Continuing Education for the Fire Fighter

Copyright: IFSTA, Essentials of Fire Fighting and Fire Department Operations, 6th Edition

Fire Streams

Module 2

Chapter 16

Copyright: IFSTA, Essentials of Fire Fighting and Fire Department Operations, 6th Edition

LEARNING OBJECTIVES

Describe the methods by which fire fighting foam prevents or controls a hazard.

Identify foam concentrates.

Explain the factors that impact foam expansion and selection.

LEARNING OBJECTIVES

Describe methods by which foam may be proportioned.

Explain the advantages and disadvantages of various foam proportioners, delivery devices, and generating systems.

Identify causes of poor foam production.

Distinguish among various foam application techniques.

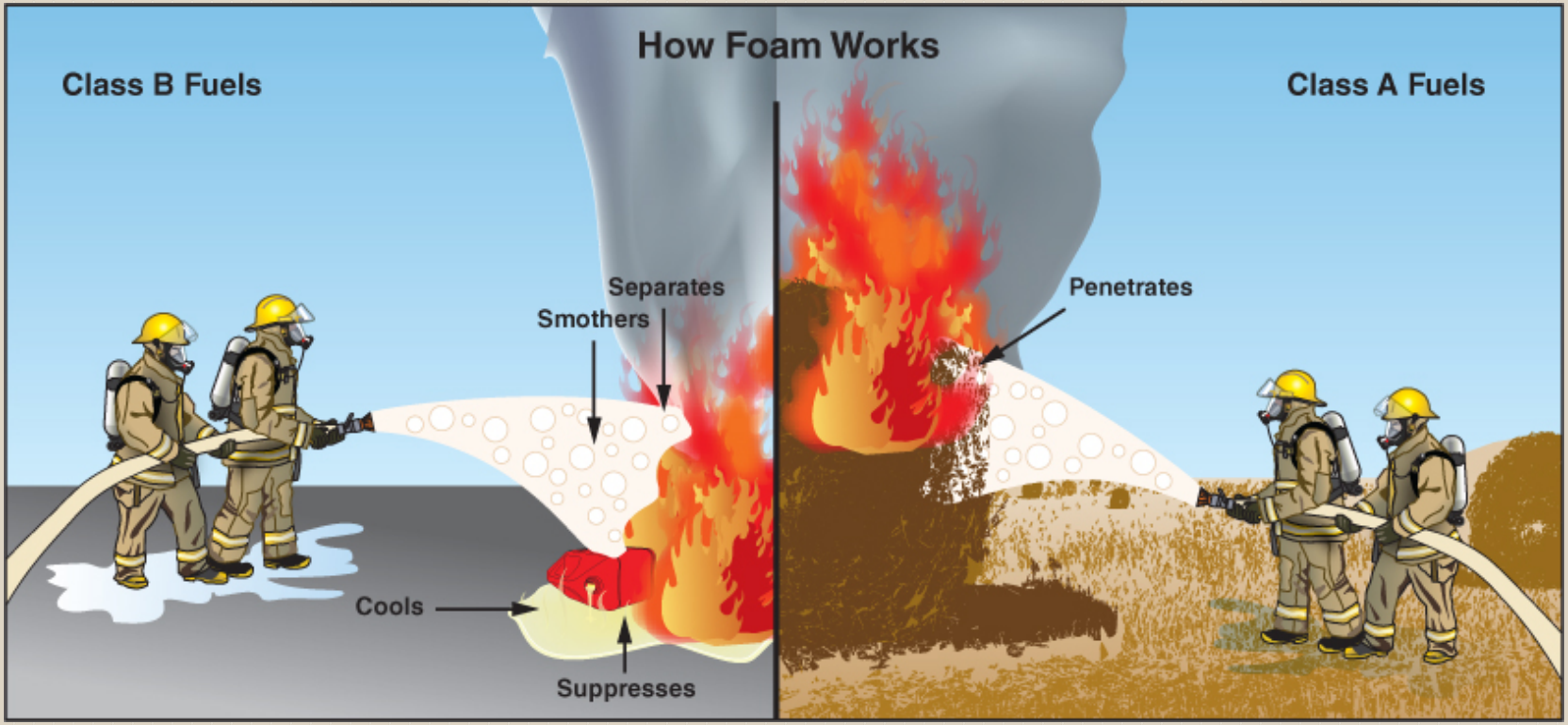
LEARNING OBJECTIVES

Identify foam hazards and ways to control them.

