Federal Aviation Administration

AIRCRAFT FIREFIGHTING FOAM TRANSITION PLAN

Requirement: In December 2022, Congress directed the FAA, through documentation accompanying the Omnibus Spending Bill, to develop a Transition Plan to ensure the orderly transition from current aircraft fire fighting foam to a replacement firefighting foam.

This *Aircraft Firefighting Foam Transition Plan*, dated May 8, 2023, satisfies this directive.

May 8, 2023

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This report was prepared in coordination with the Department of Defense, the Environmental Protection Agency, and industry partners.

ABBREVIATIONS AND ACRONYMS

AAAE	American Association of Airport Executives
AAS	FAA Airport Safety and Standards
AC	Advisory Circular
ACI-NA	Airport Council International–North America
AEE	FAA Environment and Energy
AFFF	Aqueous Film Forming Foam
AGC	FAA General Council
ARFF	Aircraft Rescue and Firefighting
ATR	Airport Technology and Research
CERLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DoD	Department of Defense
DOT	Department of Transportation
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
F3	Fluorine Free Foam
MILSPEC	Military Specification
NAVSEA	Naval Sea Systems Command
NDAA	National Defense Authorization Act
QPD	Qualified Product Database
QPL	Qualified Product List
QRV	Quick Response Vehicle
PFAS	Per- and Polyfluoroalkyl Substances
Premix	A combination of water and firefighting foam mixed in a tank in either a 3% or 6% solution
Rinsate	Liquid generated from the cleaning process

INTRODUCTION

Per- and Polyfluoroalkyl Substances (PFAS) are a group of manufactured chemicals that have been used in industry and consumer products since the 1940s. Many organizations worldwide mandate the use of firefighting foam that contains PFAS, known as Aqueous Film Forming Foam (AFFF). However, per the Environmental Protection Agency (EPA), certain PFAS can cause serious health problems, including cancer, if people are exposed to them over a long period of time, and they can also be harmful to aquatic and terrestrial organisms.

Because these chemicals potentially present health hazards to humans, the Department of Defense (DoD) and the FAA have partnered on a significant research project involving the testing of unfluorinated firefighting foam. Section 332 of the *2018 FAA Reauthorization Act* directed the FAA to not require the use of fluorinated chemicals to meet the performance standards referenced in chapter 6 of Advisory Circular (AC) 150/5210-6, *Aircraft Fire Extinguishing Agents,* and acceptable under Section 139.319(l) of title 14, Code of Federal Regulations. This mandate accelerated research for an alternative firefighting foam that did not contain PFAS and prompted the FAA to issue guidance intended to help reduce the existing foam's impact on the environment. Specifically, Part 139 Policy Guidance #108, *Discharge of Aqueous Film Forming Foam (AFFF) at Certificated Part 139 Airports,* dated June 20, 2019, advised FAA Airport Certification Safety Inspectors to no longer require the discharge of AFFF during the timed response drill.

On January 6, 2023, the DoD published a new fluorine-free foam (F3) military specification (MILSPEC) to comply with the requirements for the Secretary of Defense and Secretary of the Navy set forth by the *National Defense Authorization Act* for Fiscal Year 2020 (FY2020 NDAA). The next step is for foam manufacturers to submit their F3 agents for qualification by DoD. Once DoD certifies that a foam meets the new MILSPEC, it will be added to the Qualified Product List. The FAA considers the foams on the Qualified Product List as acceptable for satisfying the regulatory requirements of part 139.

The FAA will provide guidance to airport operators on MILSPEC F3 issues falling within the FAA's regulatory purview. For issues that are outside of its authority, the FAA will identify industry best practices as such practices become available. Examples of items that are outside of the agency's authority include the following:

- Aircraft rescue and firefighting (ARFF) vehicle cleaning procedures
- Acquisition of temporary vehicles during the cleaning process
- State environmental regulations for AFFF and MILSPEC F3
- Allowable amounts of residual PFAS in ARFF vehicles after the cleaning process
- Storage/destruction of AFFF after transition
- Fire suppression systems at airport hangars

OVERVIEW OF THE TRANSITION PLAN

In 2020, well in advance of an MILSPEC F3 being identified, the FAA began working with critical stakeholders on a detailed national transition plan for part 139 certificated airports. In December 2022, Congress formally directed the FAA to develop a transition plan that would include all known legislative requirements, personnel training changes, and other operational aspects to be implemented for a certificate holder's transition to MILSPEC F3. This *Federal Aviation Administration Aircraft Firefighting Foam Transition Plan* (hereinafter referred to as the "Transition Plan") has been developed in coordination with the DoD, industry work groups, and the Environmental Protection Agency (EPA) to meet this directive.

