INDUSTRIAL FIRE JOURNAL

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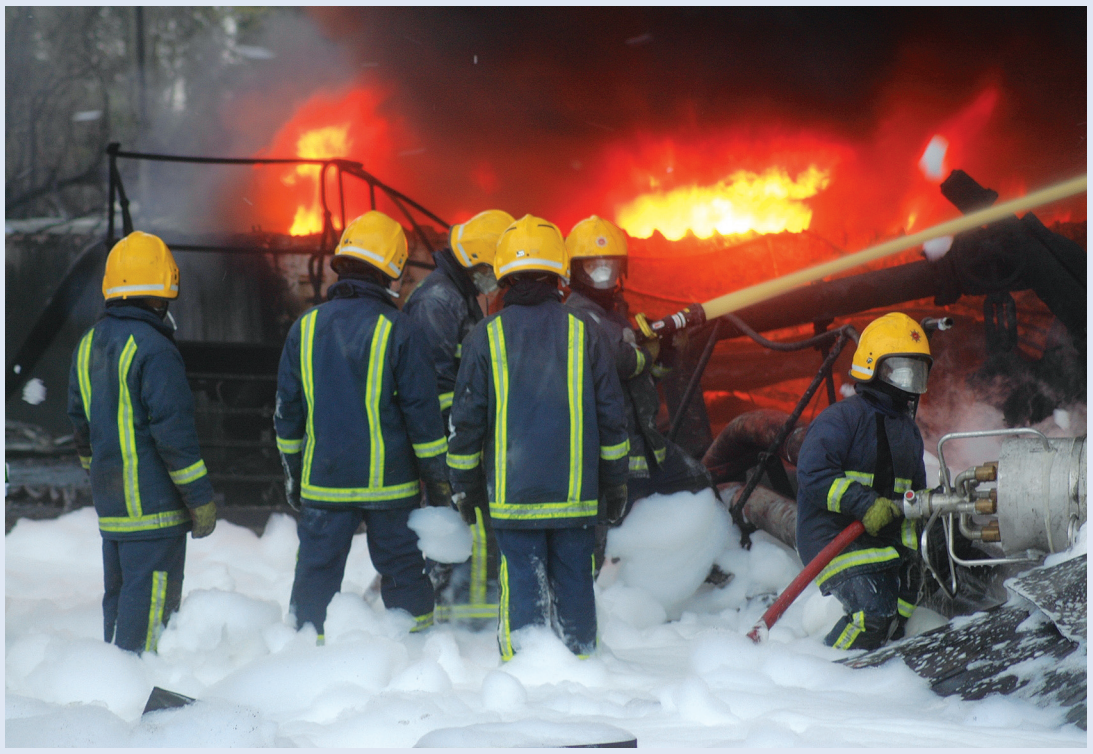


Currently approved AFFF agents are safe for their intended uses, provide unsurpassed performance, and contrary to recent reports do not present an environmental hazard when properly used, suggests Tom Cortina of the Firefighting Foam Coalition.

The safety & benefits of AFFF agents

– Let the facts speak?

Articles published in recent issues of this journal suggest that there is an environmental 'tragedy' or serious public safety issue associated with the use of fluorotelomer-based AFFF agents.

These articles attempt to correlate the presence of perfluoroalkyl carboxylates (PFCAs) such as PFHxA in breast milk with the use of fluorotelomer-based AFFF, even though current scientific evidence indicates that modern AFFF agents are not likely to be a significant source of PFCAs.

The question we have is why would someone raise such an emotional issue as contaminated breast milk without presenting direct scientific evidence that these AFFF agents were the cause?

Small part of a bigger issue

Reading these articles you might get the impression that fluorosurfactant-based fire fighting foams are a major part of a raging environmental issue. In fact, firefighting foams are a very small part of a much broader issue that is currently being evaluated by environmental authorities around the world.

Only about 5% of the fluorotelomer-based products that are manufactured worldwide are used in the production of fire fighting foams. And in a recent paper in a leading environmental journal, the authors conclude that fluorotelomer-based products in general are a very minor source of PFCAs on a global basis (Environmental Science and Technology, Vol. 40, No. 1, 2006).

Foam proved a decisive issue at the Buncefield 2005 incident. [Pic: courtesy of Captured Images]

This means that the main sources of PFCAs are products and applications other than firefighting foams. It also means that if a fluorinated chemical like a PFCA is found randomly in humans or the environment, the chance that it came from a firefighting foam is highly remote.

