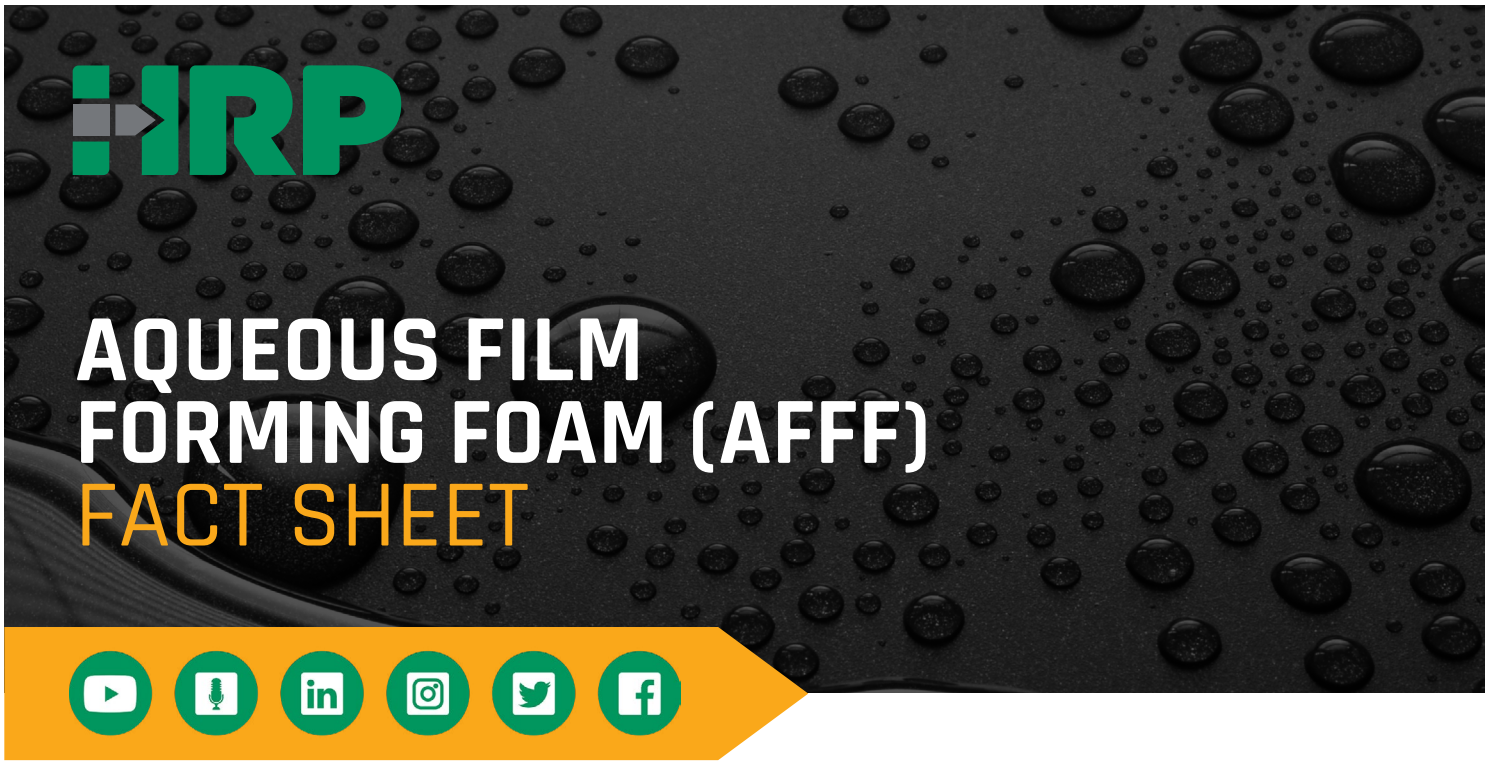

AQUEOUS FILM FORMING FOAM (AFFF) FACT SHEET

AQUEOUS FILM FORMING FOAM (AFFF)

Firefighting foam is used to suppress fires by coating the fuel causing the fire, preventing its contact with oxygen, resulting in suppression of the combustion. There are 2 classes of firefighting foams, categorized by the type of fire they are used to extinguish:

- Class A firefighting foams are designed to extinguish "ordinary combustibles" such as wood, paper, fabric, and municipal waste. Class A foams are not produced using per- and polyfluoroalkyl substances (commonly referred to as PFAS).
- Class B foams are designed to extinguish flammable liquids, including hydrocarbons such as oil, diesel, gasoline, and propane, as well as alcohols, by coating the liquid's surface with foam, cooling the liquid fuel, and preventing contact with oxygen.