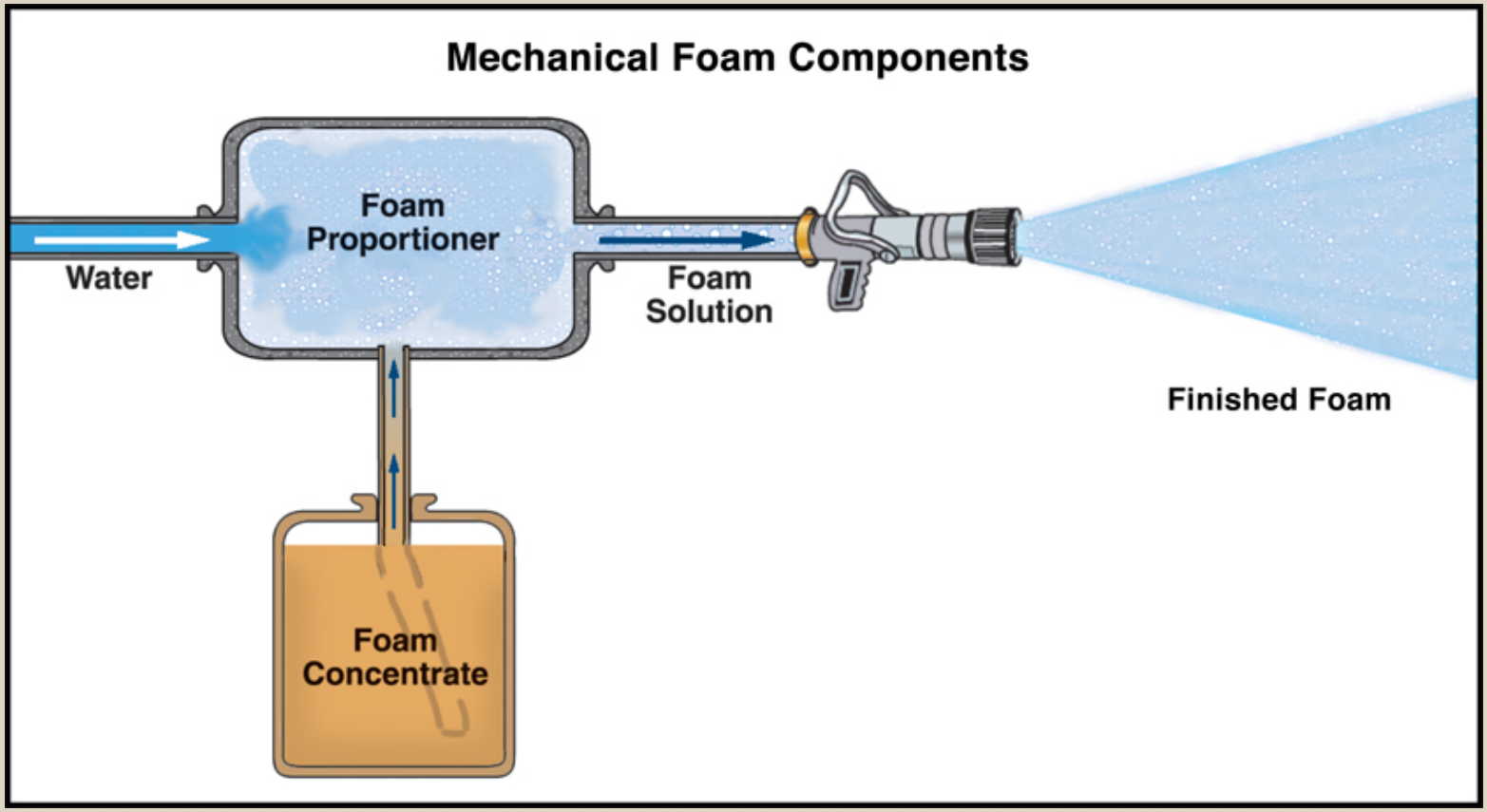
Place a foam line in service using an in-line eductor.

Extinguish an ignitable liquid fire.

FIRE FIGHTING FOAM WORKS BY FORMING A BLANKET ON THE SURFACE OF BURNING FUELS.



FOAM IS GENERATED BY MIXING FOAM CONCENTRATE AND WATER IN CORRECT RATIOS.



FOAM EXPANSION IS A KEY CHARACTERISTIC WHEN CHOOSING APPLICATIONS FOR FOAM.

Increase in volume when aerated

Depends on

- Type of concentrate used
- Accurate proportioning
- Quality of concentrate
- Method of aeration

THERE ARE THREE CLASSIFICATIONS OF FOAM BASED ON EXPANSION RATES.

Classification	Rate
Low Expansion	Less than 20:1
Mid-Expansion	Between 20:1 and 200:1
High Expansion	Greater than 200:1

FOAM CONCENTRATES MUST MATCH THE FUEL TO WHICH THEY ARE APPLIED TO BE EFFECTIVE.

Class A not designed for Class B

Class B designed for hydrocarbon will not extinguish polar solvents

Foam for polar solvents may be used on hydrocarbon ONLY if manufacturer states

Incompatibility factor makes selection important

CAUTION

Failing to match the proper foam concentrate to the burning fuel will result in an unsuccessful extinguishing attempt and could endanger firefighters. Likewise, mixing different types of foam together can result in substandard quality foam.

CLASS A FOAM CONCENTRATES ARE SPECIFICALLY DESIGNED FOR CLASS A FUELS.

Courtesy of Bob Esposito

CLASS B FOAM CONCENTRATES HAVE SEVERAL USES BASED ON CLASS B FUELS.

Uses – Involving flammable/ combustible liquids	• Prevent ignition or extinguish fires • Suppress vapors from unignited spills
Types of fuels effective on	• Hydrocarbon fuels • Polar solvents
Several types of concentrates	• Advantages • Disadvantages

CLASS B FOAM CONCENTRATES ARE MANUFACTURED FROM EITHER A SYNTHETIC OR PROTEIN BASE, SOME MAY BE A COMBINATION.

