

Headquarters U.S. Air Force

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Replacement of Legacy AFFF COAs

**AFCEC/CXF
14 Aug 15
Version 2**

Executive Summary

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- **Purpose: Provide Courses of Action (COAs) to replace AF inventory of legacy AFFF (Aqueous Film Forming Foam)**
 - **Findings:**
 - **AF wants to transition to a “better” AFFF to improve health / environmental posture, offset future environmental liabilities and maintain mission critical firefighting agent performance capabilities**
 - **Estimated cost to replace legacy (PFOS) AFFF in fixed systems and fire vehicles ranges from an immediate cost of \$10.4M to \$74.6M (based on FY15 costs) over 5-6 years, with cost reductions possible if efficiencies related to flushing can be achieved**
 - **Disposal cost information based on \$10.00 per gallon (5-gallon pails); cost reductions possible for bulk disposal methods**
 - **AF has 2.01M gallons of PFOS and/or mixed PFOS/PFOA AFFF in installed systems, fire vehicles and stockpiles (includes AFRC/ANG)**
 - **Plan provides three COAs: two short-term & one long-term solution**
 - **Recommendation: COA 2 as it ultimately satisfies all EPA and AF fire fighting concerns**
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Problem Statement and Situation

Tasking

- SAF/IE/IEE tasked key stakeholders to develop a plan to eliminate legacy AFFF from AF inventory
- A4CX directed AFCEC to develop COAs, costs, and interim guidance related to use and replacement of legacy AFFF
 - AFCEC developed three COAs
 - COAs 1 & 3 provide immediate action, less initial cost; allows out year funding forecast
 - COA 2 provides long-term solution but is costly
 - AF Fire Chief issued temporary directive to cease all testing/operational checks of ARFF vehicle AFFF systems

~~Classes of AFFF~~

- Legacy PFOS-based AFFF: No longer commercially available
 - Blended C8-C6-based AFFF: Most environmentally-friendly MilSpec-approved AFFF currently available, but can potentially degrade into the environment to form PFOA
 - C6-based AFFF*: Industry moving to this AFFF. Commercially available, but not yet MilSpec-approved. One manufacturer now in progress to obtain MilSpec-approval, expected by end of 2015
 - Fluorine-Free Agent: Commercially available, but not MilSpec-approved. Early testing revealed potential problems on ability to meet MilSpec. Likely would not be a “drop-in” replacement agent and probably would require modified fire fighting techniques/procedures
- * Potential for some >C6 to occur as a result of manufacturing process (quantity is TBD)

What is AFFF?

- AFFF is a fire suppressant containing fluorinated surfactants for low surface tension used to extinguish flammable liquid fires
- Perfluorooctane sulfonate (PFOS) is a long-chain perfluorinated compound (PFC) either present in legacy stocks of AFFF or a potential breakdown product of PFOS-based AFFF
- Perfluorooctanoic acid (PFOA) is also a long-chain PFC, and while not an ingredient in AFFF, long-chain fluoroteleomer-based AFFF can break down to PFOA
- Prior to 2000, most fluorosurfactants used in the AFFF MilSpec were PFOS-based (MilSpec PFOS-based AFFFs are no longer available)
- Use of PFOS-based AFFF not currently restricted by US regulations

~~EPA Fact Sheet – PFOS / PFOA – At a Glance~~

Current Status

Current Situation

- PFOS and PFOA considered Emerging Contaminates that have resulted in EPA and state regulators directing corrective actions at several AF locations (Pease, Horsham, Eielson)
- AF Restoration Program (active and BRAC) anticipates hundreds of locations to have contamination above PHA levels, and accordingly have initially programmed ~\$250M in the FYDP to address situation
- AF inventory composed mostly of legacy PFOS-based AFFF
 - Where more environmentally-friendly, post-2000 AFFF have been used, those stocks have largely been intermixed with the legacy AFFF
- AF desires to transition to a “better” AFFF to improve health / environmental posture and off-set future environmental liabilities

Current AF Inventory of AFFF

Application	Gallons (K)
Fixed Systems*	1,340
ARFF Vehicles**	203
Stockpile (PFOS-based)	117
Stockpile (blended C8-C6)	357
Total	2,017

* Includes estimated 500K for ANG and Reserve systems

** Includes ANG and Reserve ARFF vehicles

(Quantities based on draft AFCEC input to TMT tasking)

Which AFFF should be AF replacement?

