Pierce®

Foam Training

Training Manual

Part No. PM-F-TM510-0212

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MODULE 1. FOAM TRAINING

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Topic A. Introduction

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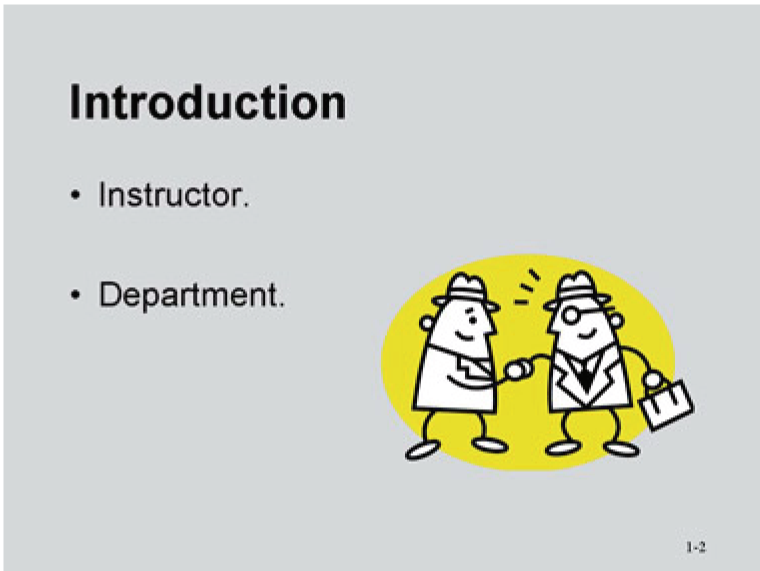

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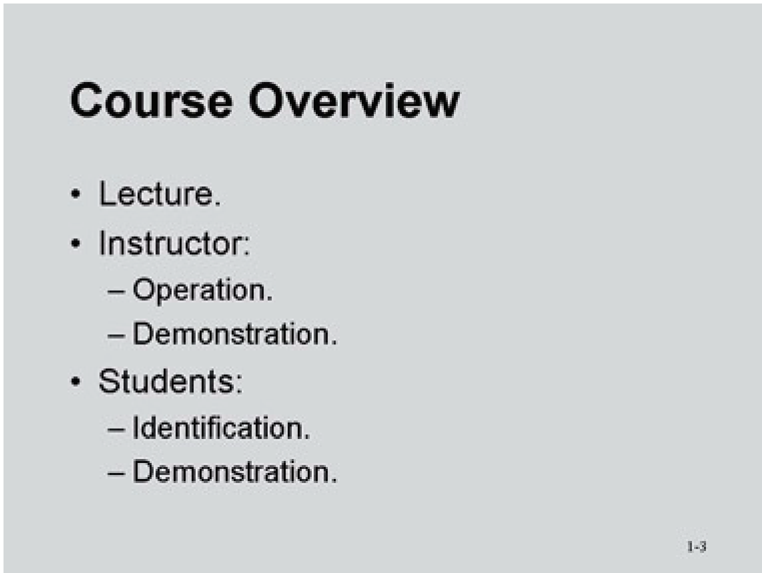
- Introduction and background of instructor
- Introduction of department
- Past foam usage / system issues / water supply

Topic B. Course Overview

Figure 1-2:



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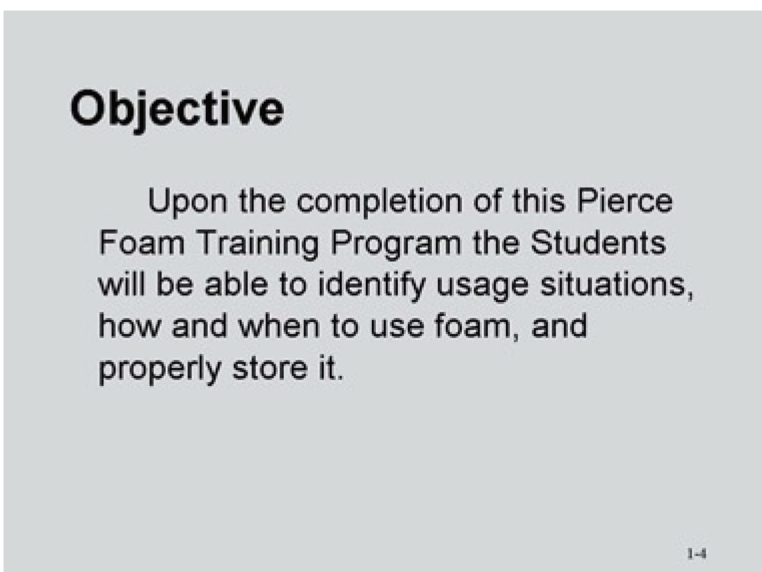
Topic C. Objective

Figure 1-3:



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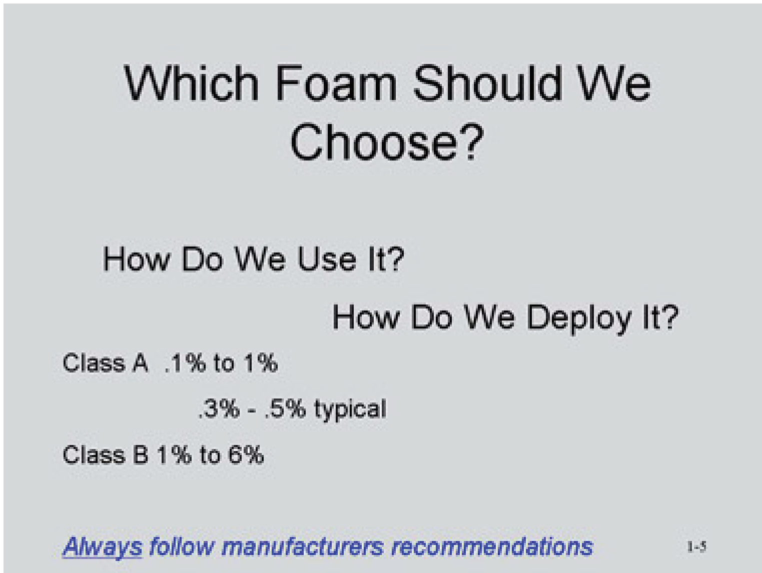
- Pierce does not sell foam concentrates. Each fire department makes their own choice.
- This class may possibly help you to make an educated choice, based on good information

Topic D. Which Foam Should We Choose?

Figure 1-4:



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- Class A foams are designed for Class A Applications. Typically used at three tenths up to one half percent. Lower rates work well for extended mop up situations, while higher percentages can be used for exposure protection and minor fuel spills. Running the class A over 1% is generally not beneficial, and a waste of foam and money.
- The fact that Class A is used at such low percentages, is what makes it affordable to use on a regular basis. .3% is ten times less product than 3%. Most Class B foams are used at 3 to 6%. It is these numbers that deter some people from using foam... “It’s too expensive. We can’t afford to use foam.”
- Foam is a strong degreaser or detergent. If regular dish soap effects yours hands, this will too. Gloves and eye protection is always a good idea when working with pure concentrates.
- When used properly, Class A foam can reduce many other expenses involved in fire fighting.
  - — The amount of time on scene can be less.
  - — The number of air bottles used, that will need to be recharged should be less.
  - — The amount of fuel used by the truck will be less.
  - — Fire fighter safety will be enhanced due to less time on scene.
  - — These savings can pay for the amount of foam used.
- Class B foams may be used at many different percentages. It all depends on the manufactures recommendation for the type of fuel it to be used on. There are 1 x 3’s, 3 x 3’s, 3 x 6’s, some are a straight 6%.
- Not all B foam’s work on all B fuels, it is imperative to know what type fuels your foam is designed for.
- *Always follow the foam manufacturer’s recommendations.*

Figure 1-5:

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Mixing of foam concentrates should be avoided. Classes of foam or different manufactures of the same class of foam can cause coagulation and cause system failure.

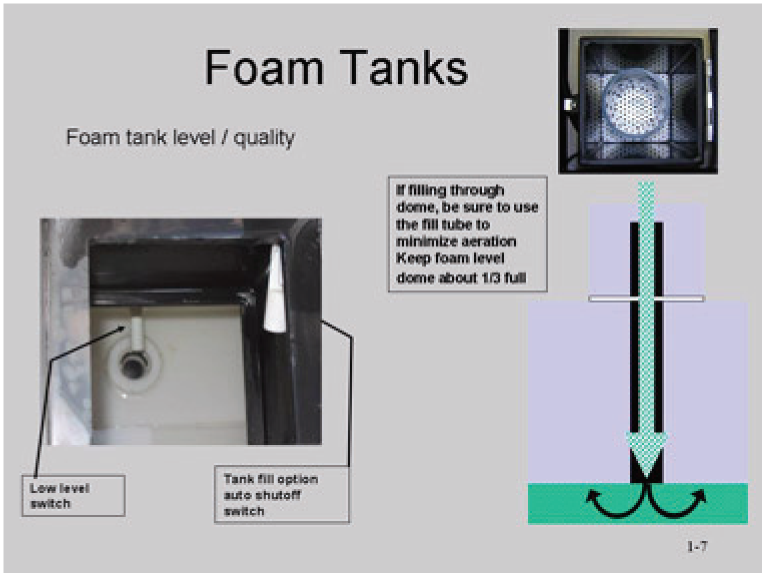
Inspected regularly, gelled foams may be able to be drained out before turning solid, allowing the foam tank to be rinsed with hot water, allowed to drain, and refilled with good foam.

Foam solutions are compatible in their finished form when discharged as they are mostly water at that point.

Plastic like polymers and stabilizing agents are used in AR-AFF or ATC foams. If this is mixed with Class A concentrates, especially ones that have alcohols in their make-up, this will be the most drastic effect of coagulation.

