CHAPTER 7: HAZARD-SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

Chapter Overview

The environment, region, and circumstances in which rope rescues take place present unique hazards and risks to everyone involved. As a result, it is crucial for emergency responders to secure hazard-specific personal protective equipment (PPE) and eliminate distractions that can hinder rescue efforts to reduce the risk of injury, permanent disability, and death in these settings.

PPE items of particular importance include protective garments, footwear, gloves, helmets, and harnesses. All items must be regularly inspected and properly maintained in order to ensure the integrity of the equipment.

While the NFPA provides classifications and standards for harnesses and guidance regarding the care of PPE equipment in general, it does not provide standards for the other specific types of PPE required for high-angle rope rescue activities. However, several other sources and NFPA standards can be used as a starting point when attempting to determine which types of PPE are most appropriate for use in rope rescue operations.

Objectives and Resources

**Knowledge Objectives**

After studying this chapter, you should be able to:

 Differentiate personal protective equipment from rescue equipment.

 Define hazard-specific personal protective equipment. (p. 98)

 Identify the standards associated with rope rescue personal protective equipment. (p. 98 – 103)

 Explain the considerations for selecting personal protective equipment for rope rescue operations. (p. 98 – 103)

 Explain the differences among harness classes and what each is used for. (pp. 103 – 107)

 Identify the considerations for selecting a harness. (pp. 103 – 107)

 Identify at least two methods of constructing an emergency harnesses. (pp. 103 – 107)

 Identify the personal tools and equipment a rope rescuer might carry. (pp. 107 – 108)

 Describe how to clean personal protective equipment. (NFPA 1006: 5.2.2, p. 109)

 Describe inspection of personal protective equipment for damage, defects, or wear. (NFPA 1006: 5.2.2, pp. 108–109)

 Identify the documentation and recordkeeping recommendations for rope rescue personal protective equipment. (NFPA 1006: 5.2.2, pp. 108–109)

**Skill Objectives**

After studying this chapter, you should be able to:

 Create an emergency hasty harness. (pp. 105 – 106)

 Clean rope rescue personal protective equipment. (NFPA 1006: 5.2.2, p. 109)

 Inspect rope rescue personal protective equipment for damage, defects, or wear. (NFPA 1006: 5.2.2, pp. 108–109)

Support Materials

 Dry-erase board and markers or chalkboard and chalk

 LCD projector, slide projector, overhead projector, and projection screen

 PowerPoint presentation or slides

 **Navigate for Students**

 **Advantage**

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Reading and Preparation

Review all instructional materials, including *Rope Rescue: Principles and Practice,* Fifth Edition, Chapter 7, and all related presentation support materials.

Chapter Presentation Overview

Pre-lecture

I. You Are the Rescuer

Small-Group Activity/Discussion

Purpose

The purpose of this activity is to introduce students to concepts surrounding the understanding and management of water rescue incidents.

Instructor Directions

1. Direct students to read the “You Are the Rescuer” scenario found at the beginning of Chapter 7 (p. 98).

2. You may assign students to a partner or a group. Direct them to review the discussion questions at the end of the scenario and prepare a response to each question. Facilitate a class dialogue centered on the discussion questions.

3. You may also assign this as an activity and ask students to turn in their comments on a separate sheet of paper.

Lecture

I. Introduction

A. Review the learning objectives

B. Equipment used by rescuers generally fits into one of two categories:

1. Personal protective equipment (PPE)

a. Items typically worn by a rescuer to provide protection against recognized hazards

2. Rescue equipment

a. Gear used to perform a rescue task

C. By choosing clothing and personal equipment for the high-angle environment, the margin of safety and comfortability increases, as does the rescuer’s ability to perform tasks efficiently and effectively

D. The choice of PPE is influenced by many factors, including:

1. Regulatory requirements

2. Requirements of the authority having jurisdiction (AHJ)

3. Environment

4. Personal preference

E. Variations in PPE exist as a result of many factors, including:

1. Region

2. Local protocol

3. Temperature variations

4. Available resources

F. Hazard-specific criteria can be defined as:

1. Equipment particularly suited for protection against the hazards common to rope rescue

2. Equipment inherent in rescue disciplines addressed by the following standards:

a. NFPA 1006, *Standard for Technical Rescue Personnel Professional Qualifications*

b. NFPA 2500, *Standards for Operations and Training for Technical Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services*