Of particular concern with regards to PFAS are Class B Aqueous Film Forming Foam (AFFF) that has been widely used over the past 50 years by the US military, airports, industrial facilities, and some municipal fire departments. Although there are many types of firefighting foam, AFFF is unique in that it uses PFAS as a surfactant, allowing it to spread rapidly over flammable liquids such as oil, gasoline and alcohols to suffocate fires. Studies have indicated that repeated use of PFAS containing AFFF have adversely impacted nearby water supplies.

TYPES OF AFFF

PFAS containing AFFF can be divided into three categories, including legacy PFOS AFFF, legacy fluorotelomer AFFF, and modern fluorotelomer AFFF based on the manufacturer and usage.

- Early 1960s to 2002 (at which time it was voluntarily phased out) - Legacy PFOS AFFF were manufactured by 3M, under the brand name Lightwater. According to the literature Legacy PFOS AFFFs contain PFOS and perflouroalkane sulfonates (PFSAs) such as perfluorohexane sulfonate (PFHxS) (Backe, Day, and Field 2013).
- 1970 to 2016 - Legacy fluorotelomer AFFF encompass all other brands of AFFF besides 3M Lightwater or their licensed products (Schultz et al. 2006). Although they are not made with PFOS or perfluorooctanoate (PFOA), they contain polyfluorinated precursors (Backe, Day, and Field 2013) (Place and Field 2012) that are known to degrade to the long chain PFAS, polyfluoroalkyl carboxylates (PFCAs), including PFOAs (Weiner et al. 2013).
- Current Production – in response to the USEPA's 2010/2015 voluntary PFOA Stewardship Program, most foam manufacturers have transitioned to the production of only short-chain (C6) fluorotelomer-based fluorosurfactants. These products also referred to as "C6 foams," do not contain or break down in the environment to PFOS or PFOA and are currently considered to be less toxic. However, it must be noted that breakdown products of C6 foams can include PFHxA, PFPeA, and 5:3 FTCA (Kempisty, Xing, and Racz 2018). Further, modern fluorotelomer AFFF may contain trace levels of PFOA as impurities.

AQUEOUS FILM FORMING FOAM (AFFF)

USE AND ENVIRONMENTAL IMPACT

AFFF's ability to extinguish hydrocarbon fires effectively and efficiently has led to its widespread use anywhere hydrocarbon fires (and other liquid and gas-based fires) occur. AFFF has been widely used at a variety of facilities for both training and emergency response purposes, including airports, military bases, firefighting training facilities, oil and gas refineries, as well as petroleum and chemical bulk storage facilities. The first DOD military specification (MILSPEC) for AFFF was published in 1969, requiring military bases to use AFFF for firefighting purposes. Beginning in the 1970s, many airports adopted the use of AFFF as well, and in 2004, the FAA required the use of MILSPEC AFFF at FAA-regulated airports. In 2018, Congress passed a law which will allow PFAS free foams at airports by 2021. Municipal fire departments with a history of fighting hydrocarbon-based fires (e.g., commercial gas stations, auto repair facilities, or any of the facilities listed above), may also have a history of AFFF use.

In the past 20 years, numerous studies have linked the use of AFFF to the release of PFAS in the environment. Unlike other sources of environmental contamination which are generally released through improper disposal or poor housekeeping (leaking storage tanks, etc.), the use of AFFF has released PFAS into the environment through intentional applications, sometimes in mass quantities and in an uncontrolled manner in response to emergency situations. At some facilities, the repeated application of AFFF in designated training areas over many years has led to the infiltration of PFAS into soil, creating a source area or hot spot which contributes to groundwater contamination. Due to its ability to persist in the environment, PFAS can travel long distances in groundwater without breaking down. This can lead to the contamination of drinking water supplies downgradient from facilities using AFFF. Environmental investigations at military bases, airports, and firefighting training facilities have indicated the use of PFAS at these sites and have impacted nearby drinking water supplies.

