

Fire Fighter Qualifications and Safety

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NFPA 1001 Standard

Fire Fighter I

5.1.1.2 General Skill Requirements. The ability to don personal protective clothing within one minute; doff personal protective clothing and prepare for reuse; hoist tools and equipment using ropes and the correct knot: tie a bowline, clove hitch, figure eight on a bight, half hitch, becket or sheet bend, and safety knots; and locate information in departmental documents and standard or code materials.

5.3.1 Use SCBA during emergency operations, given SCBA and other personal protective equipment, so that the SCBA is correctly donned and activated within one minute, the SCBA is correctly worn, controlled breathing techniques are used, emergency procedures are enacted if the SCBA fails, all low-air warnings are recognized, respiratory protection is not intentionally compromised, and hazardous areas are exited prior to air depletion.

5.3.1 (A) Requisite Knowledge. Conditions that require respiratory protection, uses, and limitations of SCBA, components of SCBA, donning procedures, breathing techniques, indications for and emergency procedures used with SCBA, and physical requirements of the SCBA wearer.

5.3.1 (B) Requisite Skills. The ability to control breathing, replace SCBA air cylinders, use SCBA to exit through restricted passages, initiate and complete emergency procedures in the event of SCBA failure or air depletion, and complete donning procedures.

5.5.3 Clean and check ladders, ventilation equipment, self-contained breathing apparatus (SCBA), ropes, salvage equipment, and hand tools, given cleaning tools, cleaning supplies, and an assignment, so that equipment is clean and maintained according to the manufacturer's or departmental guidelines, maintenance is recorded, and equipment is placed in a ready state or reported otherwise.

Fire Fighter II

6.1.1 For certification at Level II, the Fire Fighter I shall meet the general knowledge requirements in 6.1.1.1, the general skill requirements in 6.1.1.2, and the job performance requirements defined in Sections 6.2 through 6.5 of this standard and the requirements defined in Chapter 5, Competencies for the First Responder at the Operational Level of NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*.

Additional NFPA Standards

NFPA 1404, *Standard for Fire Service Respiratory Protection Training*

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*

NFPA 1582, *Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians*

NFPA 1971, *Standard on Protective Ensemble for Structural Firefighting*

NFPA 1975, *Standard on Station/Work Uniforms for Fire and Emergency Services*

NFPA 1976, *Standard on Protective Ensemble for Proximity Firefighting*

NFPA 1977, *Standard on Protective Clothing and Equipment for Wildland Firefighting*

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*

NFPA 1982, *Standard on Personal Alert Safety Systems (PASS)*

Knowledge Objectives

After completing this chapter, you will be able to:

- Discuss the educational, age, medical, physical fitness, and emergency medical care requirements for becoming a fire fighter.
- Describe how standards and procedures, personnel, training, and equipment are related to the prevention of fire fighter injuries and deaths.
- List safety precautions you need to take during training, during emergency responses, at emergency incidents, at the fire station, and outside your workplace.
- Describe the protection provided by personal protective equipment (PPE).
- Explain the importance of standards for PPE.
- Describe the limitations of PPE.
- Describe how to properly maintain PPE.
- Describe the hazards of smoke and other toxic environments.
- Explain why respiratory protection is needed in the fire service.
- Describe the differences between open-circuit breathing apparatus and closed-circuit breathing apparatus.
- Describe the limitations associated with self-contained breathing apparatus (SCBA).
- List and describe the major components of SCBA.
- Explain the skip-breathing technique.
- Explain the safety precautions you should remember when using SCBA.
- Describe the importance of daily, monthly, and annual SCBA inspections.
- Explain the procedures for refilling SCBA cylinders.
- List the steps for donning a complete PPE ensemble.

Skills Objectives

After completing this chapter, you will be able to perform the following skills:

- Don approved personal protective clothing.
- Doff approved personal protective clothing.
- Don an SCBA from a seat-mounted bracket.
- Don an SCBA from a side-mounted compartment.
- Don an SCBA from a storage case using the over-the-head method.
- Don an SCBA from a storage case using the coat method.
- Don a face piece.
- Doff an SCBA.
- Perform daily SCBA inspections.
- Perform monthly SCBA inspections.
- Replace an SCBA cylinder.
- Clean and sanitize an SCBA.

You Are the Fire Fighter

Before leaving the fire station to respond to a house fire, you don your personal protective clothing, board the apparatus, and fasten your seat belt. The fire is on the second floor. Your officer tells you and your partner to mount an interior attack, so you put on your self-contained breathing apparatus (SCBA) and stretch a hose line to the house. Smoke fills the downstairs as you make your way to the seat of the fire. You can feel the heat through your face piece and hear the sounds of breaking glass and crackling flames. You open the nozzle and direct a stream of water onto the fire to extinguish it. You continue to use your SCBA until the Safety Officer approves working without it.

1. How does your personal protective equipment keep you safe in this hostile environment?
2. What are some of the limitations of your personal protective equipment?

Fire Fighter Qualifications

Not everyone can become a fire fighter. Those who do understand the vital mission of the fire department: to save lives and protect property. A fire fighter must be healthy and in good physical condition, assertive enough to enter a dangerous situation, but mature enough to work as a member of a team (► **Figure 2-1**). The job requires a person who has the desire to learn, the will to practice, and the ability to apply the skills of the trade. A fire fighter is constantly learning as the body of knowledge about fires increases and the technology used in fighting fires develops.

The training and performance qualifications for fire fighters are specified in NFPA 1001, *Standard for Fire Fighter Professional Qualifications*. Age, education requirements, medical requirements, and other criteria are established locally.

Age Requirements

Most career fire departments require that candidates be at least 18 years of age, although some require a minimum age of 21. Candidates should possess a valid driver's license, have a clean driving record, have no criminal record, and be drug-free.

Volunteer fire departments usually have different age requirements, which often depend on insurance considerations. Some volunteer fire departments allow "junior" members to join at age 16, but restrict their activities until they reach age 18.

Education Requirements

Most career fire departments require that applicants have at least a high school diploma or equivalent. Some require candidates to have more advanced college-level courses in a fire- or EMS-related field. All departments will require fire fighters who wish to be considered for promotion or extra responsibility to take additional courses.

Medical Requirements

Because firefighting is both stressful and physically demanding, fire fighters must have a medical evaluation before training begins. The medical evaluation will identify any medical condition or physical limitation that could increase the risk of injury or illness to the candidate or other fire fighters. Medical requirements for fire fighters are specified in NFPA 1582, *Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians*.

Physical Fitness Requirements

Physical fitness requirements are established to ensure that fire fighters have the strength and stamina needed to perform the tasks associated with firefighting and emergency operations. Several performance-testing scenarios have been validated by qualified organizations. NFPA 1001 allows indi-



Figure 2-1 Firefighting requires a special person.

vidual fire departments to choose the fitness-testing method that will be used for fire fighter candidates.

Emergency Medical Care Requirements

Delivering emergency medical care is an important function of most fire departments. NFPA 1001 allows individual fire departments to specify the level of emergency medical care training required for entry-level personnel. At a minimum, you will need to understand infection control procedures, perform CPR, control bleeding, and manage shock. These skills are discussed in more detail in Chapter 23, Fire and Emergency Medical Care. Many departments require fire fighters to become certified at the first responder, EMT-Basic, or higher levels.

Fire Fighter Safety

Firefighting, by its very nature, is dangerous. Each individual fire fighter must learn safe methods of confronting the risks presented during training exercises, on the fireground, and at other emergency scenes.

Every fire department must do what it can to reduce the hazards and dangers of the job and help prevent fire fighter injuries and deaths. Each fire department must have a strong commitment to fire fighter safety and health with designated personnel to oversee these programs. Safety must be fully integrated into every activity, procedure, and job description.

Appropriate safety measures must be applied routinely and consistently. During serious incidents, safety officers are responsible for evaluating the hazards of various situations and recommending appropriate safety measures to the **Incident Commander (IC)**. Each accident or injury must be thoroughly investigated to learn why it happened and how it can be avoided in the future.

Advances in technology and equipment require fire departments to review and revise their safety policies and procedures regularly. Information reviews and research by designated safety personnel can identify new hazards as well as appropriate risk-management measures. Reports of accidents and fatalities from other fire departments can help identify problems and develop preventive actions.

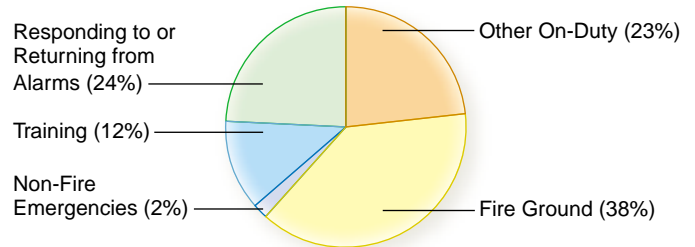
Causes of Fire Fighter Deaths and Injuries

Each year about 100 fire fighters are killed in the line of duty in the United States. These deaths occur not only at emergency incident scenes, but also in the station, during training, and while responding to or returning from emergency situations. Approximately the same number of fire fighter deaths occur on the fireground or emergency scene as during training or while performing other nonemergency duties. The remainder, approximately 24%, occur while responding to or returning from alarms (► **Figure 2-2**). The leading cause of fire fighter deaths is heart attacks, both on and off the fireground.

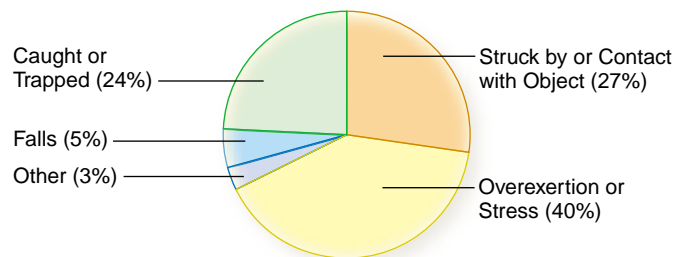
Vehicle collisions are a major cause of fire fighter fatalities. For every 1,000 emergency responses, there is one vehi-

cle collision involving an emergency vehicle (▼ **Figure 2-3**). One study found that 27% of the fire fighters who died in those incidents were ejected from the vehicle, which suggests that they were not using seatbelts. Fire fighters should never overlook basic safety procedures, such as always fastening seat belts, especially during emergency responses.

Fire Fighter Deaths by Type of Duty – 2001



Fire Fighter Deaths by Cause of Injury – 2001



Fire Fighter Deaths by Nature of Injury – 2001

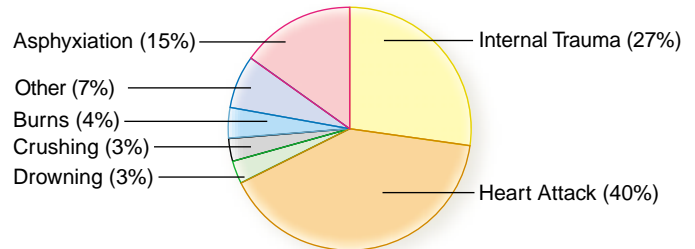


Figure 2-2 Fire fighter deaths in the United States.



Figure 2-3 Motor vehicle collisions are a leading cause of death for fire fighters.

Table 2-1 Fire Fighter Injuries

| Type of Injury | % of total |
|--------------------------|------------|
| Strains and sprains | 40% |
| Soft-tissue injuries | 22% |
| Burns | 7.9% |
| Smoke and gas inhalation | 6.2% |

The NFPA estimates that 82,250 fire fighters were injured in the line of duty in 2001. Half of these injuries occurred while fighting fires and another 17% occurred at other emergencies. The rest occurred during other on-duty activities. The most common injuries were strains, sprains, and soft-tissue injuries. Burn injuries and smoke and gas inhalation made up only a small percentage of total injuries (▲ Table 2-1).

Injury Prevention

Injury prevention is a responsibility shared by each member of the firefighting team. Fire fighters must always consider:

- Personal safety
- The safety of other team members
- The safety of everyone present at an emergency scene

To reduce the risks of accidents, injuries, occupational illnesses, and fatalities, a successful safety program must have four major components:

- Standards and procedures
- Personnel
- Training
- Equipment

Standards and Procedures

Because safety is such a high priority, several organizations set standards for a safe working environment for the fire service. NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program* provides a template for implementing a comprehensive health and safety program. Other NFPA standards focus on specific subjects directly related to health and safety. The Federal **Occupational Safety and Health Administration (OSHA)**, as well as various state and provincial health and safety agencies, develops and enforces government regulations on workplace safety. NFPA standards often are incorporated by reference in government regulations.

Every fire department should have a set of **standard operating procedures (SOPs)** or standard operating guidelines (SOGs), which outline how to perform various functions and operations. SOPs and SOGs cover a range of topics from uniform and grooming standards to emergency scene operations. These procedures should incorporate safe practices and policies. Each fire fighter is responsible for understanding and following these procedures.

The fire department chain of command also enforces safety goals and procedures. The command structure keeps everyone working toward common goals in a safe manner. The **Incident Management System (IMS)** is a nationally recognized plan to establish command and control of emergency incidents. Flexible enough to meet the needs of any emergency situation, IMS should be implemented at every emergency scene, from a routine auto accident to a major disaster involving numerous agencies.

Many fire departments have a health and safety committee responsible for establishing policies on fire fighter safety. Members of the committee should include representatives from every area, component, and level within the department, from fire fighters to chief officers. The safety officer and the fire department physician also should be members of the committee.

Personnel

A safety program is only as effective as the individuals who implement it. Personnel selection and training in the science of safe and effective fire suppression is a significant part of fire department operations and budgets.

Teamwork is an essential element of safe emergency operations. On the fireground and during any hazardous activity, fire fighters must work together to get the job done. The lives of citizens, as well as the lives of other members of the department, depend on compliance with basic safety concepts and principles of operation.

An overall plan also is essential to coordinate the activities of every team, crew, or unit involved in the operation. The IMS coordinates and tracks the location and function of every individual or work group involved in an operation.

Freelancing is acting independently of a superior's orders or the fire department's SOPs. Freelancing has no place on the fireground; it is a danger to both the fire fighter who acts independently and every other fire fighter. A fire fighter who freelances can easily get into trouble by being in the wrong place at the wrong time or by doing the wrong thing. For example, a fire fighter who enters a burning structure without informing a superior may be trapped by rapidly changing conditions. By the time the fire fighter is missed, it may be too late to perform a rescue. Searching for a missing fire fighter exposes others to unnecessary risk.

Safety officers are designated members of the fire department whose primary responsibility is safety. At the emergency scene, a safety officer reports directly to the IC and has the authority to stop any part of an action that is judged to be unsafe. Safety officers observe operations and conditions, evaluate risks, and work with the IC to identify hazards and ensure the safety of all personnel. Safety officers also determine when fire fighters can work without self-contained breathing apparatus (SCBA) after a fire is extinguished.

Safety officers contribute to safety in the workplace, at emergency incidents, and at training exercises. However, each

member of the department shares the responsibility for safety, as an individual and as a member of the team.

Training

Adequate training is essential for fire fighter safety. The initial fire fighter training covers the potential hazards of each skill and evolution and outlines the steps necessary to avoid injury. Fire fighters must avoid sloppy practices or shortcuts that can contribute to injuries and learn how to identify hazards and unsafe conditions.

The knowledge and skills developed during training classes are essential for safety. The initial training course is only the beginning. Fire fighters must continually seek out additional courses and work to keep their skills current to ensure personal and team safety.

Equipment

A fire fighter's equipment ranges from power and hand tools to **personal protective equipment (PPE)** and electronic instruments. Fire fighters must know how to use equipment properly and operate it safely. Equipment also must be properly maintained. Poorly maintained equipment can create additional hazards to the user or fail to operate when needed.

Manufacturers usually supply operating instructions and safety procedures. Instructions cover proper use, limitations, and warnings of potential hazards. Fire fighters must read and heed these warnings and instructions. New equipment must meet applicable standards to ensure that it can perform under difficult and dangerous conditions on the fireground.

Safety and Health

Safety and well-being are directly related to personal health and physical fitness. Although fire departments regularly monitor and evaluate the health of fire fighters, each department member is responsible for personal conditioning and nutrition. Fire fighters should eat a healthy diet, maintain a healthy weight, and exercise regularly.