The FAA does not expect to update this document, but going forward, the FAA will track publication of each policy and guidance document related to the Transition Plan and provide updates to airports as new information and research becomes available.

The FAA encourages the expeditious transition away from PFAS-containing AFFF and toward MILSPEC F3 in order to reduce potential human health and environmental impacts from PFAS contamination.

CONGRESSIONAL TIMELINE AND AUTHORIZATIONS

In documentation accompanying the December 2022 Omnibus Spending Bill, Congress directed the FAA to create a Transition Plan by May 8, 2023, to "ensure the orderly transition from current to replacement firefighting foam" and stipulated it must include, among other information—

- Direction on obtaining EPA guidance
- Best practices for decontamination of equipment
- Timelines for releasing policy and guidance about an airport operator's implementation plan for obtaining approved F3 products

This Transition Plan uses the term "Required Elements" to identify these three requirements. The specific language from the House and Senate reports is as follows.

> *From the House report 117-402 [December 12, 2022]:*
>
> *Firefighting foam.—The Committee is encouraged by DOD's progress in developing specifications for firefighting foam and the FAA's long-standing research and testing thereof. The Committee urges the FAA to ensure an orderly transition from current to replacement firefighting foam for the safety of passengers and crew members, airport firefighters and workers, and the communities that neighbor airports. The Committee directs the FAA, in coordination with DOD and EPA, to develop a transition plan not later than 120 days after the date of the publication of the military specifications (mil-spec) for firefighting foam. The transition plan should, at a minimum, achieve the following goals: provide Part 139 airports with information on obtaining EPA guidance on acceptable environmental limits; best practices for the decontamination of existing*

aircraft rescue and firefighting vehicles, systems, and other equipment previously used to deploy firefighting foam; and timelines for the release of policy and guidance relating to Part 139 airport implementation plans for obtaining approved mil-spec products and firefighting personnel training.

Joint Explanatory Statement [December 20, 2022]:

Transition plan to fluorine-free firefighting foam. Not later than 120 days after the date of the publication of the new military specification [MIL-SPEC] for firefighting foam, the FAA is directed to develop a transition plan for part 139 airports to use the MIL-SPEC. In addition to the requirements for the transition plan in House Report 117-402, the FAA shall also provide airports information on any supplemental equipment needed to utilize approved MIL-SPEC products.

FLUORINE-FREE FOAM TRANSITION WORKGROUPS

To develop the Transition Plan, the FAA worked with the Aircraft Firefighting Foam Advisory Group, an advisory group to the Airport Sub-Committee of the Research Engineering and Development Committee (REDAC), to establish three workgroups that met regularly to help the FAA address each of the three required elements of the Transition Plan. The workgroups included staff from the FAA, DoD, and industry groups; firefighters; research experts; environmental experts; and firefighting training personnel. Each workgroup met three to four times in late January and February 2023 to provide input for use in the development of this Transition Plan. The workgroups considered a wide-range of issues related to the transition to MILSPEC F3 by airports, although not all of the issues discussed fall within the FAA's jurisdiction. Workgroup members were also given an opportunity to comment on a draft version of the Transition Plan. The FAA used input from the three workgroups to prepare this plan.

Workgroup 1
Required Element Addressed: *Provide timelines for the release of policy and guidance relating to part 139 airport implementation plans for obtaining approved MILSPEC products and firefighting personnel training.*

Workgroup 2
Required Element Addressed: *Provide part 139 airports with information on obtaining EPA guidance on acceptable environmental limits.*

Workgroup 3
Required Element Addressed: *Provide best practices for the decontamination of existing aircraft rescue and firefighting vehicles, systems, and other equipment previously used to deploy firefighting foam and provide airports information on any supplemental equipment needed to utilize approved MILSPEC F3 products.*

SUMMARY OF FAA TIMELINES FOR POLICY & GUIDANCE RELATED TO REQUIRED ELEMENTS

Required Element 1: Provide timelines for the release of policy and guidance relating to part 139 airport implementation plans for obtaining approved MILSPEC products and firefighting personnel training

FAA's Timeline:

After DoD's qualification of new MILSPEC F3 products, the FAA will—

- Release a CertAlert to inform airport operators when the Defense Logistics Agency (DLA) QPL adds FAA-accepted MILSPEC F3 products to the list. The DoD is required by Congress to have products qualified and listed on the QPL no later than October 1, 2023.
- Update AC 150/5210-6, *Aircraft Fire Extinguishing Agents*, to include pertinent information about new MILSPEC F3 products.
- Provide airport operators with the latest information via CertAlerts on any changes/impacts to existing certified firefighter training facilities and their training curricula.
- Provide any related guidance updates required as a result of new data from research and field demonstrations.

