NFSA NATIONAL FIRE SPRINKLER ASSOCIATION
The Voice of the Fire Sprinkler Industry

TechNotes

Editor - Roland Asp, CET #538 06/25/2024

This edition of TechNotes was written by John Swanson, Codes and Standards Specialist for the NFSA.

Technotes: The ABC's of AFFF

There has been much discussion lately regarding Aqueous Film-Forming Foam, or AFFF for short. This TechNotes will discuss the history of AFFF firefighting foam, current issues, and where the industry is heading in the future as replacement options. But first, it's important to clarify the primary issue with AFFF foam.

AFFF foam contains a chemical called polyfluoroalkyl substances, or PFAS. PFAS substances are a group of synthetic chemicals that are resistant to heat, water, grease, and oil. They have been labeled as a "forever chemical" by the Environmental Protection Agency (EPA) because the chemical breaks down very slowly and can accumulate in people, animals, and the environment. It has also been categorized as a probable human carcinogen. Exposure to PFAS chemicals has been linked to a higher risk of cancer in firefighters, airport workers, military personnel, and any other professions that worked closely with AFFF.

History of AFFF

AFFF was first introduced in the 1960s and developed by the United States Naval Research Laboratory. Because of its low viscosity and ability to spread quickly when applied, AFFF was found to be very effective at extinguishing liquid fuel fires. For this reason, the United States government expanded the use of AFFF in the 1970s to Department of Defense facilities,

military bases, and installations. Soon after, AFFF was being used at airports and by local fire departments throughout the United States. Today, the United States military is the largest user of firefighting foams comprising of roughly 75% of the market. The remainder of the market consists of use by local fire departments and petroleum processing refineries.

Because of AFFF's ability to work quickly to cover the fuel and vapor release from the flammable liquid, the US military found it very effective as a firefighting agent on US Navy vessels and aircraft carriers. When fires occurred onboard aircraft carriers due to either a fuel liquid release or a crash, AFFF was extremely effective at smothering fires quickly so medical responders could quickly tend to the pilot(s).

Why is AFFF effective as a fire-extinguishing agent?

The fire tetrahedron points out that to start a fire, three things must be present: oxygen, heat, and fuel. This is referred to as the fire triangle. But for a fire to start and support combustion, a fourth element, the chemical chain reaction, must occur. This is referred to as the fire tetrahedron. What's important to remember is, if you take any of the four away (oxygen, heat, fuel source, or chemical chain reaction), a fire cannot occur and/or it cannot support/sustain combustion. AFFF foam creates a film over the surface of the liquid-fuel fire that acts as a blanket suppressing the fuel vapor, inhibiting the fire's ability to continue burning. The film-forming foam creates a cooling and covering effect that inhibits the transfer of heat and oxygen. The blanket formed by the film disrupts the chemical chain reaction by smothering the fire and sealing in the flammable vapors, extinguishing the fire. Because AFFF could spread quickly over the liquid fuel, it was extremely effective at fire control and knockdown. In some cases, it's possible to witness a fire being extinguished before the foam covers the liquid due to the invisible film acting as a blanket over the flammable liquid.

Where do we go from here?

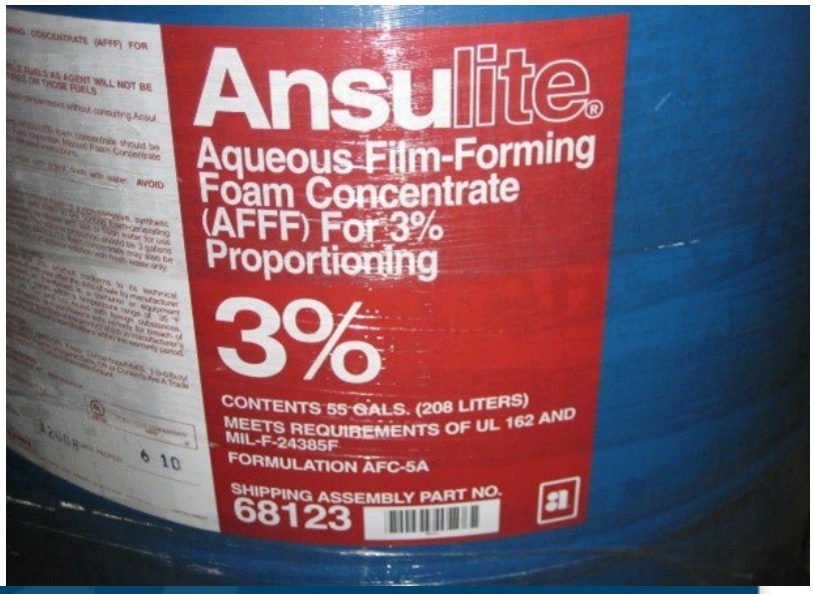
We know that AFFF foam contains PFAS, which is known as a forever chemical and its probable link as a carcinogen in people. So, one of the most common questions that NFSA receives regarding AFFF is, what should we do with all the existing AFFF systems currently installed. This is a very good question, and unfortunately, there is no simple answer to this question. First, it's important to note that the United States Congress has not passed any laws requiring the removal, replacement, or discontinued use of AFFF. The US Department of Defense has mandated all their facilities 'turn off' all fire extinguishing systems utilizing AFFF; however, this decision was made internally by the Department of Defense and was not mandated by Congress.

