known AFFF releases).

b. What if the release originated off-site (e.g., mutual aid) to an off-base incident in coordination and support of a local fire department)?

RPMs should bring these instances to the ER Manager (ER,N), Base Closure Manager (BRAC), and NAVFAC HQ attention. While these instances are not eligible for DERP funding, they should be summarized separately in a manner that can be shared with local agencies. Appendix B to these FAQs provides some example talking points when RPMs are supporting the installation during discussions about these situations with local agencies.

E3. What if the site has achieved site closure (SC)?

If a site has already been investigated and achieved SC, then any additional investigation should only be initiated after careful consideration, with adequate justification, and with concurrence from the respective ER Manager (for ER,N) or Base Closure Manager (for BRAC). To consider sampling a site for PFAS, the CSM must be well understood and strongly suggest that there is reason to believe these chemicals are present and where unacceptable risk may occur.

E4. Are recent releases or spills of AFFF eligible for ERP response actions?

ER,N funding cannot be used for immediate, short-term responses to address a PFAS spill or release. RPMs should coordinate with appropriate Environmental Compliance staff at the installation and the Facilities Engineering Command (FEC), to maintain awareness of AFFF spills and releases[2].

A response to a spill or release will be immediate (e.g., as soon as the spill or release occurs, is discovered, or should have been discovered). The immediate, short-term response is not time-limited when slow or no actions are taken to respond to a spill or release. An immediate, short-term response should include debris and soil removal and end before long-term cleanup characterization (DON 2018).

ER,N funding may be used to perform long-term response actions to address the environmental impacts of residual PFAS from a recent spill or release. Such response actions typically pertain to spill or release migrating to and impacting groundwater.

Because of the national awareness of PFAS, specifically the DoD use of AFFF, information about recent spills provided by Environmental Compliance, should be discussed in the PFAS PA. The PFAS PA should include supporting information regarding the immediate and short-term actions

[2] Note that per the Assistant Secretary of Defense (Sustainment) Memo, "*Aqueous Film Forming Foam Usage and Spill Reporting*" dated 13 January 2020, there is a reporting requirement for use/release of AFFF including date of AFFF usage or spill, amount and concentration, cause, etc. Similarly, CNICINST 5214.1B, "Commander's Critical Information Report Requirements" dated 22 January 2019 requires reporting of AFFF releases to the environment via the procedures and chain of command for Commander's Critical Information Reports. These information sources can be helpful for NAVFAC RPMs when documenting recent AFFF releases.

to address the spill or release. The PFAS PA should also include a recommendation as to whether additional CERCLA investigation is necessary. If the PFAS PA is already complete these situations would have to be evaluated on a case-by-case basis in consultation with the ER Manager and NAVFAC HQ.

FAQ – Sampling and Analysis

Due to the evolving state of science in the development of PFAS analytical methods, (i.e., the existence of multiple analytical methods which report slightly different target analytes), general information pertaining to PFAS analytical methods and analyte lists is provided herein. To maintain currency on PFAS analytical methods and analyte lists and NAVFAC's approach for analyzing PFAS in frequently sampled media in DERP projects, please refer to Appendix A *Approved Per- and Polyfluoroalkyl Substances (PFAS) Analytical Methods and Analyte Lists, Version 1.0 (November 2020),* which will be updated as new EPA analytical methods are finalized, as EPA and DoD issue guidance and directives regarding their appropriate use, and as otherwise directed by NAVFAC HQ.

S1. Are there special concerns when sampling for these chemicals?

Yes, while sampling for PFAS is similar to sampling for other chemicals, there are additional precautions that need to be taken to prepare the sampling site, collect the sample, clean the sampling equipment, store the sample, and ship the sample. The focus should at all times be on avoiding potential PFAS sources that would come into direct contact with the sample during the sampling event.

Since the EPA established drinking water health advisories at low concentrations (70 parts per trillion) for two PFAS (i.e., PFOA and PFOS), the slightest amount of PFAS introduced to the sample as a result of using such materials, equipment, and supplies, can affect the disposition of the sample. For these reasons, generic sampling standard operating procedures (SOPs) cannot be used when samples are to be analyzed for PFAS; sampling procedures must include steps to lessen the likelihood of introducing bias through contamination.

More information on sampling can be found in the Environmental Data Quality Workgroup (EDQW) fact sheet titled "Bottle Selection and other Sampling Considerations When Sampling for Per- and Poly-Fluoroalkyl Substances (PFAS)", Rev. 1.2, July 2017 (http://www.denix.osd.mil/edqw/home/) and the ITRC PFAS Fact sheets and technical regulatory document (https://www.itrcweb.org/Team/Public?teamID=78).

S2. What analytical method and target analyte list should be used for PFAS in drinking water samples?

This answer may evolve over time. There are not specific EPA guidance/directives and the target analyte list for PFAS differ amongst the final EPA Methods for PFAS in drinking water. To maintain currency on PFAS analytical methods and analyte lists and NAVFAC's approach for analyzing PFAS in frequently sampled media in DERP projects, please refer to Appendix A *Approved Per- and Polyfluoroalkyl Substances (PFAS) Analytical Methods and Analyte Lists, Version 1.0 (November 2020).* This appendix will be updated as new EPA and DoD guidance and directives are issued.

S3. What analytical methods are currently available for PFAS in other environmental media?

When required to conduct sampling and analysis of environmental media, RPMs will follow DoD policy (ASD 2019a).

To maintain currency on PFAS analytical methods and analyte lists and NAVFAC's approach for analyzing PFAS in frequently sampled media in ERP projects, please refer to Appendix A *Approved Per- and Polyfluoroalkyl Substances (PFAS) Analytical Methods and Analyte Lists, Version 1.0 (November 2020)*. This appendix will be updated as new EPA and DoD guidance and directives are issued.

S4. Are there any DoD Environmental Laboratory Accreditation Program (ELAP) accredited laboratories that can perform PFAS analysis?

