

STUDY PLAN (DRAFT)

- Addendum to Phase I Impact Assessment for PFOS/PFOA - Cost-Benefit Analysis for Replacement of Legacy Aqueous Film-Forming Foam (AFFF)

1 Background and Extent of Effort

The current military specification for aqueous firefighting foams (MIL-F-24385; August 1994, F Version) mandates the use of fluorinated chemicals to enable film formation to meet the MILSpec performance requirements.¹ AFFF formulations that were manufactured by 3M using an electrochemical fluorination process contained perfluorooctanoic sulfonate (PFOS). 3M voluntarily ceased production of the fluorosurfactants used to make PFOS-based AFFF in 2002 due to rising regulatory concerns. However, there is no restriction on the use of stockpiled PFOS-based AFFF in the United States.² In 2004, it was estimated that 75% of the DoD AFFF inventory consisted of 3M AFFF (i.e., PFOS-based AFFF).³ Other MILSpec AFFF formulations contain fluorosurfactants synthesized using telomerization processes. These fluorosurfactants are reported to degrade into fluorochemicals of increasing regulatory concern (e.g., perfluorooctanoic acid [PFOA]). Recently, manufacturers started to manufacture AFFF formulations containing only lower chain ($\leq C6$) fluorosurfactants to avoid risks associated with the higher chain fluorosurfactants. These formulations are undergoing (or are soon to undergo) MILSpec testing.

The Office of the Deputy Under Secretary of Defense (Installations and Environment) (ODUSD(I&E)) Science & Technology (S&T) Directorate Chemical and Material Risk Management Program (CMRMP) conducted an Emerging Contaminant (EC) Phase I Impact Assessment on PFOA and PFOS in January 2007 and a Phase II Assessment on PFOA in August 2008. Risk management actions were implemented to address the high risks to the DoD

¹ The Naval Sea Systems Command controls the MilSpec and the Naval Research Laboratory is the designated institution for certification evaluation of new AFFF products and placement on the DoD AFFF Qualifying Products List (QPL).

² Several countries have established regulations to cease the use of and remove PFOS-based AFFF stockpiles. (1) In Canada, the use of AFFF having a concentration of PFOS greater than 0.5 ppm is prohibited except for purposes relating to certain military operations after May 28, 2013. Disposal of PFOS must follow Canada/Ontario's hazardous waste regulations. http://www.mcscs.jus.gov.on.ca/english/FireMarshal/FireServiceResources/Communiqués/OFM_Com_2013-07.html. (2) Under the European REACH regulations, fire-fighting foams placed on the market before December 27, 2006 can be used until June 27, 2011. Council Directive 76/769/EEC, amended on 12 December 2006; <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006L0122&from=EN>. (3) Norway prohibits firefighting foam that contains 0.005% by weight or more of PFOS or PFOS related compounds. Firefighting foam that contains 0.005% by weight or more of PFOS or PFOS related compounds shall be delivered to an approved facility for destruction. Regulation dated August 27, 2013. <http://www.miljodirektoratet.no/no/Regelverk/Forskrifter/Regulations-relating-to-restrictions-on-the-manufacture-import-export-sale-and-use-of-chemicals-and-other-products-hazardous-to-health-and-the-environment-Product-Regulations/Chapter-2-Regulated-substances-preparations-and-products/>.

³ Darwin RL. 2004. Estimated Quantities of Aqueous Film Forming Foam (AFFF) in the United States. Prepared for the Fire Fighting Foam Coalition, Arlington, VA by Hughes Associates, Inc., Baltimore, MD. August.

acquisition community due to the possible phase out of PFOA. Both compounds remain on the EC Watch List for continued monitoring.

On 4 September 2014, ODUSD(I&E) held a meeting to discuss issues involving cleanup of legacy (PFOS-based) AFFF and the possibility of removing legacy AFFF from the U.S. Navy inventory. As a result of this meeting, ODUSD(I&E) Science & Technology Directorate Chemical and Material Risk Management Program (CMRMP) agreed to lead a cost benefit study on replacing DoD's inventory of legacy AFFF formulations with a suitable MILSpec qualified C6-based AFFF formulation.