**G. Hazards imposed by the workplace, and any other relevant hazards, should also be taken into consideration when choosing PPE, including:**

1. Electrical hazards

2. Fire-ground environment

3. Chemical

4. Nature

II. Rope Rescue Personal Protective Equipment

**A. Just because an item of hazard PPE meets regulations and safety requirements does not mean that the equipment is adequate for rope rescue purposes or for a given rescue.**

1. NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting,* subjects garments considered for firefighting to measurable test criteria, including:

a. Heat

b. Flame

c. Chemical resistance

2. The criteria measured by NFPA 1971 are generally not important factors for rope rescue operation; therefore, it not an appropriate standalone reference or specification for rope rescuers.

**B. Universal standards are not available for rope rescue PPE because operations can occur in virtually any environment and the protection required varies with accompanying hazards.**

**C. The AHJ may require that rope rescuers adhere NFPA 2500 or previous editions of NFPA 1983, *Life Safety Ropes and Equipment,* when choosing PPE.**

**D. A mindset that prioritizes maximum protection of the rescuer over one that focuses on simple compliance is crucial when selecting PPE for rope rescue operations.**

**E. Equipment selection depends upon several factors, including:**

1. Local standard operating procedures

2. Regulatory compliance

3. Performance specifications, size, color, and other measurable factors

4. Other factors such as comfort, fit, value, durability, and other personal preferences

**F. Protective garments**

1. There are currently 11 different NFPA standards related to clothing worn by rescuers; however, none of these standards are specific to high-angle rope work.

2. Two of the 11 standards, though still not directly related to rope rescue, provide some helpful information.

a. NFPA 1951, *Standard on Protective Ensembles for Technical Rescue Incidents,* and its accompanying user guide address parameters for protection against elements (e.g., surface abrasion and thermal conditions) and even comfort and ergonomics, none of which are specific to rope rescue.

b. NFPA 1977, *Standard on Protective Clothing and Equipment for Wildland Fire Fightin*g, heavily informs the US Fire Authority (USFA) report, *Protective Clothing and Equipment Need of Emergency Responders to US&R Missions*.

i. The USFA document is focused on Urban Search & Rescue (US&R); however, it provides a good starting point.

ii. It acknowledges a need for mobility and comfort and the fact that incidents often occur over an extended period as the most significant risks technical rescuers face.

3. In fire service definitions, the term technical rescue most often refers to the following:

a. Building/structural collapse

b. Vehicle/machinery extrication

c. Confined space entry

d. Trench rescue

e. Water rescue

4. When selecting garments for rope rescue operations, the following should be considered:

a. Comfort

b. Mobility

c. Dexterity

d. Fit (i.e., form-fitting but not too tight)

e. Elements that can cause obstructions (e.g., loose edges or wayward straps)

f. Coverage and durability against abrasion and tears

g. Comfortability overextended periods

h. Thermal protection relative to the environment, whether hot, cold, wet, or dry

5. Dressing in layers works well for rope rescuers. Each layer chosen should be specially selected for its ability to achieve a specific purpose:

a. Base layer wicks moisture

i. Some of the best base layers to use for wicking moisture (sweat) away from the skin are wicking synthetics such as polypropylene.

ii. Many of these synthetics are plastic-based and can melt, shrink, or stick to the skin when exposed to heat and flame.

b. Insulating layer provides warmth (if needed)

i. This layer must also protect the wearer against chilling even when wet, either from precipitation or perspiration.

ii. The ability to retain air in the fibers and not get wet from outside or inside the garment is key.

iii. Pile fleece or down are good choices, as thick, bulky insulative layers can restrict movement.

c. Final layer provides environmental protection (if needed)

i. The final layer may provide protection against weather conditions or against contaminants.

ii. Bulky garments should be avoided, as should garments that are too loose or floppy because they can get in the way or become entangled in rigging.