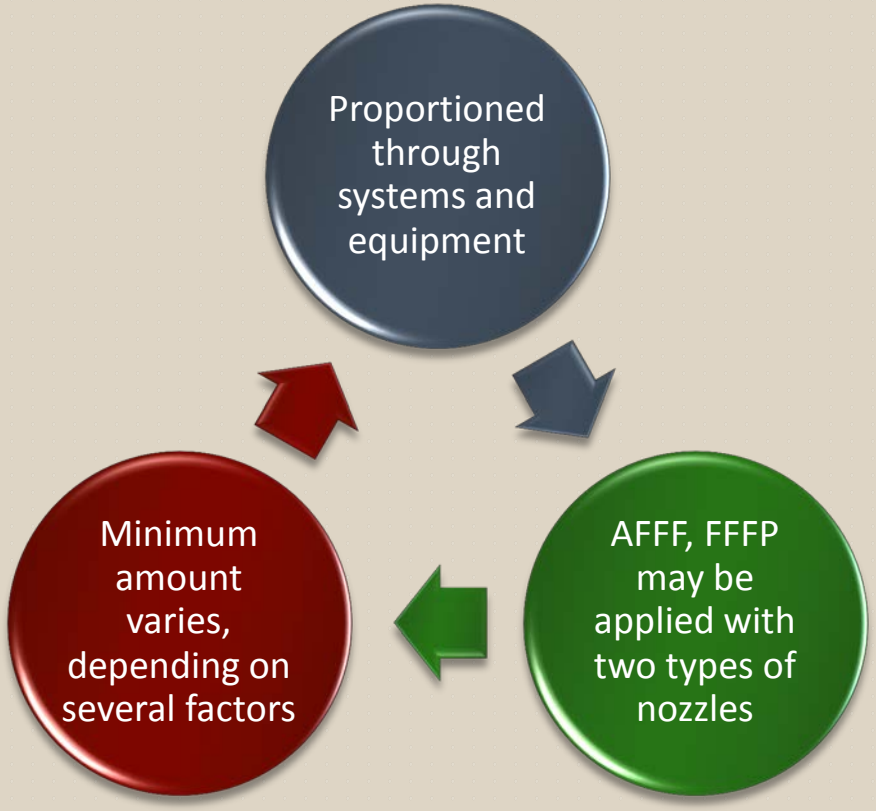
Effective because they float on fuels

Courtesy of James Mack/Richmond International Airport

Alcohol-resistant foams

- Developed for polar solvents
- Required for ethanol or ethanol-based fuels

PROPORTIONING AND APPLICATION ARE INFLUENCED BY SEVERAL FACTORS.



APPLICATION OF FOAM ALSO REQUIRES UNDERSTANDING OTHER CONCEPTS.

Unignited spills
- May create vapor hazards
- Apply foam blanket to suppress
- Depth depends on type, recommendations

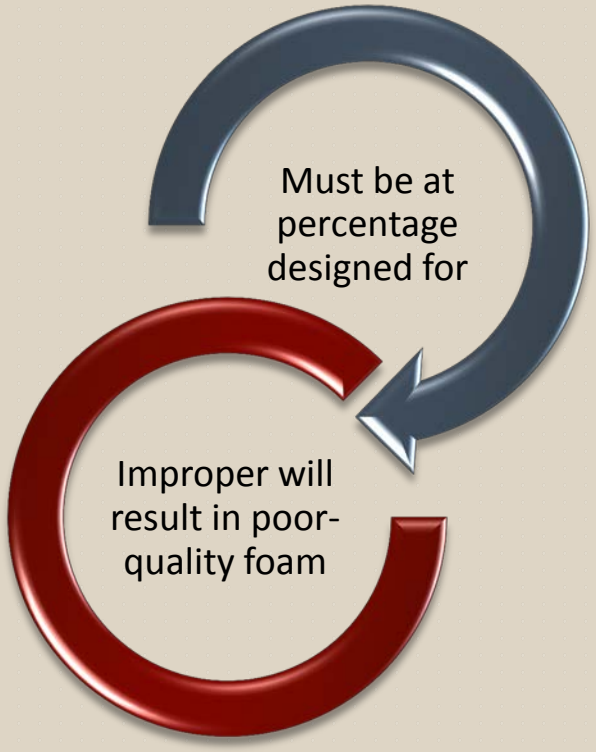
Supplies should be on fireground before beginning application
- Once begun, continue until extinguishment
- Starting, stopping can allow fire to consume blanket

