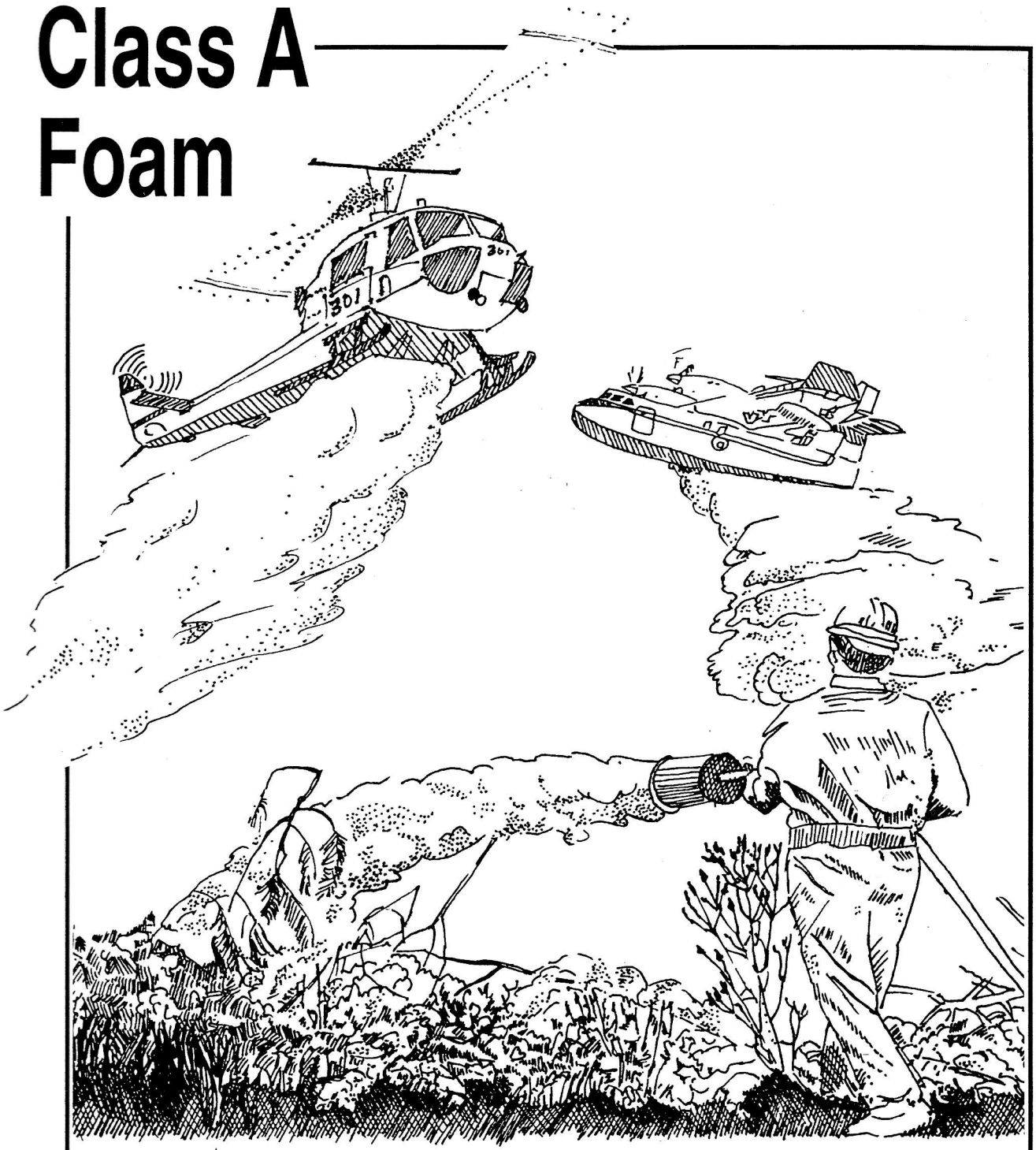
Class A Foam



Instructor's Guide

November 1995

NFES 1301

DETAILED INSTRUCTOR'S GUIDE

COURSE: Class A Foam

UNIT: 0 - Introduction Unit

OBJECTIVES: At the completion of this unit, the students will have been introduced to the:

- Instructors/fellow students
- Course objectives
- Expectations of Cadre and Students
- Course Material
- Agenda

SUGGESTED TIME: 30 minutes

TRAINING AIDS NEEDED: Flip chart; slide and overhead projectors; handout

OUTLINE	KEY POINTS & AID CUES
I. INTRODUCTION	
A. Welcome	
B. Introduce instructors and students -- use any method desired	
C. Present Course Purpose: To provide the student with the skills necessary to use Class A foam on fires in wildland fuels in a safe and efficient manner.	00-01-FOAM-SL Pg 1 NTG
D. Present the Course Objectives.	00-02-FOAM-SL 00-03-FOAM-SL 00-04-FOAM-SL Pg 2 NTG
Upon completion of the course the student will:	
1. Explain the effects of water and foam on fire.	

OUTLINE	KEY POINTS & AID CUES
2. Describe safe handling procedures and environmental considerations when using Class A foam.	
3. Describe some of the equipment that is needed to produce a foam solution.	
4. Describe an aspirating foam system and give two advantages and two disadvant-ages of the system.	
5. Define a compressed air foam system and provide two advantages and two disadvantages of that system.	
6. Explain when, where, and how to use Class A Foam.	
7. Describe some types of aircraft that deliver foam to fires.	
II. EXPECTATIONS	
A. Student Expectations Exercise	
In groups of three to five, have students list their expectations for the course on a flip chart.	5 to 10 minutes
Have each group report their list to the class. Post lists so they can be reviewed periodically.	10 minutes

OUTLINE	KEY POINTS & AID CUES
B. Instructor Expectations 1. Students have read the reference text. Pre-course worksheets should be collected at this time. Explain when the worksheets will be returned to the students. 2. Attendance at all sessions. 3. Be ready to start on time. 4. Participate and share ideas and experiences.	
III. ADMINISTRATIVE INFORMATION A. Facility 1. Restrooms 2. Smoking/non-smoking areas 3. Eating establishments B. Breaks C. Phone Messages	
IV. REVIEW COURSE MATERIALS Review the contents of the three-ring binder.	Three-ring binder with handouts.

OUTLINE	KEY POINTS & AID CUES
A. Agenda. (Have copies prepared ahead from page 6). Review course timeframes, lesson plan lengths, breaks, quizzes, and evaluations. Emphasize punctuality, both for start of class each morning and for return from breaks.	
B. Unit and Course Evaluation. (Have copies prepared ahead from Appendix M.) Discuss importance of form for future training.	
C. Foam vs. Fire. Explain the course flow parallels that of the pre-reading document. Students may want to follow along and keep it with their binder.	
D. Note Taking Guide. This contains course and unit objectives and all diagrams and figures presented. Recommend students follow the lecture with this document.	00-01-FOAM-HO
E. Material Safety Data Sheets. For Unit 2, Personal Safety and Environmental Concerns.	
F. Foam Concentrate to Add Chart. For Unit 3, Proportioners.	
G. In-Line CAFS Instructions. For Unit 5, Compressed Air Foam Systems.	
H. Any other material included in the binder at the discretion of the cadre.	

DETAILED INSTRUCTOR'S GUIDE

COURSE: Class A Foam

UNIT: 1 - Water, Wetting Agents, and Foaming Agents

OBJECTIVES: At the completion of this unit, the students will be able to:

1. Describe the extinguishing properties of water.
2. Define foam.
3. Describe the four types of foam.
4. Explain expansion ratio and draintime.
5. List four reasons why foam makes water more effective.