6. Shirts and pants must be sized so that they do not bind when the arms are extended above the head or when the legs are raised.

7. Clothing should provide maximum comfort during the anticipated activity.

8. Ensembles or jumpsuits made of Nomex, aramid, or FR cotton may not be adequate for teams operating in a wilderness environment.

9. Where a variety of hazards exist, priorities must be carefully balanced and protection suited to the conditions and exposures that pose the greatest risk and consequence to the rescuer.

**G. Footwear**

1. The requirements for footwear include:

a. Comfort

b. Protection

c. Adhesion

2. Leather is still the material with the qualities most needed in a multipurpose boot for rope rescue.

3. Boots should provide the following:

a. Support to the ankles

b. Protection against scrapes, cuts, and bruises

c. Pliability that allows comfortable after hours of standing or walking

d. Non-slick soles to help the wearer maintain balance

4. Rubber boots (e.g., those commonly used in the fire service) are not appropriate for rope rescue operations.

5. Lug soles are optional if the footwear offers proper adhesion and may actually be a disadvantage because some types of lug soles may become dangerously slick when wet or caked with mud.

6. Technical climbing boots may be used for specialized rock climbing.

a. The soles of technical climbing boots are constructed of special rubber compounds that may adhere to rocks better and often feature a welt to make it easier to execute certain techniques.

b. These boots are not comfortable for walking or standing for long periods.

7. Socks must meet the same requirements as other footwear (e.g., warmth, comfort, and prevention of injury such as blisters).

a. A two-sock combination can reduce friction on the skin that causes blisters.

i. Inner sock wicks moisture away from the foot; often made of a synthetic.

ii. Thick outer sock provides protection and increased warmth; often made of wool.

**H. Gloves**

1. Requirements for gloves include:

a. Protection against burns and abrasions

b. Comfort

c. Durability and dexterity

i. Heavy leathers offer durability and heat resistance, while soft leathers offer dexterity.

ii. Extra layers and padding in the body of the glove offer protection from friction.

2. “Fast-rope gloves” are not appropriate for rope rescue operations.

a. Fast-roping is a special technique for tactical helicopter insertions.

b. If you need gloves with such extra heat protection (more than a few layers of leather), you are rappelling too fast for rescue ropework.

**I. Helmet**

1. It is imperative that rescuers choose a well-fitting helmet specifically designed for work/rescue at height.

2. Helmets provide the following benefits:

a. Protection against injury

b. Reduced severity of injury from falling objects (e.g., rocks or climbing hardware)

c. Reduced severity of brain injury should the wearer fall and hit their head

3. Structural firefighting helmets are inadequate for rope rescue operations for the following reasons:

a. They are often heavy and lack a chin strap/retention system that works well for rope rescuers.

b. These helmets can obstruct vision and make it difficult to maneuver in confined and cluttered rescue environments.

c. They are uncomfortable to wear for long periods and/or in hot weather.

4. Other types of helmets may provide only an illusion of protection and can actually be dangerous to the wearer.

5. Rope rescue teams should only purchase helmets specifically designed for rope rescue activities; these helmets should include the following:

a. Secure chin strap

i. Elastic chin straps are not suitable for rope rescue work because they stretch when stressed.

ii. This can cause the helmet to flip off the head when the helmet is under stress and leave the wearer without head protection.

b. Three-point retention system

i. This system, which should be part of any helmet used for rope rescue activities, provides a third retention point at the back of the helmet to keep it from falling forward over the eyes.

ii. “Three-point” refers to the three locations (left side, right side, rear) of security relative to the head, not the number of rivets in the helmet itself.

iii. Neither the NFPA standards nor the ANSI Z89.1 standard address this concept, though European standard EN 397 standard for industrial helmets and EN 12492 standard for mountaineering helmets do.

iv. The easy release feature of a three-point retention system is covered in EN 397.

v. If a helmet that is designed to release easily is needed (e.g., the user’s head become wedged during an operation), a quick-release chin strap feature may be selected.

vi. A good high-angle helmet should have a chin strap that requires much greater force to cause release to help keep the helmet on the user’s head in the event of a fall.

