

FLAMMABLE GAS (PROPANE)

FIRE CONTROL 4A

INSTRUCTOR GUIDE

approved by



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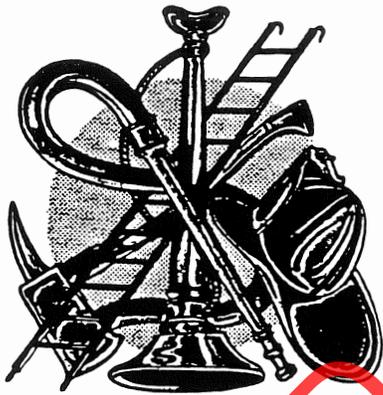
FIRE SERVICE TRAINING
AND EDUCATION PROGRAM

First Edition, May 1996

RETIRED CURRICULUM

FIRE CONTROL 4A

INSTRUCTOR GUIDE



published by

STATE FIRE TRAINING
California State Fire Marshal
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REQUIRED CURRICULUM

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.

ACKNOWLEDGEMENTS

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.

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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.

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FIRE CONTROL 4A FLAMMABLE GAS (PROPANE)

COURSE OBJECTIVES: To...

- a) Provide the student with information on the characteristics and hazards of flammable gases.
- b) Provide the student with methods and procedures on handling flammable gases whether involved in fire or not.
- c) Provide the student with an opportunity to utilize control methods on flammable gases.

COURSE CONTENT:

6:00 HOURS

1. Course Introduction and Administration	0:30
2. Characteristics of Flammable Gases	0:30
3. Hazards of Flammable Gases	0:30
4. Tactics to Utilize on Flammable Gases not Involved with Fire	0:30
5. Tactics to Utilize on Flammable Gases Involved with Fire	0:30
6. BLEVE Situations	0:30
7. Field Exercise	3:00

TEXTS & 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 4A 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 4A 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 4A 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

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 Gas 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 gas 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?

PRESENTATION	APPLICATION
<ul style="list-style-type: none">a) Instructorb) Crew Leaderc) Safety Officerd) Anyone noting safety violations <p>IV. RECORD KEEPING</p> <p>NOTE: Provide forms to students and review correct procedures.</p> <ul style="list-style-type: none">A. StateB. Local	

RETIRED CURRICULUM

INSTRUCTOR GUIDE

COURSE INTRODUCTION & ADMINISTRATION

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 gas 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!

RETIRED CURRICULUM

INSTRUCTOR GUIDE

CHARACTERISTIC OF FLAMMABLE GASES

<u>TOPIC:</u>	Characteristics of Flammable Gases
<u>TIME FRAME:</u>	0:30
<u>LEVEL OF INSTRUCTION:</u>	I
<u>BEHAVIORAL OBJECTIVE:</u>	
Condition:	An oral quiz
Behavior:	The student will identify the properties of flammable gases
Standard:	To the instructor's satisfaction according to 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 2-1
<u>PREPARATION:</u>	In order to act in a safe and proper manner on a Flammable Gas incident you should know the characteristics of the product. This session will provide you with that information and an Information Sheet to take with you to reinforce what has been taught during this session. Keep it handy when responding to these incidents.

PRESENTATION

APPLICATION

NOTE: Distribute Information Sheet 2-1

I. COMMON SYNONYMS

A. Dimethylmethane

1. Propane
2. Most common LP gas

II. CHEMICAL DESIGNATION

A. Compressed gas (CG) compatibility

1. Paraffin

B. Formula (propane)

1. C_3H_8

C. United Nations (UN) and Department of Transportation (DOT) designation

1. 1978 vapor
2. 1075 liquid

III. OBSERVABLE CHARACTERISTICS

A. Physical state

1. Liquified flammable gas
 - a) As shipped

B. Odor

What is the technical name for propane?

PRESENTATION

APPLICATION

1. Faint
2. Skunk
3. Odorized by Ethyl Mercaptan

IV. LABEL

A. Category

1. Flammable gas

B. Class

1. 2

V. NFPA HAZARD CLASSIFICATION

A. Health hazard (blue)

1. 1

B. Flammability (red)

1. 4

C. Reactivity (yellow)

1. 0

VI. CHEMICAL REACTIVITY

What does propane smell of?

What is the NFPA 704 classification diamond rating?

Is propane reactive?

PRESENTATION

APPLICATION

A. Propane is not reactive

VII. PHYSICAL AND CHEMICAL PROPERTIES

A. Physical state of gas

1. 15 C
2. 1 ATM

B. Molecular weight

1. 44.09

C. Boiling point at 1 ATM

1. -43.8 F or -42.1 C

D. Freezing point

1. -305.9 F or -187.7 C

E. Critical temperature

1. 206.0 F or 96.67 C

F. Specific gravity

1. 0.590 at -50 C (liquid)
2. 1.5 (gas)

G. Vapor pressure

1. 190 PSIA in vessel

How does propane react with water?

PRESENTATION	APPLICATION
<p>H. Will not react with or pollute water</p> <p>VIII. SHIPPING</p> <p>A. Grade of purity</p> <ul style="list-style-type: none">1. 97% <p>B. Storage temperature</p> <ul style="list-style-type: none">1. Ambient <p>C. Venting</p> <ul style="list-style-type: none">1. Safety relief valve <p>NOTE: Expansion Ratio - 270:1</p>	<p>What is one of the safety features of a propane vessel?</p>

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INSTRUCTOR GUIDE

CHARACTERISTIC OF FLAMMABLE GASES

SUMMARY:

The chemical name for propane is DIMETHYLMETHANE. Its DOT and UN designation is 1978 as a vapor and 1075 as a liquid. It is typically shipped as a liquid (LPG).

It has no color and can smell like a skunk. Its label says Flammable Gas. The NFPA Hazardous classification is Blue 1, Red 4 and Yellow is 0. Remember the liquid boils at a very low temperature and the gas is heavier than air and will travel down hill. Propane will not react with or pollute water. It is not water soluble.

EVALUATION:

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

ASSIGNMENT:

Review your notes and appropriate Information Sheet(s) in order to prepare yourself for the upcoming quiz. Keep your Information Sheet's handy for a possible incident.

LIQUIFIED PETROLEUM GASES

INTRODUCTION:

Fire fighters face the risk of serious injury at any incident involving liquified petroleum gases (LPG). Through knowledge of liquified petroleum gases, 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:

Liquified petroleum gas, known as LPG, is a mixture formed mainly of propane (C_3H_8) and butane (C_4H_{10}) and sometimes propylene and butylene. LPG is widely used in industry, agriculture, and for domestic and commercial purposes.