Yes. A list of DoD-ELAP accredited laboratories can be found on DENIX at: http://www.denix.osd.mil/edqw/accreditation/home/.

A list of DoD-ELAP laboratories that are currently accredited to perform analysis of drinking water samples can be generated by performing a method search for the analytical method (e.g., EPA 537.1). In order to determine the version of EPA Method the laboratory is accredited for, the laboratory's DoD-ELAP Scope of Accreditation Certificate must be reviewed.

Currently, a list of DoD-ELAP laboratories that are currently accredited to perform analysis of other media in accordance with the requirements of the DoD Quality Systems Manual (QSM) can be generated by performing a method search on DENIX for "PFAS by LCMSMS Compliant with Table B-15 of QSM 5.1 or latest Version". In order to determine which version of the DoD QSM the laboratory is accredited for, the laboratory's DoD-ELAP Scope of Accreditation Certificate must be reviewed.

The DENIX database should be used as a starting point when selecting a laboratory for a project. It does not provide all information needed (e.g., version of method or requirements and list of analyte lists under accreditation). To ensure the laboratory you select is accredited for your project analytes, the project manager/chemist must review the laboratory's scope of accreditation, which is found on their accreditation body's website.

The DoD-ELAP accredited laboratory database can be found by following the link under the heading "Search Accredited Labs" on the EDQW page on the DENIX website: http://www.denix.osd.mil/edqw/home/

S5. Is there a standard target analyte list for PFAS investigations?

No. Currently EPA only has approved PFAS test methods and target analyte lists for drinking water (see S2). As such, laboratories have developed in-house methods to address other media such as soil, groundwater, and sediment (see S3). These methods are not standardized among laboratories and therefore, neither are the lists of analytes that can be analyzed and reported.

As EPA continues to develop and approve new PFAS analytical methods, the list of target PFAS analytes may change.

To maintain currency on PFAS analytical methods and analyte lists and NAVFAC's approach for analyzing PFAS in frequently sampled media in DERP projects, please refer to Appendix A

Approved Per- and Polyfluoroalkyl Substances (PFAS) Analytical Methods and Analyte Lists, Version 1.0 (November 2020). This appendix will be updated as new EPA and DoD guidance and directives are issued.

S6. Are proficiency testing (PT) samples recommended for PFAS drinking water investigations?

Yes. Although data quality for all samples collected to support site management decisions is vitally important, there can be even more concerns when performing sampling and analysis for drinking water. Therefore, PT samples are important for all projects that involve the evaluation of potential exposure to human health through drinking water.

PT samples provide for an evaluation of the performance of individual laboratories for specific tests and can be used to monitor laboratories' performance. RPMs should consult with their project chemist and NAVFAC quality assurance officer (QAO) for project-specific implementation of PT samples.

FAQ – Investigation

INV1. What should an installation-wide PA include?

Objectives for Navy PFAS PAs are as follows:

- Identify and catalog all known and potential PFAS sources.
- Eliminate from further consideration those areas where there is no evidence of a PFAS release or suspected release and document the rationale for their elimination.
- Identify areas requiring further PFAS investigation.
- Identify receptors and migration pathways (both on and off the facility).
- Determine whether an expedited response effort is warranted because of potential complete exposure pathways (for example, on-base or off-base drinking water source within 1-mile downgradient of a potential source area).
- Prioritize areas identified for further PFAS investigation.

Although AFFF is typically the primary source of PFAS releases at Naval installations, PFASs could also be found in a variety of other materials/processes including sources such as some chromium plating bath mist suppressant, wastewater treatment plant biosolids/effluent, etc. (See G2.) The list of potential products that contain PFAS seems to expand continually as scientific understanding improves. However, it is important to note that when something is purported to contain “PFAS” that does not necessarily correlate to the PFAS compounds which have vetted toxicity values or even EPA analytical methods.

For additional information on Navy PFAS PAs please see the Technical Insight and Problem Solving (TIPS) forum slides from 26 June 2019 (https://hub.navfac.navy.mil/webcenter/portal/exwc/Business_-_Program_Lines/page142/page197/page1287/page186?_afrLoop=1422986179175526&_adf.ctrl-state=agthyiw1l_656#!).

INV2. When should a Site Inspection (SI) for PFAS be initiated?

As with hazardous substances, the approach to initiating an SI for PFAS is consistent with the Navy’s Environmental Restoration Program Manual. An SI is needed if the PA concludes there is evidence of a potential release.

INV3. Should a PFAS SI be carried out at a site where AFFF was released but there are no records supporting that the formulation contained PFAS?

Yes, for the following reasons:

- Current understanding is that any AFFF formulations on the QPL may have included perfluoroalkyl substances like PFOA,
- AFFF formulations likely also contain polyfluoroalkyl substances, some of which have the potential to degrade into the perfluoroalkyl substances, including PFOA,
- The equipment used to deliver AFFF may still contain small amounts of the older product from previous refills.

Reported uses of "protein foam" could actually be "fluoroprotein foam" which contained fluorinated surfactants. Given the different formulations used, it is recommended that PFAS investigations should include sites that report uses of "protein foam" or "fluoroprotein foam."

INV4. Are there special considerations for PFAS investigations on operational ranges (i.e., Major Range and Test Facility Base and Test and Evaluation ranges)?

Yes, NAVFAC RPMs should refer to the CNO policy memo (CNO 2020) for detailed information.

Consistent with the CNO policy memo (CNO 2020), for land-based ranges RPMs need to identify if PFAS releases occurred on operational ranges, including but not limited to releases that could impact drinking water resources. To accomplish this, NAVFAC RPMs should coordinate with Range Program Managers (or their designee). At operational ranges, the presence of PFAS will largely be from past AFFF use on range areas for emergency responses.

