Basic SCBA

Instructor Manual

Alabama Fire College

October 2013

Basic Self-Contained Breathing Apparatus

OVERVIEW

In this chapter, the student will learn about the criteria for selection and use of a self-contained breathing apparatus, in addition to the care and servicing of a self-contained breathing apparatus.

LEARNING OBJECTIVES

After completing this lesson, the student should be able to:

7-1 List conditions requiring respiratory protection.

7-2 Explain ways that smoke harms the body.

7-3 Describe the effects of oxygen deficiency and toxic gases on the human body.

7-4 List the legal requirement(s) for use of self-contained breathing apparatus (SCBA).

7-5 Describe the limitations of SCBA.

7-6 Identify the physical requirements of an individual wearing an SCBA.

7-7 Describe methods for conserving air at the emergency scene.

7-8 Identify the common types of SCBA used in the fire service.

7-9 Name the components of the SCBA used in the fire service.

7-10 Given a specific piece of equipment, list and describe various tools as well as inspection and cleaning methods used to return the equipment back to service.

7-11 Given manufacturer recommendations, departmental guidelines, tools, and cleaning materials, demonstrate the ability to properly clean, inspect, and service tools and equipment.

7-12 Identify the donning procedures for an SCBA.

7-13 Demonstrate the ability to don an SCBA and activate the system within 1 minute.

7-14 Identify the proper uses of SCBA.

7-15 Demonstrate proper breathing techniques while wearing an SCBA.

7-16 Demonstrate the ability to maneuver through restricted passages while wearing an SCBA.

7-17 List the five steps that can lead to an organized rapid escape.

7-18 List the three steps that should be taken when entrapment occurs.

7-19 Explain emergency procedures that responders take when an air supply is depleted.

7-20 Given a situation and specified SCBA malfunction, list self-preservation, and emergency actions.

7-21 Given a situation involving a specified SCBA malfunction, demonstrate self-preservation, and emergency actions.

7-22 Demonstrate rescue techniques for locating and removing a downed firefighter with a functioning SCBA.

7-23 Demonstrate rescue techniques for locating and removing a downed firefighter with a malfunctioning SCBA.

7-24 List and describe proper use of cleaning solvents.

7-25 Describe the proper manufacturer's or department's procedures for tool and equipment cleaning.

7-26 Demonstrate proper exchange of an SCBA air cylinder.

7-27 Demonstrate air conservation techniques.

EQUIPMENT:

- Instructional outline
- PowerPoint presentation
- Equipment required to run PowerPoint presentation
- PowerPoint presenter
- Chalkboard/whiteboard or easel pad
- Chalk or markers
- SCBA with spare cylinder for each student
- PASS device for each student
- SAR system, if available

REQUIRED REFERENCES:

- Individual manufacturers' operating instructions for assigned breathing apparatus

INSTRUCTIONAL OUTLINE

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I. INTRODUCTION

A. Failure to use the **SCBA** properly can result in injury or death

B. **Respiratory system** extremely vulnerable

C. Fire departments must have a mask rule

D. Wear and use SCBA in **IDLH** atmosphere

E. SCBA necessary even during exterior defensive operations

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F. Any inhaled toxic gas can directly cause disease of the lung tissue

G. One in 12 firefighters is injured in the line of duty each year

H. Smoke inhalation accounts for 18 percent of fatalities

1. 21 percent of fireground injuries

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II. CONDITIONS REQUIRING RESPIRATORY PROTECTION

Objective: *7-1 List conditions requiring respiratory protection.*

Objective: *7-2 Explain ways that smoke harms the body.*

Objective: *7-3 Describe the effects of oxygen deficiency and toxic gases on the human body*

A. Oxygen deficiency

B. High temperatures

C. Smoke or by-products of combustion

D. Toxic environments

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E. Oxygen-deficient environments

1. Fire consumes oxygen
    a) Produces toxic gases
    b) Displace or dilute oxygen
2. Oxygen concentrations below 19.5 percent are **oxygen-deficient atmospheres**
3. Affects on the human body:
    a) Muscular impairment
    b) Mental confusion
    c) Death

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F. Elevated temperatures

1. Respiratory system sensitive to temperature
2. Air temperatures as low as 165°F can cause death within one minute
3. Inhaling gases causes:
    a) Pulmonary edema
    b) Asphyxiation
    c) Long-term damage
4. Temperatures in structure fire reach 1000°F
    a) One unprotected breath will cause death or severe damage to respiratory system