All fire fighters, whether paid or volunteer, should spend at least an hour a day in physical fitness training. Fire fighters should be examined by either a personal or departmental physician before beginning any new workout routine. An exercise routine that includes weight training, cardiovascular workouts, and stretching with a concentration on job-related exercises is ideal. For example, many fire fighters will use a stair-climbing machine and focus on the muscle groups used for firefighting. This builds strength and endurance on the fireground, but other muscle groups should not be neglected.

Hydration is an important part of every workout. A good guideline is to consume 8 to 10 ounces of water for every 5 to 10 minutes of physical exertion. Do not wait until you feel thirsty to start rehydrating. Fire fighters should drink up to a gallon of water each day to keep properly hydrated.

Proper hydration enables muscles to work longer and reduces the risk of injuries at the emergency scene.

Diet is another important aspect of physical fitness. A healthy menu includes fruits, vegetables, low-fat foods, whole grains, and lean protein. Pay attention to portion sizes; most people eat larger portions than their bodies need. Substitute healthy choices such as fruit for high-calorie desserts.

Heart disease is the leading cause of death in the United States and among fire fighters. A healthy lifestyle that includes a balanced diet, weight training, and cardiovascular exercises helps reduce many risk factors for heart disease and enables fire fighters to meet the physical demands of the job (▼ **Figure 2-4**).

Many fire departments have adopted policies that prohibit the use of tobacco products by fire fighters, on-duty or off-duty. Smoking is a factor in cardiovascular disease, reduces the efficiency of the body's respiratory system, and increases the risk of lung cancer. Fire fighters should avoid tobacco products entirely for both health and insurance reasons.

Alcohol is another substance that fire fighters should avoid. Alcohol is a mood-altering substance that can be abused. Excessive alcohol use can damage the body and affect performance. Fire fighters who have consumed alcohol must not be permitted to engage in emergency operations.



Figure 2-4 Regular exercise will help you to stay healthy and perform your job.

Drug use has absolutely no place in the fire service. Many fire departments have drug-testing programs to ensure that fire fighters do not use or abuse drugs. The illegal use of drugs endangers your life, the lives of your team members, and the public you serve.

Everyone is subject to an occasional illness or injury. Fire fighters should not try to work when ill or injured. Operating safely as a member of a team requires fitness and concentration. Do not compromise the safety of the team or your personal health by trying to work while ill or injured.

Employee Assistance Programs

Employee assistance programs (EAPs) provide confidential help with a wide range of problems that might affect performance. Many fire departments have EAPs so that fire fighters can get counseling, support, or other assistance in dealing with a physical, financial, emotional, or substance abuse problem. An officer may refer a fire fighter to an EAP if the problem begins to affect job performance. Fire fighters who use an EAP can do so with complete confidentiality and without fear of retribution.

Safety During Training

During training, fire fighters learn the actual skills that are later used under emergency conditions. The patterns that develop during training will continue during actual emergency incidents. Developing the proper working habits during training courses helps ensure safety later.

Many of the skills covered during training can be dangerous if they are not performed correctly. According to the NFPA, an average of nine fire fighters are fatally injured during training exercises every year. Proper protective gear and teamwork are as important during training as they are on the fireground.

Instructors and veteran fire fighters are more than willing to share their experiences and advice. They can explain and demonstrate every skill and point out the safety hazards involved because they have performed these skills hundreds of times and know what to do. But here, too, safety is a shared responsibility. Do not attempt anything you feel is beyond your ability or knowledge. If you see something that you feel is an unsafe practice, bring it to the attention of your instructors or a designated safety officer.

Do not freelance on the training ground. Wait for specific instructions or orders before beginning any task. Do not assume that something is safe and act independently. Follow instructions and learn to work according to the proper procedures.

Teamwork is also important during training exercises. Assignments are given to firefighting teams during most live fire exercises. Teams must stay together. If any member of the team becomes fatigued, is in pain or discomfort, or needs to leave the training area for any reason, notify the instructor or safety officer. EMS personnel will be nearby to per-

form an examination and refer for further treatment if necessary. A fire fighter injured during training should not return until medically cleared for duty.

Safety During Emergency Response

When a company is dispatched to an emergency, fire fighters need to get to the apparatus and don appropriate PPE quickly before mounting the vehicle and proceeding to the incident. Walk quickly to the apparatus; do not run. Be careful not to slip and become injured before reaching the apparatus.

Personal protective gear should be properly positioned so you can don it quickly before getting into the apparatus (▼ **Figure 2-5**). Be sure that seat belts are properly fastened before the apparatus begins to move. All personnel responding on fire apparatus must be seated with seat belts fastened. Seat belts should remain fastened until the apparatus comes to a complete stop. Fire fighters can don SCBA while seated in some vehicles. Learn how to do this without compromising safety.

Drivers have a great responsibility. They must get the apparatus and the crew members to the emergency scene without having or causing a traffic accident en route. They must know the streets in their first-due area and any target hazards. They must be able to operate the vehicle skillfully and keep it under



Figure 2-5 Protective clothing should be properly positioned so you can quickly don it.

control at all times. They must anticipate all responses from other drivers who might not see or hear an approaching emergency vehicle or know what to do. Prompt response is a goal, but safe response is a much higher priority.

Volunteer fire department members must exercise extreme care when responding in private vehicles. Other volunteers will be responding at the same time, so you must be aware of their vehicles. Excessive speed is a major factor in many fire fighter fatalities involving private vehicles. The few seconds gained by speeding are not worth the risk created. A fire fighter responding in a private vehicle is legally required to comply with all traffic laws.

Safety at Emergency Incidents

At the emergency scene, fire fighters should never charge blindly into action. The officer in command will “size-up” the situation, carefully evaluating the conditions to determine if the burning building is safe to enter. Wait for instructions and follow directions for the specific tasks to be performed. Do not freelance or act independently of command.

Teamwork

On the fireground, a firefighting team should always consist of at least two fire fighters who work together and are in constant communication with each other. Some departments call this the **buddy system** (▼ Figure 2-6). In some cases, fire fighters work directly with the company officer, and all crew members function as a team. In other situations, two individual fire fighters may be a team assigned to perform a specific task. In either case, the company officer must always know where teams are and what they are doing.

Partners or assigned team members should enter together, work together, and leave together. If one member of a team must leave the fire building for any reason, the entire team must leave together, regardless if it is a two-person team or an entire crew working as a team.



Figure 2-6 A firefighting team should consist of at least two members who work together.

Before entering a burning building to perform interior search and rescue or fire suppression operations, fire fighters must be properly equipped with approved PPE. Partners should check each other’s PPE to ensure it is on and working correctly before they enter a hazardous area.

Team members working in a hazardous area should maintain visual, vocal, or physical contact with each other at all times. At least one member of each team should have a portable **two-way radio** to maintain contact with the IC or a designated individual in the chain of command who remains outside the hazardous area. The radio can be used to relay pertinent information and to summon help if the team becomes disoriented, trapped, or injured. The IC can contact the team with new instructions or an evacuation order.

Fire fighters operating in a hazardous area require back-up personnel. The back-up team must be able to communicate with the entry team, either by sight or by radio, and ready to provide assistance. During the initial stages of an incident, at least two fire fighters must remain outside the hazardous area, properly equipped to respond immediately if the entry team has to be rescued.

As the incident progresses and additional crews are assigned to work in the hazardous area, a designated **rapid intervention company/crew (RIC)** should be established and positioned outside the hazardous area. This team’s sole responsibility is to be prepared to provide emergency assistance to crews working inside the hazardous area.

Accountability

Every fire department should have a **personnel accountability system** to track personnel and assignments on the emergency scene. The system should record the individuals assigned to each company, crew, or entry team; the assignments for each team; and the team’s current activities. Several kinds of accountability systems are acceptable, ranging from paper assignments or display boards to laptop computers and electronic tracking devices.

Some departments use a “passport” system. Each company officer carries a small magnetic board called a passport. Each crew member on duty with that company has a magnetic name tag on the board (► Figure 2-7). At the incident scene, the company’s passport is given to a designated individual who uses it to track the assignment and location of every company at the incident.

An “accountability tag” system is often used by many fire departments. Each fire fighter carries a name tag and turns it in or places it in a designated location on the apparatus when the individual is on the scene. The tags are collected and used to track crews working together as a unit. This system works well when crews are organized based on the available personnel.

Both systems provide an up-to-date accounting of everyone who is working at the incident and how they are organized. At set intervals, an accountability check is performed

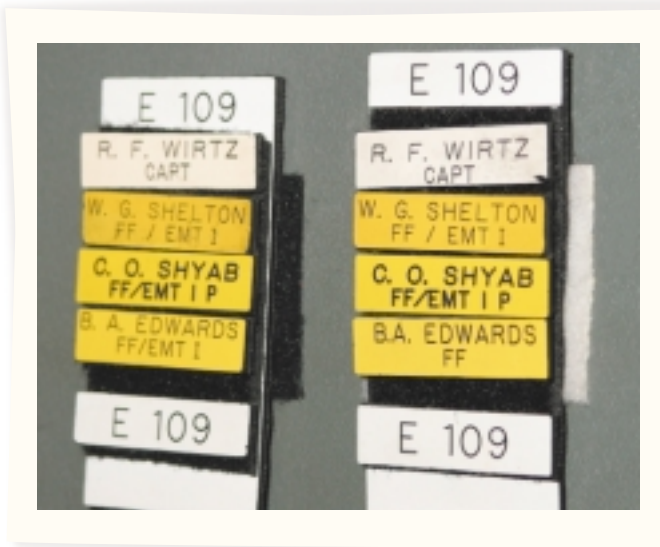


Figure 2-7 A passport lists each fire fighter assigned to a crew.

to account for everyone. Usually, a company officer reports on the status of each crew. The company officer should always know exactly where each crew is and what it is doing. If a crew splits into two or more teams, the company officer should be in contact with at least one member of each team.

An accountability check is also performed when there is a change in operational strategy or when a situation occurs that could endanger fire fighters. If an accountability check is needed, the list of personnel and assignments is available at the command post.

Fire fighters must learn their department's accountability system, how to work within it, and how it works within the IMS. Fire fighters are responsible for complying with the system and staying in contact with a company officer or assigned supervisor at all times. Teams must stay together.

Incident Scene Hazards

Fire fighters must be aware of their surroundings when performing their assigned tasks at an emergency scene. At an incident, make a safe exit from the apparatus and look at the building or situation for safety hazards such as traffic, downed utility wires, and adverse environmental conditions. An incident on a street or highway must first be secured with proper traffic- and scene-control devices. Flares, traffic cones, or barrier tape can keep the scene safe and the public at a safe distance. Always operate within established boundaries and protected work areas.

Changing fire conditions will also affect safety. During the overhaul phase and while picking up equipment, watch out for falling debris, smoldering areas of fire, and sharp objects. If a safety officer is not on the scene, another qualified person should be assigned to monitor the atmosphere for the presence of **carbon monoxide** (CO). CO is an odorless, colorless, tasteless gas that can cause asphyxiation, resulting in

unconsciousness or death. Because the chance for injury increases when you are tired, do not let down your safety guard even though the main part of the fire is over.

Using Tools and Equipment Safely

Fire fighters must learn how to use tools and equipment properly and safely before using them at an emergency incident. Follow the proper procedures and safety precautions in training and at an incident scene. Use protective gear such as PPE, safety glasses, and hearing protection when they are required.

Proper maintenance includes sharpening, lubricating, and cleaning each tool. Equipment should always be in excellent condition and ready for use. Fire fighters should be able to do basic repairs such as changing a saw blade or a handlight battery. Practice these tasks at the fire station until you can perform them quickly and safely on the emergency scene.

Electrical Safety

Electricity is an emergency scene hazard that must always be respected. Many fires are caused by electricity, such as those ignited by faulty wiring or involving electric-powered equipment. Energized power lines may be present on the fireground. Fire fighters must always check for overhead power lines when raising ladders. During any fire, the electric power supply to the building should be turned off. This is part of the fireground task called "controlling the utilities."

Fire departments are often called to electrical emergencies, such as downed power lines, fires or arcing in transformers and switchgear, and stuck elevators. Always disconnect the power to any electrical equipment involved in an emergency incident.

Park apparatus outside the area and away from power lines when responding to a call for an electrical emergency. A downed power line should be considered energized until the power company confirms that it is dead. Secure the area around the power line and keep the public at a safe distance. Never drive fire apparatus over a downed line or attempt to move it using tools. If a sparking power line causes a brush fire, attempt to contain the fire but do not use water near the line.

Lifting and Moving

Lifting and moving objects are part of a fire fighter's daily duties. Do not try to move something that is too heavy alone—ask for help. Never bend at the waist to lift an object; always bend at the knees and use the legs to lift. Use equip-

Fire Fighter Safety Tips

Never be afraid to ask for help when moving a heavy object.

ment such as handcars, hand trucks, and wheelbarrows to move objects a long distance.

Fire fighters must often move sick or injured patients. Discuss and evaluate the options before moving a patient, then proceed very carefully. If necessary, request help. Never be afraid to call for additional resources, such as an additional engine or truck company, to assist in lifting and moving a heavy patient.

Working in Adverse Weather Conditions

In adverse weather conditions, fire fighters must dress appropriately. A turnout coat and helmet can keep you warm and dry in rain, snow, or ice. Firefighting gloves and knit caps will also help retain body heat and keep you warm. If conditions are icy, make smaller movements, watch your step, and keep your balance.

During the hot summer months, many departments allow their members to wear cotton T-shirts and short pants. Check your department's SOPs.

Rehabilitation

Rehabilitation is a systematic process to provide periods of rest and recovery for emergency workers during an incident. Rehabilitation is usually conducted in a designated area away from the hazards of the emergency scene. The rehabilitation area, or "rehab," is usually staffed by EMS personnel.

A fire fighter who is sent to rehab should be accompanied by the other members of the crew. The company officer should inform the IC of their change in location. While in rehab, fire fighters should take advantage of the opportunity to rest, rehydrate, have their vital signs checked by EMS personnel, and have minor injuries treated **▶ Figure 2-8**. Rehab gives fire fighters the chance to cool off in hot weather and to warm up in cold weather.

Rehabilitation time can be used to replace SCBA cylinders, obtain new batteries for portable radios, and make repairs or adjustments to tools or equipment. Firefighting teams can discuss recently completed assignments and plan their next work cycle. When a crew is released from rehab, they should be rested, refreshed, and ready for another work cycle. If the crew is too exhausted or unable to return to work, they should be replaced and released from the incident.

Never be afraid or embarrassed to admit you need a break when on the emergency scene. Heat exhaustion is a common condition, characterized by profuse sweating, dizziness, confusion, headache, nausea, and cramping. If a fire fighter shows the signs or symptoms of heat exhaustion, the company officer should be notified immediately. The company officer will request approval for rehabilitation so the problem can be treated.

Heat exhaustion is usually not life-threatening and, if identified early, can be remedied by rehydration, cooling, and rest. Left untreated, heat exhaustion can progress quickly to heat stroke, which is a life-threatening emergency. A lack of

sweating, low blood pressure, shallow breathing, and seizures are some of the signs of heat stroke. If you or a member of your team experience these symptoms during training or on the fireground, place a "mayday" or "fire fighter in trouble" call. You must leave the fireground or training area and seek immediate medical attention.

A fire fighter who experiences chest pain or discomfort should stop and seek medical attention immediately. Heart attacks are the leading cause of death among fire fighters.

Violence at the Scene

Fire fighters are often dispatched to situations involving domestic disputes, injuries from an assault, or other violent scenes. The staging area and the apparatus should be some distance from the scene until the police arrive, investigate, and declare the area safe. Only then should fire fighters proceed into the emergency scene. A fire fighter's personal safety should always be paramount. If there is any threat to personal safety, slowly back away from the emergency scene to a safe distance and request the police to secure the scene. Do not become a victim.

If you are confronted with a potentially violent situation, do not respond violently. Remain calm, speak quietly, and attempt to gain the person's trust. You may consider taking additional classes to increase your understanding and develop appropriate skills for these situations.



Figure 2-8 In the rehabilitation area, fire fighters can rest and rehydrate.

Fire Fighter Safety Tips

Remember these guidelines to stay safe—on and off the job.

- **You are personally responsible for safety.** Keep yourself safe. Keep your teammates safe. Keep the citizens—your customers—safe.
- **Work as a team.** The safety of the firefighting unit depends on the efforts of each member. Become a dependable member of the team.
- **Follow orders.** Freelancing can endanger other fire fighters as well as yourself.
- **Think!** Before you act, think about what you are doing. Many people are depending on you.

