

Wisconsin DNR Fire Fighting Foam
10-18-19
Mike Lehman
Mechanical Engineer/Superintendent
Forestry Equipment R&D Center

Introduction

Various types of foam have been developed to assist in suppressing fires. The design and additives of the various foams make them better suited for different types of fires. The National Fire Protection Association (NFPA) has defined five fire classifications based on fuel type:¹

- Class A: Ordinary combustible materials, such as wood, cloth, paper, rubber and many plastics. They burn with an ember and leave an ash. Extinguishing can be done by cooling the fuel to a temperature that is below the ignition temperature. Water and other extinguishing agents are effective.
- Class B: Flammable liquids (burn at room temperature) and combustible liquids (require heat to ignite). This includes petroleum greases, tars, oils, oil-based paints, solvents, lacquers, alcohols, and flammable gases. Class B fuel types are a high fire hazard and water may be ineffective in extinguishing the flames. Class B fires are most quickly extinguished by creating a barrier between the fuel and the oxygen, such as layer of foam.
- Class C: Fuels with the same properties as Class A or B, but which involve energized electrical equipment.
- Class D: Combustible metals, such as magnesium, titanium, zirconium, sodium, potassium.
- Class K: Fires in cooking appliances that involve combustible cooking media (vegetable oils, etc.).

Wildland fires fall into Class A. For this reason, the Wisconsin DNR uses only foams designed to be most effective on Class A fires. The primary additive that makes foam work is called a surfactant. Surfactants function by reducing the surface tension of water so that it will cover and penetrate porous materials (such as wood) more effectively. The surfactant used in Class A foam is often used in shampoo and other household cleaning products. As it is essentially soap, it is readily biodegradable.

Class B fires require a foam that creates a film between the fuel and the air, sealing the surface and preventing the escape and ignition of flammable vapors.² These foam types are commonly referred to as AFFF (Aqueous Film-Forming Foam Concentrates). They combine fluorinated and hydrocarbon-surfactant technologies to provide superior fire and vapor suppression for Class B fires.³ Fluorinated surfactants have included Per- and polyfluoroalkyl substances (PFAS), a group of man-made chemicals that includes PFOA, PFOS, GenX, and many other additives.⁴

Discussion

In 1984 the DNR started experimenting with foam and the LeMay Forestry Equipment R&D Center built several Compressed Air Foam systems (CAFS) for DNR engines. The foam used at that time was termed “protein foam” (made from animal rendering waste) and was acquired from military surplus.⁵ These foams do not contain PFAS ingredients⁶ and the DNR has not used this foam since the early 1990s.

The LeMay Center operates a stockroom to supply tools and equipment, including Class A foam, to DNR programs and partners. This includes Wisconsin fire departments and several non-profit organizations

Wisconsin DNR Fire Fighting Foam
10-18-19
Mike Lehman
Mechanical Engineer/Superintendent
Forestry Equipment R&D Center

involved in prescribed burning. Sales are only made to partners that have a current Memorandum of Understanding (MOU) with the department to support wildland fire suppression and prescribed burning. Foam sales are limited to 50 gallons per year per partner organization.

When purchasing Class A foam, we require that it meet the U.S. Forest Service (USFS) specification 5100-307a and is on the USFS Qualified Products List (QPL).⁷ According to Shirley Zylstra, program lead of Wildland Fire Chemical Systems at the Missoula Technology and Development Center⁸, part of the certification process includes a complete ingredient list for foams that they test. **They have researched their files back to the 1980s and NO Class A foams on the Qualified Products List have EVER included PFAS ingredients.** While there is no specific prohibition to PFAS additives in the specification, these additives are simply not used for Class A foams.

The stockroom has researched purchase orders back to the early 1990s, and we have always specified USFS-approved foam. Additionally, only USFS-approved Class A foam is acceptable for reimbursement via the Forest Fire Protection (FFP) grant program, which is utilized by many Wisconsin fire departments.

In late September 2019, the Equipment R&D Center sent samples of four different Class A foam concentrate (our current product, two previously-used brands and a brand under consideration for possible future use) to a certified lab for testing of PFAS. The lab used method ASTM D7979-17M and tested for 24 different PFAS-related chemicals. Within the constraints and limits of the lab's testing instrumentation, reporting levels and dilution requirements, none of the 24 PFAS-related chemicals were detected.⁹

References

1. <https://www.nfpa.org>
2. <https://phoschek.com/product-class/class-b-foam-for-municipalities/>
3. <https://www.chemguard.com/fire-suppression/catalog/foam-concentrates/aqueous-film-forming-foam-fff/>
4. <https://www.epa.gov/pfas/basic-information-pfas>
5. Phil Puestow, Retired Forestry and LeMay Center Technician
6. Aqueous Film-Forming Foam (AFFF), p.3, Interstate Technology Regulatory Council (ITRC)
7. https://www.fs.fed.us/rm/fire/documents/qpl_foam.pdf
8. <https://www.fs.fed.us/rm/fire/wfcs/>
Shirley K. Zylstra, Program Leader
Shirley.Zylstra@USDA.GOV
USDA Forest Service
Wildland Fire Chemical Systems
5785 Hwy 10 W
Missoula, MT 59808
(406) 329-4859
9. Analytical Laboratory Report 9/25/2019, Merit Laboratories Inc., Sample ID S07307.01-.04.