

FLAMMABLE LIQUIDS

FIRE CONTROL 4B

INSTRUCTOR GUIDE

approved by



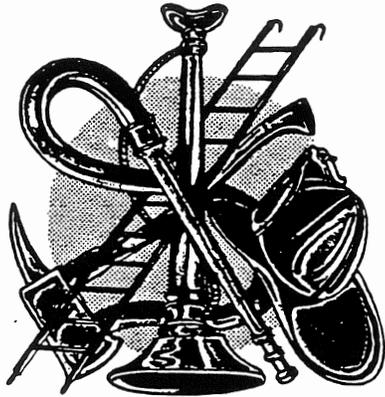
as a component of the

FIRE SERVICE TRAINING
AND EDUCATION PROGRAM

First Edition, May 1996

FIRE CONTROL 4B

INSTRUCTOR GUIDE



published by

STATE FIRE TRAINING
California State Fire Marshal
7171 Bowling Drive, Suite 410
Sacramento, CA 95823-2034

FSTEP

The Fire Service Training and Education Program (FSTEP) was established to provide specific training needs of local fire agencies in California. State Fire Training coordinates the delivery of this training through the use of approved curricula and registered instructors.

The FSTEP series is designed to provide both the volunteer and career fire fighter with hands-on training in specialized areas such as fire fighting, extrication, rescue, and pump operations. All courses are delivered through registered instructors and can be tailored by that instructor to meet your department's specific need.

Upon successful completion of a FSTEP course, participants will receive a California State Fire Marshal's course completion certificate.

A C K N O W L E D G E M E N T S

The development of the material contained in this guide was coordinated by the Training Division of the California State Fire Marshal's Office and approved by the State Training and Education Advisory Committee (STEAC) and the State Board of Fire Services (SBFS). This curriculum is appropriate for fire service personnel and for personnel in related occupations.

Ronny J. Coleman, Chief
California State Fire Marshal

Steve Hart
Deputy Chief, State Fire Training

Art Cota
Division Chief, State Fire Training

Special acknowledgement and thanks are extended to the following members of the Training Division for their diligent efforts and contributions that made the final publication of this document possible.

Ray Russell
Fire Service Training Specialist

Randy D. Shelton
Deputy State Fire Marshal

Alicia Hamilton
Fire Service Training Specialist

Kim Kirkpatrick
Curriculum Technician

We gratefully acknowledge the following individual who served as one of the principal developers for this document.

Les W. Miller, Battalion Chief
76 Products Company
San Francisco Refinery
Fire Protection Department

FIRE CONTROL 4B FLAMMABLE LIQUIDS

COURSE OBJECTIVES: To...

- a) Provide the student with information on the characteristics and hazards of flammable liquids.
- b) Provide the student with methods and procedures on handling flammable liquids whether involved or not involved with fire.
- c) Provide the student with laws and regulations pertaining to flammable liquids in California and at the national level.
- d) Provide the student with an opportunity to utilize control methods on flammable liquids.

COURSE CONTENT:

6:00 HOURS

1. Course Introduction and Administration	0:30
2. Characteristics Of Flammable Liquids	0:30
3. Hazards Of Flammable Liquids	0:30
4. Tactics To Utilize On Flammable Liquids Not Involved With Fire	0:30
5. Tactics To Utilize On Flammable Liquids Involved With Fire	0:30
6. Case Studies Of Flammable Liquid Incidents	0:30
7. Field Exercise	3:00

TEXT & REFERENCES:

- State Fire Training Policies & Procedures, CFSTES, 1996
- North American Emergency Response Guidebook, D.O.T., 1996 Edition

S A F E T Y N O T I C E

This Guide is designed to assist instructors in preparing their Fire Control 4B exercises. The State of California, State Fire Marshal's Office, State Fire Training, and their employees assume no liability for any injury or illness that occurs as a result of a Fire Control 4B class accredited through the Fire Service Training and Education Program (FSTEP).

The sponsoring department(s) and the instructors are responsible for the safety of all participants in their class. Any person injured or becoming ill as a result of a Fire Control 4B course should be given immediate first aid. Only then should the facts be documented and reported pursuant to Labor Code Section 6409 ET AL and each department's SOPs.

The Safety Officer shall stop the exercises immediately in the event of injury or illness in order to investigate the cause and determine if it is safe to proceed with the class.

INSTRUCTOR GUIDE

COURSE INTRODUCTION & ADMINISTRATION

TOPIC: Course Introduction And Administration

TIME FRAME: 0:30

LEVEL OF INSTRUCTION: I

BEHAVIORAL OBJECTIVE:

Condition: Given an oral evaluation

Behavior: The student will demonstrate knowledge of the course requirements

Standard: To the instructor's satisfaction according to State Fire Training Policies & Procedures, CFSTES, 1996

MATERIALS NEEDED:

- Writing board with markers/erasers
- VCR with monitor
- FLAG Trailer video, CSFM, 1995
- CSFM class roster and registration form

REFERENCES:

- Assembly Bill 1911, Propane Storage Systems
- North American Emergency Response Guidebook, D.O.T., 1996 Edition
- State Fire Training Policies & Procedures, CFSTES, 1996

PREPARATION: You may never respond to a flammable liquid incident. But, the chances are that you could respond in the next few hours. This course will assist you in preparing to respond and act in a SAFE manner to this type of incident.

These incidents have caused death and injury to many fire fighters over the years. It is our mission to give you enough information and the procedures necessary, to walk away from each flammable liquid incident with added experience and no injuries.

INSTRUCTOR GUIDE

PRESENTATION

APPLICATION

NOTE: Show and discuss FLAG Trailer video.

I. COURSE OUTLINE

- A. 3 hours classroom
- B. 3 hours field exercise

II. INSTRUCTORS

- A. Introduce each instructor
 - 1. Give qualifications
 - 2. Include self last

III. SAFETY DISCUSSION

- A. During field exercise

- 1. CAL-OSHA required gear
 - a) Helmet with shield or goggles
 - b) Turnouts
 - c) Gloves
 - d) Boots
 - e) Self-contained breathing apparatus (SCBA)
- 2. Follow all instructions during field exercise from

Show video FLAG Trailer (10 minutes)

What safety clothing should you wear?

INSTRUCTOR GUIDE

PRESENTATION	APPLICATION
<p>a) Instructor</p> <p>b) Crew Leader</p> <p>c) Safety Officer</p> <p>d) Anyone noting safety violations</p> <p>IV. RECORD KEEPING</p> <p>NOTE: Provide forms to students and review correct procedures.</p> <p>A. State</p> <p>B. Local</p>	

INSTRUCTOR GUIDE

SUMMARY:

You will be given three hours of classroom training and three hours of field exercise. The information and experience you gain from this course can help to keep you safe when dealing with a flammable liquid incident whether just a leak or involved with fire.

EVALUATION:

The student will be evaluated in accordance with stated performance objectives at a time to be determined by the instructor.

ASSIGNMENT:

Have a safe and productive course!

