Report to the Joint Standing Committee on Environment and Natural Resources
130th Legislature, Second Regular Session

Report on the Implementation of An Act to Restrict the Use of Perfluoroalkyl and Polyfluoroalkyl Substances in Firefighting Foam

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Purpose

The Maine Department of Environmental Protection (Department) submits this report to the Joint Standing Committee on the Environment and Natural Resources pursuant to Public Law 2021, Chapter 449, *An Act to Restrict the Use of Perfluoroalkyl and Polyfluoroalkyl Substances in Firefighting Foam*. Maine law now prohibits manufacturers from producing, selling or distributing in Maine a specific category of firefighting foam known as Aqueous Film Forming Foam to which PFAS chemicals have been intentionally added, with certain exceptions. (38 MRSA §424-C) For the purposes of this report, firefighting foams with intentionally added PFAS chemicals will be referred to as AFFF. Maine law also prohibits the discharge of AFFF for testing or training purposes.

The purpose of this prohibition is to help prevent AFFF from being released into the environment where its fluorinated chemicals may cause ground and surface water contamination. Data collected by the Department and other environmental and health agencies across the country have found that repeated releases of AFFF used for fire training exercises have led to high levels of contamination in nearby soil and water, and in some cases a one-time release due to use for actual fire response has created similar results.

P.L. 2021, ch. 449, Section 2 directs the Department to collaborate with the Maine Department of Defense, Veterans and Emergency Management (DVEM), Maine Emergency Management Agency (MEMA) and interested parties, to develop a framework for the collection and safe storage of AFFF, in cases where the product has not been returned to the manufacturer of the foam pursuant to a recall issued in accordance with Title 38, section 424-C, subsection 5, paragraph B.

Background

A. Uses of Aqueous Film Forming Foam

Because fluorinated surfactants have unique properties (such as low surface tension, ability to repel water, ability to repel oils, and thermal stability) their formulations allow an aqueous film to spread across liquid fuel fires creating a stable barrier that quickly starves the fire of oxygen and adds thermal stability that prevents reignition.[1] For these reasons, this category of foam extinguishing agents plays a critical role in large capacity fuel storage areas, airports, military bases and ships. However, in recent years discovery of soil and water contamination from the fluorinated chemicals used in AFFF has prompted massive research and development initiatives into the search for an equally effective fluorine-free fire suppressing foam.

[1] Snow, A. et al. Fuel for Firefighting Foam Evaluations: Gasoline vs Heptane. Naval Research Laboratory, Washington, D.C. (NRL/MR/6123-19-9895). (2019). p8.

The U.S. Department of Defense (DoD) and the Federal Aviation Administration (FAA), along with private industry, are taking part in the development of fluorine-free foam (F3) formulations that have the capability to extinguish fuel fires with equivalent effectiveness to foams containing fluorinated surfactants. The key factors for determining equivalent effectiveness and practical use application for F3 products are established in performance specifications from several organizations including the DoD (MIL-F-24385F), European Committee for Standardization (EN1568-Part 3), Underwriters Laboratory (UL 162), International Civil Aviation Organization (ICAO-Level C) and the National Fire Protection Association (NFPA 11).[2]

The evaluation testing protocol established by these organizations varies for foam formulation product qualification. The DOD's MilSpec performance standard is the most rigorous for foam extinguishing product qualification. While there are several fluorine-free firefighting foam concentrates commercially available, none have received DoD's MilSpec qualification for performance.[3] In some cases, the failure of F3 formulations to meet DoD MilSpec performance standards may result, in part, from DoD's use of alcohol-free gasoline as the fuel source in pool fire extinguishing tests.[4] Most other qualifying protocols use a type of diesel fuel as their pool fuel agent.[5] This important variable exemplifies why there is concern among users that some F3 products will react differently to variations in fuel source. The currently qualified AFFF product's insensitivity to fuel source is a common rationale for maintaining its use for high hazard liquid fuel fires.

B. Review of Terms

According to the National Fire Protection Association (NFPA), the different types of material that fuel a fire require specific types of extinguishing agents designed to react accordingly, and not all are equally effective. It is for this reason that NFPA classifies fire incidents by the type of material fueling a fire. For instance, a Class A fire consists of ordinary combustibles that might be found in a common home and leave an ash behind; examples include wood, plastic, cloth, and rubber. The category of Class A fire is the only classification that responds well to water as a suppressant and can include use of a foam product made specifically for this purpose.