Required Element 2: Provide part 139 airports with information on obtaining EPA guidance on acceptable environmental limits

FAA's Timeline:

Upon DoD's qualification of new MILSPEC F3 products, the FAA will —

- Coordinate with EPA prior to releasing a new CertAlert that provides information on applicable environmental considerations for the MILSPEC F3 transition, including applicable EPA website links.

Required Element 3: Provide best practices for the decontamination of existing aircraft rescue and firefighting vehicles, systems, and other equipment previously used to deploy firefighting foam (and) provide airports information on any supplemental equipment needed to utilize approved MIL-SPEC products.

FAA's Timeline:

The FAA will—

- Release the most current information about vehicle/equipment cleaning practices, as soon as it becomes available.

- Release the most current information about necessary supplemental equipment, as soon as it becomes available.

POLICY AND GUIDANCE RELATED TO PART 139 AIRPORT IMPLEMENTATION PLANS

The purpose of this section is to provide airports information on the fire suppression differences between MILSPEC F3 and AFFF and tactics/techniques to successfully apply foam. Based on several years of research and data collection, conducted by multiple federal agencies, the US Navy published MIL-PRF-32725, *Fire Extinguishing Agent, Fluorine-Free Foam (F3) Liquid Concentrate for Land-Based, Fresh Water Applications*, on January 6, 2023. This specification outlines the performance requirements MILSPEC F3s must meet in order to be qualified to the specification and listed on DLA's QPL. Using the AFFF MILSPEC (MIL-PRF-24385) as the starting point for this MILSPEC development, the Navy added additional fire tests to the specification. In particular, the MILSPEC fire tests now include fire tests that use Jet A fuels, which better represents the primary hazard at military installations and other shore-based facilities. The existing unblended gasoline tests remain in the new standard because using lower flash point fuels adds additional rigor that better distinguishes the higher-performing products from the lower.

In FAA CertAlert 23-01, *New Military Specification for Performance-Based Standards for Fluorine-Free Aircraft Fire Fighting Foam,* dated January 12, 2023, the FAA stated it will accept the use of the new MILSPEC F3s listed on the DLA's QPL for ARFF purposes at part 139 certificated airports in addition to the existing AFFFs. The Navy is required by Congress to have the new MILSPEC F3 firefighting agent available for use no later than October 1, 2023. Once MILSPEC F3s are posted to the QPL, civil airports can begin their transition to these new foams.

MILSPEC F3 products qualified under the new MILSPEC will only be available in concentrates of 3%. At this time, the MILSPEC F3s will be proportioned at a foam concentrate to water ratio of 3 gallons of foam concentrate to 97 gallons of water. The 2 gallons per minute (GPM) application rate in the F3 MILSPEC qualification tests is the same as in the legacy AFFF guidance. This quantity of foam solution has been proven to readily extinguish fuel fires, absorb heat, and smother vapors.

It is critical that ARFF departments fully understand the differences between the AFFFs and the new MILSPEC F3s. While both foams are very effective, training must be adjusted to emphasize the differences in MILSPEC F3 performance in extinguishing Class B, liquid fuel spill fires.

AFFF products extinguish fuel spill fires in three ways: (1) the foam blanket suppresses the combustible fuel vapors, (2) the water cools the fire, and (3) the fluorinated surfactant drains from the foam bubbles and creates a film between the foam and fuel layers. This film helps the foam blanket travel across the fuel spill and reseal itself when the foam blanket has been broken. Even when the foam blanket has degraded, the film from the fluorinated surfactant continues to provide vapor suppression.

