Tempe Fire Department Policies and Procedures
Class B/Haz Mat Foams
409.05
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PURPOSE

The Tempe Fire Department currently uses two different types of foam concentrates; AFFF-ATC and MSA VEEfoam. Both are synthetic-based concentrates. This procedure identifies the purposes and uses of each type of concentrate.

CHARACTERISTICS AND PUMPING PROCEDURES OF AFFF-ATC

Aqueous Film-Forming Foam (AFFF) agents are composed of synthetically produced materials that form air foams similar to those produced by the protein-based materials. In addition, these foaming agents are capable of forming water solution films on the surface of flammable liquids; hence the term, aqueous film-forming foam (AFFF). AFFF-ATC (alcohol type concentrates) or AFFF-P (polar) concentrates are available for proportioning to a final concentration of either 3% or 6% by volume with water. A 3% eductor setting should be utilized when an incident involves a non-polar flammable liquid, such as gasoline or diesel fuel. A 6% eductor setting should be utilized when an incident involves a polar flammable liquid, such as alcohols, ketones, acetates, organic acids, and aldehydes.

The air foams generated from AFFF solutions possess low viscosity, have fast spreading and leveling characteristics, and act as surface barriers to exclude air and to halt fuel vaporization. These foams also develop a continuous aqueous layer of solution under the foam. The surface activity of this solution maintains a floating film on hydrocarbon fuel surfaces that helps suppress combustible vapors with limited cooling of the fuel itself.

The film, which can also spread over fuel surfaces not fully covered by foam, has a characteristic of self-healing following mechanical disruption, however, it self-heals only as long as there remains a reservoir of nearby foam for the production of additional film. The foam blanket may not reseal for the following reason: any active fire or spark may cause ignition of the vapors in the disturbed foam blanket which will result in burnback. Additionally, whenever possible, the application of an AFFF-ATC type foam should be continuous; synthetic foams may appear to be providing good vapor protection, when in reality they are not. Atmospheric monitoring of the area is the only way to be assured that the foam blanket is in fact securing vapors. The continuous application of foam is a necessity when an incident involves a heavy hydrocarbon fuel, such as diesel fuels or jet fuels. An illustration of film formation on a fuel surface by aqueous film-forming foams is shown in Figure 1.

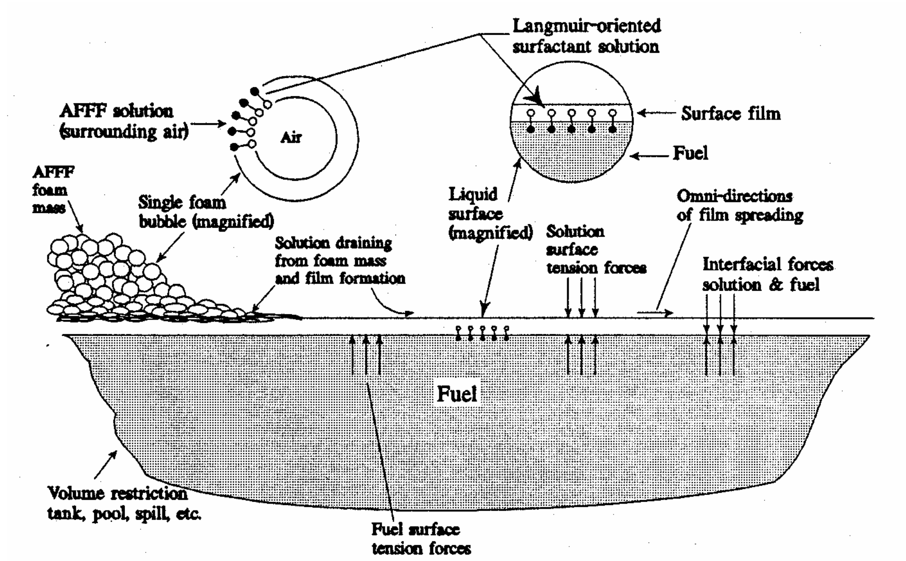

Figure 1

The layer of solution draining from the foam mass and floating on the fuel surface has a density equal to ordinary water; it should sink in the liquid fuel below it which has a lesser density. It does not sink until it reaches a limiting thickness; when drops form it will finally sink. The reasons for this are because of the surface tension between these two liquids. As the drops become larger, prior to sinking, the drops will absorb larger fuel molecules, leaving the smaller molecules at the surface of the liquid. This action actually lowers the flashpoint of the fuel. This type of situation is more evident with the heavier fuels as previously mentioned and is the main reason for continuous foam application.

AFFF-ATC can be used as a foam cover and protecting material for flammable liquids that have not been ignited. It may be used for extinguishment of most water soluble polar solvents at a 6% eductor setting. Because of the extremely low surface tension of AFFF solutions, these foams may be useful under mixed-class fire situations (Classes A and B) where deep penetration of water is needed in addition to the surface-spreading action of the foam itself.

