

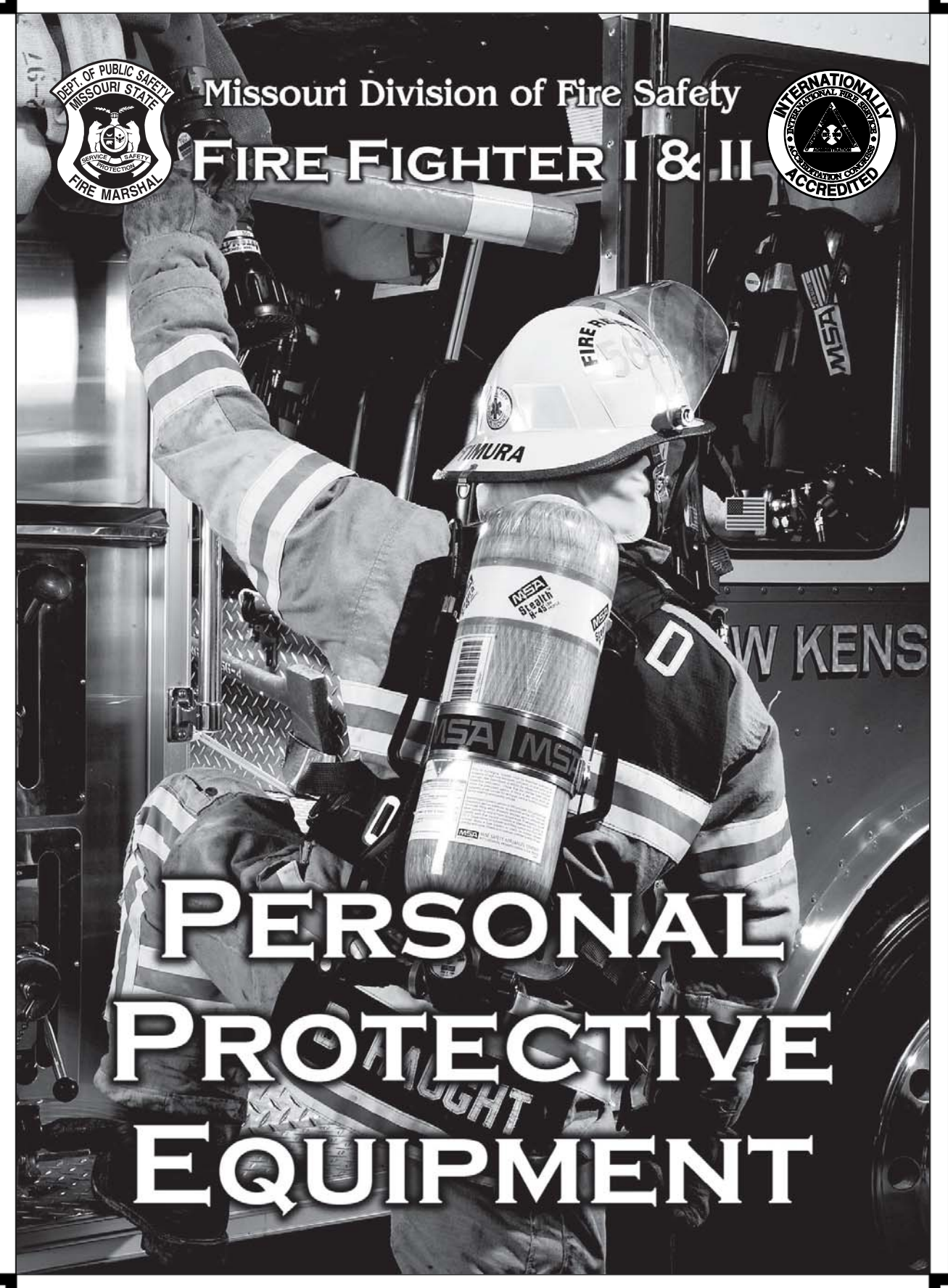


Missouri Division of Fire Safety

FIRE FIGHTER I & II



PERSONAL PROTECTIVE EQUIPMENT





UNIT OBJECTIVES

Upon completion of this unit of study, the student should be able to:

1. Describe the features of structural firefighting personal protective clothing.
2. Describe the procedures for the care of personal protective clothing.
3. Demonstrate donning personal protective clothing within one minute.
4. Identify respiratory hazards and their impact on the human body.
5. Identify self-contained breathing apparatus parts and terminology.
6. Identify the physical requirements of the wearer, the limitations of the SCBA, and the safety features of all types of SCBA.
7. Demonstrate donning SCBA within one minute.
8. Demonstrate or identify the procedures for cleaning and sanitizing SCBA using approved manufacturer's procedures.
9. Demonstrate the procedures for daily inspection and maintenance of SCBA.
10. Demonstrate procedures for exchanging air cylinders.
11. Demonstrate the use of SCBA for use in restricted passages.
12. Demonstrate emergency procedures while wearing SCBA including use of emergency bypass and breathing from the regulator.
13. Demonstrate techniques for conserving the use of air under work conditions.



