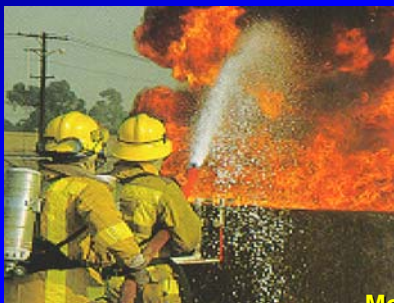


Fire Fighting Foam



Module 9

Fire Fighting Foam

Objectives

Why use Foam?

Many agents can extinguish a Class "B" fire, however, foam provides:

- ♦ Suppression of Flammable Vapors
- ♦ Prevention of Fuel Ignition, or Re-Ignition
- ♦ Post Fire Security

Class "B" Fuel Types

- Hydrocarbons
 - ♦ Hydrophobic (will not mix with water)
 - ♦ Float on Water
 - ♦ ie. Gasoline, Kerosene, Fuel Oil
 - ♦ Typically give off black smoke
- Polar Solvents
 - ♦ Hydrophilic (mix with water)
 - ♦ ie. Ketone, Acetone, Isopropyl Alcohol
 - ♦ Usually burn cleaner than hydrocarbons
 - ♦ Flame is sometimes not visible.

Types of Incidents that May Require Foam

- Transportation Accidents
 - ♦ Tank Truck Roll-overs
 - ♦ Tank Car Derailments
 - ♦ Fuel Spills at an Automobile Accident
- Chemical Spills
- Paint, Motor Oil, Lacquer Thinner, and Other Flammables Liquids Stored in Warehouses & Department Stores

Hazmat Applications

- Vapor Suppression of fuming chemicals
 - ♦ Acids
 - ♦ Alkali
 - ♦ Organic
- Medium Expansion Foams
- Stabilizing Additives

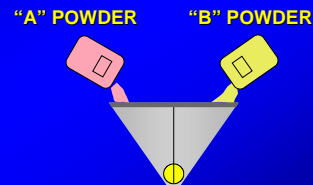
Hazmat Vapor Suppression

- Insulates chemical from:
 - ♦ Solar radiation
 - ♦ Ambient air
 - ♦ Heat input
- Reduces vaporization
- Suppresses vapors
- Absorbs vapors and particulates



Chemical Foams

- Developed in the 1920's
- Foam as a result of a chemical reaction
- Difficult to handle and use
- Wet powders would cake up



Mechanical Foam Types

- Foams can be grouped into two basic categories:

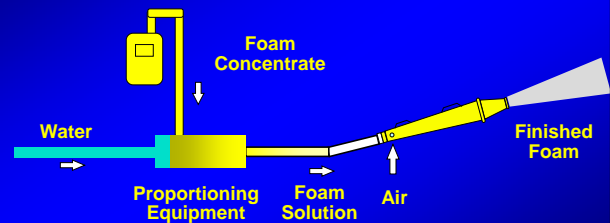
Proteins

- Regular Protein
- Fluoroprotein (FP)
- Film Forming Fluoroprotein (FFFP)
- Alcohol Resistant Film Forming Fluoroprotein (AR-FFFP)

Synthetics

- Synthetic Detergents (High Expansion)
- Aqueous Film Forming Foam (AFFF)
- Alcohol Resistant Aqueous Film Forming Foam (AR-AFFF)

Production of Mechanical Foam



Foam Properties

- Knockdown
- Heat Resistance
- Vapor Suppression
- Fuel Tolerance
- Cooling

Knockdown

- Speed at which the fire is extinguished



Heat Resistance

The foam's ability to withstand exposure to heat



Sealability (Vapor Suppression)

Ability of the foam blanket to prohibit fuel vapors from migrating through the finished foam blanket



Fuel Tolerance

Ability of foam bubbles to resist fuel pickup when subsurface injected or plunged from topside



Foam Performance Criteria

Property	Protein	Fluoro-protein	AFFF	FFFP	Alcohol Resistant AFFF	Alcohol Resistant FFFP
Knockdown Speed	●	●●	●●●●	●●●●	●●●●	●●●●
Heat Resistance	●●●●	●●●●	●●	●●●	●●	●●●
Fuel Tolerance	●	●●●●	●●	●●●●	●●	●●●●
Vapor Suppression	●●●●	●●●●	●●	●●●●	●●●	●●●●
Alcohol Tolerance	None	* None	None	None	●●●●	●●●●

* (MTBE is an exception, to be discussed later)

● ●● ●●●● ●●●●

AFFF How it works

Aqueous Film Formation Across Fuel Surface

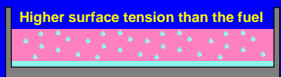


Film formation relies on the reduced surface tension characteristics of the solution draining from the blanket.

Surface Tension

Application of Water Only

Water sinks rapidly to the bottom of a hydrocarbon fuel.



Application of Foam

Foam solution drains from the blanket and spreads across the surface of a hydrocarbon fuel. It accumulates on the surface, and slowly sinks to the bottom.




Drainage rate is proportional to the expansion of the finished foam blanket.

Greater Expansion = Slower Drainage

FFFP How it works

Fluoroprotein Blanket
Provides Firefighter
Security

Film Formation
Across Fuel
Surface

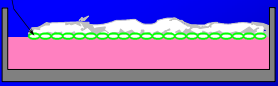


Rapid knockdown is achieved while still maintaining the heat resistance and vapor suppression characteristics of protein based foams.

AR-Foams How they work AR-AFFF and AR-FFFP

- Film formation on hydrocarbon fuels but not on polar fuels
- Polymeric membrane formation only on polar fuels
- The polymeric membrane is not self healing
- Reapplication is necessary to reseal areas where the membrane has been broken

Polymeric Membrane Formation
Separates the Foam from the Fuel




The foam blanket floats on the polymeric membrane like a raft

Application Techniques

- Bounce Off
- Roll In
- Rain Down

Do Not Plunge



Application Technique

BOUNCE OFF



Application Technique

ROLL-IN



Application Technique



Safety Considerations

- Identifying the Hazard
- Preserving the Blanket
 - Do not Apply Water to Foam
 - Do not Walk in Blanket
 - Do not Drag Hose in...
- Wind Direction
- Safety Officer (Observer)
- Backup Lines
- Flowing Fuel