- C6-based AFFF is currently the industry “target” AFFF, based in large part on EPA PFOA Stewardship Program that has garnered industry support to withdraw from sale any fluorosurfactant with a carbon chain length greater than C6 by 2015
- Accordingly, AF should transition to C6-based AFFF that will soon be available...rather than transition to a blended C8-C6 based AFFF that still has potential environmental issues
 - Cost, effort and benefits of AFFF transition should be invested in long-term solution

Required AF Inventory of AFFF

Application	Gallons (K)
Fixed Systems*	1,340
ARFF Vehicles**	203
ARFF Resupply Stockpile	203
Total	1,746

* Includes estimated 500K for ANG and Reserve systems

** Includes ANG and Reserve ARFF vehicles

(Quantities based on draft AFCEC input to TMT tasking)

COA 1

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- COA 1 is a short-term solution that immediately addresses fire vehicles and delays facility installed systems due to their static nature
 - Incinerate legacy AFFF in fire station stockpiles
 - Rinse(3X)/incinerate AFFF & effluent from tanks in fire vehicles and replace with available MilSpec C₈ certified AFFF in inventory
 - Purchase MilSpec AFFF to satisfy resupply requirement
 - Delay action on facility installed systems until C6 AFFF is approved by NAVSEA; will require funding in out years (New bladders/AFFF)
 - PROS:
 - Immediately addresses potential AFFF discharges by firefighters
 - Allows out year POMing action to address installed systems incrementally
 - CONS:
 - Does not eliminate EPA concerns current C₈ MilSpec AFFF has been found to degrade into PFOA
 - Potential exists for duplicative funding costs
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AFFF Replacement COA 1

(FY15 Dollars)

	OCT 2015	JAN 2016	APR 2016	JUL 2016	OCT 20XX	OCT 20XX	OCT 20XX	OCT 20XX	OCT 20XX
ARFF Vehicle Funding	\$1.1M	Estimated cost (\$22.00 gallon) to purchase AFFF (49,000 gallons)							
		Immediate incineration of 3M legacy AFFF (117,205 gallons)							
ARFF Vehicle Disposition (Incineration)	\$1.2M	\$2.7M	\$2.7M	\$2.7M		Estimated cost assumes \$10.00 per gallon (5-gallon pails) for incineration of AFFF and effluent (1.2M gallons)			
Facility Labor		N/A	N/A	N/A	\$1.1M	\$1.1M	\$1.1M	\$1.1M	\$1.1M
Facility Funding		Facility replacement/disposition can be delayed since they are static and pose minimal threat to the environment		COA allows facilities to be delayed until funding is available	\$7.9M	\$7.9M	\$7.9M	\$7.9M	\$7.9M
		Estimated cost (\$22.00 gallon) is based on availability of approved C6 AFFF (1.3M gallons) & bladder tank replacement							
Facility Disposition (Incineration)		Estimated cost assumes \$10.00 per gallon (5-gallon pails) for incineration			\$1.6M	\$1.6M	\$1.6M	\$1.6M	\$1.6M
TOTAL	\$2.3M	\$2.7M	\$2.7M	\$2.7M	\$10.6M	\$10.6M	\$10.6M	\$10.6M	\$10.6M
	FY16/01	FY16/02	FY16/03	FY16/04	FYXX	FYXX	FYXX	FYXX	FYXX
FY16 total vehicle cost = \$10.4M IMMEDIATE TOTAL = \$10.4					FYXX-XX total facility cost = \$53M (Assumes delay) Total over the FYDP = \$63.4				

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- COA 2 is a long-term solution that ultimately satisfies all AFFF fire fighting requirements and eliminates EPA environmental concerns
 - Incinerate legacy AFFF in fire station stockpiles
 - Rinse(3X)/incinerate AFFF & effluent in fire vehicles and replace it with C₆ AFFF when MilSpec-approved by NAVSEA
 - Replace/incinerate legacy AFFF in resupply stockpile with C₆ AFFF when MilSpec-approved by NAVSEA
 - Replace/incinerate legacy AFFF in facility installed systems with C₆ AFFF when MilSpec-approved by NAVSEA
- PROS:
 - Replaces all AFFF in AF inventory with the most environmentally friendly product commercially available
 - Most cost effective life cycle approach
 - Does not alter fire fighting tactics, techniques and procedures
- CONS:
 - Have to wait for NAVSEA MilSpec certification (expected by EOY15), anticipate successful outcome
 - Largest near term costs



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AFFF Replacement COA 2 (FY15 Dollars)

	OCT 2015	JAN 2016	APR 2016	JUL 2016	OCT 2016	OCT 2017	OCT 2018	OCT 2019	OCT 2020
ARFF Vehicle Funding		\$3M	\$3M	\$3M	Estimated cost (\$22.00 gallon) for approved C6 AFFF (406,236 gallons)				
		Immediate incineration of 3M legacy AFFF (117,205 gallons)							
ARFF Vehicle Disposition	\$1.2M	\$3.8M	\$3.8M	\$3.8M	Estimated cost assumes \$10.00 per gallon (5-gallon pails) for incineration of AFFF and effluent (1.5M gallons), includes 356,859 gallons in stockpile				
Facility Labor		N/A	N/A	N/A	\$1.1M	\$1.1M	\$1.1M	\$1.1M	\$1.1M
Facility Funding					\$7.9M	\$7.9M	\$7.9M	\$7.9M	\$7.9M
		Facility replacement/disposition can be delayed since they are static and pose minimal threat to the environment				Estimated cost (\$22.00 gallon) for approved C6 AFFF (840,000 gallons) & bladder tank replacement			
Facility Disposition					\$1.6M	\$1.6M	\$1.6M	\$1.6M	\$1.6M
					Estimated cost assumes \$10.00 per gallon (5-gallon pails) for incineration				
TOTAL	\$1.2M	\$6.8M	\$6.8M	\$6.8M	\$10.6M	\$10.6M	\$10.6M	\$10.6M	\$10.6M
	FY16/01	FY16/02	FY16/03	FY16/04	FY17	FY18	FY19	FY20	FY21
FY16 total vehicle cost = \$21.6M					FY17-21 total facility cost = \$53M				
TOTAL OVER THE FYDP = \$74.6M									

