

Department of Defense
Alternatives to Aqueous Film Forming Foam
Report to Congress



June 2018

Under Secretary of Defense
for Acquisition and Sustainment

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Appendix A: DoD Policy Memorandums Regarding the Control, Disposal, and/or Replacement of AFFF Containing PFOS or PFOA

Introduction

Section 1059 of the National Defense Authorization Act for Fiscal Year (FY) 2018, directs the Secretary of Defense to submit a report on the following requirements:

1. A detailed explanation of the Department of Defense's (DoD) status with respect to developing a new military specification (MILSPEC) for safe and effective alternatives to Aqueous Film Forming Foam (AFFF) that do not contain perfluorooctane sulfonate (PFOS) or perfluorooctanoic acid (PFOA);
2. An update on DoD's plans for replacing AFFF containing PFOS or PFOA at military installations across the country and methods of disposal for AFFF containing PFOS or PFOA;
3. An overview of current and planned research and development for AFFF alternatives that do not contain PFOS or PFOA; and
4. An assessment of how the establishment of a maximum contaminant level (MCL) for PFOS or PFOA under the Safe Drinking Water Act (SDWA) rather than the current health advisory level, would impact DoD's mitigation actions, prioritization of such actions, and research and development related to PFOS and PFOA.

Background

PFOS and PFOA are part of a large group of man-made chemicals used in many industrial and consumer products to make them resistant to heat, stains, water, and grease. These substances are ubiquitous in industrial and consumer products and are not uniquely attributable to Department of Defense (DoD) activities. In the 1970s, DoD began using AFFF that contained PFOS and, in some formulations, PFOA. AFFF is mission critical because it quickly extinguishes petroleum-based fires. The Federal Aviation Administration adopted its use at airports nationally.

In May 2000, American manufacturers began voluntarily phasing out the production of PFOS-related products, including AFFF containing PFOS, in response to proposed U.S. Environmental Protection Agency (EPA) regulations under the Toxic Substances Control Act. While AFFF containing PFOS (other than potential trace amounts) is no longer manufactured or available for purchase, the DoD Components may still have AFFF containing PFOS in equipment, such as aircraft hangar suppression systems.

To address rising concerns associated with using AFFF containing PFOS, DoD issued a human health and environmental risk alert for AFFF in 2011 that suggested guidelines to control future releases. The alert also advised the DoD Components to determine site-specific characterization, assessment, and risk management procedures if records indicate that a facility may have a release of AFFF to the environment.

On January 28, 2016, the Department issued a policy requiring Military Service-specific risk management procedures to prevent uncontrolled land-based AFFF releases during maintenance, testing, and training activities. Additionally, the policy requires the DoD Components to remove and properly dispose of AFFF containing PFOS from the local stored supplies for non-shipboard use, where practical.

On May 19, 2016, the EPA issued a SDWA lifetime health advisory (LHA) recommending that the individual or combined levels of PFOS and PFOA concentrations in drinking water be below 70 ppt. While the LHA is only guidance under the SDWA and not a required or enforceable drinking water standard, DoD began taking actions to address impacted drinking water. The DoD Components also developed strategies under the Defense Environmental Restoration Program (DERP) to start proactively investigating and addressing DoD releases of PFOS and PFOA.

As part of DoD's multifaceted approach to address PFOS and PFOA, the Department is also taking steps to remove and replace AFFF containing PFOS from its inventory and supply system. As explained in the next sections of this report, the Department is initiating research and development projects related to developing a fluorine-free foam, and developing technologies to quantify and clean up PFOS and PFOA.

I. DoD Status with Respect to Developing a New MILSPEC for Safe and Effective Alternatives to AFFF

MILSPEC (MIL-PRF-24385F) for AFFF was developed to rapidly extinguish flammable liquid fuel fires in critical fire scenarios, such as on flight decks and where aircraft movement, fueling, and weapons loading occur in very close proximity to each other. Some of the MILSPEC criteria include: quicker fire extinguishment times; compatibility with both seawater and freshwater; demonstrated viability at various strengths in case the product is proportioned incorrectly; and the capability to intermix MILSPEC AFFFs from different manufacturers.