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G. Smoke

1. Unburned products of combustion, particles of carbon, tar, associated gases
2. Large amounts of gases due to use of plastics
3. Inhalation of small amounts may be fatal

4. Four causes of damage by smoke:
    a) Asphyxiation
    b) Chemical irritation
    c) Chemical asphyxiation
    d) Any combination of these

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III. EFFECTS OF TOXIC GASES AND TOXIC ENVIRONMENTS

Objective: *7-3 Describe the effects of oxygen deficiency and toxic gases on the human body*

A. Combustion produces toxic gases and irritants
    1. Affect short- and long-term health
B. When combustion products combine may form lethal toxins
C. Some common gases affect circulatory system
D. Commercial occupancies may produce additional toxins
    1. Requires higher level of protection
E. Carbon monoxide
    1. Produced in great quantity during combustion process: one of most lethal gases found in a fire
    2. Colorless and odorless, always present
    3. Found in homes with defective furnaces, clogged chimneys
    4. CO attaches to red blood cells and prevents oxygen from bonding with hemoglobin
    5. Effects are compounded through repeated exposure

F. Hydrogen cyanide

1. Colorless and produced by combustion of natural materials as well as synthetics
2. Can be present long before ignition temperature of material is reached
    a) Off-gassing or **quantitative decomposition**
3. Difficult to detect in the body
    a) Very short half-life
4. Significantly compounded when combined with carbon monoxide

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IV. LEGAL REQUIREMENTS FOR SELF-CONTAINED BREATHING APPARATUS USE

Objective: *7-4 List the legal requirement(s) for use of self-contained breathing apparatus (SCBA).*

A. Common sense: use SCBA on every fire scene

1. Start to finish

B. Regulations developed for SCBA use

C. Organizations established regulations and standards

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D. Title 29 Code of Federal Regulations, Section 1910.134

1. Establishes standards for all entries into IDLH atmospheres
2. April 1998 revision contains requirements related to interior structural firefighting
    a) Defines interior structural firefighting as IDLH
3. Requires the use of SCBA

4. Requirements for complete respiratory protection program

a) Regular medical evaluation

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E. NFPA 1500: *Standard on Fire Department Occupational Safety and Health Program*

1. **Authority having jurisdiction (AHJ)** must adopt the standard for the fire department
2. Three additional standards:

a) NFPA 1404: minimum requirements for protection programs

b) NFPA 1981: design and performance criteria

c) NFPA 1982: standards on PASS

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V. LIMITATIONS OF SELF-CONTAINED BREATHING APPARATUS

Objective: *7-5 Describe the limitations of SCBA.*

Objective: *7-6 Identify the physical requirements of an individual wearing an SCBA.*

Objective: *7-7 Describe methods for conserving air at the emergency scene.*

A. Understand limitations to use unit effectively and safely

B. Limitations of the SCBA unit itself

1. Size, weight, air supply

C. Physiological limitations of the user

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D. SCBA design and size

1. SCBA units add weight and bulk to PPE

2. SCBA cylinder consumed more quickly than length of time rated for:
    a) Limits advance into building
    b) More frequent crew rotations
3. Other concerns:
    a) Restricted visibility
    b) Added weight and bulk
    c) Firefighter's voice muffled
    d) Limited air quantity


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E. Limitations of the SCBA user

1. Physical, mental, emotional state cause usage problems
    a) Physical limitations: added weight and bulk
    b) Physiological limitations
        (1) Lack of confidence in SCBA unit
        (2) Physical stress and anxiety
        (3) Emotional conditions


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2. Air supply management
    a) Must understand air consumption rates
    b) Individual **point of no return**
    c) Heads up display
3. Various methods of breathing take experimentation on the part of the firefighter
    a) Use normal breaths and exhale slowly
    b) **Never** hold breath
    c) Controlled breathing is most efficient use of air

VI. TYPES OF SELF-CONTAINED BREATHING APPARATUS

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Objective: *7-8 Identify the common types of SCBA used in the fire service.*

Objective: *7-9 Name the components of the SCBA used in the fire service.*

Objective: *7-10 Given a specific piece of equipment, list and describe various tools as well as inspection and cleaning methods used to return the equipment back to service.*

Objective: *7-11 Given manufacturer recommendations, departmental guidelines, tools, and cleaning materials, demonstrate the ability to properly clean, inspect, and service tools and equipment.*

A. Two types of SCBA:

1. Open-circuit SCBA
    a) Exhaled air is vented to outside atmosphere
    b) Most common
2. Closed-circuit SCBA
    a) Exhaled air stays in the system for filtering, cleaning, circulation
    b) Sometimes used for specialized rescue incidents