Under moderate pressure the gases liquify, but upon release they are converted to the gaseous phase and this characteristic makes them more practical to use. When in a gaseous state, these gases present a hazard comparable to natural gas with the added danger that being heavier than air, and when released, they stay close to the ground and travel along the contours of the terrain. But, when liquid LPG is released, it vaporizes rapidly. One gallon of liquid expands to 270 gallons of vapor, and this rapid production of flammable gas can quickly migrate a great distance, and makes a liquid leak much more dangerous than a vapor leak.

Released LPG will combine with the air to form an explosive mixture. A large, drifting, vapor cloud can potentially reach a source of ignition that will cause it to ignite and flashback to its origin. Fortunately for fire fighters, a liquid LPG release is easy to see because it forms a visible vapor cloud. This cloud serves as a warning of the danger of the LPG leak, and aids in tracking the direction of its travel, but does not necessarily reflect the extent of the actual flammable area. This area may extend out a great distance.

LP Gases are liquified to increase the efficiency of transport and storage. LPG is transported in many ways including by pipeline; by rail in specially designed tank cars; by motor transport in tanker trucks, and automobiles; by sea in ships and barges; and even by airplane.

Typical LPG containers range from small one pound cylinders to large storage tanks with a capacity of 120,000 gallons or more. Motor transport vehicles may carry as much as 10,000 gallons and rail cars up to 20,000 gallons. Rail cars are thermally protected, but most other LPG containers are not.

LPG emergencies occur when valves or fittings break; when containers are damaged or overfilled; and when containers are affected by fire or radiant heat. Traditionally, fire fighters are expected to attack fires rapidly and vigorously as is the nature of the job under normal circumstances. Experience has shown that there is nothing average about an LPG fire and the adoption of a philosophy of cautious assessment before taking action is vital.

There are many factors that fire department personnel will have to assess when an incident occurs and some of these are: identification of the product; explosive potential; missile effects; fireball; ground flash; blast wave; protection for fire fighters; fire control, and area evacuation. In any event, the standard rule is not to extinguish an LPG fire unless the fuel supply is shut off.

The explosion potential of a container of LPG involved in fire becomes an explosion reality, as experience has shown, in 10-15 minutes; from the time that the tank is first exposed to the heat of the fire. Explosions of this type are referred to as BLEVE's (Boiling Liquid Expanding Vapor Explosions). The explosion is brought on when fire impinges on a tank shell above the liquid level causing the metal to lose strength. The increase in metal temperature is rapid as the vapor does not provide adequate heat absorption. Eventually, the tank ruptures from gas pressure inside the tank and releases the liquified gas in one huge mass. When the pressurized liquid is suddenly released following tank rupture, a large volume of the liquid is converted to vapor. This often results in a missile or rocket effect which propels the tank or its parts long distances while the escaping gas is invariably ignited and a fireball occurs with its accompanying heat radiation and blast wave.

The missile effects of a BLEVE are quite spectacular as is the fireball that signals the launching of large pieces of the steel tank for distances approaching a radius of one-half mile. Persons and property within this area are in jeopardy and this zone can realistically be considered as a possible mass-evacuation zone. Control of bystanders and evacuation of area residents must be of necessity handled by the Police Department on request of the Fire Department.

Fire control procedures can be enhanced by preplanning to meet this particular type of hazard. Response time after an alarm is received plus the delay in making an alarm must be less than 10 minutes and water supplies in the area should be capable of supplying at least 500 gpm to each container involved in fire. Adequate cooling of the shell, particularly the vapor space area and at the flame impingement point is extremely important. Ideally, a minimum of personnel should quickly place remote-controlled unmanned monitors into position and withdraw to a safe location behind natural or man made barriers.

Although basically true of all types of emergencies, pre fire planning is particularly vital to emergencies involving LPG. Despite the huge amounts of LPG that are handled and transported every day, there are relatively few LPG emergencies; consequently, there is a tendency to overlook this problem. A review of past LPG emergencies in which the fire department's activities produced a favorable outcome indicates that the single and most significant factor leading to a favorable outcome was when the strategies and tactics employed were based on a sound prefire plan implemented by personnel well trained on the behavior of these products. Firefighters must have this knowledge in order to initiate those actions that will allow them to function with safety as well as to bring about successful termination of the emergency.

INSTRUCTOR GUIDE

HAZARDS OF FLAMMABLE GASES

<u>TOPIC:</u>	Hazards Of Flammable Gases
<u>TIME FRAME:</u>	0:30
<u>LEVEL OF INSTRUCTION:</u>	I
<u>BEHAVIORAL OBJECTIVE:</u>	
Condition:	An oral quiz
Behavior:	The student will identify the hazards of propane
Standard:	To the instructor's satisfaction according to 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 2-1
<u>PREPARATION:</u>	<p>In order to operate on a flammable gas incident you should know the hazards you will encounter. Not knowing these hazards could cause injury or death to fire fighters and civilians.</p> <p>This session will provide you with information on these hazards.</p>

PRESENTATION	APPLICATION
<p>I. HAZARDS WHEN NOT INVOLVED IN FIRE</p> <p>A. Vapor</p> <ol style="list-style-type: none">1. Inhaled<ol style="list-style-type: none">a) Dizzinessb) Difficulty breathingc) Can cause loss of consciousnessd) Can easily ignite from an ignition source2. Is heavier than air and will flow down hill and can flash back to leak3. Flammable limits<ol style="list-style-type: none">a) 2.1% - 9.5%4. Ignition temperature<ol style="list-style-type: none">a) 842 F5. Auto ignition temperature<ol style="list-style-type: none">a) 874 F <p>B. Liquid</p>	<p>What is the effect of inhaling propane?</p> <p>What are the flammable limits of propane?</p> <p>What physical effect can the liquid have on a body?</p>

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PRESENTATION	APPLICATION
<ul style="list-style-type: none">1. Can cause frostbite2. Floats and boils on water<ul style="list-style-type: none">a) Flammable visible Vapor cloud is produced3. Boils at -43.8 F4. Liquid can pool <p>II. HAZARDS WHEN INVOLVED WITH FIRE</p> <ul style="list-style-type: none">A. Containers may explode when involved with fire (BLEVE)B. Flash back along vapor trail may occurC. Vapor may explode if ignited in an enclosed areaD. Burns with a loud pressurized flameE. Flame<ul style="list-style-type: none">1. Burns yellow orange or blue2. Can be invisible when approaching behind a water curtain3. Extremely hot<ul style="list-style-type: none">a) Will cause major burns if not protected4. Usually stays at leak source5. Radiant heat can be deceptive	<p>Can the flame move away from source of supply?</p>

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HAZARDS OF FLAMMABLE GASES

SUMMARY:

Vapors if inhaled can cause dizziness, difficulty breathing or unconsciousness. The vapors can ignite easily. They travel down hill and can find an ignition source. The liquid boils at 43 F. It can cause frost bite. The liquid will form a vapor cloud when discharged on water. The liquid can pool on dry land. Keep these hazards in mind when working on a propane incident. When involved with a fire, containers can explode (BLEVE). Flame can be invisible when you are behind a protective water curtain. Exposure to flame will cause major burns.