SUGGESTED TIME: 2.0 hours

TRAINING AIDS NEEDED: Flip chart; video player; slide and overhead projector; videos, "Introduction to Class A Foam", "Class A Foam Video Database", "Properties of Foam"; and Note Taking Guide (NTG).

OUTLINE	KEY POINTS & AID CUES
I. PRESENT UNIT OBJECTIVES **SHOW THE VIDEO "INTRODUCTION TO CLASS A FOAM" AS AN OVERVIEW TO THE COURSE. ANSWER GENERAL QUESTIONS IF APPROPRIATE BUT DEFER SPECIFIC QUESTIONS TO RELATED UNITS.** This unit covers pages 1-5 and 23-24 in "Foam vs. Fire".	01-01-FOAM-SL 01-02-FOAM-SL Pg 3 NTG 01-01-FOAM-VT

OUTLINE	KEY POINTS & AID CUES
II. WATER AS AN EXTINGUISHING AGENT	01-03-FOAM-SL
A. Managing and often extinguishing fire is why we are here. Fires need to be extinguished. (Slide is of flames to aid visualizing the process of ignition and combustion.)	01-04-FOAM-SL
B. Fire Models, explain what they describe.	Pg 4 NTG Pg 4 "Foam vs. Fire"
1. Fire Triangle - Models Smoldering Combustion.	
2. Fire Tetrahedron - Models Flaming Combustion.	
3. These models describe the conditions necessary to support glowing or flaming combustion. Remove one or more conditions or break one or more sides of the model, and fire will cease to exist.	
4. Flame - Fuel Interface. The "target" location for extinguishment is the vapor released by the fuel. The vapor is burning, not the fuel itself.	
C. Properties of Water:	Pg 5 NTG
1. Primarily water is used to absorb heat, for cooling and to reduce the heat leg of the fire models. When converted to steam, water can absorb approximately 9,000 BTUs per gallon. This is why we use it. (Slide shows direct attack with water.)	01-05-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
2. Water can reduce the amount of oxygen available by generating steam, but this has limited effectiveness on a freeburning fire.	
3. Water can separate fuels, such as when submerged in water, but how often does this happen on wildland fires?	
D. Advantages and Disadvantages of Water:	Pg 5 NTG
1. Water is plentiful and readily available.	
2. Water is relatively harmless to use.	
3. High surface tension of 72 dynes/cm^2. Important is the magnitude of 72, not the units of measure. Surface tension holds water together, effectively limiting its ability to absorb heat, penetrate or wet fuels, and remain in place.	01-01-FOAM-LB APPENDIX B
4. Water resists bonding to hydrocarbons. Class A fuels such as wood, peat, and rubber tires are made of hydrocarbon molecules.	01-02-FOAM-LB APPENDIX B
5. Check back periodically on the results of 01-01-FOAM-LB and 01-02-FOAM-LB.	
E. The water molecule.	Pg 6 NTG
1. The shape of the molecule affects its arrangement in water.	01-06-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
2. Under the surface, water molecules reach equilibrium, as shown.	01-07-FOAM-SL
3. At the surface, molecules are forced closer together, resulting in the 72 dynes/cm^2 of surface tension and in the results of demonstrations above.	01-08-FOAM-SL
III. SURFACTANTS	01-09-FOAM-SL Pg 7 NTG
A. To improve the wetting, penetrating, spreading, and overall effectiveness of water, we can use a surface active agent or surfactant.	01-10-FOAM-SL
B. The surfactants in Class A foam are synthetic hydrocarbon surfactants. These are petroleum-based, man-made, long-chain molecules that are common in many spreadable, squeezable, expandable products such as margarine, toothpaste, and hair shampoo.	01-11-FOAM-SL
C. The top of the surfactant molecule is: 1. Attracted to carbon. 2. Repelled by water. The bottom of the molecule is: 1. Attracted to water. 2. Repelled by carbon.	

OUTLINE	KEY POINTS & AID CUES
D. Surfactants arrange themselves at the surface of water because the top of the molecule "wants" to be as far away from water as possible, yet the bottom of the molecule readily attaches to water molecules. The only place the surfactant can be "happy" is at the surface of water. When at the surface of water, surfactant molecules physically spread out water molecules on the surface and in doing so, the tension between water molecules is reduced.	01-12-FOAM-SL
E. Surfactants in Class A foam agents reduce the surface tension of water from 72 to 25-30 dynes/cm^2. What is important to realize is that the surface tension is reduced by more than half, significantly altering the form of water.	
F. This large reduction in surface tension allows surfactant-treated water to:	
1. Spread into a thin film. This form of water can be spread over a larger area than the same volume of untreated water.	01-03-FOAM-LB APPENDIX B
2. Become wetter, as a thin film, thus increasing its penetration and absorption capacities. Surfactant-treated water penetrates some fuels 20 times faster than untreated water.	01-04-FOAM-LB APPENDIX B 01-05-FOAM-LB APPENDIX B
3. Form bubbles. Air can be trapped inside the thin films. Bubbles effectively hold water in place for a short time until the bubble collapses. Water can now be placed on tree trunks, in canopies, on structure walls, etc., without immediately falling off. Bubbles also increase the surface-to-mass ratio which improves heat absorption efficiency.	

OUTLINE	KEY POINTS & AID CUES
G. Hydrocarbon surfactants help water cling to carbon-based materials such as wood, ash, leaves, etc. Remember that the top of the surfactant molecule is attracted to carbon. 1. Think of dishwashing. The surfactants in dishsoap are very similar to those in Class A foam. You know that washing dishes with plain water does not get the grease off. Add dishsoap and you have an agent in the water than grabs the grease off the plate, holds on to water, and flows down the drain. 2. This is how Class A foam surfactants act on Class A fuels, promoting clinging to exposures, wetting waxy fuels, reducing smoke emissions, and absorbing heat.	
H. Another type of surfactant is the fluorocarbon surfactant. This molecule is the main component of Class B foams like Aqueous Film-Forming Foam or AFFF. The important difference between fluorocarbon and hydrocarbon surfactants is the additional fluorine which changes the attractions to carbon. One part of the hydrocarbon surfactant is <u>attracted</u> to carbon, but the same part of fluorocarbon surfactant is <u>not</u> attracted to carbon. This property allows AFFF to maintain a vapor-sealing layer on top of flammable liquids. What do you think would happen with a hydrocarbon surfactant from a Class A foam? (More on this in Unit 6, page 59)	01-13-FOAM-SL Pg 8 NTG

OUTLINE	KEY POINTS & AID CUES
I. Surfactants are found in both wetting agents and foaming agents:	Pg 8 NTG
1. <u>WETTING AGENTS</u>	01-14-FOAM-SL
a. Reduce water's surface tension to improve wetting and penetration, <u>but</u> also have de-foaming agent added, so they do not make foam.	
b. Provide rapid cooling of fuel to below its ignition point.	
2. <u>CLASS A FOAMING AGENTS</u>	01-15-FOAM-SL
a. Reduce water's surface tension to improve wetting <u>and</u> are able to make foam.	
b. Provide rapid cooling of fuel to below its ignition point.	
c. Are designed for application to Class A fuels and fires in Class A fuels.	
(Instructor note: The name "Class A" refers to the fuels (wood) on which fire these foams are designed for is burning; it does not refer to the size Class "A" for small fires.)	
d. Make more efficient use of water because in a bubble form, water has a high surface area-to-volume ratio which allows most efficient heat absorption.	