Topic E. Foam Tanks

Figure 1-6:



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The on board foam tank should be checked periodically to ensure there is good foam in the tank. The gauge may read full, but what is it full of?

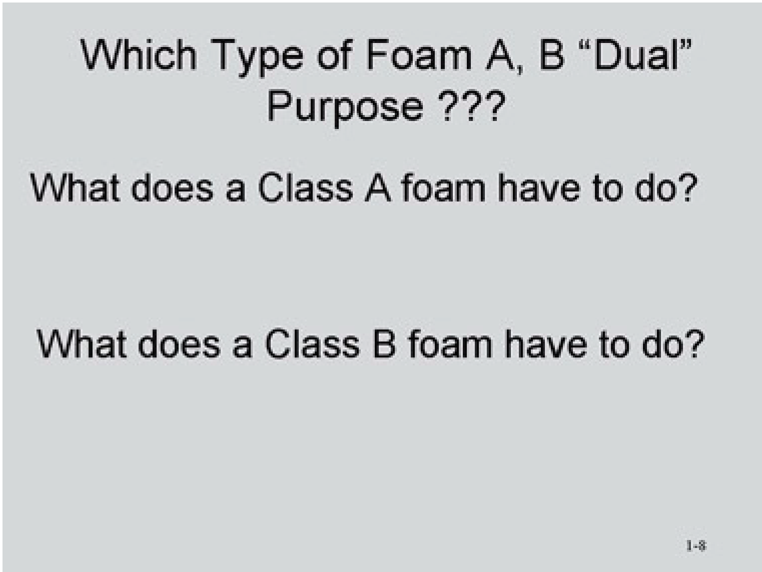
Filling the foam tank may be done from the ground with fill systems if equipped or filled from above through the expansion tower. When filling from above, the fill tube should be used to help eliminate aeration of the foam. The fill tube keeps most of the air bubbles in the tube and allows the foam to enter from below. Using a street cone as a funnel helps too.

Always pour slowly, and steady. Don't let the foam "glug" as you pour it. This adds air to the concentrate and makes a lot of bubbles. If the fill tube is removed, and you pour the foam on top of what is currently in the tank, you will make even more bubbles. Your goal is to fill the tank with liquid, not bubbles.

Keeping the tank filled about 1/3 to 1/2 full in to the dome ensures a full tank and allows for less exposure to air. See *Figure 1-6*.

Topic F. Which Type of Foam A, B “Dual” Purpose???

Figure 1-7:



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Foam is simply soapy water. Class A and Class B foams are two types of soap. Dish soap, laundry soap, shampoo, and car wash soap, are other types of soap.

If you use the correct soap for the job at hand, you get the most bang for the buck. Trying to use the wrong soap for the wrong job, ends up being impractical.

Class B foam is not supposed to be carbon attractive. Many Class B fuels are carbon based. When putting foam on top of class B fuels, we do not want it to mix with the fuel.

Water droplets are heavier than fuel. In order to get foam to stay on top of fuel, foam is mixed in with the water. With the foam being repulsive to the fuel, and the use of air aspiration, the blanket can now float on top of the fuel because of the air that is trapped inside of the droplets, which are now bubbles.

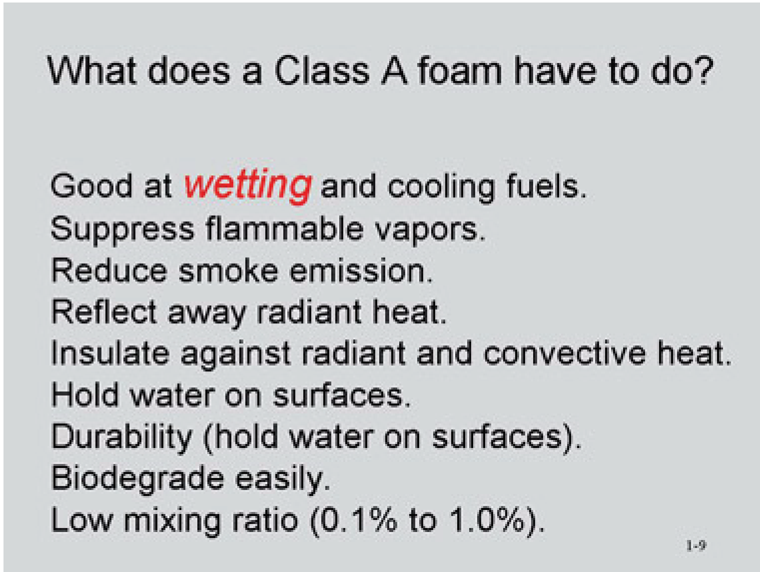
Many of the Class A foams claim they can be used for extinguishing and emulsifying hydrocarbon spills. As in earlier slides ALWAYS follow the guidelines set by the foam manufacturer.

Special care should be used when using Class A on class B fire spill situations. The utilization of air-aspirating nozzles, over non-aspirating nozzles, may offer more effective control of these situations. Class A foam should never be used on polar solvent or water miscible fuels.

Some class B foams claim that they can be used for class A situations. While they may lower the surface tension of the water, they are not as effective as a true Class A in that they are not attracted to carbon. They also do not work at low percentages, thus will cost a lot more to use.

Topic G. Class A Foam

Figure 1-8:



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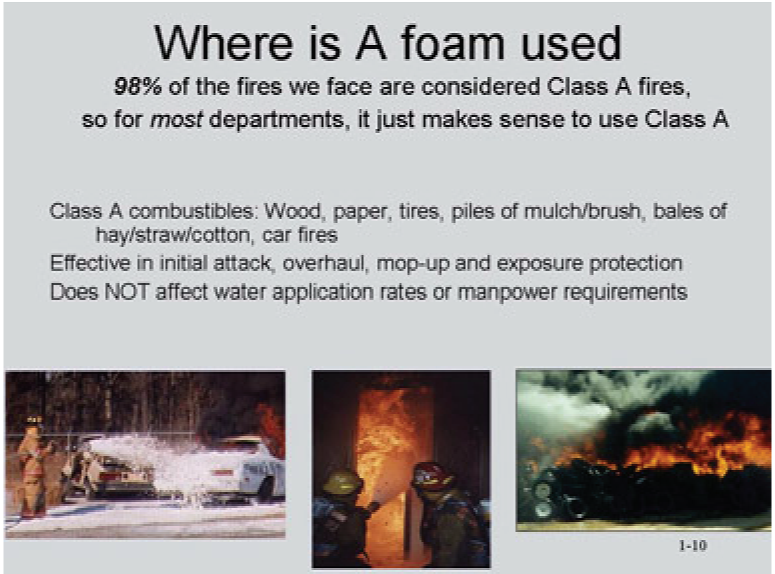
- Class A foam is very good at making bubbles at very low percentages.
- Class A foam is carbon attractive. It makes the water stick to charred carbon based fuels
- Class A foam is a wetting agent, that reduces the surface tension that exists in water. This surface tension allows water to sit on surfaces and not soak in.
- Foam helps to increase the surface area of a gallon of water; it is how you absorb more BTUs. A bubble will turn to steam much quicker than a droplet of water. This steam production is what makes foam capable of knocking fires down very quickly.
- During over-haul and mop-up type operations, the foam is effectively used as a wetting agent that has low surface tension that can soak in fast, and stay attached to the surfaces, because of the carbon affinity, or attractiveness of the soapy water. Milky water without a lot of bubbles is best during this phase.
- Exposure Protection: Class A foam is excellent for exposure protection. The foam will keep the water on a structure were the water would run off.
- The fact that Class A is used at such low percentages, is what makes it affordable to use on a regular basis.

Figure 1-9:



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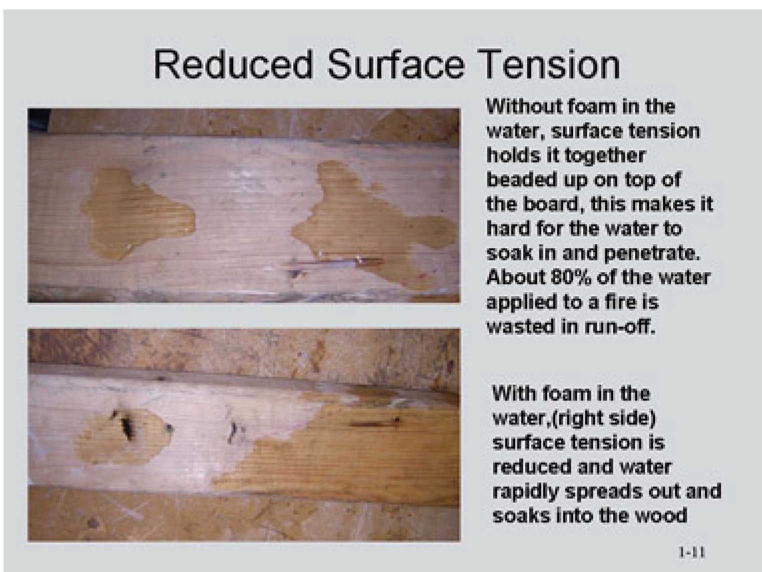
- Most situations now days are class A situations. Unless there is an significant amount of fuel, in depth (over 1").
- Putting Class A foam on tires, in a wet state can allow the water to cool because of its ability to stick to the tires.
- Exposure Protection: Class A foam is excellent for exposure protect. The foam will keep the water on a structure were the water would run off.