INSTRUCTOR GUIDE

<u>TOPIC:</u>	Characteristics Of Flammable Liquids
<u>TIME FRAME:</u>	0:30
<u>LEVEL OF INSTRUCTION:</u>	I
<u>BEHAVIORAL OBJECTIVE:</u>	
Condition:	Given an oral evaluation
Behavior:	The student will identify the characteristics of flammable liquids
Standard:	To the instructor's satisfaction according to the information contained in Information Sheet 2-1
<u>MATERIALS NEEDED:</u>	<ul style="list-style-type: none">• Writing board with markers/erasers• Information Sheet 2-1
<u>REFERENCES:</u>	<ul style="list-style-type: none">• Information Sheet
<u>PREPARATION:</u>	<p>It is important to know the characteristics of flammable liquids especially if a spill or leak has occurred and there is no fire.</p> <p>This is probably the most dangerous situation because the probability of fire is very likely. Especially if a knowledge of these liquids is not known. The most common flammable liquid fires occur in gasoline. Diesel, if not handled properly can become quite volatile.</p> <p>During this course we will be giving information on the characteristics and behavior of these flammable liquids.</p>

PRESENTATION

APPLICATION

I. GASOLINE

- A. Most common fires
- B. Exposure to humans

- 1. Vapor
 - a) Irritating to eyes
 - b) Inhalation causes dizziness, headache, difficulty breathing and loss of consciousness
- 2. Liquid
 - a) Irritation to eyes and skin

C. Fire hazards

- 1. Flash point -44 F
- 2. Flammable limits in air
 - a) 1.4% to 7.4%
- 3. Vapor is heavier than air

Which of the flammable liquids is present most often during a flammable liquid fire?

What are the dangers to humans if exposed to vapor or liquid?

What are the fire hazards of gasoline?

PRESENTATION	APPLICATION
<ul style="list-style-type: none">a) May travel a considerable distance to an ignition source, and then flash back4. Specific Gravity<ul style="list-style-type: none">a) Gasoline = 0.8b) Water = 1.0c) Gasoline floats on water and can spread rapidlyD. Labeling<ul style="list-style-type: none">1. Category = Flammable liquid2. Class 33. NFPA hazard rating<ul style="list-style-type: none">a) Health hazard (blue)<ul style="list-style-type: none">1) 1b) Flammability (red)<ul style="list-style-type: none">1) 3c) Reactivity (yellow)<ul style="list-style-type: none">1) 04. DOT designation<ul style="list-style-type: none">a) 1203E. Water pollution	<p>How is gasoline labeled?</p>

SUMMARY:

Gasoline is the most common flammable liquid spill or fire you will encounter. It is dangerous to humans as either a vapor or liquid. It is heavier than air and can travel to an ignition source and flash back. It is injurious to humans and wildlife when it gets into a water source. It is almost easier to handle when on fire than not. However, don't ignite a spill or leak. Diesel can become as volatile as gasoline when heated or treated with flourine based foams (AFFF).

EVALUATION:

The student will be evaluated in accordance with stated performance objectives at a time to be determined by the instructor.

ASSIGNMENT:

Read the Information Sheet 2-1. Keep it handy when encountering these types of spills, leaks or fires.

FLAMMABLE AND COMBUSTIBLE LIQUIDS

INTRODUCTION:

Fire fighters face the risk of serious injury at any incident involving flammable liquids. But, there is a tendency to overlook these types of emergencies. This is because there are very few incidents involving flammable liquids, even though billions and billions of gallons are handled and transported each day. As fire fighters, we must not lose sight of the destruction these products can cause. Through knowledge of flammable liquids, their uses, characteristics, hazards, and the tactics to be utilized when handling these types of incidents, fire fighters are better prepared to safely effect the outcome of these emergencies.

INFORMATION:

Flammable and combustible liquids such as gasoline, diesel, jet fuel, alcohol, lube oil, kerosene and various solvents, to name a few, can be found virtually everywhere. The quantities of these liquids can vary from a few ounces in paint cans to several million gallons in bulk storage tank facilities.

A flammable liquid does not itself burn. It gives off a vapor which can be ignited. Vapor from a flammable liquid is usually invisible and may be difficult to detect unless a combustible-gas indicator is used. Because, in most cases the vapor is heavier than air, it can settle to the ground or to lower levels. A large, drifting, vapor cloud can potentially reach a source of ignition that will cause it to ignite and flashback to its origin.

The National Fire Protection Association (NFPA) defines flammable liquids as liquids that have a flash point below 100°F and combustible liquids are defined as liquids having a flash point at, or above, 100°F. Flammable liquids are considered the more hazardous because they release ignitable vapors at lower temperatures. Basically, the flash point is the temperature a liquid must be at before it will provide the fuel vapor required for a fire to ignite.

Generally speaking, combustible liquids are considered less hazardous than flammable liquids because of their higher flash points. Fire fighters must not allow this to mislead them as there are situations when it is not a valid assumption. It is possible for certain combustible liquids to be at their flash point when the hot summer sun has been striking the metal container that holds them, or the hot pavement they have spilled onto.

Although the flash point of a liquid is commonly referred to as being the most important criterion of the relative hazard of flammable and combustible liquids, it is by no means the only criterion that should be used in evaluating the hazard. The ignition temperature, flammable (explosive) range, rate of evaporation, vapor density, viscosity, specific gravity, solubility in water, and boiling point all have a bearing on the hazards of a liquid.

Flammable liquids can be a major threat to the fire fighters health. If not wearing the proper personal protective equipment (PPE); dermatitis, unusual behavior, coughing or complaints of respiratory irritation, headache, and ill feeling are all potential consequences. Fire fighters must always use the proper PPE.

The strategies and tactics necessary for responding to flammable liquid emergencies will differ somewhat from those normally used for structure fire situations. Keeping this in mind, you should always approach these emergencies in a cautious, thoughtful way, making all moves in a deliberate manner. The following are some very general control tactics to be used for these types of emergencies:

FLAMMABLE/COMBUSTIBLE LIQUIDS NOT INVOLVING FIRE

The immediate concern is to prevent ignition of the fuel. The primary objective is to stop the flow of fuel. If the fuel is prevented from igniting, the incident will be much easier to handle. The vapors from flammable liquids are often two to three times heavier than air. All ignition sources must be immediately removed. In those situations where there is an immediate threat to life or exposures, a blanket of foam should be applied to the spilled material. This helps to suppress the amount of vapors given off by the fuel. The area should be isolated and measures taken to evacuate all civilians beyond a specified perimeter.

If possible, leaking liquids should be channeled away from the incident scene and exposures. If ignition does occur, the material can be allowed to burn under a controlled situation isolated away from on-scene activities. Storm drains or manholes should be diked to prevent material from getting into the storm drain system. At the collection point, the material should be diked in a safe holding area. The use of water must be restricted to minimize runoff. Arrangements can be made to facilitate removal and cleanup.

FLAMMABLE/COMBUSTIBLE LIQUIDS INVOLVING FIRE

The immediate concern is to cool exposures, including the leaking container itself. The primary objective is to stop the flow of fuel to enable extinguishment. Consideration must be given on the need for additional resources. Apparatus should be placed upwind and uphill (if possible) and at a safe distance away. Identification of the involved material is the next step. Fire streams must be quickly placed in service to protect exposures and if possible, to flush burning liquid to a safer location. The area must be isolated and all civilians evacuated. The fire should be blanketed with the appropriate foaming agent, and dry chemical agents used as necessary to facilitate extinguishment. Ensure that the leak has been stopped, and that all fire is out. Arrangements can then be made for proper cleanup.

