



# AFFF Update . . .

2111 Wilson Boulevard  
8th Floor  
Arlington, VA 22201  
(703) 524-6636  
Fax (703) 243-2874  
cortina@alcalde-fay.com  
www.fffc.org

## Fire Fighting Foam Coalition

June 2003

Issue 3

### EPA Defines Path Forward on PFOA

On April 14 EPA announced that it would not be taking regulatory action on PFOA at this time, but will seek additional data from manufacturers on potential sources and effects of the chemical in the environment. EPA also released a preliminary risk assessment of the developmental toxicity of PFOA, and will seek Science Advisory Board review of the risk assessment this summer.

Last year EPA initiated a priority review to determine whether PFOA (perfluorooctanoic acid) and its salts, which are mainly used as an industrial process aid in the manufacture of fluoropolymers, met the criteria for action under section 4(f) of the Toxic Substances Control Act (TSCA). EPA decided against taking action under TSCA and instead started a public process to generate additional data on PFOA and fluorinated telomers through enforceable consent agreements (ECA). Fluoropolymer and telomer manufacturers have already submitted letters of intent to EPA to perform additional testing to determine whether their products contribute to PFOA in the environment.

As part of its recent announcement, EPA made it clear that it does not believe that any action is necessary at this time to reduce exposure to PFOA. An EPA fact sheet on PFOA includes the following statement

EPA does not believe that there is any reason for consumers to stop using any consumer or industrial related products.

In its December 9 PFOS final rule, EPA also cautions against drawing premature conclusions about the possible outcome of its evaluation of PFOA and telomers.

Because of the unique properties of perfluorinated compounds, EPA is currently assessing a variety of these compounds to determine their hazard profiles, including not only PFAS chemicals but also perfluorooctanoic acid (PFOA) and its salts, as well as fluorinated telomers. That these chemicals are currently under assessment does not necessarily indicate that regulation will follow; it indicates only that EPA is seeking answers to questions that have been raised about these chemicals and their behavior.

### The Relationship Between PFOA and AFFF

PFOA is sometimes mentioned in relation to AFFF because 3M's PFOS-based products, including their AFFF, also contained varying quantities of PFOA or PFOA-based products. In addition, one of the issues that is being investigated as part of the multi-year testing program is whether telomers can break down in the environment into PFOA or similar chemicals, and to what degree and under what conditions this might occur. Presented below are some important facts about the relationship between PFOA and telomer-based AFFF.

- Telomer-based AFFF agents are not made with PFOA and do not contain any PFOA-based products. PFOA is an eight-carbon molecule (C<sub>8</sub>).
- Only a very small percentage (<5%) of the overall global production of telomers is used in the production of telomer-based AFFF agents.
- The majority (over 75%) of the fluorosurfactants used in telomer-based AFFF are derived from six-carbon molecules (C<sub>6</sub>). We are not aware of any pathway for the C<sub>6</sub> fluorosurfactants used in AFFF to break down, under any circumstances, into PFOA.

## FFFC Participates in Mobile and NFPA Conferences

The Fire Fighting Foam Coalition (FFFC) and its member companies recently participated in the Workshop on Fire Suppression Technologies in Mobile, Alabama, and the NFPA World Safety Conference and Exposition in Dallas, Texas. Tom Cortina, FFFC Executive Director, made presentations at both conferences on AFFF environmental issues. He discussed the differences between the PFOS-based surfactants used in AFFFs that have been voluntarily phased out of production by 3M, and the telomer-based surfactants used in AFFFs that continue to be produced by companies such as Kidde, Ansul, and Buckeye. He outlined the progress and timing of the multi-year testing program being sponsored by the four global telomer manufacturers that focuses on toxicology, pharmacokinetics, and the environmental fate and effects of selected telomer-based products. He also discussed recent actions by the U.S. Environmental Protection Agency (EPA) related to PFOS and PFOA.

Martial Pabon of DuPont made presentations at both conferences on the use of fluorinated and hydrocarbon surfactants in fire fighting foams. He provided an overview of the mechanics of film formation with AFFF (see below).

## Overview of the Mechanics of Film Formation of AFFF

Aqueous film-forming foam (AFFF) fire fighting agents get their name because when applied they spread and form a film of water on top of hydrocarbon fuels that augments the fire-extinguishing efficiency of the foam. Presented below is an overview of the mechanics of film formation with AFFF.

- Aqueous film-forming foam (AFFF) generally contains mixtures of hydrocarbon and fluorocarbon surfactants as the major surface-active components.
- This class of fire-fighting foams has the capability to spread and form a thin, uniform aqueous duplex film (10-30  $\mu\text{m}$  thick) on low-surface tension organic liquids such as volatile hydrocarbons and fuels.
- The formation of an aqueous layer spread over the fuel surface provides an effective fuel vapor barrier in addition to the cooling and blanketing effect of the foam. This fuel vapor barrier also helps to protect the foam matrix from excessive degradation in the presence of liquid fuel and its vapor.
- It is also known that the spontaneously spreading aqueous layer augments the fire-extinguishing efficiency of the foam. The presence of the aqueous film improves burnback stability of the foam by its spontaneous re-spreading and "repair" mechanism.
- The spontaneous spreading property of AFFF is derived mainly from the high surface activity (low surface tension) of the fluorocarbon surfactants at the solution/air interface (15-20 dynes/cm).
- This low surface tension, coupled with the low interfacial tension (1-5 dynes/cm) at the solution/substrate interface, allows the AFFF solution, as a result of a positive spreading coefficient, to spread spontaneously on many liquid hydrocarbons and fuels (20-30 dynes/cm).
- The hydrocarbon surfactants preferentially adsorb at the solution/hydrocarbon substrate interface because of the mutual phobicity between the hydrocarbon and fluorocarbon surfactants, and therefore they are largely responsible for the low interfacial tension.
- The conventional spreading coefficient concept used as a specification (e.g. mil-spec) for qualification purposes is based on the equilibrium surface and interfacial tension. This "static" spreading coefficient is not sufficiently useful to understand the dynamics (rate) of spreading. In fact, erroneous predictions can be made based on this value as to the effectiveness of the fire fighting foam. Dynamic (time-dependent) surface and interfacial tensions and hence the "dynamic" spreading coefficient concept need to be used to better understand the relationship between the film formation phenomena and the effectiveness of fire fighting.
- The rate of spreading of the aqueous film is related to the film thickness, which in turn affects the extinguishment and burnback performance of an AFFF agent.
- The second most important role of fluorosurfactants in AFFF is the phenomena of "fuel shedding." Because of their inherent oleophobicity (i.e. oil repellency), fluorosurfactants repel fuel (oil) thus preventing or reducing the "fuel pickup" problem. In contrast, hydrocarbon surfactants "attract" fuel thus turning the foam flammable. During the fire-fighting application, foam gets mixed up with the fuel and the presence of fluorosurfactants in the foam reduces/prevents (depending on concentration) the fuel contamination of the foam, which can lead to "burning" foam. Fuel contamination or fuel pickup is a serious problem because it compromises not only the speed of extinguishment but also burnback effectiveness.