In addition, firefighters and other individuals using AFFF in training and emergency scenarios are vulnerable to PFAS exposure through direct contact, inhalation, and ingestion of the foam during application. Health studies have found elevated concentrations of PFAS in the blood of firefighters and elevated rates of cancer among those more highly exposed to AFFF.

AFFF MANUFACTURERS

3M produced its brand of AFFF, Lightwater, from the late 1960s until 2002. Some examples of manufacturers who have produced and, in some cases, continue to produce AFFF are included in the table below:

MANUFACTURER	PRODUCT NAMES	NOTES
3M	Lightwater	Manufactured only PFOS-based foam. Completed a voluntary phase-out in 2002 in agreement with EPA.
National Foam, Inc./ Kidde-Fenwall	Aer-O-Lite Aer-O-Water Centurion Universal	Began producing fluorinated foams as early as 1965. Continues to manufacture AFFF and other fluorinated foams. Now a subsidiary of Kidde-Fenwall, subsidiary of Carrier.
Chemguard	Chemguard	Continues to manufacture AFFF and other fluorinated foams.
Ansul/Tyco	Ansulite	Continues to manufacture AFFF and other fluorinated foams. Now a subsidiary of Tyco.
Chemours	FM-200	Continues to manufacture AFFF and other fluorinated foams. Former subsidiary of DuPont. Now a subsidiary of Kidde-Fenwall
Buckeye Fire Equipment	Platinum (Legacy AFFF)	Continues to manufacture AFFF and other fluorinated foams.
There is no complete list of producers of PFAS containing AFFF. However, a list of historical producers we were able to identify include: AGC Chemicals, Amerex Corp., Archroma, Badger, Chemdesign Products, Chubb Fire, Corteva, Inc., Deep Water Chemicals, Dynax Corporation, Perimeter Solutions, Solberg, United Technologies Corp. and UTC Fire & Security.		

AQUEOUS FILM FORMING FOAM (AFFF)

REGULATION HISTORY

3M, the primary manufacturer of PFOS-based AFFF, discontinued the production of PFAS containing AFFF in 2002 under a voluntary agreement with the EPA. In 2006, the USEPA instituted the 2010/2015 voluntary PFOA Stewardship Program which resulted in the phase out of PFOA and other long chain PFAS by 8 major fluorochemical manufacturers by 2015. The manufacturers involved in the phase-out included Arkema, Asahi, BASF Corporation (formerly CIBA, Ciba-Geigy), Clariant, Daikin, Dyneon (a subsidiary of 3M), DuPont, and Solvay Solexis. In 2007, the EPA issued a rule to regulate 183 other PFAS. However, the production and use of most short-chained PFAS-containing AFFF is not currently regulated.

In addition to activity at the federal level, numerous states have initiated regulations related to the use and disposal of AFFF. In 2018, Washington state passed a law banning the use of PFAS containing firefighting foam for training purposes as well as the foams' manufacture and distribution. Exceptions to the Washington state rule allow AFFF to be used in applications where required by federal law (such as military bases and airports), as well as petroleum terminals, oil refineries, and chemical plants. Other states, including New York, New Hampshire, and Colorado have passed similar regulations.

Current and future federal and state regulations on PFAS concentrations in drinking water may also impact facilities using AFFF.

WHAT SHOULD YOU DO?

First and foremost, complete a review to determine if your facility stored or used Legacy PFOS AFFF or Legacy fluorotelomer AFFF. If PFAS containing AFFF is present remove and properly dispose of it. Further, evaluate if the AFFF was released to the environment via use or storage leaks. If you determine that the potential for a release exists, then sampling of soils and groundwater may be recommended. Prior to sampling review state regulations to determine if soil and groundwater cleanup levels have been established for PFOS and PFOA. Currently, PFOS and PFOA are not classified as hazardous wastes under the Resource Conservation and Recovery Act (RCRA); however, under the Toxic Substances Control Act, these compounds are regulated through Significant New Use Rules (SNURs) which give the EPA the authority to restrict the production and use of PFOS and PFOA containing products. AFFF constitutes a U.S. Occupational Safety and Health Administration (OSHA) hazardous material because of its physical hazards, such as skin and eye irritation. Discharge of wastewater and runoff containing AFFF on land, at sea, or to surface water bodies is also subject to regulation under the Clean Water Act. PFOS and PFOA may also qualify as pollutants or contaminants under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

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