MILSPEC F3s lack the fluorinated surfactant, and therefore do not have the film forming properties of AFFFs. As a result, MILSPEC F3s suppress the fire in only two ways: cooling it with water and suppressing vapors with the foam blanket. Without the film formation, the mechanical structure and maintenance of the foam blanket become a critical aspect to the success of the fire suppression. When a foam blanket is disturbed by a firefighter or passenger traversing through it or a fire hose being pulled through it, no resealing occurs, as it does with AFFF. The disturbance of the foam blanket has the potential to create a break through burn. Therefore, new tactics or techniques should be provided to firefighters to help them prevent this phenomenon.

FAA guidance on MILSPEC F3 implementation will focus on four main areas, as described below: application tactics and techniques, foam blanket management, responder responsibilities, and training information.

Tactic and Technique Differences

Firefighters should review basic foam application and accepted methods of applying foam, since one of the most common failures in foam performance is human error. Incorrect firefighter application of AFFF does not always affect the fire extinguishment. This is because the fire suppressing characteristics of AFFF, as well as the fluorinated surfactants role in aiding the foam blankets ability to travel across the fuel spill, often compensate for incorrect firefighting technique. MILSPEC F3 does not have fluorinated surfactants, so there is no compensation for incorrect technique. Its use requires the correct application methods and foam blanket management. A firefighter cannot effectively fight a fire using MILSPEC F3 if improper foam operations, techniques, methods, and management are used. Poor application techniques can cause the foam blanket to break.

There are three basic foam application techniques: roll-on, bank-down, and rain-down.

- Roll-on uses the impact with the ground to further aerate the foam, and the velocity of the discharge pushes the foam blanket across the spill. The absence of the fluorinated surfactant makes MILSPEC F3 foam travel slower than with AFFFs.
- Bank-down application uses the impact with a hard surface like the fuselage of the airplane to further aerate the foam and allow the foam to drop onto the surface of the fuel spill.
- Rain-down involves a foam that is discharged in a high arc that gently drops onto the fuel spill. This technique may be very effective at foam blanket maintenance but is not as effective in fire extinguishment. In the rain-down technique, a large portion of the foam is consumed within the thermal column of the fire and never reaches the base of the fire and the fuel.

Testing has shown proper angle of attack is essential between downward plunging and rain-down. A discharge of the foam downward into the fuel spill (plunging) will cause fuel pick-up in the foam blanket, which results in small flickering flames across the foam blanket. These flames can travel across the blanket and find a vapor source from a hole in the foam blanket causing full

re-ignition. The oleophobic (oil repelling) characteristic of the fluorinated surfactant prevented this phenomenon from happening with AFFF.

A hybrid of foam applications may be the best solution to an effective fire attack and foam blanket management. More testing and practice in the field will be necessary to generate additional best practices. No one technique may single-handedly accomplish all goals on the incident scene. The best combination of techniques may be to use a lower angle, base sweep to first push the fire and initial foam application across the spill, followed by a bank-down generated foam blanket over to the fuel spill to build up added protection. A rain-down technique can also follow the initial fire attack by gently applying the foam to increase the blanket quality after the initial thermal plume has been knocked down.

From research and product demonstrations, the following basic foam techniques and skills are consistent best practices across all MILSPEC F3s used:

- Do not plunge the foam stream into the fuel spill.
- Slowly sweep the nozzle left to right and let the foam blanket build up.
- When using a variable stream, low expansion nozzle, consider using the bank-down and roll-on methods to create thicker finished foam.

A few topics related to application techniques require more research and demonstration, particularly as they relate to potential chemical mixing from multiple foam discharges onto the same fire area. Further research must take into consideration an ARFF department having assistance from a mutual aid department or at a dual-use airport where the same multiple foam concentrates are not being used throughout the fire attack. The FAA and DoD are already working together to address some of these questions in active research programs.

Foam Blanket Management

Foam blanket management is critical when using MILSPEC F3s. As described earlier, the absence of a fluorinated surfactant in MILSPEC F3, to create the vapor sealing film, means the integrity of the foam blanket is the only means of containing the fuel vapors and preventing re-ignition.

The following factors can impact the quality of the foam blanket and should be constantly considered and monitored during foam applications.

- Foam concentrate to water ratio – poor proportioning will impact foam production
- Application rate – not achieving proper application density
- The presence of heated metals and fire – hot surfaces will degrade the blanket
- Walking and driving through the foam – no film formation to seal the opening in the foam blanket
- Weather – rain, snow, wind, etc.

