Interim
Air Force Guidance
On Sampling and Response Actions for
Perfluorinated Compounds at Active and BRAC Installations

27 Aug 2012

1**. Summary**. Perfluorinated compounds (PFCs) are classified as emerging environmental contaminants based on increasing regulatory interest, potential risk to human health and the environment, and evolving regulatory standards. Some Air Force installations have received requests from regulators to environmental sampling for PFCs. The Air Force will exercise due diligence to protect human health and the environment. Requests for action on PFCs will be addressed on a case-by-case basis when a regulatory driver, direct human exposure, and/or off-site migration is identified. In the absence of a regulatory driver, the Air Force will respond to emerging contaminants such as PFCs at targeted Air Force restoration sites in a systematic manner informed by site-specific exposure data and supporting evaluation of potential risk. The systematic evaluation will begin with fire training areas (FTAs) that were operable between 1970 and 2000. Sampling, when authorized, will be executed as a standalone activity using an appropriate contract mechanism. It is not appropriate to address PFCs under Performance Based Remediation Contracts (PBR) at this time because of the lack of a clear legal drivers and specific performance objectives. Results of initial sampling will confirm release, identify sites with potential PFC contamination, and provide necessary input for planning, programming, and budgeting for follow-on efforts. Upon confirmation of release, delineation and potential response actions for PFCs will be approved by AFCEE/ER (active installations) or AFRPA/BPM (BRAC installations), and coordinated with installation Bioenvironmental Engineering (BE) flight as separate steps.

This guidance will:

- Provide installation RPMs and Base Environmental Coordinators (BECs) with a response to regulator request for PFC sampling
- Provide guidance for initiating Air Force Enterprise-wide strategy for PFCs
- Provide supporting technical information for analysis and risk assessment
- Be updated periiodically to reflect the evolving understanding of the environmental characteristics and risks associated with PFC exposure

2. **Background.** PFCs are a class of synthetic fluorinated chemicals used in many industrial and consumer products, including defense-related applications. They are persistent, found at low levels in the environment, and bioaccumulate. PFCs have demonstrated toxicity, but levels that cause effects are not yet established. In 1970, the Air Force began using Aqueous Film Forming Foam (AFFF) fire fighting agents containing PFCs to extinguish petroleum fires. AFFF can contain and degrade into

perfluorooctane sulfonate (PFOS), and may further degrade into perfluorooctoanoic acid (PFOA). During fire training, equipment maintenance, and use, AFFF was released directly to the environment. Although manufacturers have reformulated AFFF to eliminate PFOS, EPA continues to permit use of PFOS-based AFFF and the Air Force maintains a significant inventory of PFOS-based AFFF product.

Because the number of PFC contaminated Air Force sites and the extent of impacted groundwater and soil contamination is unknown, AFCEE/TDV initiated limited environmental sampling at targeted locations based on previous activities. This limited sampling demonstrated potential for PFC release at unlined Air Force FTAs that were in operation between 1970 and 2000.

3. **Regulatory Requests for Sampling**. Requests for environmental sampling for PFCs by regulatory agency officials will be addressed on a case-by-case basis. Upon receiving a request for sampling of PFCs, the installation must notify AFCEE/ER (active installations) or AFRPA/BPM (BRAC installations) prior to agreement to initiate any PFC-related sampling action.

A. The base must receive, in writing, (letter or e-mail) the request for sampling citing the specific local, state or federal statute, regulation or written enforceable agreement driving the requirement. If there is a legal requirement, the installation must then:

    1. Describe a reasonable basis to suspect a potential release of PFCs that is associated with Air Force activities at specific locations on the installation.

    2. Determine if an exposure pathway exists for the probable contamination to threaten public health and/or if potential for offsite migration is likely.

    3. Coordinate and obtain authorization from the AFCEE/ER (active installations) or AFRPA/BPM (BRAC installations). AFCEE/ER or AFRPA/BPM will validate the possibility of an environmental release and the legal basis for requested sampling with AFLOA/JACE-FSC, and coordinate technical issues with AFCEE/TDV before authorizing sampling.

    4. Program for initial sampling as a standalone contracting action.

B. In the absence of a legal requirement, the installation shall discuss with regulators the Air Force approach to systematically addressing potential responses to PFC releases Air Force–wide at targeted Air Force environmental restoration sites (see Section 4 below).

C. Initial sampling, when authorized, should be a one-time event, and the quality assurance project plan for such efforts should comply with the technical guidance in Section 1, ATCH 1. Initial sampling should not be included with ongoing remedial action operation or long term monitoring work plans.