c. Shell

i. Plastic, fiberglass, Kevlar, or composite materials are often used in the construction of the shells of helmets used in high-angle rope.

ii. The shell should be rigid enough to resist penetration by sharp objects, but flexible enough to absorb some of the blow that otherwise would be directly transmitted to the skull and spine.

iii. The helmet should protect the head against objects falling from above and hitting from the side.

d. Inside suspension

i. The helmet may hold the shell away from the skull, either through an inside suspension system or a layer of impact-resistant Styrofoam-like material.

ii. Air circulation and comfort, particularly during hot weather or sweat-inducing labor and durability during carrying and storage, should be considered.

iii. A slight brim will help to deflect dropped objects and prevent rainwater or spray from dripping into the face.

iv. Coverage on the sides, back, and front should provide adequate protection while still allowing a good upward field of vision.

v. The design should ensure that the back of the helmet cannot get caught on equipment when carried backpack style (e.g., rope bags or rescue kits).

III. Harnesses for Rescue

**A. Recreational climbing harnesses can be used for rescue (or vice-versa), though caution should be used when selecting a harness for rope rescue operations.**

1. The harness that most closely meets the performance requirements associated with the application should be selected. Consider the following:

a. Climbing harnesses

i. Construction is generally lighter in weight and cut for ease of movement.

ii. They are made for recovering from leader falls.

iii. The attachment point generally consists of reinforced webbing loop that sits a bit lower.

b. Rescue harnesses

i. The construction is usually heavier and bulkier because they have wider webbing and padding for comfort for rescuers who must sit in suspension for longer periods.

ii. The attachment point on a rescue harness is typically a bit higher, more suited to prolonged suspension.

iii. Climbing harnesses have a reinforced webbing loop to which a rope may be tied directly, or a carabiner clipped.

c. Caving harness

i. Caving harnesses are more similar to a climbing harness than a rescue harness.

ii. The main attachment point sits even lower, for better functionality with ascending systems.

iii. Abrasion guards are often included on the seat and/or leg loops and may be paired with an independent chest harness to support a more efficient ascending system.

iv. The straps tend to be narrow, not designed for extended periods of sitting in suspension.

2. Features and benefits set harnesses apart from one another and can be used as determining criteria.

**B. NFPA 2500 (1983) classifies harnesses into two groups:**

1. Class II: a harness meant for heavy-duty work by one person or in rescue situations in which another person’s weight may be added in the course of the rescue

2. Class III: a full-body harness meant for fall protection and for use in rescues in which inversion may occur

**C. Class I harness**

1. Previous editions of NFPA 1983 included a Class I harness, but this harness type was removed for the 2012 edition, and does not exist in NFPA 2500. Instead, the term BELT is now used.

**D. Considerations for a secure, comfortable seat harness include the following:**

1. The harness should have waist, leg, and thigh supports to distribute body weight (or the force of a fall) over a relatively wide area.

2. Where support features contact the body, the webbing should be wide enough to provide comfort and not constrict blood flow. Padding can make the webbing even more comfortable.

3. Stitching should be securely and evenly sewn and of contrasting color so that abrasion and wear can be detected.

4. The harness should allow freedom of movement both when the rescuer is hanging in it and when wearing it on the ground.

5. The harness should be easy to put on and to adjust.

6. The harness should not slip down when the rescuer walks around.

7. When you fall and are caught by the harness, it should allow you to easily return yourself upright.

8. The harness must not allow rescuers to fall out when upside down.

9. The harness should have a front tie-in point designed so that rescuers maintain a correct center of gravity.

10. The stress points, such as the tie-in, should be faced with extra webbing and/or use heavy metal connectors.

11. Depending on how it is to be used, the harness should be certified as meeting appropriate standards.

**E. Harness seat**

1. No one seat harness design is suitable for everyone. Before selecting a particular seat, rescuers should try several different designs to see which one is best.

a. In certain circumstances, a Class III full-body harness may be preferable to a Class II seat harness:

i. When a person is involved in a dangerous activity that requires that they constantly be held upright

ii. When equipment is worn that makes a person top heavy (e.g., breathing apparatus)

iii. When a person is of greater than average weight

iv. During certain climbing or mountaineering activities when it is necessary to be held upright should a fall occur

v. For placement on a subject in certain rescue situations

b. A Class III harness, with separate seat-and-chest components, is preferred by many rescuers because it allows the wearer to choose options based on the specific conditions and can be less constraining than a Class II harness.