Large fires involving crude oil in product storage tanks require specialized training and expertise. Here there is the potential for a phenomenon called a "boilover." A boilover is a violent eruption of part of the burning tank contents. Crude oils generally contain some moisture which settles at the bottom of the tank. As the crude oil burns, a heat wave begins

STUDENT INFO

to extend downward toward the bottom of the tank. This wave of heated oil may reach 400°F to 500°F. When the heated oil reaches the moisture, it turns the water into steam which expands more than 1600 times, forcefully discharging the burning contents up and out of the tank.

INSTRUCTOR GUIDE

TOPIC: Hazards Of Flammable Liquids

TIME FRAME: 0:30

LEVEL OF INSTRUCTION: I

BEHAVIORAL OBJECTIVE:

Condition: Given an oral evaluation

Behavior: The student will identify the hazards of flammable liquids

Standard: To the instructor's satisfaction according to the information contained in the Information Sheet 2-1

MATERIALS NEEDED:

- Writing board with markers/erasers
- Information Sheet 2-1

REFERENCES:

- Information Sheet 2-1

PREPARATION: Many fire fighters throughout the world have been seriously injured or killed because they didn't understand the hazards of flammable liquids.

Time and again we read in the fire service periodicals of the death and destruction caused by flammable liquids. In this session we will give you information that will assist you in making decisions relative to flammable liquid incidents based on their hazards.

PRESENTATION

APPLICATION

I. HEALTH HAZARDS

A. Target organs

1. Respiratory system
2. Eyes
3. Skin

II. INHALATION HAZARDS

A. Irritation of the upper respiratory tract

- B. Central nervous system stimulation followed by depression
- C. Dizziness
- D. Difficulty breathing
- E. Death

III. CONTACT HAZARDS

A. Eyes

1. Irritation
2. Blurred vision

B. Skin

What are the inhalation hazards caused by flammable liquids?

What problems can contact with the eyes cause?

INSTRUCTOR GUIDE

HAZARDS OF FLAMMABLE LIQUIDS

PRESENTATION

APPLICATION

1. Irritation
2. Allergic reaction

IV. INGESTION

A. Nausea

B. Vomiting

C. Shut down of the bronchial tube and epiglottis

V. FIRE DANGER

A. Low flash point (gasoline)

B. Heavier than air

1. Vapor may travel long distances, find an ignition source and flash back to the point of release

C. Catches fire easily

1. Match
2. Road flare

D. Liquid travels downhill

E. Liquid pools

F. Burns hot

What happens when a flammable liquid is swallowed?

What are the particulars about flammable liquids that can cause them to ignite?

INSTRUCTOR GUIDE

PRESENTATION

APPLICATION

G. Radiates long distance

H. Wind affects the flame direction

VI. ECOLOGY HAZARDS

A. In water

1. Affects aquatic life
2. Affects human drinking water
3. Fouls beach
4. Can affect other wild animals
5. Can float and burn on water
6. Some flammable liquids mix with water (alcohol)

What are the dangers of flammable liquids to the environment?

INSTRUCTOR GUIDE

SUMMARY:

Flammable liquids have caused many deaths and injuries to fire service personnel. When not involved in fire, they can be dangerous to the eyes, skin and the respiratory system. The vapors can travel great distances and find an ignition source. Flammable liquids are easily ignited, burn hot and are not easily controlled. In addition, they can cause a great deal of damage to the environment.

EVALUATION:

The student will be evaluated in accordance with stated performance objectives at a time to be determined by the instructor.

ASSIGNMENT:

Read the Information Sheet 2-1. Keep it handy for a flammable liquid incident.

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON
FLAMMABLE LIQUIDS NOT INVOLVED WITH FIRE

<u>TOPIC:</u>	Tactics To Utilize On Flammable Liquids Not Involved With Fire
<u>TIME FRAME:</u>	0:30
<u>LEVEL OF INSTRUCTION:</u>	I
<u>BEHAVIORAL OBJECTIVE:</u>	
Condition:	Given an oral evaluation
Behavior:	The student will identify tactics used on flammable liquid spills or leaks not involved with fire
Standard:	To the instructor's satisfaction according to the information contained in Information Sheet 2-1 and <u>North American Emergency Response Guidebook</u> , DOT, 1996
<u>MATERIALS NEEDED:</u>	<ul style="list-style-type: none">• Writing board with markers/erasers• Information Sheet 2-1
<u>REFERENCES:</u>	<ul style="list-style-type: none">• <u>North American Emergency Response Guidebook</u>, DOT, 1996• Information Sheet 2-1
<u>PREPARATION:</u>	<p>Many of the flammable liquid incidents you respond to will not be on fire. This is a very dangerous situation. You must take extra precautions to reduce vapor production and prevent ignition.</p> <p>This session will give you information on methods of handling these incidents in a safe manner.</p>

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON
FLAMMABLE LIQUIDS NOT INVOLVED WITH FIRE

PRESENTATION

APPLICATION

I. OBJECTIVES FOR A SPILL OR LEAK

A. Control all ignition sources

1. Use proper protective clothing
2. No flares
3. No smoking
4. No open flame
5. Shut off electric motors

B. Stop leak

1. If it can be done safely
2. Shut off valves
3. Plug with proper material
4. Pinch lines
 - a) Requires special equipment
 - 1) Power spreader

C. Control spilled material

1. Small spills

How can you control ignition sources?

What are some of the methods of stopping leaks?

What can be used to control small spills?

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON:
FLAMMABLE LIQUIDS NOT INVOLVED WITH FIRE

PRESENTATION	APPLICATION
<ul style="list-style-type: none">a) Use sandb) Non combustible absorbentc) Place in containers for later disposald) Have dry chemical extinguisher available <ul style="list-style-type: none">1) Proper size2) ABC or BC agents	<p>What fire extinguishing equipment should you have available for a small spill?</p>
<p>2. Large spills</p> <ul style="list-style-type: none">a) Dike far ahead of spillb) Use local dirt or bring in dump trucks of dirtc) Float on water if possible<ul style="list-style-type: none">1) Keeps soil from being contaminated2) Makes recovery easierd) Have foam lines ready	<p>What are some of the methods of containing a large spill?</p>
	<p>What kind of fire extinguishing equipment should you have available for a large spill?</p>

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON
FLAMMABLE LIQUIDS NOT INVOLVED WITH FIRE

PRESENTATION	APPLICATION
<ul style="list-style-type: none">1) Foam nozzle preferred2) Fog nozzle<ul style="list-style-type: none">• Keep on straight stream setting3) Have adequate foam concentrate availablee) Contact clean up crews as soon as possible	

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON
FLAMMABLE LIQUIDS NOT INVOLVED WITH FIRE

SUMMARY:

Flammable liquid spills and leaks not involved with fire can be extremely dangerous. An initial priority is to control all ignition sources. For the safety of your personnel, always utilize full protective clothing and have the proper fire extinguishing equipment set up. Spills can usually be controlled by diking. Call a clean up crew as soon as possible. This will help to negate the incident and assist in the safety of the responding personnel.

EVALUATION:

The student will be evaluated in accordance with stated performance objectives at a time to be determined by the instructor.

ASSIGNMENT:

Study Information Sheet 2-1 and the DOT Guide. Keep guide available for this kind of incident.