NFPA STANDARDS

Successful completion of the information in this section is necessary to fulfill the requirements of the following sections of NFPA 1001-2008:

Fire Fighter I Standard

5.1.1 General Knowledge Requirements. The organization of the fire department; the role of the Fire Fighter I in the organization; the mission of fire service; the fire department's standard operating procedures (SOPs) and rules and regulations as they apply to the Fire Fighter I; the role of other agencies as they relate to the fire department; aspects of the fire department's member assistance program; the importance of physical fitness and a healthy lifestyle to the performance of the duties of a fire fighter; the critical aspects of NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, as they apply to the Fire Fighter I; knot types and usage; the difference between life safety and utility rope; reasons for placing rope out of service; the types of knots to use for given tools, ropes, or situations; hoisting methods for tools and equipment; and using rope to support response activities.

5.1.2 General Skill Requirements. The ability to don personal protective clothing within 1 minute; doff personal protective clothing and prepare for reuse; hoist tools and equipment using ropes and the correct knot; and locate information in departmental documents and standard or code materials.

5.3.1* Use self-contained breathing apparatus (SCBA) during emergency operations, given SCBA and other personal protective equipment, so that the SCBA is correctly donned and activated within 1 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.

(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.

(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.



NFPA STANDARDS

5.3.5* Exit a hazardous area as a team, given vision-obscured conditions, so that a safe haven is found before exhausting the air supply, others are not endangered, and the team integrity is maintained.

(A) Requisite Knowledge. Personnel accountability systems, communication procedures, emergency evacuation methods, what constitutes a safe haven, elements that create or indicate a hazard, and emergency procedures for loss of air supply.

(B) Requisite Skills. The ability to operate as a team member in vision-obscured conditions, locate and follow a guideline, conserve air supply, and evaluate areas for hazards and identify a safe haven.

5.3.9* Conduct a search and rescue in a structure operating as a member of a team, given an assignment, obscured vision conditions, personal protective equipment, a flashlight, forcible entry tools, hose lines, and ladders when necessary, so that ladders are correctly placed when used, all assigned areas are searched, all victims are located and removed, team integrity is maintained, and team members' safety - including respiratory protection - is not compromised.

(A) Requisite Knowledge. Use of forcible entry tools during rescue operations, ladder operations for rescue, psychological effects of operating in obscured conditions and ways to manage them, methods to determine if an area is tenable, primary and secondary search techniques, team members' roles and goals, methods to use and indicators of finding victims, victim removal methods (including various carries), and considerations related to respiratory protection.

(B)* Requisite Skills. The ability to use SCBA to exit through restricted passages, set up and use different types of ladders for various types of rescue operations, rescue a fire fighter with functioning respiratory protection, rescue a fire fighter whose respiratory protection is not functioning, rescue a person who has no respiratory protection, and assess areas to determine tenability.

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

(A) Requisite Knowledge. Types of cleaning methods for various tools and equipment, correct use of cleaning solvents, and manufacturer's or departmental guidelines for cleaning equipment and tools.

(B) Requisite Skills. The ability to select correct tools for various parts and pieces of equipment, follow guidelines, and complete recording and reporting procedures.

PERSONAL PROTECTIVE EQUIPMENT



MISSOURI DIVISION OF FIRE SAFETY FIRE FIGHTER I & II

NOTES	STUDENT GUIDE
	<p>I. Personal Protective Equipment (<i>Essentials p. 165</i>)</p> <ul style="list-style-type: none">A. Today's complex environment offers a multitude of problems for fire fighters involving toxic and hazardous materialsB. Fire fighters must understand the problems and respond to these situations with all of the protection they can affordC. Personal protective equipment includes:<ul style="list-style-type: none">1. Protective clothing to protect fire fighters while fighting fires, performing rescues, and delivering emergency medical services2. Self-contained breathing apparatus or other respiratory protection3. Personal alert safety systemsD. Fire departments must provide personnel with NFPA-approved protective clothing and equipment<ul style="list-style-type: none">1. The best equipment is worthless if fire fighters do not wear everything provided it is not worn properly2. Even with approved equipment used properly, safety is not guaranteed3. However, many injuries can be prevented or the severity reduced with correct use of full protective equipment

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MISSOURI DIVISION OF FIRE SAFETY FIRE FIGHTER I & II

NOTES	STUDENT GUIDE
	<p>II. Personal Protective Clothing (<i>Essentials, p. 167</i>)</p> <p>A. Referred to as "turnouts" or "bunker gear"</p> <p>B.</p> <ol style="list-style-type: none">1. Inhibits the transfer of heat away from the body2. Body heat and moisture get trapped within turnout clothing increasing the physical stress<ol style="list-style-type: none">a. The cooling effects of sweating are limited during workb. Can increase heart rate, respiration, and skin and core temperaturec. <p>C. NFPA 1971, <i>Standard on Protective Ensemble for Structural Fire Fighting</i>, sets the minimum design, performance and certification requirements for structural fire fighting protective clothing</p> <ol style="list-style-type: none">1. All components must have an appropriate label permanently attached which includes:<ol style="list-style-type: none">a. "This structural fire fighting protective...meets the...requirements of NFPA 1971, <i>Standard on Protective Ensemble for Structural Fire Fighting</i>, 2008 Edition."b. The manufacturer's<ol style="list-style-type: none">(1) Name or designation(2) Address

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	<ul style="list-style-type: none">(3) Country of manufacture(4) Identification or serial numberc. Month and date of manufactured. Model name, number, or designe. Sizef. Principal construction materialsg. Cleaning precautions <p>2. Fire fighters always must be aware of the limitations of each piece of PPE</p> <p>D. Helmets</p> <ul style="list-style-type: none">1. The traditional function of fire helmets was to prevent hot water and embers from reaching the ears and neck2. Newer helmets still provide water protection and also:<ul style="list-style-type: none">a.b.c. Secondary protection of the face and eyes3. Helmets shall consist of at least all of the following assembled components:<ul style="list-style-type: none">a. Shellb. Energy absorbing system