Class B fires are those fueled by combustible liquids such as petroleum, gasoline, tar, oils, solvents, alcohols, and gases such as hydrogen, butane, methane, and ethylene. In that circumstance, choosing an effective extinguishing agent takes on additional importance because of the high hazard potential of those types of fuel sources. Response to a Class B fire requires

[2] Ibid.
[3] Snow, A. et al. Fuel for Firefighting Foam Evaluations: Gasoline vs Heptane. Naval Research Laboratory, Washington, D.C. (NRL/MR/6123-19-9895). (2019). p12.
[4] Ibid.
[5] Ibid.

extinguishers suitable for the fuel source and the elevated level of danger the situation presents. AFFF products have been highly effective for this purpose by creating a barrier between the fuel and the oxygen feeding the fire - extinguishing the fire quickly and preventing reignition. This unique property of Class B AFFF is what makes it desirable for fire response in high hazard situations where large volumes of fuel or gas is involved and the danger to human life and property is significant.

[Note: Classification of fire source material continues with Class C being those that involve energized electrical equipment; Class D are fires fueled by combustible metals; and Class K are fires that are fueled by cooking appliances that involve vegetable or animal cooking oils.]

C. Federal requirements

Use of AFFF containing fluorine compounds became prevalent during the early 1970's when the DoD placed the extinguishing agent on its qualified product list and used it as a preferred tool for fire response due to the product's unique efficacy.[6] Because AFFF has rapid control and extinguishment capabilities the product became uniquely positioned for use in large, dangerous fires where seconds could mean the difference between control and extinguishment or catastrophe.[7] The AFFF product met all of DoD's specifications for fire response, including extinguishment time, burn back time, strength of mixture tests, and compatibility among vendors.

The qualification standards for DoD fire extinguishing agent have gone through several phases of amendment and now permit non-fluorinated foams to qualify for use. In one of its most recent revisions, MIL-PRF-24385F commits DoD to the objective of finding a fluorine-free AFFF product that will meet performance requirements. Section 6 of the amended MilSpec notes the following:

> *6.6 PFOA and PFOS content.[8] The DoD's goal is to acquire and use a non-fluorinated AFFF formulation or equivalent fire-fighting agent to meet the performance requirements for DoD critical fire-fighting needs. The DoD is funding research to this end, but a viable solution may not be found for several years. In the short term, the DoD intends to acquire and use AFFF with the lowest demonstrable concentrations of two particular per- and polyfluoroalkyl substances (PFAS); specifically, PFOS and PFOA. The DoD intends to be open and transparent with Congress, the Environmental Protection Agency (EPA), state regulators, and the public at large regarding DoD efforts to address these matters. AFFF manufacturers and vendors are encouraged to determine the levels of PFOS, PFOA, and other PFAS in their products and work to*

[6] Robin Nissan. AFFF Alternatives: Art of the Possible. Department of Defense, Strategic Environmental Research and Development Program (SERDP). Nov. 2019. p22.
[7] Ibid.
[8] PFOA refers to Perfluorooctanoic acid, and PFOS refers to Perfluorooctanesulfonate. Both of these PFAS compounds are commonly found in AFFF where PFAS is intentionally added.

drive these levels toward zero while still meeting all other military specification requirements.[9]

DoD has also acknowledged that immediate changes have been necessary to improve management of AFFF to better protect human health and the environment by codifying their commitments within the National Defense Authorization Act (NDAA) of 2020 (Public Law 116-92). These commitments, which are also practiced by FAA, include a prohibition on uncontrolled releases of AFFF, except in cases of actual emergency response, a prohibition on the use of fluorinated foam for training exercises, and a commitment to minimize the amount of fluorine in the AFFF product in use until an effective fluorine-free product can meet its safety standards. The FY 2020 NDAA prohibits any land-based fluorinated AFFF use effective October 1, 2024.[10]

Available fluorine-free extinguishing agents have not yet been able to meet minimum DoD performance standards during testing. Some of those standards include demonstrating efficacy on small and large scale fires; product forgiveness during use, comparing ½ and 5x concentration strength due to equipment failure or misapplication; ability to intermix product between manufacturers; product effectiveness with aspirated and non-aspirated nozzles; and compatibility with existing equipment.[11]

A consideration in the search for alternatives that is often overlooked is the percentage of product concentrate required for efficacy. Currently qualified AFFF products use approximately 1.65 gallons of concentrate to meet this standard; several times less than the fluorine-free alternative tested according to the Underwriters Laboratories 162 standard which requires 15 gallons of concentrate and more than 240 seconds longer to control a fire of the same size.[12] Other fluorine-free foams offer similar results by taking longer to extinguish a fire and multiplying the quantity of concentrate required to do so. Performance assessments by NFPA showed similar results with an application rate and density of the F3 product required to produce similar results to AFFF ranging from 2 to 7 times higher.[13]