**F. The harness is perhaps the most important piece of personal gear. An unsuitable or poorly fitted rescue harness can cause severe discomfort, which can hinder rescue efforts, and can even be a danger to the wearer.**

**G. Portions of NFPA 2500 derived from NFPA 1858 provide guidance for the selection of harnesses for rescue and advocates that potential harnesses meet the minimum requirements of the equipment testing portions of NFPA 2500, as absorbed from NFPA 1983. NFPA 2500**

1. Harness materials exposed to heat, flame, chemicals, or water should be carefully considered (e.g., aramids or para-aramids).

2. Other features (e.g., gear loops, pockets, or methods for holding the loose ends of webbing) should enhance functionality of the harness without impeding its function.

3. When a harness is integrated with a bunker gear ensemble, it should not compromise the integrity of the protective gear as outlined in NFPA 1971 and vice versa.

**H. Victim extrication device**

1. NFPA 2500 makes provision for Class II and Class III victim extrication devices (i.e., a harness intended to be placed on a subject).

2. These harnesses are subjected to some of the same testing requirements as Class II and Class III rescuer.

3. Victim extrication devises might be easier to don but have fewer provisions for comfort.

4. Emergency harnesses

a. A tied emergency seat harness may be constructed in the field with a piece of rope or webbing to protect either a rescuer or a subject.

b. While not addressed by NFPA, it is a good skill for a rescuer to know.

c. Diaper emergency harness

i. The diaper-style emergency harness is constructed using a piece of webbing or rope, usually around 10 to 12 feet (3 to 3.7 m) in length.

ii. Skill Drill 7-1: Creating a Diaper Style-Harness

iii. Limitations to this type of harness include notable lack of security, low comfort, minimal adjustability, and a tendency to not stay in place well when not under tension.

d. Swiss-seat emergency harness

i. A slightly more adjustable harness, the Swiss-seat emergency harness takes a bit longer to tie but is arguably more secure.

ii. Skill Drill 7-2: Creating a Swiss Seat Emergency Harness

iii. These emergency harness ties may be used in a pinch but should not be used as the standard or as a long-term solution.

iv. A well-engineered harness should support the pelvic girdle so that a person’s weight does not create pressure points on the nerves and arteries in the groin and back.

v. No harness is totally comfortable, but the tied seat harness tends to cause greater discomfort and even circulatory problems after long periods of time.

5. Pickoff seat (rescue triangle)

a. This device is made of webbing straps and durable material and is generally in the shape of an oversized isosceles triangle.

i. It securely holds victim in its folds when wrapped and clipped properly together.

ii. Some include arm holes and curved shapes.

b. Pickoff seats can be an efficient and quick solution for urgent rescue.

c. Pickoff seats should light, simple, easily transported, large enough to ensure the subject sits deeply in the seat with their center of gravity well below the connection/suspension point.

6. Escape belts

a. These belts are intended to provide emergency escape capability to a fire fighter from a life-threatening emergency at height.

b. Escape belts differ from ladder belts.

i. Escape belts

a. Subjected to additional force testing because they may be used for suspension

ii. Ladder belts

a. Intended only for restraint

c. Although some belts are commercially sewn and even certified as meeting the minimal requirements of NFPA 2500 (1983), they are often less secure and possibly riskier to use than improvised tied emergency seats.

i. Escape belts do not have leg loops to hold the belt down when the wearer is suspended.

ii. They are generally constructed of narrow fabric, such as 2-inch (51-mm) webbing.

iii. They do not provide the support of a harness and pose a high danger of creating a constrictive horse-collar arrangement around the torso.