In response to concerns over PFOS and PFOA, the Department of the Navy (DON)¹ amended MIL-PRF-24385F in 2017. The amendment identifies DoD's goal to develop and transition to a non-fluorinated agent and encourages AFFF manufacturers to minimize the levels of PFOS and PFOA in their products in the interim. The amendment established a maximum concentration for PFOS and PFOA at the limit of quantitation of current test methods (800 parts per billion (ppb)). Due to the complex chemical matrices involved in analyzing per- and polyfluoroalkyl substances (PFAS)² in finished AFFF concentrates, DON is working with industry leaders to develop a standardized PFAS test method for lower quantitation levels.

DON is also working with manufacturers to determine the exact chemical composition of AFFF alternatives and plans to publish a revised MIL-PRF-24385F in late 2018. The revision will lay the framework for segregating products by PFOS and PFOA content, and will establish lower limits to enable acquiring AFFF formulations with the lowest possible levels of PFOS and PFOA.

¹ DON includes the U.S. Navy and the U.S. Marine Corps.

² PFAS are a diverse group of compounds resistant to heat, water, and oil, that include PFOS and PFOA.

Developing a new MILSPEC for a fluorine-free AFFF replacement depends on results from ongoing Strategic Environmental Research and Development Program (SERDP)-funded research efforts to develop a fluorine-free AFFF replacement which meets or exceeds Navy firefighting performance required to protect safety of life and military assets. This report covers SERDP's research efforts in more detail in section III, "Overview of Current and Planned Research and Development for AFFF Alternatives that Do Not Contain PFOS or PFOA".

II. Update on DoD's Plans for Replacing AFFF Containing PFOS or PFOA at Military Installations and Methods of Disposal

In January 2016, the Assistant Secretary of Defense for Energy, Installations, and Environment issued a policy requiring the DoD Components to: 1) issue Military Service-specific risk management procedures to prevent uncontrolled land-based releases of AFFF during maintenance, testing, and training activities; and 2) remove and properly dispose of AFFF containing PFOS from the local stored supplies for non-shipboard use to prevent future environmental response action costs, where practical. In response to this policy, the DoD Components have taken the following actions to remove AFFF containing PFOS from the supply system.

Army

In 2019, the Army plans to replace its supply of long chain (C8) AFFF which contains PFOS and PFOA, with shorter chain (C6) AFFF, on the DoD qualified product list (QPL). C8 AFFF refers to the AFFF formulations containing long-chain fluorosurfactants, where long-chain is defined as seven or greater carbons, that DoD previously used and is removing from its inventory. Long-chain fluorosurfactants do not break down in the environment, spread rapidly, and bioaccumulate (i.e., become concentrated in humans). C6 AFFF refers to new AFFF formulations containing short-chain fluorosurfactants, where short-chain is defined as six or fewer carbons. The Army will dispose of the C8 AFFF and other AFFF-related waste³ by incineration. The AFFF waste disposal contracts are scheduled for award in August 2018.

Navy

On June 17, 2016, DON established a policy for the control, removal, and disposal of AFFF containing PFOS. This policy directed the Navy and Marine Corps to: 1) immediately stop the uncontrolled release of AFFF at shore side installations, with the exception of emergency responses; 2) update and implement Navy and Marine Corps firefighting system requirements to ensure fire and emergency service vehicles are not releasing AFFF to the environment; and 3) remove and dispose of uninstalled AFFF containing PFOS in drums and cans from local stored supplies for shore installations and ships to prevent future environmental release by the end of FY 2017.

On March 6, 2018, DON established a policy that outlined additional actions to manage AFFF, including the disposal and replacement of AFFF installed in shore side fixed and mobile systems. The policy directs the Navy and Marine Corps to test installed AFFF formulations, as

³ AFFF-related wastes include AFFF concentrates, associated rinse water, contaminated surface, storm and groundwater, and contaminated solids like soil, rubble, sludge, and debris.

necessary, and to determine the removal and disposal requirements for products exceeding the MILSPEC amendment's maximum permissible PFOS and/or PFOA levels by the end of FY 2019. The policy also requires that the Navy and Marine Corps remove, dispose of, and replace installed and uninstalled AFFF that does not meet the amended MILSPEC PFOS and/or PFOA limits by the end of FY 2020. Additionally, the Navy and Marine Corps must triple rinse installed systems to remove residual PFOS and PFOA concentrations. The policy requires that AFFF be disposed of by incineration, while the AFFF-contaminated water can be treated using granular activated carbon treatment (preferred method) or disposed of via solidification/landfill, incineration, or another equally protective disposal technology.