OUTLINE	KEY POINTS & AID CUES
e. Bubbles also hold water in place when wet water would drain away from treated areas.	
IV. FOAM SOLUTION	01-16-FOAM-SL Pg 9 NTG
A. By mixing Class A foam concentrate and water together, you get a foam solution.	01-17-FOAM-SL
1. Mix ratio is a small quantity of foam concentrate added to a larger quantity of water and is expressed as a percent. An example is five-tenths of a percent is 5 gallons of concentrate added to 1000 gallons of water, or 2.5 gallons of concentrate added to 500 gallons of water.	01-18-FOAM-SL Pg 10 NTG
2. Class A foam concentrate-to-water mix ratios are usually in a range from one-tenth of a percent (0.1%) to one percent (1%).	01-19-FOAM-SL
B. The adage "If a little is good, more must be better" does not necessarily apply to mix ratios.	Pg 10 NTG
1. Surface tension is reduced to 25-27 dynes/cm^2 at 0.01%.	
2. Additional concentrate begins to <u>increase</u> surface tension to 28-30 at 0.1% or more.	
3. The value of 0.5% or more is for creating bubbles to hold water in place such as in exposure protection. Some foam generating devices need higher mix ratios to make stable foam bubbles than other devices.	

OUTLINE	KEY POINTS & AID CUES
4. Because surfactants are attracted to carbon compounds; brackish water, hard water, or water with high mineral or organic content will require higher mix ratios to achieve the same results with softer water.	
V. FOAM By introducing air into the foam solution, the end result is foam.	01-20-FOAM-SL Pg 9 NTG 01-21-FOAM-SL
VI. FOAM EXPANSION A. All foams produced have a specific expansion ratio. Expansion ratio is the volume of foam (the bubbles) per volume of foam solution flowed. An example is, "we flowed 1 gallon of solution and we produced 50 gallons of foam": we would say that we have a 50-to-1 expansion ratio. B. Foam is generally grouped into three ranges of expansion. They are: 1. Low Expansion 1/1 to 20/1 2. Medium Expansion 21/1 to 200/1 3. High Expansion 201/1 to 1000/1 C. Generally speaking, change expansion by changing the mix ratio. Higher mix ratios produce higher expansions. With compressed air foam systems, it is possible to adjust air or water flows as well.	Pg 11 NTG 01-22-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
D. Currently approved foam concentrate products vary widely in their ability to make bubbles under the same conditions.	
VII. DRAINTIME	Pg 11 NTG
A. All foams produced have a specific drain rate. This is the amount of solution that the bubbles give up over a period of time, or the ability of the bubbles to wet fuels that they are lying on. Refer to definition in glossary of Foam vs. Fire.	
B. A useful measure of draintime would be something like: "How much of the original foam solution has drained out in 5 minutes?" This would be helpful if you were going to set a backfire against a foamline. Current products may drain between 40% and 90% in 5 minutes.	
C. Change draintime by changing mix ratio (or air and water with CAFS). More concentrate will produce slower draintimes, all else being equal. Slower draintimes are less useful for applications like mop-up and pretreating grasses.	
SHOW THE "DRAINTIME" SEGMENT OF THE VIDEO, "CLASS A FOAM VIDEO DATABASE", AS PART OF A DISCUSSION ON DRAIN RATE. REFER TO APPENDIX K.	01-02-FOAM-VT Tape 2
D. Understanding expansion and draintime will help us determine the right type of foam to use during presuppression and suppression efforts.	

OUTLINE	KEY POINTS & AID CUES
VIII. FOAM TYPE	
A. All foams produced can be divided into four types. They are:	Pgs 23-24 "Foam vs Fire" Pg 12 NTG
1. Foam Solution	
a. Looks and acts just like wet water. When fire stream comes in contact with fuels white frothing occurs. Low mix ratios of 0.1-0.2% are often not aerated.	01-23-FOAM-SL
b. Used for initial attack and mopup and sometimes pre-wetting if there is time to return with a drier foam.	01-24-FOAM-SL
2. Wet Foam	
a. Like watery shaving cream; peaks collapse, immediately runs on vertical surfaces. Small to large bubbles.	01-25-FOAM-SL
b. Used for direct attack, mopup, wetting.	
3. Fluid Foam	
a. Like shaving or whipped cream; holds peaks, does not immediately run on vertical surfaces. Small to medium bubbles.	01-26-FOAM-SL
b. Used for direct attack, exposure protection.	01-27-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
4. Dry Foam	
a. Mostly air, very little moisture in the foam. Holds well to vertical, horizontal and overhead surfaces. Small to medium bubbles.	01-28-FOAM-SL
b. Used for insulation, long exposure times, barriers.	
B. Demonstrate foam types.	01-06-FOAM-LB
IX. FOAM ENHANCEMENTS TO WATER	Pg 13 NTG
A. Foam makes water more effective because:	
1. It more easily absorbs heat than plain water (greater surface-to-mass ratio). Foam is being used to extinguish a log deck fire.	01-29-FOAM-SL
2. It controls the release of water at a rate commensurable to the fuel's ability to absorb it. Slide shows foam applied to timber stand adjacent to cut area prescribed fire.	01-30-FOAM-SL
3. It reduces evaporation. As long as bubbles remain over the coated fuel, moisture will not be lost.	01-31-FOAM-SL
4. The opaque surface reflects heat. Note the "age" of the foam in this slide, much of the foam solution has drained out.	01-32-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
5. It provides heat insulation to the fuels that it is in contact with. Slide shows a dry foam.	01-33-FOAM-SL
6. It adheres to most surfaces. Water by itself does not hang on to fuels the same way.	01-34-FOAM-SL
7. It is highly visible.	01-35-FOAM-SL
SHOW THE VIDEO, "THE PROPERTIES OF FOAM", AND EXPLAIN TO THE STUDENTS THAT THIS VIDEO WILL GIVE THEM AN OVERVIEW AND REINFORCE THE IDEAS IN UNIT 1.	01-03-FOAM-VT
X. REVIEW UNIT OBJECTIVES.	01-36-FOAM-SL 01-37-FOAM-SL
XI. ADMINISTER UNIT 1 QUIZ. ALLOW 30 MINUTES FOR COMPLETION/DISCUSSION.	APPENDIX A

DETAILED INSTRUCTOR'S GUIDE

COURSE: Class A Foam

UNIT: 2 - Personal Safety and Environmental Concerns

OBJECTIVES: At the completion of this unit, the students will be able to:

1. Explain what a Material Safety Data Sheet (MSDS) is.
2. Describe three safety concerns or environmental procedures when handling foam concentrate.

SUGGESTED TIME: 1 hour

TRAINING AIDS NEEDED: Flip chart; slide and overhead projectors; handout; "Foam vs. Fire"; and Note Taking Guide.

OUTLINE	KEY POINTS & AID CUES
I. PRESENT UNIT OBJECTIVES This unit covers pages 5-7 in "Foam vs. Fire."	02-01-FOAM-SL Pg 14 NTG
II. SAFETY A. Class A foam concentrates are similar to common household detergents and shampoos. You can expect cleansing, drying, slipperiness, and other properties similar to soaps you have at home.	Pg 15 NTG

OUTLINE	KEY POINTS & AID CUES
Safety concerns with foam use include:	
1. Human sensitivity to concentrate and solution on skin and in eyes and mouth.	
2. Degradation of clothing such as leather boots and gloves.	
3. Effects of concentrate spills on the environment.	
4. Effects of foam applications on the environment.	
B. Documents have been developed to require and display information about personal safety and effects on the environment.	02-01-FOAM-HO
1. Material Safety Data Sheets.	
2. User-specific requirements.	
3. Studies.	
4. Field Guides.	
C. Know what Material Safety Data Sheets (MSDS) are and follow the manufacturer's recommendations which appear on them.	Pg 15 NTG
GO TO THE HANDOUT AND SPEND SOME TIME ACTUALLY LOOKING THROUGH ONE OR TWO MSDS's.	
1. All chemicals that are produced have a MSDS about them.	
2. All chemicals that are purchased must be accompanied by an MSDS to provide information.	