INSTRUCTOR GUIDE

TACTICS TO UTILIZE
FLAMMABLE LIQUIDS INVOLVED WITH FIRE

<u>TOPIC:</u>	Tactics To Utilize On Flammable Liquids Involved With Fire
<u>TIME FRAME:</u>	0:30
<u>LEVEL OF INSTRUCTION:</u>	I
<u>BEHAVIORAL OBJECTIVE:</u>	
Condition:	Given an oral evaluation
Behavior:	The student will identify the tactics used to control a flammable liquid fire
Standard:	To the instructor's satisfaction according to the information contained in Information Sheet 2-1 and <u>North American Emergency Response Guidebook, DOT, 1996</u>
<u>MATERIALS NEEDED:</u>	<ul style="list-style-type: none">• Writing board with markers/erasers• Overhead projector and screen• Overhead transparencies for this lesson plan• Information Sheet 2-1
<u>REFERENCES:</u>	<ul style="list-style-type: none">• Information Sheet 2-1• <u>North American Emergency Response Guidebook, DOT, 1996</u>
<u>PREPARATION:</u>	<p>You are responding to a flammable liquid fire. There are several things going through your mind: rescue, evacuations, water supply, exposures, wind direction, terrain, product involved, fire control, extinguishment etc.</p> <p>Keeping the preceding points in mind, the number one priority should always be the safety of you and your personnel. A cautious approach to the emergency scene is a must.</p>

INSTRUCTOR GUIDE

TACTICS TO UTILIZE
FLAMMABLE LIQUIDS INVOLVED WITH FIRE

PRESENTATION

APPLICATION

I. INITIAL CONSIDERATIONS AT A FLAMMABLE LIQUID FIRE

- A. Exposures
- B. Toxic material
- C. Non toxic material
- D. Type of spill or leak
- E. Amount of fuel available to burn
- F. Amount of extinguishing equipment available
- G. Amount of water available

II. TYPES OF FLAMMABLE LIQUID FIRES

- A. Thin
 - 1. Surface fire
 - 2. Aircraft crashes
- B. Thick
 - 1. Vessel fires
 - 2. Tank truck fires

What are the initial considerations at a flammable liquid fire? Evacuations?

What are the three "T's" of flammable liquid fires?

PRESENTATION	APPLICATION
<p>C. Three dimensional</p> <ol style="list-style-type: none">1. Leaking flange, valve, or flowing from a hole in a container <p>III. EXTINGUISHING METHODS FOR FLAMMABLE LIQUID FIRES THAT HAVE GONE BEYOND HAND EXTINGUISHERS</p> <p>A. Toxic</p> <ol style="list-style-type: none">1. Evacuate to a safe distance<ol style="list-style-type: none">a) Upwind2. Deny entry3. Dike if needed<ol style="list-style-type: none">a) Far ahead of spill <p>B. Non toxic</p> <ol style="list-style-type: none">1. Thin<ol style="list-style-type: none">a) Use standard fog nozzle set on straight stream and foam equipment2. Thick	<p>What are the methods of controlling a flammable liquid fire if toxic or non toxic?</p> <p>What are the methods of controlling a non toxic flammable liquid fire?</p>

INSTRUCTOR GUIDE

TACTICS TO UTILIZE
FLAMMABLE LIQUIDS INVOLVED WITH FIRE

PRESENTATION

APPLICATION

- a) Use aspirating foam nozzles
 - 1) This is foam solution
- b) Foam should be ten parts air to one part water or better
 - 1) This is called low expansion foam
3. Three dimensional
 - a) Turn off leak
 - 1) Valve
 - 2) Plug
 - b) Use aerated foam
 - 1) Proper amount
 - c) Dike if needed
 - 1) Far ahead of flow
 - Right size for containment
 - d) Use fire streams to cool exposures
4. Use proper amount of foam solution for size of fire
 - a) Two gallons per minute for each 10 square feet of surface area (rule of thumb)

How much foam solution should be utilized?

INSTRUCTOR GUIDE

TACTICS TO UTILIZE
FLAMMABLE LIQUIDS INVOLVED WITH FIRE

PRESENTATION

APPLICATION

NOTE: Refer to NFPA 11 for more information.

- 1) Small fires
 - Enough foam solution for 15 minutes
- 2) Large tank fires
 - Enough foam solution for 60 minutes
5. Other extinguishing chemicals

What other chemicals can we use to control small flammable liquid fires (non toxic)?

INSTRUCTOR GUIDE

TACTICS TO UTILIZE
FLAMMABLE LIQUIDS INVOLVED WITH FIRE

PRESENTATION	APPLICATION
<ul style="list-style-type: none">a) ABC dry chemicalb) BC dry chemicalc) CO₂	

INSTRUCTOR GUIDE

TACTICS TO UTILIZE
FLAMMABLE LIQUIDS INVOLVED WITH FIRE

SUMMARY:

There are several details to take into consideration prior to attacking a flammable liquid fire. Know what they are for the safety of you and your personnel. There are three types of flammable liquid fires: thin, thick and three dimensional. Know how to control these incidents. Always use the proper extinguishing agent in the right amount. Know proper methods for diking.

EVALUATION:

The student will be evaluated in accordance with stated performance objectives at a time to be determined by the instructor.

ASSIGNMENT:

Study Information Sheet 2-1 and the DOT Guide. Keep guide available for this kind of incident.

INSTRUCTOR GUIDE

<u>TOPIC:</u>	Case Studies Of Flammable Liquid Incidents
<u>TIME FRAME:</u>	0:30
<u>LEVEL OF INSTRUCTION:</u>	I
<u>BEHAVIORAL OBJECTIVE:</u>	
Condition:	Given an oral evaluation
Behavior:	The student will identify the problems and solutions of various flammable liquid incidents
Standard:	To the instructor's satisfaction according to the information contained in Information Sheet 2-1
<u>MATERIALS NEEDED:</u>	<ul style="list-style-type: none">• Writing board with markers/erasers• Information Sheet 2-1• Various optional videos-any one: <u>Chevron Honolulu Bulk Terminal Fire</u>, American Heat, 1981 <u>Gasoline Tanker Fire, Wilson, NC</u>, American Heat, 1995 <u>Petroleum Fire</u>, NFPA
<u>REFERENCES:</u>	<ul style="list-style-type: none">• Information Sheet 2-1
<u>PREPARATION:</u>	<p>During this session, the instructor will present information on various recent flammable liquid incidents and discuss the operations and how the responders may have improved their tactics. Try to utilize injuries to fire fighters.</p> <p>These incidents can be found in various fire service publications or the instructor may choose to utilize some experience of their own.</p> <p>The instructor may also utilize the simulator to do this exercise.</p> <p>It is up to the instructor to put some preparation into this lesson.</p>

INSTRUCTOR GUIDE

PRESENTATION

APPLICATION

NOTE: In order to conduct this session you must be knowledgeable on a flammable liquid incident and its outcome. You might have to talk to others familiar with these types of incidents. Obtain copies of any reports, slides or video tapes of incidents you may know about. Use only factual information when preparing your presentation and give the facts only. Allow discussion among the students.

