



AFFF Update . . .

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Fire Fighting Foam Coalition

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EPA Workgroup Determines AFFF Not a Likely Source of PFOA

A workgroup of the U.S. Environmental Protection Agency (EPA) has determined that telomer-based AFFF is not likely to be a source of perfluorooctanoic acid (PFOA) in the environment and will not have to be tested in the current enforceable consent agreement (ECA) process. This is very good news for users of fire fighting foams. It means that the future of AFFF made by current manufacturers is not tied to the fate of PFOA, as some had speculated in recent years.

The decision of the EPA Telomer Technical Workgroup (10/29/03) was based in part on the following information:

- Telomer-based AFFF agents are not made with PFOA and contain no PFOA-based products.
- PFOA is an eight-carbon molecule (C₈). The majority (over 80%) of the fluorosurfactants used in telomer-based AFFF are derived from six-carbon molecules (C₆). There is no known pathway for the C₆ fluorosurfactants used in AFFF to break down into PFOA.
- Concern that telomer products can break down into perfluoroalkyl carboxylates such as PFOA is based on limited data from telomer alcohols in environmental and biological systems. The fluorosurfactants in telomer-based AFFF are derived from telomer iodides, not telomer alcohols. There is no direct evidence that the telomer iodide-based fluorosurfactants contained in AFFF can breakdown in the environment into PFOA, or its homologues such as perfluorohexanoic acid (PFHA).

- The known primary breakdown product, based on the available limited data, is the 6-2 telomer sulfonate and not either perfluorohexanoic acid or PFOA.

The Workgroup, which is evaluating the potential of telomer products to be future sources of PFOA, is made up of EPA staff, members of the public, and other interested parties including chemical manufacturers and environmental organizations.

3M Decision Leads to Speculation

In May 2000, 3M decided to end production of a line of products that included AFFF because they contain and break down into perfluorooctyl sulfonate (PFOS), a chemical the EPA considers to have both environmental and toxicological concerns. PFOS-based products were produced by a unique process called electrochemical fluorination (ECF). 3M's decision did not have any direct impact on the production and availability of other AFFF agents because those agents contain fluorosurfactants produced by a telomerization process which are generally referred to as telomers. Telomer-based fluorosurfactants neither contain nor breakdown into PFOS.

Ever since 3M announced its decision to end production of AFFF there has been intense speculation, fueled by a variety of interest groups, that other AFFF agents would also eventually disappear. This speculation was based largely on the belief that telomer-based AFFF agents could break down in the environment into PFOA, and that EPA would eventually regulate sources of PFOA as they have for PFOS. In April EPA decided not to take regulatory action on PFOA and instead started a public process to generate additional data through an enforceable consent agreement (ECA). The focus of the ECA process is not to measure the toxicity of PFOA, but to find future potential sources of PFOA in the environment.

Enforceable Consent Agreement

One of the items proposed in EPA's initial ECA framework (5/20/03) was an assessment of the potential for telomer-based fire fighting foams to break down in the environment into PFOA. EPA's principal focus for fire fighting foams was the monitoring of sites where the foams had been used to look for PFOA or PFOA precursors. In response to EPA's ECA framework, the Fire Fighting Foam Coalition (FFFC) commissioned a literature study of available relevant site monitoring data. FFFC also presented information to the EPA Telomer Technical Workgroup on the chemical structure of the fluorosurfactants contained in AFFF (9/16/03). Included in this information was the commissioned report by Dr. Jennifer Field of Oregon State University on AFFF fluorosurfactants in the groundwater of the fire training areas of three military bases (7/3/03, EPA docket number OPPT-2003-0012-0144).

Groundwater Monitoring

Dr. Field analyzed three military sites where AFFF was used to train fire responders and an area at one of these sites where foams were used to put out an actual airplane fire following a crash. The sites were the Naval Air Station Fallon in Nevada, Tyndall Air Force Base in Florida, and Wurtsmith Air Force Base in Michigan, which is also where the plane crash occurred in 1988.

A variety of fluorinated chemicals were found in groundwater at each location. She broke the fluorinated chemicals into three classes: perfluoroalkyl sulfonates, which include PFOS; perfluoroalkyl carboxylates, which include PFOA; and telomer sulfonates. Perfluoroalkyl sulfonates ranging from four to eight carbons and perfluoroalkyl carboxylates ranging from six to eight carbons were found at all three locations. Telomer sulfonates, 97-99% with six carbons, were found at two of the three locations.

Figure 1

Telomer fluorosurfactants in AFFF sold to the U.S. military:

Precursor - $C_6F_{13}CH_2CH_2SH$ normally made from $C_6F_{13}CH_2CH_2I$, or 6-2 Telomer B iodide

Type of telomer surfactants - All contain group $C_6F_{13}CH_2CH_2S-$ or $C_6F_{13}CH_2CH_2SYCH_2CH-$

Degradation products found in groundwater -

6:2 telomer sulfonate

Perfluorooctyl sulfonate (PFOS)

Perfluorooctanoic Acid (PFOA)

Perfluorohexanoic Acid (PFHA)

$C_6F_{13}CH_2CH_2SO_3^-$

$C_8F_{17}SO_3^-X^+$

$C_7F_{15}CO_2H$

$C_5F_{11}CO_2H$

Conclusion - 6:2 telomer sulfonate is the likely biodegradation product of the C_6 fluorosurfactants contained in AFFF sold to the U.S. military

Telomer Breakdown

Dr. Field concluded that the perfluoroalkyl sulfonates and perfluoroalkyl carboxylates came from ECF-based AFFF agents and that the telomer sulfonates came from telomer-based AFFF agents. She also concluded that there was no evidence from this study that telomer sulfonates were breaking down in the groundwater into perfluoroalkyl carboxylates. Based on their knowledge of the exact chemistry of the telomer-based AFFF agents sold to the military, FFFC scientists have concluded that the telomer sulfonates found in the groundwater on military bases are the likely biodegradation product of the fluorosurfactant active ingredients in AFFF (see Figure 1).

Inventory Study

One of the conclusions that can be drawn from the Field report is that the presence of PFOS and PFOA from fire fighting foams currently in the environment may well be mainly a legacy issue associated with the historical use of ECF-based AFFF. In order to get a handle on how much ECF-based AFFF is still out in the field (a current use picture), EPA asked the FFFC to do a study of inventories of ECF-based and telomer-based AFFF in the U.S. FFFC recently submitted a letter to EPA outlining a voluntary AFFF inventory study that it expects to complete by June.

Conclusions

Aqueous film-forming foams are the most effective agents currently available to fight hydrocarbon, solvent, and alcohol fuel fires in military, industrial, and municipal settings. Telomer-based foams, manufactured by companies such as Kidde, Ansul, and Buckeye, are not a source of PFOS and are unlikely to be a source of PFOA or its homologues. Now that the biggest perceived threat to the continued availability of telomer-based AFFF has been debunked, maybe the speculation about the imminent demise of AFFF will end.