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B. Open-circuit self-contained breathing apparatus

1. Designed and built in accordance with NIOSH and NFPA standards
2. Four basic assembly components:
    a) Backpack and harness
    b) Cylinder
    c) Regulator
    d) Face piece assembly

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C. Closed-circuit self-contained breathing apparatus
   1. Not used for firefighting operations
   2. Most common use: hazardous materials incidents
   3. Air supplies range from thirty minutes to four hours
   4. Contain cylinder, filter system, regulator, and valves
   5. Clean and filter exhaled breath and add oxygen
      a) Air supply duration based on filtering/cleaning and oxygen capacity of unit

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D. Open-circuit supplied air respirators
   1. Open-circuit **supplied air respirators (SARs)**
      a) Also called airline respirators
      b) Remote air supply
   2. Commonly used for hazardous materials incidents
      a) Confined space rescues
   3. Long-duration of air supply, mobility, agility
   4. SCBA escape unit with five to ten minutes

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VII. INSPECTION AND MAINTENANCE OF SELF-CONTAINED BREATHING APPARATUS

Objective: *7-24 List and describe proper use of cleaning solvents.*

Objective: *7-25 Describe the proper manufacturer's or department's procedures for tool and equipment cleaning.*

A. Inspection on daily or regular basis

B. Always follow manufacturer's instructions

C. Procedures in this chapter may differ from the recommendation

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D. Daily maintenance

1. SCBA units should be checked daily
2. If used during emergency scene or training exercise should be serviced in same manner
3. Follow 10-step inspection procedure

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E. Monthly maintenance

1. Monthly SCBA check contains all elements of the daily check
   a) Adds several checks of mechanics of system
2. Irregularities noted and repaired or pull SCBA from service

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F. Annual and biannual maintenance

1. NIOSH and SCBA manufacturers require different functional tests of SCBA units
2. Only manufacturer's authorized or trained service personnel shall conduct these tests
3. Firefighters should refer to the instructions for the SCBA units used

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VIII. DONNING AND DOFFING SELF-CONTAINED BREATHING APPARATUS

Objective: *7-12 Identify the donning procedures for an SCBA.*

Objective: *7-13 Demonstrate the ability to don an SCBA and activate the system within 1 minute.*

Objective: *7-14 Identify the proper uses of SCBA.*

A. General considerations

1. Operational safety checks must be performed

2. Conducted on a daily or regular basis
    a) Immediately prior to using the SCBA unit
3. If any component does not operate properly or is damaged, unit taken out of service immediately


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B. Most common donning procedures:
1. Seat-mounted position in the apparatus
2. Side compartment on the apparatus
3. Storage case

C. Refer to manufacturer's instructions


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D. Storage case
1. Two methods to don unit:
    a) "Over the head"
    b) "Coat"
    c) Choice is a matter of personal preference and training
2. Refer to donning instructions for the particular SCBA unit


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E. Seat-mounted apparatus
1. Allows for quick donning
2. Unit readily available for regular inspection
3. Three important safety requirements:
    a) Storing of the face piece
    b) Donning the unit while vehicle is moving
    c) Checking the cylinder gauge
4. Never don while vehicle is in motion
5. Check gauge before response or use the buddy system

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F. Compartment or side-mounted apparatus

1. Similar to seat-mounted position except firefighter is standing
2. If mount bracket wrong height, use "coat" method
3. Follow donning methods for particular mounting style

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G. Donning the SCBA face piece

1. Most SCBA face pieces donned in a similar manner
    a) Difference in style of head straps, regulator location
2. Essential to protect firefighter from toxic gases
3. Firefighter must be fitted for the face piece to be used with a particular manufacturer's SCBA
4. Prohibit anything that may interfere with proper fit and seal of face piece
    a) Examples: eye glasses, beards, sideburns

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H. Removing/doffing the SCBA unit

1. Generally to remove SCBA donning procedure is reversed
2. If awaiting another assignment, remove face piece
    a) Allow normal breathing, conserve air
3. Do not wear the mask without air flowing into it
4. Regulator or face piece must not be contaminated
5. After assignment complete, report to rehabilitation

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IX. SELF-CONTAINED BREATHING APPARATUS OPERATION AND EMERGENCY PROCEDURES

Objective: *7-15 Demonstrate proper breathing techniques while wearing an SCBA.*

Objective: *7-16 Demonstrate the ability to maneuver through restricted passages while wearing an SCBA.*