Critical Incident Stress Debriefing

Some calls are particularly difficult and emotionally traumatic. Afterwards, fire fighters who were involved may be required to attend a **critical incident stress debriefing (CISD)**. Usually, a stress debriefing is held as soon as possible after a traumatic call. It provides a forum for firefighting and EMS personnel to discuss the anxieties, stress, and emotions triggered by a difficult call. Follow-up sessions can be arranged for individuals who continue to experience stressful or emotional responses after a challenging incident.

Most fire departments have qualified, designated CISD staff available 24 hours a day. The initial CISD is usually a group session for all fire fighters and rescuers. It can also be done on a one-on-one basis or in smaller groups. Everyone handles stress differently, and new fire fighters need time to develop the personal resources to deal with difficult situations. If any call is emotionally disturbing, ask your superior officer for a referral to a qualified CISD counselor.



Figure 2-9 Always use your seat belt.

Safety at the Fire Station

The fire station is just as much a workplace as the fireground. Fire fighters will spend much of the time during a 12- or 24-hour shift at the fire station. Be careful when working with power tools, ladders, electrical appliances, pressurized cylinders, and hot surfaces. Injuries that occur at the firehouse can be just as devastating as those that occur at an emergency incident scene.

Safety Outside Your Workplace

Continue to follow safe practices when you are off-duty as well. An accident or injury, regardless of where it happens, can end your career as a fire fighter. For example, if you are using a ladder while off duty, follow the same safety practices that you would use on duty. Use the seat belts in your personal vehicle, just as you are required to do when you are on duty (◀ **Figure 2-9**).

Personal Protective Equipment

Personal protective equipment (PPE) is an essential component of a fire fighter's safety system. It enables a person to survive under conditions that would otherwise result in death or serious injury. Different PPE ensembles are designed for specific



Figure 2-10 A protective ensemble for structural firefighting provides protection from multiple hazards.

Fire Fighter Safety Tips

A structural firefighting ensemble is designed only for structural firefighting. It is not designed for other functions such as hazardous materials, water rescue, or wildland firefighting. Each of these specialized functions requires specific PPE. If your department performs specialized operations, you need the appropriate PPE for that activity.

hazardous conditions, such as structural firefighting, wildland firefighting, airport rescue and firefighting, hazardous materials operations, and emergency medical operations.

PPE ensembles provide specific protections, so an understanding of their designs, applications, and limitations is critical. For example, a structural firefighting ensemble will protect the wearer from the heat, smoke, and toxic gases present in building fires (◀ **Figure 2-10**). It cannot provide long-term protection from extreme weather conditions and it limits range of motion. The more you know about the protection your PPE can provide, the better you will be able to judge conditions that exceed its limitations.

A fire fighter's PPE must provide full body coverage and protection from a variety of hazards. To be effective, the entire ensemble must be worn whenever potential exposure to those hazards exists. PPE must be cleaned, maintained, and inspected regularly to ensure that it will provide the intended degree of protection when it is needed. Worn or damaged articles must be repaired or replaced.

Structural Firefighting Ensemble

Structural firefighting PPE enables fire fighters to enter burning buildings and work in areas with high temperatures and concentrations of toxic gases. Without PPE, fire fighters would be unable to conduct search-and-rescue operations or perform fire suppression activities. A structural firefighting ensemble is designed to cover every inch of the body. It provides protection from the fire, keeps water away from the body, and helps reduce trauma from cuts or falls. Structural firefighting PPE is designed to be worn with **self-contained breathing apparatus (SCBA)**, which provides respiratory protection.

The structural firefighting ensemble consists of a protective coat, trousers or coveralls, a helmet, a hood, boots, and gloves. The helmet must have a face shield, goggles, or both. The clothing is worn with SCBA and a personal alert safety system (PASS) device. All of these elements must be worn together to provide the necessary level of protection (▶ **Figure 2-12**).

Protection Provided

A structural firefighting ensemble is designed for full body coverage and provides several different types of protection

Standards for Personal Protective Equipment

Personal protective equipment for fire fighters must be manufactured according to exacting standards. Each item must have a permanent label verifying that the particular item meets the requirements of the standard (▼ **Figure 2-11**). Usage limitations as well as cleaning and maintenance instructions should also be provided. The requirements for firefighting PPE are outlined in:

- NFPA 1971, *Standard on Protective Ensemble for Structural Firefighting*
- NFPA 1976, *Standard on Protective Ensemble for Proximity Firefighting*
- NFPA 1977, *Standard on Protective Clothing and Equipment for Wildland Firefighting*

The requirements for self-contained breathing apparatus and personal alert safety systems are outlined in:

- NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*
- NFPA 1982, *Standard on Personal Alert Safety Systems (PASS)*



Figure 2-11 The label provides important information about each item of PPE.



Figure 2-12 The complete structural firefighting ensemble consists of a helmet, coat, trousers, protective hood, gloves, boots, SCBA, and PASS device.

Table 2-2 Types of Protection Furnished by PPE

Personal protective equipment:

- Provides thermal protection
- Repels water
- Provides impact protection
- Provides protection against cuts and abrasions
- Furnishes padding against injury
- Increases your visibility
- Provides respiratory protection

▲ **Table 2-2**. The coat and trousers have tough outer shells that can withstand high temperatures, repel water, and provide protection from abrasions and sharp objects. The knees may be reinforced with pads for greater protection when crawling. Fluorescent/reflective trim adds visibility in dark or smoky environments. Insulating layers of fire-resistant materials protect the skin from high temperatures. A moisture barrier between the layers keeps liquids and vapors, such as hot water or steam, from reaching the skin.

The helmet provides protection from trauma to the head and includes ear coverings. The face shield helps protect the eyes. A fire-retardant hood covers any exposed skin between the coat collar and the helmet. Gloves protect the hands from heat, cuts, and abrasions. Boots protect the feet and ankles from the fire, keep them dry, prevent puncture injuries, and protect the toes from crushing injuries.

Self-contained breathing apparatus provides respiratory protection. An SCBA gives the fire fighter an independent air supply. This protects the respiratory system from toxic products and hot gases present in the atmosphere.

Helmet

Fire helmets are manufactured in several designs and shapes using different materials. Each design must meet the requirements specified in NFPA 1971, *Standard on Protective Ensemble for Structural Firefighting*. The hard outer shell is lined with energy-absorbing material and has a suspension system to provide impact protection against falling objects

► **Figure 2-13**. The helmet shell also repels water, protects against steam, and creates a thermal barrier against heat and cold. The shape of the helmet helps to deflect water away from the head and neck.

Face and eye protection can be provided by a face shield, goggles, or both. These components must be attached to the helmet and are used when SCBA is not needed or when the SCBA face piece is not in place. A chin strap is also required and must be worn to keep the helmet in the proper position. The chin strap also helps to keep the helmet on the fire fighter's head during an impact.



Figure 2-13 A helmet is constructed with multiple layers and components.

Fire helmets have an inner liner for added thermal protection. This liner also provides protection for the ears and neck. When entering a burning building, the fire fighter should pull down the ear tabs for maximum protection.

Helmets are manufactured with adjustable inner suspension systems that hold the head away from the shell and cushion it against impacts. This suspension system must be adjusted to fit the individual, with the SCBA face piece and hood in place. Helmet shells also come in various sizes. Fire fighters must be sure to wear the correct size shell.

Helmet shells are often color-coded according to the fire fighter's rank and function. They often carry company numbers, rank insignia, or other markings. Some fire departments use a shield mounted on the front of the helmet to identify the fire fighter's rank and company. Bright, reflective materials are applied to make the fire fighter more visible in all types of lighting conditions.

NFPA 1971 requires that helmets approved for structural firefighting have a label permanently attached to the inside of the shell. This label lists the manufacturer, model, date of manufacture, weight, size, and recommended cleaning procedures.

Protective Hood

Although the helmet's ear tabs cover the ears and neck, this area is still at risk for burns when the head is turned or the neck is flexed. **Protective hoods** provide additional thermal protection for these areas. The hood, which is constructed of flame-resistant materials such as **Nomex®** or **PBI®**, covers the whole head and neck, except for that part of the face protected by the SCBA face piece ► **Figure 2-14**. The lower part of the hood, which is called the bib, drapes down inside the turnout coat.



Figure 2-14 A protective hood.

Protective hoods are worn over the face piece but under the helmet. After securing the face piece straps, carefully fit the hood around the face piece so that no areas of bare skin are left exposed. The hood must fit snugly around the clear area of the face piece so that vision is not compromised and hot gases cannot leak between the face piece and the hood.

Turnout Coat

Coats used for structural firefighting are generally called **bunker coats** or **turnout coats** (▼ **Figure 2-15**). Only coats that meet NFPA 1971 should be used for structural firefighting. Turnout coats have three layers. The outer layer or shell is constructed of a sturdy, flame-resistant, water-repellant material such as Nomex, **Kevlar®**, or PBI. Fluorescent reflective material applied to the light-colored outer shell makes the fire fighter more visible in smoky conditions and at night. The light-colored fabric also makes it easier to identify con-



Figure 2-15 A bunker or turnout coat.

Fire Marks



Before hoods were introduced, the skin on the neck and ears was often exposed. Fire fighters “measured” the temperature in a burning building by how hot their ears felt. This often resulted in burns to the ears. Fire fighters still must be careful to avoid situations where the temperature exceeds the protection provided by PPE.

taminants such as hydrocarbons, blood, and body fluids on the coat.

The second layer of the coat is the moisture barrier, which is usually a flexible membrane attached to a thermal barrier material (the third layer). The moisture barrier helps prevent the transfer of water, steam, and other fluids to the skin. Water applied to a fire generates large amounts of superheated steam, which can engulf fire fighters and burn unprotected skin.

The thermal barrier is a multilayered or quilted material that insulates the body from external temperatures. It enables fire fighters to operate in the high temperatures generated by a fire and keeps the body warm during cold weather.

The front of the turnout coat has an overlapping flap to provide a secure seal. The inner closure is secured first, and then the outer flap is secured, creating a double seal. Several different combinations of D-rings, snaps, zippers, and Velcro can be used to secure the inner and outer closures.

The collar of the coat works with the hood to protect the neck. The collar has snaps or a Velcro closure system in front to keep it in a raised position. The coat’s sleeves have wristlets that prevent liquids or hot embers from getting between the sleeves and the skin. They also prevent the sleeves from riding up the wrists, so there is no exposed skin between the gloves and the sleeves, which could result in wrist burns.

Bunker coats come in two different lengths—long and short. Both will protect the body as long as the matching style of pants or coveralls are also worn. The coat must be long enough that you can raise your arms over your head without exposing your midsection. The sleeve length should not hinder arm movement, and the coat should be large enough that it does not interfere with breathing or other movements.

Fire Fighter Safety Tips

The inner thermal liner of most turnout coats can be removed while the outer shell is being cleaned, but the turnout coat should never be used without the thermal liner. Severe injury could occur if the coat is used without the liner.

Fire Marks

Bunker coats were originally made of rubber and designed primarily to repel water. Today's coats provide protection from flames, heat, abrasions, and cuts as well as water.

Pockets in the coat can be used for carrying small tools or extra gloves. Additional pockets or loops can be installed to hold radios, microphones, flashlights, or other accessories.

Bunker Pants

Protective trousers are also called **bunker pants** or **turnout pants** (▼ Figure 2-16). They can be constructed in a waist-length design or bib-overall configuration. Bunker pants also must meet the NFPA 1971 and are constructed with multiple layers, just like bunker coats. The outer shell resists abrasion and repels water. The second layer is a moisture barrier to protect the skin from liquids and steam burns, and the inner layer is a quilted, thermal barrier to protect the body from elevated temperatures. Bunker pants are reinforced around the ankles and knees with leather or extra padding.



Figure 2-16 Bunker pants.

Bunker pants are manufactured with a double fastener system at the waist, similar to the front flap of a turnout coat. Florescent or reflective stripes around the ankles provide added visibility. Suspenders hold the pants up. Pants should be large enough to allow you to don them quickly. They should be big enough to allow you to crawl and bend your knees easily, but they should not be bigger than necessary.

Boots

Structural firefighting boots can be constructed of rubber or leather and come in different lengths. Rubber firefighting boots come in a step-in style without laces (▼ Figure 2-17). Leather firefighting boots are available in a knee-length, pull-on style or in a shorter version with laces (▼ Figure 2-18). Many fire fighters install a zipper on the laced boots to aid in quick donning and doffing.



Figure 2-17 Rubber firefighting boots.



Figure 2-18 Leather firefighting boots.

Fire Fighter Safety Tips

Fire boots must be worn with approved bunker pants. Boots worn without bunker pants leave the legs unprotected and exposed to injury.

Both boot styles must meet the same test requirements specified in NFPA 1971. The outer layer repels water and must be both flame- and cut- resistant. The boots must have a heavy sole with a slip-resistant design. Boots must have a puncture-resistant sole and a reinforced toe to prevent injury from falling objects. An inner liner constructed of materials such as Nomex or Kelvar adds thermal protection.

Boots must be the correct size for the foot. The foot should be secure within the boot to prevent ankle injuries and enable secure footing on ladders or uneven surfaces. Improperly sized boots will cause blisters and other problems.

Gloves

Gloves are an important part of the firefighting ensemble, because most fire suppression tasks require the use of the hands (▼ [Figure 2-19](#)). Gloves must provide adequate protection and still enable the manual dexterity needed to accomplish tasks. NFPA 1971 specifies that gloves must be resistant to heat, liquid absorption, vapors, cuts, and penetration. Gloves must have a wristlet to prevent skin exposure during normal firefighting activities.

Firefighting gloves are usually constructed of heat-resistant leather. The wristlets are usually made of knitted Nomex or Kevlar. The liner adds thermal protection and serves as a moisture barrier.

Many fire fighters carry a second set of gloves in their bunker gear or on the fire apparatus so they can change



Figure 2-19 Firefighting gloves.

Fire Fighter Safety Tips

Plain leather work gloves or plastic-coated gloves should never be used for structural firefighting. Gloves used for structural firefighting must be labeled and meet NFPA 1971.

gloves if one pair gets wet or damaged. Do not wring or twist wet gloves because this can tear or damage the inner liners.

Although gloves furnish needed protection, they reduce manual dexterity. Fire fighters need to practice manual skills while wearing gloves to become accustomed to them and to adjust movement accordingly.

Respiratory Protection

Self-contained breathing apparatus is an essential component of the PPE used for structural firefighting. Without adequate respiratory protection, fire fighters would be unable to mount an attack. The design, parts, operation, use, and maintenance of this complex equipment are covered later in this chapter.

Personal Alert Safety System (PASS)

A **personal alert safety system (PASS)** is an electronic device that sounds a loud audible signal when a fire fighter becomes trapped or injured. A PASS will sound automatically if a fire fighter is motionless for a set time period. The PASS can also be manually activated to notify other fire fighters that the user needs assistance.

A PASS can be separate from or integrated into the SCBA unit. (▼ [Figure 2-20](#)) The integrated PASS devices automatically turn on when the SCBA is activated. The separate PASS devices are often worn on the SCBA harness and must be turned on manually. Fire fighters must check that their PASS



Figure 2-20 A PASS can save a fire fighter's life.



VOICES OF EXPERIENCE

// Despite advances in protective clothing and equipment, we are not invincible on the job. //

On a late winter evening early in my career, the fire tone activated, reporting a fire in a two-story residential structure in the number 1 district. Arriving on scene, we encountered a woman in the front yard who was screaming that her children were upstairs. She said the fire started when she fell asleep while waiting for food to cook on the stove. She stated that the stairwell was right off the kitchen. The officer instructed us to enter and attack the fire using a “fog” pattern because he believed the fire had already vented sufficiently and a quick “knock-down” could provide relief for those trapped upstairs.

As we entered the front door, we could see heavy fire in the kitchen, approximately twenty feet in front of us. Visibility was good and we could see approximately five feet above the floor. Suddenly, the conditions began to change. The smoke banked down quickly, heat build-up was now intense, and we could see the flame rolling over toward us from the kitchen. What we could not see was the fire development in the living room immediately behind us and to the left. I opened the nozzle and began to knock down the fire ahead of us. Within seconds, we were hit with a tremendous blast of super-heated gas from behind and then in front. Crews outside later reported a flash of bright orange light with flame rolling out the front door, and with us silhouetted in the middle. We continued to flow water, but this seemed to make conditions worse. As we backed our line out to the door, we could see the fire from the living room pushing toward us. We turned on it and proceeded to knock down the fire, and then made our withdrawal.