Figure 1-10:



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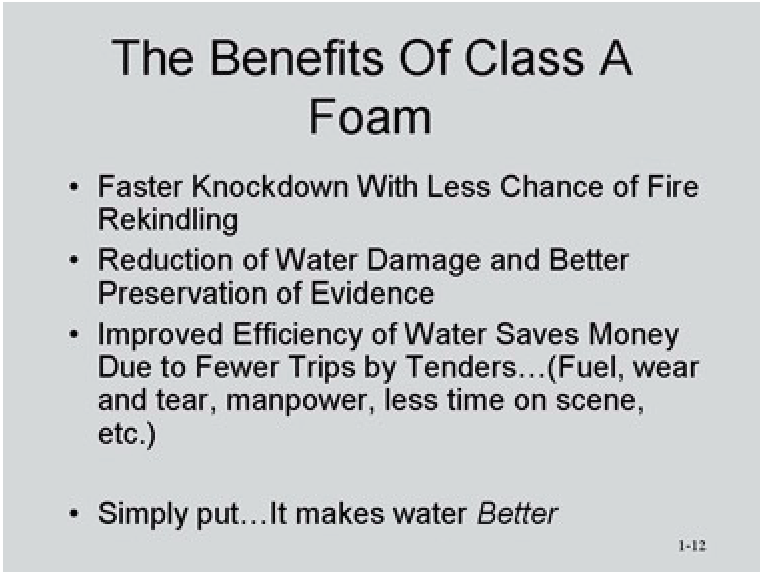
- Class A reduces the surface tension of the water allowing it to soak in and penetrate.

Figure 1-11:



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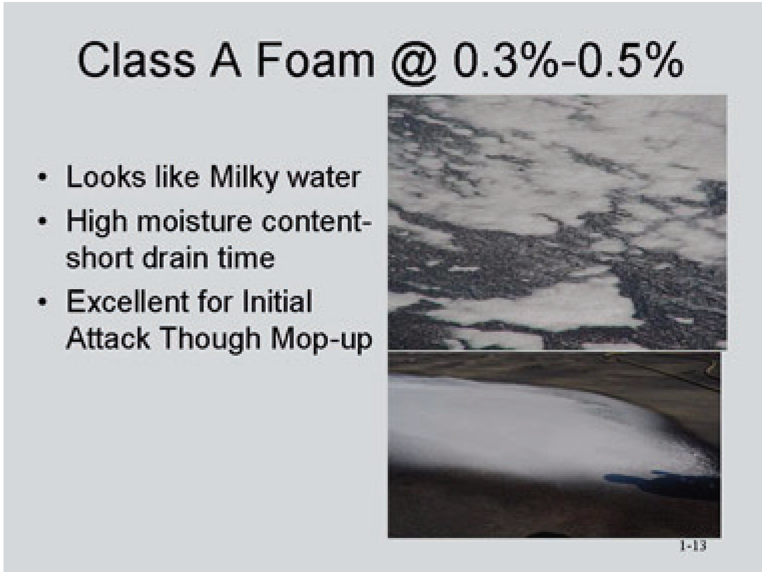
- "We're going to use foam now instead of water." Foam is water. Most application rates are .3 to .5% leaving 99.5% water
- Better Cooling: Class A foam will increase the surface area of water. The result is that the water can turn to stream quicker resulting in quicker cooling.
- Less Rekindles: Class A foam is excellent for mop up applications because it improves penetration into the crevices of the fuel. The results are a reduction in rekindles.
- Reduced water damage: Because the foam knocks the fire down with less water and is more effective at mop up the water damage is substantially reduced to the structure.
- 2-3 times faster knockdown than water: The surface area of water is increased when it becomes foam. All of the water is on the outside of the water bubble, which increases the surface area. The water will turn to stream easier with the increase in surface area.
- One advantage, the increased steam conversion has to be watched for one "disadvantage"... More steam. When you use foam, you will make more steam. Be prepared, and allow for the steam to escape.

Figure 1-12:



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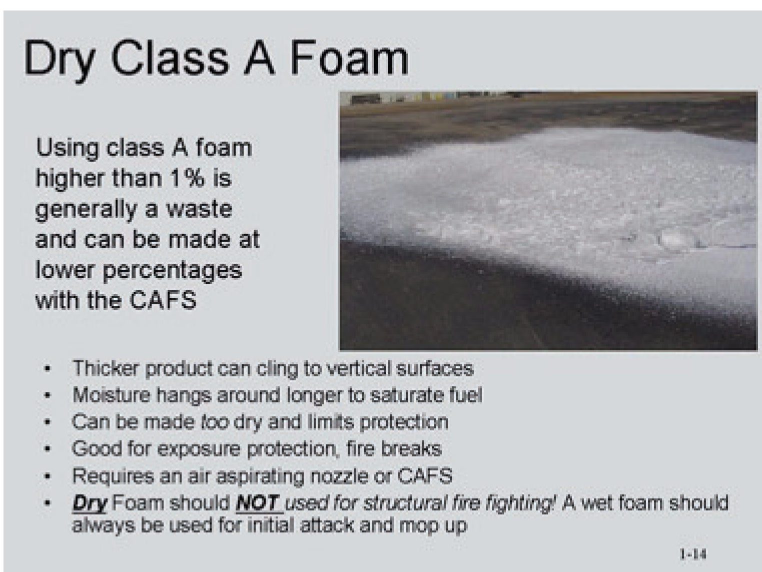
- Milky looking water is what is generally preferred for initial attack. Bubbles help to put out the fire, but are not really needed during overhaul and mop up operations. In fact, too high of a foam percentage may cause bubbles to stack up, hiding smoke from deep seated embers.
- Do not try to bury, smother, blanket, when doing the over-haul. This does not cool. Allow the water/foam solution to soak in, to do the cooling. Wet foam is used to fight fires and do over-haul. DO NOT USE A DRY FOAM FOR THIS.
- With CAFS, about a 2/1 water/air ratio is generally a good starting point for an initial attack.

Figure 1-13:



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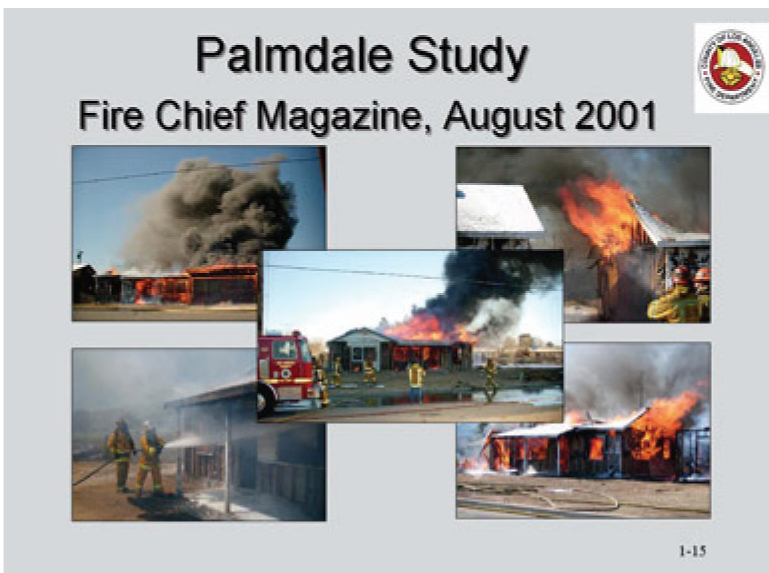
- Running the class A at too high of a percentage is detrimental to initial attack in that it can hide burning embers under the foam. Due to the longer drain time and low moisture content, the fire has a chance to rekindle.
- Use of the higher percentage on fuel spills and exposure protection can aid in suppressing fuel vapors.

- For exposure protection, depending on the weather conditions, some departments will come through first with a wet water/foam solution with the shorter drain time to allow the moisture to soak in, then make another pass with the dryer solution to hold the moisture in, while creating a blanket that will help reflect the heat.
- **A good example of more is not better:**
  - — Training with a department, many of the guys commented on how much "better" the 1% class A "shaving cream" was. Tried explaining to them that would waste a lot of foam and actually hinder their mop up operations, as the thick foam bubbles would tend to hide smoke and smoldering embers. Doing training burns the next day, first with water only, water/foam, then the third with CAFS. To get the point across ran the CAFS at 2%. Fire went out pretty fast, outside temperature was 85+, low humidity, and 20-25mph winds. The frothy foam blanket dried quickly and allowed the fire to rekindle.
  - — The rest of the burns with CAFS that day were done @ 0.3%. The fires went out and stayed out.
  - — Trapping air in your water is what allows foam to insulate against heat. It is about the same as having gas trapped between two pieces of glass in a window, having an insulating effect.