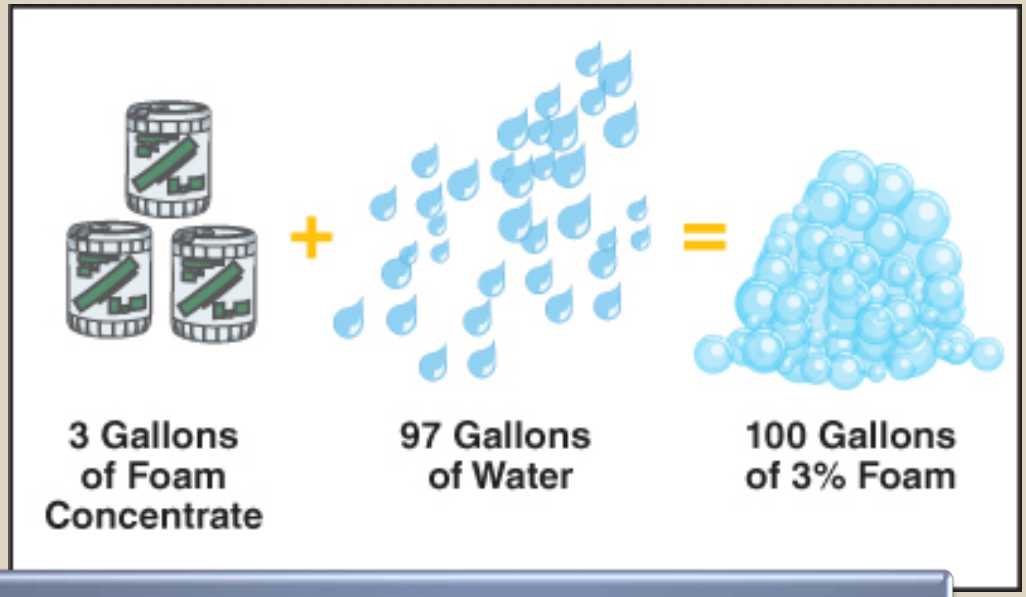
Know application rate for each type of polar solvent
- Vary with type of concentrate, manufacturer
- Manufacturer's provide application rates

SPECIFIC APPLICATION FOAMS ARE ALSO USED FOR SUPPRESSION.

Based on properties, performance	Used for	Designed for use only on unignited spills of hazardous liquids
• Thick, viscous form tough, heat-resistant blankets • Thinner spread more rapidly • Some produce vapor-sealing film • Medium-, high-expansion used in large volumes	• Acid spills • Pesticide fires • Confined- or enclosed-space fires • Deep-seated Class A fires	• These materials tend to change pH or remove water from foams • May render regular foams ineffective

FOAM PROPORTIONING IS THE MIXING OF WATER WITH FOAM CONCENTRATE.





Most intended to mix with 94 to 99.9% water

PROPORTIONING PERCENTAGES DEPEND ON SEVERAL FACTORS.

Class A

- Can be adjusted within limits
  - Dry (thick) foam – Higher percentage
  - Wet (thin) foam – Lower percentage
- Most mixed in proportions of 1 percent or less

PROPORTIONING PERCENTAGES DEPEND ON SEVERAL FACTORS.

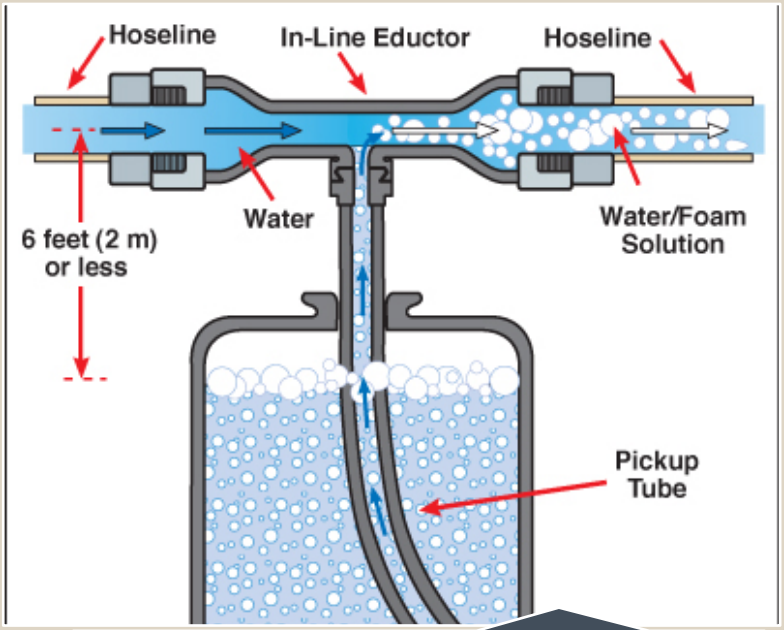
Class B

- Mixed in proportions from 1 to 6 percent
- May be multipurpose
  - Hydrocarbons – 3 percent rate
  - Polar solvents – 6 percent rate
- Always follow manufacturer's recommendations

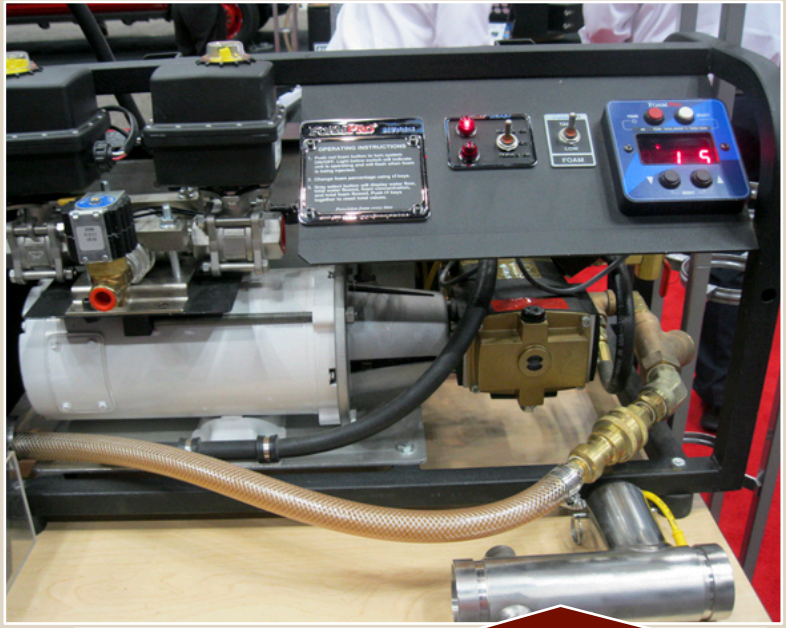
THE PROPORTIONING EQUIPMENT REQUIRED TO PRODUCE FOAM VARIES.