Once we returned to the street, we performed a quick check of our team and our gear. We had been fully protected, with the latest personal protective clothing, SCBA, gloves, and hoods. Everyone appeared to be okay, except for me. My helmet shield was melted, my earflaps were burned, and my hood was stuck to my ears. I had received second- and third-degree burns to both ears, and first-degree burns to the sides of my face.

Looking back on this incident, I still consider the options and the choices we made that night and what we could have done differently. All the signs of the impending flashover were present—rapid heat build-up, banking smoke conditions, and rollover—but we were focused on the stairwell off the kitchen and the children upstairs, whom we found out later were not at home. We let the emotion of the incident drive our attack without regard for our own safety. We believed if we were aggressive, we could knock down the fire. However, aggressiveness is not a substitute for patience and planning when attacking a fire. Despite advances in protective clothing and equipment, we are not invincible on the job. Plan your interior attack carefully and move methodically with regard to safety.

Paul E. Ricci

Sandusky Fire Division
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Fire Fighter Tips

Fire fighters have personal preferences about the tools and equipment they carry in their pockets. Observe what seasoned members of your department carry in their pockets. This will help you decide whether you need to carry similar equipment.

is on and working properly before they enter a burning building or hazardous area.

The PASS combines an electronic motion sensor with an alarm system. If the user is motionless for 30 seconds, the PASS will sound a low warning tone before sounding a full alarm. The user can reset the device by moving during this warning period. Newer PASS devices also have a radio transmitter that sends a signal to the command post when the alarm sounds.

Additional Personal Protective Equipment

Eye protection is provided by the face shield mounted on fire helmets. When additional eye protection is needed, such as when using power saws or hydraulic rescue tools, fire fighters can use approved goggles. Goggles can be carried easily in turnout coat pockets.

Fire fighters can also be exposed to loud noises such as sirens and engines. Because hearing loss is cumulative, it is important to limit exposure to loud sounds. An intercom system on the apparatus can provide hearing protection **▼ Figure 2-21**. A small microphone is incorporated into large earmuffs located at each riding and operating position. Fire fighters don the earmuffs, which reduce engine and siren noise. The microphone enables crew members to talk to each other in a normal tone of voice and to hear the apparatus radio.



Figure 2-21 Some fire apparatus are equipped with an intercom system.

Flexible ear plugs are useful in other situations involving loud sounds. Fire fighters should use the hearing protection supplied by their departments to prevent hearing loss.

A fire fighter should always carry a **hand light**. Most interior firefighting is done in near-dark, zero-visibility conditions. A good working hand light can illuminate your surroundings, mark your location, and help you find your way under difficult conditions.

Two-way radios link the members of a firefighting team. At least one member of each team working inside a burning building or in any hazardous area should always have a radio. Some fire departments provide a radio for every on-duty fire fighter. Follow your department's SOP on radio use. A radio should be considered part of PPE and carried with you whenever it is appropriate.

Limitations of the Structural Firefighting Ensemble

The structural firefighting ensemble protects a fire fighter from the hostile environment of a fire. Each component must be properly donned and worn to provide complete protection. But even today's advanced PPE has drawbacks and limitations. Understanding those limitations will help you avoid situations that could result in serious injury or death.

First, this ensemble is not easy to don. There are several components that must be put on in the proper order and correctly secured. You must be able to don your equipment quickly and correctly, either at the firehouse before you respond to an emergency, or after you arrive at the scene. Properly donning and doffing PPE takes practice **▼ Figure 2-22**.

PPE is also heavy—nearly 50 pounds of extra weight. This increased weight means that everything you do—even walking—requires more energy and strength. Tasks such as advancing an attack line up a stairway or using an axe to ventilate a roof can be difficult, even for a fire fighter in excellent physical condition.



Figure 2-22 It takes practice to don the full PPE.

PPE retains body heat and perspiration, making it difficult for the body to cool itself. Perspiration is retained inside the protective clothing rather than released through evaporation to cool you. Fire fighters in full protective gear can rapidly develop elevated body temperatures, even when the ambient temperature is cool. The problem of overheating is more acute when surrounding temperatures are high. This is one reason that fire fighters must undergo regular rehabilitation and fluid replacement.

Another drawback to PPE is that it limits mobility. Full turnout gear not only limits the range of motion, it also makes movements awkward and difficult. This increases energy expenditure and adds stress.

Wearing PPE also decreases normal sensory abilities. The sense of touch is reduced by wearing heavy gloves. Turnout coats and pants protect skin but reduce its ability to determine the temperature of hot air. Sight is restricted when you wear SCBA. The plastic face piece reduces peripheral vision and the helmet, hood, and coat make turning the head difficult. Earflaps and the protective hood over the ears limit hearing. Speaking becomes muffled and distorted by the SCBA face piece, unless it is equipped with a special voice amplification system.

For these reasons, fire fighters must become accustomed to wearing and using PPE. Practicing skills while wearing PPE will help you become comfortable with its operation and limitations.

Work Uniforms

A fire fighter's work uniform is also part of the personal protective package. Certain synthetic fabrics can melt at relatively low temperatures and cause severe burns, even when worn under a complete personal protective ensemble. NFPA 1975, *Standard on Station/Work Uniforms for Fire and Emergency Services*, defines criteria for selecting appropriate fabrics for work uniforms.

Clothing containing nylon or polyester, even if they are blended with natural fibers, should not be worn in a fire-fighting environment. Clothing made of natural fibers, such as cotton or wool, is generally safer to wear. Nylon and polyester will melt, but cotton and wool may char or even burn without melting. Special synthetic fibers such as Nomex and PBI, which are used in turnout clothing, have

Fire Fighter Safety Tips

DO NOT don protective clothing inside the apparatus while en route to an emergency incident. Stay in your assigned seat, properly secured by a seat belt or safety harness while the vehicle is in motion. Don protective clothing in the firehouse before mounting the apparatus, or on the scene after you arrive.

excellent resistance to high temperatures. Volunteer fire fighters, who often wear PPE over their normal clothing, should consider these fabric properties when selecting their wardrobe.

Donning Personal Protective Clothing

Donning protective clothing must be done in a specific order to obtain maximum protection. It also must be done quickly. Fire fighters should be able to **don**, or put on, personal protective clothing in one minute or less. This requires considerable practice, but remember that your goals should first be to don PPE properly, and second to do it consistently in 60 seconds or less.

Following a set pattern of donning PPE can help reduce the time it takes to dress. Many fire fighters follow the pattern described in **► Skill Drill 2-1**. This exercise does not include donning SCBA. First become proficient in donning personal protective clothing, and then add the SCBA. Follow the steps in Skill Drill 2-1 to don personal protective clothing:

1. Place equipment in a logical order for donning. **(Step 1)**
 - Place the legs of your bunker pants over your boots and fold the pants down around them.
 - Place your protective hood over the top of your boots to remind you to put on your protective hood.
 - Lay out your coat, helmet, and gloves.
2. Place your protective hood over your head and down around your neck. **(Step 2)**
3. Step into your boots and pull up your bunker pants. Place the suspenders over your shoulders and secure the front of the pants using the closure system. **(Step 3)**
4. Put on your turnout coat and secure the inner and outer closures. **(Step 4)**
5. Place your helmet on your head with ear tabs extended and adjust the chin strap securely. Turn up your coat collar and secure it in front. **(Step 5)**
6. Put on your gloves. **(Step 6)**
7. Check all clothing to be sure it is properly secured and in the correct position. Have your partner check your clothing. **(Step 7)**

Fire Fighter Tips

NFPA 1001 requires fire fighters to don personal protective clothing in one minute. Practice donning your protective clothing ensemble until you can do it quickly and smoothly. Remember that each piece of the ensemble must be in place for maximum protection.



Skill Drill

Donning Personal Protective Clothing



1 Place your equipment in a logical order for donning.



2 Place your protective hood over your head and down around your neck.



3 Put on boots and pull up bunker pants. Place the suspenders over your shoulders and secure the front of the pants.



4 Put on your turnout coat and close the front of the coat.



5 Place your helmet on your head and adjust the chin strap securely. Turn up your coat collar and secure it in front.



6 Put on your gloves.



7 Have your partner check your clothing.

Fire Fighter Safety Tips

In hot weather, remove as much of your PPE as possible when you arrive at rehab. This will help you to cool down quickly. Some fire departments even place fans and misting equipment in the rehab area to provide additional cooling.

Doffing Personal Protective Clothing

To **doff**, or remove, your personal protective clothing, reverse the procedure used in getting dressed. Follow the steps in **► Skill Drill 2-2** to doff personal protective clothing:

1. Remove your gloves. **(Step 1)**
2. Open the turnout coat collar. **(Step 2)**
3. Release the helmet chin strap and remove your helmet. **(Step 3)**
4. Remove your turnout coat. **(Step 4)**
5. Remove your protective hood. **(Step 5)**
6. Remove your bunker pants and boots. **(Step 6)**

If necessary, PPE should be cleaned after it is used, and then kept in a convenient location for the next response. PPE may be kept close to the apparatus, on the apparatus, or in an equipment locker. Personal protective clothing must be properly maintained, organized, and ready for the next emergency response.

Care of Personal Protective Clothing

Approved personal protective clothing is built to exacting standards but requires proper care to continue to afford maximum protection. Avoid unnecessary wear on turnout clothing. A complete set of approved turnout clothing (excluding SCBA) costs more than \$1,000. Keep this expensive equipment in good shape for its intended use—structural firefighting.

Check the condition of PPE on a regular basis. Clean it when necessary; repair worn or damaged PPE at once. PPE that is worn or damaged beyond repair must be replaced immediately because it will not be able to protect you.

Avoid unnecessary cuts or abrasions on the outer material. This material already meets NFPA standards; do not look for opportunities to test its effectiveness. If the fabric is damaged, it must be properly repaired to retain its protective qualities. Follow the manufacturer's instructions for repairing or replacing PPE.

Personal protective clothing must be kept clean to maintain its protective properties. Dirt will build up in the clothing fibers from routine use and exposure to fire environments. Smoke particles will also become embedded in the outer shell material. The interior layers will frequently be soaked with perspiration. Regular cleaning should remove most of these contaminants.

Other contaminants are formed from the by-products of burnt plastics and synthetic products. These residues are flammable and can be trapped between the fibers or build up on the outside of PPE, damaging the materials and reducing their protective qualities. A fire fighter who is wearing contaminated PPE is actually bringing additional fuel into the fire on the clothing.

PPE that has been badly soiled by exposure to smoke, other products of combustion, melted tar, petroleum products, or other contaminants needs to be cleaned as soon as possible. Items that have been exposed to chemicals or hazardous materials may have to be impounded for decontamination or disposal.

Cleaning instructions are listed on the tag attached to the clothing. Follow the manufacturer's cleaning instructions. Failure to do so may reduce the effectiveness of the garment and create an unsafe situation for the wearer.

Some fire departments have special washing machines that are approved for cleaning turnout clothing. Other departments contract with an outside firm to clean and repair protective clothing. In either case, the manufacturer's instructions for cleaning and maintaining the garment must be followed.

Other PPE also require regular cleaning and maintenance. The outer shell of your helmet should be cleaned with a mild soap as recommended by the manufacturer. The inner parts of helmets should be removed and cleaned according to the manufacturer's instructions. The chin strap and suspension system must be properly adjusted and all parts of the helmet kept in good repair.

Protective hoods and gloves get dirty quickly and should be cleaned according to the manufacturer's instructions. Most hoods can be washed with appropriate soaps or detergents. Repair or discard gloves or hoods that have holes in them; do not use them. A small cut or opening can result in a burn injury.

Boots should be maintained according to the manufacturer's instructions. Rubber boots need to be kept in a place that does not result in damage to the boot. Leather boots must be properly maintained to keep them supple and in good repair. Boots need to be repaired or replaced if the outer shell is damaged.

Fire Fighter Safety Tips

Make sure your PPE is dry before using it on the fireground. If wet protective clothing is exposed to the high temperatures of a structural fire, the water trapped in the liner materials will turn into steam and be trapped inside the moisture barrier. This can result in painful steam burns.

**Skill Drill**

Doffing Personal Protective Clothing



1 Remove your gloves.



2 Open the collar of your turnout coat.



3 Release the helmet chin strap and remove your helmet.



4 Remove your turnout coat.



5 Remove your protective hood.



6 Remove your bunker pants and boots.

Fire Fighter Safety Tips

Turnout clothing must be properly cleaned and maintained to provide maximum protection. Dirty turnout clothing is a sign of carelessness, not of experience.

Specialized Protective Clothing

Vehicle Extrication

Due to the risk of fire at the scene of a vehicle extrication incident, most members of the emergency team will wear full turnout gear. The officer in charge may also designate one or more members to don SCBA and stand by with a charged hoseline. A structural firefighting ensemble protects against many of the hazards present at a vehicle extrication incident, such as broken glass and sharp metal objects.

There is protective clothing, such as special gloves and coveralls or jumpsuits, specifically designed for vehicle extrication. These items are generally lighter in weight and more flexible than structural firefighting PPE, although they may use the same basic materials.

Fire fighters performing a vehicle extrication must always be aware of the possibility of contact with blood or other body fluids. Latex gloves should be worn when providing patient treatment. Eye protection also should be worn, due to the possibilities of breaking glass, contact with body fluids, metal debris, and accidents with tools.

Wildland Fires

Firefighting gear designed specially for fighting wildland or brush fires must meet NFPA 1977, *Standard on Protective Clothing and Equipment for Wildland Firefighting*. The jacket and pants are made of fire-resistant materials, such as Nomex or specially treated cotton, which are designed for comfort and maneuverability while working in the wilderness. Wildland fire fighters wear a helmet of a thermo-resistant plastic, eye protection, and pigskin or leather gloves. Their boots are designed for comfort and sure footing while hiking to a remote fire scene, and for protection against crush and puncture injuries.

Respiratory Protection

Respiratory protection equipment is an essential component of the structural firefighting personal protection ensemble. A self-contained breathing apparatus is both expensive and complicated; using one confidently requires practice. Fire fighters must be proficient in using SCBA before they engage in interior fire suppression activities.

The interior atmosphere of a burning building is considered to be **IDLH (immediately dangerous to life and health)**. Attempting to work in this atmosphere without proper res-

piratory protection can cause serious injury or death. Never enter or operate in a fire atmosphere without appropriate respiratory protection.

Respiratory Hazards of Fires

Fire fighters need respiratory protection for several reasons. A fire involves a complex series of chemical reactions that can rapidly affect the atmosphere in unpredictable ways.

The most evident by-product of a fire is smoke. The visible smoke produced by a fire contains many different substances, some of which are dangerous if inhaled. In addition, smoke contains invisible, highly toxic products of combustion. The process of combustion consumes oxygen and can lower the oxygen concentration in the atmosphere below the level necessary to support life. The atmosphere of a fire may become so hot that one unprotected breath can result in fatal respiratory burns.

These respiratory hazards require fire fighters to use respiratory protection in all fire environments, regardless of whether the environment is known to be contaminated, suspected of being contaminated, or could possibly become contaminated without warning. The use of SCBA allows fire fighters to enter and work in a fire atmosphere with a safe, independent air supply.


Smoke

Most fires do not have an adequate supply of oxygen to consume all of the available fuel. This results in **incomplete combustion** and produces a variety of by-products, which are released into the atmosphere. Many of these by-products are extremely toxic. Collectively, the airborne products of combustion are called smoke, which has three major components: particles, vapors, and gases.

Smoke Particles

Smoke particles consist of unburned, partially burned, and completely burned substances. These particles are lifted in the thermal column produced by the fire and are usually very visible. The completely burned particles are primarily ash; the unburned and partially burned smoke particles can

Fire Marks



Modern SCBA has made interior firefighting operations safer and more effective. Before SCBA, fireground injuries and fatalities caused by smoke inhalation were common. Thousands of fire fighters died from respiratory diseases, cancer, or other medical conditions that were direct consequences of repeated, unprotected exposure to smoke and other products of combustion. These exposures often had a cumulative, sometimes delayed effect. Each time fire fighters inhaled poisonous compounds, their lungs became more damaged, even though the damage was not evident until years later.