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 Sheet(s) in order to prepare yourself for the upcoming quiz. Study for our next session.

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON
FLAMMABLE GASES NOT INVOLVED WITH FIRE

<u>TOPIC:</u>	Tactics To Utilize on Flammable Gases (Propane) Not Involved with Fire
<u>TIME FRAME:</u>	0:30
<u>LEVEL OF INSTRUCTION:</u>	I
<u>BEHAVIORAL OBJECTIVE:</u>	
Condition:	An oral quiz
Behavior:	The student will identify the tactics to use on a flammable gas leak NOT involved with fire
Standard:	To the instructor's satisfaction according to 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 2-1
<u>PREPARATION:</u>	<p>Many of the Flammable Gas incidents you respond to will involve leaks. These can be caused by a variety of ways from a valve breaking or a large object coming into contact with the storage unit.</p> <p>The storage unit can be a vessel or pipeline.</p> <p>During this session you will be given information on methods to use to safely handle one of these leaks. Your main objective is to dissipate the gas, keep it from igniting and shut off, if possible, the source of the leak.</p>

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON
FLAMMABLE GASES NOT INVOLVED WITH FIRE

PRESENTATION

APPLICATION

NOTE: Vapors can travel up to 5,000 feet.

- A. Use full protective turnout gear

- B. Use self-contained breathing apparatus (SCBA)

- C. Use water fog
 - 1. Three lines
 - 2. 95 gallons per minute minimum

- D. Have a plan of shutoff, prior to moving up to the leak
 - 1. Proper equipment

- E. Water fog to reduce vapors
 - 1. Multiple streams
 - a) One at point of release
 - b) Two 50' to 75' downwind
 - 1) On opposite sides of vapor cloud

- F. Check for and remove any ignition sources

- G. Have a safety officer

- H. Have a back up crew
 - 1. 1 1/2" hose w/95 GPM nozzle flow minimum

What protective gear should be used?

What is the minimum size of a back up crew?

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON
FLAMMABLE GASES NOT INVOLVED WITH FIRE

PRESENTATION	APPLICATION
<p>2. Three personnel</p> <ul style="list-style-type: none">a) Officerb) Two fire fighters <p>I. Shut off crew</p> <ul style="list-style-type: none">1. Two - 1 1/2" hose lines w/ 95 GPM nozzles minimum2. Five personnel (minimum)<ul style="list-style-type: none">a) Officerb) Four fire fighters <p>J. Move with caution</p> <ul style="list-style-type: none">1. Listen for directions from Safety Officer <p>K. After shut off isolate area until gas has dispersed</p> <ul style="list-style-type: none">1. Continue using fog <p>L. If gas cannot be shut off isolate area and continue using water fog to disperse vapors until vessel is empty</p> <p>M. Work on windward, if possible</p> <p>NOTE: Vapors can travel up to 5,000 feet</p>	<p>How large should the shut off crew be?</p> <p>How can you disperse vapors?</p>

RETIRED CURRICULUM

PRESENTATION

APPLICATION

II. PROCEDURES FOR GAS LEAK ON A PIPELINE

- A. Use full protective gear
- B. Use SCBA
- C. Follow all previous procedures with these added dynamics
 - 1. If this is a leaking valve do not shut off until cleared by pipeline company to do so
 - 2. If this is a leak in the pipe shut off may occur several miles away
 - 3. The line will flow for several hours
 - a) Continue to use fog nozzles to disperse vapors

III. LEAK INVOLVING LIQUID IN A GAS UNIT - PIPE OR VESSEL

- A. Do not walk into liquid
- B. If crew is exposed to liquid flush with copious amounts of water.
 - 1. Do not rub affected areas
- C. If liquid is on ground
 - 1. Flush affected area with water
 - a) Vapor cloud will form

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON
FLAMMABLE GASES NOT INVOLVED WITH FIRE

SUMMARY:

When you are going to try and stop a flammable gas leak wear proper protective equipment. Have a Safety Officer. Have proper crew, water, nozzles and water available. Use extra caution around the liquid gas. Use water to disperse vapors and liquids. Always have a plan. Work upwind, if possible.

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.

RETIRED CURRICULUM

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON
FLAMMABLE GASES INVOLVED WITH FIRE

<u>TOPIC:</u>	Tactics to Utilize on Flammable Gases (Propane) Involved with Fire
<u>TIME FRAME:</u>	0:30
<u>LEVEL OF INSTRUCTION:</u>	I
<u>BEHAVIORAL OBJECTIVE:</u>	
Condition:	An oral quiz
Behavior:	The student will identify the tactics to utilize on a Flammable Gas leak involved with fire
Standard:	To the instructor's satisfaction according to 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 2-1
<u>PREPARATION:</u>	<p>Now the leak has ignited. We have a whole new situation. You have a couple of choices you have to make. One is to evacuate and let it burn out, and the other is to shut it off.</p> <p>If you can't apply the proper amount of water you have only one choice; evacuate NOW. During this session you will be given information on handling one of these incidents. The size and complexity of the fire will require different decisions, we will try to provide you with most of these decisions.</p>

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON
FLAMMABLE GASES INVOLVED WITH FIRE

PRESENTATION

APPLICATION

I. GAS FIRE INVOLVING A VESSEL

A. Use full protective clothing

B. If fire is impinging on vessel

1. Listen for an increase in noise level
2. If impinging for over five minutes evacuate

a) If you don't know... evacuate

3. If not place copious amounts of water on vessel

a) Large tank 1,000 gallon or more

1) 500 GPM at point of impingement

- Within five minutes otherwise evacuate

b) Small tank 999 gallon or less

1) 500 GPM at point of impingement

- Within five minutes otherwise evacuate

C. Limit the amount of personnel exposed and utilize unmanned master streams

What protective equipment should be used?