If there is no evidence of a release, the NAVFAC RPM, in coordination with the Range Program Manager (or their designee), will document these findings in a draft technical memorandum. The NAVFAC RPM will archive the draft technical memorandum to preserve information about the investigation for future use. The PA should provide sufficient level of investigation details and findings to support a conclusion that there was no finding of release at the range complex.

If there is evidence of a potential release, the NAVFAC RPM, in coordination with the Range Program Manager (or their designee), will document the findings in a technical memorandum. The NAVFAC RPM shall use information from the technical memorandum in the PA, which should focus on the specific locations on a range where evidence of a potential PFAS release to the environment exists. As appropriate, the NAVFAC RPM will contract further work to investigate and address areas of potential PFAS releases under the DERP for those specific locations where there is a known or suspected PFAS release on the range complex.

INV5. What is needed in an SI to support initiating a remedial investigation/feasibility study (RI/FS)?

If the SI confirms an environmental release warrants further investigation, the RPM should follow the CERCLA process to initiate the RI/FS (Table, Scenario a).

The SI is an on-site investigation intended to gather more information to determine whether there is a release or potential release, and to characterize the nature of the release and associated threats or potential threats to human health and the environment. The SI phase provides the first

opportunity to generate current site characterization data by collecting and analyzing samples. The objective of the SI sampling effort is to verify the presence of a PFAS release, not to determine the full nature and extent of the release.

Currently, soil screening levels for PFOA and PFOS are available from ASD (2019b) and groundwater screening levels are also provided in EPA's Directive No. 9283.1-47 (EPA 2019c). State-derived screening values should not be used for decision making at this time.

Since the result of the SI is typically either a recommendation for no further action (NFA) (Table, Scenario c), or initiation of a remedial investigation (RI), the SI report must provide substantiating evidence for either of these paths. As such, the SI may require more than one sampling event to adequately address data gaps to support the recommended path forward (Table, Scenario b).

Table: SI Example Scenarios

Scenario	Site Conditions	SI Recommendation
a	CSM and initial SI data confirm environmental PFAS concentrations greater than screening levels provided in ASD 2019b	Site proceeds to RI
b	CSM and initial SI data are inconclusive (e.g., not clear evidence of an environmental release)	Data gaps identified - additional samples may be collected (provided additional sampling is to determine if enough of a release occurred to support proceeding to an RI or to support a no further action (NFA) determination)
c	CSM and initial SI results confirm PFAS concentrations are non-detect or significantly less than screening levels provided in ASD 2019b	Site recommended for NFA

INV6. What should be expected regarding fate and transport of PFAS?

Current sampling results from previous investigations indicate the highest groundwater concentrations will likely be found near the source area and diminish with distance. Research data suggest that individual PFAS may differ in their affinity for each matrix as well as their rates of migration from a source. Although PFAS are very water soluble, some PFAS have been found in soils at FTAs that have been closed for years.

AFFF that was released at installations may have migrated to the subsurface, therefore potential PFAS-impacted soil or sediment may be an on-going source for PFAS impacts to groundwater and/or surface water.

Due to the emerging status and complex chemistries of PFAS, a clearer picture of environmental fate and transport is not available at this time. In an effort to begin answering some of these questions, the DoD has funded several Strategic Environmental Research and Development Program (SERDP) projects related to this topic.

INV7. What if PFAS may have reached a drinking water source?

If anytime during an investigation, a potential for drinking water exposure to an on-base or off-base human receptor is identified, the FEC should immediately (1) notify NAVFAC HQ, and (2) implement the drinking water sampling process for affected properties. NAVFAC Atlantic is a resource and has implementation plans, fact sheets, etc. from multiple investigations, which can be provided to expedite the initial actions.

If PFOS/PFOA are confirmed in drinking water above the EPA drinking water health advisories, then immediate actions must be taken to notify affected individuals and eliminate the exposure. For immediate response, this typically involves providing alternate (e.g., bottled) water for drinking and cooking until a long term solution is implemented.

If PFAS have migrated to drinking water wells, but do not have levels of PFOA and/or PFOS above the EPA drinking water health advisories, then a site-specific decision needs to be made regarding continued monitoring and the appropriate path forward in coordination with the ER Manager (for ER,N) or Base Closure Manager (for BRAC).

INV8. During the implementation of the RI/FS, to what concentrations is the nature and extent of PFAS delineated?

The Navy will follow approved EPA methods for PFAS analysis; however, only certain compounds will typically be used to define the nature and extent of impacted media from the Navy release (e.g., those compounds with vetted toxicity values which are currently PFOA, PFOS, and PFBS). In general, the soil screening levels for PFOA and PFOS available from ASD (2019b) and groundwater screening levels provided in EPA's Directive No. 9283.1-47 (EPA 2019c) should be used for the delineation of PFAS. It is expected that site-specific criteria may be developed to refine these criteria; RPMs should consult Echelon 3 support or their ER Manager (for ER,N) or Base Closure Manager (for BRAC) to ensure current information is considered.

INV9. What if a release is suspected to have migrated offsite?

If the CSM indicates that a historical release may have migrated offsite, then sampling may need to be initiated offsite to identify nature and extent and potential exposures. NAVFAC HQ should be notified before moving the investigation off-site. Coordination with legal and real estate will be needed to gain access to offsite properties.

INV10. How should investigation-derived waste (IDW) at PFAS sites be disposed?

Environmental investigations at potential PFAS sites will generate IDW. All IDW that is suspected to contain PFAS can be analyzed for these substances, and a copy of the analytical results should be provided to the disposal facility.

Currently no PFAS meet the Federal definition of hazardous waste, and therefore, solid material may be able to be disposed as non-hazardous solid waste. If incineration is considered, RPMs should consult NAVFAC HQ and their ER Manager (for ER,N) or Base Closure Manager (for BRAC) to ensure current information is considered.

For aqueous IDW, RPMs should consult with NAVFAC HQ and their ER Manager (for ER,N) or Base Closure Manager (for BRAC) for the most current technical considerations, limitations, and options.

