Fire Fighter I Objectives

- List the conditions that require respiratory protection or self-contained breathing apparatus (SCBA).
- Describe the differences between open-circuit breathing apparatus and closed-circuit breathing apparatus.
- Describe when a supplied-air respirator is used.
Fire Fighter I Objectives

- Describe the limitations of SCBA.
- Describe the physical and psychological limitations of an SCBA user.
- List and describe the major components of SCBA.
- Describe the devices on an SCBA that can assist the user in air management.
Fire Fighter I Objectives

- Describe the pathway that air travels through an SCBA.
- Explain the skip-breathing technique.
- List the complete sequence of donning PPE.
Introduction

- PPE protects the body against limited amount of heat.
- SCBA allows fire fighters to enter smoky and toxic areas and provides respiratory protection for limited time.
Personal Alert Safety System

- Electronic device that sounds a loud signal if a firefighter:
  - Is motionless for a set period
  - Activates it
- Can be separate or integrated into the SCBA unit
Respiratory Protection

- The interior atmosphere of a burning building is considered immediately dangerous to life and health (IDLH).
- Firefighters must be proficient in using SCBA before engaging in interior fire-suppression activities.
Respiratory Hazards of Fires: Smoke

- Three major components:
  - Smoke particles
  - Smoke vapors
  - Toxic gases
    - Carbon monoxide
    - Hydrogen cyanide
    - Phosgene
Respiratory Hazards of Fires: Oxygen Deficiency

- Occurs in two ways:
  - Fire consumes available oxygen.
  - Fire produces gases that displace oxygen.
- Can lead to disorientation, inability to control muscles, and irrational thinking

<table>
<thead>
<tr>
<th>TABLE 3-2 Oxygen Concentration</th>
<th>Physiological Effects of Reduced Oxygen Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>21%</td>
<td>Normal breathing air</td>
</tr>
<tr>
<td>17%</td>
<td>Judgment and coordination impaired; lack of muscle control</td>
</tr>
<tr>
<td>12%</td>
<td>Headache, dizziness, nausea, fatigue</td>
</tr>
<tr>
<td>9%</td>
<td>Unconsciousness</td>
</tr>
<tr>
<td>6%</td>
<td>Respiratory arrest, cardiac arrest, death</td>
</tr>
</tbody>
</table>
Respiratory Hazards of Fires: Increased Temperature

- Inhaling the superheated gases produced by a fire can cause severe burns of the respiratory tract.
Other Toxic Environments

- Fire fighters will encounter toxic gases or oxygen-deficient atmospheres in many emergency situations, including:
  - Hazardous materials releases
  - Confined-space or below-grade structures
Conditions that Require Respiratory Protection

- SCBA must be used:
  - In enclosed areas where there is smoke
  - During overhaul until the air has been tested
  - Whenever toxic gases or an oxygen-deficient atmosphere is possible

- Golden rule: Always assume that the atmosphere is hazardous!
Types of Breathing Apparatus

- Open-circuit SCBA
  - Used for structural firefighting
  - Tank of compressed air provides supply
  - Exhaled air is released into the atmosphere
Types of Breathing Apparatus

- **Closed-circuit SCBA**
  - Used for extended operations
  - Air passes through a mechanism that removes carbon dioxide and adds oxygen within a closed system.
Types of Breathing Apparatus

- Supplied-air respirator
  - Uses a hose line connected to a breathing-air compressor or to compressed air cylinders
  - Sometimes used for specialized operations
SCBA Standards and Regulations

- **NIOSH**
  - Sets the design, testing, and certification requirements for SCBA

- **OSHA and state agencies**
  - Responsible for establishing and enforcing regulations for respiratory protection
NFPA standards related to SCBA:

- NFPA 1500: Basic requirements
- NFPA 1404: Requirements for SCBA training
- NFPA 1981: Requirements for design, performance, testing, and certification of open-circuit SCBA
Limitations of SCBA

- Use is limited by amount of air in cylinder
- Fire fighters must consider:
  - Time and effort required to reach destination
  - Amount of air available once destination is reached
  - Amount of time needed to complete task
  - Amount of time to reach a safe area
Limitations of SCBA

- Added weight and bulk decrease flexibility and mobility
- Face piece can limit visibility
- May affect ability to communicate
- May limit hearing
Physical Limitations of the User

Moving with the extra weight of SCBA and PPE requires additional energy, which increases air consumption and body temperature.
Psychological Limitations of the User