Show any one of the following videos:

- Chevron Honolulu Bulk Terminal Fire, American Heat, 1981
- Gasoline Tanker Fire, Wilson, NC, American Heat, 1995
- Petroleum Fire, NFPA
- Any video showing the use of Class B fire fighting foam
- Any video that contains flammable liquid incidents

INSTRUCTOR GUIDE

SUMMARY:

After your presentation sum up the problems, the solutions that were utilized, and any solutions the students may come up with. Try not to discount any solution. In this business any of several solutions may solve the problem.

EVALUATION:

The student will be evaluated in accordance with stated performance objectives at a time to be determined by the instructor.

ASSIGNMENT:

Read the Information Sheet 2-1. Keep it handy when encountering these types of spills, leaks or fires.

INSTRUCTOR GUIDE

<u>TOPIC:</u>	Field Exercises
<u>TIME FRAME:</u>	3:00
<u>LEVEL OF INSTRUCTION:</u>	II
<u>BEHAVIORAL OBJECTIVE:</u>	
Condition:	Field exercises
Behavior:	The student will <ul style="list-style-type: none">• analyze the simulated incident to determine the problem and predict the outcome• utilize appropriate technical references to determine product identification, hazards and tactical operations procedures• select and use proper protective clothing and equipment
Standard:	To the instructor's satisfaction according to the Information Sheet 7-1
<u>MATERIALS NEEDED:</u>	<ul style="list-style-type: none">• Writing board with markers/erasers• Overhead projector and screen• Overhead transparencies for this lesson plan• FLAG Trailer - Props necessary to support the selected exercise• A location appropriate to conduct the exercises• Scenarios• Information Sheet 7-1
<u>REFERENCES:</u>	<ul style="list-style-type: none">• FLAG manual• Information Sheet 7-1
<u>PREPARATION:</u>	<ol style="list-style-type: none">1. Select or develop a scenario<ol style="list-style-type: none">a) Select the site for the exercisesb) Check with local pollution board for burn day approvals (if applicable)c) Assemble the required equipmentd) Divide the class into groups by assigned roles2. Brief students as to their roles and responsibilities3. Conduct the exercises4. Clean up site and equipment5. Conduct a debriefing

INSTRUCTOR GUIDE

PRESENTATION

APPLICATION

NOTE: Distribute Information Sheet 7-1

OHT 7-1

I. FLAMMABLE LIQUIDS AND GASES TRAINING EXERCISE

OHT 7-2/OHT 7-3

NOTE: The personnel requirements listed for each of the FLAG props are based on recommended staffing levels only. The use of two person hose teams is a minimum.

A. Flammable liquid pit prop

1. Water extinguishment

a) Objective

- 1) Shut off valve located inside pit at front of prop

b) Procedure

- 1) Attack prop from front
- 2) Push flames away from valve
 - Do not reach through fog pattern to shut off valve
 - Hold nozzles steady
- 3) Turn the handle clockwise at least three revolutions

OHT 7-4

OHT 7-5

PRESENTATION

APPLICATION

- Backout using full fog patterns until clear of pit

c) Personnel

- 1) One team/crew leader
- 2) Six crew persons on attack lines
- 3) Three safety crew persons on the left
- 4) Three safety crew persons on the right

d) Equipment

- 1) 4 - 1½" hose lines and nozzles
- 2) For training purposes only, set nozzles at 60 GPM

NOTE: 95 - 125 - 150 GPM would be utilized for a real emergency.

2. Foam extinguishment

a) Objective

- 1) Put out flammable liquids (simulated) with aerated foam

b) Procedure

- 1) Attack prop from front
- 2) Use the rain drop technique to build up foam on prop

- When the fire is out

OHT 7-4

INSTRUCTOR GUIDE

PRESENTATION	APPLICATION
<ul style="list-style-type: none">• One person is to simulate shutting off valve <ol style="list-style-type: none">3) Turn the handle clockwise at least three revolutions <p>c) Personnel</p> <ol style="list-style-type: none">1) One team/crew leader2) Three crew persons on the foam line3) Three crew persons on the safety line <p>d) Equipment</p> <ol style="list-style-type: none">1) Two - 1½" hose lines and nozzles2) One foam nozzle3) One foam eductor4) For training purposes only, set nozzles at 60 GPM5) One fog nozzle6) Foam<ul style="list-style-type: none">• AFFF - ATC or equal <p>3. Backstop prop</p> <p>NOTE: This prop is the most hazardous, remember SAFETY first.</p> <p>a) Objective</p> <ol style="list-style-type: none">1) Shut off the valve at bottom of the prop	

PRESENTATION

APPLICATION

b) Procedure

- 1) Attack prop from front
- 2) Use two nozzles to push flames away from the valve
 - Hold nozzles steady
- 3) Move up slowly
 - Insure there are no breaks in the fog stream
- 4) Do not reach through the fog pattern to shut off the valve
- 5) Shut off valve at the bottom of the prop
 - Turn the handle clockwise at least three revolutions

- Backout using full fog patterns until clear of prop

OHT 7-4OHT 7-5**c) Personnel**

- 1) One team/crew leader
- 2) Six crew persons on attack lines
- 3) Three safety crew persons on the left
- 4) Three safety crew persons on the right

INSTRUCTOR GUIDE

FIELD EXERCISES

PRESENTATION

APPLICATION

- d). Equipment
 - 1) Four - 1½" hose lines and nozzles
 - 2) For training purposes only, set nozzles at 60 GPM

4. Pipe and valve prop

- a) Objective
 - 1) Two shut off valves
 - One on the right
 - One on the left

- b) Procedure

NOTE: Prop is a simulated three dimensional flammable liquid leak.

OHT 7-4

- 1) Attack prop from front
- 2) Use two nozzles to push fire away from the valve
- 3) Move up onto the prop slowly
- 4) Protect crew with two fog patterns
- 5) Push the flames away from the valve
- 6) Do not reach through the fog pattern to shut off the valves
- 7) Turn clockwise at least three complete revolutions

INSTRUCTOR GUIDE

PRESENTATION

APPLICATION

OHT 7-5

- 8) Backout using full fog patterns
- 9) Until clear of the prop
- c) Personnel
 - 1) One team/crew leader
 - 2) Six crew persons on attack lines
 - 3) Three safety crew persons on the right
 - 4) Three safety crew persons on the left
- d) Equipment
 - 1) Four - 1½" hose lines with nozzles
 - 2) For training proposes only set nozzles at 60 GPM

B. Tank Prop, Gases (left side)

- 1. Objectives
 - a) Shut off valve, located on left side of prop
- 2. Procedures
 - a) Attack prop from front

OHT 7-4

NOTE: This prop simulates a pressure relief valve operating intermittently, caused by fire at the bottom of the tank. Therefore, you must keep your fog pattern in proper position to protect from sudden large volume of fire and heat.

PRESENTATION

APPLICATION

- a) Attack the prop from the front side

NOTE: This prop simulates a valve that has been left on and is overflowing the tank.

- 1) Move the crew slowly to the right side
- 2) Front of the tank
- 3) Push the flames and liquid away
- 4) From the crew

- b) Do not reach through the fog pattern

- 1) To turn off valve
- 2) Move valve one quarter turn

NOTE: This valve simulates a ball valve.