FAQ - Risk Assessment

R1. What human health risk assessment screening levels are available?

Screening levels are currently available for a handful of PFAS. The EPA's Regional Screening Level (RSL) table includes the current screening levels for PFBS.

Currently, interim guidance from EPA (2019c) provides initial screening levels for PFOA and PFOS in groundwater. Soil screening levels for PFOA and PFOS are available from ASD (2019b).

R2. What human health toxicity values are available?

Currently there are no toxicity values for any PFAS available from the Tier 1 (i.e., EPA's Integrated Risk Information System [IRIS]) source.

Non-cancer toxicity values are currently available for PFOA and PFOS for the ingestion route of exposure (i.e., oral reference doses [RfDs]) (EPA 2016b; 2016c). The chronic noncancer RfDs for both PFOA and PFOS is 2E-05 milligrams per kilogram and day (mg/kg-day). For both chemicals, the values are based on developmental effects.

The EPA Office of Water also evaluated both PFOA and PFOS for potential carcinogenicity. The evidence for both compounds was only considered suggestive of carcinogenicity. The EPA Office of Water estimated a cancer slope factor (CSF) for oral exposure to PFOA of 0.07 $(mg/kg\text{-}day)^{-1}$. However, this is subject to uncertainty because the same assessment explained that the slope factor was estimated by EPA to provide "a sense of the magnitude of potential carcinogenic risk" (EPA 2016b). EPA determined that there is "Suggestive Evidence of Carcinogenic Potential of PFOA in humans" and typically a slope factor would not be derived for chemicals in this category.

ASD policy (ASD 2019b) allows for the PFOA and PFOS toxicity values mentioned above to be used in CERCLA investigations. As such, Navy is using these as Tier 3 toxicity values (DoD 2019).

A Tier 2 (i.e., EPA's Provisional Peer-Reviewed Toxicity Value [PPRTV]) oral reference dose is currently available for PFBS (EPA 2014b). The chronic Tier 2 noncancer RfD for PFBS is 0.02 mg/kg-day. This is based on kidney effects in a subchronic rat study. EPA also established a Tier 2 subchronic RfD of 0.2 mg/kg-day also based on kidney effects in a rat study.

Currently, inhalation toxicity values are not available for any PFAS.

For dermal exposures, RPMs should check with a Navy risk assessor regarding current guidance for this exposure pathway.

R3. Do PFAS need to be considered in the ecological risk assessment?

Yes, if the CSM includes complete exposure pathways for ecological receptors and there are accepted screening values provided in accordance with Question R4.

R4. What ecological risk assessment screening levels are available?

Currently EPA has not issued ecological screening values for any PFAS. Many scientific papers have been published that try to start establishing potential toxicity values for ecotoxicity of some PFAS, but data gaps still exist. As such, current approaches for ecological evaluations will likely need to be approached in a very site-specific manner. RPMs are encouraged to check with a Navy ecological risk assessor to determine the most current, appropriate site-specific approaches.

FAQ – Applicable or Relevant and Appropriate Requirements (ARARs) and/or To Be Considered (TBCs) Values

ARAR1. Are there Federal ARARs or TBCs for any PFAS?

At this time, no federal ARARs have been identified for PFAS. The EPA's drinking water lifetime health advisories for PFOA and PFOS are not ARARs, because the health advisories are not promulgated enforceable laws.

It may be appropriate to include the EPA drinking water health advisories as TBCs, or as measures of protectiveness. If the drinking water health advisories are identified as TBCs, they will have the effect of an ARAR when finalized in a decision document. However, if the drinking water health advisories are cited in establishing a risk-based level for the protection of human health, they do not have the effect of an ARAR. Consequently, risk-based protective levels are more flexible than ARARs or TBCs.

ARAR2. Are there state ARARs for any PFAS?

ARARs are identified on a site-specific basis. If a state identifies a potential ARAR in a timely manner, RPMs should consult with environmental legal counsel to conduct an ARAR analysis. This evaluation of state standards as potential ARARs is performed during the Feasibility Study (FS), consistent with CERCLA.

Several states have issued drinking water or other standards which will possibly be considered ARARs. It is important to note that several states also have general risk-based screening values for several PFAS in various environmental media; these are generally not ARARs.

RPMs should consult their ER Manager (for ER,N) or Base Closure Manager (for BRAC) to ensure current information is considered.

FAQ – Remedial Action Considerations

RA1. If sampling indicates presence of PFAS, is remedial action warranted?

A decision regarding whether a remedial action is warranted is based on a risk determination (See, for example, OSWER Directive 9355.0-30 [EPA 1991]). Potential risk is evaluated based on a risk assessment, and if there is unacceptable risk, potential chemical-specific ARARs should be evaluated. Note that the USEPA drinking water health advisories are not promulgated and do not qualify as potential federal ARARs. If a state identifies a potential state requirement, it is important that RPMs contact environmental counsel for a legal interpretation of whether the requirement is promulgated, and whether it is acceptable as a potential ARAR, TBC, or a risk-based value for evaluating protectiveness.

RA2. How should cleanup levels be established for PFAS?

As with any EC, it can be challenging to reach concurrence on the potential risk and/or cleanup levels for chemicals of potential concern with limited toxicity information, such as PFAS. Therefore RPMs should check with ER Managers (for ER,N) or Base Closure Managers (for BRAC) before agreeing to cleanup levels to ensure that the state of the science information is being appropriately considered**.**

The EPA's interim guidance (EPA 2019c) recommends the EPA drinking water health advisory can be used as an initial preliminary remediation goal (PRG).

If it is determined that a site warrants remediation, site-specific cleanup levels should be established in the same manner as other chemicals of concern (COCs). Cleanup levels must meet the two threshold National Oil and Hazardous Substances Pollution Contingency Plan (NCP) criteria, which are: (1) overall protection of human health and the environment, and (2) compliance with ARARs. The protectiveness of a cleanup level addresses the human and ecological risks identified in the RI as warranting a remedial action (i.e., cancer, non-cancer, or ecological risks, and risk-based chemical standards). Compliance with ARARs may introduce additional requirements that were not considered during risk characterization.