Objective: *7-17 List the five steps that can lead to an organized rapid escape.*

Objective: *7-18 List the three steps that should be taken when entrapment occurs.*

Objective: *7-19 Explain emergency procedures that responders take when an air supply is depleted.*

Objective: *7-20 Given a situation and specified SCBA malfunction, list self-preservation, and emergency actions.*

Objective: *7-21 Given a situation involving a specified SCBA malfunction, demonstrate self-preservation, and emergency actions.*

Objective: *7-22 Demonstrate rescue techniques for locating and removing a downed firefighter with a functioning SCBA.*

Objective: *7-23 Demonstrate rescue techniques for locating and removing a downed firefighter with a malfunctioning SCBA.*

Objective: *7-26 Demonstrate proper exchange of an SCBA air cylinder.*

Objective: *7-27 Demonstrate air conservation techniques.*

A. Fire departments must establish respiratory protection programs

B. Firefighters must be proficient in the safe use of SCBA

1. Donning and doffing procedures
2. Individual limitations
3. Limitations of SCBA unit

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C. Safe use of SCBA

1. Essential to firefighter survival
2. SCBA unit and protective equipment add weight and bulk
    a) Increased exertion and loss of body fluids
3. Firefighters must be aware of symptoms of heat stress
    a) Be aware of own limitations and abilities

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D. Operating in a hostile environment

1. General rules:
    a) Check in with accountability officer when entering or exiting
    b) Remain low, check the environment and conditions
    c) Never remove the face piece, maintain an awareness of location
    d) Ventilate as you advance if it does not spread fire
    e) Check for outside openings
    f) Maintain direct contact with other team members
    g) Never enter a hostile environment alone

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E. Restricted openings

1. Probe tight spot with a tool
2. Be sure conditions on other side of obstacle are safe
3. Shift pack to left side
4. "Swim" through obstacle backwards
5. "Forward dive" technique
6. Do not remove SCBA unless absolutely necessary

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F. Emergency procedures

1. Emergency procedures exist to assist a firefighter in safe escape from hazard
2. Remain calm, rely on training and knowledge
3. Never remove the face piece of the SCBA
4. Standard emergency check procedure stressed
5. If entangled, do not pull forward
    a) Use wire cutters to cut one wire at a time
    b) "Swim" method

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G. Changing SCBA cylinders

1. Cylinders changed after use, following local SOPs
2. Cylinder 90 percent full could mean loss of two to five minutes of air supply
    a) Could make the difference in successful exit
3. Follow 12-step replacement procedure
4. Additional steps for two-person SCBA cylinder replacement

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H. Servicing SCBA cylinders

1. Cylinder serviced when below full
    a) Air source must be tested and certified
    b) All cylinders must have a current hydrostatic test date
    c) All fill stations must have fragmentation containment devices
    d) All manufacturer's recommendations should be followed
    e) Fill rate may vary
2. Cascade system

3. Compressor/purifier system

I. **LESSONS LEARNED**

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A. SCBA unit is to a firefighter as a weapon is to a soldier

B. No substitute for proper SCBA training

1. Continued practice and advanced training necessary

C. Prevent failures: thoroughly inspect and test SCBA function as often as possible

D. Firefighters must be prepared to go in harm's way

1. Be knowledgeable and proficient in use of SCBA

SUMMARY:

- SCBA is one of the most important items of PPE that firefighters have available to them.
- An increase in safety regulations and improvements in design and construction of SCBA have greatly increased their safety and reliability.
- An SCBA has limitations and also increases the limitations and demands on the firefighter's physical conditioning.
- The firefighter must be familiar and comfortable with the use, emergency procedures, inspection, and maintenance of an SCBA.
- The firefighter must be proficient in the proper and rapid procedures for donning and doffing SCBA.

Skills and Evolutions

Skills to be completed: *(All skills shall be demonstrated by Instructor first!)*

Demonstration of SCBA Assembly and Proper Daily Check-Off Procedures

Purpose: To have students learn and understand the identity and function of the individual parts of the SCBA

Instructions- Have student demonstrate proper assembly and check-off procedures as outlined in the PowerPoint. The students shall also locate and verify the hydro date on their cylinder and at least one other (preferably a different type/brand).

Demonstration of Methods for Donning and Doffing-

Purpose: To acclimate the students in the proper use and procedures for wearing a SCBA.