DoD has committed $49 million through fiscal year 2025 for the research, development, testing and evaluation of an AFFF alternative.[14] Estimated costs associated with changing to a fluorine-free foam include retrofitting and retooling delivery apparatus at an estimated $200,000 per vehicle. To replace the fleet of 3,000 airport response vehicles in order to accommodate a

[9] Department of Defense. Performance Specification for Fire Extinguishing Agent. MilSpec MIL-PRF-24385F with Amendment 4. (April 7, 2020).
[10] https://www.epa.gov/system/files/documents/2021-11/epa-hq-olem-2020-0527-0002_content.pdf
[11] Robin Nissan. AFFF Alternatives: Art of the Possible. Department of Defense, Strategic Environmental Research and Development Program (SERDP). (Nov 2019). p30.
[12] Ibid.
[13] Gerard Back and John Farley. National Fire Protection Association. Fire Protection Research Foundation. *Evaluation of the fire protection effectiveness of fluorine-free firefighting foams*. (January 2020). pxi.
[14] Department of Defense. Per- and Polyfluoroalkys Substances (PFAS) Task Force Progress Report. (March 2020). p3,4.

different foam delivery system is estimated to cost about 4 to 6 billion dollars, and was estimated to take more than 18 years to accomplish assuming DoD could acquire 50% of the commercial production volume as measured in 2019.[15]

In partnership with DoD, the FAA invested $5.1 million to build an Aircraft Rescue and Firefighting (ARFF) fire extinguishing testing facility that took five years to build. Completed in 2019, their facility has performed over 400 research tests to evaluate 15 commercially available and prototype F3 products.[16] Because currently available F3 product has not yet met performance standards to meet the needs of the FAA to protect the flying public, the FAA is focusing on new, innovative formulations for foams developed under research agreements with manufacturers and developers of this product. This allows FAA to test prototype formulations and provide feedback to developers during product development to more efficiently pursue a viable F3.[17]

Both DoD and FAA lead in establishing fire safety standards for effective extinguishment of high hazard Class B fires. Because of this, firefighters, especially those in industrial settings, rely heavily on this standard's qualification requirements for fire suppressant products and have confidence that DoD's standards offer the highest level of fire protection.

While DoD leads in establishing a protective performance standard for Class B fire extinguishing agents, the DoD standard is generated to respond to unique and potentially catastrophic emergencies. For instance, a cargo plane crash or a major fire incident occurring on a Navy ship located far from friendly shores are those envisioned for application of DoD's firefighting MilSpec standard. These are scenarios that differ dramatically from municipal fire response, such as a car fire on the side of the road. Municipal firefighting most commonly involves Class A types of fuel, and it is reasonable to expect that municipal fire response involving Class B types of fuel rarely occur and will typically be small in scale compared to those envisioned by DoD's MilSpec standard. Therefore, it is realistic to expect that there are commercially available F3 products which are capable of meeting the current needs of most of Maine's municipal fire services. However, there are not F3 products available for Maine businesses that may be required to use products that meet the MilSpec standard for DoD customers. 38 M.R.S. §424-C, subsection 4 provides an exemption from the AFFF sale and distribution prohibition for oil terminal facilities and airports, but prohibits the sale of AFFF for use in marine defense applications. Bath Iron Works has notified the Department that their contract with the DoD requires them to install AFFF in the construction of the DDG 51 Class ships. Since January 1, 2022, Bath Iron Works has not been able to legally procure AFFF as required to fulfill their contract.

[15] Ibid.
[16] Federal Aviation Administration. National Part 139 Cert Alert. No. 21-05. To All Title 14 CFR Part 139 Airport Operators, Part 139 Extinguishing Agent Requirements. October 4, 2021.
[17] Ibid.

D. State of AFFF Use in Maine

The Maine Emergency Management Agency (MEMA) provides information to fire departments regarding safe storage and handling of their current inventory of AFFF to prevent unintended releases to the environment. See MEMA's website https://www.maine.gov/mema/mema/hazards/human-caused-hazards/pfas for best practices guidance, and information regarding federal standards and specifications.