If potentially unacceptable risks are identified in the baseline human health risk assessment (HHRA), toxicity values can be used to estimate site-specific risk-based cleanup goals following standard risk procedures, i.e., cleanup goals should be within the cancer risk range (10^{-6} to 10^{-4}) and have a non-cancer hazard index of 1 or less. However, RPMs should be cognizant of the potentially significant uncertainty inherent in cleanup goals based on Tier 2 or Tier 3 toxicity criteria.

RA3. What treatment technologies are available for PFAS?

Before implementing any active remedy for these ECs the RPM should contact NAVFAC HQ. For other media (e.g., sediment, surface water), RPMs should consult their ER Manager (for ER,N) or Base Closure Manager (for BRAC) to ensure current information is considered.

<u>GROUNDWATER TREATMENT</u>

Currently, the leading technologies are to extract ground water and treat *ex-situ* with activated carbon, reverse osmosis, nano-filtration, and/or ion exchange. Ion exchange also shows promise

as a result of recent advances and development, with the potential advantage for on-site regeneration, which could reduce the overall amount of PFAS related remediation waste in the long-term. However, it is important to understand that these treatment processes can be impaired by other groundwater contaminants (e.g., chlorinated solvents) in addition to the high costs of operation. Therefore, the importance of completing treatability studies and/or pilot studies to evaluate the efficiency of these treatment technologies used solely, or in combination, to treat PFAS and other potentially present contaminants cannot be understated in assisting with designing and scaling up longer-term solutions. As technologies are tested and implemented using ex-situ filtration it can be important to understand not only the treatment of targeted PFAS (e.g., PFOS and PFOA), but also the treatment of non-targeted chemicals and their potential for passing through. For example, if there are additional PFAS in the plume, ex-situ filtration with release to surface water bodies, may unintentionally result in the release and spread of other PFAS. Because the toxicity of these other PFAS is not well defined at this time, the potential impact of their release to surface water is unknown.

Research is beginning to provide the potential for alternative strategies for groundwater impacted with PFAS. For example, there have been some promising bench scale studies that suggest oxidation-based technologies may have the capacity to break down these recalcitrant chemicals. The research is still in the early stages of development, but there is promise that alternative technologies are possible. However, this form of *in-situ* treatment is expected to potentially increase the amount of smaller-chained PFAS in the plume, as a byproduct of the oxidation. Because the relative toxicity of smaller chained PFAS has not been defined, this alternative runs the risk of potentially increasing the toxicity of the plume. Thus, treatment which breaks down the PFOA and PFOS to smaller chained PFAS should be approached with a high degree of caution until such time that there is a better understanding of the relative toxicity of these chemicals.

Lastly, research and demonstration into applying sorbents (e.g., activated carbon) *in situ* into PFAS impacted groundwater source areas, or incorporating them into permeable reactive barrier (PRB) or funnel and gate PRB approaches, to reduce or mitigate plume transport is also being assessed. These approaches, like other *in situ* groundwater remediation approaches for PFAS, are still being studied and validated for potential wider applications. However, if situations dictate the necessity to consider such options on a site-specific basis, the performance of treatability and/or pilot studies should be considered prior to any full-scale application to evaluate performance goals and the potential for development of unintended consequences or limitations that are not currently understood about these developing technologies.

SOIL TREATMENT

Remedial strategies for soils impacted with PFAS, like groundwater, are still continuing to develop, as the ability to assess PFAS impacted soils and their potential to leach to groundwater on a site-specific basis is not thoroughly understood at the current time. Removal and disposal (via *ex situ* treatment such as thermal destruction or disposal at an approved landfill) of PFAS impacted soils remains a potentially viable strategy, provided that appropriate disposal or treatment requirements are followed. Additionally, strategies for *in situ* treatment of PFAS impacted soil to reduce the leaching potential (e.g., stabilization via amendment addition) have been researched and demonstrated, but the long-term effectiveness of these approaches, as well as some potential site-specific limitations (e.g., effectiveness in different soil types) still remains uncertain. Lastly, recent environmental research and development is looking at other potential technologies to treat and reduce PFAS concentrations *in situ* in soil. However, these technologies are still being developed and their potential advantages and limitations are not fully understood at

this time. Therefore, as all potential remedial strategies for soil remediation are evaluated, if *in situ* approaches appear feasible and are considered, it is highly recommended that site-specific treatability studies, or in some cases small field pilots, be completed to further assess and support the viability and cost effectiveness of these approaches for broader field implementation.

FAQ – Land Use Controls (LUCs)

LUC1. Should LUCs be considered when PFAS are present?

LUCs may be used to limit contact when an unacceptable exposure risk has been determined in accordance with the guidance above.

In off-base scenarios, local and state governments may want to restrict current and future access to aquifers containing PFAS. Although DON has been eliminating current exposures to drinking water tested above EPA's health advisory levels at sites where PFOS or PFOA impacts from DON activities is suspected, some localities/states may want to do more to prevent future exposure. In coordination with these responses, and with future off-base investigation and response efforts, LUCs can be a helpful risk management tool for localities/states to help ensure future exposures to PFAS above risk-based concentrations will not occur. Coordination with local and state government agencies about their implementation of institutional controls in these situations is important.

On-base, LUCs may include both engineering controls (to contain/restrict) and institutional controls (administrative/legal devices) to limit exposure to PFAS. These controls may be put in place as a risk management tool before a decision document is in place. RPMs should the use LUC Tracker as required by NAVFAC Implementation of the LUC Tracker (DON 2011a).

FAQ - Five-Year Review (FYR) Issues

FY1. Should PFAS be considered during a FYR?