OUTLINE	KEY POINTS & AID CUES
3. MSDS' describe: a. Hazardous ingredients. b. Flammable properties. c. Physical characteristics. d. What to do with a spill. e. Any necessary personal protective measures. f. Any special precautions. g. Manufacturer's name and address. h. Reactivity and toxicity of product. i. Emergency first aid procedures.	
D. User-specific Requirements:	Pg 16 NTG
1. International Foam Specification (administered by the U.S. Forest Service) Foam concentrates passing this specification have met requirements for: a. Oral toxicity. b. Skin toxicity. c. Eye irritation. d. Metals corrosion. This means the approved products are reasonably safe to handle, store, and use. It does not mean they are safe to drink or spill.	
2. National Fire Protection Association Standard 298. Foam concentrates meeting this standard will meet requirements similar to the International Foam Specification.	

OUTLINE	KEY POINTS & AID CUES
E. Studies:	Pg 16 NTG
1. "Chemicals Used in Wildland Fire Suppression, a Risk Assessment" 1994. This legally-defensible document is available from the Forest Service for managers to demonstrate the low risk to firefighters, handlers, and the environ-ment from foam concentrates and foams.	
2. All impacts to vegetation and animals are far less than impacts due to fire.	
3. Due to effects of surfactants on ability of fish gills to function, foams in small quantities can have large impact on fish.	
a. About 8 gallons of 1% foam solution per acre-foot of water in a pond or lake is the most that can be applied without any biological effect. That is not very much.	
b. Acceptable exposures in streams and rivers will be higher due to dilution. (Studies on-going)	
F. Field Guides.	Pg 16 NTG
Review with the class the information in "Foam vs. Fire" on appropriate practices for handling and using foam while protecting yourself and the environment. A partial list of these items (below) and any others can then be reviewed:	Pgs 5-7 "Foam vs. Fire"

OUTLINE	KEY POINTS & AID CUES
1. When working with foam or foam concentrates, wear gloves, hard hat, sunscreen, and rubber boots if permitted. Carry hand lotion/skin cream and use as necessary. Wear goggles or safety glasses. Some glasses come with tinted lenses.	02-02-FOAM-SL
2. Label containers, including backpack pumps, which contain foaming agents.	
3. Clean up concentrate spills with absor-bents. Do not rinse.	
4. Avoid application of foam and spillage of foam concentrate into bodies of water. What is going on in this picture? What are the potential impacts of what you see? What prevention techniques are available?	02-03-FOAM-SL 02-04-FOAM-SL
5. A more detailed field guide for foam use in the environment is being developed.	
6. Hand tools with foam on them are slippery and a safety concern.	
7. Avoid concealing walking hazards with foam until access is no longer necessary.	
8. Maintain good housekeeping with concentrates and equipment by rinsing tools and flushing proportioners, nozzles, and anything else that is regularly exposed to solution.	

OUTLINE		KEY POINTS & AID CUES
III.	REVIEW UNIT OBJECTIVES	02-05-FOAM-SL
IV.	ADMINISTER UNIT 2 QUIZ. ALLOW 30 MINUTES.	APPENDIX A

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COURSE: Class A Foam

UNIT: 3 - Proportioning

OBJECTIVES: At the completion of this unit, the students will be able to:

1. List two manual proportioning methods or devices.
2. Describe the advantages and disadvantages of two manual proportioners.
3. Name one automatic proportioning device and describe its advantages and limitations.

SUGGESTED TIME: 2.5 hours

TRAINING AIDS NEEDED: Flip chart; video player; video "Class A Foam Proportioners"; slide projector; handouts; "Foam vs. Fire"; Note Taking Guide.

OUTLINE	KEY POINTS & AID CUES
I. PRESENT UNIT OBJECTIVES This material is described on pages 7-12 in "Foam vs. Fire".	03-01-FOAM-SL Pg 17 NTG
II. PROPORTIONERS There are two types of devices used to mix concentrate and water. A. Manual Proportioners. A manual proportioner requires an adjustment by the operator of the device to maintain constant mix ratio when water flow changes.	03-02-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
B. Automatic Proportioners. An automatic proportioner makes an adjust-ment on its own to maintain a constant mix ratio when water flow changes. C. Refer to Table of Proportioner characteristics page 8 of Foam vs. Fire (for the following discussion). Refer to proportioner descriptions pages 9-11 for discussion of how to operate each unit. More detail can be presented in hands-on demonstration.	
III. MANUAL PROPORTIONERS Manual methods or devices of adding foam concentrate to water are: **INSTRUCTION SHOULD INCLUDE THOSE DEVICES THAT MEET NEEDS OF THE STUDENTS.** A. Batch Mixing 1. Proportional, the first time. After that it is difficult to know exact amount of water and solution in the tank. 2. Labor intensive. 3. Knowledge of mix ratios. 4. Foam solution runs through pump, over time this could wear on seals.	03-03-FOAM-SL 03-04-FOAM-SL Pg 18 NTG 03-01-FOAM-HO

OUTLINE	KEY POINTS & AID CUES
5. It is very easy with no upfront equipment cost.	
6. Accurate at any water flow for a single mix ratio.	
B. Suction-side Proportioner	03-05-FOAM-SL Pg 19 NTG
1. Proportional, but not automatic.	03-02-FOAM-HO
2. Works on suction of side of pump.	
3. Dependent on pump pulling a draft. There has to be suction on the suction-side of the pump. Whether this happens or not depends on the water source, the pump and the output of the pump.	03-06-FOAM-SL
4. Foam solution runs through the pump.	
5. Accurate at a single water flow and single mix ratio.	
C. In-Line Proportioning System (Eductor)	03-07-FOAM-SL Pg 20 NTG
1. Proportional, but not automatic.	03-08-FOAM-SL
2. Situation sensitive.	
3. Works anywhere on the pressure side of the pump.	
4. Must use a nozzle rated for a gallonage equal to the flow of the eductor.	
5. Requires minimum of 200 psi inlet pressure.	

OUTLINE	KEY POINTS & AID CUES
6. Limited to a maximum of 300 feet of hose from the eductor to the nozzle.	
7. Maximum 10 feet elevation from eductor to nozzle.	
8. Discharge pressures reduced at least 30% at the eductor.	
9. Accurate at single water flow and single mix ratio.	
D. By-Pass Eductor	03-09-FOAM-SL Pg 21 NTG
1. Proportional, but not automatic.	03-10-FOAM-SL
2. Situation sensitive.	
3. Works anywhere on the pressure side of the pump.	
4. Limited water flow.	
5. Discharge pressures reduced at least 30%.	
6. Accurate at narrow water flow range for single mix ratio.	
E. Around-the-Pump Proportioning System	03-11-FOAM-SL Pg 22 NTG
1. Proportional, but not automatic.	03-12-FOAM-SL
2. Connects to both the suction and discharge sides of the pump. The pump must pull a draft in order for foam solution to flow in a loop around the pump from pressure-side to suction-side.	