When should you evacuate?

How much water at point of impingement?

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON
FLAMMABLE GASES INVOLVED WITH FIRE

PRESENTATION	APPLICATION
<ul style="list-style-type: none">D. Safety officer must be presentE. Never approach a bullet tank from the sides - the ends may fail <p>II. FIRE INVOLVING A FLAMMABLE GAS LINE OR FLANGE</p> <ul style="list-style-type: none">A. Use of crews<ul style="list-style-type: none">1. Full crew and back up<ul style="list-style-type: none">a) Crews will get wet<ul style="list-style-type: none">1) Try to keep them dry if possibleB. Use 95 GPM nozzlesC. Shut off valves<ul style="list-style-type: none">1. If line cannot be shut down use water to cool flange, valves, pipes, and any other exposures until gas is shut off at a remote site or runs out2. Do not shut off valve without advice from pipeline engineer3. Never extinguish an LPG fire unless the fuel supply can first be shut off	

INSTRUCTOR GUIDE

TACTICS TO UTILIZE ON
FLAMMABLE GASES INVOLVED WITH FIRE

SUMMARY:

A gas leak fire poses a couple of problems, one is a boiling liquid expanding vapor explosion which will be discussed in the next session and failure of valves and flanges due to exposure to fire. Keep vessels and other devices cool with water. If you are not sure of the situation EVACUATE to a 5000 foot radius and let it burn out.

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 pages in your Student Manual or Information Sheets in order to prepare yourself for the upcoming quiz. Study for our next session.

RETIRED CURRICULUM

INSTRUCTOR GUIDE

TOPIC: BLEVE Situations

TIME FRAME: 0:30

LEVEL OF INSTRUCTION: I

BEHAVIORAL OBJECTIVE:

Condition: An oral quiz

Behavior: The student will identify BLEVE situations and the safety precautions utilized for same.

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

MATERIALS NEEDED:

- Writing board with markers/erasers
- VCR with monitor
- LP Gas: Emergency Planning and Response video, NFPA, 1986
- Information Sheet 2-1

REFERENCES:

- Information Sheet 2-1

PREPARATION: Several years ago in Yucca Valley there was a large propane explosion. One fire fighter was killed, another spent months in the hospital getting burn treatments that could only be described as pure torture. The explosion wasn't named, it was just called an explosion.

A few years later in Kingman, Arizona a railroad tank car became involved with fire. The tank had 25000 gallons of a Liquified gas petroleum product called PROPANE. It also exploded killing 12 Kingman fire personnel. This time they had a name for it. BOILING LIQUID EXPANDING VAPOR EXPLOSION or BLEVE for short. During this session you will be provided information on how it happens and what you have to do to NOT become its next victim.

During this session you will be given information on methods to use to safely handle one of these leaks. Your main objective is to dissipate the gas, keep it from igniting and shut off, if possible, the source of the leak.

PRESENTATION	APPLICATION
<p>I. METHODS OF IDENTIFYING A POTENTIAL BLEVE</p> <p>A. Sealed pressure vessel with direct flame impingement above liquid level (vapor space)</p> <ol style="list-style-type: none">1. Increase in noise level2. Increase in size of fire plume at relief valve3. Tank color changes4. Depression in tank shell <p>B. Pressure relief valve operating and louder</p> <p>C. Impingement for longer than 5 minutes</p> <ol style="list-style-type: none">1. Evacuate<ol style="list-style-type: none">a) At a 5,000 foot radius	<p>What are the signs of a potential BLEVE?</p>
<p>II. METHODS OF DEALING WITH POTENTIAL BLEVE</p> <p>A. Copious amounts of water at flame impingement</p> <ol style="list-style-type: none">1. Tank size 1,000 gallons and up<ol style="list-style-type: none">a) 500 GPM<ol style="list-style-type: none">1) In 5 minutes2) If not evacuated	<p>How much water?</p> <p>Evacuate how far?</p>

INSTRUCTOR GUIDE

BLEVE SITUATIONS

PRESENTATION	APPLICATION
<ul style="list-style-type: none">• 5,000 foot radius <p>2. Tank size 999 gallons and below</p> <ul style="list-style-type: none">a) 500 GPM<ul style="list-style-type: none">1) In three minutes <ul style="list-style-type: none">• Tanks construction is a thinner shell <ul style="list-style-type: none">2) If not evacuated <p><u>NOTE:</u> There are several recommended videos on the market, this is one of those.</p>	<p>Why in three minutes?</p> <p>Show video LP Gas: Emergency Planning and Response (19 minutes)</p>

RETIRED CURRICULUM

SUMMARY:

The film says it all. If you can't take immediate steps then evacuate a minimum of 5,000 feet. The radiation from the ball of fire and the resulting shrapnel can injure and kill. Be aware of the signs of BLEVE, it can happen very fast. If you notice in this lesson the word evacuate is used extensively. It can be a positive action.

EVALUATION:

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

ASSIGNMENT:

Review your notes and appropriate pages in your Student Manual or Information Sheets in order to prepare yourself for the upcoming quiz. Study for our next session.

RETIRED CURRICULUM

INSTRUCTOR GUIDE

FIELD EXERCISES

TOPIC: Field Exercises

TIME FRAME: 3:00

LEVEL OF INSTRUCTION: II

BEHAVIORAL OBJECTIVE:

Condition: Field exercises

Behavior: The student will

- 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

MATERIALS NEEDED:

- 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

REFERENCES:

- FLAG manual
- Information Sheet 7-1

PREPARATION:

1. Select or develop a scenario
 - a) Select the site for the exercises
 - b) Check with local pollution board for burn day approvals (if applicable)
 - c) Assemble the required equipment
 - d) Divide the class into groups by assigned roles
2. Brief students as to their roles and responsibilities
3. Conduct the exercises
4. Clean up site and equipment
5. Conduct a debriefing

