ADAPT & RESPOND

THE FIRE PROTECTION INDUSTRY IS RESPONDING TO ENVIRONMENTAL CHALLENGES, WRITES THE FIRE FIGHTING FOAM COALITION, A TRADE ASSOCIATION COMPOSED OF MANUFACTURERS, DISTRIBUTORS AND USERS OF AQUEOUS FILM-FORMING FOAM (AFFF) FIRE FIGHTING AGENTS.

Over the past 25 years, the fire protection industry has had to respond to a number of different environmental challenges related to the composition and use of its products. In each situation the industry has shown leadership by moving quickly to revise industry standards, minimise emissions, and mobilise resources to develop new and reformulated products with reduced environmental impacts.

It started in the late 1980s with the news that halons were potent ozone-depleting substances and likely to be controlled through an international treaty called the Montreal Protocol. Prior to regulations being approved, the industry revised international standards to eliminate requirements for testing and training, improved detection systems to reduce accidental discharges, and created programs to manage the recycling and banking of existing halon reserves. These actions contributed to halon production being phased out in developed countries in 1994, two years earlier than other ozone-depleting substances.

A decade later the fire protection industry learned that another of its key products had an environmental issue when it was announced that AFFF agents manufactured by 3M contained PFOS, a chemical that environmental authorities had determined to be persistent, bioaccumulative, and toxic (PBT). At the time PFOS-based products represented about 50% of the global market for AFFF. Fortunately there were telomer-based foams already available that did not contain or degrade to PFOS and provide the same level of fire suppression capability. This allowed for the end of PFOS foam production in 2002 (except for China), and the removal from service of existing PFOS foam stocks in Europe in 2011 and Canada in 2013.

Top: bladder tank proportioning system set-up for surrogate liquid-type test. Below: ARFF vehicle being tested with water containing environmentally benign dye.

At this same time there was an increased focus within the industry on minimising uncontrolled releases of foam to the environment. In 1998, for the first time, extensive information was added to the NFPA 11 foam standard on methods to control, collect, treat, and properly dispose of foam discharges from training, testing, and emergency use. This information was revised and expanded in 2009 to reflect the regulation of PFOS foams and to further promote minimising uncontrolled releases of all foams. The NFPA 11 foam standard has now entered the 2014 revision cycle and the industry has proposed new additions that focus on replacing the use of AFFF for training and equipment testing with alternative fluids and methods. Based on the discussions at the Fifth Reebok Fire Fighting Foam Conference in March 2013 (see Summer and Autumn 2013 issues of IFJ), it appears that most foam users have already embraced these environmentally responsible practices.

Now, more than a decade onwards from the PFOS issue, foam manufacturers are responding to a new challenge with the reformulation of foam products to eliminate long-chain perfluorochemicals in response to the EPA PFOA Stewardship Program. Once again the industry is fortunate in that telomer-based AFFF agents are already based predominantly on the use of short-chain, C6 fluorosurfactants. This mitigates somewhat the investment and time necessary to reformulate and have reapproved what for some larger manufacturers can be as many as 20 different foam products. The decision to use predominantly C6 fluorosurfactants in telomer-based AFFF was made initially 30 years ago for reasons of effectiveness, but it has turned out to also be a good decision from an environmental perspective.

The environmental impact of AFFF-type fluorosurfactants has been extensively studied and a large body of data is available in the peer-reviewed scientific literature. The bulk of this data continues to show that C6-based AFFF fluorosurfactants and their likely breakdown products are low in toxicity and not considered to be bioaccumulative or biopersistent. This conclusion is confirmed in a recent paper by Dr. Jimmy Seow of the Western Australia Department of Environment and Conservation that was featured prominently

by *IFJ* in the Summer and Autumn 2013 issues.

Below is one of the six main recommendations contained in the Seow report. It states clearly that telomer-based foams are of 'low toxicity, low biopersistence, and are not bioaccumulative.' At the same time it reinforces the industry's focus on eliminating unnecessary releases of all foams:

Fluorotelomers (mainly 6:2 FTS)

The US EPA is not particularly concerned with fluorotelomer fluorosurfactants, in particular those based on 6:2 FTS, as these eventually partly degrade to PFHxA (perfluorohexanoic acid) and PFPeA (perfluoropentanoic acid), which are of low toxicity, low biopersistence and are not bioaccumulative. However, as research is still being carried out on the impact of fluorotelomers, the use of fire fighting foams containing fluorotelomers and their manner of application must be considered in order to reduce unnecessary impact upon the environment and the human population to ALARP levels. Although available research has shown that these materials have low toxicity and bioaccumulative potential, their environmental acceptability should not only be based upon acute toxicity testing but also based upon bioaccumulation in fauna and the persistence of degradation products in the environment as well as any BOD/COD related effects upon the aquatic environment, which are significant for any foam.

A new OECD/UNEP synthesis paper on perfluorinated chemicals further confirms the conclusions of the Seow report. Data is presented on the elimination half-life of PFHxA in serum showing that one of the potential breakdown products of fluorotelomer-based foams is not bioaccumulative and not of concern to OECD. The report confirms that C6-based fluorochemicals may be used as acceptable replacements for long-chain fluorochemicals, and it recognises that non-fluorine alternatives may not work as well as these C6-based fluorochemicals, particularly where low surface tension or inherent oil (fuel) repellency is required.

ABOUT THE FFFC

The Fire Fighting Foam Coalition (FFFC) is a not-for-profit trade association whose members are manufacturers, distributors and users of aqueous film-forming foam (AFFF) fire fighting agents and their chemical components. The Coalition was formed to represent the fire fighting foam industry's interests on all issues related to the environmental acceptability of AFFF agents. The coalition provides a focal point for technical reviews, development of industry positions, and interactions with relevant organisations such as environment agencies, militaries, and standards organisations.

Conclusions

When faced with environmental challenges, the fire protection industry has been proactive in its response by moving ahead of regulations to reduce emissions of existing products and develop better products. This leadership continues today.

AFFF and fluorochemical manufacturers have worked closely with environmental authorities and are currently doing the research and testing necessary to incorporate into their AFFF formulations pure short-chain fluorochemicals that comply with global stewardship programs. This work will ensure that safe and effective AFFF agents that meet new and challenging environmental requirements will continue to be available to fight flammable liquid fires in military, aircraft, industrial, and municipal settings.