PFAS should be considered during FYRs if (1) it was a chemical of concern (COC) in accordance with the DON Policy for Conducting Five-Year Reviews (DON 2011b), or (2) it was not previously considered but the CSM indicates releases potentially have occurred. It is important to note that considering PFAS in the FYR because the CSM indicates the potential for PFAS to be present does not mean PFAS is an issue that affects protectiveness.

FY2. When are PFAS an issue that affects protectiveness?

When

- PFAS are known to be present at a site; and
- At least one PFAS is a COC (i.e., exposure to PFAS poses a potential unacceptable risk); and
- the existing remedy does not address PFAS,

then PFAS may affect protectiveness. In this case, PFAS should be evaluated as part of the protectiveness determination for the site, the same as any other COC.

FY3. How should I address the Navy program for conducting installation-wide PFAS PA/SIs in the FYR?

It is acceptable to acknowledge the Navy has initiated a program to conduct installation-wide PFAS PA/SIs in a proactive effort. If results of the installation-wide effort identify PFAS is present at a site that requires evaluation in the FYR then it should be considered in the FYR in accordance with the guidance above. It is not necessary to address or evaluate protectiveness of PFAS in the FYR if there is no connection with a site that requires evaluation in the FYR.

References

Assistant Secretary of Defense (ASD) 2019a. Memo: Establishing a Consistent Methodology for the Analysis of Per- and Polyfluoroalkyl Substances in Media Other that Drinking Water. 22 Nov 2019

ASD 2019b. Memo: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. 15 Oct 2019.

ASD 2020a. Memo: Monitoring of Per- and Polyfluoroalkyl Substances Sampling for Installations with Non-Department of Defense Drinking Water. 23 Jul 2020.

ASD 2020b. Memo: Per- and Polyfluoroalkyl Substances Sampling of Department of Defense Drinking Water Systems. 02 Mar 2020.

Chief of Naval Operations (CNO), N45, 2020. Memo: Navy Policy Assessment of Potential PFAS Releases on Operational Ranges. 6 April 2020.

Department of Defense (DoD) 2019. Instruction 4715.18. Emerging Contaminants (ECs) of Environmental Concern. 4 September 2019.

Department of the Navy (DON) 2011a. Memo 5090 Ser/11009/ENC-RS. Implementation of the Land Use Control (LUC) Tracker. 27 July 2011.

DON 2011b. DON CNO memo (5090 N453 Ser/11U158119). Policy for Conducting Five-Year Reviews. 7 June 2011.

DON 2014. ASN (EI&E) Memo - Perfluorinated Compounds (PFCs) – An Emerging Environmental Issue. 21 Oct 2014.

DON 2016. ASN (EI&E) memo Policy Memo - Perfluorinated Compounds/Perfluoroalkyl Substances (PFC/PFAS) - Identification of Potential Areas of Concern (AOCs). 20 Jun 2016.
DON 2018. Environmental Restoration Program Manual.

United States Environmental Protection Agency (EPA) 1991. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. OSWER Directive 9355.0-30. 22 April 1991.

EPA 2009. Method 537. Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). Version 1.1. EPA/600/R-08/092. September 2009.

EPA 2014a. Emerging Contaminants – Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA). March. (online at: http://www2.epa.gov/sites/production/files/2014-04/documents/factsheet_contaminant_pfos_pfoa_march2014.pdf).

EPA 2014b. Provisional Peer-Reviewed Toxicity Values for Perfluorobutane Sulfonate (CASRN 375-73-5) and Related Compound Potassium Perfluorobutane Sulfonate (CASRN 29420-49-3). Superfund Health Risk Technical Support Center; National Center for Environmental Assessment; Office of Research and Development. 17 July 2014.

EPA 2016a. FACT SHEET: PFOA & PFOS Drinking Water Health Advisories. May 2016.

EPA 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA). EPA 822-R-16-005. Office of Water, Washington, DC. May 2016.

EPA 2016c. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS). EPA 822-R-16-004. Office of Water, Washington, DC. May 2016.

EPA 2019a. EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan. EPA 823R18004. February 2019.

EPA 2019b. Method 533: Determination of Per- and Polyfluoroalkyl Substances in Drinking Water by Isotope Dilution Anion Exchange Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry. December 2019.

EPA 2019c. Interim Recommendations to Address Groundwater Contaminated with Perfluorooctanoic Acid and Perfluorooctanesulfonate. OLEM Directive No. 9283.1-47. 19 December 2019.

EPA 2020. Method 537.1 Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). Version 2.0. EPA/600/R-20/006. March 2020.

Interstate Technology and Regulatory Council (ITRC) 2020. Fact Sheets webpage: https://pfas-1.itrcweb.org/fact-sheets/ which includes:

- Naming Conventions and Physical and Chemical Properties (updated April 2020)
- Regulations, Guidance, and Advisories (updated April 2020)
- History and Use (updated April 2020)
- Environmental Fate and Transport (published April 2020)
- Physical and Chemical Properties Table for select PFAS Excel file (updated April 2020)
- Site Characterization Considerations, Sampling Precautions, and Laboratory Analytical Methods (published April 2020)
- Aqueous Film-Forming Foam (published April 2020)

OPNAV N45 (N452 & N453) 2019. Interim Guidance on the Assessment of Potential PFAS Releases on Navy/Marine Corps Operational Ranges. 25 July 2019.

Interim Per- and Polyfluoroalkyl Substances (PFAS) Site Guidance for NAVFAC Remedial Project Managers (RPMs)

November 2020 Update

APPENDIX A: Approved Per- and Polyfluoroalkyl Substances (PFAS) Analytical Methods and Analyte Lists

Version 1.0 (November 2020)

PURPOSE:

Due to the evolving state of science in the development of PFAS analytical methods (i.e., the existence of multiple analytical methods which report slightly different target analytes), general information pertaining to PFAS test methods and analyte lists is provided within the *Interim Per- and Polyfluoroalkyl Substances (PFAS) Site Guidance for NAVFAC Remedial Project Managers (RPMs).* This appendix provides detailed information on PFAS analytical methods and analyte lists and Naval Facilities Engineering Systems Command's (NAVFAC's) approach for analyzing PFAS in frequently sampled media in Defense Environmental Restoration Program (DERP) projects. This appendix will be updated as new test methods are approved and U.S. Environmental Protection Agency (EPA) and Department of Defense (DoD) issue guidance and directives regarding their appropriate use, and as directed by NAVFAC Headquarters (HQ).