PRESENTATION	APPLICATION
<p><u>NOTE:</u> Distribute Information Sheet 7-1</p>	<p><u>OHT 7-1</u></p>
<p>I. FLAMMABLE LIQUIDS AND GASES TRAINING EXERCISE</p>	<p><u>OHT 7-2/OHT 7-3</u></p>
<p><u>NOTE:</u> 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.</p>	
<p>A. Flammable liquid pit prop</p> <p>1. Water extinguishment</p> <p>a) Objective</p> <p>1) Shut off valve located inside pit at front of prop</p> <p>b) Procedure</p>	<p><u>OHT 7-4</u></p>
<p>1) Attack prop from front</p> <p>2) Push flames away from valve</p> <ul style="list-style-type: none">• Do not reach through fog pattern to shut off valve• Hold nozzles steady <p>3) Turn the handle clockwise at least three revolutions</p>	<p><u>OHT 7-5</u></p>

RETIRED CURRICULUM

INSTRUCTOR GUIDE

FIELD EXERCISES

PRESENTATION

APPLICATION

- Back out 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 - 1 1/2" 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

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	

RETIRED CURRICULUM

PRESENTATION	APPLICATION
<p data-bbox="412 331 630 367">b) Procedure</p> <ol data-bbox="483 478 1079 1396" style="list-style-type: none"><li data-bbox="483 478 868 514">1) Attack prop from front<li data-bbox="483 556 1079 703">2) Use two nozzles to push flames away from the valve<ul data-bbox="560 661 917 703" style="list-style-type: none"><li data-bbox="560 661 917 703">• Hold nozzles steady<li data-bbox="483 735 1031 882">3) Move up slowly<ul data-bbox="560 808 1031 882" style="list-style-type: none"><li data-bbox="560 808 1031 882">• Insure there are no breaks in the fog stream<li data-bbox="483 913 1063 997">4) Do not reach through the fog pattern to shut off the valve<li data-bbox="483 1029 1023 1207">5) Shut off valve at the bottom of the prop<ul data-bbox="560 1134 1023 1207" style="list-style-type: none"><li data-bbox="560 1134 1023 1207">• Turn the handle clockwise at least three revolutions <p data-bbox="402 1428 620 1463">c) Personnel</p> <ol data-bbox="479 1501 1063 1795" style="list-style-type: none"><li data-bbox="479 1501 860 1537">1) One team/crew leader<li data-bbox="479 1575 998 1610">2) Six crew persons on attack lines<li data-bbox="479 1648 1063 1684">3) Three safety crew persons on the left<li data-bbox="479 1722 1015 1795">4) Three safety crew persons on the right	<p data-bbox="1128 409 1250 445"><u>OHT 7-4</u></p> <p data-bbox="1120 1249 1242 1285"><u>OHT 7-5</u></p>

PRESENTATION	APPLICATION
<p>d) Equipment</p> <ol style="list-style-type: none">1) Four - 1½" hose lines and nozzles2) For training purposes only, set nozzles at 60 GPM <p>4. Pipe and valve prop</p> <p>a) Objective</p> <ol style="list-style-type: none">1) Two shut off valves<ul style="list-style-type: none">• One on the right• One on the left <p>b) Procedure</p> <p><u>NOTE:</u> Prop is a simulated three dimensional flammable liquid leak.</p> <ol style="list-style-type: none">1) Attack prop from front2) Use two nozzles to push fire away from the valve3) Move up onto the prop slowly4) Protect crew with two fog patterns5) Push the flames away from the valve6) Do not reach through the fog pattern to shut off the valves7) Turn clockwise at least three complete revolutions	<p><u>OHT 7-4</u></p>

RETIRED CURRICULUM

INSTRUCTOR GUIDE

FIELD EXERCISES

PRESENTATION	APPLICATION
<p>8) Back out using full fog patterns</p> <p>9) Until clear of the prop</p> <p>c) Personnel</p> <ul style="list-style-type: none">1) One team/crew leader2) Six crew persons on attack lines3) Three safety crew persons on the right4) Three safety crew persons on the left <p>d) Equipment</p> <ul style="list-style-type: none">1) Four - 1 1/2" hose lines with nozzles2) For training purposes only set nozzles at 60 GPM <p>B. Tank Prop, Gases (left side)</p> <ul style="list-style-type: none">1. Objectives<ul style="list-style-type: none">a) Shut off valve, located on left side of prop2. Procedures<ul style="list-style-type: none">a) Attack prop from front <p><u>NOTE:</u> 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.</p>	<p><u>OHT 7-5</u></p> <p><u>OHT 7-4</u></p>

RETIRED CURRICULUM

PRESENTATION	APPLICATION
<ul style="list-style-type: none">b) Approach the prop slowly<ul style="list-style-type: none">1) Do not reach through fog pattern to shut off valvec) Turn valve at least three revolutionsd) Back out with full fog patternse) Shut off when clear of the prop3. Personnel<ul style="list-style-type: none">a) One team/crew leader<ul style="list-style-type: none">1) Six crew persons on attack linesb) Three safety crew persons on the rightc) Three safety crew persons on the left4. Equipment<ul style="list-style-type: none">a) Four - 1½" hose lines with nozzlesb) For training proposes only, set nozzles at 60 GPMC. Tank Prop, Flammable liquid (Right side)<ul style="list-style-type: none">1. Objective<ul style="list-style-type: none">a) Shut off flow of fuel to the top of the tank<ul style="list-style-type: none">1) Turning the valve one quarter turn2. Procedure	<p>OHT 7-5</p> <p>OHT 7-4</p>

INSTRUCTOR GUIDE

FIELD EXERCISES

PRESENTATION	APPLICATION
<p>a) Attack the prop from the front side</p> <p><u>NOTE:</u> This prop simulates a valve that has been left on and is overflowing the tank.</p> <ol style="list-style-type: none">1) Move the crew slowly to the right side2) Front of the tank3) Push the flames and liquid away4) From the crew <p>b) Do not reach through the fog pattern</p> <ol style="list-style-type: none">1) To turn off valve2) Move valve one quarter turn	
<p><u>NOTE:</u> This valve simulates a ball valve.</p> <p>c) When the valve is closed</p> <ol style="list-style-type: none">1) Back out using full fog pattern for protection2) Until clear of the prop <p>3. Personnel</p> <ol style="list-style-type: none">a) One team/crew leaderb) Six crew persons on attack lines<ol style="list-style-type: none">1) Three safety crew persons on the left2) Three safety crew persons on the right	<p><u>OHT 7-5</u></p>

INSTRUCTOR GUIDE

FIELD EXERCISES

PRESENTATION

APPLICATION

c) You may have to use three lines to control prop

4. Equipment

a) Four - 1 1/2" lines with nozzles

b) Nozzles may be set at 60 GPM

RETIRED CURRICULUM

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.