4. **Air Force Restoration Enterprise-Wide Response to Possible Release of PFCs.** Per DoDI 4715.18, *Emerging Contaminants*, in the absence of an applicable legal driver, the Air Force may confirm a possible release of an emerging contaminant such as PFCs, followed by delineation, if: a reasonable basis exists to suspect a potential release associated with Air Force activities at an installation; an exposure pathway exists for the probable contamination to threaten public health; and/or potential for off-site migration is likely.

A. This Air Force guidance initiates a step-wise Air Force strategy. Step 1 is to confirm an environmental release of PFCs has occurred. Step 2 is to delineate the extent of PFC contamination and conduct a pathway evaluation to determine potential risk to human health or off-site migration as described in Section 2, ATCH 1. Step 3 is to mitigate, on a case-specific basis, any validated human exposures with interim action until promulgated cleanup standards and improved remedial technologies are available. If circumstances warrant, such as to expedite property transfer, AFRPA may seek SAF/IEE approval through its chain of command to implement a final mitigation strategy.

B. AFCEE/ER (active installation) or AFRPA/BPM (BRAC installation) will validate the program funding requests and coordinate technical issues with AFCEE/TDV before authorizing sampling.

1. Programming funds for initial sampling is anticipated at the FY 2014 budget submission, with initial sampling to occur in FY 2015.

2. Programming funds for delineation of extent of PFC release and evaluation of potential risk to human health and/or off site migration (based on initial sampling results) is anticipated in FY 2016, with activities to delineate extent of PFC contamination to occur in FY 2017.

3. In the absence of a regulatory requirement for PFCs, the Air Force will respond to validated human exposure to PFCs with appropriate interim action to mitigate exposures. Programming funds for potential interim response actions will be considered at sites where the extent of release is delineated and a human exposure pathway is complete and/or off-site migration has been identified and is anticipated after FY 2017.

4. Programming funds and authorization for interim action before FY 2018 in response to human exposure will be addressed on a case-specific basis. The Air Force will exercise due diligence to protect human health and the environment.

5. **Initial Confirmation Sampling of PFCs at Targeted Air Force Environmental Restoration Program Sites.** Step 1 of the Environmental Restoration Program (ERP) Air Force-wide strategy for addressing potential environmental contamination of PFCs

above the EPA Office of Water provisional health advisory (PHA) levels is initial sampling to confirm a possible environmental release of PFOS at concentrations greater than or equal to 0.2 µg/L, and of PFOA at concentrations greater than or equal to 0.4 µg/l in ground water. Each active Air Force installation in the United States with a FTA that was operable between 1970 and 2000 must prepare a Project Cost Estimating Assumptions Document (PCEAD) to program funds for initial sampling. It is assumed that each FTA will have a previously assigned site identifier in EESOH-MIS and results of prior investigation to inform work planning. The sampling activity will be programmed according to the current EESOH-MIS site status or, if the site is at Site Completion, as an AFCEE/ER (active installations) or AFRPA/BPM (BRAC installations)-validated "new site".

A. Data collected from sampling should be of sufficient quality and quantity to definitively confirm if PFCs are present within known site boundaries. Please refer to the attached "Technical Support Guidance: Section 1" for information on Analytical methods.

B. AFCEE/TDV will continue preliminary evaluation of other potential PFC release locations to determine whether more locations associated with other activities and systems need to be considered. Objectives of initial PFC sampling actions at FTAs will be to confirm release and identify potential human exposure and/or off-site migration.

6. **Response Actions Following Confirmation of PFC Contamination:** Step 2 of the Environmental Restoration Program AF-wide strategy for addressing potential environmental contamination of PFCs is delineation of confirmed environmental releases. Following confirmation of an environmental release at concentrations greater than or equal to the thresholds of 0.2 µg/L for PFOS and 0.4 µg/L for PFOA, the potential for human and environmental risk must be evaluated. The installation will prepare follow-on PCEADs, validated by AFCEE/ER (active installations) or AFRPA/BPM (BRAC installations), for delineation of the extent of the PFC release and evaluation of risk to human health and off site migration based on initial sampling results.

For purposes of this guidance "delineation" is defined as determination of the length, depth and width of impact to soil, groundwater, surface water, and sediment. Delineating the extent of a release requires sampling, analysis, validation, pathway analysis, risk evaluation, and reporting activities. This information must be of sufficient quality to define the magnitude of groundwater, subsurface soil, surface water, and/or sediment PFC contamination. Coordination with regulatory agencies is necessary to determine appropriate Data Quality Objectives and project design. If agreement cannot be reached at the installation level, consult with AFCEE/ER (active installations) or AFRPA/BPM (BRAC installations) to determine an appropriate course of action.