Maine's total volume of AFFF product currently available for use in fire response has been challenging to quantify. In 2019, the Governor's PFAS Task Force established an AFFF working group consisting of 25 professionals in the fields of emergency management services, fire service, industry, and government partners. The AFFF working group endeavored to establish an inventory of AFFF in Maine. The working group contacted fire departments and relevant industrial sites (such as oil terminal locations) across Maine requesting data on the volume of AFFF stored and available for use at each site. With 20% of fire department and 40% of industry survey recipients providing responses, there is a confirmed 9,730 gallons of AFFF concentrate available for use at fire departments and 6,100 gallons at industry sites. Using this data to roughly extrapolate the volume of AFFF across the state, there could be up to 48,000 gallons of AFFF housed in Maine's fire departments.

38 M.R.S. 424-C requires manufacturers of AFFF to "recall such foam, which must include a process by which a person in the State that received their foam will be reimbursed by the manufacturer for the recalled foam." As described during proceedings to adopt this language into law, it does not require manufacturers to physically take the AFFF back from purchasers, nor does it require purchasers to return the product to manufacturers in exchange for the reimbursement. Persons who purchased AFFF must contact the manufacturer they purchased AFFF from to obtain reimbursement for their purchase costs. The Department can enforce against a manufacturer if they refuse to provide a reimbursement to a purchaser, and if the Department is notified of the refusal.

The Department has received inquiries from fire departments and fire training providers regarding identification of firefighting and fire suppression foams available for purchase that comply with the prohibition on foams that contain intentionally added PFAS. Manufacturers provide varying information and statements about their products to customers and the Department. The Department recommends that manufacturers should be required to provide a certificate of compliance to the Department upon request.

Framework for Managing Collection, Disposal, and Replacement of AFFF

Products no longer intended for use are classified as wastes subject to the Resource Conservation and Recovery Act (RCRA). How they must be managed depends on a variety of factors,

including toxicity. The U.S. EPA is currently analyzing how various PFAS-containing waste types should be managed under federal law. On December 18, 2020, the U.S. EPA released *Interim Guidance on the Destruction and Disposal of Perfluoroalkyl and Polyfluoroalkyl Substances and Materials Containing Perfluoroalkyl and Polyfluoroalkyl Substances*[18] that outlines the current state of the science on techniques and treatments that may be used to destroy or dispose of PFAS and PFAS-containing materials from non-consumer products, including aqueous film-forming foam (for firefighting). EPA's interim guidance avoids making any regulatory determinations about waste types, but identifies the most protective options for managing PFAS-containing wastes as those used for hazardous wastes, such as incineration in a hazardous waste incinerator. The Department applied a similar approach to evaluating options for an AFFF collection and storage program in Maine, and considered waste AFFF as hazardous waste for the purposes of constructing a framework for AFFF waste management activities although AFFF waste would not be classified as hazardous waste under current federal or Maine laws and rules.

A. Storage

Any stored AFFF, whether at fire departments or waste consolidators, must be stored according to state and federal laws to protect groundwater and to prevent leaks and spills. MEMA provides guidance to fire departments regarding safe handling and storage practices for AFFF, and the AFFF Working Group conducted statewide outreach in 2019 to emphasize safe storage and spill reporting. AFFF should be stored in intact and labeled containers, with some form of secondary containment, and stored containers should be inspected regularly for leaks or other damage. Any leaking containers should be emptied and properly disposed of. Each time a container is moved creates an opportunity for a spill, so any consolidation efforts should minimize unnecessary handling.

There are three state licensed hazardous waste transfer and storage facilities in Maine that could potentially conduct temporary drum storage for the purpose of transferring AFFF waste to a licensed disposal facility. These facilities are subject to specific licensing, facility operation, monitoring, and reporting requirements and would have the necessary controls in place to protect public health and the environment from a release. There are other facilities in Maine that could potentially be modified and licensed under RCRA as hazardous waste transfer and storage facilities if willing to undertake long-term storage of bulk or containerized waste AFFF. This would require a significant financial investment, state licensing, federal review, and substantial public engagement including communities with environmental justice concerns. The Department does not recommend pursuing long-term consolidated storage of waste AFFF at this time. Until the U.S. EPA provides final guidance on management of this waste stream, the Department recommends ensuring that existing stocks of AFFF are stored safely in place.

[18] https://www.epa.gov/pfas/interim-guidance-destroying-and-disposing-certain-pfas-and-pfas-containing-materials-are-not.

B. Collection

Collection could occur from individual locations, such as fire departments and industrial facilities, or by establishing regional collection sites. MEMA should serve as the state agency lead, in close collaboration with the Maine Fire Chief's Association (MFCA) in order to establish an efficient collection protocol and encourage fire department participation. Coordination with the MFCA will be important to identify appropriate locations to serve as collection sites and to conduct outreach. Collection sites must have secure, fully enclosed storage with secondary containment sufficient to contain spills or leaks. Sites should be broadly distributed geographically across the state.

