

## PFAS Use in Fire Fighting Foams: Evolution of Fire Fighting Agents and Critical Decision Criteria

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**Background/Objectives.** Over the past 10 to 15 years and particularly the past two, fire fighting foam agents of all types – fluorine-free (FFF) and fluorinated (AFFF) – have been a) under attack, b) in the news, c) sources of activist campaigns, d) the focus of academics globally as well as regulators and new regulations in various countries, e) their performance debated, f) the focus of significant research and development activities to produce the most effective and more sustainable short-chain fluorotelomer-based agents and g) the focus of industry and industry groups to provide safer and best practice handling guides. In addition to AFFF, fluorinated surfactants and repellents of all types and chain lengths have been scrutinized for their toxicological properties, their environmental fate and effects (EF&E), their PBT properties and lately their persistence (P) and mobility (M) properties and been questioned whether they are needed at all in any applications. The objective of this talk/discussion will be to establish where these valuable fluorinated products are needed and where they should be used – and not. We suggest there must be a balance struck between uses of the precautionary principle, a risk-based approach and required performance/value-in-use. This balance or holistic viewpoint, which will be explored here, is often cast aside in favor of emotion or cause.

**Approach/Activities.** The current state of toxicological studies, EF&E, PBT/PMT properties, R&D advances, performance comparisons and regulation will be presented, analyzed and critiqued. This review will frame out an approach to assess which agents to use (FFF vs AFFF vs Other Options) under the various conditions required to extinguish and control Class B flammable liquid fires. As we know there is a heated debate around the environmental consequences of extinguishing Class B fires ranging from the efficacy and clean up of FFF to the potential of aquifer contamination and clean up using AFFF, the transition to short-chain products and the pollution potential of the “Let it Burn” option. Our approach will be to look at the 7 P’s in this debate: Precaution, Persistence, Potential, Presence, Principles (approaches), Profile (Tox/EF&E) and Performance. In addition, the impact of fluorosurfactants and/or their metabolites on Mobility (M) will be explored. And finally as part of a balanced approach one must look at the critical and/or essential uses of the fluorinated products in many vital industries including aerospace and defense among others.

**Results/Lessons Learned.** When one considers both “Duty of Care” and “Life Safety” and “Performance Matters”, it becomes very clear that use of AFFF agents has to be considered as a primary option to extinguish Class B liquid fires in many circumstances. Fire fighters and facility managers must consider the following: extinguishment time and time to control the fire, burnback resistance and consequences of “Let it Burn”. In addition, when comparing an AFFF agent to the use of FFF agents one needs to strongly consider foam properties including fuel repellency, film formation, foam spreading on fuel, fuel spreading in foam as well as volume of firewater runoff, fire escalation potential, generation of toxic smoke and breakdown products, along with the active surfactant(s)/polymer(s) bioaccumulation, mobility, persistence and aquatic toxicity. And as noted, a holistic/balanced approach will clearly show there is room for both types of products – fluorine-free and fluorinated. Care must be taken to control releases of whatever agent is used regardless of type. Following best practice guidance developed by various industry groups is crucial to safeguarding the neighboring areas and overall environment.