May be designed for	Selection based on	Equipment designed to work together – If not compatible
• Mobile apparatus • Fixed fire protection system	• Foam flow requirements • Available water pressure • Cost of foam • Intended use for foam • Foam agent to be used	• Unsatisfactory foam • No foam

THERE ARE SEVERAL METHODS THAT CAN BE USED TO PROPORTION FOAM.



Eduction (Induction)



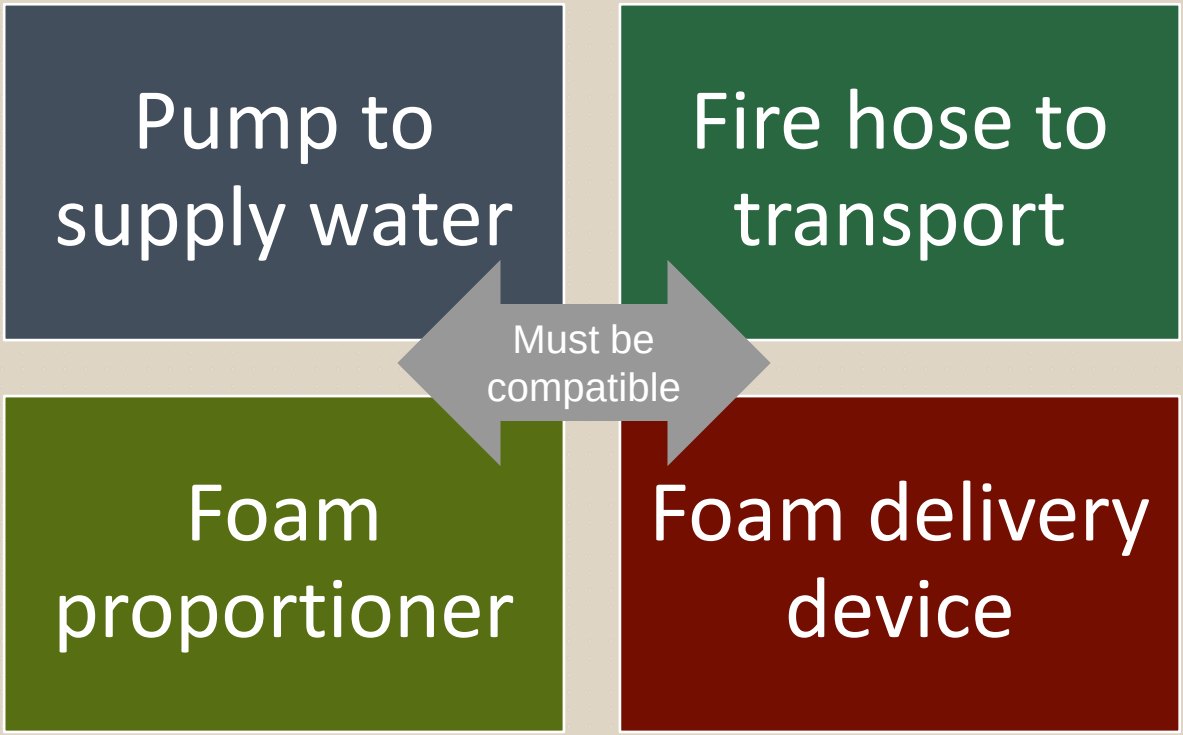
Injection

THERE ARE SEVERAL METHODS THAT CAN BE USED TO PROPORTION FOAM.

Batch-mixing

Premixing

SEVERAL PIECES OF EQUIPMENT ARE REQUIRED TO PRODUCE A FOAM FIRE STREAM.



AN EFFECTIVE FOAM STREAM RESULTS FROM TWO PROCESSES WORKING TOGETHER.

Foam proportioning

- Foam concentrate
- Water
- To form solution

Foam-generating system/nozzle

- Air
- Foam solution
- To produce finished foam

THERE ARE SEVERAL TYPES OF FOAM PROPORTIONERS USED IN THE FIRE SERVICE.

Portable

Foam nozzle eductors

In-line foam eductors

THERE ARE SEVERAL TYPES OF FOAM PROPORTIONERS USED IN THE FIRE SERVICE.

Apparatus-mounted

THERE ARE SEVERAL TYPES OF FOAM PROPORTIONERS USED IN THE FIRE SERVICE.

Compressed air foam systems (CAFS)

FOAM DELIVERY DEVICES, DESIGNED TO DISCHARGE FOAM, COME IN MANY TYPES.