RETIRED CURRICULUM

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.

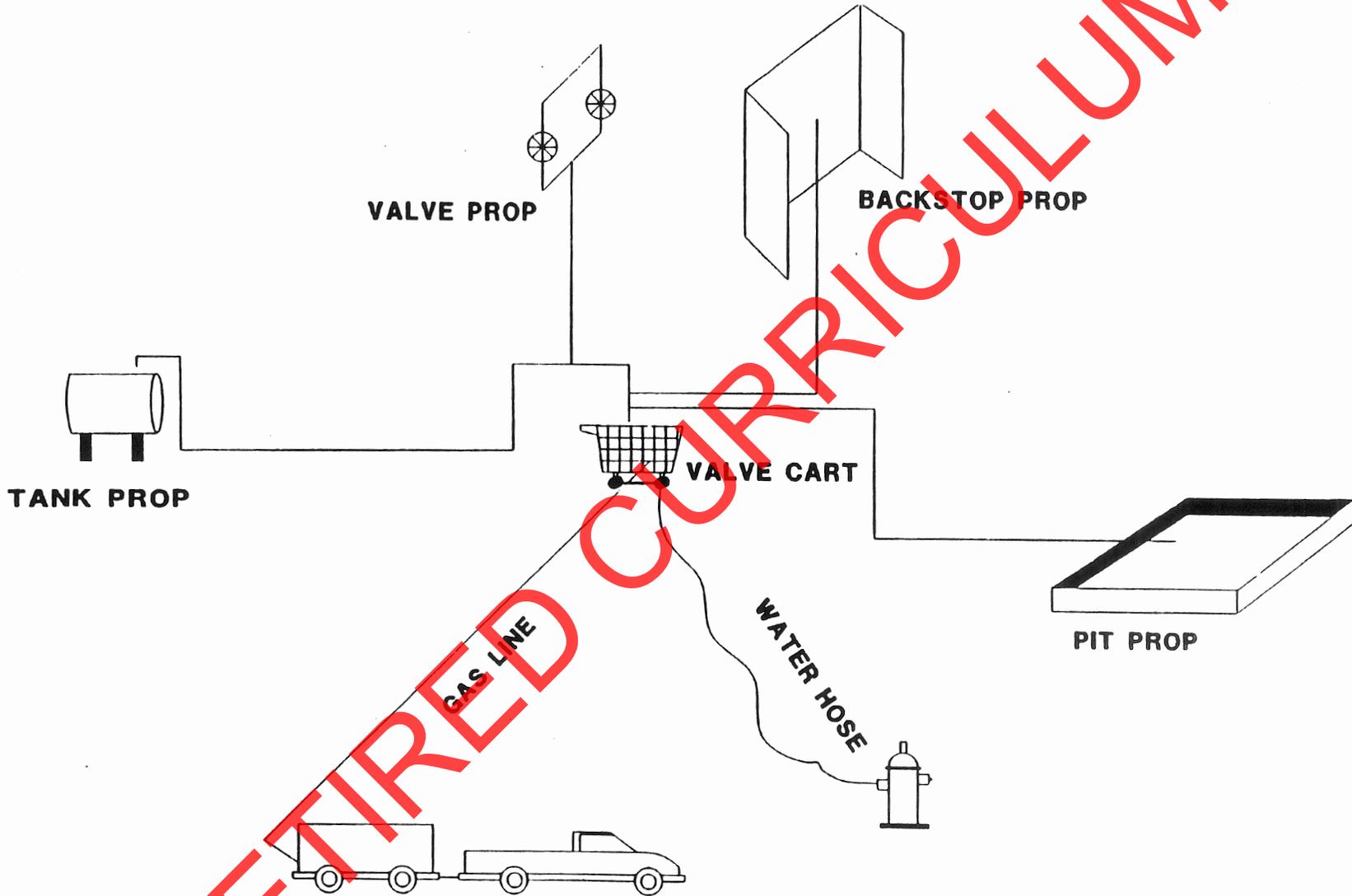
"Step" - Team or group members move forward in unison using the "shuffle step" on the command "step" given by the leader. When the command is given, slide the lead foot forward, maintaining contact with the ground as much as possible with both feet. Then move the trailing foot forward to normal spacing. 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!**



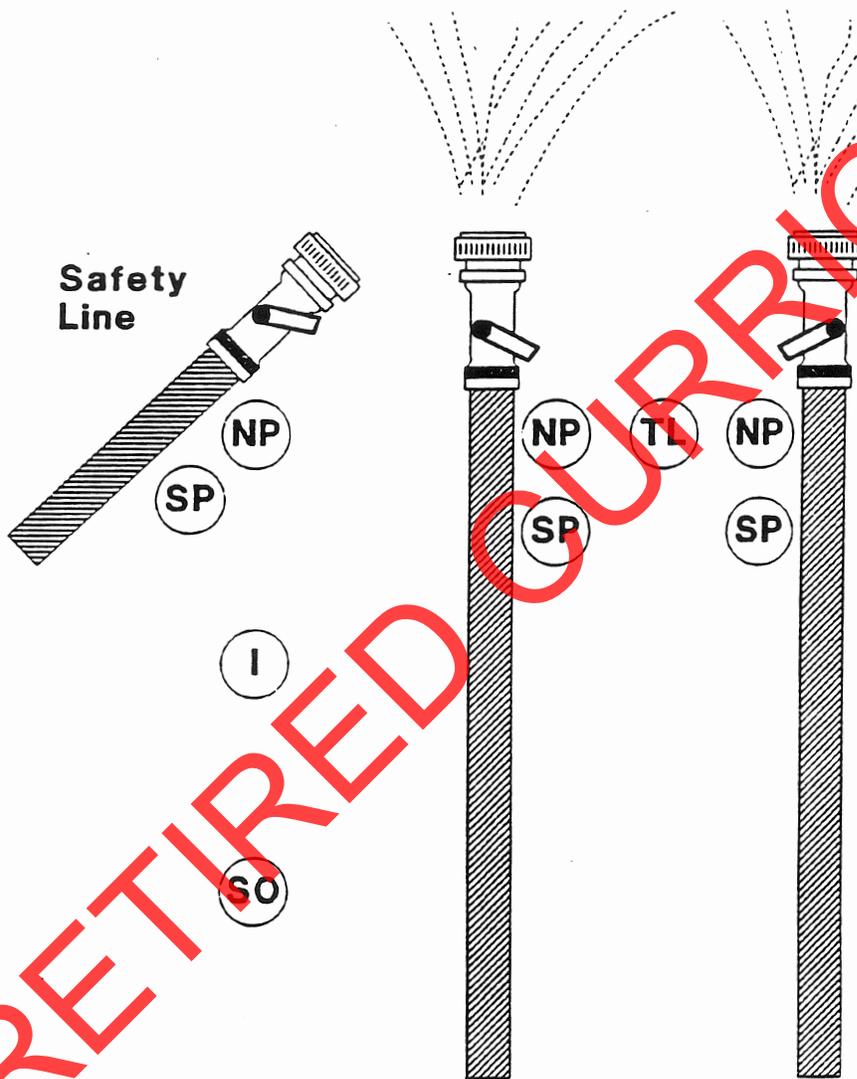
F.D.A.G. Trailer Layout Overview

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Attack Group Overview

(Minimum Staffing)