Instructions- "Over the head, coat, *Seated (Jump seat)"

Once students demonstrate comfort in donning, let them attempt to don full PPE in under 2 min. To be successful, the student must be "on air" with ALL PPE on in PROPER fashion (all zippers, snaps, hooks and flaps must be securely fastened. The student's hood shall be on properly with no exposed skin, gloves shall be on correctly, helmet strap secured snuggly under chin, SCBA Cylinder valve fully opened, etc.) Allow students to check their partner; Proper doffing procedure should be followed also.

If available/feasible, have student practice donning PPE with SCBA stowed in jump seat **WITH proper use of seat belt.*

Demonstration of Proper SCBA Emergency Procedures

Purpose: To acclimate students in the proper procedures to follow should they begin to have perceived SCBA malfunctions.

Instructions- Have the students go through the emergency procedures outlined in the PowerPoint. These skills should be practiced thoroughly as a group and then students should be randomly "quizzed" during other evolutions to emphasize the importance of this skill.

SCBA Familiarization* *(optional)*

Purpose: To allow students who have never worn a SCBA to get accustomed to completing simple task while wearing one. This also gives the instructor(s) a chance to monitor new students for proper use and signs of anxiety.

Instructions- Have students don PPE and have them complete some very simple assignments. Assignments can include but are not limited to going for a short walk, going up/down stairs, completing various firehouse chores, etc. Depending on the experience of the students, consider starting off not on air and without a mask. As they get accustomed to wearing SCBA, then consider having them go on air and continue the task. There is no set task to complete; but any task assigned should be easy to complete with minimal effort, as this drill is to allow for the students to gain confidence in themselves and in the use of their air pack.

*Restricted Opening/Low Profile

Purpose: To allow students a chance to negotiate an obstacle(s) in which they must manipulate their SCBA in such a manner to clear the obstacle WHILE staying "on air."

Instructions - This drill can be done in a number of ways. The instructor should have a preplanned method for completing the drill. A simulated stud wall or barrel crawls – re: just a couple of suggestions. Whatever prop is used, the student should demonstrate the proper doffing or loosening of the SCBA to negotiate the obstacle and then must don the SCBA prior to the evolution being completed.

Basic Air Consumption Course (2 rounds -1 bottle each round)

Purpose: To let students gain confidence in their ability to comfortably work in an SCBA while "on air."

- demonstrate the limitations of a "30 min." cylinder.

- demonstrate the feasibility and practice of various breathing techniques in an effort to conserve air in an emergency situation.

Instructions- A Basic consumption course should be set up with stations designed to simulate various firefighting activities. The students will go in 2 rounds. The first round the students will continue the course until they have completely exhausted 1 "30 min." cylinder. (Instructor consideration-If students utilize a higher volume cylinder, consider "bleeding" the cylinder down to the equivalent of a "30 min." cylinder. Students with larger volume cylinders can make this drill quite time consuming!) A timer shall be started at the start of the course and stopped when the student removes his/her regulator. The student's time shall be recorded for the student to compare later. After the first round, the students should be given ample time to rehab. (Option: go on to another skill or break for lunch prior to starting round 2) For round two, the student shall complete the same consumption course in the same manner with the exception that as soon as the low air alarm starts, the student will immediately go to a designated area* to attempt to conserve air until he/she has exhausted his/her cylinder. The timekeeper shall mark the time the student starts the drill, the time when the low air alarm begins to sound, and the time when the student removes his/her regulator.

(*Students in designated area shall be closely monitored by an instructor to insure the well-being of the students)*

*Hose Follow *(250' Spaghetti Drill)*

Purpose: To allow students the opportunity to "work" in their SCBA while gaining further confidence in their equipment and themselves.

Instructions- The instructors should have a charged section of 1.75" hose laid out in a spaghetti drill fashion. The use of "dummy" hose is optional. Start the students at the nozzle and have them find their way to the pump. Some additional instruction will possibly be necessary regarding "reading the coupling" with a gloved hand. The students should have their vision obscured for this drill.

Search/Hose Advance

Purpose: To allow students to utilize skills they have learned while conducting basic firefighting operations

Instructions- Have students split into crews. Place one crew as a search team and have them enter a structure as a search team. Prior instruction on "right/left hand search" patterns is essential. It is recommended that the search crew be limited to a one-level search. The use of victims is optional but not recommended as the goal is for the individuals to gain further confidence in themselves and SCBA. If a victim is used, it is recommended that he/she be lightweight and easy to manipulate. A second crew can be tasked with advancing a charged hose line through a structure to a simulated fire room.