Handline nozzles

Smooth bore

Fog

Air-aspirating

Specialized application

Courtesy of Shad Cooper, Wyoming State Fire Marshal's Office

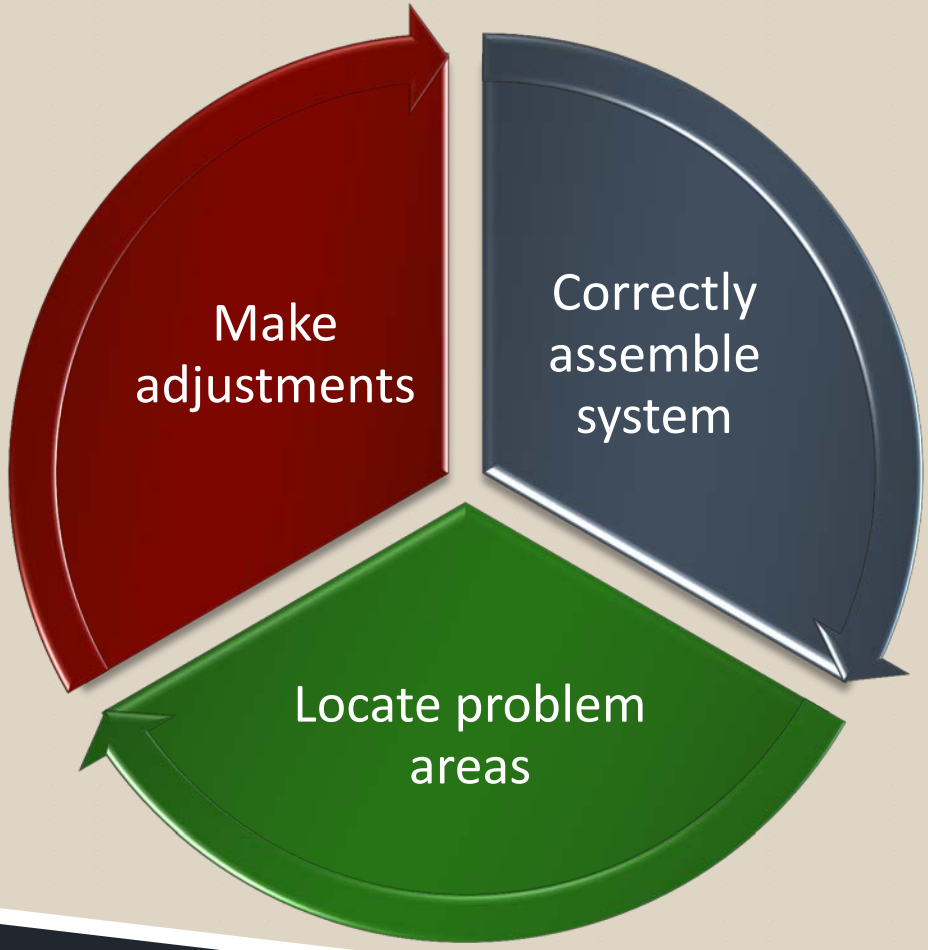
FOAM DELIVERY DEVICES, DESIGNED TO DISCHARGE FOAM, COME IN MANY TYPES.

Medium- and high-expansion foam generating devices

Water-aspirating type nozzle

Mechanical blower generator

ASSEMBLING A FOAM FIRE STREAM SYSTEM REQUIRES UNDERSTANDING SEVERAL CONCEPTS.

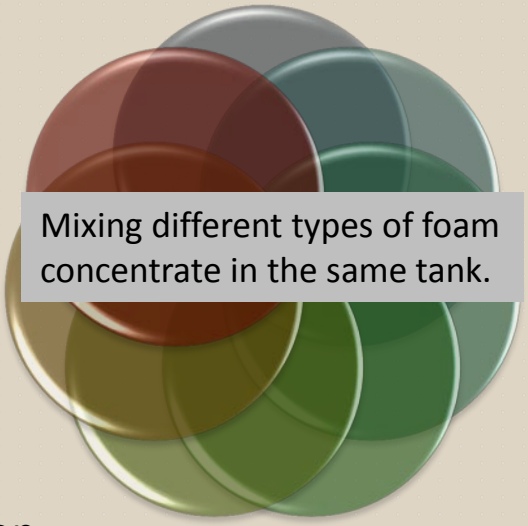


THERE ARE SOME COMMON REASONS FOR FOAM FAILURE YOU SHOULD RECOGNIZE.