Topic H. Compressed Air Foam Systems (CAFS)

Figure 1-14:



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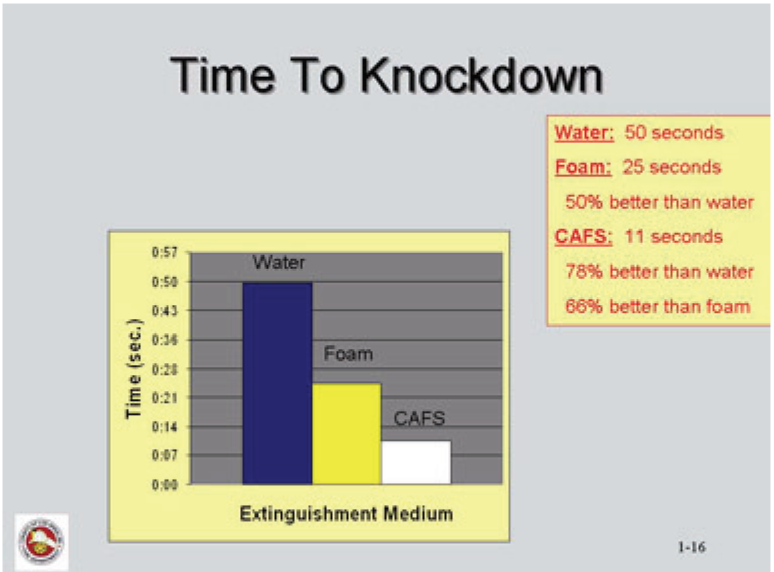
- Full article can be found at: http://firechief.com/suppression/foam/firefighting_bubbles_beat_water/
  - — Structures. The burn tests were conducted in Palmdale, Calif., northern Los Angeles County. The test structures consisted of three one-story, wood-framed single-family dwellings that were part of a large housing development built in the 1940s Each of the test structures had an identical 1,105-square-foot floor plan consisting of six rooms. Interior walls were lath-and-plaster construction, but the exterior stucco walls had been removed prior to the tests because of asbestos contamination. The composition shingle roofing was left in place. All window glass had been removed and replaced with plywood.
  - — Each structure was furnished with identical new furniture to simulate a typical small-residence fire load. Items included beds and bedding, dressers, wood dining room tables and chairs, bookcases, chairs, upholstered couches, coffee tables, various plastic items, magazines, and wall hangings. All carpets were removed. The interior of each structure was rigged with thermocouples to detect temperatures at various locations.

— Weather. All tests were conducted in the afternoon within two days of each other in February. Outside air temperatures were in the low- to mid-60s. Winds were light and judged not to be a factor.

— Equipment. All attacks were conducted using the same LACFD structure pumper equipped with a 1,500gpm single-stage centrifugal pump, Waterous/Pneumax 100cfm CAFS, FoamPro 2001 foam proportioning system, and Phos-Chek WD881 Class A foam concentrate by Astaris. The attack line was 200 feet of 1 1/2inch hose. A combination nozzle was used in the water and Class A foam/water solution tests, and a 1-inch smooth-bore nozzle was used in the CAF test.

Figure 1-15:



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The IOWA formula was used to calculate flow rate. They kept the water at 90gpm in all 3 tests

All attacks were conducted by fire suppression personnel trained in the use of foam for interior attacks. The same attack team was used in each test. Capt. Darryl Dutton, who has been instrumental in the development of Class A foam use within the department, supervised the attacks.

Fires were started by igniting furnishings with a propane torch at several locations within each of the four main rooms. Accelerants or added fuels weren't used, and the bathroom in the center rear of the house, laundry room and attached garage weren't involved in the tests. When the average interior room temperature reached between 550° and 850°F, firefighters outside the building started pulling the plywood panels away from the windows with trash hooks to simulate heat failure of the glass.

After the interior was exposed to outside air and allowed to burn freely for a short time, the attack began and data recording started. The attack team started from a position in front of the structure and directed a stream through an open window or door. The team then moved across the front of the structure or around to one side to direct a stream through another opening. The CAF attack was started from a position at the curb, approximately 35 feet from the front of the dwelling, because of the tremendous carry of the CAF stream.

All flowrates were based on the Iowa formula. The flowrates for the water and the Class A foam/water solution attacks were 90gpm; the flowrate for the CAF attack was 90gpm with 30cfm air. Foam concentrations were set at 0.5% for the Class A foam/water solution test and 0.2% for the CAF test.

All attacks were halted when the fire was knocked down, but data recording continued through overhaul. In the case of the water attack, firefighters eventually had to enter the dwelling and switch to a Class A foam/water stream to stop the fire, which had extended into the attic. This was the only test where firefighters had to enter the structure to attack the fire.

The results:

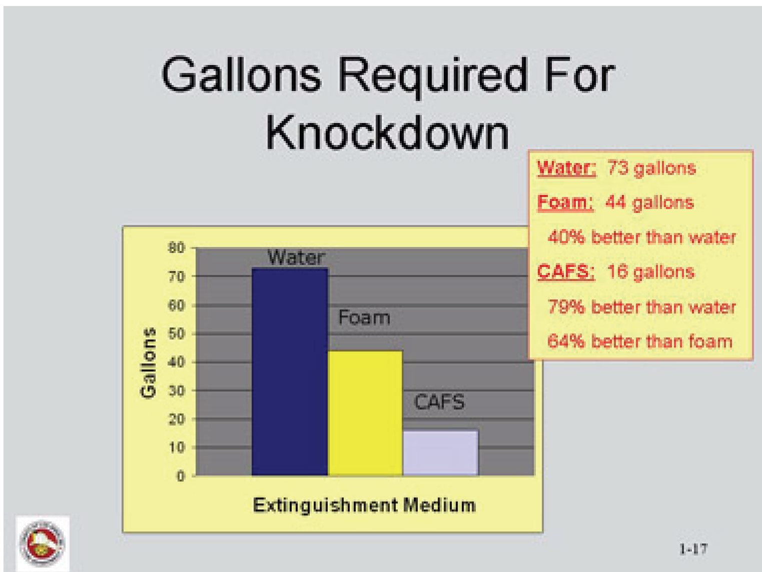
The test results seemed to confirm many things that were generally known about foam, but had not been rigorously documented. Most importantly, the tests clearly showed where CAF is superior to either water or Class A foam/water solution for interior attacks.

First of all, it took only 25 seconds to knock down the fire with the Class A foam/water solution, compared to the 50 seconds it took with water. (See table above.) Using CAF cut that figure by more than half to 11 seconds, making CAF roughly four times more effective than water in terms of knockdown time.

The test team noted several other benefits of foam, but those factors weren't measured in the test.

- Less water damage to a building and its contents, as well as less contaminated water runoff.
- Faster knockdown means fewer products of combustion in the building and eventually outside in the air.
- Increased firefighter standoff distance as a result of CAF's throw being 33% greater than either Class A foam/water solution or water.

Figure 1-16:



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The use of a smooth bore nozzle does not make CAFS an "east coast thing"

CAFS is not "just" for exposure protection or a "west coast thing"

CAFS can be an effective tool if used properly.

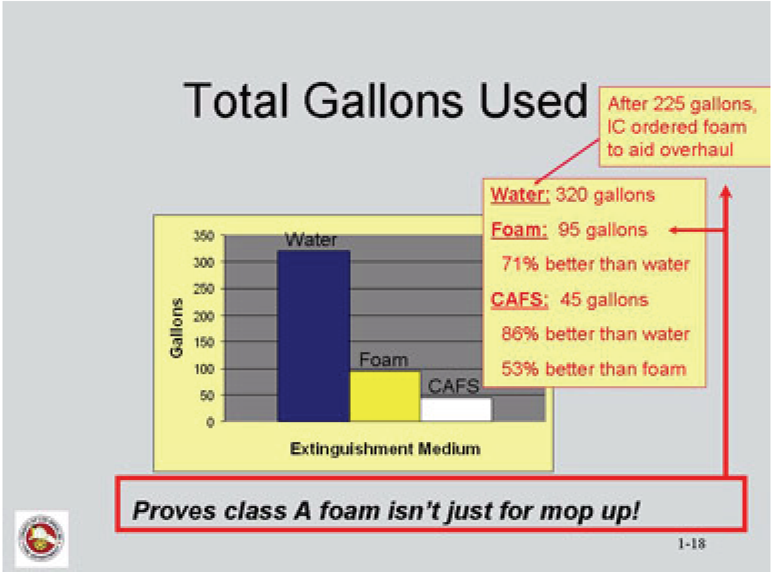
***Water* is still the main ingredient.** We can use different nozzles to make different consistencies of foam for different situations.

Less water damage to a building and its contents, as well as less contaminated water runoff.

Faster knockdown means fewer products of combustion in the building and eventually outside in the air.

Increased firefighter standoff distance as a result of CAF's throw being 33% greater than either Class A foam/water solution or water when using smooth bore nozzles or combination nozzles that have been modified for CAFS.

Figure 1-17:



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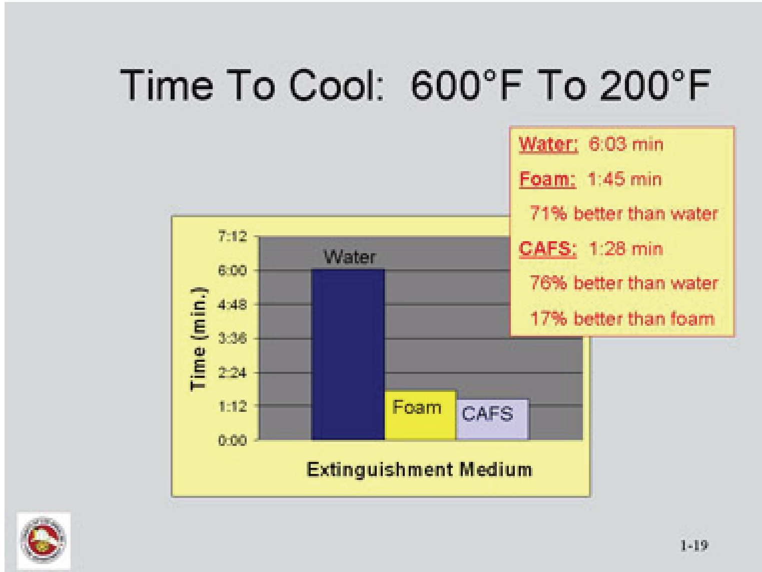
Using compressed-air foam for an interior attack requires training. Here are a few lessons the Los Angeles County Fire Department personnel learned:

- *Interior CAF attacks should be made at the flow rate required for the structure.* CAF saves water by knocking down the fire faster, not by knocking down the fire with a lower flow rate.
- *A fully charged CAF line has a very strong nozzle reaction.* Pistol-grips or other auxiliary support devices are recommended, because the high-energy stream can kick up loose objects. Eye protection should be used when working up close.
- *An interior CAF attack often can be made by directing the stream through a door or window.* This allows a greater standoff distance and reduces exposure for firefighters. Firefighters should aim at the ceiling level for the best results.
- *When CAF hits a fire, it generates a large volume of steam.* Because this steam will fill the structure and vent strongly through any exterior openings, other personnel working in the vicinity should take adequate precautions.
- *Even though CAF reduces interior temperatures faster than water, the upper portions of rooms will still be quite hot.* Once inside, the attack team should stay low and not stand up too quickly after knockdown.
- *Always overhaul.* Firefighters should use low foam concentrations to produce a wet CAF, as high foam concentrations produce a dry foam that doesn't penetrate as well.