To facilitate replacing AFFF containing PFOS, the March 2018 DON policy also directs the Naval Supply Systems Command (NAVSUP) to coordinate with the Defense Logistics Agency (DLA) to enact a method that ensures only AFFF that meets the amended MILSPEC is supplied to Navy and Marine Corps customers by September 2018. In addition, NAVSUP will inventory and dispose of all stored legacy AFFF not compliant with the amended MILSPEC.

Air Force

The Air Force is executing a three-phased approach to minimize AFFF releases to the environment from fire trucks and crash response vehicles. During phase one, the Air Force procured 418,000 gallons of C6 AFFF to replace the C8 AFFF that contains PFOS and PFOA. Next, the Air Force replaced and disposed of the C8 AFFF in fire trucks and crash response vehicles. During the replacement, the Air Force triple rinsed the vehicles to avoid contaminating the replacement AFFF, then incinerated the C8 AFFF and rinse water. All Air Force installations except for King Salmon Air Force Station, Alaska, have transitioned to the C6 AFFF. During the final phase, the Air Force will retrofit fire vehicles to enable foam system testing without discharging foam by December 2018.

The Air Force initiated contracts for removing AFFF that could contain PFOS from aircraft hangars at active, reserve, and Air National Guard installations worldwide.⁴ Specifically, the Air Force will remove and incinerate C8 AFFF, and replace with C6 AFFF at its facilities by the end of FY 2019.

III. Overview of Current and Planned Research and Development for AFFF Alternatives that Do Not Contain PFOS or PFOA

The Department is primarily researching and developing AFFF alternatives that do not contain PFOS or PFOA through two key programs –SERDP, which focuses on basic and applied research, and the Environmental Security Technology Certification Program (ESTCP), which focuses on validating more mature technologies to transition them to widespread use. SERDP is sponsoring research projects to develop a fluorine-free AFFF, and in FY 2019, ESTCP will initiate demonstrations of existing fluorine-free AFFF formulations. These combined efforts support DoD's commitment to finding an AFFF alternative that meets critical mission requirements while protecting human health and the environment.

⁴ Due to unique host country agreements, the Air Force will issue two separate contracts for removing C8 AFFF at Incirlik Air Base and Thule Air Base; the contracts are projected to be complete by the end of FY 2019.

Over the past two years, SERDP issued two statements of need to solicit research projects regarding developing a fluorine-free AFFF. The FY 2017 statement of need solicited research to identify and test fluorine-free surfactants for use in AFFF while still meeting the performance requirements defined in MIL-PRF-24835F. In FY 2017, SERDP funded two core projects and one limited scope project, totaling \$2.5 million over three years. The first core project, “Fluorine-Free Foams with Oleophobic Surfactants and Additives for Effective Pool Fire Suppression,” will identify and develop fluorine-free surfactants that are effective in fire suppression and have a low environmental impact.⁵ The second core project, “Fluorine-Free Aqueous Film Forming Foam,” will conduct a life cycle assessment comparing the environmental impact of each foam type, evaluating fire performance by foam type, and identifying routes to improving environmental performance.⁶ The limited scope project, “Novel Fluorine-free Replacement for Aqueous Film Forming Foam,” will demonstrate a proof-of-concept for developing fluorine-free foam formulations that are sustainable, non-toxic, water-soluble (or water-dispersible), and will be applied using existing military firefighting equipment.⁷

SERDP also issued a supplemental FY 2018 statement of need regarding innovative approaches to developing fluorine-free AFFF for use in fire-suppression operations. As a result of this statement of need, SERDP will fund six limited scope projects from government labs, industry, and academia, totaling \$1.2 million over one year.⁸

In February 2018, ESTCP issued a Broad Agency Announcement seeking projects to demonstrate and validate more environmentally sustainable fluorine-free AFFF formulations against the performance requirements outlined in MIL-PRF-24385F. Proposed fluorine-free surfactants will enable sustained use of AFFF by meeting both environmental and performance requirements to ensure the safety of DoD personnel at airfields and onboard ships.