Eductor, nozzle flow ratings do not match

Nozzle too far above eductor

Air leaks at fittings



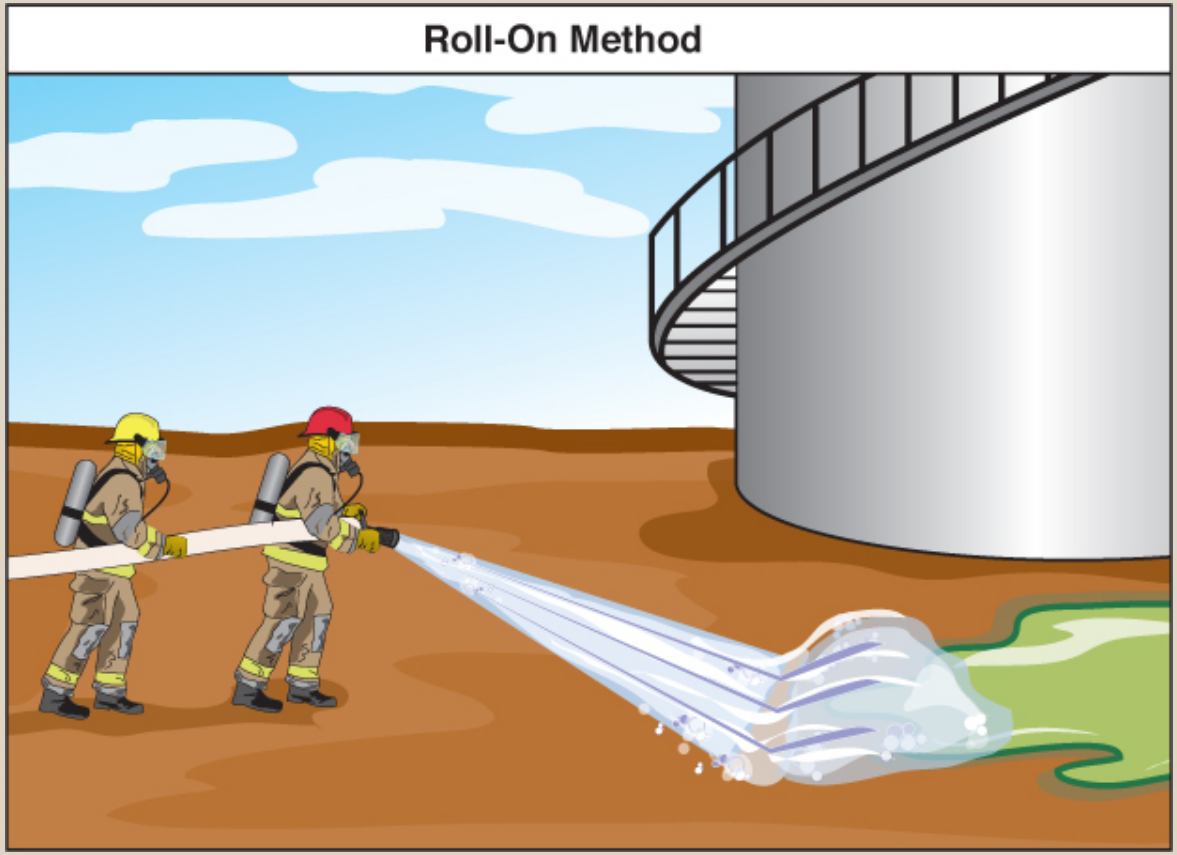
Hose kinked

Improper cleaning causing clogs

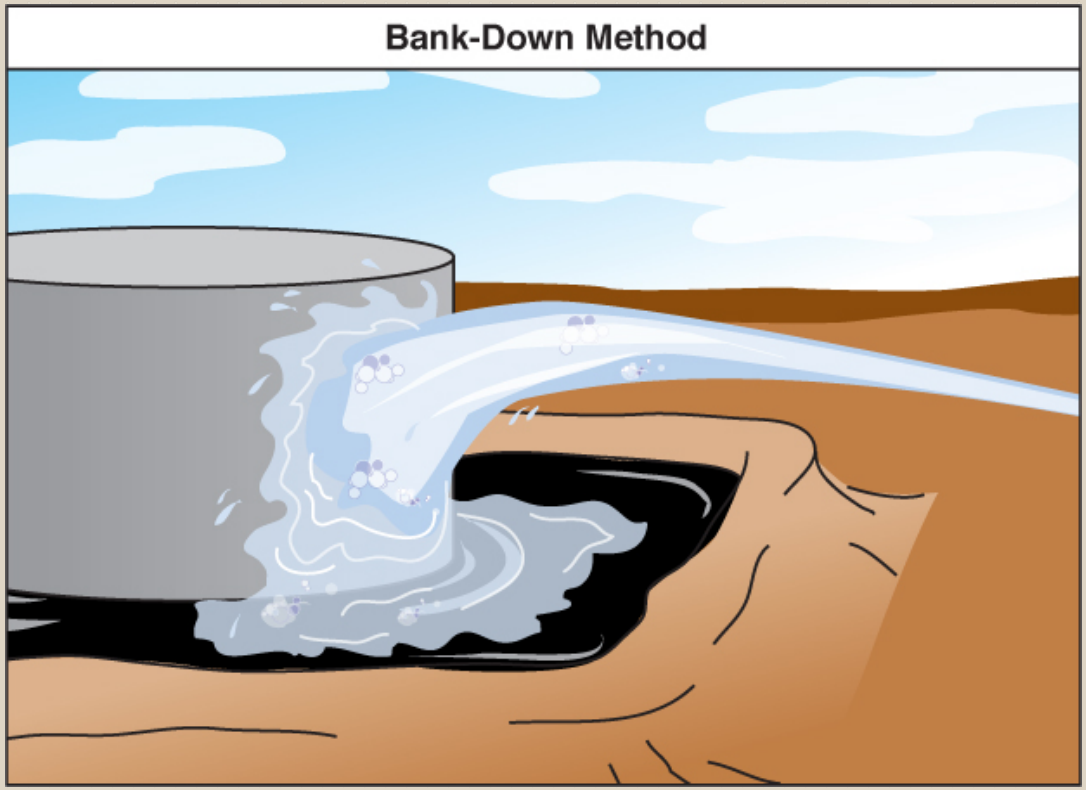
Hose lay on discharge side of eductor too long