That said, several states have passed laws over the past several years regulating the use of PFAS. Maine, Minnesota, and Washington have given state agencies the authority to ban PFAS in varying different products. Currently, twelve states, including California, Colorado, Connecticut, Hawaii, Illinois, Maine, Maryland, Minnesota, New Hampshire, New York, and Vermont, have banned the sale of firefighting foam containing PFAS.

If you are in one of the states banning the sale of firefighting foams containing PFAS, eventually, replacement will be mandated as these existing systems come due for hydrostatic testing. Refer to Chapter 11 in NFPA 25 for more specifics. Since the previously mentioned states will not permit the sale of new AFFF foam, existing AFFF systems will need to be changed out at the time hydrostatic testing is due since new AFFF foam cannot be used to refill the system.

If, however, you are not located in one of the states that has banned the sale of firefighting foams containing PFAS, it's important to point out that currently, there is no sunset date or current requirement to replace existing AFFF installations as long as the system can be inspected, tested, and maintained in accordance with the manufacturer's instructions and Chapter 11 of NFPA 25. It should be noted that many of the manufacturers of AFFF foam have discontinued making AFFF due to the foreseeable phase out, along with concerns over potential liability given the known hazards associated with AFFF and PFAS. In June of 2023, the chemical manufacturer 3M indicated it would pay $10 billion in lawsuit settlements after plaintiffs argued the company's firefighting foam was partially responsible for contaminating tap water with PFAS. Since many manufacturers have discontinued making AFFF, replacement of any existing systems over the next few years is likely unavoidable due to lack of replacement parts and equipment. In other words, it's only a matter of time until existing installations are due for hydrostatic testing and unable to purchase new AFFF from the manufacturers.

Many of the states that regulate PFAS chemicals used in firefighting agents, also establish rules and limitations on protecting runoff from AFFF (PFAS) from contaminating nearby soil as PFAS chemicals have been found in drinking water in various parts of the United States. Therefore, an important consideration for those companies that service existing AFFF systems is how to comply with NFPA 25's requirement to conduct flow tests for the foam system, especially when several states have prohibited the nonemergency use of AFFF foam. Currently, The International Fire Code (IFC) requires foam systems to be inspected, tested, and maintained in accordance with NFPA 25.



Alternatives to AFFF

Recognizing the long-term health and environmental impacts with PFAS foam, manufacturers are transitioning to fluorine-free foam alternatives. Synthetic fluorine-free foams, or SFFFs, do not use PFAS. Therefore, the health and environmental impacts are negated. As mentioned previously, AFFF foam works by creating a thin aqueous film over the surface of the fuel to separate the fuel from the oxygen. Conversely, SFFF foams create a physical barrier between the fuel and the oxygen by using bubbles only. This prevents the fire from spreading and creates a cooling effect. However, SFFF is not without its shortcomings. There are practical challenges that must be overcome for fire protection system designers to consider. Each manufacturer of SFFF foam has their own unique mix of chemicals and chemistry to make the foam effective. In other words, not all SFFF foams are created equally. Different manufacturers have differing specifications in regard to application densities and proportion rates. Each have their own strengths and weaknesses based on the type of fire, type of fuel, and size of the fire. This means existing fire protection systems utilizing AFFF may need to be modified or replaced entirely to handle the new SFFF foams. Furthermore, SFFF foams do not provide the same level of freeze protection that AFFF foam offers. Understanding how to effectively use the different types of SFFF foams available on the market and how they differ from AFFF is critical for fire protection system designers and fire service personnel alike.