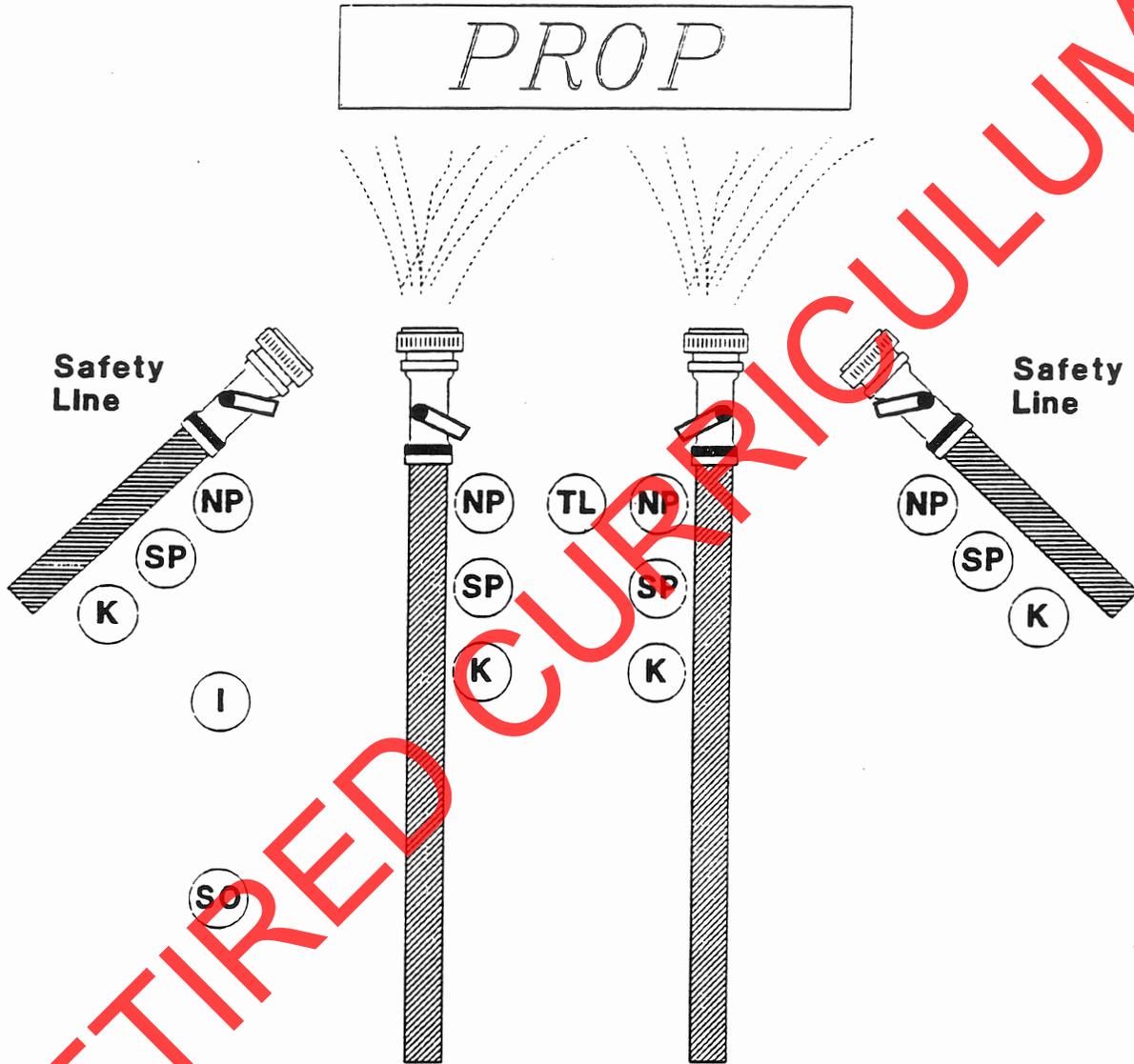
PROP



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

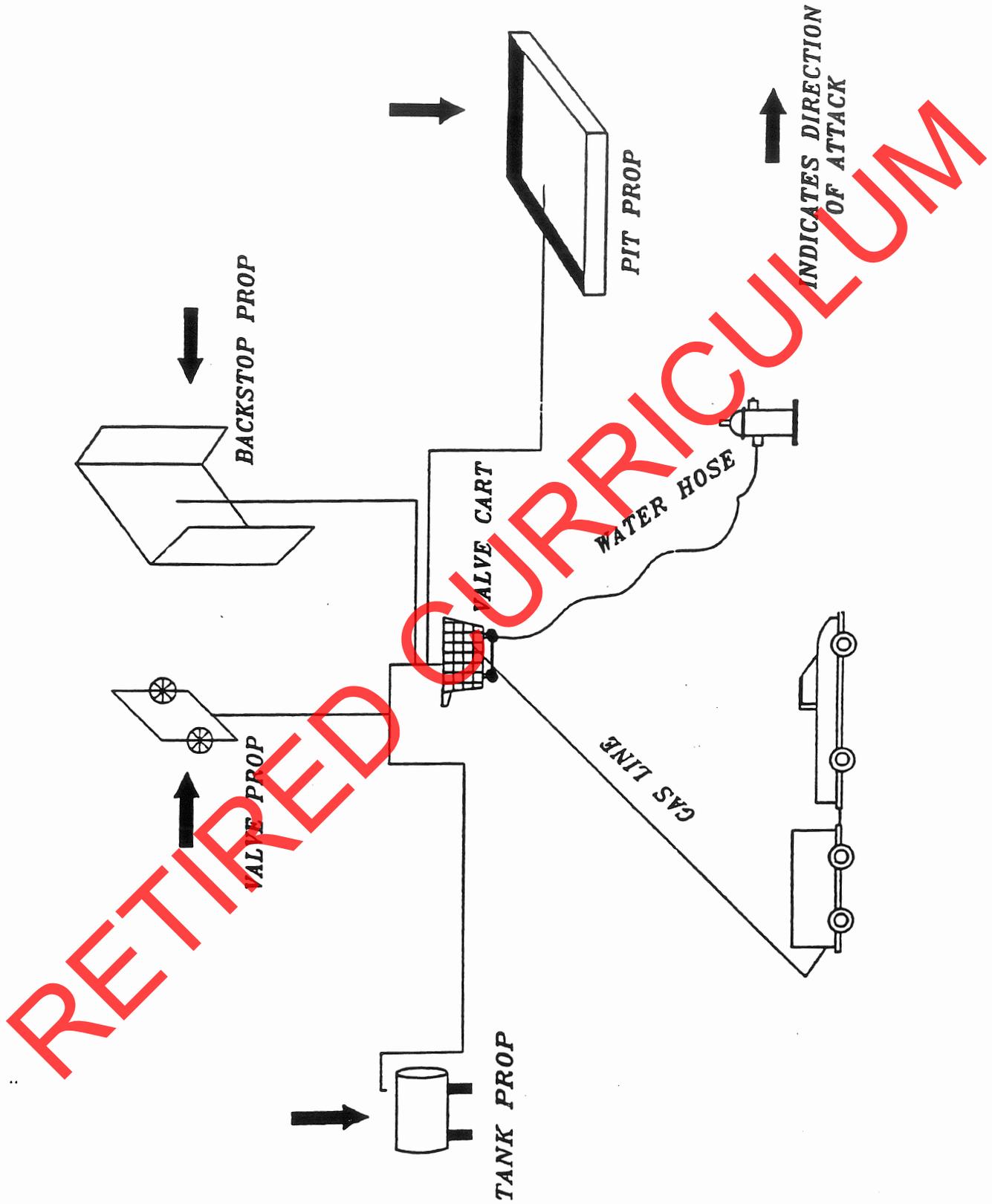
Attack Group Overview

(Recommended Staffing)



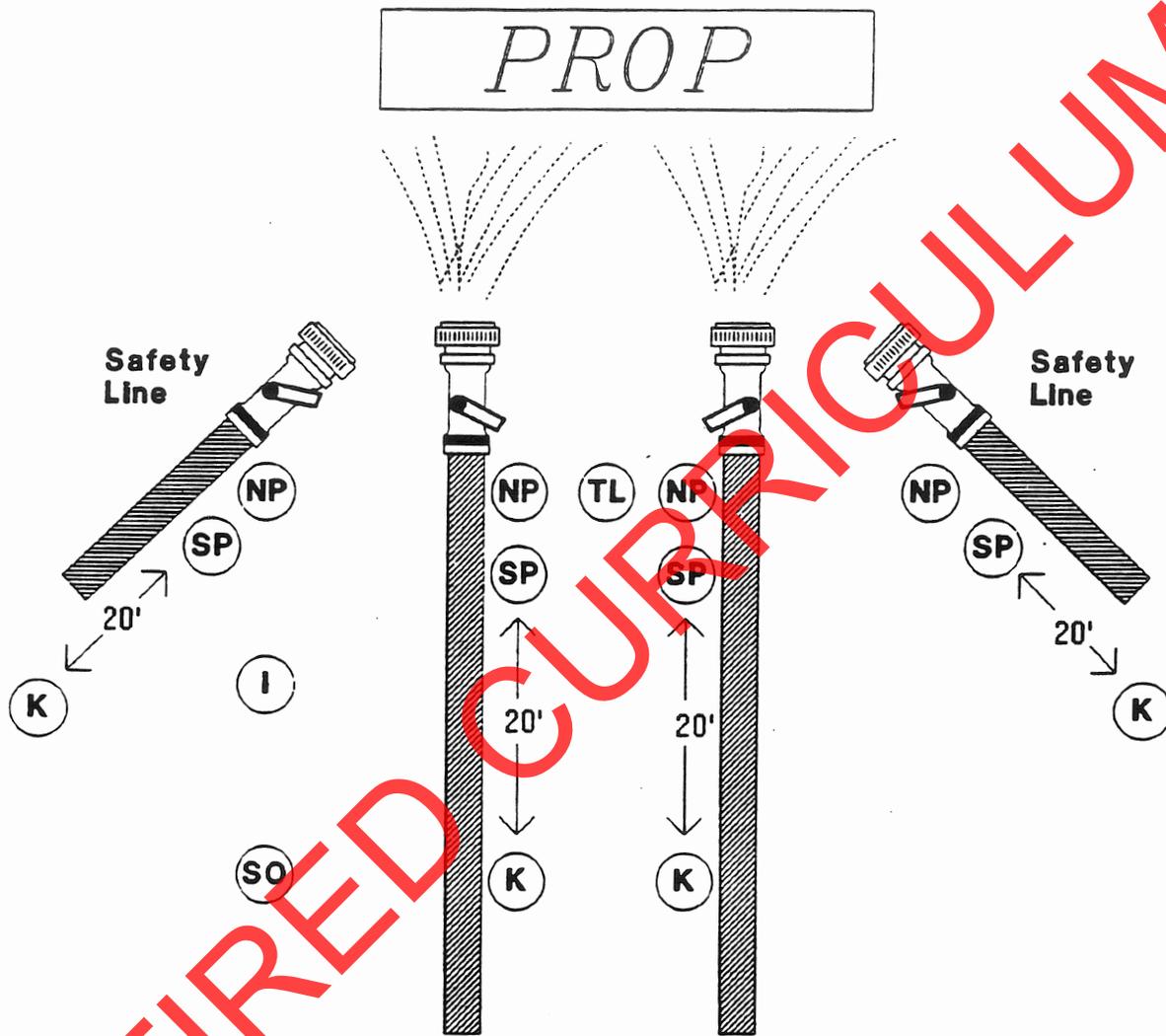
NP = Nozzle Person
SP = Support Person
K = Kinker

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



Backout Overview

(Recommended Staffing)



- NP ■ Nozzle Person
- SP ■ Support Person
- K ■ Kinker
- TL ■ Team/Crew Leader
- I ■ Instructor
- SO ■ Safety Officer

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