Nozzle not fully open

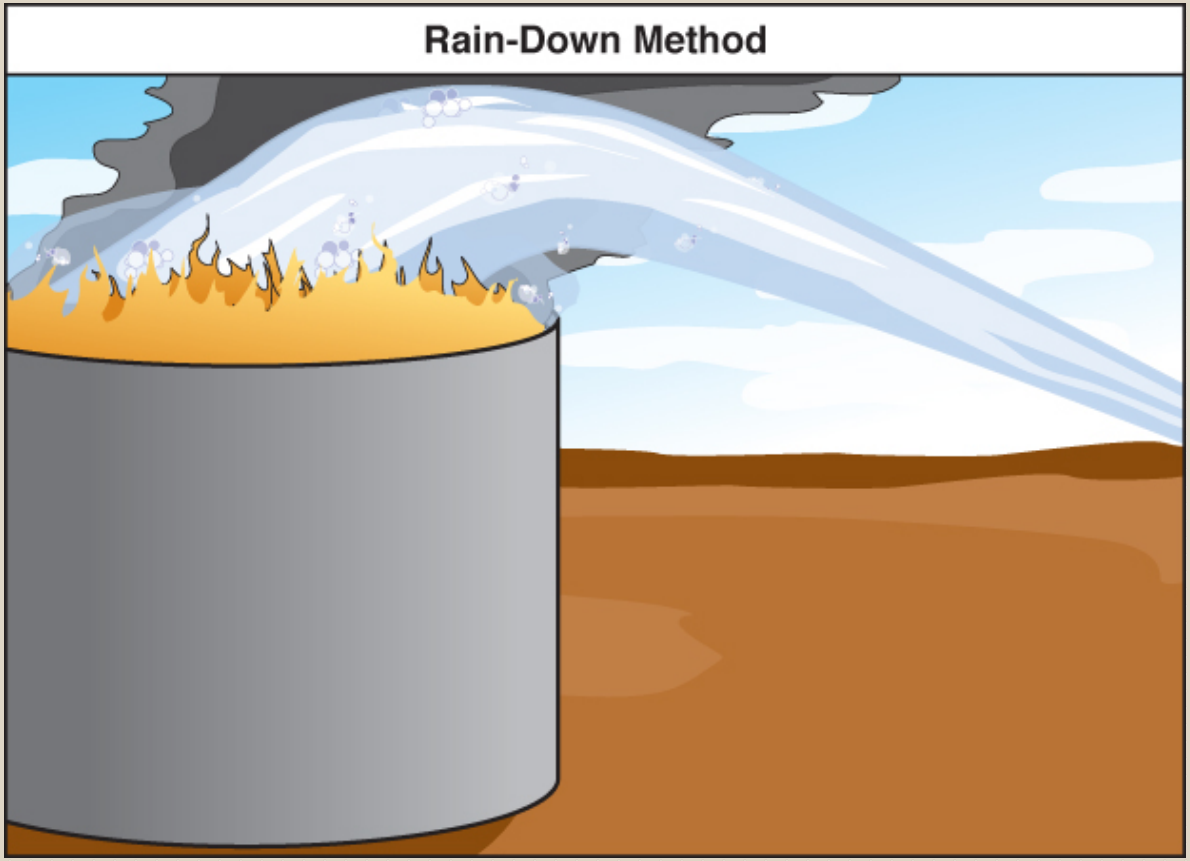
FOAM REQUIRES PROPER APPLICATION TECHNIQUES TO BE EFFECTIVE.



FOAM REQUIRES PROPER APPLICATION TECHNIQUES TO BE EFFECTIVE.



FOAM REQUIRES PROPER APPLICATION TECHNIQUES TO BE EFFECTIVE.



THERE ARE SEVERAL HAZARDS ASSOCIATED WITH FOAM THAT YOU SHOULD UNDERSTAND.

Foam concentrates	Most Class A and Class B foams
• Minimal health risks – Either full strength or diluted • Mildly irritating to skin, eyes • Concentrates, vapors harmful if ingested or inhaled • Consult SDS for information	• Mildly corrosive • Follow proper flushing procedures • Must be thoroughly flushed, washed to remove residue

THERE ARE SEVERAL HAZARDS ASSOCIATED WITH FOAM THAT YOU SHOULD UNDERSTAND.

Effect after applied to liquid fuel fire, spill

- Primarily environmental concern
- Biodegradability determined at rate of decomposition
- Prevent from entering bodies of water
- Less oxygen required to degrade – More environmentally friendly

Environmental effect of concentrate varies

- Manufacturer provides specific information
- In U.S. – Class A approved for environmental suitability
- Class B properties vary
- Protein-based generally safer
- Consult data sheets for specifics

SUMMARY

Firefighters must know the differences between the types of foam used by their departments.

They must know how to generate foam.

They must know how to apply foam most effectively.