Non-Foam Alternatives to AFFF

The following considerations are important factors in determining the appropriate type of foam for the application. The following are guidelines and considerations as the transition from AFFF to other foams moves forward:

1. What are you trying to protect?
2. Is existing equipment compatible with the new foam?

Both questions must be answered to determine how to move forward. It is important to research the different formulations of foam currently available and considerations include expansion rate, drainage time, and cooling capacity.

For a decade or more, manufacturers of foam have been developing and testing replacements to AFFF. Today, there are several different types of foam products made without fluorine available on the market. Testing completed by the US Department of Defense, Fire Protection Research Foundation, and the industry have shown these new fluorine-free products can be effective at extinguishing liquid fuel fires. But again, studies have shown that the performance of fluorine-free foam products often vary significantly based on the manufacturer, the type of fuel, and type of discharge device used. The challenge is, AFFF has been successful because it creates a film layer over the burning fuel. Fluorine-free foams don't make a film on the fuel like AFFF, they work by providing a barrier of bubbles that contain the fuel vapors that prevents them from mixing with oxygen. So, there is no "one size fits all" approach to replacing AFFF.

Another issue that has emerged for contractors and public safety agencies alike is, when AFFF is replaced, it must be disposed of properly. Some states have offered to dispose of AFFF for free; but this service is typically only available to fire departments and/or other public safety agencies. Contractors, on the other hand, should be prepared to cover the costs of disposal, which can run upwards of $20 per gallon.

In summary, the question of how to replace existing AFFF fire protection systems have been a valid concern for many years and this issue is unlikely to go away anytime soon. As mentioned previously, even if your state has not passed laws prohibiting AFFF (or PFAS), the likelihood of companies being able to maintain these systems over the coming months and years will present challenges since manufacturers have discontinued selling AFFF. For that reason, it's only a matter of time until fire protection professionals must address how and when to change out existing AFFF systems.

Training and Education

Sign-Up for one of our Layout Technician Pathway Courses

NFSA's newly updated fire sprinkler Layout Technician Pathway (LTP) prepares fire sprinkler layout and design professionals for NICET Levels I & II certifications. It also provides a great refresher for those who have been designing systems but need a comprehensive refresher. Students will receive a hard copy of the recently updated and revised "Layout Book" as well as a copy of the 2022 edition of the NFPA 13 standard.

The LTP consists of two parts. Students must first complete the on-line Part 1: Fundamentals before attending the in-person Part 2: Application session. The 25 self-paced online modules cover everything from "Parts of a Sprinkler" to "Introduction to Fire Sprinkler Calculations." The 3-day in-person instructor-led Part 2: Application class applies the content learned in the previous Fundamentals course. There are four in-person and one virtual session offered in 2023.

NOTE: Students must register for Part 1: Application at least one month before the start of in-person Part 2: session in order to allow enough time to complete the on-line modules.

Layout Technician Pathway cost:
Members: $2,200.00
Non-members: $4,400.00 – **Join here** to save 50%!

Registration Deadline for Fundamental & Application	Layout Technician: Fundamentals Completion Deadline	Layout Technician: Application Class Dates	Location
1-Jul-24	28-Jul-24	July 29-31, 2024	CO
23-Sep-24	11-Oct-24	October 12-24, 2024	Virtual

Check Out All Options Here

Register for our next Tech Tuesday!

Our next Tech Tuesday will be July 16th, 2024 from 12:30 pm to 1:30 pm eastern time. The topic will be The ABC's of AFFF.

This course will provide attendees with the background behind the use of aqueous film forming foam (AFFF), its association with polyfluoroalkyl substances, or PFAS, and proposals to address AFFF in the codes and standards. The IFC and NFPA 30 have specified AFFF in certain storage arrangements. This seminar will address where the codes and standards are going in relation to AFFF and regulation of PFAS chemicals by the federal government and state governments.

Member Cost: Free
Non-member Cost: $50.00 Learn more about membership.

*** As of October 2023, NFSA has transitioned back to Microsoft Teams using the Webinar client to deliver Tech Tuesdays.

With this process, once you have registered for the event you be sent an email with a Microsoft link that will bring you to the Microsoft Teams Event registration page. You must provide simple identifying information here to generate your email with the "Join" link to the Webinar.

We must be able to identify each participant as accessing, being present, engaging, and evaluating the course to issue a CEU Certificate.

Thank you for your patience, we will continue to improve the user experience as we continue this transition back to Microsoft Teams. Your feedback is always welcome!

Register for the next Tech Tuesday Here

National Fire Sprinkler Association
514 Progress Dr, Ste A,
Linthicum Heights, MD 21090
1-800-683-NFSA (6372)