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	<ul style="list-style-type: none">c. Retention systemd. Fluorescent and retroreflective trime. Ear coversf. A faceshield or goggles, or both <p>3.</p> <p>4. Faceshields provide supplemental face and eye protection</p> <ul style="list-style-type: none">a. Do not provide adequate protection from flying particles or splashesb. <p>E. Eye protection</p> <ul style="list-style-type: none">1. Eye injuries are some of the most common fire-ground injuries2. Safety glasses and goggles protect against 85% of all eye hazards3. Eye protection is necessary when:<ul style="list-style-type: none">a. Working with tools that can create airborne fragmentsb. Working with chemicals that may be splashed into eyesc. Conducting vehicle extrication

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	<ul style="list-style-type: none">d. Exposure to bodily fluids is possiblee. Fighting wildland fires <p>4. Department SOPs and supervisors should require use of eye protection when required</p> <p>F. Hearing protection</p> <ul style="list-style-type: none">1.2. NFPA 1500 requires departments to initiate hearing protection programs to control and reduce harmful noise and provide hearing protection3. Many departments provide hearing protection and procedures for their use4. The common hearing protection use is for personnel riding apparatus5. Apparatus intercom systems provide hearing protection and communications6. Wearing hearing protection during structural fire fighting is impractical and hampers operations by interfering with:<ul style="list-style-type: none">a. On-scene communicationsb. Cries for helpc. Sounds indicating collapsed. Evacuation signals

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	<p>G. Protective hoods</p> <ol style="list-style-type: none">1.<ol style="list-style-type: none">a. Covers areas not protected by SCBA facepiece, helmet, ear flaps, or coat collarb.3. Made of fire-resistant material and available in long and short styles4. No part of the hood should be between skin and SCBA facepiece<ol style="list-style-type: none">a. The hood should be donned before the turnout coat to keep the bottom of the hood under the coatb. <p>H. Turnout coats</p> <ol style="list-style-type: none">1. Provide protection in structural fire fighting and other emergencies2.<ol style="list-style-type: none">a. Outer shell: lightweight and flame resistantb. Vapor barrier: Gortex, neoprene, or vinylc. Inner lining: lightweight and non-removabled. Serve to trap insulating air to slow heat transfer to the body

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	<ul style="list-style-type: none">e. Provide limited protection from:<ul style="list-style-type: none">(1)(2) Hot water and steam(3) Cold temperatures(4) Environmental hazards3. Additional protection features<ul style="list-style-type: none">a. Collars with a closure must be turned up for neck protectionb. Wristlets prevent water, embers, and debris from entering the sleevesc. The front closure system prevents water and fire products from entering through gapsd. Newer coats are equipped with a Drag Rescue Device (DRD): built-in harness and hand loop at the back of the neck to allow a rescuer to grab and drag a downed fire fighter4. Using all appropriate protective equipment according to manufacturer's recommendations is the only way to be properly protected<ul style="list-style-type: none">a.5. Turnout gear limitations:<ul style="list-style-type: none">a. Increases risk of heat stressb. Burns may be suffered with no warning

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	<ul style="list-style-type: none">c.d. Damaged gear puts fire fighters at greater riske. Structural PPE provides no protection from the following hazards:<ul style="list-style-type: none">(1)(2) Biological(3) Nuclear(4) ExplosiveI. Turnout pants<ul style="list-style-type: none">1. Same design requirements of layers as required for turnout coats2.3. Reinforced knees and cuffs make turnout pants more durable4. Suspenders are necessary so pants do not sag when wetJ. Fire fighting gloves must be:<ul style="list-style-type: none">1.2. Penetration resistance3. Cut resistance4.5. Properly fit and designed for dexterity

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NOTES	STUDENT GUIDE
	<p data-bbox="618 411 878 443">K. Foot protection</p> <ol data-bbox="667 485 1386 1549" style="list-style-type: none"><li data-bbox="667 485 1386 1016">1. NFPA approved fire fighting boots provide protection from:<ol data-bbox="716 600 1243 1016" style="list-style-type: none"><li data-bbox="716 600 1053 632">a. Hot embers and water<li data-bbox="716 674 1243 705">b. Nails, glass, and other sharp objects<li data-bbox="716 747 915 779">c. Body fluids<li data-bbox="716 821 1005 852">d. Punctures and cuts<li data-bbox="716 894 987 926">e. Crushing injuries<li data-bbox="716 968 902 999">f. Electricity<li data-bbox="667 1058 1386 1436">2. Structural fire fighting boots may be leather or rubber<ol data-bbox="716 1173 1403 1436" style="list-style-type: none"><li data-bbox="716 1173 1403 1247">a. Thermal, physical, and moisture protection shall be continuous for the entire footwear height<li data-bbox="716 1289 740 1320">b.<li data-bbox="716 1362 1403 1436">c. Have insulation bonded to boot shell for thermal protection<li data-bbox="667 1478 1386 1549">3. In many departments, safety shoes or boots are part of the station uniform <p data-bbox="618 1591 1167 1623">L. Wildland personal protective clothing</p> <ol data-bbox="667 1665 1386 1896" style="list-style-type: none"><li data-bbox="667 1665 1386 1738">1. Structural fire fighting turnout gear is too heavy and bulky for use in wildland fire fighting<li data-bbox="667 1780 1386 1896">2. Wildland gear should meet the requirements of NFPA 1977, <i>Standard on Protective Clothing and Equipment for Wildland Fire Fighting</i>

