

DEVELOPMENT PLAN

For

Aqueous Film Forming Foam (AFFF)
Alternative



January 2001

PURPOSE

Developmental Plans (DPs) are an integral part of the NAVAIR Environmental, Safety and Health (ESH) Strategic Plan. The purpose of a DP is to communicate and document a course of action in resolving an issue. This is accomplished by bringing the right people together to reach a consensus on the appropriate course of action. The DP provides the short, medium and long-term plan of actions in resolving an issue and builds consensus for the development of corporate policy. Once a plan is developed, it is then disseminated to the NAVAIR community, where it is supported and tracked until final resolution.

The issue addressed by this DP is the problems associated with Aqueous Film Forming Foam (AFFF).

The purpose of this DP is to propose a course of action for developing and evaluating solutions identified via Need Assessment Summary 217, and recommended for development in Decision Memo 217. These documents discuss the issues and solution alternatives in detail, and are the basis for the decision to develop the new solutions to these problems discussed below.

Aqueous Film Forming Foam (AFFF), is used throughout the Navy, and by other Services, commercial airports, and industrial facilities to extinguish flammable liquid fires and guard against catastrophic events such as ordnance cook-off. Performance of this agent is critical to life safety, and the protection of DoD assets.

AFFF is available from 5 suppliers in 12 qualified formulations. The largest manufacturer, 3M Company, has disclosed it will phase out production of a key component in AFFF by the end of 2002 and has provided the US Environmental Protection Agency (EPA) with data on the biologically and environmentally persistent product of AFFF release – perfluorooctylsulfonate (PFOS). EPA considers PFOS a Persistent Bioaccumulative Toxic (PBT) chemical.

1.0 DRIVERS

1.1 Near Term Drivers

Due to its environmental persistence, bioaccumulation in human blood with unknown long-term effects, and toxicity to aquatic life and laboratory animals, the EPA will most likely regulate PFOS (under the Toxic Substance Control Act (TSCA)) following the phase-out in production by 3M Company. The EPA intends to conduct a Risk Benefit Analysis and will likely not act in a manner that would accelerate 3M's plan for phase-out. 3M originally announced its intent to phase out the production of PFOS in May 2000, subsequently submitted a plan to the EPA in June 2000, and amended the plan in July 2000. The plan submitted phases out the use of fluorochemical surfactants in surface products by December 2001 and in performance products (such as AFFF) by December 2002. 3M does have the option to request an extension for specific performance uses for which adequate substitutes do not exist or have not yet been qualified. Consequently, the future availability of AFFF for critical applications is uncertain, and options for its potential non-availability after December 2002 must be developed.

1.2 Additional Drivers Information

Clean Water Act (CWA) as amended in 1977 with National Pollutant Discharge Elimination System. The CWA regulates discharges to "waters of the state," which includes all navigable waterways and bodies of water that feed into navigable waterways. Most discharges to the water or land that have the potential to be mixed with stormwater are covered by this act. AFFF can easily migrate to a waterway and can pose a hazard to aquatic life. Much of the MILSPEC AFFF contains diethylene glycol monobutyl ether, which is regulated under the CWA as glycol ether. AFFF should be considered in either the stormwater and/or the point of source National Pollutant Discharge Elimination System (NPDES) permits.