Table 1-1:

Concentrate Cost:	Foam Solution:	CAFS:
$15/gal	31 oz = $3.63	5.8 oz = $0.68

Figure 1-18:



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As an added benefit, the heat-absorbing properties of foam reduced the average interior temperatures significantly faster than water. With Class A foam/water solution, it took 1:45 minutes for the average interior temperature to drop from 600°F to 200°F, compared to 6:03 minutes with water. CAF produced slightly better results with a time of 1:28 minutes.

A plot of interior temperatures versus time reveals that not only did the foam cool the interior in less time, it started to work more quickly. This was especially true for CAF, which produced an almost immediate reduction of temperatures. By contrast, there was an extended period of high temperature before the cooling effect kicked in when using water. In fact, CAF cooled the interior from 600°F to 200°F about four times faster and with a significantly larger initial temperature drop.

CAFS benefits:

- Uses less foam concentrate.
- Penetrates fuels more effectively to reach deep-seated fires.
- Forms a vapor barrier around fuels to exclude oxygen.
- Absorbs heat more rapidly to lessen the chance of flashover in structure fires.
- Gives a faster knockdown to contain the spread of fire.
- Reduces the potential for rekindle
- Can be pumped twice as high as water under the same pressure.
- Allows firefighters to see where foam has been applied.
- Coats wood, metal, glass, brick, concrete and vegetation.
- Clings to vertical surfaces.
- Can be used with Class A or B foams.
- Reduces smoke and steam.
- Greater safety, less stress
- Produces up to three times longer stream throw, allowing greater standoff distances.
- Reduces the weight of hose lines.
- Lowers risk of heat stress during interior attack.
- Reduces the chance of structural collapse from accumulated water.

- Reduces time at the scene, resulting in less personnel fatigue and allowing more time for recovery.
- Permits the application of a protective foam coating up to several hours before the arrival of the wild land fire front. Firefighters can cover an exposed area, then move to a safer location.

Less equipment damage

- Reduces loading on aerial devices from the weight of the filled waterway for elevated master streams. (Water adds about 540 pounds per 100 feet in a 4-inch waterway.)
- Reduces pressure drop in hose so the pump can operate at a lower discharge pressure, resulting in lower engine rpm, less wear and lower noise levels
- Fewer water refills mean less damage to apparatus traveling back and forth over rough terrain.

Less property damage

- Reduces water and smoke damage to structures and contents.
- Reduces the potential for flooded basements.
- Reduces water runoff.
- Aids fire investigation by lessening disruption of the scene by water streams.

Figure 1-19:

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10-15 seconds of attack

Figure 1-20:

21

40 sec. later… Now look at the smoke, it is beginning to disappear. Notice the amount of steam. The windows have shattered due to the heat, allowing the heat and steam to escape. In an enclosed structure, the upper levels will fill with steam first, eventually working its way down to the lower level. If entry is attempted, it must be made as low as possible or after ventilation.

Figure 1-21:

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About 90 seconds later. Suppression of flammable vapors and reduction of smoke.

NOTE: Heat escaped out failed windows and allows them to be standing as they enter:

- good visibility
- no fire in doorway
- little or no smoke

Figure 1-22:

23

Notice half this brush pile was extinguished with water, the other half with Class A Foam.
Notice a big difference in the vapor production.
This is because class A foam has the ability to penetrate the class a fuel and stop the vapor production.

Figure 1-23:

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Class A Foam/water .3%
Flow rate though the Deluge was limited to about 500 GPM using the onboard water tank

Figure 1-24:

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Kept the flow rate up as much as possible from the tank to pump. After achieving knockdown flow is stopped.

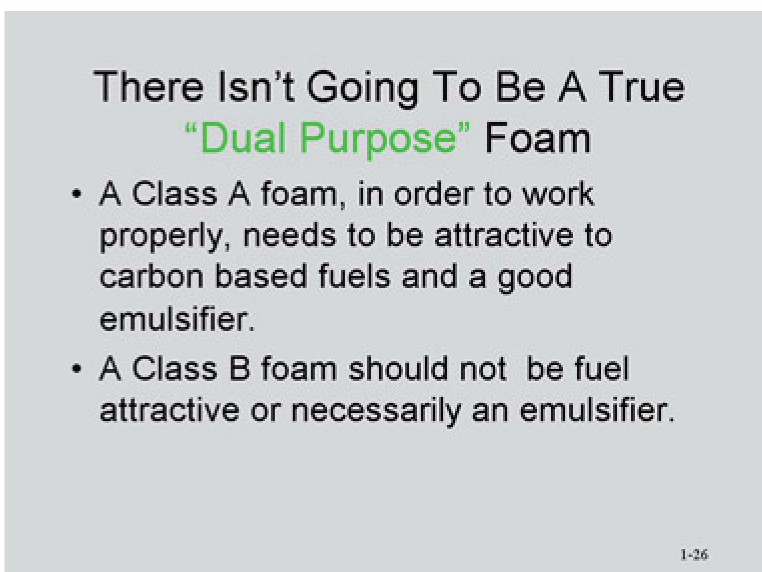
Most agree there is a fair amount of knockdown for the water used. Had that same amount of water been applied with a booster line, at a lower flow rate, the house would have been lost.

Foam works because it makes the water that is being put in more efficient. Different burns have been shown with guys showing a lot of knockdown using way too little flow (like at the end of this presentation).

Notice how the class A foam attached itself to the charred surfaces.

Topic I. “Dual Purpose” Foam

Figure 1-25:



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- Good Class A foam is attracted to carbon.
- Dual purpose foams are very carbon attractive, as a good Class A, but dual purpose foams do not make bubbles at low percentages.
- A Class B foam does not destroy the fuel; it sets on top forming a vapor barrier. Without vapors to burn - no fire.
- “Dual Purpose” foam works by “rendering the fuel inert” Fuel that has been “rendered inert” now must be disposed of as hazardous waste!
- Class B foam does not destroy the fuel - it covers it - simply putting a vapor barrier over the top. After time, the water/ foam solution settle to the bottom and can be drained off, saving the remaining fuel for re-refining.
- The dual purpose do not make good bubbles until you get to 3%. as a wetting agent they are used at 1%. If used with CAFS, you may need to be at 3% or higher.
- Cost of good Class A is about $60-75 per pail. Dual purpose foams are “dual” cost: anywhere from $120-175 for the same five gallon pail. If Class A is used at .3% and the dual is used at 3%, you will be using 10 times as much foam. For every $1 of Class A, it would be $20 for dual purpose foam.

Figure 1-26:

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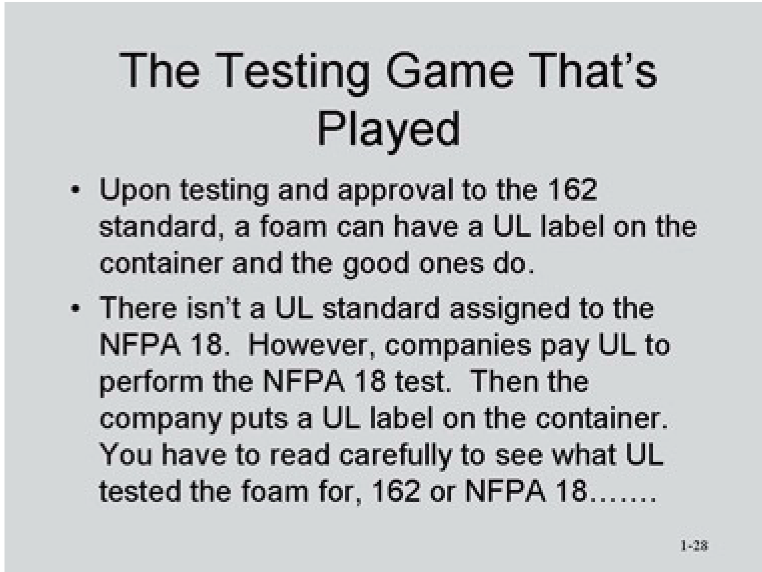
NOTE: There is also a new version of NFPA 18 Test.

Most fuel storage facilities, airports, and refineries forbid the use of Class A or dual purpose foams. Note also that dual purpose foams have not been certified to be used on alcohol fuel.

The only foams that have worked well on alcohol is the AR-AFFF or ATC foams. It is very important to do your homework in purchasing. Most often the good ones do not cost much more or any more than weaker foams.

