

There is some confusion in today's firefighting market over which products should be used on *Class A and B* fires. Hopefully, the following questions and answers can help clarify the testing procedures and capabilities of each type of firefighting agent.

Q: What is firefighting foam?

A: Chemical formulations aside, firefighting foam is simply a stable mass of small, air-filled bubbles with a lower density than oil, gasoline, or water. The foam is made up of three ingredients...water, a foam concentrate, and air. The water is mixed with the concentrate to form a foam solution. This solution is then mixed with air, by means of a discharge device, to produce foam which is very fluid and flows readily over liquid surfaces. Basically, foam extinguishes flammable or combustible liquid fires in four ways:

- 1) Excludes air from the flammable vapors.
- 2) Eliminates vapor release from fuel surface.
- 3) Separates the flames from the fuel surface.
- 4) Cools the fuel surface and surrounding metal surfaces.

Firefighting foams have been commercially used since the early 1900's.

Q: What is Aqueous Film Forming Foam (AFFF)?

A: AFFF (such as **ANSULITE® AFFF**) is a synthetic foam. It consists of combinations of fluorochemical and hydrocarbon surfactants combined with high boiling point solvents and water. Surfactants are chemicals that have the ability to alter the surface tension of water. Fluorochemical surfactants alter these properties in such a way that a thin film can spread on a hydrocarbon fuel (such as heptane, kerosene, diesel and jet fuels) even though the aqueous film is denser than the fuel. Thus, a blanket is formed across the liquid surface blocking flammable vapors.

There is another category of AFFF called **Alcohol-Resistant Concentrate (ARC)**. ARC produces a foam that is effective on fuels such as methyl alcohol, ethyl alcohol, and acetone which have appreciable water solubility and miscibility. The most current ARC's are based on AFFF concentrates to which a water soluble polymer (polysaccharide) has been added. When ARC foam agents are applied to a water soluble fuel, a polymeric membrane is formed between the foam and the water soluble fuel, thus preserving the foam blanket.

Q: What is Class A foam?

A: *Class A* Foams (such as **SILV-EX® concentrate**) are typically formulated from a combination of specialty hydrocarbon surfactants, stabilizers, inhibitors, and solvents. They reduce the surface tension of water for improved wetting and penetrating characteristics and create a clinging foam blanket that suppresses combustible vapors while cooling the fuel. *Class A* foams can be applied using a variety of proportioning/discharge devices and have proven effective in fighting forest fires and many deep-seated fires that involve tires, paper, coal bunkers, wooden structures, etc. Some *Class A* Foam concentrates are also excellent emulsifiers.

Q: What is a firefighting emulsifier?

A: The use of firefighting emulsifying agents has been recently introduced to the firefighting community for fighting *Class A and B* fires. The goal of an emulsifier is similar to foam agents in that they aim to reduce the surface tension of water. However, instead of forming a foam blanket on the surface of the fuel, the solution is "vigorously" mixed with the fuel to form a nonflammable emulsion. Most emulsifiers have limited foaming capabilities. An emulsifier must be mixed with water at a given percentage and "applied forcefully" onto the entire surface of the burning fuel. The resulting solution then mixes with the fuel, breaking it into very small droplets (the very definition of an emulsion). These droplets of fuel are surrounded or encapsulated by the surfactant/water mixture to extinguish the fire and prevent reignition.

Other items of note concerning emulsifiers:

- 1) The term "micelle" is the unit of encapsulation in an emulsion, such as is formed with vinegar and water surrounding oil droplets in a salad dressing. It is a known and understood technical area that is relevant to all emulsions.
- 2) In some cases, once emulsification of a fuel occurs, it may be extremely difficult to separate the mixture from the fuel, thus the fuel cannot be salvaged once the fire is out.
- 3) Due to the mixing action required, it is suggested that emulsifiers not be used on fires where there is fuel in depth and the mixing action cannot occur throughout the entire fuel layer.

Q: What is a wetting agent?

A: According to the UL Directory, wetting agents are liquid concentrates which, when added to plain water in proper quantities, materially reduce the surface tension of plain water (to <33 dynes per centimeter) and increases its penetrating and spreading ability. Water, to which a wetting agent has been added, is sometimes termed "wet water" because of its increased ability to wet the surfaces it contacts. Listed wetting agents improve the efficiency of water in extinguishing fires in *Class A* combustibles. Use on *Class B* combustibles requires much higher application rates than those required when using foam agents, such as AFFF, and is limited to non-water soluble flammable liquids. Little if any burn-back resistance is present on *Class B* fires extinguished with "emulsifiers" or "wetting agents."