Any detection of PFOS at concentrations greater than or equal to the 0.2 µg/L, and of PFOA at concentrations greater than or equal to 0.4 µg/L, in ground water requires risk evaluation and pathway assessment. Please see Attachment 1*: Supporting Technical*

Information: Section 2 *Risk Evaluation and Pathway Assessment* at page 7 for information on risk evaluation and pathway assessment.

7. **Response Actions Following Delineation of PFC Contamination:** Step 3 of the Environmental Restoration Program Air Force-wide strategy for addressing potential environmental contamination of PFCs is to determine whether an interim response action is warranted. At BRAC installations, program managers should consult with AFRPA/BPM as to whether a remedy needs to be final or interim. Based on the evaluation of risk and the potential for human exposure (e.g., drinking water is affected) or if there is off-site migration, it may be necessary to initiate interim response actions. The current US EPA OSRTI sub chronic toxicity values (described in the attached "*Supporting Technical Information*: Section 3") are not appropriate to derive final remedial actions. However, screening values developed using these values may be used to inform the need for site-specific interim actions. Interim response to reduce risk may include plume migration control, provision of drinking water, land use controls, or monitoring until appropriate risk-based values are identified.

When delineation and pathway assessment indicate a response action is warranted, the proposed response will be evaluated to determine whether it is appropriate to integrate the response into the restoration program. When an action is warranted, consult with AFCEE/ER (active installations) or AFRPA/BPM (BRAC installations) to determine whether to prepare a standalone PCEAD for each site, or integrate the programming requirement into on-going remediation requirements. AFCEE/ER will notify HQ USAF/A7CA of instances in which a response action has been found to be warranted. AFRPA/BPM will notify SAF/IEE through its chain of command of instances in which a response action has been found to be warranted. Programming funds for potential response action is anticipated after FY 2017 unless a case-specific response to mitigate validated human exposure is warranted. All funding requirements will be validated by AFCEE/ER (active installations) or AFRPA/BPM (BRAC installations). Coordinate findings addressing confirmation of release, delineation and potential response actions for PFCs, with the installation BE flight. The BE flight will sample the base drinking water supply when knowledge gained from environmental sampling indicates the system may be impacted.

8. **Reporting and Data Management.** Active and BRAC installations will submit data on PFC sampling (e.g., location and media sampled, results, etc.) to AFCEE/ERD (ERPIMS data group). AFCEE/ER in coordination with AFCEE TDV will validate the accuracy of the data and compliance with Air Force and DoD policies. All validated PFC sampling data submitted to ERPIMS and reports of potential release investigation submitted to AFCEE/ER will be retained as part of the installation Administrative Record.

9. **Conflict Resolution.** Air Force and regulators should strive to agree on how and when to sample for PFCs, the means to determine the nature and scope of the risk to human health and the environment and the response actions needed in accordance with DoDI 4715.18 References (e) and (f). Should the public or regulator disagree with the

Air Force about potential PFC contamination and/or possible exposure routes and additional sampling, the issue should be elevated for resolution to AFCEE/ER (active installations) or AFRPA/BPM (BRAC installations) and AFLOA/JACE-FSC. The AFCEE Regional Environmental Offices in Atlanta, GA; Dallas, TX; and San Francisco, CA (AFCEE/TDA/TDC/TDW) provide assistance within their respective regions.

10. **Public Affairs.** All communication with the public and/or the media regarding potential or confirmed PFC contamination shall be reviewed and approved prior to release by the BE flight and the Air Force Public Affairs office responsible for the installation in question. AFCEE/ER (active installations) or AFRPA/BPM (BRAC installations) and AFLOA/JACE-FSC must also review and approve communication with the public and/or the media before release. The responsible Public Affairs office shall furnish a copy of this information to SAF/PAO. Risk communication support will be considered during response planning and implementation for sites involving human exposure when appropriate.

Attachment 1:

Supporting Technical Information:

1. **Analysis.** Analysis will be performed using a combination of liquid chromatography and tandem mass spectrometry (LC-MS-MS) methodology in accordance with guidance developed by the DoD Environmental Data Quality Workgroup (EDQW) and supported with appropriate quality assurance and quality control measures. Analysis will include six PFCs:

    a. Perfluorooctanesulfonic acid (PFOS),

    b. Perfluorohexanesulfonic acid (PFHXS),

    c. Perfluorooctanoic acid(PFOA),

    d. Perfluoroheptanoic acid(PFHPA),

    e. Perfluorononanoic acid (PFNA) and

    f. Perfluorobutanesulfonic acid (PFBS).

    USEPA Method 537 provides for the analysis of PFCs in drinking water and commercial labs have developed standard operating procedures for the analysis of PFCs in other media (soil, sediments, and groundwater). All of these methods use LC/MS/MS instrumentation. Laboratories must be accredited for PFC analysis under the DoD Environmental Laboratory Accreditation Program (ELAP).