- c) When the valve is closed

- 1) Backout using full fog pattern for protection
- 2) Until clear of the prop

3. Personnel

- a) One team/crew leader
- b) Six crew persons on attack lines
 - 1) Three safety crew persons on the left
 - 2) Three safety crew persons on the right

OHT 7-5

INSTRUCTOR GUIDE

PRESENTATION	APPLICATION
<ul style="list-style-type: none">c) You may have to use three lines to control prop <p>4. Equipment</p> <ul style="list-style-type: none">a) Four - 1½" lines with nozzlesb) Nozzles may be set at 60 GPM	

INSTRUCTOR GUIDE

SUMMARY:

Before the exercise, it is important to remember to determine the objective, procedures, number of personnel and equipment required, to safely conduct the six field exercises.

EVALUATION:

The student will be evaluated in accordance with stated performance objective at a time to be determined by the instructor.

ASSIGNMENT:

Review your notes and appropriate Information Sheets in order to prepare yourself for the upcoming quiz.

NOZZLE AND HOSE HANDLING PROCEDURES

INTRODUCTION:

Flammable liquid and gas fire fighting is a highly specialized field. Team work is extremely important to effectively fight these types of fires. Normal structural nozzle and hose handling techniques are not used. Instead, specialized techniques for hose handling have been developed to effectively deal with flammable fuel fires.

INFORMATION:

Effective flammable fuel fire fighting requires a high degree of team work between the fire fighters. These fires are very different from the typical Class A combustible type fire. They burn much hotter, increase in size and intensity very quickly, are very slippery, and they are dynamic. Each time there is a change in the nozzles "action," the fire gives a "reaction." Fire fighters must understand how these fires burn and they must know the proper procedures for operating a hose line. The following provides information on these procedures and their associated terminology:

Hose Team

Hose teams are utilized for cooling of exposures and as a safety line for training. A hose team typically consists of three or more fire fighters staffing a hose line. Three fire fighters is the recommended staffing level, however, two may be used for minimum staffing levels. Each person stands on the same side of the hose, and the hose should be between the fire fighters and the fire. (See Overhead 7-2)

Attack Team

Attack teams are used to attack the fire for the purposes of cooling, controlling or extinguishment and/or to isolate valves to shut off product flow. An attack team is simply a hose team with the addition of a team leader. (See Overhead 7-3)

Attack Group

The attack group is used for the same purposes as the attack team. It consists of two hose teams and a team leader. Unless otherwise directed by the Team Leader, persons forming an attack group will position themselves on the inside of the hose lines. (See Overhead 7-4) This is the normal attack organization.

PERSONNEL ON THE HOSE LINES:

Team/Crew Leader

The team leader is in charge of the attack team or attack group. The leader's number one priority is for the overall safety of the team or group. In addition, other team leader duties include: cooling, control, isolation and extinguishment of the fire; controlling all team and group movements; giving clear, correct, concise and loud commands; insuring slow, smooth, accurate nozzle adjustments; and delegating responsibilities to other team members as needed.

Nozzle Person

The nozzle person moves the nozzle as directed by the team leader. The nozzle person's duties include: maintaining the required nozzle position; making pattern and nozzle placement changes as directed; remaining alert to changes in the fire situation; and to follow directions as given by the team leader.

Support Person

The support person's primary job is to provide 80% to 90% of the support needed to counteract the hose line thrust (nozzle reaction). The support person should provide enough support so that the nozzle person does not have to support the hose at all. This way the nozzle person can concentrate on their nozzle placement and adjustment responsibilities. If the support person gets tired, they should request relief as necessary.

The support person is positioned one arms length behind the nozzle person, on the same side of the hose. Their feet should be shoulder width apart. This spacing makes it easier to handle the hose (it is difficult to handle if fire fighters are spaced too far apart), and it eliminates foot contact with the persons in front, and behind.

Kinker

The kinker has the responsibility of water supply from its source, throughout the hose line, up to the nozzle (watch for hose line kinks and failures etc.). They must take any action necessary to prevent interruption of the water supply. The kinker also helps support the hose and in addition, assures the smooth movement of the hose line during the attack and when backing out.

The kinker is positioned one arms length behind the support person. However, when the command "prepare to backout" is given, the kinker lays down the hose and moves back 15' behind the support person, and picks up the hose. The kinker then allows about 5' of hose to drag on the ground to help support the hose line thrust, watches for kinks in front of and behind, and aids in smooth hose movement while backing out. (See Overhead 7-5)

NOTE: When faced with minimum hose line staffing levels, the support person will be required to perform the duties of the kinker.

It is essential that all team members move in unison, therefore a common set of commands have been developed so that all team members understand what is expected of them. Some of the basic commands are:

"Prepare to advance" - Team or group members prepare to move forward, but do not move until the command "step" is given.

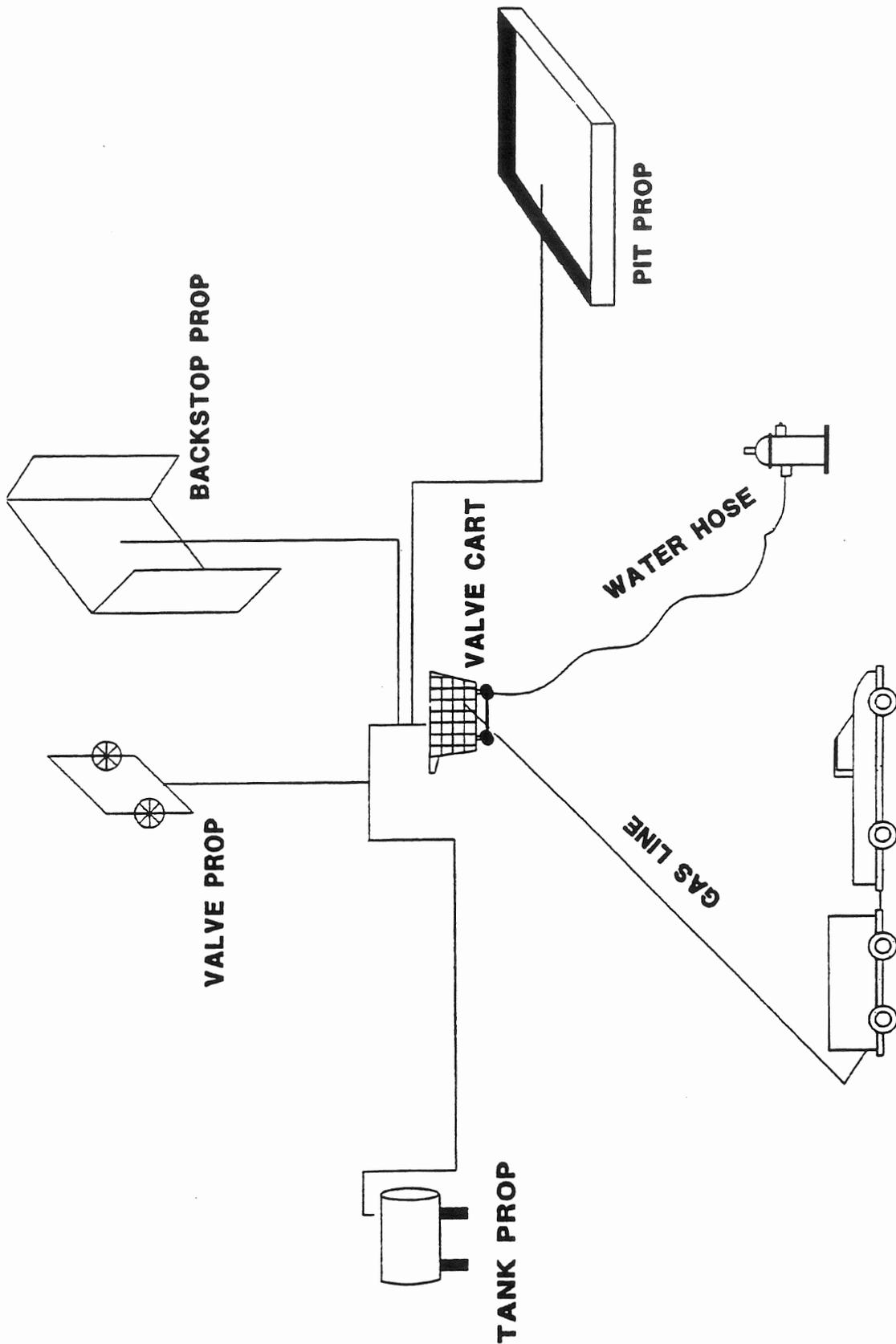
"Step" - Team or group members move forward in unison using the "shuffle step" on the command "step" given by the leader. When the command is given, slide the lead foot forward, maintaining contact with the ground as much as possible with both feet. Then move the trailing foot forward to normal spacing. Backward or sideways movements are basically the same. **NOTE:** The shuffle step enables movement in any direction at a uniform rate and provides minimal risk of tripping or slipping. It further provides the control necessary for fighting flammable fuel fires.