Q: Which UL listings do these agents fall under and what is the UL test protocols?

A: AFFF Foam Agents are listed under Foam Liquid Concentrates and must follow UL 162 test protocol. Emulsifying agents and some *Class A* foam agents are UL listed as wetting agents and follow the UL wetting agent test protocol. Please note that some *Class A* foams have been tested per alternate guidelines; for example, SILV-EX foam has been approved to USDA Forest Service Specification 5100-304a.

The following is a comparison of the two test protocols:

	AFFF Foam <u>Test Protocol</u>	Wetting Agent <u>Test Protocol</u>
Standard No.:	UL-162	UL Standard not assigned (test program on file)
NFPA Ref.:	NFPA 11, 16, 16A	NFPA 18
Size of Fire:	50 sq. ft. 8" freeboard (4.5 m ² – 203 mm)	50 sq. ft. 8" freeboard (4.5 m ² – 203 mm)
Fuel:	n-heptane	n-heptane
Amount of Fuel:	2" (50 mm) on water	2" (50 mm) on water
Application Method:	direct on fuel	flow down back-board to reduce fuel pickup
Pre-burn:	1 minute	1 minute
Application Rate:	2 gpm (7.6 Lpm) 0.04 gpm/sq.ft. (1.63 Lpm/m ²)	10 gpm (37.9 Lpm) 0.20 gpm/sq.ft. (8.15 Lpm/m ²)
Time Allowed to Extinguish:	3 minutes	no max. time – only restriction is that pan not overflow
Secure Time Req.:	9 minutes	none
Re-ignition Test:	try twice	none
Burn Back Test:	yes	none

As you can see the UL-162 testing is much more demanding.

Q: What is the typical use rate for AFFF? Emulsifying agents? *Class A* foam?

A: AFFF is UL listed at ratios of 6%, 3%, and 1% with 3% (3 parts foam concentrate and 97 parts water) being the most frequently used.

Although the proportioning ratios are not identified by all emulsifier/wetting agent manufacturers, the ratios are similar to AFFF or 1 to 6%.

Class A Foam is proportioned at much lower ratios, from 0.1% to 1.0%, which leads to a considerable cost savings.

The use rates and the type of agent used will vary per the actual application.

Q: If emulsifying agents can and do indeed extinguish fires, where would they be used?

A: As stated earlier, emulsifiers should not be used on fuel-in-depth fires which are generally defined as 1" (25 mm) or greater in depth. When applying emulsifiers, all the fuel must be vigorously mixed or portions might not be emulsified. They should also not be considered for use on water soluble or water miscible fuels as an emulsion cannot be formed. They may be used for hydrocarbon fuel spill fires, but not all hydrocarbon fuels form stable emulsions with all types of emulsifiers. The manufacturer of the emulsifying agent should be consulted for proper mix ratios and application rates for each type of fuel. Emulsifiers are also used on *Class A* combustibles.

Q: What are the cost comparisons of the different agents?

A: The cost per gallon (Liter) of each agent will vary based on the manufacturer and quantity purchased, but comparisons can be made based on use rates and published agent prices in the marketplace.

Class A foams and emulsifier/wetting agents can both extinguish a *Class A* type fire. However, due to the use rates required, the average cost to use an emulsifying agent will be 3 to 4 times higher than a *Class A* foam. Plus, *Class A* foams give the user the necessary foaming capability along with superior penetrating performance on deep-seated fires.

For *Class B* flammable liquid fires, the published use rates and prices for AFFF and emulsifying agents are relatively close. However, UL approved AFFF's have gone through the stringent UL-162 test protocol (including polar-solvent fuels), while emulsifying agents have been UL approved as wetting agents only. And as stated above, wetting agents are not approved for use with water-miscible *Class B* combustibles. Also, the user has to take into account that AFFF has been successfully used for decades in refineries, chemical plants, and warehouse sprinkler systems.

If you have any other questions concerning the different fire-fighting foams and wetting agents... or to obtain additional literature or an interactive compact disk (complete with videos) on **ANSUL firefighting foams...** please contact your local Ansul representative or call Ansul headquarters at 800-862-6785 or 715-735-7411.