Fire Fighter Safety Tips

Smoky environments and oxygen-deficient atmospheres are deadly! It is essential to use SCBA at all times when operating in a smoky environment.

include various substances. The concentration of unburned or partially burned particles depends on the amount of oxygen that was available to the fire.

Many smoke particles are so small that they can pass through the natural protective mechanisms of the respiratory system and enter the lungs. Some of these particles can be toxic to the body and result in severe injuries or death if they are inhaled. They also can be extremely irritating to the eyes and digestive system.

Smoke Vapors

Smoke also contains small droplets of liquids. These smoke vapors are similar to fog, which consists of small water droplets suspended in the air. When oil-based compounds burn, they produce small hydrocarbon droplets that become part of the smoke. If inhaled or ingested, these compounds can affect the respiratory and circulatory systems. Some of the toxic droplets in smoke can cause poisoning if they are absorbed through the skin.

Water applied to a fire creates steam and water droplets that also become part of the smoke. These water droplets can absorb some of the toxic substances contained in the smoke.

Toxic Gases

A fire also produces several gases. The amount of oxygen available to the fire and the type of fuel being burned determine which gases are produced. A fire fueled by wood produces a different mixture of gases than one fueled by petroleum-based products. (Remember, many common products such as plastics are made from petroleum-based compounds.) The concentrations of these gases can change rapidly as the oxygen supply is consumed or as fresh oxygen is introduced to the combustion process.

Many of the gases commonly produced by residential or commercial fires are very toxic. Carbon monoxide, hydrogen cyanide, and phosgene are three of many gases often present in smoke.

Carbon monoxide is deadly in small quantities. When inhaled, carbon monoxide quickly replaces the oxygen in the bloodstream because it combines with the hemoglobin in the blood 200 times more readily than oxygen. A small concentration of carbon monoxide can quickly disable and kill a fire fighter. Carbon monoxide is odorless, colorless, and tasteless, which also makes it dangerous. Because carbon monoxide cannot be detected without special instru-

ments, fire fighters must always assume that it is present in the atmosphere around a fire.

Hydrogen cyanide is formed when plastic products, such as the PVC pipe used in residential construction, burn. It is a poisonous gas that is quickly absorbed by the blood and interferes with cellular respiration. A small amount of hydrogen cyanide can easily render a person unconscious.

Phosgene gas is formed from incomplete combustion of many common household products, including vinyl materials. Phosgene gas can affect the body in several ways. At low levels, it causes itchy eyes, a sore throat, and a burning cough. At higher levels, phosgene gas can cause pulmonary edema (fluid retention in the lungs) and death. Phosgene gas was used as a weapon in World War I to disable and kill soldiers.

Fires produce other gases that have different effects on the human body. Among these toxic gases are hydrogen chloride and several compounds containing different combinations of nitrogen and oxygen. Carbon dioxide, which is produced when there is sufficient oxygen for complete combustion, is not toxic, but it can displace oxygen from the atmosphere and cause asphyxiation.

Oxygen Deficiency

Oxygen is required to sustain human life. Normal outside or room air contains about 21% oxygen. A decrease in the amount of oxygen in the air will drastically affect an individual's ability to function as shown in [Table 2-3](#). Atmosphere with an oxygen concentration of 19.5% or less is considered oxygen-deficient. If the oxygen level drops below 17%, people can experience disorientation, an inability to control their muscles, and irrational thinking, which can make escaping a fire much more difficult.

During compartment fires (fires burning within enclosed areas), **oxygen deficiency** occurs in two ways. First, the fire consumes large quantities of the available oxygen, decreasing the concentration of oxygen in the atmosphere. Second, the fire produces large quantities of other gases, which decrease

Table 2-3 Physiological Effects of Reduced Oxygen Concentration

| Oxygen Concentration | Effect |
|----------------------|--|
| 21% | Normal breathing air |
| 17% | Judgment and coordination impaired; lack of muscle control |
| 12% | Headache, dizziness, nausea, fatigue |
| 9% | Unconsciousness |
| 6% | Respiratory arrest, cardiac arrest, death |

the oxygen concentration by displacing the oxygen that would otherwise be present inside the compartment.

Increased Temperature

Heat is also a respiratory hazard. The temperature of the gases generated during a fire varies, depending on fire conditions and the distance traveled by the hot gases. Inhaling superheated gases produced by a fire can cause severe burns of the respiratory tract. If the gases are hot enough, a single inhalation can cause fatal respiratory burns. More information about fire behavior and products of combustion is presented in Chapter 5, Fire Behavior.

Other Toxic Environments

Not all hazardous atmospheric conditions are caused by fires. Fire fighters will encounter toxic gases or oxygen-deficient atmospheres in many emergency situations. Respiratory protection is just as important in these situations as in a fire suppression operation.

Toxic gases can be released at hazardous materials incidents from leaking storage containers or industrial equipment, from chemical reactions, or from the normal decay of organic materials. Carbon monoxide can be produced by internal combustion engines or improperly adjusted heating appliances. Exposure to carbon monoxide or some other toxic gas should be suspected whenever fire fighters find one or more unconscious patients with no evident cause.

Toxic gases can quickly fill confined spaces or below-grade structures. Any confined space or below-grade area must be treated as a hazardous atmosphere until it has been tested to ensure that an adequate concentration of oxygen and no hazardous or dangerous gases are present.

Conditions that Require Respiratory Protection

We have looked at several factors that contribute to the dangers that exist in or near a fire atmosphere. Fires produce huge quantities of smoke, which contains unburned, partially burned, and completely burned poisonous particles, as well as toxic compounds and gases. Most fire deaths are caused by smoke inhalation rather than burns.

Fine liquid droplets, suspended in the smoke, contain highly toxic compounds formed from the breakdown of fuels. Smoke contains a wide variety of highly toxic gases resulting from incomplete combustion. Fires consume huge quantities of oxygen and generate huge quantities of poisonous gases, which can displace oxygen, causing an oxygen-

deficient environment. Superheated gases are also produced. All of these factors contribute to classifying the atmosphere in a fire environment as IDLH.

Adequate respiratory protection is essential to your safety. The products of combustion from house fires and commercial fires are so toxic that a few breaths can result in death. Most fire deaths are caused by smoke inhalation rather than burns. As you arrive at the scene of a fire you do not have any way to measure the immediate danger to your life and your health posed by that fire. You must use approved breathing apparatus if you are going to enter and operate within this atmosphere.

Anytime you are in an area where there is smoke, SCBA must be used. This includes outside fires such as vehicle and dumpster fires. Utilize your SCBA at the fire scene until the air has been tested and proven to be safe by the safety officer. Do not remove your SCBA just because a fire has been knocked down. SCBA should be worn during overhaul until the air has been tested and deemed safe by your safety officer.

SCBA must also be used in any situation where there is a possibility of toxic gases being present or oxygen deficiency, such as a confined space. Always assume that the atmosphere is hazardous until it has been tested and proven to be safe.

Types of Breathing Apparatus

The basic respiratory protection hardware used by the fire service is the self-contained breathing apparatus or SCBA.



Figure 2-23 Open-circuit SCBA.

Fire Fighter Safety Tips

Consider all below-grade areas or confined spaces to be IDLH—immediately dangerous to life and health—until they have been tested.

Fire Fighter Safety Tips

Always put on SCBA before entering a confined space or a below-ground structure. Continue to use respiratory protection until the air is tested and deemed safe by the safety officer. Do not attempt confined space operations without special training.

Fire Fighter Tips

Do not confuse SCBA and SCUBA. Self-contained breathing apparatus, SCBA, is used by fire fighters during fire suppression activities. Divers use **self-contained underwater breathing apparatus (SCUBA)** while swimming underwater.

The term self-contained refers to the requirement that the apparatus is the sole source of the fire fighter's air supply. It is an independent air supply that will last for a predictable duration.

The two main types of self-contained breathing apparatus are **open-circuit breathing apparatus** and **closed-circuit breathing apparatus**. Open-circuit breathing apparatus is usually used for structural firefighting. A tank of compressed air provides the breathing air supply for the user (◀ **Figure 2-23**). Exhaled air is released into the atmosphere through a one-way valve. Approved open-circuit SCBA comes in several different models, designs, and options.

Closed-circuit breathing apparatus recycles the user's exhaled air. The air passes through a mechanism that removes carbon dioxide and adds oxygen within a closed system (▶ **Figure 2-24**). The oxygen is generated from a chemical canister. Many closed-circuit SCBAs have a small oxygen tank as well as the chemically-generated oxygen. Closed-circuit breathing apparatus is more often used for extended operations, such as mine rescue work, where breathing apparatus must be worn for a long time.

A **supplied-air respirator (SAR)** uses an external source for the breathing air (▶ **Figure 2-25**). A hose line is connected to a breathing-air compressor or to compressed air cylinders located outside the hazardous area. The user breathes air through the line and exhales through a one-way valve, just as with an open-circuit SCBA.

Although supplied-air respirators are commonly used in industrial settings, they are not used by fire fighters for structural firefighting. Hazardous materials teams and confined space rescue teams sometimes use supplied-air respirators for specialized operations. Some fire service SCBA units can be adapted for use as supplied-air respirators.

SCBA Standards and Regulations

In the United States, the **National Institute for Occupational Safety and Health (NIOSH)** sets the design, testing, and certification requirements for SCBA. NIOSH is a federal agency that researches, develops, and implements occupational safety and health programs. It also investigates fire fighter fatalities and serious injuries, and makes recommendations on how to prevent accidents from recurring.

The U.S. Occupational Safety and Health Administration (OSHA) and state agencies are responsible for establishing and enforcing regulations for respiratory protection programs. In some states and in Canadian provinces, there are



Figure 2-24 Closed-circuit SCBA.



Figure 2-25 A supplied-air respirator may be needed for special rescue operations.

Fire Marks

Many of the occupational health and safety regulations for the fire service and other workers use the term **respirator**. A respirator is a device that provides respiratory protection for the user. There are several different types of respirators for different applications. A self-contained breathing apparatus is a particular type of respirator.

individual occupational safety and health agencies to establish and enforce regulations.

The NFPA has developed three standards directly related to SCBA. NFPA 1500, *Standard for a Fire Department Occupational Safety and Health Program*, includes the basic requirements for SCBA use and program management. NFPA 1404, *Standard for Fire Service Respiratory Protection Training*, sets requirements for an SCBA training program within a fire department. NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*, includes requirements for the design, performance, testing, and certification of open-circuit SCBA for the fire service. Each fire department must follow applicable standards and regulations to ensure safe working conditions for all personnel.

Uses and Limitations of Self-Contained Breathing Apparatus

SCBA is designed to provide pure breathing air to fire fighters working in the hostile environment of a fire. It must meet rigid manufacturing specifications so that it can function in the increased temperature and smoke-filled environments that fire fighters encounter. When properly maintained, it will provide sufficient quantities of air for fire fighters to perform rigorous tasks.

Using SCBA requires that fire fighters develop unique skills, including different breathing techniques. SCBA limits normal sensory awareness; scent, hearing, and sight are all affected by the apparatus. Proficiency in the use of SCBA and other PPE requires ongoing training and practice.

SCBA also has its limitations, as with any type of equipment. Some of these limitations apply to the equipment; others apply to the user's physical and psychological abilities.

Limitations of the Equipment

Because an SCBA carries its own air supply in a pressurized cylinder, its use is limited by the amount of air in the cylinder. SCBA for structural firefighting must carry enough air for a minimum of 30 minutes; cylinders rated for 45 minutes and 60 minutes are also available. These duration ratings, however, are based on ideal laboratory conditions. The realistic useful life of an SCBA cylinder for firefighting operations is usually much less than the rated duration, and actual



Figure 2-26 SCBA expands a user's profile, making it more difficult to get through tight spaces.

use time will depend on the activities being performed and on the person using the apparatus. An SCBA cylinder will generally have a realistic useful life of 50% of the rated time. For example, an SCBA cylinder rated for 30 minutes can be expected to last for a maximum of 15 minutes of interior fire fighting.

Fire fighters must manage their working time while using SCBA so they have enough time to exit from the hazardous area before exhausting the air supply. If it takes 5 minutes to reach the work area and 5 minutes to return to fresh air, a 15-minute air supply only provides a maximum of 5 minutes of working time.

The weight of an SCBA varies, based on the manufacturer and the type and size of cylinder. Generally, an SCBA weighs at least 25 pounds. The size of the unit also makes it more difficult for the user to fit into small places **▲ Figure 2-26**. The added weight and bulk decrease the user's flexibility and mobility, and shift the user's center of gravity.

The design of the SCBA face piece limits visibility, particularly peripheral vision. The face piece may fog up under some conditions, further limiting visibility. SCBA also may affect the user's ability to communicate, depending on the type of face piece and any additional hardware provided, such as voice amplification and radio microphones. The

equipment is noisy during inhalation and exhalation, which may limit the user's hearing.

Physical Limitations of the User

Conditioning is important for SCBA users. An out-of-shape fire fighter will consume the air supply more quickly and will have to exit the fire building long before a well-conditioned fire fighter. Overweight or poorly conditioned fire fighters are also at greater risk for heart attacks due to physical stress.

The protective clothing and SCBA that must be worn when fighting fires weigh more than 50 pounds. Moving with this extra weight requires additional energy, which increases air consumption and body temperature. This places additional stress on a fire fighter's body. A person with ideal body weight will be able to perform more work per cylinder of air than a person who is overweight.

The weight and bulk of the complete PPE ensemble limits a fire fighter's ability to walk, climb ladders, lift weight, and crawl through restricted spaces. Fire fighters must become accustomed to these limitations and learn to adjust their movements accordingly. Practice and conditioning are required to become proficient in wearing and using PPE while fighting fires.

Psychological Limitations of the User

In addition to the physical limitations, the user must also make mental adjustments when wearing an SCBA. Breathing through an SCBA is different from normal breathing and can be very stressful. Covering your face with a face piece, hearing the air rushing in, hearing valves open and close, and exhaling against a positive pressure are all foreign sensations. The surrounding environment, which is often dark and filled with smoke, is foreign as well.

Fire fighters must adjust to these stressful conditions. Practice in donning PPE, breathing through SCBA, and performing firefighting tasks in darkness helps to build confidence, not only in the equipment, but also in personal skills. Training generally introduces one skill at a time. Practice each skill as it is introduced and try to become proficient in that skill. As your skills improve, you will be able to tackle increasing levels of difficulty.

Components of Self-Contained Breathing Apparatus

SCBA consists of four main parts: the backpack and harness, the air cylinder assembly, the regulator assembly, and the face piece assembly. There are several different manufacturers and models with varying features and operations. Although the basics are similar, you need to become familiar with the specific SCBA used by your department.

Backpack and Harness

The **backpack** provides the frame for mounting the other working parts of the SCBA (► **Figure 2-27**). It is usually con-

structed of a lightweight metal or composite material. The **harness** consists of the straps and fasteners used to attach the SCBA to the fire fighter. Most harnesses have two adjustable shoulder straps and a waist belt. Depending on the specific model of SCBA, the waist belt and shoulder straps will carry different proportions of the weight. The procedures for tightening and adjusting the straps also vary based on the model.

The harness must be secure enough to keep the SCBA firmly fastened to the user, but not so tight that it interferes with breathing or movements. The waist strap must be tight enough to keep the SCBA from moving from side to side or getting caught on obstructions.

Air Cylinder Assembly

A compressed **air cylinder** holds the breathing air for an SCBA. This removable cylinder is attached to the backpack harness and can be changed quickly in the field. An experienced fire fighter should be able to remove and replace the cylinder in complete darkness.

Fire fighters should be familiar with the type of cylinders used in their departments. Cylinders are marked with the materials used in construction, the working pressure, and the rated duration.

The air pressure in filled SCBA cylinders ranges from 2200 to 4500 **pounds per square inch (psi)**. The greater the air pressure, the more air that can be stored in the cylinder.

Low-pressure cylinders, rated for 2200 psi, can be constructed of steel or aluminum and are usually rated for 30 minutes of use. Composite cylinders are generally constructed of an aluminum shell wrapped with carbon, Kevlar, or glass fibers. They are significantly lighter in weight, can be pressurized up to 4500 psi, and are rated for 30, 45, or 60 minutes of use.