Clean Air Act (CAA) and the 1990 Amendments including National Emission Standards for Hazardous Pollutants (NESHAP). A release is exempt from the CAA Section 311(b)(5) and the Comprehensive Environmental Responsibility Compensation and Liability Act (CERCLA) reporting requirement when the following criteria are met: (1) a NPDES permit is held by the discharger, (2) the permit contains an effluent limitation applicable to the substance discharged, and (3) the discharge is in compliance with the effluent limitation. If the substance is not listed and the discharger has a permit, then for them to be in compliance: (1) the identified treatment system must be in place and capable of treating the identified amount of substance, (2) the permit must require the identified substance to be treated in the event of an onsite release, and (3) the release must be less than the quantity or concentration listed on public record. The final scenario is the discharge of a hazardous substance from the point source. The CAA has both criteria pollutant and Hazardous Air Pollutant (HAP) regulatory requirements. Much of the MILSPEC AFFF contains diethylene glycol monobutyl ether (classified as glycol ether) and ethylene glycol, both of which were regulated as HAPs. By definition, a facility is a "Major Source" of HAPs if it has emissions of 10 tons per year of a single HAP or emissions of 25 tons per year of any combination of HAPs. Major Sources must comply with all relevant NESHAP standards, file a Facility or Title V Permit with the state that becomes a guiding document for emission limits, as well as record-keeping and reporting requirements. Failure to comply with these requirements could result in facility fines and possible civil or criminal liability. Major Sources of HAPs are also subject to applicable NESHAPs. Applicable NESHAPs for the United States Navy would be the NESHAP for Aerospace and Rework Facilities and the NESHAP for Shipbuilding and Ship Repair.

Superfund Amendments and Reauthorization Act (SARA). Both diethylene glycol monobutyl ether and ethylene glycol must be reported under SARA Title III (Emergency Planning and Community Right-to-Know Act (EPCRA)). The surfactant alcohol ethoxylates and their derivatives contained in AFFF have recently been de-listed.

Comprehensive Environmental Responsibility Compensation and Liability Act (CERCLA). Under CERCLA, releases of ethylene glycol must be reported. Diethylene glycol monobutyl ether has no RQ established, so any significant spill must be reported.

Uniform National Discharge Standards (UNDS). The National Defense Authorization Act of 1996 amended section 132 of the Federal Water Pollution Control Act (FWPCA) (also known as the CWA) to require the Secretary of Defense and the Administrator of the EPA to develop uniform national discharge standards for vessels of the Armed Forces for discharges other than sewage incidental to normal operations.

2.0 ACCOMPLISHMENTS AND FINDINGS

2.1 Current Method of Controlling the Problem:

One method to mitigate environmental impacts of AFFF waste is to sequester wastewater in a holding pond and allow biodegradation to lower the BOD to an acceptable level for open discharge or treatment by a WWTP. Once discharged to a WWTP, the potential for foaming exists due to the fluorocarbon surfactants that remain in the water. Anti-foaming agents can be added to AFFF wastewater, and the input flow to the WWTP can be controlled so as not to overburden the facility since WWTP cleanup can be very costly.

Another method to mitigate AFFF environmental impact is to accelerate biodegradation using commercial technology such as an anaerobic fluidized bed reactor (FBR) system. This system degrades the glycol component in AFFF wastewater and reduces the foaming sufficiently so waste may be discharged directly to a WWTP. The Chief of Naval Operations (N45) is executing a Pollution Prevention and Equipment Program evaluation of an anaerobic FBR system for the remediation of AFFF and aircraft deicing fluid wastewaters at the Naval Air Station Whidbey Island. POC: SPAWARSYSCEN, San Diego, CA, Leslee Shumway, shumway@spawar.navy.mil.

A third method to mitigate AFFF environmental impact is to remove the surfactants in AFFF wastewater. The Air-Sparged Hydrocyclone (ASH) unit has been successfully demonstrated at NS Mayport, Florida. The results of the ASH demonstration indicate that the process is effective in reducing the amount of foam-producing agent in Fleet Training Center (FTC)-generated wastewater; the process produced little rejected waste (2.5 percent of total amount processed). The ASH treatment unit demonstrated is a prototype that needs to be engineered for a more permanent application. The ASH vendor estimates a treatment cost of about \$0.63 per 1000 gallons of treated water. The Air Force is purchasing an ASH unit for further evaluation.

2.2 Solutions Selected from Need Assessment Summary (NAS):

NAVAIR should continue to expediently evaluate technology to remove the environmentally persistent components (fluorocarbon surfactants) from AFFF waste streams such as the ASH system discussed in the previous section where practical.

