Check the facts

Fluorine-free foams are not as effective as AFFF agents at extinguishing flammable liquid fires, writes Tom Cortina of the Fire Fighting Foam Coalition.

Tom Cortina is executive director of the not-for-profit trade association FFFC.

AFFF agents that contain fluorotelomer-based fluorosurfactants are the most effective foam agents currently available to fight flammable liquid fires in military, industrial, aviation, and municipal applications.

This fact that has been consistently proven in fire tests done over the past 30 years and fire tests that are being performed today. As such it is puzzling that one or two companies continue to make statements at public meetings that AFFF agents are no longer needed and can be fully replaced by fluorine-free foams. It is confusing to regulators that need technically correct information on which to base policy decisions and damaging to the credibility of the fire protection industry. It is also surprising considering that these same companies continue to sell AFFF agents, we assume because their customers demand AFFF based on their own fire testing and need for adequate fire and life safety protection.

All major foam manufacturers produce and sell both fluorinated and fluorine-free foams. On the other hand most foam manufacturers neither produce nor sell fluorochemicals, and thus have no vested interest in selling fluorinated foam over fluorine-free foam. Yet almost none of these companies promote and sell fluorine-free foams as directly equivalent to fluorinated foams because fire testing and the experience of their customers provides clear evidence that they are not equivalent. Below we summarise some recent test data and events that continue to affirm this conclusion.

At the 2016 American Chemical Society Symposium, the United States Naval Research Laboratories (NRL) presented test data comparing AFFF agents to fluorine-free foams[1]. In pool fire tests, an AFFF agent achieved extinguishment in less than half the time (18 seconds) compared to fluorine-free foam (40 seconds). In foam degradation tests, fluorine-free foam degraded after 1-2 minutes while AFFF lasted 35 minutes before degrading. Similar results from a series of foam degradation tests on AFFF agents and fluorine-free foams were published in a trade magazine in 2012[2].

Fluorine-free foams are inherently oleophilic (fuel attractive). In the absence of oleophobic (fuel-repelling) fluorosurfactants, fluorine-free foam can easily pick up fuel and the contaminated foam degrades quickly and becomes flammable. This fuel contamination problem compromises the fire performance and severely limits the application of fluorine-free foams.

Previous testing by NRL in 2011 showed that extinguishment times for AFFF agents on pool fires were on average 77% faster for gasoline and 70% faster for heptane when compared to fluorine-free foam[3]. Both the 2016 and 2011 NRL testing confirm that fluorine-free foams are unable to pass the fire tests necessary to meet the requirements of the US military specification (milspec). Foam agents must meet the requirements of the milspec in order to be listed on the US Department of Defense qualified products database (QPD) and used for military applications[4]. The Federal Aviation Administration requires all US airports to carry AFFF agents that meet the milspec and are listed on the QPD[5]. In addition many national authorities in other countries require the use of AFFF agents that meet the milspec.

In July 2016 the Singapore Aviation Academy (SAA) and the International Aviation Fire Protection Association (IAFPA) jointly organised a fire-fighting foam seminar[6]. The major focus of the seminar was on the advantages and disadvantages of fluorine-free foam versus short-chain (C6) AFFF agents. One of the highlights of the seminar was a planned fire test demonstration scheduled with fluorine-free foam on an ICAO level B fire. This was of great interest to many of the delegates, some who have had difficulty replicating tests showing that fluorine-free foams can pass ICAO level B. Unexpectedly, the planned demonstration of fluorine-free foam was run instead with a short-chain (C6) AFFF. According to the company sponsoring the fire test demonstration, the fluorine-free foam test was not undertaken because "too many environmental factors were not under our control." Not surprisingly, several delegates noted: "those variables usually happen during fire incidents." The short-chain (C6) AFFF agent had no problem extinguishing the ICAO level B fire in the required time, despite the extenuating environmental factors.

Also during this seminar, Spanish foam manufacturer

	FFF (F3)					AFFF				
Test/Fuel	1	2	3	4	5	1	2	3	4	5
Gas. 95O	YES	NO	NO	NO	Late	YES	YES	YES	YES	Late
Heptane	YES	NO	NO	YES	Late	YES	YES	YES	YES	YES
Jet A1	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Diesel	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

NB: 1-5 above represent five unique, commercially available AFFFs and F3 foams

Figure 1: foam test results presented by Auxquimia at the fire fighting foam seminar organised by SAA and IAFPA in July 2016.