"Prepare to side step right" - Members prepare to move the hose line alignment, shuffle stepping, towards the right. The right foot becomes the lead foot and is moved first.

"Prepare to side step left" - Members prepare to move the hose line alignment, shuffle stepping, towards the left. The left foot becomes the lead foot and is moved first.

"Prepare to backout" - Members prepare to back out. The nozzle person changes the stream to full fog and the kinker changes position on the hose line to facilitate smooth movement while backing out. All members step backwards when the command "step" is given.

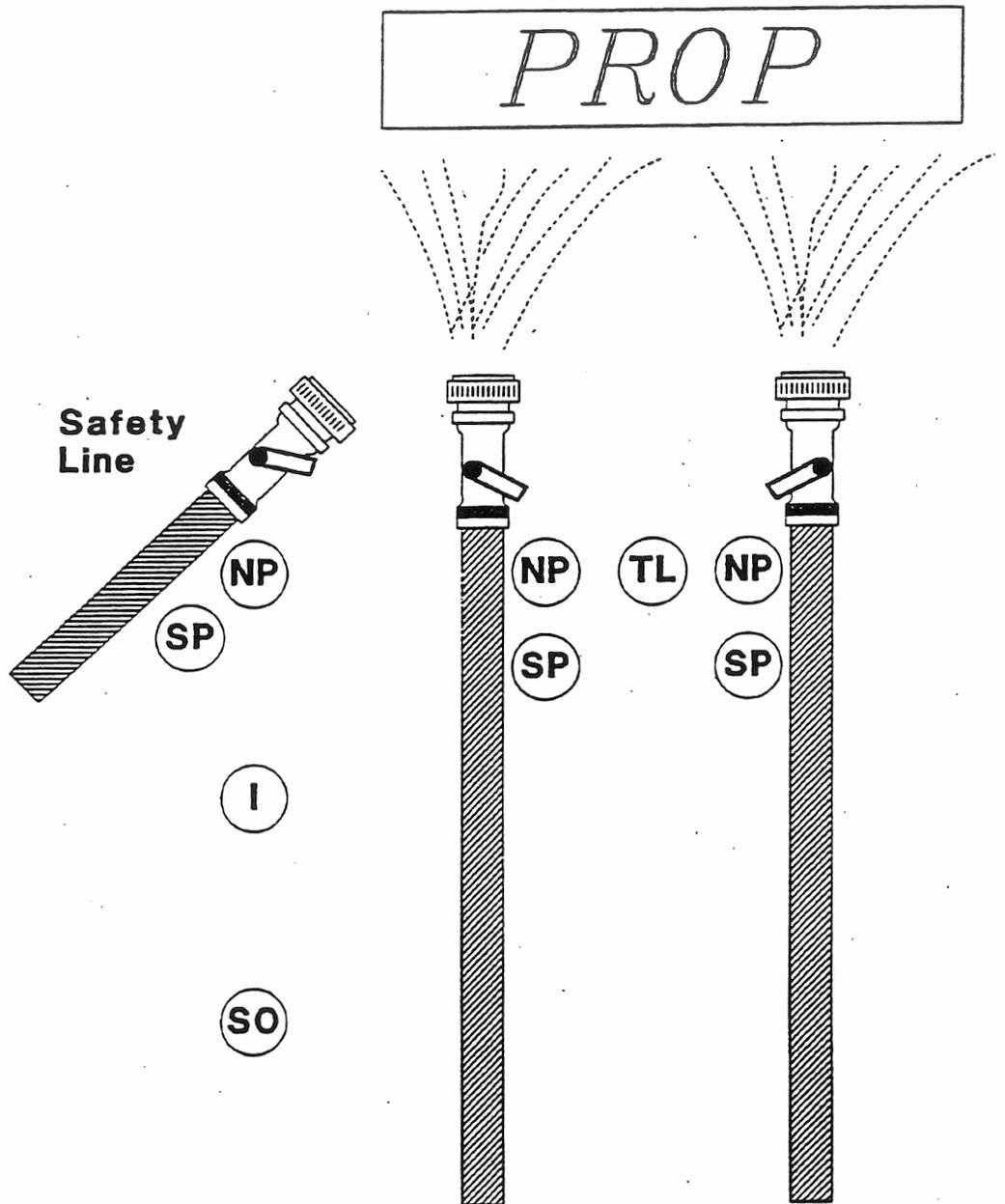
Personnel safety is the number one priority. Water can provide a wide safety margin when applied appropriately and with teamwork. Following are some general rules to keep in mind: a fog spray absorbs more heat than a straight stream; when using bail-operated nozzles, the hands should remain off of the bail after it is opened - a loss of footing could result in unintentional closure of the nozzle valve; communication is a factor of teamwork; correct nozzle position improves the margin of safety; the shuffle step helps prevent slipping and falling and aids the leader in maintaining hose line control; plan your attack carefully; be careful on stairways; make all pattern adjustments and nozzle movements slowly; and **never reach through a fog pattern!**