In August 2000 an AFFF workshop was held. The R&D strategy proposed at that meeting is summarized here.

Define the Problem. An accurate, quantitative definition of the problem would include a status of the DoD AFFF inventory: quantities, concentrations, and locations of AFFF stores; types (training, system testing and maintenance, accidental discharges, research, firefighting), amounts, and locations of applications and releases; and compliance with DoD, federal, state, and local regulations and policy.

Provide Guidance. A useful, quantitative, and accepted (EPA endorsed) definition of "environmentally friendly" is needed to guide replacement or alternative technology insertions. This definition should address acceptable thresholds from an environmental

standpoint for biodegradability, persistence, BOD/COD, bioaccumulation, and toxicity of replacement or alternative solutions.

Establish Goals. Contributors to the problem's solution must know what is expected or acceptable in resolving the problem in the short term (commercial industry and acquisition community), mid-term (developers of future technology), and long-term (researchers via ONR, SBIR, and universities). These goals must be agreed upon by the user community, updated as knowledge about AFFF grows and user needs change, and communicated to the developer and supplier communities.

Develop a Coordinated Plan/Strategy with Affected Services and Other Users. This strategy should provide a transition plan with implementation options (e.g., from "worst case" availability of AFFF to "ideal" solution found); a coordination mechanism; and a description of the enabling capabilities or documents needed, e.g. small-scale screening tests, "SNAP-equivalent" guidance for alternative compounds, quantitative detection capability for AFFF (learn 3M methods), and hazard protocols and appropriate response methodologies (for AFFF use and response).

Coordinate Implementation. Existing working groups for AFFF and other firefighting/damage control organizations should cooperatively assess the commercial state of the art; conduct an appropriate comparison to provide guidance on the appropriateness of particular technologies and tactics for application areas (e.g., aircraft carrier decks vs. flammable structure fires); consider applicability and appropriateness of the AFFF MilSpec to application environments; recommend policy changes where necessary; and communicate what will or will not be acceptable for life safety and asset protection performance to the user, developer, and regulator communities.

In addition to the above strategy, NAVAIR and the entire user community should continue to identify and apply best management practices to reduce/eliminate AFFF discharges into the environment.

2.3 Additional Solution Alternatives Not Addressed in the NAS:

None

3.0 CURRENT PLANS

3.1 Short-term

Survey Navy bases to determine 1) the quantity of AFFF on hand, 2) the quantity of AFFF used, 3) how AFFF releases are treated (point of release treatment such as ASH, sent to wastewater treatment plant, placed in a holding tank and/or oil water separator, discharged to "waters of the State"), 4) reasons for releases (training or fire fighting), and 5) compliance status.

Develop best practices guidance and define what is considered "environmentally friendly".

3.1.1 Resources and Planning Details

A survey should be sent out to all Navy activities to find out:

1. The quantity of AFFF stores on hand
2. The quantity of AFFF used over the last 10 years for each year
3. How AFFF releases are treated:

- Treated at the point of release (state type of treatment)
 - Held in a holding area and tested before being discharged (state type of holding area and tests performed)
 - Discharged to an industrial wastewater treatment or publicly owned wastewater treatment works.
 - Disposed as hazardous waste.
 - Discharged directly to "waters of the State".
4. Amounts and reasons for releases (Firefighting, Training, System Tests/Maintenance, Accident/Malicious or Research).
 5. Compliance status (AFFF releases covered in the facility NPDES permit, whether the facility has been issued a Notice of Violation or not within the last 10 years, \$ amount of any fines that may have been paid or levied pending negotiations ...)
 6. Any other data that may be needed to support the comparative risk analysis and or the cost/benefit analysis.

The survey questionnaire should be coordinated with whoever will be writing the cost/benefit or risk analysis. EPA may be conducting their own survey, in which case the Navy may wish to be a clearinghouse for Navy supplied information to the EPA, but they may want to ask additional questions that EPA is not concerned with for the Navy's own analysis. It is estimated that coordinating the survey and sending the survey off will require approximately half a man-year of effort. It is anticipated that putting coordinating the survey, putting it together and sending it off will take approximately 9 months.