NAVFAC supports all DoD policies regarding PFAS analysis and reporting. Additionally, laboratory accreditation is crucial to data integrity and the Navy's ERP and therefore, only laboratories with specific method accreditation[1] for target analytes shall be used for ERP projects. All laboratories used for ERP projects must be accredited through the DoD Environmental Laboratory Accreditation Program (ELAP); additionally, some states have their own accreditation requirements that laboratories must attain to perform analysis for DERP projects.

Regardless of the test method, there are only limited PFAS for which toxicity and screening criteria are available for use in decision making[2]. NAVFAC currently recommends the following:

DRINKING WATER ANALYSIS

Currently, the final EPA methods for finished drinking water are:

[1] May also be called a 'Scope of Accreditation Certificate.'

[2] For specific information on PFAS toxicity and screening refer to Interim Per- and Polyfluoroalkyl Substances (PFAS) Site Guidance for NAVFAC Remedial Project Managers (RPMs) (NAVFAC, November 2020 Update), ASD guidance memo dated 15 October 2019 titled "Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program" and EPA's Directive No. 9283.1-47, 19 December 2019.

- Method 533 (EPA 2019[3]), which focuses on "short chain" PFAS (i.e., those with carbon chain lengths of 4 to 12) and includes 25 target analytes, and
- Method 537.1 (EPA 2020[4]), which includes 18 target analytes (Note: Four PFAS included in this method are not included in Method 533).

While both are final drinking water analytical methods, current DoD PFAS drinking water policies (ASD 2020a[5]; 2020b[6]) require use of Method 537.1. NAVFAC supports DoD policy regarding drinking water analysis and reporting of analytes specified in EPA Method 537.1, so at this time only Method 537.1 should be used for drinking water samples collected as part of the DERP. This means drinking water analyses will report results for 18 PFAS[7].

Since the analyte lists are slightly different between Method 537.1 and Method 533 (which combine to 29 different PFAS), some RPMs may be asked to use both methods to analyze drinking water samples. NAVFAC is implementing DoD policy consistently and therefore **not** supporting that both drinking water methods be analyzed together (per sample), in order to encompass both analyte lists (i.e., 29 total PFAS).

ANALYSIS OF ALL OTHER MATRICES

There currently are no published final EPA methods for media other than drinking water. The Assistant Secretary of Defense policy memorandum "*Establishing a Consistent Methodology for the Analysis of Per- and Polyfluoroalkyl Substances in Media Other that Drinking Water"* (22 November 2019) will be followed when required to conduct sampling and analysis of environmental media. This policy requires the use of the current version of the DoD Quality Systems Manual (QSM), Appendix B, Table B-15 (*Per- and Polyfluoroalkyl Substances (PFAS) Using Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS) With Isotope Dilution or Internal Standard Quantification in Matrices Other Than Drinking Water*) to ensure appropriate levels of quality assurance and quality control (QA/QC) are maintained when performing analysis of these media. Although the QSM establishes sample preparation and analysis criteria for these media, it does not define a specific PFAS analyte list. As such, there is no standardized list of PFAS analytes amongst the DoD-ELAP accredited laboratories when analyzing these environmental media. For data consistency within the DERP, NAVFAC currently recommends the 18 analytes listed in Method 537.1 be analyzed within these environmental media.

If the project team sees value in collecting additional analyte data, then an expanded analyte list can be used provided the following conditions are met:

---

[3] Method 533: Determination of Per- and Polyfluoroalkyl Substances in Drinking Water by Isotope Dilution Anion Exchange Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry. December 2019

[4] Method 537.1 Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). Version 2.0. EPA/600/R-20/006. March 2020.

[5] Assistant Secretary of Defense (ASD) 2020a. Memo: Monitoring of Per- and Polyfluoroalkyl Substances Sampling for Installations with Non-Department of Defense Drinking Water. 23 Jul 2020.

[6] ASD 2020b. Memo: Per- and Polyfluoroalkyl Substances Sampling of Department of Defense Drinking Water Systems. 02 Mar 2020.

[7] Laboratories must have accreditation not only for a specific test method, but also for each analyte on the target list for that method.

- The laboratory's DoD-ELAP certificate identifies each analyte per matrices
- The project team has a use for the data, and developed appropriate data quality objectives (DQOs) in the sampling and analysis plan (SAP).
    - An example of the use of the expanded PFAS analyte list might be applicable to a Remedial Investigation (RI), particularly if the goal was to find the source of PFAS. An expanded analyte list could possibly help with fingerprinting of PFAS from an aqueous film forming foam (AFFF) source rather than from other PFAS sources (e.g., specialized plastics).
- Approval from the Environmental Restoration (ER) Manager during the planning phase, before SAP review and sample collection.

BIOTA SAMPLING

RPMs should not proceed with tissue analysis until a multi-laboratory validated and final EPA published method is available. As a media class, biota tends to be a more complex matrix than other media, thus requiring a more prescriptive, extensive sample preparation in order to release PFAS from the sample matrix and render it extractable (commonly called extraction efficiency). A multi-laboratory validated method for preparation is needed to help ensure that the PFAS content in biota media is extracted and matrix interferences that cause quantitative bias and elevated quantitation limits are reduced to the greatest extent possible. Without such a method, methods employed by laboratories can vary greatly in this respect, and as a result, greatly increase the inter-laboratory variability when comparing reported PFAS sample concentrations.