- Water streams – dilute or break apart the foam blanket
- Dry chemical agents – break down the foam blanket if applied on top of the foam blanket
- Holes in the foam blanket – holes provide no protection so foam must be reapplied over openings in the foam blanket

In addition to the factors listed above, a phenomenon known as AFFF draindown can also impact the quality of the foam blanket. AFFF draindown is a combination of loss of foam blanket and building of the film formation for vapor suppression. Draindown times also affect the foam blanket. There are significant differences between the draindown times of AFFF and MILSPEC F3. AFFF draindown is much quicker than with MILSPEC F3. With AFFF, the liquid draining from the foam is cooling water, as well as the vapor sealing fluorinated surfactant. The draining of the surfactant from the foam creates the vapor suppression. MILSPEC F3s need to have a slower draindown as the mechanical structure of the foam blanket is the only vapor-suppressing characteristic of an MILSPEC F3.

There are multiple discharge nozzles available in the fire industry; however, research is ongoing to determine how different types of nozzles might interact with MILSPEC F3 specifically.

In the United States, the primary nozzles used on ARFF apparatus are variable stream nozzles. Variable stream nozzles are designed for water discharge; however, they have been found to perform adequately with AFFF applications. Variable stream nozzles provide the widest range of spray pattern options. They also provide the best throw range. The downside to variable stream nozzles is that they do not provide air aspiration and thus have lower foam expansion.

Variable stream nozzles can be used with the addition of a foam tube. Foam tubes are an easy clip-on accessory to the existing variable stream nozzle. They can, however, reduce the ability to effectively adjust the spray pattern. A benefit to the foam tube is that it adds aeration to the foam discharge and provides higher foam expansion. This added aeration, however, can severely limit throw distance of the foam.

Another method of making quality foam is the use of a compressed air foam (CAF) system. Currently, CAFs are not widely used in ARFF applications outside of small units with handline applications. CAFs use a smooth bore nozzle as opposed to a variable stream nozzle and add an air injection into the discharge solution to further aerate the foam solution. CAFs also have a shorter throw range compared to a variable stream nozzle. CAFs creates a thicker, drier foam which can be more impacted by winds.

Responder Responsibilities and Considerations

As indicated throughout this document, MILSPEC F3 does not have the surfactant to effectively create a resealing vapor suppressing film. Without the film forming characteristic, the condition of the foam blanket becomes the critical factor. A poor-quality foam blanket can allow the fuel spill to reignite and wrap around behind responders. Failure to identify this hazard can be catastrophic, so fire departments should consider the use of a spotter. The spotter could be the

backup firefighter on the handline but slid further back to provide a clearer view of the foam blanket. The spotter function could also be provided by a second backup handline crew. This crew could monitor the conditions and maintain an effective foam blanket behind the initial fire attacking crew.

For truck operations, it is important for the driver/operator to maintain awareness of the foam blanket. The driver/operator can reapply foam to the blanket as handline operations are ongoing to provide added protection to the handline crew. Fire departments might consider conducting a new resource task analysis for emergency responses using MILSPEC F3s.

Training Information Dissemination

As airport fire departments transition from AFFF to MILSPEC F3, they will need knowledge of the different characteristics of MILSPEC F3 to ensure successful emergency responses using these new foams. Initial training for ARFF departments will be through information dissemination such as journals, conferences, webinars, and similar formats. The most immediate means of disseminating training material will come from print and online sources. This material can consist of information released by the FAA via CertAlert, best practices, website updates, and email blasts. Other material can be disseminated through articles in the ARFF Working Group's *ARFF News* magazine and the National Fire Protection Association's *NFPA Journal.* The NFPA Research Foundation is also revising the *Firefighting Foams: Fire Service Roadmap*, which was published in May 2022. The latest available MILSPEC F3 training guidance can be included in this revision.

Aside from print and online distribution, other near-term solutions for sharing available training information with the industry are webinars and conference presentations at events such as ARFF Working Group Conferences, the International Association of Fire Chiefs (IChiefs) Conference, and the Fire Department Instructors Conference.

Firefighters may benefit from hands-on training using MILSPEC F3 to reinforce the knowledge of how these foams perform in comparison to the AFFFs. However, there are still outstanding questions about the use of MILSPEC F3 at training facilities that need to be answered, including— if fire fighters can use MILSPEC F3 during training. Such factors are:

- How many existing training facilities will have restrictions on MILSPEC F3 foam discharge?
- Will there be development of MILSPEC F3 instructional techniques for students using propane facilities?