As previously noted, the rated duration times are established under laboratory conditions. A working fire fighter can quickly use up the air because of exertion. Generally, the



Figure 2-27 SCBA backpacks come in different models.

working time available for a particular cylinder is half the rated duration.

The neck of an air cylinder is equipped with a hand-operated shut-off valve. The **pressure gauge** is located near the shut-off valve and shows the pressure of the cylinder when full and shows the amount of pressure currently in the cylinder. Be careful not to damage the threads or let any dirt get into the outlet of the cylinder.

Regulator Assembly

SCBA regulators may be mounted on the waist belt or shoulder strap of the harness or attached directly to the face piece (► **Figure 2-28**). The regulator controls the flow of air to the user. Inhaling decreases the air pressure in the face piece. This opens the regulator, which releases air from the cylinder into the face piece. When inhalation stops, the regulator shuts off the air supply. Exhaling opens a second valve, the exhalation valve, to exhaust used air into the atmosphere. SCBA regulators are capable of delivering large volumes of air to support the strenuous activities required in firefighting.

SCBA regulators will maintain a slightly positive air pressure in the face piece. This feature prevents hazardous outside air from leaking into the face piece during inhalation. If there is any leakage around the face piece, the positive pressure will let breathing air seep out and prevent contaminated air from leaking in. Breathing with this slight positive pressure may require some practice. New fire fighters often say that it takes more energy to breathe when first using positive-pressure SCBA. This sensation gradually decreases.

Regulators are equipped for two modes of operation—the normal mode and the emergency by-pass mode. In the normal mode, described above, the regulator supplies breathing air during inhalation, stops when inhalation stops, then opens an exhalation valve to exhaust used air into the atmosphere. To activate the normal mode, some SCBA models require that the user turn a yellow-colored valve. Simply attaching the regulator to the face piece and beginning to breath will activate the normal mode in other models.

The **emergency by-pass mode** is used only if the regulator malfunctions (► **Figure 2-29**). It is activated when the user turns on the red-colored emergency by-pass valve. This releases a constant flow of breathing air into the face piece. The emergency by-pass mode uses more air, but it enables fire fighters to exit a hazardous environment if the regulator stops operating. A fire fighter who must use the emergency by-pass mode must leave the hazardous area IMMEDIATELY.

Like the cylinder, the regulator has a gauge that indicates the pressure of the breathing air remaining in the cylinder. This gauge enables the user to monitor the amount of air remaining in the cylinder. The regulator pressure gauge can be mounted directly on the regulator or on a separate hose so it can be attached to a shoulder strap for easier viewing.



Figure 2-28 SCBA regulator.

The regulator and cylinder pressure gauges should read within 100 psi of each other.

NFPA standards require that SCBA have a low-air alarm that activates when one quarter of the air supply remains. This alarm may be a bell or whistle, a vibration, or a flashing **light-emitting diode (LED)**. Early SCBAs (those manufactured before the 1997 edition of NFPA Standard 1981 became effective) have a single low-air supply alarm. Newer models have two different types of low-air alarms that operate independently of each other and activate different senses. For example, one alarm might ring a bell, and the second alarm might vibrate or flash an LED. Fire fighters should never ignore the low-air alarm.

Some SCBAs are manufactured with integrated PASS devices. Turning on the air supply automatically activates these PASS devices. This ensures that a fire fighter doesn't forget to turn the PASS device on when entering a hazardous



Figure 2-29 The SCBA emergency by-pass valve is used if the regulator malfunctions.



Figure 2-30 A PASS device can be integrated into an SCBA.

area. If your SCBA is equipped with a PASS device, learn how to activate it and how to turn it off (▲ **Figure 2-30**).

Although there are many different models of SCBA regulators, fire fighters must learn how to operate the particular model that is used in their department. Fire fighters should be able to operate the regulator in the dark and with gloves on.

Face Piece Assembly

The **face piece** delivers breathing air to the fire fighter (► **Figure 2-31**). The face piece also protects the face from high temperatures and smoke. The face piece consists of a facemask with a clear lens, an exhalation valve, and—on models with a harness-mounted regulator—a flexible low-pressure supply hose. Other models will have the regulator attached directly to the face piece.

The face piece should cover the entire face. The part in contact with the skin is made of special rubber or silicon to provide a tight seal. The clear lens allows for vision. Exhaled air is exhausted from the face piece through the one-way exhalation valve, which has a spring mechanism to maintain positive pressure inside the face piece. Because it is hard to communicate through a face piece, some models have a voice amplification device.

Face pieces may be equipped with **nose cups** to help prevent fogging of the clear lens. Fogging is a greater problem in colder climates. The compressed air you breathe is dry, but the air you exhale is moist. The flow of dry air helps to prevent fogging of the lens.

The face piece is held in place with a web-like series of straps, or a net and straps. Face pieces should be stored with the straps in the longest position to make them easier to don. Pull the end of the straps toward the back of the head (not out to the sides) to tighten them and ensure a snug fit.

A leak in the face piece seal can be caused by an improperly sized face piece, improper donning, or facial hair around the edge of the face piece. Leaks are dangerous for



Figure 2-31 SCBA face pieces come in several sizes.

two reasons. First, a large leak could overcome the positive pressure in the face piece and allow contaminated air to enter the face piece. Second, a leak of any size will deplete the breathing air and reduce the amount of time available for fire fighting.

Face pieces are manufactured in several sizes. NFPA 1500 requires that all fire fighters must have their face pieces fit-tested annually to ensure that they are wearing the proper size. Some departments issue individual face pieces to each fire fighter; others provide a selection of sizes on each apparatus. NFPA 1500 also requires that the sealing surface of the face piece must be in direct contact with the user's skin. There must not be hair or a beard in the seal area.

Pathway of Air through an SCBA

The breathing air is stored under pressure in the cylinder. The air passes through the cylinder shut-off valve into the high-pressure **air line**, or hose, that takes it to the regulator. The regulator reduces the high pressure to low pressure.

The regulator opens when the user inhales, reducing the pressure on the downstream side. In an SCBA unit with a face piece-mounted regulator, the air next goes directly into the face piece. In units with a harness-mounted regulator, the air travels from the regulator through a low-pressure hose into the face piece. From the face piece, the air is inhaled through the user's air passages and into the lungs.

When the user exhales, used air is returned to the face piece. The exhaled air is exhausted from the face piece through the exhalation valve. This cycle repeats with every

Fire Fighter Safety Tips

Be sure that your face piece is properly fitted and the correct size for your face.

Fire Fighter Tips

Controlled-Breathing Technique

Controlled breathing helps extend the SCBA air supply. Controlled breathing is a conscious effort to inhale naturally through the nose and to force exhalation from the mouth. Practicing controlled breathing during training will help you to maximize the efficient use of air while you are working.

inhalation. As the pressure in the face piece drops, the exhalation valve closes and the regulator opens.

Skip-Breathing Technique

The skip-breathing technique helps conserve air while using an SCBA in a firefighting situation. The technique is to take a short breath, hold, take a second short breath (do not exhale in between breaths), and then relax with a long exhale. Each breath should take 5 seconds.

A simple drill can demonstrate the benefits of skip breathing. One fire fighter dons PPE and an SCBA with a full air cylinder, and walks in a circle around a set of traffic cones, around the track at the local school, or, if safety permits, around the parking lot at the fire station. A second fire fighter times how long it takes for the fire fighter to completely deplete the air in the SCBA. After the first fire fighter is completely rested, replace the air cylinder, and repeat the same drill using the skip-breathing technique. Compare times after completion of both evolutions.

Mounting Breathing Apparatus

SCBA should be located so that fire fighters can don it quickly when they arrive at the scene of a fire. Seat-mounted brackets enable fire fighters to don SCBA en route to an emergency scene, without unfastening their seat belts or otherwise endangering themselves. This enables fire fighters to begin work as soon as they arrive.

There are several types of apparatus seat-mounting brackets. Some hold the SCBA with the friction of a clip. Others are equipped with a mechanical hold-down device that must be released to remove the SCBA. Regardless of the mounting system used, it must hold the SCBA securely in the bracket. A collision or sudden stop should not dislodge the SCBA from the brackets. A loose SCBA can be a dangerous projectile. The fire fighter who dons SCBA from a seat-mounted bracket should not tighten the shoulder straps while seated, so as not to dislodge the SCBA in a sudden stop situation. The fire fighter should be secured by a seat belt or combination seat belt and shoulder harness.

Compartment-mounted SCBA units also can be donned quickly. These units are used by fire fighters who arrive in vehicles without seat-mounted SCBA or whose seats were

not equipped with them. Apparatus drivers and fire fighters who arrive in their private vehicles often use compartment-mounted SCBA units. The mounting brackets should be positioned high enough for easy donning. Some mounting brackets allow the fire fighter to lower the SCBA without removing it from the mounting bracket. Older apparatus may have the brackets mounted on the exterior of the vehicle. An exterior-mounted SCBA should be protected from weather and dirt by a secure cover.

SCBA also may be kept in a storage case. This method is most appropriate for transporting extra SCBA units. It should not be used to transport SCBA that will be used during the initial phase of operations at a fire scene.

The SCBA should be stored on the apparatus in ready-for-use condition, with the main cylinder valve closed. After checking the SCBA, close the cylinder valve and slowly open the by-pass valve to release pressure in the system. The low-pressure alarm should sound as the pressure bleeds down. After releasing the pressure, close the by-pass valve. The SCBA is now ready to be placed in a bracket for immediate use.

Donning Self-Contained Breathing Apparatus

Donning SCBA is an important skill. Fire fighters must be able to don and activate SCBA in one minute. Personal safety and the effectiveness of the firefighting operation depend on this skill. Fire fighters must be wearing full PPE before donning SCBA. Before beginning the actual donning process, fire fighters must carefully check the SCBA to ensure it is ready for operation.

- Check to be sure the air cylinder has at least 90% of its rated pressure.
- If the SCBA has a donning/doffing switch, be sure that it is activated.
- Open the cylinder valve two or three turns, listen for the low-air alarm to sound, and then open the valve fully.
- Check the pressure gauges on the regulator and on the cylinder. Both gauges should read within 100 psi of each other.
- Check all harness straps to be sure they are fully extended.
- Check all valves to be sure they are in the correct position. (An open by-pass valve will waste air.)

Donning SCBA from an Apparatus Seat Mount

Donning SCBA while en route to an emergency can save valuable time. However, this requires that you don all of your protective clothing before mounting the apparatus. Place your arms through the shoulder straps as you sit down, and then fasten your seat belt. Or, you can fasten your seat belt first, and then slide one arm at a time through the shoulder straps of the SCBA harness. You can partially tighten the shoulder straps while you are seated.

When you arrive at the emergency scene, release your seat belt, activate the bracket release, and exit the apparatus. Be sure to take a face piece with you. Face pieces should be kept in a storage bag close to each seat-mounted SCBA or attached to the harness. After exiting from the apparatus, attach the waist strap, and then tighten and adjust the shoulder and waist straps.

Follow the steps in **► Skill Drill 2-3** to don SCBA from a seat-mounted bracket. Before beginning this skill drill, inspect the SCBA to ensure it is ready for service.

1. Don full PPE ensemble prior to mounting the fire apparatus. Safely mount the apparatus and sit in the seat, placing arms through SCBA shoulder straps. **(Step 1)**
2. Fasten your seat belt. Partially tighten the shoulder straps. Do not fully tighten at this time. When the apparatus comes to a complete stop at the emergency scene, release your seat belt and release the SCBA from the mounting bracket. Carefully exit the apparatus. **(Step 2)**
3. Attach the waist belt and cinch down. **(Step 3)**
4. Adjust shoulder straps until they are tight. **(Step 4)**
5. Open the main cylinder valve. **(Step 5)**
6. Remove or loosen your helmet and pull back the protective hood. Don the face piece and check for leaks. Pull the protective hood up over the head, put the helmet back in place, and secure the chin strap. **(Step 6)**
7. If necessary, connect the regulator to the face piece. **(Step 7)**
8. Activate the airflow and PASS alarm. **(Step 8)**

Donning SCBA from a Compartment Mount

To don a compartment-mounted SCBA, slide one arm through the shoulder harness strap. Slide the other arm through the other shoulder strap. Release the SCBA from the mounting bracket. Adjust the shoulder straps to carry the SCBA fairly high on your back. Attach the ends of the waist strap and tighten the waist strap.

Follow the steps in **► Skill Drill 2-4** to don SCBA from a side-mounted compartment or bracket. Before starting, check to be sure that the SCBA has been inspected and is ready for service. Examine the SCBA to see how it is mounted in the compartment. Check the release mechanism and how it operates. If the SCBA is mounted on an exterior bracket, remove the protective cover before beginning the donning sequence.

1. Stand in front of the SCBA bracket and fully open the main cylinder valve.
2. Turn your back toward the SCBA, slide your arms through the shoulder straps, and partially tighten the straps.
3. Release the SCBA from the bracket and step away from the apparatus.

4. Attach the waist belt and tighten.
5. Adjust the shoulder straps.
6. Remove your helmet and pull the hood back.
7. Don the face piece and check for adequate seal.
8. Pull the protective hood into position, replace your helmet, and secure the chin strap.
9. If necessary, connect the regulator to the face piece.
10. Activate the airflow and PASS alarm.

Donning SCBA from the Ground, the Floor, or a Storage Case

Fire fighters must sometimes don an SCBA that is stored in a case or on the ground. Two methods can be used: the over-the-head method and the coat method.

Over-the-Head Method

To don an SCBA using the over-the-head method, place the SCBA on the ground or on the floor with the cylinder valve facing away from you. Lay the shoulder straps out to each side of the backpack. Grasp the backplate with both hands and lift the SCBA over your head. Let the backpack slide down your back. The straps will slide down your arms. Balance the unit on your back. Attach and tighten the waist strap and then tighten the shoulder straps. Follow the steps in **► Skill Drill 2-5** to don SCBA using the over-the-head method. Before starting, ensure that the SCBA has been inspected and is ready for service.

1. If necessary, open the protective case and lay out the SCBA so that the cylinder valve is away from you and the shoulder straps are to the sides. **(Step 1)**
2. Fully open the main cylinder valve. **(Step 2)**
3. Bend down and grasp the SCBA backplate with both hands. Using your legs, lift the SCBA over your head. Once the SCBA clears your head, rotate it 180°, so the waist straps are pointed toward the ground. **(Step 3)**
4. Slowly slide the pack down your back. Make sure that your arms slide into the shoulder straps. Once the SCBA is in place, tighten the shoulder straps and secure the waist strap. **(Step 4)**
5. Remove your helmet and pull the hood back. Don the face piece and check for an adequate seal. Pull your protective hood into position, replace your helmet, and secure the chin strap. **(Step 5)**
6. If necessary, connect the regulator to the face piece. Activate the airflow and PASS alarm. **(Step 6)**

Coat Method

To don an SCBA using the coat method, place the SCBA on the ground or on the floor with the cylinder valve facing toward you. Spread out and extend the shoulder straps. Use your left hand to grasp the left shoulder strap close to the backplate. Use your right hand to grasp the right shoulder strap farther away from the backplate. Swing the SCBA over your left shoulder. Release your right arm and slide it



Skill Drill

Donning SCBA from a Seat-Mounted Bracket



1 Don full PPE ensemble prior to mounting fire apparatus. Safely mount the apparatus and sit in the seat, placing arms through SCBA shoulder straps.



2 Fasten your seat belt. Partially tighten the shoulder straps. When the apparatus stops, release the seat belt and release the SCBA from its brackets. Exit apparatus.



3 Attach waist belt and cinch down.



4 Adjust shoulder straps until they are tight.

through the right shoulder harness strap. Tighten both shoulder straps. Attach and tighten the waist belt.

Follow the steps in [Skill Drill 2-6](#) to don SCBA using the coat method. Before starting, ensure that the SCBA has been inspected and is ready for service.