F.L.A.G. Trailer Layout Overview

Attack Group Overview

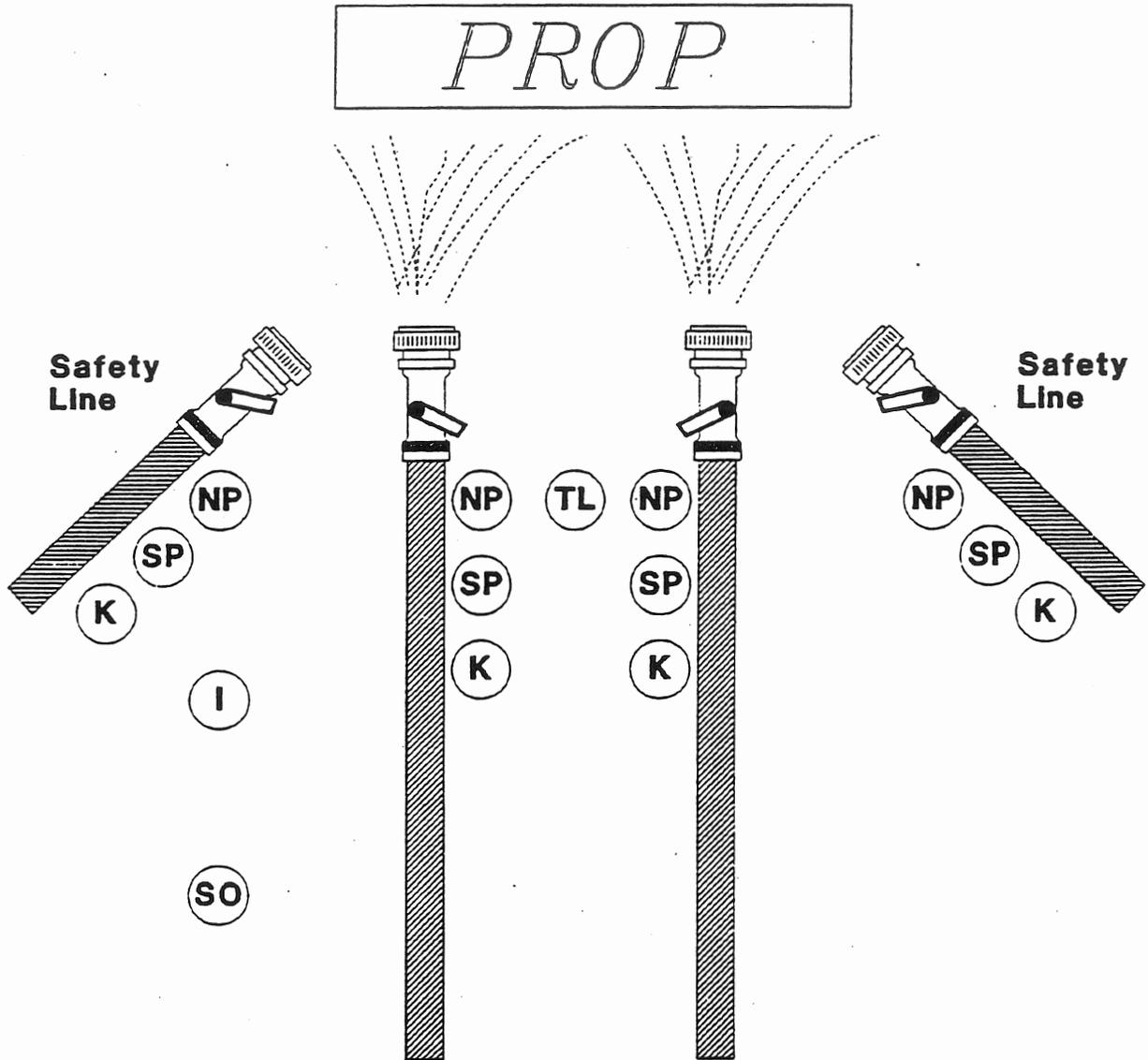
(Minimum Staffing)



NP = Nozzle Person TL = Team/Crew Leader
SP = Support Person I = Instructor
SO = Safety Officer

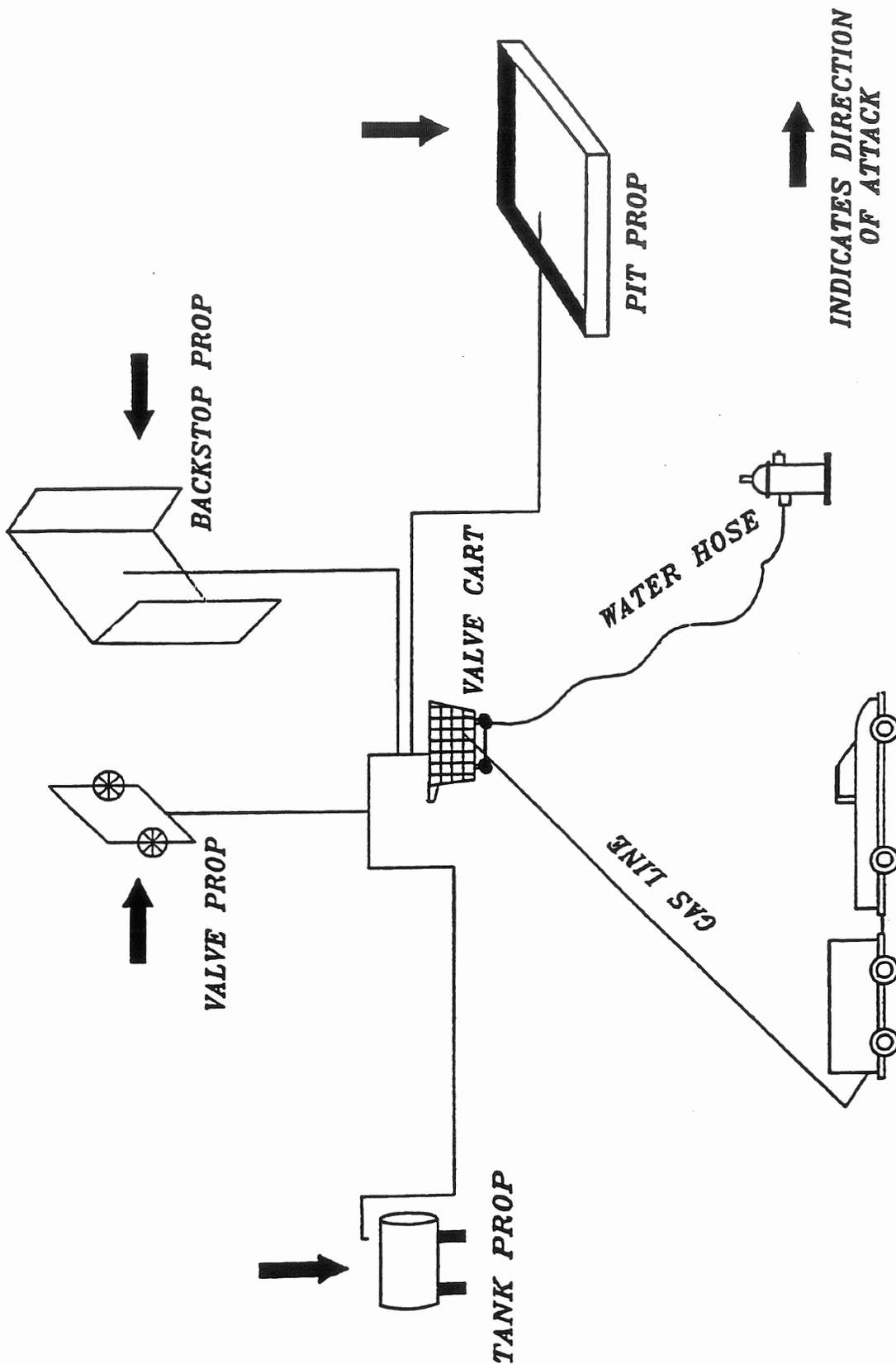
Attack Group Overview

(Recommended Staffing)



NP = Nozzle Person
SP = Support Person
K = Kinker

TL = Team/Crew Leader
I = Instructor
SO = Safety Officer



Backout Overview

(Recommended Staffing)