Evaluation of the survey results is expected to take 3 months and will require roughly a two-person level of effort. The results should compile usage practices and identify any potential compliance issues.

In parallel with the survey development, the Navy should prepare a "best practices" manual to provide guidance to Navy personnel about the best way to handle AFFF. The manual should be issued as a directive from N45. The manual should be worked into regular training materials for firefighting crews and should cover:

- How to select low environmental impact AFFF alternatives,
- How to store and maintain AFFF stores,
- How best to deploy AFFF so as to minimize environmental impacts,
- How best to treat AFFF once it has been released,
- Alternatives to training and maintenance procedures that do not involve live AFFF, and
- How to minimize the possibility of accidental/malicious releases.

3.2 Mid-term

Establish R&D goals coordinating what is expected by the user community, researchers and logistics staff.

Develop a Technology Transition Plan (TTP) incorporating Research, Development, Evaluation and Deployment of new technology and/or equipment.

3.2.1 Resources and Planning Details

Once the results of the survey have been received and evaluated, the Navy will need to determine what alternatives are most attractive for the Navy activities and allocate funding to support further R&D efforts. This task involves performing a detailed Need Assessment Summary (NAS) for each distinct need associated with AFFF as it is used by Navy activities. This may be researching alternatives to PFOS or alternatives to live AFFF for training or maintenance activities, whichever the greatest need exists in the Navy. It is anticipated that there will be several distinct AFFF related needs in the Navy and that NASs will be prepared, a separate Decision Memo (DM) and Development Plan (DP) should be prepared for each distinct need that appears to be worthy of further R&D efforts.

After the DPs have been prepared outlining the R&D goals, more detailed R&D planning can be initiated and a Technology Transition Plan (TTP) can be put together. It is anticipated that preparing a DM, coordinating reviews of the DM and preparing a DP will require approximately one man-month of effort for each R&D need.

4.0 FUTURE PLANS

- 4.1 Long-term:** Coordinate and Implement the TTP, modifying the TTP as required by new information about replacement technologies.

4.1.1 Resources and Planning Details

As more is understood about the technologies being investigated, the TTP and the associated impact analysis and implementation data will need to be revised. Also as the technology matures it will need to pass through logistics and deployment activities; the TTP should be updated to coordinate these activities as well as the research and development activities, so the technology can be deployed smoothly. It is anticipated that each technology will require 1/10th of a man-year to maintain the TTP while the technology is in R&D, to make sure data from the research and development activities is incorporated into the impact analysis and implementation data portions of the TTP. Once the technology has completed R&D stages and enters logistics, the level of effort required to track the technology is halved. After the technology has been deployed for a year, a follow-up evaluation should be made which includes checking the impact analysis assumptions and implementation requirements. It is anticipated that this effort will require a half a man-month to complete.

5.0 PROJECT SCHEDULE

Figure 1 below shows an overview of the schedule of events for the current and future plans that should be undertaken to identify alternatives to Aqueous Film Forming Foam (AFFF).

Task Item No.	Task Description	FY1				FY2				FY3				FY4			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1.0	Survey Navy AFFF Practices																
1.1	Coordinate survey questions with other activities																
1.2	Prepare survey																
1.3	Conduct survey																
1.4	Evaluate survey results																
2.0	Develop AFFF Best Practices Guidance																
2.1	Draft Guidance and get it approved																
2.2	Initial training of guidance materials																
3.0	Establish R&D Goals and Develop TTP																
3.1	Evaluate survey data and determine scope of needs																
3.2	Develop Need Assessment Summaries of needs																
3.3	Prepare Decision Memos of R&D needs.																
3.4	Prepare Development Plans for R&D needs																
3.5	Prepare technology Transition Plans for the R&D needs																
3.6	Track technology transition through R&D, Logistics and Deployment.																