Most flammable liquid incidents will be one of two types: (A) a two dimensional incident, meaning the liquid is contained on the bottom and sides such as a pit, open container, etc.; and (B) a three dimensional incident, meaning the liquid is not contained, such as a tanker spill with free flowing fuel.

On arrival at such incidents, especially the three dimensional type, care should be taken not to place apparatus down grade or down wind of the spill.

AFFF-ATC Foam Operation

The eductor should be placed on a 2-1/2" discharge at the engineer's panel so the operator can observe the pressure gauge and the fluid level of the concentrate. With the eductor in place, the operator must be sure that the proportioner dial is set at 3% or 6%, depending upon the type of fuel that is involved in the incident.

The 1-1/2" attack line can range from 50 ft. to a maximum of 150 ft. Any length longer than 150 ft. will cause excess water turbulence and friction loss, with the result being substandard foam application.

Current foam eductors are rated for 60 GPM or 95 GPM. The nozzle GPM must match the eductor GPM. Flows greater than the eductor rating will cause the foam to be thin and weak. Make sure when you attach a fog nozzle to the attack line that it will adjust to the GPM rating of the eductor. The preferable nozzle for foam application is the ABS plastic foam nozzle. This nozzle provides air aspiration of the foam solution which results in a significantly greater expansion of the foam. Firefighting fog nozzles are non-air-aspirating which provide low foam expansion and the need for more foam usage and application.

The application of the correct amount of foam solution is an important consideration. This may be calculated quickly by estimating the square footage of the spill or fire area. The square footage is then multiplied by a factor (application rate) of .16. This number is the required gallons per minute flow of foam solution to effectively extinguish a flammable fuel fire. For example, a 500 square foot spill would require the application of 80 gpm of foam solution (500 X .16). To determine the amount of foam concentrate required, multiply the required gallons per minute of foam solution by either .03 (3%) or .06 (6%). Multiply by .03 if the fuel is non-polar (i.e., gasoline, diesel fuel, etc.) and .06 if the fuel is a polar solvent water-soluble (i.e., alcohols, ketones, etc.). To continue the example, an 80 gpm flow of foam solution would require 2.4 gallons per minute of foam concentrate for a 3% application (.03 X 80) and a water supply of 77.6 gallons per minute (80-2.4). A five gallon can of foam concentrate would last approximately two minutes at a 3% eductor setting. A ten minute supply of foam concentrate is recommended prior to the start of foam application. In the example, this would be 24 gallons of foam concentrate.

When the nozzleman indicates that he is ready and in position, the engineer will place the pickup tube in the foam concentrate, making sure it is at the bottom of the container. Then open the discharge valve and bring the discharge pressure to 200 PSI. It is important that this pressure be maintained for effective results. If the eductor is placed in the line away from the pump, calculations reflecting friction loss should be made to provide 200 PSI at the inlet of the eductor. The nozzleman should not attack a fire until he has foam coming from the nozzle.

After the above operation has been completed, the engineer should remove the second container from the compartment so it will be readily available. Remember that each engine company has fifteen gallons of foam concentrate and L73 has 40 gallons of foam concentrate, which will cover approximately 500 square feet and provide a four to five-minute supply.

In the event a large incident is encountered and assistance is several minutes away, extra time and coverage can be gained by changing the proportional dial to 2%. This is to be considered an emergency measure, providing only minimal coverage, and should only be used as a last resort.

Keep in mind that in critical situations that large amounts of foam concentrate is available from the Phoenix Fire Department, as they carry 40-50 gallons on each engine company, on crash firefighting companies at the airport, and foam companies at the tank farm.

Foam concentrates will leave a gummy residue inside which will affect the metering mechanism of the eductor. Therefore, <u>it is important that the eductor and pickup tube be cleaned immediately and thoroughly after any use by removing the check ball and flushing with clear water. Any hose line and nozzle that was utilized for foam operations should also be flushed with clear water</u>.

CHARACTERISTICS AND PUMPING PROCEDURES FOR MSA VEEFOAM

VEEfoam concentrate is a synthetic-based foam concentrate. It is an effective foam agent as a high expansion concentrate at a 2% concentration and is effective as a low expansion concentrate at a 6% concentration. Sixty gallons of VEEfoam concentrate is currently available on HM-72. VEEfoam provides an effective foam blanket that suppresses vapors from non-polar hydrocarbons, <u>most acids</u>, <u>most alkalis</u>, and some polar solvents. VEEfoam is ineffective in controlling vapors from small polar solvents, such as, methanol, ethanol, and acetone.

<u>VEEfoam Operation</u>

VEEfoam should be pumped through a 1-1/2" attack line that is no longer than 150 feet. The most effective foam is achieved by applying VEEfoam through a foam nozzle. The MSA Vari-X foam nozzle and matched eductor have been utilized as an effective method for application. When using the Vari-X nozzle, the inlet pressure to the eductor should be 135 PSI and the pressure at the nozzle should be 80 PSI.