OUTLINE	KEY POINTS & AID CUES
3. Foam solution runs through the pump. 4. Can build up pressure on suction-side of pump when all nozzles are closed. Need a pressure relief valve. 5. Accurate at single water flow and any mix ratio. Will need to monitor mix ratio. F. Manual Direct Injection Proportioning Systems 1. Proportional, but not automatic. 2. Works on pressure side of pump. 3. May provide knowledge of gallons per minute flowing. 4. Stops concentrate injection when water flow stops. 5. Requires additional power supply to operate the proportioner. 6. Shop repairable. 7. Accurate for single water flow at any mix ratio.	03-13-FOAM-SL Pg 23 NTG 03-14-FOAM-SL
IV. AUTOMATIC PROPORTIONERS Automatic devices for adding foam concentrate to water are:	03-15-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
A. Balanced Pressure Bladder Tank Propor-tioning System	03-16-FOAM-SL Pg 24 NTG 03-17-FOAM-SL
1. Proportional and automatic. Describe how it operates.	
2. Works on the discharge side of the pump.	
3. Can be placed anywhere in a hose lay or pump manifold.	
4. Requires only water flow to operate proportioner.	
5. Field or shop repairable.	
6. No restriction to hose length/elevation.	
7. No significant loss in pressure or flow.	
8. Accurate at wide range of water flow for any mix ratio.	
B. Balanced Pressure Pump Proportioning System.	03-18-FOAM-SL Pg 25 NTG 03-19-FOAM-SL
1. Proportional and automatic.	
2. Works on the discharge side of the pump.	
3. Can be placed anywhere in a hose lay or pump manifold.	
4. Requires an additional power supply to operate proportioner.	

OUTLINE	KEY POINTS & AID CUES
5. Shop and manufacturer repairable. 6. Accurate for any mix ratios at flow ranges of 5-125 gpm or 25-250 gpm. C. Automatic Direct Injection Proportioning System 1. Proportional and automatic. 2. Works on the discharge side of the pump. 3. Integral to pumping platform. 4. Requires an additional power supply to operate. 5. Shop and manufacturer repairable. 6. No restriction to hose length/elevation. 7. No loss in pressure or flow. 8. Accurate for any water flow at any mix ratio. **SHOW THE VIDEO, "CLASS A FOAM PROPORTIONERS", AS A REVIEW OF ALL THE INFORMATION PRESENTED IN THIS UNIT. DISCUSS QUESTIONS.**	03-20-FOAM-SL Pg 26 NTG 03-21-FOAM-SL 03-01-FOAM-VT
V. CONDUCT OUTDOOR EXERCISES OF PROPORTIONERS AS OUTLINED IN APPENDIX D.	
VI. REVIEW UNIT OBJECTIVES	03-22-FOAM-SL
VII. ADMINISTER UNIT 3 QUIZ. ALLOW 30 MINUTES	APPENDIX A

DETAILED INSTRUCTOR'S GUIDE

COURSE: Class A Foam

UNIT: 4 - Nozzle Aspirating Foam Systems

OBJECTIVES: At the completion of this unit, the students will be able to:

1. Define a nozzle aspirating foam system.
2. List two types of nozzles used in an aspirating system.

SUGGESTED TIME: 2 hours

TRAINING AIDS NEEDED: Flip chart; video player; video "Aspirating Nozzles"; slide projector; handouts (2); "Foam vs. Fire"; and Note Taking Guide.

OUTLINE	KEY POINTS & AID CUES
I. PRESENT UNIT OBJECTIVES This unit covers material on pages 13-14 of "Foam vs. Fire".	04-01-FOAM-SL Pg 27 NTG
II. FOAM GENERATING SYSTEMS	
A. Nozzle Aspirating Foam Systems. Foam is generated in the nozzle.	04-02-FOAM-SL Pg 14 "Foam vs. Fire"
1. Produce foam by drawing air into the solution stream through a specially designed nozzle. Discuss functions of:	
a. Conventional single pattern nozzle.	04-03-FOAM-SL Pg 28 NTG
b. Multiple-pattern nozzle.	04-04-FOAM-SL Pg 29 NTG

OUTLINE	KEY POINTS & AID CUES
2. Low energy foam (passive) This slide is meant to show the low velocity, low pressure, short discharge of the aspirated nozzle concept. Note also the large air intake at the back of this nozzle. What begins as a narrow jet of foam solution becomes a wide, slow foam discharge. a. Uses only the energy supplied by the water pump to project the water stream. b. Discharge distance of the foam stream is less than plain water.	04-05-FOAM-SL
3. Foam expansion, draintime, and type can be changed by changing the amount of concentrate added to the water and by changing nozzle pressure.	
4. Mix ratio for aspirated foam solution is generally from 0.5% to 1.0%.	
5. Can be used with any type of pump. a. Backpack pump. b. Portable pump. c. Tracked vehicle integral pump. d. 200 gallon engine with BB4 pump. Nozzle is on the hose reel.	 04-06-FOAM-SL 04-07-FOAM-SL 04-08-FOAM-SL 04-09-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
6. Use low, medium, and high expansion nozzles according to task at hand. Consider several different nozzles to be part of your "tool box" of foam equipment.	
a. Low expansion nozzles generally have expansion ratios of 10:1 or less, and are used for direct attack, mop-up, line construction, and exposure protection.	04-10-FOAM-SL
b. Medium expansion nozzles generally have expansion ratios of 75:1 and are used for line construction, mopup, and exposure protection.	04-11-FOAM-SL
c. High expansion nozzles are useful in certain conditions or fuel types for line construction and ground fuel protection.	04-12-FOAM-SL 04-13-FOAM-SL
d. Aspirating nozzles can either be homemade or commercially built. Discuss how to make an aspirating nozzle.	04-14-FOAM-SL 04-01-FOAM-HO 04-02-FOAM-HO
7. Nozzle Pressure. Low expansion - generally 100-150 psi. Depends on the nozzle. Relatively high pressure to make bubbles in a short, narrow tube and project foam long distances. Medium and high expansion - generally about 50 psi. relatively low pressure because high pressure through these nozzles breaks the bubbles.	04-15-FOAM-SL 04-16-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
8. Foam durability in general terms:	
THE TIMES GIVEN HERE ARE NOT ABSOLUTE. THEY ARE RELATIVE TO EACH OTHER.	
a. Low expansion foam lasts about 30 minutes.	04-17-FOAM-SL
b. Medium expansion foam lasts about 2 hours. Medium expansion foam on the right, low expansion on the left.	
9. Ability to cling to a vertical surface is good for a short time.	04-18-FOAM-SL
10. Aspirating nozzle performance. Nozzles vary widely in discharge distance, gpm flow, expansion ratio and draintime. Choose a nozzle which best fits the situation.	Pg 30 NTG
SHOW THE VIDEO, "ASPIRATING NOZZLES", TO REINFORCE THE IDEAS AND CONCEPTS PRESENTED IN THIS UNIT.	04-01-FOAM-VT
IV. CONDUCT OUTDOOR EXERCISES OF ASPIRATING NOZZLES AS OUTLINED IN APPENDIX D.	
V. REVIEW UNIT OBJECTIVES	04-19-FOAM-SL
VI. ADMINISTER UNIT 4 QUIZ. ALLOW 30 MINUTES	APPENDIX A

DETAILED INSTRUCTOR'S GUIDE

COURSE: Class A Foam

UNIT: 5 - Compressed Air Foam Systems (CAFS)

OBJECTIVES: At the completion of this unit, the students will be able to:

1. Define a compressed air foam system.
2. Explain why a compressed air foam system is a high energy system.
3. List two ways to change the type of foam projected from a CAFS unit.
4. List three safety concerns with a CAFS unit.
5. Describe two differences between CAFS and aspirating nozzle foam systems.