d. Suspension trauma

i. Suspension trauma

1. A potentially hazardous condition that can occur when a person hangs motionless in a seat harness for a long

ii. The medical community divided on the pathophysiology, urgency, treatment for this condition, and even the mechanism of injury

iii. Previous protocols: keep the subject upright, in a seated position, even after the subject is on the ground

iv. Current protocols: treat the subject for shock, including providing high-flow oxygen and fluid replacement

v. It is still prudent to make prompt rescue of any person who is suspended in a harness, particularly one who is unconscious or unable to move.

vi. When it is necessary to be suspended in a seat harness for long periods, the rescuer can attach footloops, stirrups, or etrier above their attachment point.

e. Life belts, ladder belts, pompier belts, and similar safety belts with support only around the waist must not be used as the single point of support in high-angle activities.

i. These types of equipment are designed only as a safety element to help prevent falls from ladders or other elevated positions.

ii. The belts can constrict the waist and rib cage and slip up under the armpits and result in devastating injury; when used in place of a seat harness as the single support, can result in injury, permanent disability, or death.

IV. Other Considerations

**A. Preventing dropped objects**

1. Pieces of high-angle hardware can be lost or easily be dropped and can injure a person who happens to be in the path of its fall; therefore, rescuers must keep all equipment attached to something secure.

2. Rescuers have several options when choosing how to secure their tools and equipment, including equipment loops on harnesses and tool lanyards.

3. Large tools weighing 12 pounds (5.4 kg) or more are better secured by a separate line.

**B. Light sources**

1. Rope rescue operations often take place at night or in enclosed areas with no light; therefore it is crucial that all personally have a reliable light source.

2. Light sources should be in form of a hands-free device (e.g., mountable light or a head lamp).

3. Head lamps should be easily adjustable and field serviceable.

4. Personnel should always carry extra batteries and a spare bulb.

5. Head lamps should remain stable on the head and not fall off easily.

6. Battery options should be carefully considered.

a. Lithium batteries

i. Generally considered the most desirable choice, have the longest shelf life, and are resistant to the effects of cold is the lithium cell

ii. More expensive and older models have been known to cause explosions by venting gas

b. Alkaline batteries

i. Less expensive than lithium batteries

ii. Can include a secure switch to help preserve battery life

7. Source of light should also be carefully considered. Examples include the following:

a. Halogen bulbs are amazingly bright but drain the batteries quickly.

b. LEDs make for extremely lightweight head lamps with incredibly long burn times.

c. Combination halogen/LED bulbs provide best long-duration light from the LED and a strong beam needed for distance.

8. When operating in hazardous atmospheres, special attention should be given to the light source of choice.

a. Individuals entering potentially explosive atmospheres must use light sources that are intrinsically safe for the particular conditions (i.e., the design of the lighting equipment safeguards it against ignition in a hazardous atmosphere).

b. There are several levels or classes of hazards, and lamps that are certified for one level may not be safe in others.

**C. Knives**

1. Careless use of knives can result in personal injury and the destruction of fiber-based life-safety equipment.

2. Knives can free a person’s shirt or hair from a rappel device; however, a victim’s stress level, pain level, and limited movement can make it difficult to avoid cutting a loaded fiber member in the process.

3. Alternatives to knives

a. The tool used by emergency services personnel to cut seat belts in motor vehicle crashes has a recessed blade and is, therefore, less likely to accidentally cut a lifeline.

b. Trauma shears can to cut through tough material but also require intentional action to apply.

c. Self-rescue skills and optional equipment (e.g., a Prusik knot or ascender and a footloop) are even better options in these situations.

V. Inspection, Maintenance, and Recordkeeping

**A. Always read manufacturer’s instructions and obtain proper training on new equipment prior to the equipment being placed into service.**

**B. Tracking and recordkeeping**

1. Several methods can be used to mark equipment and track inspections/maintenance over time, including etching, engraving, and permanent marker.

2. The following information should be retained and stored for reference as needed:

a. Date equipment is placed into service.

b. Instructions for that piece of equipment

3. The following information should be logged in a recordbook or spreadsheet:

a. Product name

b. Manufacturer

c. Date of purchase

d. Date in service

e. Unique identifier

f. Other relevant information

**C. Preuse inspections**

1. A competent rescuer should complete an cursory once-over inspection of equipment before each use.

a. This abbreviated inspection should just ensure that the equipment is in good working order and ready for use.

b. Any equipment found to not be in good working condition should not be used.

c. Preuse inspections do not necessarily require formal documentation.