Table 1 – Recommended Methods for PFC Analysis

Method (Technique)	Applicability	Limitations	Target Reporting Limits
EPA 537 Rev 1.1 LC-MS-MS	Drinking Water	Validated for drinking water samples only	PFOS 20.0 ng/L PFOA 40.0 ng/L
LC-MS-MS	Groundwater		PFOS 20.0 ng/L PFOA 40.0 ng/L
LC-MS-MS	Soil		PFOS 0.5 mg/kg PFOA 1.2 mg/kg

Should installations have questions or concerns regarding sample collection techniques, sample volumes required, analysis method, etc., prior to conducting PFC sampling, they should contact AFCEE TDV (all media), or the approved lab conducting the analyses. Additional guidance with more procedural detail will be provided separately.

If groundwater sample concentrations of the four non-PFOS or PFOA PFCs are found to exceed 0.2 µg/L, consult with AFCEE/ER (active installations) or AFRPA/BPM (BRAC installations) to determine a recommended course of action.

2. **Risk Evaluation and Pathway Assessment.** There is little guidance on evaluating associated risks from human or ecological exposure to PFCs. When warranted, site-specific risk assessment in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Defense Environmental Restoration Program (DERP), and/or the National Contingency Plan (NCP) will be accomplished to evaluate the extent of actual or potential exposure and risk.

A. The USEPA Office of Water (OW) established sub chronic Provisional Health Advisories (PHAs) for PFOS (0.2 µg/L) and PFOA (0.4 µg/l) for drinking water. EPA health advisory values are non-enforceable concentrations of drinking water contaminants. Note: the OW is currently revising these values with updated level expected by mid-2013.

B. The USEPA Office of Superfund Remediation and Technology Innovation (OSRTI) developed sub chronic toxicity values for PFOA (2E-4 mg/kg/day) and PFOS (8E-5 mg/kg-day) for oral exposures.

C. AFCEE/TDV calculated soil screening values based on the OSRTI (residential, direct contact) for PFOS, at 5 mg/kg and PFOA at 12 mg/kg.

D. State regulatory agencies (e.g. Minnesota, New Jersey, and North Carolina) have also established their own advisory levels for drinking water and groundwater. Additionally, several other states are currently discussing adopting pre-existing or deriving de novo toxicity values to set enforceable remedial objectives.

E. Pathway assessment shall include the development of a conceptual site model (CSM) to verify and evaluate completed exposure pathways. At a minimum, the assessment should:

    1. Determine and confirm a release of PFCs and that a drinking water source has been or may be impacted.

    2. Verify whether any drinking water systems on or near the Air Force installation have been sampled for PFCs or if PFCs have otherwise been detected.

    3. Establish through personal knowledge/interviews and record searches whether any soil or sediment potentially contaminated with PFCs that may threaten public health has or could be used for material, topsoil, or other uses on or off the installation.

4. Review existing documentation of environmental sampling/testing and/or hydrogeological investigations conducted for other contaminants at the site and other relevant information provided by personnel. Determine the direction of groundwater flow and proximity of potential PFC sources to drinking water wells on and/or off an Air Force installation. Note: sampling and analysis for PFOS and PFOS has not typically been accomplished during previous investigations.

5. Confirm that an actual or potential complete exposure pathway exists from source to receptor.

6. Provide Installation remedial restoration project and water quality managers' data to work with regulators and the public, as appropriate, to discuss potential exposure scenarios and pathways.

3. **Remedial Investigation/Site-Specific Risk Assessment.**

A. The USEPA Office of Superfund Remediation and Technology Innovation (OSRTI) developed sub chronic toxicity values for PFOA (2E-4 mg/kg/day) and PFOS (8E-5 mg/kg-day) for oral exposures. The current US EPA OSRTI sub chronic toxicity values (described above) are not appropriate to derive remedial actions. However, screening values developed using the US EPA OSRTI values may be used to inform the need for site-specific interim actions (i.e. to mitigate a complete human exposure pathway or off- site migration).

B. The site-specific risk assessment will be based on delineation of the release (extent of impact to soil and groundwater at the site) and appropriate site-specific assumptions about exposure. Where a site-specific risk assessment indicates PFC concentrations could potentially result in unacceptable risk, the site will be prioritized for potential response action in accordance with the DoD relative risk assessment process. Risk shall be assessed using the toxicity values approved by AFCEE/TDV in accordance with DoDI 4715.18 Enclosure 3, unless there are promulgated applicable or relevant and appropriate requirements (ARARs) that dictate the use of another value. Coordinate with AFCEE/ER (active installations), AFRPA/BPM (BRAC installations) and AFCEE/TDV to identify the most scientifically valid and appropriate toxicity values and risk assessment methodologies.