SUGGESTED TIME: 2 hours

TRAINING AIDS NEEDED: Flip chart; video player; video "Compressed Air Foam Systems"; slide projector; handout; "Foam vs. Fire"; and Note Taking Guide.

OUTLINE	KEY POINTS & AID CUES
I. PRESENT UNIT OBJECTIVES Material in this Unit can be found on pages 13-16 of "Foam vs. Fire".	05-01-FOAM-SL 05-02-FOAM-SL Pg 31 NTG

OUTLINE	KEY POINTS & AID CUES
II. FOAM GENERATING SYSTEMS CONTINUED	
A. Compressed Air Foam System (CAFS)	Pg 32 NTG
1. Produces foam by <u>injecting</u> air into foam solution and making the foam <u>in the hose</u>.	05-03-FOAM-SL 05-04-FOAM-SL
EXPLAIN TO THE STUDENT THAT THIS IS HOW AN INDIVIDUAL CAN BUILD AND EXPERIMENT WITH CAFS UNIT WITHOUT INCURRING GREAT COSTS.	05-01-FOAM-HO
2. Produces a high energy foam because energy is added to the water stream.	
a. It takes 1 brake hp. to compress 4 cfm of air at 100 psi.	
b. Generally, mix one gpm of foam solution to one cfm of air. (gpm is gallons per minute of liquid, cfm is cubic feet per minute of air.)	
c. Foam being applied to an 80-foot snag (45 gpm water and 45 cfm air, at 150 psi, 600 feet from truck).	05-05-FOAM-SL
d. Hose and nozzle pressures are NOT higher than those for water-only systems.	
3. Foam expansion, draintime, and type can be changed either by changing air, water, or concentrate ratios, that is: volumes.	

OUTLINE	KEY POINTS & AID CUES
4. Air and foam solution mix together most effectively at equal static pressure. Do not adjust pressures once air and solution are flowing.	
5. Mix ratio of concentrate for CAFS foam solution is 0.2% to 0.3%.	05-06-FOAM-SL
6. Generates a small-bubbled foam.	05-07-FOAM-SL
7. Expansion ratios vary from 1-to-1, up to about 20-to-1, sometimes more.	05-08-FOAM-SL
8. Foam durability in general terms is about 1.5 hours. Note: This foam was made with everything in the picture plus a pump hidden from view and a manifold as described in the handout "In-Line CAFS Instructions".	05-09-FOAM-SL
9. When dry, compressed air foam's ability to cling to vertical and overhead surfaces is excellent.	05-10-FOAM-SL
10. For the most versatile CAFS nozzle, we would use a ball valve or open bore non-restrictive nozzle.	05-11-FOAM-SL
11. Most types of conventional nozzles will work with CAFS; however, a wetter foam will result. This is because we are stripping out some of the air in the discharge stream.	05-12-FOAM-SL
12. With an open bore nozzle, a typical flow of foam solution and air from a 1" hose is about 10-15 gpm. 25-30 gmp from 1.5" hose.	

OUTLINE	KEY POINTS & AID CUES
13. Foam will follow the path of least resistance, enabling the firefighter to extinguish fire in hollow, burning snags and cavity-pocketed downfall.	
B. Operational Safety What is right and what is wrong with the scene in this slide? 1. CAFS nozzle reaction: Opening the ball valve too far or standing without proper leverage against the discharge force could result in being knocked to the ground and/or struck by the uncontrolled fitting. When opening the ball valve, plant your feet wide apart with one foot ahead of the other, bend your knees for a low center of gravity, and open the valve slowly. 2. Charging a CAFS hose-lay: Due to the pressure situation similar to the one with the ball valve, the firefighter should gradually open a gate on a wye to charge a new lateral or when extending the main line. This is also true about opening any nozzles or ball valves in the hoselay. 3. Slug Flow: Slug flow is what occurs when the mix ratio is too low to mix the water with the air in the hose. Instead, water and air move through the hose separately in "slugs" or "plugs". This can be difficult to control at the nozzle.	05-13-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
Slug flow can be solved by increasing the mix ratio, batch mixing immediately if necessary, or by shutting off the air flow. Bleed out the air/water slugs by cracking the nozzle just open.	
C. CAFS vs. Aspirated Foam Discuss impacts of the following concepts. 1. High energy vs. low energy. 2. Foam made in the hose vs. at the nozzle. 3. Stronger bubble structure vs. weaker bubble structure. 4. 0.3% vs. 0.5%. 5. Low expansion vs. low, medium or high expansion. 6. High equipment cost vs. low equipment cost. 7. Light hose filled with foam vs. heavy hose filled with water. 8. Complicated to operate vs. simpler to operate. 9. Perhaps the class can suggest other differences.	Pg 33 NTG Pg 13 "Foam vs. Fire"

OUTLINE	KEY POINTS & AID CUES
SHOW THE VIDEO "COMPRESSED AIR FOAM SYSTEMS" TO REINFORCE THE IDEAS AND CONCEPTS PREVIOUSLY PRESENTED.	05-01-FOAM-VT
III. CONDUCT OUTDOOR EXERCISES ON COMPRESSED AIR FOAM SYSTEMS AS OUTLINED IN APPENDIX D.	
IV. REVIEW UNIT OBJECTIVES	05-14-FOAM-SL 05-15-FOAM-SL
V. ADMINISTER UNIT 5 QUIZ. ALLOW 30 MINUTES	APPENDIX A

DETAILED INSTRUCTOR'S GUIDE

COURSE: Class A Foam

UNIT: 6 - Applications From the Ground

OBJECTIVES: At the completion of this unit, the students will be able to:

1. Define Critical Application Rate.
2. List four applications for foam generating systems.
3. Explain why foam is a suppressant rather than a retardant.
4. Explain why foam is a short-term protection tool.
5. Explain why Class A foams are not used on Class B fires.

SUGGESTED TIME: 1 hour

TRAINING AIDS NEEDED: Flip chart; video player; videos "Tactical Applications with Class A Foam", and "Class A Foam Video Database"; slide projector; "Foam vs. Fire"; and Note Taking Guide.

OUTLINE	KEY POINTS & AID CUES
I. PRESENT UNIT OBJECTIVES This unit covers material on pages 17-24 in "Foam vs. Fire."	06-01-FOAM-SL 06-02-FOAM-SL Pg 34 NTG

OUTLINE	KEY POINTS & AID CUES
II. APPLICATIONS FOR USING FOAM SYSTEMS **CRITICAL APPLICATION RATE IS NOT COVERED BY "FOAM vs. FIRE". IT IS PRESENTED HERE TO GET THE STUDENTS THINKING ABOUT HOW THEY HAVE BEEN USING WATER AND HOW THEY MIGHT TRY USING WATER AS FOAM. THE OPTIONAL VIDEO PROVIDES A REAL EXAMPLE OF THE DIFFERENCE BETWEEN FLOW RATES OF FOAM AND WATER NECESSARY FOR KNOCKDOWN. SLIDES 06-03 AND 06-04 DESCRIBE GENERICALLY HOW, IF FOAM IS MORE EFFECTIVE, YOU CAN EXPECT TO FLOW A LOWER RATE OF WATER AS FOAM TO DO AN ATTACK OR YOU CAN EXPECT TO COMPLETE THE ATTACK SOONER. USE OF FOAM WILL OFTEN RESULT IN IMPROVED EFFICIENCY OF WATER USE AND THIS CONCEPT OF CRITICAL APPLICATION RATE IS A BIG REASON WHY.**	
"Critical Application Rate." Definition: The water flow rate on a fire at which the fire does not grow. Exceed the critical application rate and the fire is extinguished. Flow less than the Critical Application Rate and the fire burns unchecked until fuel is burned up. This theory supports basic water use ideas we have followed for a long time and some we may not have realized: -- Only use as much water as necessary, but do use as much as necessary. -- If you cannot exceed the Critical Application Rate, do not waste your water.	06-03-FOAM-SL Pg 35 NTG