DON is funding research and development efforts related to AFFF alternatives. The DON funding is focused on developing analytical methods to test commercial products for PFAS. DON has tested commercially available fluorine free foams to determine if they can meet the MILSPEC. These tests are critical from a personnel safety perspective and validate a foam’s performance capabilities. To date no commercially available fluorine free foam has demonstrated comparable performance on critical MILSPEC required performance tests.

IV. Assessment of How the Establishment of an MCL for PFOS or PFOA under the SDWA Would Impact DoD’s Mitigation Actions, Prioritization of Such Actions, and Research and Development Related to PFOS and PFOA

⁵ Additional information on this project is available at: <https://www.serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP-2739>

⁶ Additional information on this project is available at: <https://www.serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP-2738>

⁷ Additional information on this project is available at: <https://www.serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP-2737>

⁸ SERDP will ask successful limited scope projects to submit proposals for additional funding.

The Department supports EPA working through the SDWA regulatory process to determine if federal drinking water standards (i.e., MCL) for PFOS and PFOA are warranted. MCLs are scientifically-based, peer-reviewed, and undergo a public process. EPA also considers the best available technology to implement the MCL and performs a cost analysis. MCLs are legally enforceable standards under the SDWA, which provide consistent, nationwide standards for drinking water suppliers, and are also used in setting cleanup standards nationally. Federal drinking water standards would help all entities faced with the challenge of addressing PFOS and PFOA in drinking water by providing clear, definitive, and consistent requirements on what actions to take and at what levels, and would enable stakeholders to understand why those actions were taken.

The Impact of the Establishment of an MCL for PFOS or PFOA on DoD's Mitigation Actions

Under the SDWA, EPA has issued LHAs recommending that the individual or combined levels of PFOS and PFOA concentrations in drinking water be below 70 ppt. Unlike an MCL, the LHA is non-regulatory guidance and is not a required or enforceable drinking water standard. A MCL would provide a consistent and enforceable standard for all public drinking water systems, including where DoD supplies drinking water at its installations. A Federal MCL would also encourage national consistency rather than the current varying State efforts.

In addition to establishing a Federal drinking water standard under the SDWA, MCLs are also used nationwide in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, aka Superfund) cleanup process. Because the LHA is unenforceable guidance, it cannot qualify as a cleanup standard under CERCLA. Instead, DoD considers the LHAs when addressing risk to human health, consistent with the EPA Office of Land and Emergency Management's CERCLA risk assessment process. This process uses the "reference dose" in EPA's LHAs to determine the need for cleanup action as well as a risk-based cleanup levels for groundwater used as drinking water. Following EPA's CERCLA risk assessment process, DoD estimates that the groundwater cleanup levels for PFOS or PFOA are approximately 380 ppt.

If the PFOS or PFOA levels in groundwater exceed 70 ppt but are below 380 ppt, responsible parties will face the challenge of explaining to communities the difference between the 70 ppt guidance for drinking water and the approximately 380 ppt risk-based groundwater cleanup level. This site-by-site approach would create tremendous risk communication challenges for all concerned parties – states, EPA, DoD, and community leaders – when explaining how the groundwater cleanup levels are protective of human health.

Furthermore, the lack of a consistent nationwide approach to meeting CERCLA responsibilities makes it difficult for DoD to plan and execute its cleanup program because DoD cannot determine what cleanup activities are needed at a site. As a result, there is rising frustration among states and communities concerning cleanup at DoD installations due to the absence of a clear legal standard. Additionally, in the absence of Federal drinking water standards, some states are issuing regulations and guidance for PFOS and PFOA, thus adding to the uncertainty and confusion. EPA issuance of drinking water standard would provide nationwide consistency to address PFOS and PFOA. As sites progress through the CERCLA

process, the lack of Federal drinking water standards for PFOS and PFOA and patchwork state standards exposes DoD to potentially inconsistent response actions across the DoD Components and states, making it difficult to plan, program, and budget.

EPA establishing Federal drinking water standards for PFOS and PFOA would eliminate the uncertainty surrounding response actions to PFOS and PFOA and provide national consistency. If EPA established Federal drinking water standards, DoD would follow CERCLA's procedures to incorporate the standard into ongoing investigations and cleanup. Federal drinking water standards would provide clear and consistent guidance on how to move forward under CERCLA and assist in providing clear communication to stakeholders on why actions and remedies are selected.

