

LESSON TWO

RT: Confined Space - Personal Protective Equipment

DOMAIN: COGNITIVE / PSYCHOMOTOR

LEVEL OF LEARNING: COMPREHENSION /
APPLICATION

MATERIALS

IFSTA 6th edition Fire Service Rescue manual; IFSTA 4th edition Essentials, IFSTA 2nd edition Self-Contained Breathing Apparatus; NFPA 1006 Standard for Rescue Technician Professional Qualifications; NFPA 1951 Standard on Apparel for Urban Technical Rescue Incidents; NFPA 1670 Standard on Operations and Training for Technical Rescue Incidents; OSHA 29 CFR 1910 subpart I- Personal protective equipment; multimedia projector and laptop computer; access to white board or flipchart; assorted marker pens, cartridge respirators, dust masks, SCBA, elbow pads, knee pads, flame resistant rescue apparel, turn-out gear, steel toed boots, safety glasses or goggles, and gloves.

NFPA 1006, 2003 edition JPRs

9.1.2 Assess the incident

TERMINAL OBJECTIVE

The Rescue Technician shall correctly identify in writing the various types of personal protective equipment that are considered appropriate for use in confined space rescue incidents.

ENABLING OBJECTIVES

1. The Rescue Technician shall correctly identify in writing personal protective garments and accessory gear

recommended for wear at confined space rescue incidents.

2. The Rescue Technician when given the appropriate equipment shall correctly demonstrate the use of breathing apparatus used at confined space rescue incidents.
3. The Rescue Technician when given the appropriate equipment shall correctly demonstrate the proper donning techniques of SCBA and SAR.

LESSON TWO

RT: Confined Space - Personal Protective Equipment

MOTIVATION

Personal Protective Equipment (PPE) is an essential part of a rescuer's tools of the trade. A confined space rescue incident has the potential for subjecting the rescuer to a variety of personal hazards. Selecting the appropriate PPE for the task, understanding its use and limitations, and spending time training and becoming proficient with the use of various types of PPE will drastically reduce the risk of injury, disability, or even death for the rescuer.

PRESENTATION

ENABLING OBJECTIVE #1

The Rescue Technician shall correctly identify in writing personal protective garments and accessory gear recommended for wear at confined space rescue incidents.

1. When establishing guidelines for personal protective equipment for specialty rescue responses, the AHJ may choose to review NFPA 1951 Standard on Apparel for Urban Technical Rescue Incidents that would be appropriate for a confined space rescue incident. The apparel list includes a helmet; wrap around eye protection, long pants and long sleeve shirt or jumpsuit, steel-toed boots, and leather work gloves.
2. Point out that additional PPE may include knee and elbow protection, SCBA, hearing protection, safety vest and dust masks.

Reference: IFSTA 6th edition Fire Service Rescue, pages 301 and 181 through 182.

3. Discuss with the students the criteria for selecting a helmet for rescue activity.
 - a) Fire helmets, construction helmets, motorcycle helmets, and helmets used for sport activities are not suitable for most rescue activities.
 - b) Rescue helmets should have a three-point suspension type chin strap. A single chinstrap is inadequate for rescue activities.
 - c) The shell of the helmet should be constructed of material that will resist impacts and penetration of sharp objects. Examples of such materials include Kevlar or fiberglass composites.
 - d) The design of the helmet should protect the head from falling objects and side impacts.
 - e) The helmet should have a narrow profile with a slight brim.
 - f) The inside suspension system of a helmet should hold the helmet away from the skull to reduce the shock of impact and provide comfort and adequate air circulation.
 - g) The helmet used should comply with ANSI Z87.1 Occupational and Educational Eye and Face Protection.

Reference: IFSTA 6th edition Fire Service Rescue, pages 76 and 182.

4. Discuss with the students the criteria for selecting appropriate clothing protection for confined space rescue incidents.
 - a) Clothing that has potential for coming into contact with fire should be constructed of fire resistant material such as Nomex.
 - b) Turnout gear tends to be bulky and too hot for most rescue activities. Jumpsuits or BDUs (battle dress uniforms) tend to be more functional.
 - c) Clothing should give full body protection and have the ability for self-ventilation. Gore-tex™, polypropylenes, and Thinsulate™ are materials that provide good ventilation and protection from the elements.
 - d) Clothing used for rescue should be sized so as not to bind when arms are extended above the head or when legs are raised. Avoid binding at the wrists and ankles.