1. If necessary, open the protective case and lay out the SCBA so that the cylinder valve is facing you and the straps are laid out to the sides. Fully open the main cylinder valve. Place your dominant hand on the opposite shoulder strap. For safety reasons be sure to grasp the strap as close to the backplate as possible. **(Step 1)**

2. Lift the SCBA and swing it over your dominant shoulder, being careful of people or objects around you. **(Step 2)**
3. Slide your other hand between the SCBA cylinder and the corresponding shoulder strap. **(Step 3)**
4. Tighten the shoulder straps. **(Step 4)**
5. Attach the waist belt and adjust tightness. **(Step 5)**
6. Remove your helmet and pull your hood back. Don the face piece and check for an adequate seal. **(Step 6)**
7. Pull the protective hood into position, replace the helmet, and secure the chin strap. If necessary, con-



Skill Drill



Open the main cylinder valve.



Loosen or remove helmet and pull hood back. Don face piece and check for leaks. Replace protective hood and helmet and secure chin strap.



If necessary, connect regulator to face piece.



Activate airflow and PASS alarm.

nect the regulator to the face piece. Activate the airflow and PASS alarm. **(Step 7)**

These instructions will have to be modified for different SCBA units. The sequence for adjusting shoulder straps and waist belts varies with different models. Modifications must also be made for SCBAs with waist-mounted regulators. Refer to the specific manufacturer's instructions supplied with each unit. Follow the standard operating procedures for your department.

Donning the Face Piece

Your face piece keeps contaminated air outside and pure breathable air inside. To perform properly, it must be the correct size and it must be adjusted to fit your face. Be sure you have been tested to determine your proper size.

There must be no facial hair in the seal area. Eyeglasses that pass through the seal area cannot be worn with a face piece, because they can cause leakage between the face piece and your skin. Your face piece must match your SCBA. You cannot interchange a face piece from a different SCBA model.



Skill Drill

Donning SCBA Using the Over-the-Head Method



1 Open the case and lay out the SCBA with the cylinder valve away from you and the shoulder straps out to the sides.



2 Fully open the main cylinder valve.



3 Bend down and grasp the SCBA backplate with both hands. Using your legs, lift the SCBA over your head. Rotate the SCBA 180°, so the waist straps are pointed to the ground.



4 Slide the SCBA down your back while your arms slide into the shoulder straps. Tighten the shoulder straps and secure the waist belt.



5 Remove your helmet and pull the hood back. Don your face piece and check for an adequate seal. Pull your protective hood into position, replace your helmet, and secure the chin strap.



6 If necessary, connect the regulator to the face piece. Activate the airflow and PASS alarm.



Skill Drill

Donning SCBA Using the Coat Method



1 Open the case and lay out the SCBA with the cylinder valve away from you and the shoulder straps out to the sides. Fully open the main cylinder valve. Place your dominant hand on the opposite shoulder strap.



2 Lift the SCBA and swing it over your dominant shoulder.



3 Slide your other hand between the SCBA cylinder and the corresponding shoulder strap.



4 Tighten the shoulder straps.



5 Attach the waist belt and adjust tightness.



6 Remove your helmet and pull your hood back. Don the face piece and check for an adequate seal.



7 Pull the hood into position, replace the helmet, and secure the chin strap. If necessary, connect the regulator to the face piece. Activate the airflow and PASS alarm.

Face pieces for various brands and models of SCBAs are slightly different. Some have the regulator mounted on the face piece; others have it mounted on the harness straps. Fire fighters must learn about the face pieces used by their departments.

Follow the steps in **▼ Skill Drill 2-7** to don a face piece:

1. Make sure you have donned your protective hood. Remove your helmet and pull the hood down over your neck.
2. Fully extend the straps on the face piece. **(Step 1)**
3. Rest your chin in the chin pocket at the bottom of the mask. **(Step 2)**
4. Fit the face piece to your face, bringing the straps or webbing over your head. **(Step 3)**
5. Tighten the lowest two straps. To tighten, pull the straps straight back, not out and away from your head. **(Step 4)**
6. Tighten the pair of straps at your temple, if any.
7. If your model has additional straps, tighten the top strap(s) last. **(Step 5)**
8. Check for a proper seal. This process depends on the model and type of face piece you use. **(Step 6)**
9. Pull the protective hood up so it covers all bare skin. Be sure it does not get under your face piece or obscure your vision.
10. Replace your helmet and secure the chin strap. **(Step 7)**
11. Install the regulator on your face piece or attach the low-pressure air supply hose to the regulator. **(Step 8)**



Skill Drill

Donning a Face Piece



1 Fully extend the straps on the face piece.



2 Place your chin in the chin pocket.



3 Fit the face piece to your face, bringing the straps or webbing over your head.



4 Tighten the lowest two straps.

Safety Precautions for Self-Contained Breathing Apparatus

As you practice using your SCBA, remember that this equipment is your protection against serious injury or death in hazardous conditions. Practice safe procedures from the beginning.

Learn to recognize the low-air alarm on your SCBA. As soon as your alarm goes off, you must exit the hazardous environment before your air supply is depleted. Never get into a situation from which you cannot escape when your low-air alarm goes off.

Before you enter a hazardous environment, make sure your PASS device is activated. Be sure you are properly

Fire Fighter Safety Tips

NFPA 1001 requires you to don and activate your SCBA in one minute. Practice donning your SCBA until you can do it quickly and smoothly.

logged into your accountability system. Always work in teams of two in hostile environments. Always have at least two fire fighters outside at the ready whenever two fire fighters are working in a hostile environment.



Skill Drill



5 If there are more straps, tighten the top straps last.



6 Check for a proper seal.



7 Pull your protective hood up so it covers all bare skin. Don your helmet and secure the chin strap.



8 Install the regulator on your face piece or attach the low-pressure air supply hose to the regulator.

Fire Fighter Tips

Restricted Spaces

The size and shape of SCBA may make it difficult for you to fit through tight openings. Several techniques may help you navigate these spaces.

- Change your body position: Rotate your body 45° and try again.
- Loosen one shoulder strap and change the location of the SCBA on your back.
- If you have no other choice, you may have to remove your SCBA. In this case, do not let go of the backpack and harness for any reason. Keep the unit in front of you as you navigate through the tight space. Re-attach the harness as soon as you are through the restricted space. This is an absolutely “last resort” procedure!

Preparing for Emergency Situations

Because hostile environments are often unpredictable, fire fighters must be prepared to react if an emergency situation occurs while they are using SCBA. In emergencies, follow simple guidelines. First, keep calm, stop, and think. Panic increases air consumption. Try to control your breathing by maintaining a steady rate of respirations. A calm person has a greater chance of surviving an emergency.

If the problem is with your SCBA, try to exit the hostile environment. Use the emergency by-pass valve so you can breathe if your regulator malfunctions.

If you are in danger, activate your PASS device. Use your hand light to attract attention. If you have a portable radio, call for help. These are simple but effective steps; additional emergency techniques are covered in Chapter 17, Fire Fighter Survival.

Doffing Self-Contained Breathing Apparatus

The procedure for doffing your SCBA depends on the model and whether it has a face piece-mounted regulator or a harness-mounted regulator. Follow the procedures recommended by the manufacturer and your department's SOPs.

In general, you should reverse the steps used to don your SCBA. Follow the steps in **► Skill Drill 2-8** to doff your SCBA:

1. Remove your gloves. Remove the regulator from your face piece or disconnect the low-pressure air supply hose from the regulator. **(Step 1)**
2. Shut off the air-supply valve.
3. Remove your helmet and pull your protective hood down around your neck. **(Step 2)**
4. Loosen the straps on your face piece. **(Step 3)**
5. Remove your face piece. **(Step 4)**
6. Release your waist belt. **(Step 5)**
7. Loosen the shoulder straps and remove the SCBA. **(Step 6)**
8. Shut off the air-cylinder valve. **(Step 7)**
9. Bleed the air pressure from the regulator by opening the emergency by-pass valve. **(Step 8)**
10. If you have an integrated PASS device, turn it off.
11. Place the SCBA in a safe location where it will not get dirty or damaged. **(Step 9)**

Putting It All Together: Donning the Entire PPE Ensemble

The complete PPE ensemble consists of both personal protective clothing and respiratory protection (SCBA). Although donning personal protective clothing and donning and operating SCBA can be learned and practiced separately, you must be able to integrate these skills to have a complete PPE ensemble. Each part of the complete ensemble must be in the proper place to provide whole-body protection.

The steps for donning a complete PPE are listed below:

- Place the protective hood over your head.
- Put on your bunker pants and boots. Adjust the suspenders and secure the front flap of the pants.
- Put on your turnout coat and secure the front.
- Open the air-cylinder valve on your SCBA and check the air pressure.
- Put on your SCBA.
- Tighten both shoulder straps.
- Attach the waist belt and tighten it.
- Fit the face piece to your face.
- Tighten the straps, beginning with the lowest straps.
- Check the face piece for a proper seal.
- Pull the protective hood up so that it covers all bare skin, but does not obscure vision.
- Place your helmet on your head with the ear tabs extended and secure the chin strap.
- Turn up your coat collar and secure it in front.
- Put on your gloves.
- Check your clothing to be sure it is properly secured.
- Be sure your PASS device is turned on.
- Attach your regulator or turn it on to start the flow of breathing air.
- Work safely!

SCBA Inspection and Maintenance

SCBA must be properly serviced and prepared for the next use each time it is used, whether it is an actual emergency incident or a training exercise. The air cylinder must be changed or refilled, the face piece and regulator must be sanitized according to the manufacturer's instructions, and the unit must be cleaned, inspected and checked for proper operation. It is the

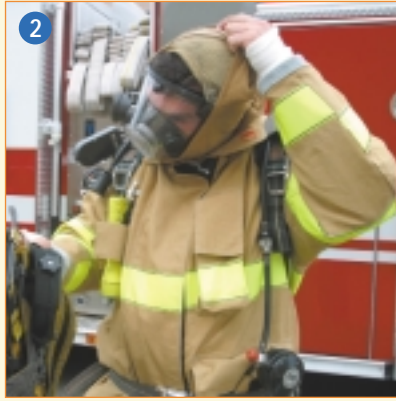


Skill Drill

Doffing SCBA



1 Remove your gloves. Remove the regulator from the face piece or disconnect the low-pressure hose from the regulator.



2 Remove your helmet and pull the protective hood down around your neck.



3 Loosen the face piece straps.



4 Remove your face piece.



5 Release your waist belt.



6 Loosen the shoulder straps and remove the SCBA.



7 Shut off the air-cylinder valve.



8 Bleed the air pressure from the regulator.



9 Place the SCBA in a safe location.

user's responsibility to ensure that the SCBA is in ready condition before it is returned to the fire apparatus.

Each SCBA must be checked on a regular basis to ensure that it is ready for use. There are different procedures for daily, monthly, and annual inspections. The daily inspection procedure should be used when restoring a unit to service after it has been used.

If an SCBA inspection reveals any problems that cannot be remedied by routine maintenance, the SCBA must be removed from service for repair. Only properly trained and certified personnel are authorized to repair SCBA.

Daily Inspection

Each SCBA unit should be inspected daily or at the beginning of each shift. When fire stations are not staffed, SCBA should be inspected at least once a week. Follow the steps in **▼ Skill Drill 2-9** for daily SCBA inspection:

1. Check the backpack and harness straps. Make sure these components are intact and the straps are kept lengthened. **(Step 1)**
2. Check the air-cylinder pressure. Make sure it is full. Turn on the air-cylinder valve. Check the regulator gauge or remote gauge. It should read within 100 psi of the cylinder gauge. **(Step 2)**



Skill Drill

Daily SCBA Inspection



1 Check backpack and harness straps.



2 Check air-cylinder pressure. Turn on the air-cylinder valve and check gauge pressure.



3 Check condition of all hoses while pressurized.



4 Activate integrated PASS device, if present.

3. Check the condition of all hoses while they are pressurized. (Step 3)
4. Activate the integrated PASS device, if there is one. (Step 4)
5. Check the face piece. It should be clean and undamaged. Check the operation of the exhalation valve. (Step 5)
6. Connect the regulator to the face piece and take one or two test breaths. (Step 6)
7. Close the cylinder valve and open the emergency by-pass valve to bleed the pressure. (Step 7)
8. Check to ensure that the low-pressure alarm(s) activate at the proper pressure. Close the emergency

by-pass valve and restore the SCBA to ready condition. (Step 8)

Monthly Inspection

SCBA should be completely checked each month for proper operation, for leaks, and for any deterioration. Follow the steps in [Skill Drill 2-10](#) for monthly SCBA inspection:

1. Remove the SCBA from the apparatus and place it on the floor or on a workbench.
2. Inspect the mounting bracket for damage or wear. Lubricate it if this is recommended by manufacturer.
3. Look at the overall condition of the SCBA and note any damage.



Skill Drill



Check the face piece.



Connect the regulator to the face piece and take test breaths.



Close the cylinder valve and open the emergency by-pass valve to bleed the pressure.



Check function and activation pressure of low-air alarm. Close by-pass valve and restore unit to ready condition.

4. Remove the air cylinder from the SCBA harness and check the hydrostatic test date.
5. Check the air cylinder for damage or wear.
6. Inspect the SCBA shoulder straps and waist belt for damage, cuts, burns, or wear.
7. Check all buckles and fasteners to ensure they work properly.
8. Examine the backplate for damage, cracks, or rust.
9. Make sure all connection points between the cylinder and the SCBA harness operate properly and are free of damage or corrosion. Lubricate them if this is recommended by the manufacturer's literature.
10. Reattach the air cylinder to the SCBA harness.
11. Check all hoses and connection points for wear, cuts, or damage.
12. Open the air-cylinder valve. Compare readings on the cylinder and regulator gauges to ensure they match.
13. Attach the face piece and check the regulator for proper operation.
14. Activate the PASS alarm. Allow the SCBA to sit idle until the PASS alarm sounds.
15. Shut off the air-cylinder valve and open the by-pass valve to bleed the pressure. Check the low-pressure alarm as the pressure bleeds down.
16. Return the SCBA to the mounting bracket.
17. Complete all necessary paperwork.

Annual Inspection

A complete annual inspection and maintenance must be performed on each SCBA. The annual inspection must be performed by a certified manufacturer's representative or a person who has been trained and certified to perform this work. SCBA requires regular inspection and maintenance to ensure that it will perform as intended.

Servicing SCBA Cylinders

A pressurized SCBA cylinder contains a tremendous amount of potential energy. Not only does the air within the cylinder exert considerable pressure on its walls, the cylinder itself is used under extreme conditions on the fireground. If the cylinder ruptures and suddenly releases this energy, it can cause serious injury or death. Cylinders must be regularly inspected and tested to ensure they are safe. Cylinders must be visually inspected during daily and monthly inspections. More detailed inspection is required if a cylinder has been exposed to excessive heat, come into contact with flame, exposed to chemicals, or dropped.

The U.S. Department of Transportation requires **hydrostatic testing** for SCBA cylinders on a periodic basis and limits the number of years that a cylinder can be used. Hydrostatic testing identifies defects or damage that render the cylinder unsafe. Any cylinder that fails a hydrostatic test is immediately taken out of service and cannot be used.

Cylinders constructed of different materials have different testing requirements. Aluminum, steel, and carbon-fiber cylinders must be hydrostatically tested every five years. Cylinders constructed of composite materials such as Kevlar-aramid or fiberglass fibers must be tested every three years. Fire fighters must know what type of cylinders are used by their departments and must check each cylinder for a current hydrostatic test date before filling it.

Replacing SCBA Cylinders

A used air cylinder can be quickly replaced with a full cylinder in the field to enable you to continue firefighting activities. A single fire fighter must doff SCBA to replace the air cylinder; two fire fighters working together can change cylinders without removing SCBA. The steps listed below outline how a single person makes a cylinder change. These procedures will change depending on the model of SCBA being used. Follow the procedures recommended by the manufacturer and by department SOPs.

Practice changing air cylinders until you become proficient. A fire fighter should be able to change cylinders in the dark and while wearing gloves. Follow the steps in **Skill Drill 2-11** to replace an SCBA cylinder:

1. Place the SCBA on the floor or a bench. **(Step 1)**
2. Turn off the cylinder valve. **(Step 2)**
3. Bleed off the pressure by opening the by-pass valve. **(Step 3)**
4. Disconnect the high-pressure supply hose. Keep the ends clean. **(Step 4)**
5. Release the cylinder from the backpack. **(Step 5)**
6. Slide a full cylinder into the backpack. Align the outlet to connect the supply hose. Lock the cylinder in place. **(Step 6)**
7. Check that the "O" ring is present and in good shape. **(Step 7)**
8. Connect the high-pressure hose to the cylinder. Hand tighten only. **(Step 8)**
9. Open the cylinder valve. Check the regulator gauge or remote gauge. It should read within 100 psi of the cylinder gauge. **(Step 9)**

To save time, someone else can replace the air cylinder while you are wearing the SCBA harness. You should not overtax yourself, however, by replacing the cylinder and going back to work without adequate rest when you need it.