In the longer term, there are other methods to provide MILSPEC F3 training to airport firefighters. In 2011, the FAA released training DVDs to airports that covered ARFF recurrency, high-reach extendible turret operations, cargo firefighting, and forcible entry. The FAA will create a similar video for MILSPEC F3 training and post it online for firefighters to review.

Modifications to existing ARFF training facilities may also be necessary. Software and algorithm modifications may be needed so propane training facilities can more closely mimic a Class B fire

attack using F3. Adding liquid hydrocarbon fire capabilities to existing propane training facilities would allow for more realistic fire training.

The FAA will provide ongoing updates about training changes as best practices are developed.

EPA GUIDANCE

The FAA and EPA encourage the expeditious transition away from PFAS-containing AFFF and toward MILSPEC F3 in order to reduce potential human health and environmental impacts from PFAS contamination. Proceeding with this transition as quickly as possible—taking into account passenger, crew, and firefighter safety and the availability of funding and replacement MILSPEC F3—will reduce the potential for further environmental contamination from PFAS and future environmental liabilities.

Under the PFAS Strategic Roadmap, EPA is pursuing a coordinated strategy to research, restrict, and remediate PFAS. Several actions EPA has taken or plans to take under the PFAS Roadmap have the potential to impact the AFFF/ MILSPEC F3 transition, including the following:

- National Pollutant Discharge Elimination System Guidance: In December 2022, EPA provided guidance to states on how to use the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) permitting program to reduce PFAS discharges and to obtain comprehensive information on the sources and quantities of PFAS discharges. The guidance identifies airports as an industry category known or suspected to discharge PFAS and includes specific recommendations for best management practices to address PFAS-containing firefighting foams for stormwater permits, including eliminating PFOS- and PFOA-containing AFFFs.
- Interim Guidance on PFAS Destruction and Disposal: In December 2020, in response to the FY2020 National Defense Authorization Act (NDAA), EPA released interim guidance that outlined 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 AFFF. EPA scientists are working to improve scientific understanding of PFAS destruction and disposal technologies, and EPA plans to update the 2020 guidance to reflect both public comments and more recent published research results. Consistent with the FY2020 NDAA, EPA plans to issue updated guidance by December 2023.

EPA is pursuing additional regulatory actions with respect to PFAS under the Safe Drinking Water Act; the Clean Water Act; the Comprehensive Environmental Response, Compensation, and Liability Act; and the Resource Conservation and Recovery Act, but no final regulatory actions have been taken at this time. As noted above, however, compliance with any future regulatory requirements under these laws with respect to PFAS should be facilitated by the transition from AFFF to MILSPEC F3.

Residual PFAS

In spite of the expected human health and environmental benefits from transitioning to MILSPEC F3, there is potential for detectable levels of PFAS to be released from an ARFF apparatus even after the transition, particularly in those that contained AFFF. The primary mechanism for this is residual PFAS present in the fire suppression system components of an ARFF apparatus, which can contaminate MILSPEC F3. See EPA's December 2022 NPDES guidance (noted above) for potentially relevant recommendations about monitoring and best management practices. The MILSPEC for F3 requires manufacturers to certify that PFAS has not been intentionally added to the concentrate (the MILSPEC allows up to 1 ppb concentration of PFAS in the concentrate) and that the PFAS content be below the method detection limit (MDL) of EPA Draft Method 1633.

The FAA, in coordination with EPA, will post guidance on acceptable environmental limits, once it is available. This guidance, which will be available from the FAA Aircraft Rescue and Fire Fighting (ARFF) webpage, will highlight key environmental compliance considerations associated with the AFFF/ MILSPEC F3 transition. The EPA and the FAA will partner to ensure this webpage is kept current as new information, guidance, or regulations are issued.

INFORMATION RELATED TO MILSPEC F3 USE AND DECONTAMINATING ARFF EQUIPMENT

Airports will need to decide whether to transition to MILSPEC F3 or to continue using AFFF as a firefighting extinguishing agent in the immediate future. At this time, the FAA has not mandated a transition to MILSPEC F3; however, airports need to be aware of applicable state laws and emerging Federal requirements, which may require a transition to MILSPEC F3. Airports may also want to transition to F3 to protect public health and manage future liability risk. Further, as foam manufacturers transition to producing MILSPEC F3, AFFF may become unavailable, which may force airports to transition sooner. Airports should develop a transition team for planning and executing a transition to MILSPEC F3[1], which should consider both Federal and state requirements related to the handling, disposal, and cleaning of equipment contaminated with PFAS.