OUTLINE	KEY POINTS & AID CUES
-- If you can exceed the Critical Application Rate, the more you do so, the <u>sooner</u> extinguishment will occur and the lower <u>total water flow</u> will be. Reconsider the brush pile comparison of foam and water in the video "Introduction to Class A Foam".	
OPTIONAL: LOCATE AND SHOW VIDEO "AMERICAN HEAT" VOL. #5 PROGRAM #4 1990 "CLASS A FOAM TESTS: SIKESTON, MO" AS SHOWN IN APPENDIX N TO REINFORCE IDEAS AND CONCEPTS OF CRITICAL APPLICATION RATE.	
With the greater efficiency of the water in foam or foam solution, you reach the Critical Application Rate faster than with plain water. The flow of water (gpm) would have to be much higher to see the same benefits as the flow of water as foam (gpm), at the same fire intensity.	06-04-FOAM-SL
III. APPLICATIONS FROM THE GROUND	Pg 36 NTG
A. Mopup	06-05-FOAM-SL
1. Foam's vapor suppressing, penetrating, smothering, and rapid cooling actions enable the firefighter to move from suppression phase of the fire to the mopup phase quicker than with plain water.	06-06-FOAM-SL
2. A wet foam type is best for immediate extinguishment and rapid penetration.	06-07-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
3. Blanketing a fire with foam is effective for securing the perimeter of a large fire and totally securing small fires.	06-08-FOAM-SL
a. Medium nozzles are very good tools for this kind of operation.	
b. Periodic patrolling of the secured fire must be done to pick up any hold-overs. (Slide shows an area secured with a foam application.)	06-09-FOAM-SL
4. Forester nozzles and mopup wands are useful mopup appliances with a CAFS unit or when using foam solution.	06-10-FOAM-SL
B. Indirect Attack/Barriers	06-11-FOAM-SL
1. Apply foam as a wet line adjacent to a backfire or burnout (fluid foam type is best). Maintain control over when fire reaches the foam line by igniting against the foam. Do not wait for fire to run at the foam. It may dry out.	06-12-FOAM-SL
2. Apply foam immediately ahead of firing crew. Allow time for foam solution to drain out of the foam to wet fuels. (Up to five minutes may be required.) This foam looks sparce and ineffective, but it has been there wetting fuels for 10 minutes and provided an effective fire break in this case.	06-13-FOAM-SL
3. The foam line should be at least 1.5 to 2.5 times as wide as the flame lengths.	06-14-FOAM-SL 06-15-FOAM-SL 06-16-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
4. Apply foam directly to fuels and coat all sides of fuel when possible. Is this foam wet enough? Do you think fire could burn under it?	06-17-FOAM-SL
5. Foam can also be used to fireproof areas or objects inside, as well as outside areas to be burned.	06-18-FOAM-SL 06-19-FOAM-SL
6. Adverse conditions (low RH, high temperature, high winds, etc.) warrant foam application to be as close to the ignition time as possible.	06-20-FOAM-SL
7. In mop-up and line construction, foam on the ground hides footing hazards. Work whenever possible on untreated ground.	06-21-FOAM-SL
8. Foam is used as a short-term protection tool (it's just thinned and stretched water). When the bubbles are gone, the fuel will lose its moisture at the normal drying rate. (Slide: foam applied has dried up.)	06-22-FOAM-SL
C. Direct Attack	06-23-FOAM-SL
1. Apply foam to the base of the flame.	
2. On wide hot spots, secure the edge and move toward the center.	06-24-FOAM-SL
3. While attacking the edge of the fireline, direct a portion of the foam stream into immediate adjacent unburned fuels. (Be sure to **not** scatter fire to unburned fuels.)	06-25-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
4. Foam's ability to continue wetting and cooling fuels long after the firefighter has left the area is a great advantage over plain water.	06-26-FOAM-SL
5. The longer discharge instances of foam through a CAFS unit is a great advantage when heavier fuels and intense fire situations are encountered.	06-27-FOAM-SL
6. The shorter discharge distances of foam through most aspirating nozzles can limit direct attack on heavy fuel loads and intense fire situations. (Slide Note: The two firefighters attacking the brush pile fire are using a KK Bubble Cup nozzle, which is seen making profuse foam, but at too short a discharge distance. The firefighters' belief that foam as bubbles was necessary and would work in this situation led them to a warm approach. Another technique with the same nozzle would be to pull the sleeve back, go to straight stream and deliver foam solution from farther away.)	06-28-FOAM-SL 06-29-FOAM-SL
D. Exposure Protection	06-30-FOAM-SL
1. The rate of foam application and type of foam to be used in exposure protection depends on air temperature, RH, fuel loadings, structural or building materials (e.g., T-111 siding painted or stained, brick, natural logs, metal siding, etc.), fuel type, time before impingement.	06-31-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
2. Foam has the ability to adhere to vertical and overhead surfaces. Water does not. Make sure all exposures are treated and covered.	06-32-FOAM-SL
3. Foam allows the firefighter the opportunity to cover an exposure and leave to work another exposure. Water is effective on exposures only as long as it continues to flow.	06-33-FOAM-SL
4. Foam is short-term. When the bubbles are gone, the treated fuel will lose its moisture at the normal drying rate.	06-34-FOAM-SL
E. Hazardous Materials	06-35-FOAM-SL Pg 37 NTG
1. Generally speaking, vehicle fires are classified as Class A fires. Class A foam works very well in extinguishing vehicle fires. The firefighter must be aware (through training) of the hazards associated with vehicle fires.	06-36-FOAM-SL
2. Flammable liquid fires are most effec-tively extinguished with foam, by sealing off the vapors. Fuels such as gasoline, diesel, aviation fuel, JP-4, etc. are categorized as Class B fuels (flammable liquids and greases). Class B foaming agents are designed for and work best on Class B fuel fires because the surfactants used in these foams are <u>not</u> attracted to carbon like the surfactants in Class A foam. Because they are not attracted to Carbon, Class B	06-37-FOAM-SL

OUTLINE	KEY POINTS & AID CUES
foams (AFFF) can stay on top of a pool of flammable liquid and form a vapor seal. Refer to Foam vs. Fire Glossary for definitions of Class A and Class B foams. The most common Class B agent is AFFF. Note: AFFF is designed for application on a confined fuel spill/pool incidents where it is designed to maintain a vapor sealing film on flammable liquids. 3. Class A agents are not recommended for use on Class B fuels.	
SHOW THE VIDEO "TACTICAL APPLICATIONS WITH CLASS A FOAM" TO REINFORCE THE IDEAS AND CONCEPTS PREVIOUSLY PRESENTED.	06-01-FOAM-VT
OPTIONAL AT THIS POINT TO SHOW PORTIONS OF THE VIDEO "CLASS A FOAM VIDEO DATA-BASE" BASED ON THE NEEDS AND INTEREST OF THE STUDENTS. THIS VIDEO IS A COLLECTION OF APPLIED FOAM EVENTS AND IS MEANT HERE TO SUPPLEMENT DISCUSSION OF GROUND-APPLIED FOAM TECHNIQUES. REFER TO SUBJECT INDEX IN APPENDIX K.	01-02-FOAM-VT
III. REVIEW UNIT OBJECTIVES	06-38-FOAM-SL 06-39-FOAM-SL
IV. ADMINISTER UNIT 6 QUIZ. ALLOW 30 MINUTES	APPENDIX A

DETAILED INSTRUCTOR'S GUIDE

COURSE: Class A Foam

UNIT: 7 - Applications From Aircraft

OBJECTIVES: At the completion of this unit, the students will be able to:

1. Explain why foam dropped from the air is only a suppressant.
2. Name two types of aircraft that can deliver foam.
3. Name two factors that affect quality of foam delivered from aircraft.