The Impact of the Establishment of an MCL for PFOS or PFOA on the Prioritization of DoD's Mitigation Actions

The Department does not have sufficient resources to simultaneously fund activities at all sites where cleanup is not complete, therefore DoD uses a nationwide, risk-based approach to prioritize its sites for cleanup. Federal drinking water or cleanup standards allow DoD to prioritize sites in an open and transparent manner. Based on site-specific information, DoD follows its risk-based approach to prioritize sites for investigation and cleanup, if necessary, and allocates its resources on a nationwide basis to address risk to human health and the environment. Federal drinking water standards provide a clear, definitive direction for DoD to prioritize sites.

As discussed in the prior section, the lack of a consistent nationwide approach to meeting CERCLA responsibilities for PFOS and PFOA makes it difficult for DoD to plan and execute its cleanup program. Because Federal drinking water standards for PFOS and PFOA do not exist, DoD considers the reference doses EPA used to develop the LHAs to determine risk. However, future peer-reviewed science could replace these toxicity values, potentially resulting in DoD reprioritizing and reprogramming cleanup activities. Stopping and restarting cleanup projects potentially causes rework and requires additional time and resources. Additionally, some states are issuing regulations and guidance for these contaminants, thus adding to the uncertainty and confusion about cleanup levels. EPA establishing Federal drinking water standards for PFOS and PFOA would eliminate the uncertainty surrounding PFOS and PFOA response actions and allow for consistent DERP prioritization and execution.

The Impact of the Establishment of an MCL for PFOS or PFOA on Research and Development Related to PFOS and PFOA

Establishing Federal drinking water standards will not impact DoD's ongoing and planned research efforts related to PFOS and PFOA. The Department's environmental technology investments focus on DoD's evolving research and development needs, which currently include PFOS and PFOA.

As discussed in section III of this report, SERDP also initiated three projects in 2017 aimed at developing fluorine-free firefighting foams to replace AFFF containing PFOS and

PFOA. SERDP/ESTCP has invested \$40 million in PFOS and PFOA research and development. SERDP solicited research into the fate, transport, and remediation of PFOS and PFOA shortly after EPA released the 2009 Provisional Health Advisories for these compounds. Follow-on research beginning in 2014 has targeted developing several approaches for treating groundwater containing PFOS and PFOA. These efforts have matured from the bench scale to field demonstrations that began under ESTCP in 2017, with an additional demonstration under evaluation that will begin in 2018. With the establishment of Federal drinking water or cleanup standards, DoD would continue these current and planned research efforts and expand research to testing, treatment, and disposal methods for PFOS and PFOA in soil and sediment in addition to groundwater.

Conclusion

In addition to taking action to ensure safe drinking water and following the CERCLA process to fulfill its cleanup responsibilities, the Department is committed to minimizing PFOS and PFOA releases to the environment that are a result of DoD's AFFF use. DoD Components are removing and replacing AFFF containing PFOS from the supply system. DoD has also invested in research to develop fluorine-free substitutes for AFFF that meet the military's stringent performance criteria, and develop technologies to quantify and clean up PFOS and PFOA. These combined efforts reinforce DoD's commitment to meeting critical mission requirements while protecting human health and the environment.

Department of Defense Alternatives to Aqueous Film Forming Foam Report to Congress

Appendix A

DoD Policy Memorandums Regarding the Control, Disposal, and/or Replacement of AFFF Containing PFOS or PFOA

This Appendix includes the following memorandums:

- Assistant Secretary of Defense for Energy, Installations, and Environment Memorandum, “Emerging Contaminants Governance Council (ECGC) Meeting Results,” January 28, 2016
- Deputy Assistant Secretary of the Air Force (Environment, Safety, and Infrastructure) Memorandum, “AFFF Disposal and Replacement – Crash Response Vehicles,” March 9, 2016
- Deputy Assistant Secretary of the Navy (Environment) Memorandum, “Aqueous Film Forming Foam (AFFF) Control, Removal, and Disposal,” June 17, 2016
- Principal Deputy Assistant Secretary of the Navy for Energy, Installations and Environment Memorandum, “Additional Aqueous Film Forming Foam (AFFF) Control, Removal, and Disposal Requirements,” March 6, 2018