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	<ul style="list-style-type: none">3. Includes brush jacket/pants or one-piece jumpsuits, gloves, goggles, head and neck protection, and footwear<ul style="list-style-type: none">a. Jackets/pants or coveralls must meet fire-resistant requirements of the standardb. Hard hats or helmets with chin straps with a protective shroud for face and neck protectionc. Wildland boots must be at least 8" to 10" high and provide heat and slip protection M. Station/work uniforms<ul style="list-style-type: none">1. Station and work uniforms should meet the requirements of NFPA 1975, <i>Standard on Station/Work Uniforms for Fire and Emergency Services</i>2. Includes pants, shirts, and coveralls3. To be approved, no garment component is to ignite, melt, drip, or separate when exposed to 500°F for five minutes N. Care of personal protective clothing (<i>Essentials p. 179</i>)<ul style="list-style-type: none">1. Manufacturer's recommendations should be followed to insure durability and endurance of protection provided2.3. Helmets<ul style="list-style-type: none">a. Clean off dirt and soot from the outer shell

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	<ul style="list-style-type: none">b.c. Replace helmets that do not fit properlyd. Replace cracked, scratched, or heat-damaged faceshieldse. Inspect the suspension system frequently and repair or replace if necessaryf. Follow manufacturer's procedures before repairing a helmet <p>4. Coats, pants, and hoods</p> <ul style="list-style-type: none">a. Clean outer shells provide better heat resistanceb. Most coats and pants can be hand scrubbed with a mild soap and water and then rinsed and hung to dryc. Extraction washes need to be used to launder turnout geard.e. High-pressure washers will damage the protective fabrics and should not be used <p>5. Most gloves can be cleaned in the same way as coats and pants</p> <p>6. Boots</p> <ul style="list-style-type: none">a.

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	<p>b. Replace worn, cut, or punctured boots</p> <p>III. Respiratory Protection (<i>Essentials p. 180</i>)</p> <p>A. The respiratory tract is highly vulnerable to injury from the products of combustion</p> <ol style="list-style-type: none">1. The toxic atmospheres created by fire are described as immediately dangerous to life and health (IDLH)2. IDLH atmospheres produce immediate, irreversible, debilitating effects of health3. OSHA defines the interior of a burning building as IDLH4. <p>B. Respiratory hazards</p> <ol style="list-style-type: none">1. Oxygen deficiency hazards<ol style="list-style-type: none">a. NFPA and OSHA defines an oxygen-deficient atmosphere as any one with less 19.5% oxygenb. As a fire burns, the oxygen can be consumed and the toxic gases produced displace oxygenc. Oxygen deficient conditions can be encountered in various non-fire situations<ol style="list-style-type: none">(1) Carbon monoxide situations(2) Confined spaces, such as sewers, trenches, storage tanks, and grain bins

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	<ul style="list-style-type: none">d. Effects of reduced oxygen (hypoxia)<ul style="list-style-type: none">(1) 21% oxygen in air =(2) 17% oxygen in air = increased respirations and muscular impairment(3) 12% oxygen in air = dizziness, headache, fatigue(4) 9% oxygen in air =(5) 6% oxygen in air =2. Elevated temperatures<ul style="list-style-type: none">a. Taken into the lungs can cause a serious decrease in blood pressure and circulatory system failureb. Can cause pulmonary edema (buildup of fluid in the lungs) and asphyxiationc. Can cause permanent tissue damaged. Can cause a spasm of the epiglottis and asphyxiation3. Smoke<ul style="list-style-type: none">a. Contains oxygen, nitrogen, carbon dioxide, carbon monoxide, carbon particles and other toxic by-productsb.<ul style="list-style-type: none">(1) Formaldehyde: suffocating effect

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	<ul style="list-style-type: none">(2) Formic acid(3) Acrolein: damages mucus membranes4. Toxic gases<ul style="list-style-type: none">a. The irritants and toxins produced by a fire cannot be determined accuratelyb. The combination of some of these substances can be more toxic than if inhaled separatelyc. The type and amount of toxic gases depends on:<ul style="list-style-type: none">(1) The nature of the combustion(2) The rate of heating(3) The temperatures of the gases produced(4) The oxygen concentrationd.<ul style="list-style-type: none">(1) Odorless and colorless(2) Produced in almost every fire(3)(4) The darker the smoke color, the more CO is present(5)(6) High concentrations can remain in a compartment after fire extinguishment(7)

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	<ul style="list-style-type: none">(8) Unconsciousness and death can occur at levels over 1%(9) Combines with hemoglobin 210 times faster than oxygen (carboxyhemoglobin) and displaces oxygen in the blood<ul style="list-style-type: none">(a) It can take years for carboxyhemoglobin to get out of the blood(b) Due to frequent exposure, fire fighters can develop a tolerance to CO and function without any symptoms(c) Fire fighters can suffer the effects of CO without being aware of it(d) A fire fighter may be incapacitated by a 1% CO concentration(e) Pure oxygen should be administered for immediate care(f)e.<ul style="list-style-type: none">(1) Irritates the eyes and respiratory tract(2)f. Hydrogen cyanide (HCN)<ul style="list-style-type: none">(1) Chemical asphyxiant(2) From sulfur based fuels, such as wool, nylon, rubber, and paper