SUGGESTED TIME:

Lesson	-- 1 hour
Review	-- 30 minutes
Final Exam	-- 1 hour

TRAINING AIDS NEEDED: Flip chart; slide projector; video player; video "Class A Foam Video Database"; "Foam vs. Fire"; Note Taking Guide.

OUTLINE	KEY POINTS & AID CUES
I. PRESENT UNIT OBJECTIVES Refer to pages 12 and 16 in "Foam vs. Fire.	07-01-FOAM-SL Pg 38 NTG
II. AERIAL APPLICATIONS A. Foam dropped from the air is a short-term suppressant. It is not intended to take the place of retardants. B. Short-term because there is nothing in the foam that remains to inhibit combustion after the water has dried up.	Pg 39 NTG

OUTLINE	KEY POINTS & AID CUES
C. Suppressant because water is an excellent extinguishing agent.	
D. A retardant is a product that has the ability to reduce or inhibit after the water it originally contained has evaporated (long-term retardant).	
E. Tactical decisions to use a suppressant or retardant must be made ahead of time based on cost, flight time, and fire characteristics.	
F. Aircraft used to drop foam are:	Pg 39 NTG
1. Water skimming airtankers.	07-02-FOAM-SL
2. Airtankers (no products are currently approved for this application).	07-03-FOAM-SL
3. Single-engine airtankers.	07-04-FOAM-SL
4. Helicopters with buckets.	07-05-FOAM-SL
5. Helicopters with fixed-tanks.	07-06-FOAM-SL
6. Review USFS QPL for products approved for use from aircraft. See Qualified Products List in Reference List, Appendix N.	
G. Safety.	
1. Stay out of the drop zone.	
2. Foam might be lighter than water, but you can not be sure the drop will be foam.	

OUTLINE	KEY POINTS & AID CUES
H. Factors affecting foam delivered. Discuss air shear as described on page 16 of "Foam vs. Fire." Each of the following factors affects air shear. 1. Mix ratio: Increased mix ratio is similar to increased air speed or increased drop height. 2. Forward air speed: Increased speed lengthens patterns and decreases coverage levels on fuels. 3. Drop height: Lower drop heights allow less shearing, creating a wetter foam. Higher drop heights may allow foam to dry out and drift away. 4. Aircraft Attitude: a. Diving. Tends to foreshorten the pattern. b. Lofting or Lifting. Tends to elongate pattern. c. Banking. Tends to force the load to the outside of the turn. Most commonly used with foam and fixed-wing tanker. 5. Wind. a. Headwind. Similar effect to diving. Shortens the front of pattern, forces coverage forward. Is effective on more intense fires.	Pg 40 NTG

OUTLINE	KEY POINTS & AID CUES
b. Downwind. Similar effect to lofting by elongating the drop. c. Crosswind. Subject to drift and dispersion of the pattern core. Move flight path upwind to compensate for drift. 6. Thermal updrafts: High intensity fires with strong updrafts can erode effective-ness of foam drops. Use combination of wetter foams, lower drop heights or head-wind drops to compensate. 7. Fuel arrangement: Adjust foam type delivered to achieve application to intended canopy fuels. Ground fuels: wet foam. Ladder fuels and crowns: fluid foam.	
SHOW THE VIDEO "CLASS A FOAM VIDEO DATA-BASE, AIRCRAFT SECTION" TO REINFORCE THE IDEAS AND CONCEPTS PREVIOUSLY PRESENTED. DISCUSS APPLICATIONS SHOWN AS DESIRED. REFER TO APPENDIX K.	01-02-FOAM-VT Tape 2
III. REVIEW UNIT OBJECTIVES	07-07-FOAM-SL
IV. ADMINISTER UNIT 7 QUIZ. ALLOW 30 MINUTES.	APPENDIX A
V. REVIEW COURSE OBJECTIVES AND MATERIAL. ALLOW ABOUT 30 MINUTES.	07-08-FOAM-SL 07-09-FOAM-SL 07-10-FOAM-SL
VI. ADMINISTER FINAL TEST. ALLOW 1 HOUR FOR COMPLETION/DISCUSSION.	APPENDIX A

NEW TERMS

Aspirating Nozzle: A foam generating device that mixes air at atmospheric pressure with foam solution in a nozzle chamber.

Automatically Regulated: Readily adjusts to changes in water flow and or pressure to maintain a desired mix ratio.

Class A Fuels: Ordinary combustible solids such as wood, rubber, and plastics.

Critical Application Rate: The critical application rate is the water flow rate applied to a fire which prevents the fire from growing in size or intensity.

Density: The ratio of the original volume of the nonaerated foam solution to the resultant volume of foam (the inverse of expansion).

"Dry" Foam: Characteristics: The bubbles of "DRY" foams are polyhedral in shape. The bubble walls are very thin with only small amounts of solution between the bubbles. This type of foam has a very slow drain time.

"Durable" Foam: Foam products, undeveloped as of 1995, which, when mixed at 1 percent or less, will remain effective at preventing ignition for 12 hours; will work with current Class A foam delivery systems including proportioners, aspirating nozzles, CAFS, fixed-wing and rotor-wing aircraft; will meet requirements for corrosion, health, safety, and environmental impact.

Fire Suppressant: Any agent used to extinguish the flaming and glowing phases of combustion by direct application to the burning fuel.

"Fluid" Foam: Characteristics: The bubbles of "FLUID" foams are mostly spherical. There is less separation of bubbles by the solution than with a "WET" foam (see "WET" Foam). Some of the bubble walls may be touching. A fluid foam has a medium to fast drain time.

Foam Blanket: A layer of foam which forms an insulating and reflective barrier from heat and is used for fuel protection, suppression, and mopup.

Foam Solution: A homogeneous mixture of water and foam concentrate to which air is added to produce foam. Characteristics: Foam "SOLUTION" has no real bubble structure but some bubble formation may occur due to agitation and impact. **ALSO**: A low expansion foam type with no expansion, therefore lacking bubble structure, which is used for mopup and flame knockdown.

High Expansion: Foam with an expansion between 201:1 and 1000:1.

Inductor: A control mechanism that allows a regulated quantity of foam concentrate to be introduced into the main hose line.

Low Expansion: Foam with an expansion between 1:1 and 20:1.

Medium Expansion: Foam with an expansion between 21:1 and 200:1.

Proportioner: A device that adds a predetermined amount of foam concentrate to water to form foam solution.

Toxicity: The quality or state of being harmful, destructive, or deadly, often expressed as a lethal concentrate (LC_{50}) or dosage (LD_{50}) necessary to kill 50 percent of a test population.

Vapor Suppression: Creating a seal with foam which prevents a release of flammable vapors from fuels.

"Wet" Foam: Characteristics: The bubbles of "WET" foams are spherical masses of air which are enclosed in solution. The bubble walls are separated by a large amount of solution, relative to other types of foams. A wet foam has a very fast drain time.