- Breathing through an SCBA can be very stressful.
  - The surrounding environment is foreign as well.
  - Fire fighters must adjust to these stressful conditions.
Components of SCBA

- **Backpack**
  - Frame for mounting the other working parts of the SCBA

- **Harness**
  - Straps and fasteners to attach the SCBA to the fire fighter
Components of SCBA

- **Air cylinder**
  - Holds breathing air for an SCBA
  - Equipped with a hand-operated shut-off valve
  - Pressure gauge shows amount of pressure currently in cylinder
Components of SCBA

- Regulator assembly
  - Controls flow of air
  - Some have a dual-path pressure reducer
  - Activation requires:
    - Opening cylinder valve
    - Donning SCBA
    - Attaching regulator to face piece
Components of SCBA

- Regulator assembly (cont’d)
  - Contains a pressure gauge
    - Requires a second heads-up display.
  - NFPA requires SCBA to include end-of-service-time-indicator (EOSTI) or low-air alarm.
Components of SCBA

- Regulator assembly (cont’d)
  - Some include PASS device.
  - Equipped with rapid intervention crew/company universal air connection (RIC UAC)
Components of SCBA

- **Face piece assembly**
  - Delivers breathing air
  - Consists of:
    - Face mask
    - Exhalation valve
    - Regulator
  - Should cover the entire face
  - Must be annually fit-tested
Pathway of Air Through an SCBA

- Air passes through the cylinder shut-off valve into the high-pressure hose that takes it to the regulator.
- Regulator sends air into the face piece and to the user.
Pathway of Air Through an SCBA

- When the user exhales, used air is returned to the face piece.
- Exhaled air is exhausted from the face piece through the exhalation valve.
Skip-Breathing Technique

- Take a short breath, hold, take a second short breath.
  - Do not exhale in between breaths.
- Relax with a long exhale.
- Each breath should take 5 seconds.
Donning SCBA

Before beginning, fire fighters must:

- Check that air cylinder has 90% pressure.
- Be sure donning/doffing switch is activated.
- Open the cylinder and listen for alarm.
- Check the pressure gauges.
- Check that harness straps are fully extended.
- Check that valves are in the correct position.
Donning SCBA From the Ground, Floor, or Storage Case

- Over-the-head
  - Grasp the back plate with both hands and lift the SCBA over your head.

- Coat
  - Grasp one shoulder strap close to the back plate and the other farther from the plate.
  - Swing the SCBA over your left shoulder.
Donning the Face Piece

- The face piece must be the correct size, and it must be adjusted to fit the face.
  - There must be no facial hair in the seal area.
  - Eyeglasses that pass through the seal area cannot be worn.
Safety Precautions for SCBA

- Before entering environment, activate PASS device.
- Properly log into accountability system.
- Work in teams of two.
- Have at least two fire fighters outside.
SCBA Use During Emergency Situations

- Keep calm, stop, and think.
- Control your breathing.
- If SCBA problems are experienced, exit the IDLH area.
- If you are in danger, follow self-survival steps and call a mayday.
Putting It All Together

- Tighten both shoulder straps.
- Attach the waist belt and tighten it.
- Fit the face piece to your face.
- Pull the protective hood up.
- Place your helmet on.
- Turn up your coat collar.
Putting It All Together

- Put gloves on.
- Check your clothing.
- Be sure your PASS device is turned on.
- Attach your regulator or turn it on.
- Work safely.
SCBA Inspection and Maintenance

- Must be properly serviced each time it is used.
  - Air cylinder must be changed or refilled.
  - Face piece and regulator must be sanitized.
  - Unit must be cleaned, inspected, and checked for proper operation.
Inspection of SCBA

- SCBA should be inspected to identify parts that are damaged or need repair.
- Operational testing checks the functioning parts of SCBA.
  - Should be done after each use and at the beginning of each shift or on a set schedule.
Summary

- The two main types of SCBA are open-circuit and closed-circuit devices.
- SCBA limits the amount of air in the cylinder.
Summary

- Breathing through an SCBA is different than breathing normally and can be stressful.
- SCBA consists of a backpack and harness, air cylinder assembly, regulator assembly, and face piece assembly.
- Air passage through SCBA follows a specific pathway.
Summary

- Skip-breathing conserves air.
- SCBA must be checked regularly.
- SCBA cylinders are refilled via compressors and cascade systems.
- Follow the 18 steps to correctly don PPE.