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	<p>g.</p> <ul style="list-style-type: none">(1) 10-12% can cause death(2) Initially increases breathing rate(3) <p>h.</p> <ul style="list-style-type: none">(1) Pulmonary irritant(2) Blocks body's respiratory process(3) Given off around grain bins <p>i.</p> <ul style="list-style-type: none">(1) Mixes with water to form acid in the lungs(2) <p>5. Non-fire toxic atmospheres</p> <ul style="list-style-type: none">a. Ammonia and sulfur dioxide are used as refrigerants in commercial occupancies and irritate the respiratory tract and eyesb. Chlorine gas leaks may be encountered at manufacturing facilities, water treatment plants, and swimming poolsc. Toxic gases and oxygen deficiencies will be encountered in confined areas where rescues may have to be conducted

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	<p>d.</p> <p>6. If there is any doubt as to the presence of toxic gases or a lack of oxygen, self-contained breathing apparatus should always be worn</p> <p>C. Limitations of the wearer of self-contained breathing apparatus</p> <ol style="list-style-type: none">1. Fire fighters must be in good physical condition to work in SCBA and maximize the air supply2.3. The shape of the face will affect the wearer's ability to get a good seal with the facepiece4. NFPA 1500, 7.13 Using Respiratory Protection<ol style="list-style-type: none">a. Respirators shall not be worn when a member has any conditions that prevent a good face sealb. Nothing shall be allowed to enter or pass through the area where the respiratory protection facepiece is designed to seal with the face, regardless of the specific fitting test measurement that can be obtainedc. Members who have a beard or facial hair at any point where the facepiece is designed to seal with the face or whose hair could interfere with the operation of the unit shall not be permitted to use respiratory protection at emergency incidents or in hazardous or potentially hazardous atmospheres

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	<ul style="list-style-type: none">d. These restrictions shall apply regardless of the specific fitting test measurement that can be obtained under test conditionse. <u>Individuals with facial hair that comes into contact with the SCBA facepiece will not be allowed to be participate in any live burn skill requiring the use of SCBA and will not be permitted to test for Missouri Division of Fire Safety certification</u>f. Use of contact lenses shall be permitted during full facepiece respiratory protection use, provided that the member has previously demonstrated successful long-term contact lens use <p>5. Fire fighters must have the physical strength and size necessary to wear the equipment and perform necessary duties</p> <p>6. Medical factors</p> <ul style="list-style-type: none">a. Neurological: good coordination skills are needed for working in SCBAb. Muscular: physical strength and size are necessary to wear SCBA properlyc. Respiratory: proper respiratory functioning will help maximize the time in SCBA <p>7. Mental factors</p> <ul style="list-style-type: none">a.

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	<ul style="list-style-type: none">b. It is important that a fire fighter be able to maintain control in high stress situations to reduce any chance of mistakes while wearing SCBAc. Wearer must be able to control effects of claustrophobia from being confined in unit and facepiece <p>D. SCBA limitations</p> <ul style="list-style-type: none">1. _____: limits mobility2. _____: facepiece limits vision and can become covered with fog3. _____: facepiece limits sound transmission4. Air supply limitations<ul style="list-style-type: none">a.b. Fire fighters must be aware of the amount of time they can be in a hazardous atmospherec. Excitement and apprehension will increase breathing and use air fasterd. Minor leaks or improper regulator adjustments can result in air losse. If the cylinder is not full, work time is reducedf.

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	<p>5. Air management</p> <p>a. For safety and survival:</p> <ul style="list-style-type: none">(1) Every fire fighter has the responsibility for managing his or her own air supply(2) Comply with the accountability system in place(3) Maintain situational awareness <p>b. Effective air management includes:</p> <ul style="list-style-type: none">(1)(2) Know the point of no return (beyond 50% of the air supply of the team member with the lowest gauge reading)(3) Make a conscious decision to stay or leave when your air supply is down to 50% <p>c. SCBA air supply should be checked:</p> <ul style="list-style-type: none">(1) At the beginning of each shift(2)(3) While working (at 5-10 minute intervals)(4) During egress from a hazard zone (at 2-3 minute intervals)

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	<p>(5) When refilling or replacing a cylinder</p> <p>E. Evolution of breathing apparatus</p> <ol style="list-style-type: none">1. Nineteenth century<ol style="list-style-type: none">a. Air pumped was through hose to helmet or helmets that entrapped airb. Neally Smoke Excluding Mask - 1877c. Siebe Gorman Mask - 1878d. Vajen-Bader Smoke protector - 1881e. Merriman Smoke Mask - 18922. Post World War I<ol style="list-style-type: none">a. Hopcalite gasmask - Type "N" canister does not filter CO but changes it to CO₂<ol style="list-style-type: none">(1) Low cost and lightweight(2) Deadly in oxygen-deficient atmospheres(3) Uncertain life of canister, recalled in 1972b. Draeger<ol style="list-style-type: none">(1)(2) Scrubbed exhaled CO₂ to use again and supplied oxygen at a fixed rate