Figure 1-27:



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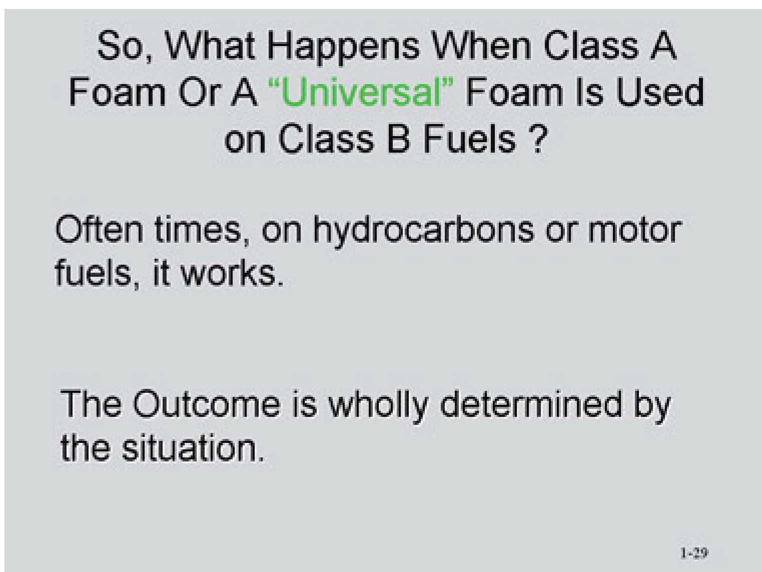
Topic J. Class A versus Class B Foam

Figure 1-28:



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The average first due engine doesn't respond to Class B incidents very often. MVAs with fuel spills aren't really that much of a Class B hazard. Rubber tires and plastic interiors aren't Class B either. In fact, Class foam is proven to be a better agent for rubber and plastic fires then Class B foam.

The Ethanol Emergency Response Coalition sponsored scientific testing to evaluate the effectiveness of six types of foam involving a spill or fire of a bulk container of ethanol or ethanol-blended fuel (known as gasohol). The International Association of Fire Chiefs is a partner in EERC.

The testing was conducted over two weeks in February at Ansul Fire Technology Center, in Marinette, Wis. Using the Underwriters Laboratory 162 Standard for Safety, Foam Equipment and Liquid Concentrates, 43 individual tests were conducted on denatured ethanol (or E95), and E10 (gasohol) using the Type II, Type III, and sprinkler applications. The following six foams were tested in the blind test.

- Alcohol-resistant, aqueous film-forming foam.
- Traditional aqueous film-forming foam.
- Class-A foam intended for fire involving ordinary combustible, or Class A materials.
- An emulsifier.
- Conventional flouro-protein foam.
- Alcohol-resistant film-forming flouro-protein foam.

The AR-AFFF was the only foam agent that successfully passed the UL162 tests against both E10 and E85/95. Some of the other foams may have some degree of effectiveness, depending on the situation and their application rate. However, the tests confirmed that AR-AFFF is the most effective foam for fires or spills involving ethanol-blended fuels. In addition to participating in the testing, IAFC and EERC are jointly producing a video documenting the test and a training package. It describes how ethanol-blended fuels are produced and distributed and the emergency-response issues that should be considered when confronting a bulk spill or fire involving ethanol-blended fuels.

Figure 1-29:

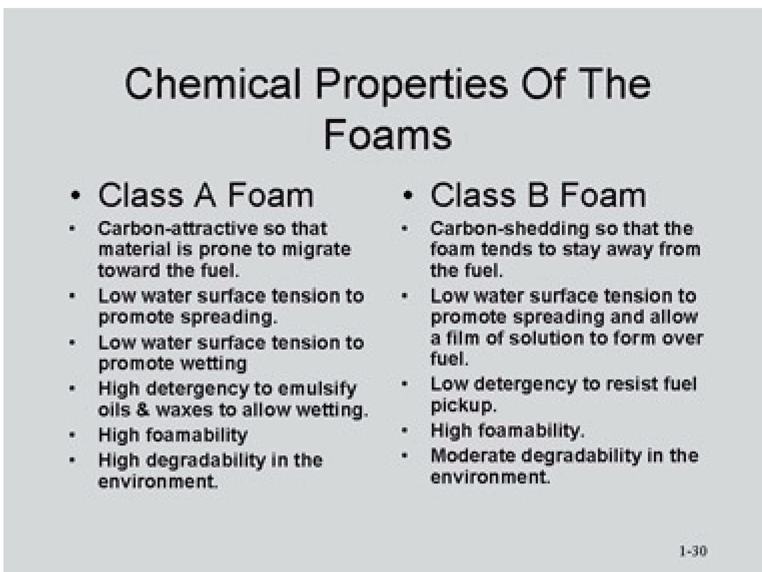

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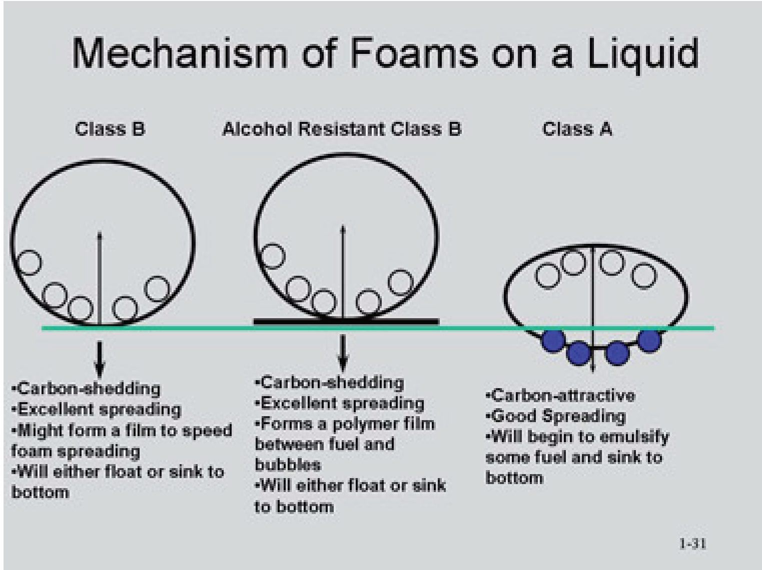
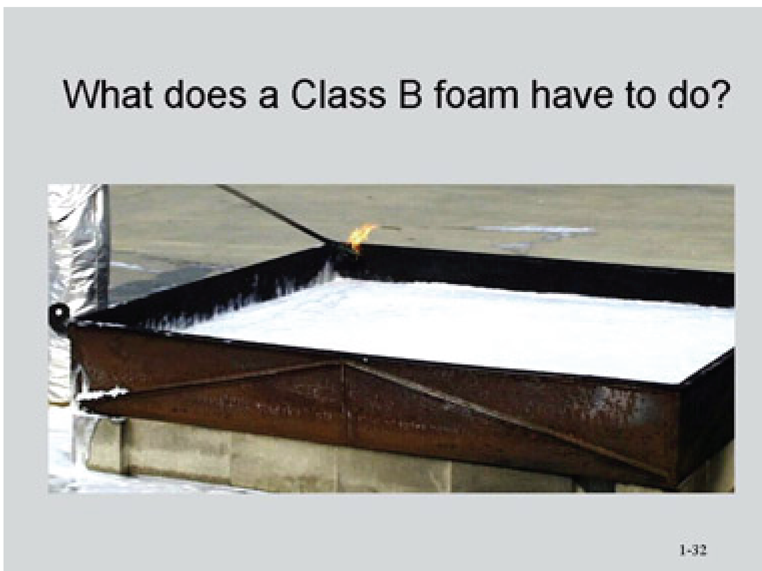
Figure 1-30:



31

Figure 1-31:



32

A Class B situation by definition has at least 1” of fuel in depth, has containment, and must be flat, foam will not work on a 3-dimensional spill such as a broken flange.

Figure 1-32:

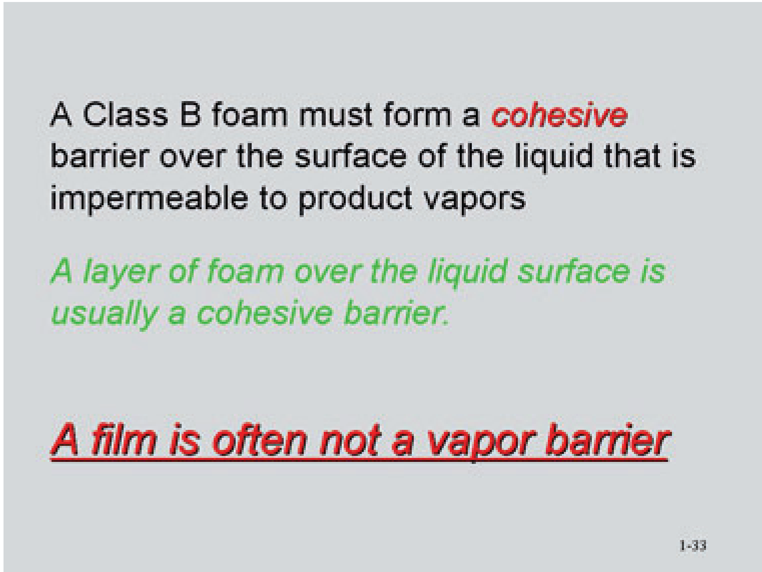


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Figure 1-33:

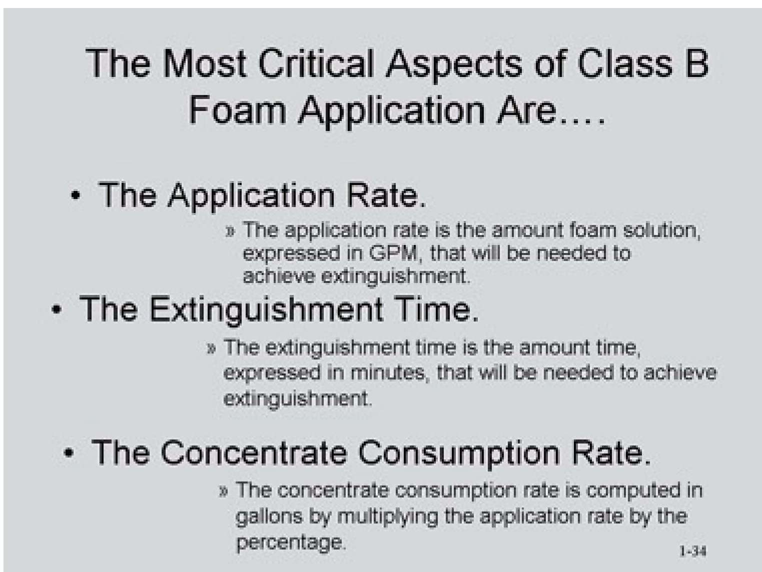

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Figure 1-34:

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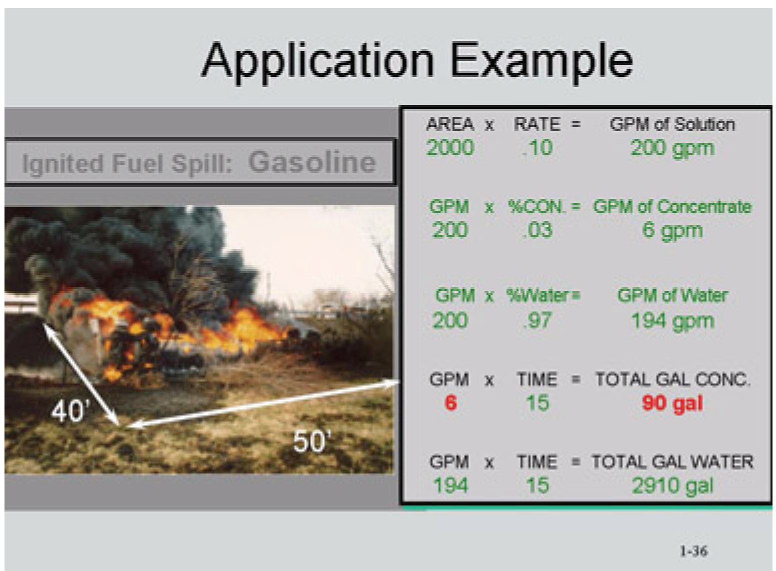
Figure 1-35:



36

Use landmark objects. A traffic lane is about 10' wide. A two lane highway is about 20' wide. Fuel spilled into the median may go an extra 20', estimated width is 40'. The length of a trailer is about 40', plus another 10' for the tractor = 50'.

Gasoline is a hydrocarbon. The application rate for a hydrocarbon spill fire is .10 GPM/ft2. Fuel in depth may require a rate of .16 GPM/ft2.

Use a 3x6 foam at 3%.

NFPA requires a minimum application time of 15 min. for spill fires. For a spill with no fire, the only requirement is to apply the correct foam at the correct percentage.

Figure 1-36:

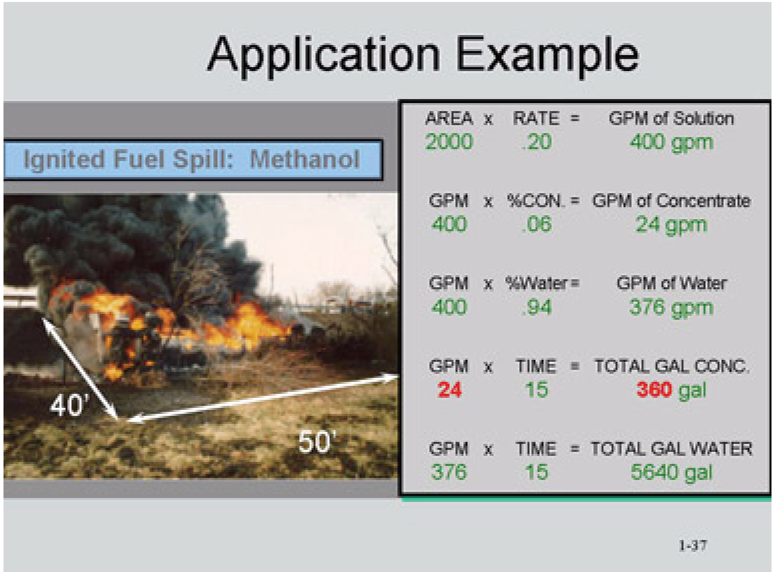


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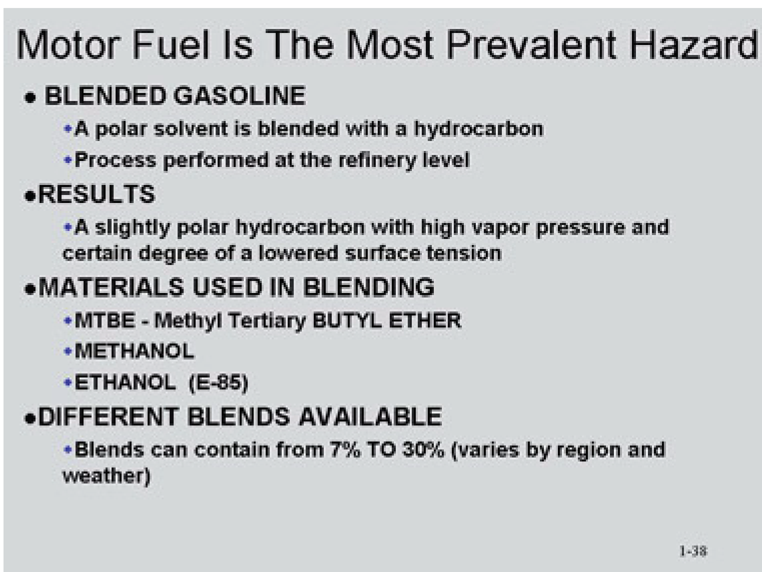
Figure 1-37:



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Topic K. MTBE Tests

Figure 1-38:

Results Of Some MTBE Tests

- MTBE Blended fuels burn hotter than regular gasoline
- They have an increased vapor pressure (Gasoline 8 psi -- Blends 10-12 psi)
- The longer the preburn, the more difficult the extinguishment
- Foam blanket quality is critical to extinguishment and post fire security
- Reduced surface tension inhibits effective film formation typically expected from AFFF's
- Low levels of polar attractiveness do not activate polymeric precipitation from within AR-AFFF's

1-39

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Topic L. Nozzles and Foam Generation

Figure 1-39:

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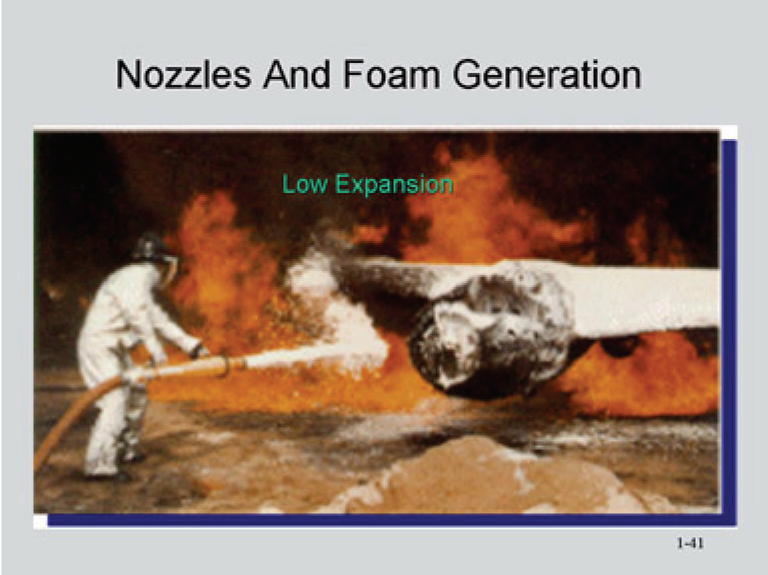
Air aspirated nozzle are required by N.F.P.A. for fuel fires.

Figure 1-40:



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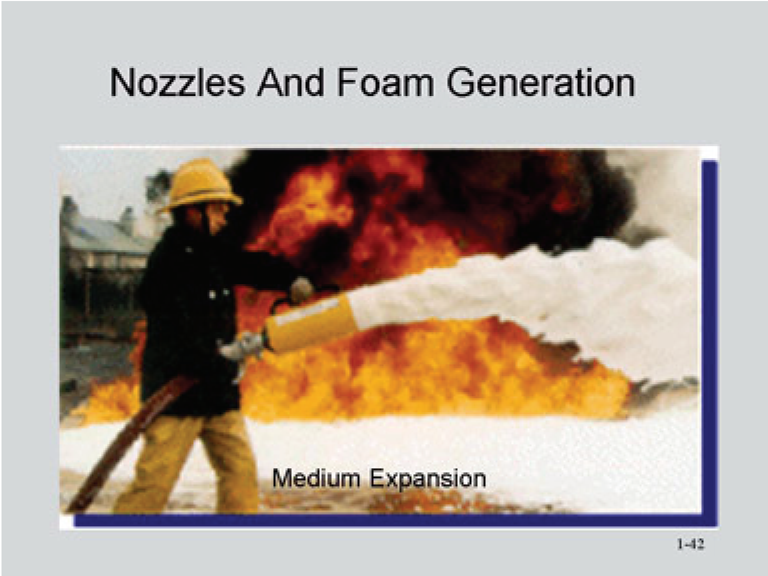
The advantage? Aspirated foam makes a thicker blanket that will smother the fuel vapors faster/longer.