5. Emphasize that cotton is the least desirable material for wet and cold environments. Discuss the most desirable materials for wet and cold environments.
6. Point out that layering clothing prepares the rescuer for various environmental conditions.
 - a) The first layer is underwear.
 - b) The second layer is for insulation.
 - c) The third layer is the outer shell.
7. Point out that footwear should provide adequate support to the ankle, and protect the feet from impact loads, bruises, scrapes, and cuts.
 - a) Work boots usually fill this requirement well.
 - b) The soles of the boot should have a good adhesion surface, not slick like street shoes.
 - c) Select socks that provide good wicking capability that pulls moisture away from the feet to keep the feet dry and warm, and decreases the formation of blisters.
8. Explain that gloves used in confined spaces should provide comfort, protection from abrasions, cuts, and ease of use for rope handling activities.
 - a) Gloves should allow the hands to retain a sense of feeling so the fingers can manipulate equipment, leather work gloves provide good hand protection and are flexible enough to pick up objects easily and are relatively inexpensive. Fire service gloves are often bulky and not the best choice.
 - b) Leather gloves may become slick when wet. Synthetic gloves work well and maintains dexterity when wet.
 - c) Many rescuers are purchasing military flight gloves that have the same features as a leather work glove with the added feature of being flame resistant.
9. Point out that protective eyewear should prevent dust and flying debris from entering the eyes.
 - a) The eyewear should be OSHA approved close fitting goggles or safety glasses; face shields alone on fire and rescue helmets do not give adequate protection from dust and flying debris.

10. Point out when working inside the confined spaces, rescuers benefit from wearing elbow pads and kneepads to protect the rescuer's joints from abrasion and blunt trauma.
11. Point out that selection of respiratory protection devices will depend on the atmospheric conditions of the environment the rescuer is working in.
 - a) To filter dust and non-toxic particulates in an open clean atmosphere (19.5-23.5 % oxygen), a simple dust mask may be adequate but will not filter out toxins.

Reference: IFSTA 6th edition Fire Service Rescue, pages 301 and 181 through, 182.

PRESENTATION

ENABLING OBJECTIVE #2

The Rescue Technician when given the appropriate equipment shall correctly demonstrate the use of breathing apparatus used at confined space rescue incidents.

1. Point out that self-contained breathing apparatus (SCBA) or supplied air respirators (SAR) must be available for use during technical rescue operations.
2. Identify and discuss the features of an SCBA backpack assembly.
 - a) The assembly is designed to securely hold the air cylinder on the rescuer's back.
 - b) Adjustable shoulder straps provide for a secure fit.
 - c) The waist strap helps distribute the weight of the cylinder to the hips. Removal or non-use of the waist strap voids the NIOSH (National Institute Occupational Safety and Health) and the MSHA (Mine Safety and Health Administration) certification.
 - d) Swapping manufacturer parts voids the above certifications.

3. Identify and discuss the features of an SAR backpack assembly.
 - a) The assemblies are streamlined with a lightweight design.
 - b) Systems are designed for entry into or escape from confined spaces or hazardous atmospheres.
 - c) Both 5 and 10 minute escape air bottle configurations are available as are various style choices for the harnesses.
 - d) Most also have an interface option for communication systems.
4. Identify the features of the air cylinder assembly.
 - a) This assembly constitutes the main weight of the SCBA.
 - b) Weight varies depending on the manufacturer and the material used for construction.
5. Identify the most common sizes of air cylinders. Discuss what the “minutes” mean to the rescuer.
 - a) 30 minute - 2216 psi.
 - b) 30 minute - 4500 psi
 - c) 45 minute - 3000 psi.
 - d) 45 minute - 4500 psi.
 - e) 60 minute - 4500 psi.

Reference: IFSTA 4th edition Essentials, page 96.

6. Point out the importance of practicing with an SCBA while doing work to identify how much time the rescuer has to actually enter, work, and exit a confined space.
7. An air consumption test is a good way to demonstrate time in a controlled environment.
8. Identify the features of the SCBA regulator assembly.
 - a) Air from cylinder passes through the high-pressure hose to the regulator.
 - b) The regulator reduces the pressure of cylinder air to slightly above atmospheric pressure and controls the airflow to meet the wearer’s requirements.