AFFF Foams...

So everyone will make it home safely tonight.

Today's C6 AFFF agents:

- Are most effective to fight flammable liquid fires.
- Provide superior extinguishment and burnback performance.
- Have reduced environmental impacts.
- Have a low toxicity and bioaccumulation profile.
- Contain short-chain (C6) fluorosurfactants that are approved by global regulatory agencies.

FFFC Fire Fighting Foam Coalition
www.fffc.org

ANGUS FIRE · ANSUL (A Tyco International Company) · AUXQUIMIA · CHEMGUARD · Chemours · Dr. STHAMER · dynax FLUOROCHEMICALS · FIRECHEM · Fire Service Plus · fomtec · ICL Performance Products · KIDRON · KV FIRE · National Foam · OILTECHNICS FIRE FIGHTING PRODUCTS · PROFOAM

Right and page 22: the US Navy Technology Center for Safety and Survivability carries out foam tests on the ex-USS Shadwell in Mobile Bay, Alabama.

Auxquimia presented results from a series of new fire tests run on five commercially available short-chain (C6) AFFF agents and five commercially available fluorine-free foams[7] (see Figure 1, p22). The tests were run with four different fuels: gasoline, heptane, Jet A1, and diesel. The results showed that AFFF agents performed significantly better than fluorine-free foams on all fuels except diesel. None of the fluorine-free foams were able to extinguish the Jet A1 fire, which is the fuel used in the ICAO fire tests that determine the acceptability of foams for airport use in many countries.

The fire protection industry fully supports the goal of protecting the environment and is committed to minimising emissions of fire protection agents through the implementation of best practices[8]. The overriding concern of the fire protection industry, however, is the reduction of risk to people and property from the threat of fire through the use of products and systems proven to be effective. With the aim of ensuring that both of these goals are achieved, foam manufacturers have transitioned to the use of only short-chain (C6) fluorotelomer-based fluorosurfactants that are low in toxicity and not considered to be bioaccumulative according to current regulatory criteria. For many manufacturers this transition has occurred years ahead of any regulatory requirement.

It is one thing to argue that protection of the environment requires that users accept an increase in risk from potential fires by using less effective but more environmentally benign fluorine-free foams. This debate has been occurring within the fire protection industry for the past 15 years and is likely to continue in the future. It is something completely different, however, to argue that there is no risk in making the switch based on exaggerated and unsubstantiated claims as to the effectiveness of fluorine-free foams.

References

1. *Evaluating differences in foam degradation between perfluoroalkyl and fluorine-free foams for the development of environmental friendly fire fighting alternatives*, Katherine Hinnant, Ramagopal Ananth, Michael Conroy, and Bradley Williams, Naval Research Laboratory, Washington, DC, presented at the March 2016 ACS Symposium
2. *Flammability and degradation of fuel – contaminated fluorine free foams*, Chang Jho, International Fire Fighter, 41, Issue 36 – November, 2012
3. *Extinguishment and burnback tests of fluorinated and fluorine-free firefighting foams with and without film formation*, Bradley Williams, Timothy Murray, Christopher Butterworth, Zachary Burger, Ronald Sheinson, James Fleming, Clarence Whitehurst, and John Farley, Naval Research Laboratory, Washington, DC, presented at the 2011 SUPDET Conference
4. United States Department of Defense Military Specification, Mil-F-24385, *Fire extinguishing agent, aqueous film forming foam.*
5. Federal Aviation Administration, National Part 139 CertAlert No. 11-02, *Identifying Mil-Spec aqueous film forming foam*, February 15, 2011
6. *Can F3 agents take the fire security heat?* Mike Wilson, International Airport Review, Vol. 20, Issue 6 (2016)
7. *Fluorine-free foams. Where is the limit?* Javier Castro, Auxquimia, presented at the July 2016 Singapore Aviation Academy and the International Aviation Fire Protection Association Fire Fighting Foam Seminar
8. *Best practice guidance for use of Class B firefighting foams* and *Best practice guidance for fluorinated firefighting foams*, published by FFFC, 2016