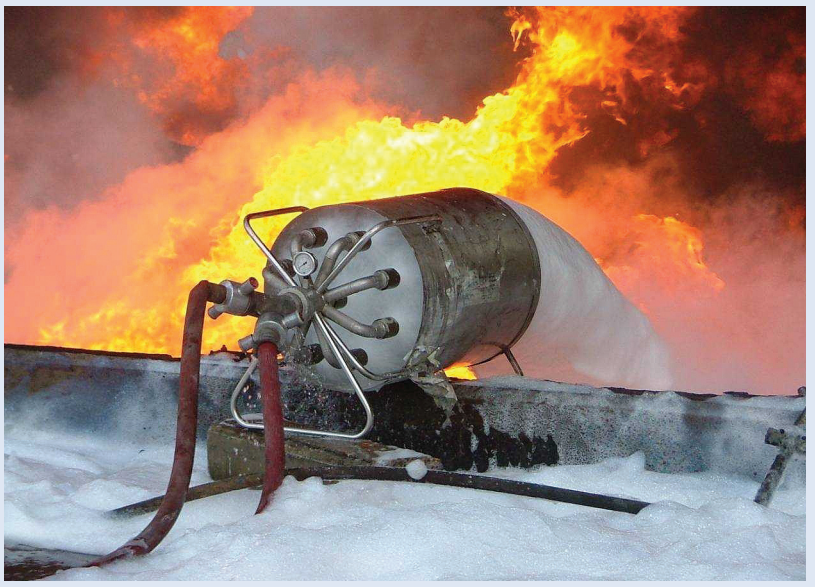
Not a likely source of PFHxA

It appears necessary to reiterate that in October 2003 a workgroup of the United States Environmental Protection Agency (EPA) determined that modern AFFF agents are not likely to be a source of PFCAs such as PFHxA and PFOA in the environment. EPA concluded that existing data "provided no evidence that these fluorosurfactants biodegrade into PFOA or its homologs..."

An influence in the EPA workgroup decision was a report by Dr. Jennifer Field of Oregon State University that contained data on fluorosurfactants in groundwater at three military sites where AFFF was used to train fire responders. Dr. Field concluded that the perfluoroalkyl sulfonates and perfluoroalkyl carboxylates found in the groundwater came from PFOS-based AFFF agents.

Dr. Field also concluded that the 6:2 fluorotelomer sulfonate was likely the primary breakdown product of the six-carbon fluorosurfactants contained in fluorotelomer-based AFFF.

It is well known and documented that the 6:2 fluorotelomer backbone is the primary building block for currently manufactured fluorotelomer surfactants.



Angus MEX foam bund pourer discharges agent.

6:2 fluorotelomer sulfonate is not PFOS

There have been statements in some recent articles that the 6:2 fluorotelomer sulfonate (6:2 FtS) is similar to PFOS in chemical structure and is therefore likely to be similar in biological toxicity and bioaccumulation. This is simply not true.

The 6:2 FtS has six fluorinated carbons, not eight like PFOS. It is not fully fluorinated as it has an ethylene spacer between the fluorocarbon chain and the functional end group. These two elements alone provide some very significant differences in chemical properties.

Recently, a number of toxicology, ecotoxicology and biodegradation studies were performed on specific AFFF fluorosurfactants that are likely to biodegrade to the 6:2 FtS.Results show that these fluorosurfactants are low in acute and subchronic toxicity, low in aquatic toxicity, negative for genetic and developmental toxicity, and do not bioconcentrate in fish.

These and other data provide strong evidence that currently used AFFF-type fluorosurfactants behave much differently from PFOS in both biological and environmental systems. Additional studies are underway and are expected to be presented at the upcoming Reebok symposium in September.

Large scale foam deluge in an industrial location.

PFOS-derived products - not dead yet

It is interesting that someone would try to correlate the presence of PFCAs in the environment with the use of fluorotelomer-based AFFF, but fail to mention that PFOS-based AFFF, which was the predominant agent used for the past 35 years, contained PFCA impurities in the products.

Although PFOS-based foams are no longer manufactured, significant quantities are still in service throughout the world. A study by Hughes Associates of AFFF inventories in the United States showed that there were 4.5 million gallons of PFOS-based AFFF concentrate in stock in 2004.

The European Union and Canada are both proposing to ban the use of existing stocks of PFOS-based fire fighting foams within 5 years as part of broader PFOS regulations. These regulations will not impact the use of fluorotelomer-based foam agents manufactured by companies such as Ansul and Kidde, as they do not contain PFOS.

US regulations published in 2002 prohibit the manufacture of new PFOS-based foam agents, but do not restrict the use of existing stocks.