Refilling SCBA Cylinders

Compressors and **cascade systems** are used to refill SCBA cylinders. A compressor or a cascade system can be permanently located at a maintenance facility or at a firehouse, or they can be mounted on a truck or a trailer for mobile use. Mobile filling units are often brought to the scene of a large fire.

**Skill Drill**

Replacing an SCBA Cylinder



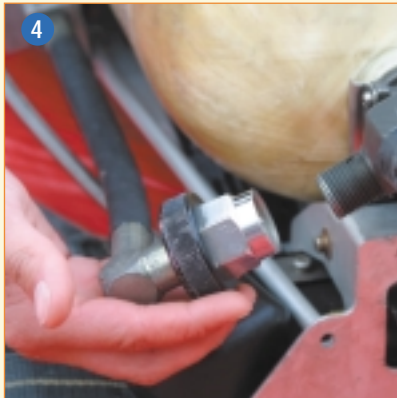
1 Place the SCBA on the floor or a bench.



2 Turn off the cylinder valve.



3 Open the by-pass valve to bleed off pressure.



4 Disconnect the high-pressure supply hose.



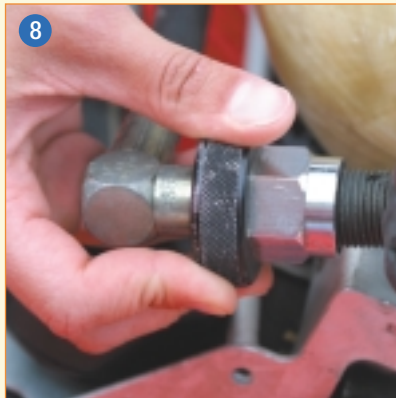
5 Release the cylinder from the backpack.



6 Slide a full cylinder into the backpack. Align the outlet to the supply hose. Lock the cylinder in place.



7 Check that the "O" ring is present and in good shape.



8 Connect the high-pressure hose to the air cylinder.



9 Open the cylinder valve. Check gauge reading.

Compressor systems filter atmospheric air, compress it to a high pressure, and transfer it to the SCBA cylinders (► **Figure 2-32**). Cascade systems have several large storage cylinders of compressed breathing air connected by a high-pressure manifold system. The empty SCBA cylinder is connected to the cascade system, and compressed air is transferred from the storage tanks to the cylinder. The storage cylinder valves must be opened and closed, one at a time, to fill the SCBA cylinder to the recommended pressure.

Proper training is required to fill SCBA cylinders. Whether your department has an air compressor or a cascade system, only those fire fighters who have been trained on the equipment should use it to refill air cylinders.

Cleaning and Sanitizing SCBA

Most SCBA manufacturers will provide specific instructions for the care and cleaning of their models. The first step in cleaning the SCBA is to rinse the entire unit using a hose with clean water. The harness assembly and cylinder can be cleaned with a mild soap and water solution. If additional cleaning is needed, the unit can be scrubbed with a stiff brush. After scrubbing, the SCBA harness and cylinder should be rinsed with clean water.

After a fire, face pieces and regulators can be cleaned with a mild soap and warm water or a disinfectant cleaning solution. The face piece should be fully submerged in the cleaning solution. If additional cleaning is needed, a soft brush can be used to scrub the face piece. Avoid scratching the lens or damaging the exhalation valve. The regulator can be cleaned with the same solution, but should not be submerged. The face piece and regulator should then be rinsed with clean water.

Allow the SCBA time to dry completely before returning it to service. Check for any damage before returning the SCBA to service. Follow the steps in (Skill Drill 2-12) to clean and sanitize an SCBA:

1. Inspect the SCBA for any damage that may have occurred before cleaning.
2. Remove the face piece from the regulator. On some models, the regulator also can be removed from the harness.
3. Detach the SCBA cylinder from the harness.
4. Rinse all parts of the SCBA with clean water. Water from a garden hose can be used for this step.
5. Using a stiff brush, along with a soap-and-water solution, scrub the SCBA cylinder and harness. Rinse and set aside to dry.
6. In a 5-gallon bucket make a mixture of mild soap and water or use the manufacturer's recommended cleaning and disinfecting solution and water.
7. Submerge the SCBA face piece into the soapy water or cleaning solution. For heavier cleaning, allow the face piece to soak.
8. Clean the regulator with the soapy water or cleaning solution, following the manufacturer's instructions.



Figure 2-32 Air compressors are installed at many fire stations to refill SCBA cylinders.

9. Use a soft brush, if necessary, to scrub contaminants from the face piece and regulator.
10. Completely rinse the face piece and the regulator with clean water. Set them aside and allow them to dry.
11. Reassemble and inspect the entire SCBA before placing it back in service.

Fire Fighter Safety Tips

Refilling SCBA cylinders requires special precautions because of the high pressures that are involved. The SCBA cylinder must be in a shielded container while it is being refilled (▼ **Figure 2-33**). The container is designed to prevent injury if the cylinder ruptures. The hydrostatic test date must be checked before the cylinder is refilled to ensure that its certification has not expired. Special procedures must be followed to ensure that the air used to fill the SCBA cylinder is not contaminated.



Figure 2-33 SCBA cylinders are refilled in a protective enclosure.

Wrap-Up

Ready for Review

This chapter discussed the qualifications required to become a fire fighter. Safety is a critical part of a fire fighter's job. Preventing injuries is always preferable to treating them. Injury prevention includes standards and procedures, personnel, training, and the department's equipment. It is important to exercise good safety practices during training, during responses, at emergency incidents, at the fire station, and outside the workplace.

Personal protective equipment must meet NFPA standards to ensure your safety. The personal protective ensemble includes a helmet, a protective hood, a turnout coat, bunker pants, boots, gloves, SCBA, and a PASS device. All parts of the ensemble must be donned and in place for maximum protection. Fire fighters must be able to don protective clothing in one minute or less. Fire fighters also must care for and maintain PPE properly so that it works as it should.

Fires produce smoke particles, smoke vapors, toxic gases, oxygen-deficient atmospheres, and high temperatures. These conditions require fire fighters to use respiratory protection. The primary respiratory protection equipment used by the fire service is SCBA. This chapter described the limitations of SCBA, the physical limitations of the user, the psychological limitations of the user, and the relationship of these factors to the safe use of SCBA.

Fire fighters must understand the major parts of SCBA and be able to don the equipment quickly. You should be able to don your SCBA in one minute or less. This chapter described how to don SCBA from an apparatus seat mount, from a compartment mount, and from a storage case. It discussed the safety precautions to follow when using SCBA and how to prepare for emergency conditions.

Regular inspection and proper maintenance of SCBA is vital to your safety. This chapter outlined the steps to change air cylinders. It described the importance of hydrostatic testing. It discussed the difference between a cascade filling system and a compressor filling system for air cylinders.

Chief Concepts

- Qualifications for becoming a fire fighter include age requirements, medical requirements, physical fitness requirements, and emergency medical care requirements.
- Good safety practices must be followed during training, during response, at emergency incidents, at the firehouse, and outside the workplace.
- The PPE ensemble for structural firefighting consists of a helmet, a protective hood, a turnout coat, bunker pants, boots, gloves, SCBA, and a PASS device.
- Respiratory hazards from fires include smoke particles and vapors, toxic gases, an oxygen-deficient environment, and high temperatures.
- Understanding the uses and limitations of SCBA is essential for your safety at fire scenes.

Wrap-Up

Hot Terms

Air cylinder The component of the SCBA that stores the compressed air supply.

Air line The hose through which air flows, either within an SCBA or from an outside source to a supplied air respirator.

Backpack The harness of the SCBA that supports the components worn by a fire fighter.

Buddy system A system in which two fire fighters always work as a team for safety purposes.

Bunker coat The protective coat worn by a fire fighter for interior structural firefighting; also called a turnout coat.

Bunker pants The protective trousers worn by a fire fighter for interior structural firefighting; also called turnout pants.

Carbon monoxide A toxic gas produced through incomplete combustion.

Cascade system An apparatus consisting of multiple tanks used to store compressed air and fill SCBA cylinders.

Closed-circuit breathing apparatus SCBA designed to recycle the user's exhaled air. The system removes carbon dioxide and generates fresh oxygen.

Compressor A mechanical device that increases the pressure and decreases the volume of atmospheric air, used to refill SCBA cylinders.

Critical incident stress debriefing (CISD) A confidential group discussion among those who served at a traumatic incident to address emotional, psychological, and stressful issues; usually occurs within 24 to 72 hours of the incident.

Doff To take off an item of clothing or equipment.

Don To put on an item of clothing or equipment.

Emergency by-pass mode Operating mode that allows an SCBA to be used even if part of the regulator fails to function properly.

Employee assistance program (EAP) Program adopted by many departments for fire fighters to receive confidential help with problems such as substance abuse, stress, depression, or burn out that can affect their work performance.

Face piece Component of SCBA that fits over the face.

Fire helmet Protective head covering worn by fire fighters to protect the head from falling objects, blunt trauma, and heat.

Freelancing Dangerous practice of acting independently of command instructions.

Hand light Small, portable light carried by fire fighters to improve visibility at emergency scenes, often powered by rechargeable batteries.

Hydrogen cyanide Toxic gas produced by combustion of materials containing cyanide.

Hydrostatic testing Periodic certification test performed on pressure vessels, including SCBA cylinders.

Immediate Danger to Life and Health (IDLH) An atmospheric concentration of any toxic, corrosive, or asphyxiant substance that poses an immediate threat to life or could cause irreversible or delayed adverse health effects. There are three general IDLH atmospheres: toxic, flammable, and oxygen-deficient.

Incident Commander (IC) The person in charge of the incident site who is responsible for all decisions relating to the management of the incident.

Incident Management System (IMS) The combination of facilities, equipment, personnel, procedures, and communications under a standard organizational structure to manage assigned resources effectively to accomplish stated objectives for an incident. Also known as Incident Command System (ICS).

Incomplete combustion A burning process in which the fuel is not completely consumed, usually due to a limited supply of oxygen.

Kevlar® Strong, synthetic material used in the construction of protective clothing and equipment.

Light-emitting diode (LED) An electronic semiconductor that emits a single-color light when activated.

National Institute for Occupational Safety and Health (NIOSH) A U.S. Federal agency responsible for research and development on occupational safety and health issues.

Nomex® A fire-resistant synthetic material used in the construction of personal protective equipment for fire fighting.

Nose cups An insert inside the face piece of an SCBA that fits over the user's mouth and nose.

Occupational Safety and Health Administration (OSHA) The federal agency that regulates worker safety and, in some cases, responder safety. OSHA is part of the Department of Labor.

Open-circuit breathing apparatus SCBA in which the exhaled air is released into the atmosphere and is not reused.

Oxygen deficiency Any atmosphere where the oxygen level is below 19.5%. Low oxygen levels can have serious effects on people, including adverse reactions such as poor judgment and lack of muscle control.

PBI® A fire-retardant synthetic material used in the construction of personal protective equipment.

Personnel accountability system A method of tracking the identity, assignment, and location of fire fighters operating at an incident scene.

Personal alert safety system (PASS) Device worn by a fire fighter that sounds an alarm if the fire fighter is motionless for a period of time.

Personal protective equipment (PPE) Gear worn by fire fighters that includes helmet, gloves, hood, coat, pants, SCBA, and boots. The personal protective equipment provides a thermal barrier for fire fighters against intense heat.

Phosgene A chemical agent that causes severe pulmonary damage.

Pounds per square inch (psi) Standard unit used in measuring pressure.

Pressure gauge A device that measures and displays pressure readings. In an SCBA, the pressure gauges indicate the quantity of breathing air that is available at any time.

Protective hood A part of a fire fighter's PPE designed to be worn over the head and under the helmet to provide thermal protection for the neck and ears.

Rapid intervention company/crew (RIC) A minimum of two fully equipped personnel on site, in a ready state, for immediate rescue of injured or trapped fire fighters. In some departments, this is also known as Rapid Intervention Team.

Rehabilitation A systematic process to provide periods of rest and recovery for emergency workers during an incident; usually conducted in a designated area away from the hazardous area.

Respirator A protective device used to provide safe breathing air to a user in a hostile or dangerous atmosphere.

Safety Officer The position within IMS responsible for identifying and evaluating hazardous or unsafe conditions at the scene of the incident. Safety officers have the authority to stop any activity deemed unsafe.

SCBA harness Part of SCBA that allows fire fighters to wear it as a "backpack."

SCBA regulators Part of the SCBA that reduces the high pressure in the cylinder to a usable lower pressure and controls the flow of air to the user.

Self-contained breathing apparatus (SCBA)

Respirator with independent air supply used by fire fighters to enter toxic and otherwise dangerous atmospheres.

Self-contained underwater breathing apparatus (SCUBA) Respirator with independent air supply used by underwater divers.

Smoke particles Airborne solid material consisting of ash and unburned or partially burned fuel released by a fire.

Standard operating procedures (SOPs) Written rules, policies, regulations, and procedures enforced to structure the normal operations of most fire departments.

Supplied-air respirator (SAR) A respirator that gets its air through a hose from a remote source, such as a compressor or storage cylinder.

Turnout coat Protective coat that is part of a protective clothing ensemble for structural firefighting; also called a bunker coat.

Turnout pants Protective trousers that are part of a protective clothing ensemble for structural firefighting; also called bunker pants.

Two-way radio A portable communication device used by fire fighters. Every firefighting team should carry at least one radio to communicate distress, progress, changes in fire conditions, and other pertinent information.



Fire Fighter in Action

You have just completed Fire Fighter I and II training and have begun your probationary period at the fire department. The importance of safety has been reinforced throughout your training. Fire Fighter Rogers is assigned as your mentor, and you are going to be her shadow for the next six months. On your first day at the fire station, Fire Fighter Rogers shows you around the station and introduces you to daily duties, and she familiarizes you with the apparatus and equipment. You are assigned to Engine 4 and are ready for your first emergency call. You have just sat down for lunch when your engine is dispatched to a garage fire. You feel a rush of adrenaline—your first call is a working structure fire! You and your crew must now get ready to respond to the call.

1. What is the proper order of donning your PPE?
 - A. Hood, turnout coat, bunker gear pants and boots, SCBA, face piece, helmet, and gloves
 - B. Hood, bunker gear pants and boots, turnout coat, SCBA, face piece, helmet, and gloves
 - C. Hood, bunker gear pants and boots, turnout coat, SCBA, helmet, face piece, and gloves
 - D. Hood, bunker gear pants and boots, SCBA, turnout coat, helmet, face piece, and gloves
2. While riding in the apparatus you should:
 - A. finish donning your personal protective gear before fastening your seat belt to save time.
 - B. not fasten your seat belt while donning your seat-mounted SCBA so that you do not inadvertently fasten yourself to the seat.
 - C. not wear a seat belt. As long as you ride in the back, seat belts are not required.
 - D. ensure your personal protective gear is donned properly prior to entering the apparatus and fasten your seat belt before the apparatus moves. Remain seated until the apparatus comes to a complete stop.

When you arrive on the scene, you observe smoke and fire rolling out of the garage windows. Your lieutenant orders you and Fire Fighter Rogers to do a quick attack with a 2 1/2" hose line.

3. You and Fire Fighter Rogers are a team, which means you should:
 - A. check each other's PPE to ensure it is on and working correctly.
 - B. enter together, work together, and leave together.
 - C. maintain visual, vocal, or physical contact with each other.
 - D. all of the above
4. Fire Fighter Rogers tells you to turn on your PASS device. What is a PASS device?
 - A. Primary Alert Sounding System—an electronic device that alerts fire fighters when toxins are in the air
 - B. Personal Alert Safety System—an electronic device that sounds a loud audible signal when a fire fighter becomes trapped or injured
 - C. Probationary Accountability Safety System—an electronic device that tracks new probationary fire fighters to ensure accountability at all times
 - D. Prevent Asbestos Safety System—an electronic device that detects asbestos so that interior crews will limit the disruption of materials containing asbestos

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