The FAA highly encourages airports to acquire input-based testing systems, which allows the testing of the proportioning system of their fire trucks to meet Part 139 requirements without dispersing AFFF (CertAlert 21-01, Aqueous Film Forming Foam (AFFF) Testing at Certificated Part 139 Airports). These testing systems can also be used with MILSPEC F3. Eligible airports may use Airport Improvement Program (AIP) grant funds to purchase one of the four qualified systems, and currently, there is no local match requirement so the equipment will be fully funded by the FAA.

[1] Although airport hangars are outside FAA's regulatory jurisdiction, airports should consider hangar fire suppression systems as significant sources of PFAS-containing AFFF and include such systems, as appropriate, in transition planning and execution.

ELEMENTS THAT SHOULD BE CONSIDERED IN AN MILSPEC F3 TRANSITION PLAN

The airport should begin transition planning prior to taking any action.

Impacts on Index Requirements and ARFF Vehicles

The airport will need to identify its airport index requirements and plan accordingly so it can maintain the regulatory requirements to comply with part 139. Airports will need to take each ARFF vehicle out of service for five days or more to make the transition. Because of the need to take vehicles out of service, some smaller airports may need to borrow or rent an ARFF vehicle to maintain index requirements.

Because MILSPEC F3 concentrates cannot be stored in a pre-mixed water/foam solution, airports that have ARFF vehicles with a premixed solution of foam and water will need to purchase new vehicles if they decide to switch from AFFF to MILSPEC F3. Airports that rent ARFF vehicles in order to maintain their airport Index could also see significant delays due to the limited number of ARFF vehicles available for rent. Further, airports will need to ensure they are fully trained on the operation of the ARFF vehicles they rent.

Airports may have a combination of vehicles using AFFF and vehicles using MILSPEC F3 at the same time. This is allowed as long as all foam being used is or has been on the QPL.

As of May 8, 2023, no foam manufacturers have had a product qualified to the F3 MILSPEC standard, so no MILSPEC F3 options are currently available for purchase on the QPL. Prior to purchasing the MILSPEC F3, once it becomes available, airports should consult both the manufacturers of their ARFF vehicles and potential foam manufacturers about the use of the product and any supplemental equipment requirements. At this time, beyond the impact to premixed foam/water solution vehicles, the FAA is not aware of any ARFF supplemental equipment requirements for MILSPEC F3 products.

Environmental Considerations

As airports continue their planning, they should consider the following:

- Has the airport's state mandated that airports make the transition?
- Are there state environmental regulatory requirements for airports? States regulate PFAS to varying degrees, and there is no single standard available across the board.
- Will the airport's state allow the discharge of MILSPEC F3 foam at the airport?

With respect to discharges regulated under the Clean Water Act, airports should contact their NPDES permitting authority (typically a state agency) to inquire about permit requirements, limitations, or other considerations associated with discharges from fire apparatus, particularly those that have used AFFF. There have been no national standards established for acceptable levels of PFAS discharged from ARFF vehicles after cleaning.

It is hard to determine the level of PFAS residuals in ancillary equipment, and a method of testing for PFAS in this equipment has not been identified. Therefore, when transitioning equipment, airports should take care that residual PFAS-containing foam is contained and not released into the environment.

As noted earlier, FAA encourages the expeditious transition from PFAS-containing AFFF to MILSPEC F3 to reduce potential human health and environmental impacts. However, following the transition to F3, there remains the potential for detectable levels of PFAS to be present in discharges from ARFF vehicles that formerly contained AFFF. The primary mechanism for this is residual PFAS present in the fire suppression system components of an ARFF apparatus. DoD has been conducting focused research on the demonstration and validation of environmentally sustainable methods to clean fire-fighting delivery systems through the Environmental Security Technology Certification Program (ESTCP)[2]. Results of the research available to date indicate the potential for varied levels of PFAS residual to be released following cleaning. Information about this research is available from the links below:

- Supercritical Water Oxidation (SCWO) for Complete PFAS Destruction
    - Lead Investigator: Marc Deshusses, Duke University
- An Innovative Plasma Technology for Treatment of AFFF Rinsate from Firefighting Delivery Systems
    - Lead Investigator: Selma Mededovic, DMAX Plasma LLC
- Clean or Replace? Decontamination Framework for Firefighting Equipment and Hangers and Disposal of PFAS Contaminated Waste
    - Lead Investigator: Matthew Magnuson, U.S. Environmental Protection Agency
- Demonstration and Validation of Environmentally Sustainable Methods to Effectively Remove PFAS from Fire Suppression Systems
    - Lead Investigator: Johnsie Lang, Arcadis
- Remediation of AFFF-Impacted Fire Suppression Systems Using Conventional and Closed-Circuit Desalination Nanofiltration
    - Lead Investigator: Christopher Bellona, Colorado School of Mines
- Sustainable Firefighting System Cleanout and Rinsate Treatment Using PerfluorAd
    - Lead Investigator: Zoom Nguyen, CDM Smith

[2] Since FY 2011, DoD has invested in efforts to develop PFAS-free firefighting formulations and improve management of PFAS in the environment through the Strategic Environmental Research and Development Program (SERDP) and ESTCP. Additional information on these efforts is available at https://www.serdp-estcp.org/focusareas/e18ec5da-d0de-47da-99f9-a07328558149/pfas-afff.

- ARFF Apparatus Disassembly and Characterization Demonstration
    - Lead Investigator: John Anderson, Arcadis

Availability of MILSPEC F3

Airports should ensure that sufficient quantities of the MILSPEC F3 products they have chosen are available when they are ready to make the transition. One of the most important considerations is the incompatibility of one MILSPEC F3 foam to other MILSPEC F3 products or AFFF. According to the new MILSPEC (MIL-PRF-32725), airports must NOT mix any F3 products together in a foam tank. Airports should attempt to transition all their vehicles consecutively over a short period of time.

Transition Costs and Other Considerations

While it is possible to project the cost of the MILSPEC F3 necessary to be replaced, it is difficult to determine the time needed and cost to adequately clean equipment that contained AFFF. Of course, these costs should be compared to potential impacts and risks associated with continued AFFF use.

The following are just some factors airports will need to consider if they choose to transition to MILSPEC F3:

- New foam (availability, storage capability, brand requirements)
- Long-term storage containers for unused AFFF product and any generated cleaning rinsate (liquid generated from the cleaning process) and storage requirements for the new MILSPEC F3 product, including storage temperature requirements, for example.
- State collection or "take-back" programs for disposal of unused AFFF and cleaning rinsate
- Whether airports can hire a company for removal of AFFF, equipment cleaning, and installation of MILSPEC F3 product or will do it themselves
- Disposition of old AFFF and rinsate requirements/methodology
- Maintenance personnel requirements during the transition process
- Vehicle and foam manufacturers assistance with the selection of an MILSPEC F3 foam and during the transition process
- State law or local union requirements to provide a health and safety plan for the transition operation
- All federal, state, and local environmental regulations
- Location where the transition will take place and whether an indoor location is available to minimize exposure to precipitation (temperature and weather can have an adverse effect)

- Potential of contaminated equipment and facilities during the transitioning process
- If vehicles will be cleaned prior to installing a new MILSPEC F3 product, sufficient space for the vehicle, necessary cleaning equipment, new foam, and containers for old foam and rinsate
- Attention to foam manufacturers' recommended procedures and guidance on vehicle preparation and transitioning
- Confirmation that all AFFF has been removed and the system has been flushed
- Availability of a hazardous material company in the event a spill cleanup is necessary

Airports may want to consider working with their state environmental agencies or other entities to establish an AFFF take-back program. This will allow all airports within the state to have one process for the disposal of AFFF and allow the state to monitor the quantity and disposal of AFFF and potentially achieve economies of scale and reduced soft costs. States may also want to consider contracting with a single company for the cleaning of all ARFF vehicles within the state.

Conducting a cleaning program prior to new foam installation will help avoid future exposures to PFAS. As noted above, EPA has issued Interim Guidance on the Destruction and Disposal of PFAS and PFAS-containing materials, which EPA plans to update in December 2023.

NEXT STEPS

DoD continues its research and is working toward identifying best practices related to the transition from AFFF to the MILSPEC F3 products. The FAA will continue to collaborate with DoD and will share with airport operators any best practices that are developed. Some airports may be mandated by their states or otherwise make a risk-based assessment to transition before formal guidance is available. If this occurs, the FAA encourages the airport operator to engage with the local regulatory authorities and suggests implementing best available methods that meet the individual airport's needs for removal of PFAS from ARFF vehicles.