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	<ul style="list-style-type: none">c. Chemox<ul style="list-style-type: none">(1) Developed by Mine Safety Appliances (MSA)(2) Moisture from exhaled air reacted with potassium superoxide to liberate oxygen(3) Canisters were expensive and needed replacement after each used.<ul style="list-style-type: none">(1) First closed circuit apparatus approved by U.S. Bureau of Mines in 1920's(2)3. Post World War II<ul style="list-style-type: none">a. Scott Aviation developed the compressed-air demand unitb. Followed later by compressed oxygen and low pressure alarmsF. Modern breathing apparatus (<i>Essentials p. 190</i>)<ul style="list-style-type: none">1. Open circuit self-contained breathing apparatus<ul style="list-style-type: none">a. Uses compressed airb.c. Maintains a constant pressure in the facepiece higher than atmospheric pressure to prevent contaminants from entering facepiece if seal is broken

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	<ul style="list-style-type: none">2. SCBA components<ul style="list-style-type: none">a.<ul style="list-style-type: none">(1)(2) Adjustable harness straps provide a secure fit to the wearer(3) Depending on the manufacturer, the weight may be distributed on the shoulders or the hips(4) A common problem is that fire fighters may not buckle the waist strapsb. Air cylinders<ul style="list-style-type: none">(1) Cylinder weight is determined by its construction: steel, aluminum, or composite(2) Fill pressures and air durations<ul style="list-style-type: none">(a) 2,216 psi: rated for 30 minutes(b) 4,500 psi: rated for 30 minutes(c) 3,000 psi: rated for 45 minutes(d) 4,500 psi: rated for 45 minutes(e) 4,500 psi: rated for 60 minutes(3)

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NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">(4) Hydrostatic testing verifies that the cylinder can safely hold its rated pressure(5) Hydrostatic testing is required by the Department of Transportation at the following intervals:<ul style="list-style-type: none">(a) Steel cylinders: _____(b) Aluminum cylinders (not including hoop-wrapped): tested every 5 years(c) Hoop-wrapped cylinders: _____(d) Fully wrapped fiberglass cylinders: tested every 3 years(e) Fully wrapped Kevlar cylinders: tested every 3 years(f) Fully wrapped carbon fiber cylinders: tested every 5 years(6) Cylinder life span<ul style="list-style-type: none">(a) Steel and aluminum cylinders: an indefinite service life until they fail a hydro test(b) Hoop-wrapped or fully wrapped cylinders: 15-year service life(c) Cylinders should not be filled if they have exceeded their valid service life or retest dates

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MISSOURI DIVISION OF FIRE SAFETY FIRE FIGHTER I & II

NOTES	STUDENT GUIDE
	<p>c. Regulator assembly</p> <ul style="list-style-type: none">(1) Functions<ul style="list-style-type: none">(a) Reduces pressure from the air cylinder to just above atmospheric pressure(b) Supplies air when individual inhales(c)(2) Newer units have regulators which mount to the facepiece(3) Mainline valve: _____ _____(4) Bypass valve: _____ _____(5) Older SCBA have a waist-strap mounted regulator and a low pressure hose to the facepiece <p>d. Remote pressure gauge</p> <ul style="list-style-type: none">(1) Mounted in a position visible to the wearer(2) Shows the pressure in the cylinder(3)

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NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">(4) If there is more than a 100 psi difference between the cylinder gauge and remote gauge, rely on the lower reading for the amount of air available e. "End-of-Service-Time Indicator"<ul style="list-style-type: none">(1) Commonly referred to as the low-pressure alarm (2) (3) Must be designed to stimulate more than one human sense<ul style="list-style-type: none">(a) Whistle (b) Flashing light (c) Vibration f. Every SCBA manufactured after March, 2003 must be equipped with a rapid intervention crew universal air connection (RIC UAC)<ul style="list-style-type: none">(1) Allows for a cylinder low on air to be transfilled from another cylinder (2) When connected, the pressure between the cylinders equalizes g. Facepiece<ul style="list-style-type: none">(1) Lens: clear safety plastic mounted in flexible rubber facepiece

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MISSOURI DIVISION OF FIRE SAFETY FIRE FIGHTER I & II

NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">(2) Head harness with adjustable straps or net to hold the mask firmly against the face(3) Speaking diaphragm or voice amplifier to aid in communications(4)<ul style="list-style-type: none">(a) A one-way valve that releases exhaled air without allowing outside air in(b) Must be kept clean of foreign materials or it may become partially open(5) Heads-up display<ul style="list-style-type: none">(a) Required on SCBA manufactured after March, 2003(b) Displays visual alert signals for cylinder content and for battery condition(c) Displays a visual alert signal when the breathing air in the SCBA cylinder has reduced to 50 percent of rated service content(6) Accessories<ul style="list-style-type: none">(a) Communications systems to connect a two-way radio to the facepiece(b) Eyeglass mounting kits are available from most manufacturers because standard glasses break seal(c) Voice amplifiers to make oral communications more understandable

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NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">3.<ul style="list-style-type: none">a. Maybe needed when personnel must remain in contaminated atmospheres for extended periods such as hazardous materials releases or some rescuesb.c. Also include a small 5- to 10-minute emergency egress cylinderd. Can allow fire fighters to travel up to 300 feet from the air supply without the weight of a backpack and cylinder4.<ul style="list-style-type: none">a. Typically used in hazardous materials incidents or shipboard operations of long durationb. Some be can used for up to 4 hoursc. Uses compressed oxygend.e. Also known as "rebreather" apparatus <p>G. Storing SCBA</p> <ul style="list-style-type: none">1. Storing methods vary2. Departments should use a storage method to facilitate donning