**D. Periodic inspections**

1. In addition to preuse checks, all equipment must regularly undergo a more thorough, periodic inspection by a competent person.

2. Periodic inspection is a more in-depth process in which the following occurs:

a. Form and function are closely considered.

b. Purchase and in-service dates are reviewed.

c. Wear and tear are considered.

3. These inspections are typically documented.

4. Periodic inspection should be performed at regular intervals.

a. Inspections should occur annually at a minimum.

b. More frequent checks (3 to 6 months) may be more appropriate for busy teams.

5. Criteria for inspecting equipment may generally be found in manufacturer’s instructions.

**E. Signs of damage**

1. Hard goods

a. Hard goods are generally easier to inspect than soft goods.

b. A mnemonic used as a checklist for inspecting hard goods (e.g., carabiners, descenders, pulleys, etc.) is ACADEMIC, with each letter representing a specific consideration:

i. A: Alignment. Is the item properly aligned with itself, as manufactured?

ii. C: Cracks. Are there visible hairline cracks, especially at connecting points?

iii. A: Action. Does the item function as intended, without sticking or jamming?

iv. D: Deformation. Are there any deformities in the body of the item?

v. E: Edges. Are there sharp or excessively worn edges, especially at rope paths?

vi. MI: Missing. Is any subcomponent missing or loose?

vii. C: Corrosion. Do you observe corrosion, especially at joints?

2. Soft goods

a. Soft goods (e.g., ropes, harnesses, slings, and other textile items) can be more difficult to inspect for a couple of reasons:

i. Soft goods can be more susceptible to abrasion and wear than hardware.

ii. They can also suffer damage that is more difficult to see (e.g., loss of elasticity or strength).

b. A mnemonic used as a checklist when inspecting soft goods is T-CHAPS, with each letter representing something specific to look for:

i. T: Thermal. Thermal damage typically appears as glazed, charred, or hardened fabric.

ii. C: Contamination. Clues might include discoloration, stiff or soft spots, or even odor.

iii. H: History. A check of the usage log is an especially important part of soft goods inspection.

iv. A: Age. Fibers deteriorate with age – a du Pont study suggests 10 years for nylon.

v. P: Physical damage. Cuts, abrasion, tears, or even fuzzy spots should get a second look.

vi. S: Soiling. While dirt is not necessarily caustic, a very dirty rope is harder to inspect and may signal contamination.

**c.** Skill Drill 7-3: Inspecting Soft Goods

**F. Maintenance**

1. Maintaining hazard PPE is an important step in keeping it ready for use and to protect its lifespan.

2. Consult the manufacturers’ guides on cleaning and storing PPE and follow their recommendations.

VI. Summary

 **Personal protective equipment (PPE) encompasses all equipment (from clothing outward) used directly to protect oneself, while rescue equipment is equipment used to affect a rescue.**

 **Within the context of rope rescue, hazard-specific PPE refers to specialized equipment needed for rope rescue, and the environments where rope rescue takes place.**

 **While most firefighters are equipped with personal protective equipment, what is appropriate for rope rescue depends upon the environment of the incident and the hazards present.**

 **Equipment selection depends upon meeting local standard operating procedures, including regulatory compliance, performance specifications, size, color, and other measurable factors. In addition, factors such as comfort, fit, value, durability, and other personal preferences impact the selection of PPE.**

 **The weight and bulk of typical firefighting garments may not afford the necessary comfort, mobility, and dexterity for rope rescue. Garments should be form-fitting but not too tight, with no loose edges or wayward straps that may become caught on obstructions.**

 **Among the requirements for footwear are comfort, protection, and adhesion.**

 **Gloves for rope rescue should protect rope rescuers’ hands against burns and abrasions.**

 **A helmet can protect the wearer from injury for falling debris or falls.**

 **NFPA 2500 (1983) classifies harnesses into two groups: Class II (seat harness) and Class III (full-body harness).**

 **An unsuitable rescue harness or one that is badly fitted can result in such severe discomfort that it can prevent the wearer from performing a task.**

 **Follow the manufacturer’s guidelines when inspecting, maintaining, and documenting equipment.**

Post-lecture

I. After-Action Review

Individual/Small-Group Activity/Discussion

On Scene

This activity is designed to help the student understanding how to approach a fire investigation. This activity incorporates both critical thinking and the application of basic trench rescue knowledge.