2 Objectives of the Effort and Tasks

The objective of this study is to perform a cost-benefit analysis on replacing DoD's inventory of legacy AFFF formulations (those that contain PFOS, PFOA, or fluorosurfactants capable of degrading to these chemicals) with a suitable MILSpec qualified C6-based AFFF formulation. The study will consider the technical feasibility, risks, costs and benefits of replacing the legacy AFFF versus long term impacts and costs to the DoD if the legacy AFFF remains in the DoD inventory for use.

The study will be structured in three tasks. Task I and Task II will be completed concurrently, with Task III initiated upon the completion of Tasks I and II.

Task I: Current Inventory and Annual Use of AFFF Concentrate. Estimate the current inventory of MILSpec AFFF concentrate by type (e.g., 3% versus 6% concentrate; PFOS-based versus telomere-based) and application (e.g., shipboard use, fire fighting vehicles, shore facility installations) held by each Military Component.

Task II: Determine the commercial availability and cost of MILSpec qualified telomere-based and lower chain ($\leq$ C6) fluorosurfactant AFFF concentrates and whether they are included on the QPL. If C6-based AFFF formulations are commercially available, but have not gone through the MILSpec qualification testing, determine if and when this will occur and the estimated cost of the final product.

Task III: Using the data gathered in Tasks I and II, perform a cost-benefit analysis of disposing and replacing the legacy AFFF with C6-based AFFF MILSpec concentrates versus continuing to use DoD stockpiles of PFOS- and telomere-based AFFF concentrates. Examples of impacts to be considered in the analysis include:

- Impacts to the cleanup program (e.g., increase number of sites that require characterization and remediation, increased level of contamination at existing sites) under the *replacement* and *continued use* scenarios.
- Compatibility of the newer C6-based formulations with the telomere-based AFFF formulations with regard to any needs for equipment or facility infrastructure changes or requirements.

This study will be coordinated with the current Air Force Civil Engineering Center (AFCEC) project to perform preliminary assessments at over 110 historically used Air Force firefighting training areas. The AFCEC project will be used to inform analysis of the potential costs for remedial actions to address releases of PFOS/PFOA containing AFFF.

3 Study Organization Roles and Responsibilities

Oversight, management, and execution of this study will follow the organizational structure described below.

Study Sponsor/Principal Study Authority: The ODUSD(I&E) S&T Directorate CMRMP is sponsoring this study and has approval authority for all tasks described herein. Oversight and approval of the study results will be provided by the CMRMP with coordination by the Emerging Contaminants Steering Group and Component offices with equities.

Study Lead: The ODUSD(I&E) S&T Directorate CMRMP tasked Noblis, Inc. with the overall execution of the study and development of all study products and deliverables into a final report package. The CMRMP will manage and direct, with input from the Components, the technical studies and analyses performed by Noblis to support the milestones and deliverables specified in this study guide. The CMRMP is responsible for establishing a Component Working Group and will be the point of contact for communication and direction between the Working Group and Noblis.

Working Group Members: Representatives from the Navy, Army, Air Force and DLA will be designated as Working Group members. The Working Group is responsible for responding to data queries and information requests and the review of the draft and final deliverables.

4. Schedule

Date	Week	Activity
Nov 1, 2014		Study begins
Dec 12, 2014		Task I
Dec 12, 2014		Task II
Jan 15, 2014		Task III
Jan 30, 2014	90 day after task start	Draft Report
Feb 28, 2014	120 days after task start	Final Report

5 Deliverables

The results of the cost benefit analysis will be documented in a draft and final report. The report will provide the information needed to determine a path forward with regard to the continued use versus replacement and disposal of the legacy AFFF concentrate.