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NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">a. Seat mountb. In compartmentsc. In carrying cases <p>H.</p> <ul style="list-style-type: none">1. NFPA 1500 mandate the use of personal alert safety system devices whenever SCBA is used2. Designed to alert others when a fire fighter has stopped moving and maybe in distress<ul style="list-style-type: none">a. If motionless for approximately 30 seconds, the device sounds loud, pulsating shriek with flashing lightsb. The alert can be operated manually if the fire fighter is conscious and in troublec.3. Newer SCBA have built-in (integrated) PASS devices which are activated when the mainline valve is opened4. PASS device procedures:<ul style="list-style-type: none">a. PASS devices must meet the requirements of NFPA 1982, <i>Standard on Personal Alert Safety Systems (PASS)</i>b. PASS devices must be maintained according to manufacturers' instructionsc. Fire fighters must be trained how to initiate an alert signal and how to react to alert signals from others

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NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">d. Retraining should be conducted twice a yeare.f. Rescuers should be trained to listen for the alert signal when searching by stopping together and controlling breathingg. When a downed fire fighter is found, the PASS device should be silenced to notify others <p>I. SCBA pre-donning check (<i>Essentials p. 200</i>)</p> <ul style="list-style-type: none">1. Straps (mask and unit) loose - all straps should be restored to extended positions after checking2. Pressure checked - tank should be full3.4. Make sure the high pressure connection is secure5. Ensure the tank is secure in holder6. Operate all valves for proper functioning7. Check the PASS device <p>J. Donning SCBA</p> <ul style="list-style-type: none">1. Many fire departments carry the majority of their SCBA mounted in seat mounts on apparatus<ul style="list-style-type: none">a. Greatly speeds the donning process because SCBA can be donned enroute

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NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">b. Seat mounts may be lever clamp, spring clamp, or flat hookc. Facepieces must be stored in bags to protect from dirt and scratchesd. Must only be done safely without removing the seatbelt<ul style="list-style-type: none">(1) Fire fighters must not breathe cylinder air while seated on apparatus(2) Personnel must never stand to don SCBA while a vehicle is movinge. Fire fighters must be careful when exiting apparatus due to the extra weight of the SCBAf. Specific steps for donning may vary by department policyg. Some departments only allow seat-mounted SCBA or the facepiece to be donned upon arrival after the apparatus is stopped <p>2. Although seat-mounted SCBA are common, all fire fighters must be proficient at donning SCBA from the ground, a storage case, or an apparatus compartment using one of two methods</p> <ul style="list-style-type: none">a. Over-the-head method<ul style="list-style-type: none">(1) SCBA is positioned with the valve end of the cylinder away from the body(2) The cylinder valve is fully opened(3) The cylinder and regulator pressure gauges are compared

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NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">(4) The harness assembly is raised over the head(5) As the unit slides down the wearer's back, the arms slide into the harness shoulder strap loops(6) The chest strap is fastened and the waist strap buckled(7) The waist strap and shoulder straps are adjusted <p>b. Coat method</p> <ul style="list-style-type: none">(1) SCBA is positioned with the valve end of the cylinder toward the body(2) The cylinder valve is fully opened(3) The cylinder and regulator pressure gauges are compared(4) The SCBA is donned like a coat with one arm at a time through the shoulder strap loops(5) The chest strap is fastened and the waist strap buckled(6) The waist strap and shoulder straps are adjusted <p>3. Donning the facepiece</p> <ul style="list-style-type: none">a. The major difference between facepieces is that some have a rubber harness with adjustable straps and other have a mesh net with adjusting straps

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NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">b. Most facepieces are not interchangeable between different SCBA brandsc. The facepiece must be tightly sealed to the wearer's face to prevent toxic gases from enteringd. The chin should be centered in the chin cup of the facepiece and the harness pulled over the heade. Facepiece straps should be pulled evenly and simultaneously to the rearf. Straps should not be pulled outward or to the sidesg.h. The facepiece must be checked for a proper seal and operation of the exhalation valvei. Positive pressure should be checked by gently breaking the facepiece sealj.k. The helmet is then donned and chin strap secured

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NOTES	STUDENT GUIDE
	<p data-bbox="618 411 857 443">K. Doffing SCBA</p> <ol data-bbox="667 489 1398 1661" style="list-style-type: none"><li data-bbox="667 489 1305 520">1. Doffing procedures differ with SCBA brands<li data-bbox="667 564 1349 636">2. SCBA must be doffed only outside of a contaminated area where it is no longer required<li data-bbox="667 680 1344 751">3. Turn off the flow of air from the regulator to the facepiece<li data-bbox="667 795 1398 905">4. Disconnect the regulator from the facepiece or the low pressure hose from the regulator (depending on the model)<li data-bbox="667 949 1003 980">5. Remove the facepiece<li data-bbox="667 1024 1360 1096">6. Remove the backplate assembly while protecting the regulator<li data-bbox="667 1140 1036 1171">7. Close the cylinder valve<li data-bbox="667 1215 1370 1287">8. Relieve the pressure from the regulator by slowly opening the bypass valve or the mainline valve<li data-bbox="667 1331 1317 1476">9. Place the facepiece and unit in an appropriate location<ol data-bbox="716 1444 1208 1549" style="list-style-type: none"><li data-bbox="716 1444 1208 1476">a. Never drop any parts of an SCBA<li data-bbox="716 1520 740 1549">b.<li data-bbox="667 1635 935 1667">10. Extend all straps