One positive outcome of these restrictions will be that once all PFOS-based foam stocks are removed from service, a major fire such as the one that occurred in Buncefield would no longer result in PFOS-contaminated wastewater. A substantial quantity of the foam used at Buncefield was of the PFOS type.

Exemption for foams not needed

A new EU directive was published in December that prohibits PFOS from being placed on the market or used in semi-finished products, articles, textiles, or other coated materials. Exemptions were included for uses of PFOS where no acceptable alternatives exist, including photoresists, photographic coatings, and chromium plating.

The original European Commission proposal released in December 2005 included an exemption for firefighting foams, but the exemption was subsequently determined to be unnecessary as alternative fluorotelomer-based foam agents are available that do not contain PFOS and provide an equivalent level of fire protection.

The final EU directive now stipulates that existing stocks of PFOS-based foam agents, the majority of which were produced by 3M, be removed from service by June 27, 2011. To facilitate tracking and adherence to the directive, EU Member States must provide the Commission with an inventory of existing stocks of PFOS-based foam agents by December 27, 2008.

No control measures on PFOA

There were proposals to include PFOA in the PFOS directive. However the Commission decided instead to keep under review its ongoing risk assessment activities. Emissions of PFOA are expected to decrease significantly in the future as manufacturers voluntarily comply with the US EPA's global stewardship program.

Under the program, manufacturers have committed to reduce by 95% by 2010 both facility emissions and product content levels of PFOA, precursor chemicals that can break down to PFOA, and related higher homologue chemicals. In addition they are working towards elimination of these same chemicals from emissions and products by 2015.

A proposed regulation was published by Environment Canada in December 2006 that would prohibit the manufacture, use, sale, and import of PFOS or products containing PFOS. Similar to the EU directive, existing stocks of PFOS-based AFFF would have to be removed from service five years after the

regulation comes into force.

During the five-year exemption period, those stocks could not be used for testing or training purposes. (In other words, they could only be used to extinguish emergency fires.) The final regulation is expected to be published later this year.

Fluorine-free foams

Foam manufacturers continue to evaluate many types of potential products that do not contain fluorosurfactants, but efforts to date have not yielded working products with fire performance across all fuels and in all operational circumstances equal to film-forming foams.

Some fluorine-free foams can provide an alternative to AFFF in some applications, but they are not currently able to provide the same level of fire suppression capability, flexibility, scope of usage, and independent validation.

Fluorine-free foams are often championed as 'environmentally-friendly' alternatives to AFFF. Although such foams may not contain fluorine, their environmental profile related to biodegradation, acute toxicity, chemical oxygen demand (COD), and biochemical oxygen demand (BOD) is typically no better than fluorine-containing products.

In addition, alternative products typically require higher application rates for control and extinguishment, resulting in higher costs for water supplies, system installations, pumping systems, and ultimately for containment and disposal costs where required.

A recent study by the University of Newcastle shows that even the best available fluorine-free foam would need to be replenished three times as often as AFFF to provide the same level of fire protection.

Industry working with environmental authorities

Since the late 1980s when the issue of ozone depletion raised the awareness of the fire protection industry to the potential environmental impacts of its products, the industry has worked closely with several environmental authorities to minimise those impacts.

Manufacturers of firefighting foams and the fluorosurfactants they contain created the Firefighting Foam Coalition in 2001 as a focal point for this co-operation. FFFC has provided extensive information on its members' products to environmental agencies in the United States, Europe, and Canada.

Included in this information is the detailed chemistry of all AFFF fluorosurfactants, the total amounts of fluorosurfactant used in the production of AFFF, US inventories of PFOS-based and fluorotelomer-based AFFF agents, and the environmental fate of the agents once they are used. In addition, manufacturers are continuing to sponsor extensive testing on the toxicity and biodegradation of AFFF-type fluorosurfactants.

A good news story?

Although you would never know it from reading recent articles in this journal, the end of production of PFOS-based foams is a good news story for both industry and the environment.

Foams that contained PFOS and PFOA are being replaced with modern, fluorotelomer-based foams that do not contain PFOS and are not made with PFOA or PFHxA. These current foams are much more efficient as they provide the same level of fire protection but contain 30-60% less fluorine.

Events over the past 6-7 years have focused the fire protection industry's attention on the need to minimise emissions of persistent chemicals to the environment. Fluorosurfactant-free training foams are now recommended and great strides have been made in the containment and treatment of foam releases. In addition, these same events have energised researchers who are working to develop even more efficient foam products with reduced environmental impacts.