Purpose

To allow students an opportunity to develop responses to critical thinking questions.

Instructor Directions

1. Direct students to read the “On Scene” questions located in the After-Action Review section at the end of Chapter 7 (p. 111).

2. Direct students to read and individually answer the discussion questions. Allow approximately 10 minutes for this part of the activity. Facilitate a class review and discussion of the answers, allowing students to correct responses as needed.

3. You may also assign these as individual activities and ask students to turn in their comments on a separate piece of paper.

Answers

1. What criteria can you use to determine whether a given harness is appropriate for use in your rescue squad?

- Of what materials is the harness constructed?

- Is it a seat-only (Class II) or full body (Class III) harness?

- Is it suited to the types of responses anticipated (industrial, confined space, mountain, cave, etc.)

- What life safety attachment points does it have (ventral, sternal, dorsal, etc.)

- Is there verification of compliance with required performance specifications (i.e., does it meet applicable standards?)

- Is it streamlined, free of excessive gear loops, attachments and other protrusions?

- Does it have sufficient gear loops, pockets, or equipment storage options?

- Does it properly fit the intended wearer (or, if it is to be shared among users, does it have a sufficiently wide fit range)?

- Does it harmonize well with other protective equipment used by the wearer?

**2.** You are on a rescue scene performing preuse inspection on gear being deployed for a vertical evacuation, and find the webbing of one of the two available harnesses to be discolored. What do you suggest to the rescuer?

 Do not use the item; properly retire and/or discard it.

**3.** You are called to the scene of a tower rescue, and workers on scene offer you a set of twin lanyards for your team to use. How do you determine whether it is acceptable for use, and what the lim­itations might be?

- Consider first whether team members have been properly trained in use of this equipment.

- Consider whether the equipment meets agency requirements (if any) for this type of gear.

- Inspect the label to determine age, performance limitations, and intended use.

- Inspect the equipment using T-CHAPS criteria for soft components and ACADEMIC criteria for hardware components.

**4.** You are asked to inspect a harness. What do you look for?

Inspect software components for thermal damage, contamination, history log, age, physical damage, and soiling. Inspect hardware components for proper alignment, visible cracks, proper action, deformation, edges that are worn or sharp, missing parts, and corrosion.

II. Lesson Review

Discussion

Note: Facilitate the review of this lesson’s major topics using the review questions as direct questions or slides. Answers are found throughout this lesson plan.

1. What is the difference between PPE and rescue equipment? (Lecture I B)

2. Identify the factors that should be taken into consideration when choosing PPE. (Lecture I D)

3. Explain why universal standards have not been established for rope rescue work. (Lecture II B)

4. Identify the factors that should be taken into consideration when choosing protective garments. (Lecture II F)

5. Explain why “fast-rope” gloves are not appropriate for rope rescue operations. (Lecture II H)

6. Explain why it is important to choose a helmet that is specifically designed for rope rescue work. (Lecture II)

7. Identify the differences between recreational, rescue, and climbing harnesses. (Lecture III A)

8. Why should rescuers avoid using belts featuring waist-only support as the single point of support in high-angle activities? (Lecture III J)

9. What alternative methods can be used to replace knives in the field? (Lecture IV C)

10. Identify the differences between peruse inspections and periodic inspections. (Lecture V C–D)

III. Assignments

Lecture

A. Advise students to review materials for a quiz (determine the date/time).

B. Direct students to read the next chapter in *Rope Rescue: Principles and Practice*, Fifth Edition, as listed in your syllabus (or reading assignment sheet) to prepare for the next class session.