If site-specific reasons dictate that biota evaluation is required before a valid final method is available, there are quality control elements that should be included in projects to further evaluate the inter- and intra-laboratory variability and bias associated with biota results. These elements can include, but are not limited to the following:

- performing laboratory split sample analyses,
- duplicate analysis on each sample,
- matrix spike analysis at a greater frequency,
- analysis of a standard reference material (SRM) of biota (https://www-s.nist.gov/srmors/browseMaterials.cfm?subkey=9&tableid=247) with the extraction of each sample batch.

Until such time that a final EPA published and multi-laboratory validated method is available, collection and analysis of tissue data at a Navy site should be vetted through appropriate management, applicable NAVFAC quality assurance officers (QAOs), and NAVFAC HQ.

Interim Per- and Polyfluoroalkyl Substances (PFAS) Site Guidance for NAVFAC Remedial Project Managers (RPMs)

November 2020 Update

APPENDIX B

Talking Points: Awareness Regarding Potential PFAS Releases from Off-Base Fire Response Actions by Navy and Marine Corps First Responders

Version 1.0 (November 2020)

PURPOSE:

The purpose of this document is to provide talking points for Naval Facilities Engineering Systems Command (NAVFAC) remedial project managers (RPMs) when they are supporting the installation communicating with local agencies about historical off-base emergency responses by Navy or Marine Corps emergency responders, which could have included releases of aqueous film forming foam (AFFF) containing per- and polyfluoroalkyl Substances (PFAS).

Many Navy and Marine Corps Installations have provided off-base emergency response support, including firefighting support, to local and state agencies through various types of agreements. The Navy is addressing on-base environmental releases of PFAS under the federal cleanup program established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). As part of the base-wide Preliminary Assessments (PAs) being conducted under CERCLA, it is likely that off-base emergency support actions will also be identified. Since historical off-base emergency response support could have resulted in the potential release of PFAS to the environment through the use of fire-fighting foam (specifically certain types of AFFF), RPMs should retain this information. However, since any remedial action for these off-base releases are not authorized under the Defense Environmental Restoration Program (DERP), these should not be documented through CERCLA (e.g., PAs). The information pertaining to emergency responses and potential releases of AFFF will be documented as such, and provided to local agencies for awareness. Following are talking points to consider when presenting this information with local agencies.

1. Department of the Navy (DON) is proactively investigating and responding to potential PFAS releases that may have impacted communities near our installations.
    a. DON is conducting PAs under CERCLA at our installations to identify historical on-base releases of PFAS to the environment; locations of off-base releases were also discovered during the PA data collection process.
    b. DON is evaluating potential off-site impacts from these on-base PFAS releases that may have migrated off-base, and implements response actions to mitigate drinking water exposure to community members with perfluorooctanoic acid (PFOA) and/or perfluorooctane sulfonate (PFOS) above the U.S. Environmental Protection Agency (EPA) lifetime health advisory of 70 parts per trillion (ppt).

2. Navy/Marine Corps fire departments have provided fire-fighting resources at off-base fire emergencies to support and protect neighboring communities
    a. Mutual Aid agreements provide a legal framework for Navy/Marine Corps to provide support off-base.
    b. Navy/Marine Corps has provided fire-fighting support off-base for military crashes, local fires, wildfires, and other emergency events to ensure the safety of the community.

c. PFAS-containing AFFF may have historically been used at some of these off-base responses by both Navy/Marine Corps and local fire departments; in many cases there is limited information regarding the locations, responding activities, and usage for AFFF by DON and other responding activities.

3. DON is committed to being a collaborative and transparent partner with local agencies as they work towards investigating and identifying PFAS impacts.
    a. Under the Defense Environmental Restoration Act, which establishes DON's cleanup program, DON only has authority to respond if the PFAS release was on a base and migrates off-base (e.g., through groundwater).
    b. While DON does not have the authority to respond using DERP funds, we are providing this information to agencies that may have authority to investigate, respond, or take other actions as they deem appropriate.

Interim Per- and Polyfluoroalkyl Substances (PFAS) Site Guidance for NAVFAC Remedial Project Managers (RPMs)

November 2020 Update

APPENDIX C: Acronyms

AFFF	aqueous film forming foam
AOC	area of concern
ARAR	Applicable or Relevant and Appropriate Requirement
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CNO	Chief of Naval Operations
COC	chemical of concern
CSF	cancer slope factor
CSM	conceptual site model
CWA	Clean Water Act
DASN (E)	Deputy Assistant Secretary of the Navy (Environment)
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DON	Department of the Navy
DQO	data quality objective
EC	emerging chemical
EDQW	Environmental Data Quality Workgroup
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ER,N	Environmental Restoration, Navy
FEC	Facilities Engineering Command
FTA	firefighting training area
FYR	five-year review

HHRA	human health risk assessment
HQ	Headquarters
IDW	investigation-derived waste
IRIS	Integrated Risk Information System
ITRC	Interstate Technology and Regulatory Council
LUC	land use control
MIL-SPEC	Military Specification
NAVFAC	Naval Facilities Engineering Systems Command
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	no further action
ng/L	nanogram per liter
PA	preliminary assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutane sulfonate
PFC	perfluorinated compounds
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
ppt	parts per trillion
PRB	permeable reactive barrier
PRG	preliminary remediation goal
PRP	potentially responsible party
PT	proficiency testing
QAO	quality assurance officer
QA/QC	quality assurance and quality control
QPL	qualified products list
QSM	Quality Systems Manual
RfD	reference dose
RI/FS	remedial investigation/feasibility study
RPM	remedial project manager
RSL	regional screening level

SAP	sampling and analysis plan
SDWA	Safe Drinking Water Act
SERDP	Strategic Environmental Research and Development Program
SI	site inspection
SOP	standard operating procedure
TIPS	Technical Insight and Problem Solving
TBC	to be considered