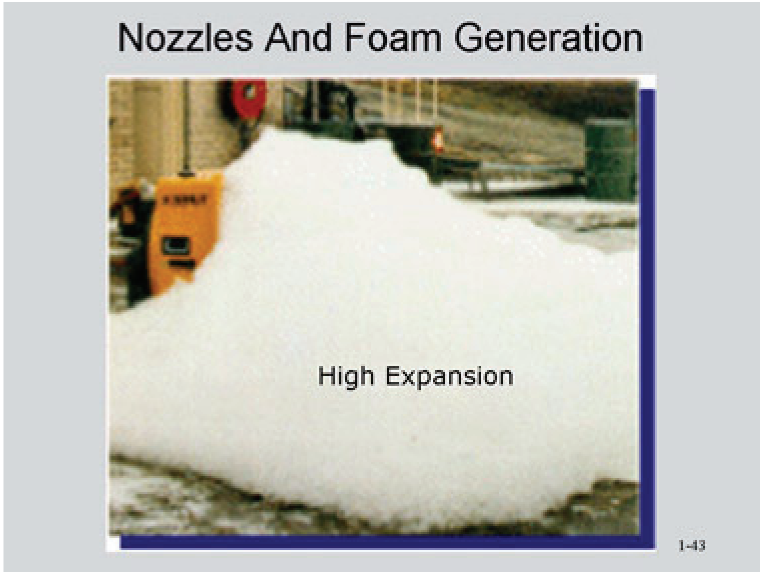
Figure 1-41:



42

The disadvantage? Lack of reach makes it difficult to actually get the foam on the fuel and it requires you to be closer to the fire.

Figure 1-42:



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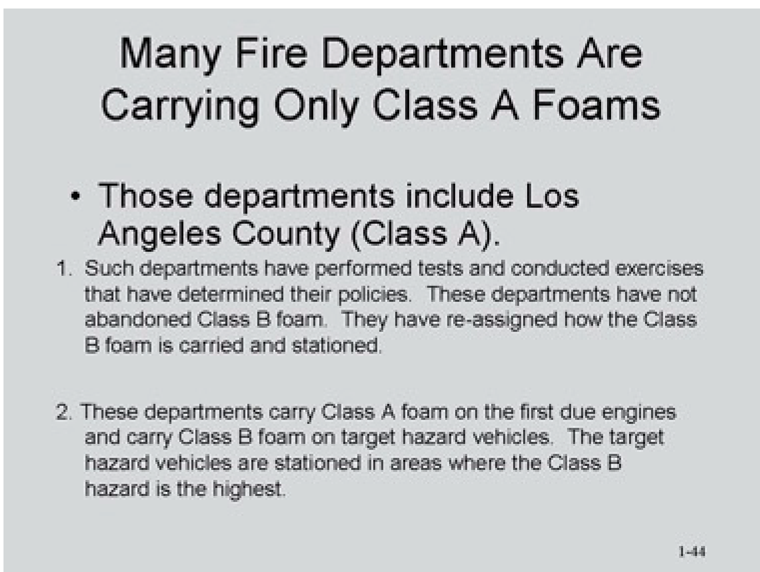
Large fuel spills/warehouses/airport hangers.

Figure 1-43:



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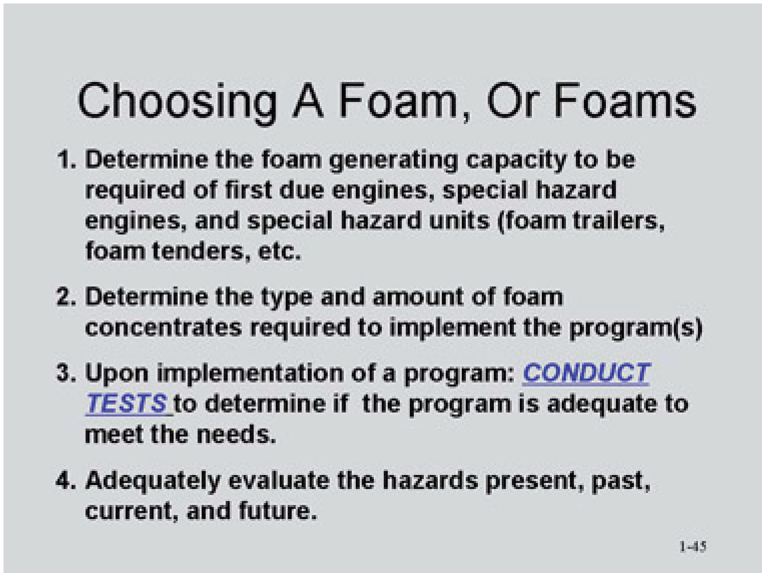
Since first due engines respond to buildings and MVAs more than anything else, L.A. County has standardized on Class A foam on all engines.

Topic M. Choosing a Foam, or Foams

Figure 1-44:



45

Don’t just look at your current needs… look at what you may be up against in 15-20 years.

Figure 1-45:

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Table 1-2: Class A Foam

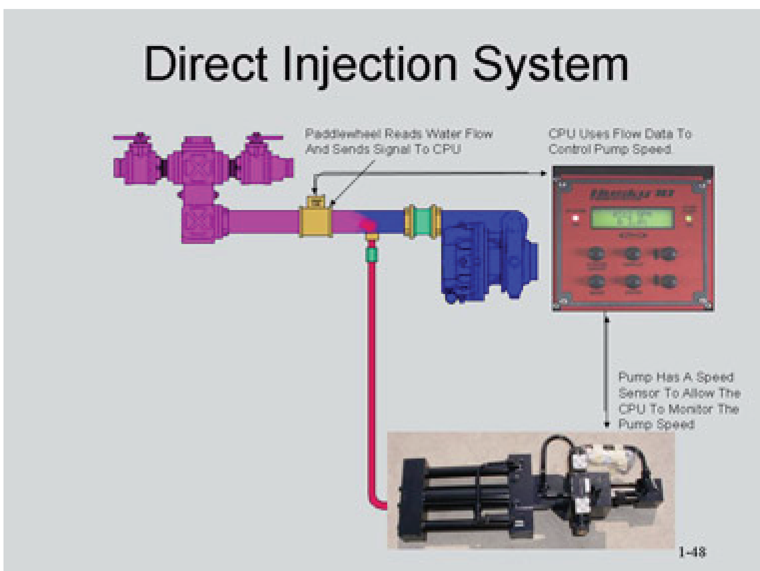
	To fill a 25 gallon foam cell	Cost per 1000 gallons of foam solution
Cheaper Class A @ $12/gallon @0.5%	$300	$60/1000
Good Class A @$15/gallon @0.3%	$375	$50/1000

Table 1-3: Class B Foam

To fill a 50 gallon foam cell:	Hydrocarbon example:	Polar Solvent example:
3x6 @ $20/gal = $1000	solution per 1000 gallons= $600	solution per 1000 gallons= $1200
3x3 @ $25/gal = $1250	solution per 1000 gallons= $750	solution per 1000 gallons= $750
1x3 @ $30/gal = $1500	solution per 1000 gallons= $300	solution per 1000 gallons= $900

Topic N. Direct Injection System

Figure 1-46:



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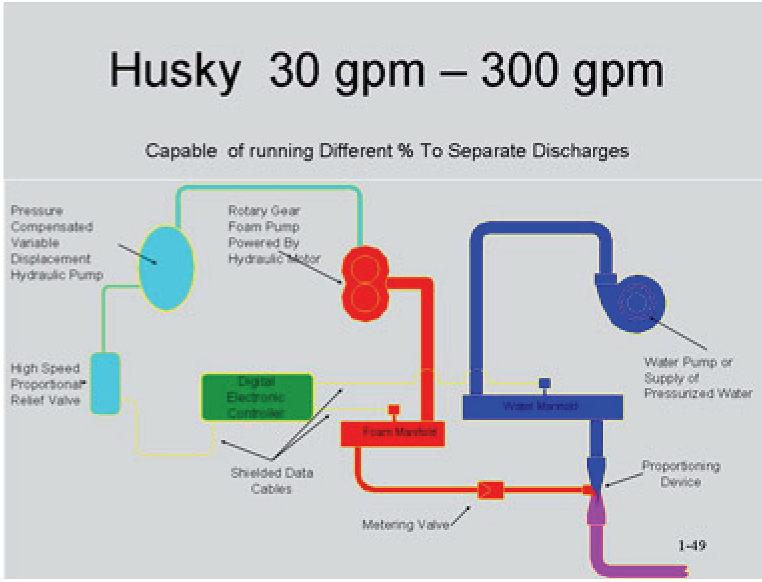
Direct injection foam proportioners use flow meters to monitor water flow in one or more passageways. The signal from the flow meter(s) is sent to a controller that uses the signal to set the speed of a foam concentrate pump. The pump speed is proportional to the foam percentage setting and the water flow in the passageway(s). The foam is pumped into a central injection point for distribution by manifold.

The foam pump is either electrically driven or hydraulically driven.

Figure 1-47:



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Balance Pressure, non-recirculating:

These systems pump the foam concentrate into the water stream. They use a positive displacement foam pump, usually a gear pump.

In addition these systems use a hydraulic system to drive the foam concentrate pump. The hydraulic system has the ability, through the use of a special controller to change the speed of the foam concentrate pump as the demand for foam changes while maintaining a constant foam concentrate pressure.

The foam pump pumps foam concentrate, at different capacities dependent on concentrate demand, during the time the system is engaged. These systems do not return any foam concentrate to the tank, or circulate any foam concentrate.

The foam concentrate is introduced to the water stream by way of venturis. Because the foam concentrate is pressurized to a level that is the same as the water pressure the venturis have a much wider operating range than do eductors and impart much lower pressure drops into the discharge piping. Each discharge that is foam capable has its own venturi and metering valve.

These systems do not cause the foam concentrate to heat or foam due to their lack of a return flow to the tank or pump suction.

Figure 1-48:

50

Water only @ 15gpm, first 2 minutes only results in pushing smoke from room to room.
Water foam solution @ 15gpm, knockdown in 10-12 seconds.

Symbols

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D

F

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M

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W