The State would need to establish a contract with an environmental services vendor to operate collection events at each regional collection site. An appropriate vendor could properly package, temporarily store and transport collected waste AFFF for disposal in accordance with state and federal waste management laws.

C. Disposal

EPA's Interim Guidance states that hazardous waste incinerators could be used to dispose of liquid phase materials containing PFAS, such as AFFF; however, the efficacy of PFAS destruction is still being researched. Hazardous waste incinerators licensed under the Clean Air Act are subject to the most stringent emission controls. However, ambient air and deposition impacts are the subject of ongoing studies.

The Department requested an informal estimate for collection and disposal services from Clean Harbors Environmental Services, Inc. (Clean Harbors), the contracted vendor supporting the State of Connecticut's AFFF collection program. The State of Connecticut spent almost $1 million to collect approximately 40,000 gallons of AFFF concentrate in containers from over 250 individual municipal fire stations in Connecticut (representing about 300 individual fire departments), state agencies, and some regional equipment. Clean Harbors Environmental Services, Inc. provided the Department with an estimated cost for AFFF product collection and disposal at a licensed out-of-state hazardous waste incinerator of approximately $240 per 5-gallon container. Each collection location would also incur a $400 transportation cost. If Clean Harbors collected AFFF from each of Maine's 330 fire departments, transportation cost would be $132,000. Using an estimate of 48,000 gallons of AFFF potentially available for collection, disposal could cost $2,304,000.

D. Replacement

Fire departments may be reluctant to relinquish their inventory of AFFF until they have a sufficient quantity of F3 to replace it. Manufacturer reimbursements required by 38 M.R.S. §424-C, subsection 5(B) may cover some or all costs to purchase replacement F3 products. The cost to replace AFFF with currently available F3 product ranges from $100 to $200 per 5 gallons and is dependent on the volume purchased. The State may need to subsidize any costs to purchase F3 products that exceed reimbursement amounts to encourage fire departments to relinquish their

AFFF. Due to the variability in fire department needs and historical costs for AFFF, the Department cannot estimate how much funding for subsidies may be needed. Collection events should be timed so that fire departments have adequate time in advance to submit reimbursement requests to manufacturers, receive payments, and purchase replacement products.

Recommendations

Statewide collection and proper management of consolidated AFFF will require sufficient funding, and, if funded, should be managed by MEMA. If the Legislature wishes to eliminate the existing inventory of AFFF available for use for fire-suppression in Maine, the Department recommends the Legislature appropriate funding to MEMA to establish a contract with an environmental services vendor to collect, transport and dispose of waste AFFF. The Department and MEMA estimate that one limited period position and up to $2.5 million may be needed for this purpose. Additional resources would be needed for a foam replacement subsidy program.

The Department also recommends two revisions to 38 M.R.S. §424-C, subsection 4 to address questions raised during implementation of the law:

1. Expand the exemption in 38 M.R.S. §424-C, subsection 4 to include use for marine defense when such use is required by the DoD.
2. Require manufacturers of firefighting or fire-suppressing foam sold or distributed in Maine to provide the Department with a certificate of compliance, attesting that their product does not contain intentionally added PFAS.

38 MRS §424-C, subsection 4 as amended:

4. Manufacture, sale and distribution prohibited. Beginning January 1, 2022, a person may not manufacture, sell, offer for sale, distribute for sale or distribute for use in the State a firefighting or fire-suppressing foam to which PFAS have been intentionally added, except when:

A. Such foam is manufactured, sold or distributed for use at an oil terminal facility in the State. As used in this paragraph, "oil terminal facility" has the same meaning as in section 542, subsection 7.

This paragraph is repealed January 1, 2025; ~~or~~

B. Such foam is manufactured, sold or distributed for use at an airport in the State, as long as the foam is required by federal law or regulation to be used at airports for firefighting or fire-suppressing purposes, including, but not limited to, as required by 14 Code of Federal Regulations, Section 139.317 as that section existed on January 1, 2021. If, on or after January 1, 2022, no federal law or regulation requires the use of such foam at airports for firefighting or fire-suppressing purposes, the exception in this paragraph to the prohibition in this subsection does not apply~~.~~<u>, or</u>

C. Such foam is manufactured, sold or distributed for a use required by the U.S. Department of Defense.

A person who manufactures a firefighting or fire-suppressing foam for sale or distribution in the State for uses not exempted above shall, upon request, provide the department with a certificate of compliance, certifying that the foam they manufacture is not prohibited under this subsection.