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- COA 3 is a short-term solution that eliminates potential contamination by firefighters but uses current AFFF in installed systems where contamination is unlikely or can be contained
 - Incinerate legacy AFFF in fire station stockpiles
 - Rinse(3X)/incinerate AFFF & effluent in fire vehicles and replace it with C₆ AFFF when MilSpec-approved by NAVSEA
 - Replace/incinerate legacy AFFF in resupply stockpile with C₆ AFFF when MilSpec-approved by NAVSEA
 - Use existing C₈ AFFF for facility installed systems and purchase C₆ for remaining systems
- PROS:
 - Replaces all AFFF in fire vehicles with the most environmentally friendly product commercially available
 - Utilizes existing stock of C₈ in low-threat environment
- CONS:
 - Does not eliminate EPA concerns and the potential exists for future funding action to replace C₈ AFFF



AFFF Replacement COA (FY15 Dollars)

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	OCT 2015	JAN 2016	APR 2016	JUL 2016	OCT 2016	OCT 2017	OCT 2018	OCT 2019	OCT 2020
ARFF Vehicle Funding		\$3M	\$3M	\$3M	Estimated cost (\$22.00 gallon) for approved C6 AFFF (406,236 gallons)				
		Immediate incineration of 3M legacy AFFF							
ARFF Vehicle Disposition	\$1.2M	\$2.7M	\$2.7M	\$2.7M	Estimated cost assumes \$10.00 per gallon (5-gallon pails) for incineration of AFFF and effluent (1.2M gallons)				
Facility Labor		N/A	N/A	N/A	\$1.1M	\$1.1M	\$1.1M	\$1.1M	\$1.1M
Facility Funding		Use current stockpiles of AFFF for initial replacement			\$2.2M	\$2.2M	\$9.4M	\$9.4M	\$9.4M
		Facility replacement/disposition can be delayed since they are static and pose minimal threat to the environment			Estimated cost (\$22.00 gallon) is based on availability of approved C6 AFFF (983,141 gallons) 7 bladder tank replacement				
Facility Disposition					\$1.6M	\$1.6M	\$1.6M	\$1.6M	\$1.6M
TOTAL	\$1.2M	\$5.7M	\$5.7M	\$5.7M	\$4.9M	\$4.9M	\$12.1M	\$12.1M	\$12.1M
	FY16/01	FY16/02	FY16/03	FY16/04	FY17	FY18	FY19	FY20	FY21
FY16 total vehicle cost = \$18.3M					FY17-21 total facility cost = \$46.1M				
TOTAL OVER THE FYDP = \$64.4									

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Plan Implementation

Follow-up actions	Implementation approach
<ul style="list-style-type: none"> ▪ Determine if there is an on-site method to reduce amount of flushing waste (i.e., drying bed, GAC w/ sanitary sewer) ... now using same costs as disposal of full strength AFFF ▪ Refine disposal and service contract costs ▪ Validate amount and timing to support expected disposal needs ▪ After costs are refined and options chosen, confirm “per year” costs ... adjust timeline and approach to meet available budget if needed 	<ul style="list-style-type: none"> ▪ Begin with disposal of excess backup stock, then AFFF in ARFF vehicles, and lastly fixed systems (less chance of contamination) ▪ Best to replace AFFF in ARFF vehicles first, but may need to adjust if flushing is required and efficiencies can be gained by having same service contract do flushing of both ARFF and fixed systems on an installation wide basis ▪ Priority given to US locations not overseas ▪ Timeline / targets may be adjusted as “best practices” are gained
Plan Timeline	Policy / Guidance
<ul style="list-style-type: none"> ▪ <u>TBD based on COA selection</u> 	<ul style="list-style-type: none"> ▪ Policy: Existing AFIs and OSD documents address PFOS/PFOA from a an emerging contaminate / cleanup perspective, as well as from a public health drinking water perspective <ul style="list-style-type: none"> ▪ The cleanup and public health communities are currently expanding / clarifying responsibilities and procedures to improve protection of environment and personnel ▪ There are various “fact sheets” from EPA, OSD, AFCEC and Fire Fighting Foam Coalition related to the emerging risk of AFFF, as well as various Working Groups to address the AFFF and larger PFOS/PFA issue ▪ Pending SAF/IEE decision to proceed with replacement of legacy AFFF, A4C and AFCEC staffs will work with SAF/IEE to develop requisite policy and implementing instructions