- c) Some regulators are mounted to the face piece. Others are attached to the chest strap or waist strap.
 - d) There are two control valves: a mainline valve and a by-pass valve.
 - e) During normal operations the mainline valve should be open and the by-pass valve shut.
 - f) The by-pass valve should be opened when there is a malfunction of the mainline valve or the rescuer feels the need for a little extra flow.
 - g) A remote pressure gauge is located on the harness in a position visible to the rescuer. The gauge reading should read within 100 psi of the cylinder gauge reading. When in doubt, use the lower reading to determine your actions.
 - h) A low-pressure alarm will activate when the cylinder pressure reaches approximately one-fourth of the cylinder's maximum rated pressure.
9. Identify the features of the SCBA face piece assembly.
- a) The face piece holds in cool breathing air.
 - b) It affords some protection against facial and respiratory burns.
 - c) Some helmets have a face piece bracket.
 - d) The exhalation valve is a one-way valve that allows air to be expelled from the mask without allowing outside contaminants inside the mask.
10. Point out that using a nose-cup and the application of an antifogging solution can reduce fogging of the mask.
11. Discuss the guidelines for SCBA weekly inspections, and before and after each use. Point out the importance of keeping records of such inspections.
- a) Make sure the cylinder is full.
 - b) All gauges are in operating order.
 - c) Low-pressure alarm is working.
 - d) No leaks in the hoses and all connections are tight.
 - e) The face piece is clean and functional. Do not use paper products to clean face piece as it may scratch the lens.
 - f) The harness system is in good working order.
 - g) All valves are operational.
 - h) PASS device is working properly.

12. Discuss the guidelines for SCBA monthly inspections, and point out the importance of keeping records of such inspections.
 - a) Check all components for deterioration.
 - b) Check for leaks around valves and cylinder connection.
 - c) Verify that all gauges, valves, regulator, exhalation valve, and low-pressure alarm are functional.

13. Discuss the guidelines for an annual inspection, and point out the importance of keeping records of such inspections.
 - a) A factory certified technician should conduct the annual inspection.
 - b) Steel and aluminum cylinders must be tested every five years.
 - c) Composite cylinders must be tested every three years.

Reference: IFSTA 4th edition Essentials of Firefighting, pages 95 through 99 and page 106.

PRESENTATION

ENABLING OBJECTIVE #3

The Rescue Technician when given the appropriate equipment shall correctly demonstrate the proper donning techniques of SCBA.

1. Demonstrate donning techniques for SCBAs.
 - a) Over-the-head-method.
 - b) Coat method.

2. Identify and discuss the donning procedures that should be conducted for supplied-air respirators (SAR).
 - a) Follow the specific manufacturer's guidelines for conducting donning procedures, safety inspection and performing maintenance procedures.

Reference: IFSTA 4th edition Essentials of Firefighting, pages 101, 111 and 112.

NOTE: The instructor is encouraged to refer to IFSTA 2nd edition Self-Contained Breathing Apparatus for

detailed reference to the discussion on SCBA, its proper use, and donning techniques.

APPLICATION

1. Divide the class into four equal groups. Set up:
 - a) An inspection station. Have the students, using their own personal SCBA, or an SCBA supplied by the AHJ, perform a safety inspection.
 - b) Over - the - head donning station. Have the students practice this technique in full PPE. Students shall practice performing this task within a maximum time of two (2) minutes.
 - c) A coat - donning method station. Have the students practice this technique in full PPE. Students shall practice performing this task within a maximum time of two (2) minutes.
 - d) Set up two skill stations. Have each student perform the skills while wearing PPE and SCBA.
2. Allow the students sufficient time to practice and advise the students regarding correct or incorrect procedures. Emphasize to the students that this is an area where the saying “practice makes perfect” is most appropriate.
3. Keep track of the time it takes to correctly don all of the different types of PPE. Then try to reduce the amount of time to two minutes, and then to one minute.
4. Have the students wear a full SCBA while performing a physical activity typical of a confined space rescue incidents. Time how long it takes for each student to run out of air. Discuss the importance of knowing this time limit when entering, working, and exiting a structural collapse incident.

SUMMARY

The importance of using appropriate PPE for the job cannot be stressed enough. When rescuers wear PPE specifically designed for the rescue environment and wear it correctly, the risk of severe injury due to the lack of adequate body

protection can be greatly reduced. It is the instructor's obligation to make sure the rescue technician understands this importance for the sake of personal safety and rescue operation efficiency.