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NOTES	STUDENT GUIDE
	<p>L. SCBA inspection and maintenance (<i>Essentials p. 205</i>)</p> <ol style="list-style-type: none">1. NFPA 1404, <i>Standard for Fire Service Respiratory Protection Training</i>, and NFPA 1500 require all SCBA to be inspected weekly, monthly, annually, and after each use2.3. Daily/weekly inspection<ol style="list-style-type: none">a. Check all components for cleanliness and damageb. Check the air cylinder for adequate air pressurec.d. Turn the cylinder valve on fullye. Don the facepiecef. Check the facepiece sealg. Check the exhalation valveh. Plug the low pressure hose into regulator or the regulator into the facepiece and ensure the mainline valve is oni. Check all hose connections are tight and free of leaksj.k. Check for adequate, comfortable air flowl. Operate bypass

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NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">m. Turn unit off and bleed the high pressure hose slowlyn. Check for operation of low pressure alarm when bleeding the air lineo. Return all straps, valves, and components back to a ready state <p>4. Annual inspection, maintenance, testing, and repair must be done by factory certified technicians in accordance with manufacturer's specifications</p> <p>5. Cleaning SCBA</p> <ul style="list-style-type: none">a.b. The facepiece should be washed with warm water and a mild detergentc. It should then be rinsed in clean warm waterd. The facepiece should then be rinsed in a disinfectant approved by the manufacturer for the SCBAe. It should then be rinsed again in clean, warm waterf. The facepiece should then be dried with a lint-free cloth or air driedg. Special attention must be paid to the exhalation valve to ensure its operationh. Paper towels should not be used to dry the facepiece to avoid scratching the lens

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NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">i. The backplate, straps, and cylinder should be cleaned with a mild detergent and soft brushj. <p>6. Filling SCBA cylinders</p> <ul style="list-style-type: none">a. Filling procedures will vary depending on the cascade system usedb. The following are to be considered general guidelines:<ul style="list-style-type: none">(1) Check the hydrostatic test date and approved maximum DOT pressure(2) Inspect the cylinder for damage(3) Place cylinder in charging station(4) Connect charging hose from cascade system to cylinder and open the cylinder valve(5) Open valve of cascade cylinder with the lowest pressure but more than the SCBA cylinder(6) Allow pressures to equalize(7) Close cascade cylinder valve(8) Open valve on cascade cylinder with the next highest pressure(9) Repeat steps 6, 7, and 8 until the SCBA cylinder is full(10) Close cascade cylinder valve

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NOTES	STUDENT GUIDE
	<p>(11) Close SCBA cylinder valve</p> <p>(12) Bleed pressure from cascade fill line and disconnect fill hose</p> <p>(13) Remove SCBA cylinder from charging station</p> <p>M. Using self-contained breathing apparatus <i>(Essentials p. 207)</i></p> <ol style="list-style-type: none">1. Fire fighters must know their own limitations and capabilities<ol style="list-style-type: none">a. The added weight of SCBA and protective clothing can contribute to fire fighter fatigueb. Personnel should be trained to recognize the signs of fatigue and heat-related illnesses and closely monitor how they are feeling2. Air supply duration varies with:<ol style="list-style-type: none">a. Cylinder size and pressureb. Fire fighter conditioningc.d. Training levele. Operational environmentf.g. Other variables

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NOTES	STUDENT GUIDE
	<ol style="list-style-type: none">3. Fire fighters must never remove SCBA after entering a contaminated area<ol style="list-style-type: none">a.b. Atmospheres must be tested with approved instruments to determine the hazards present4. In any IDHL atmosphere, fire fighters must always work in teams of two or more5. Emergency breathing procedures should be used only as a last resort in life-threatening situations<ol style="list-style-type: none">a.<ol style="list-style-type: none">(1) Inhale normally(2) Hold breath as long as it would normally take to exhale(3) Inhale again before exhalingb. In the event of SCBA failure:<ol style="list-style-type: none">(1) Panic causes rapid breathing(2)(3) Stop and attempt to control breathing(4) Alert other team members of the situation(5) Withdraw to a clear atmosphere<ol style="list-style-type: none">(a) Quickly but under control

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NOTES	STUDENT GUIDE
	<p>(b) Use any available exit opening or create one</p> <p>c. In the event of failure of mainline valve</p> <ol style="list-style-type: none">(1) Close mainline valve(2) Slightly open bypass valve(3)(4) Allow small amount of air flow into the facepiece(5) Close the bypass valve(6) Hold breath until more air is needed(7) While keeping one hand on the bypass valve, turn the bypass valve on and back off as needed(8) Try to conserve air to one breath every 6 to 8 feet <p>d. Regulator breathing - after mask or low pressure tube failure</p> <ol style="list-style-type: none">(1) Remove the facepiece and regulator(2) Shut off mainline valve to regulator(3) Bring the regulator up to the mouth(4) Place thumb and index finger around the regulator to form a tight seal

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NOTES	STUDENT GUIDE
	<p>(5) Use the bypass valve to give short bursts of air</p> <p>6. If separated, lost, or disoriented:</p> <ul style="list-style-type: none">a. Use a portable radio to declare a Maydayb.c.<ul style="list-style-type: none">(1) How did you get where you are?(2) Upstairs, downstairs(3) Right turns, left turnsd.<ul style="list-style-type: none">(1) For other personnel(2) For hose and equipment operations(3) For sounds indicating the fire locatione. Remember how to find a way out:<ul style="list-style-type: none">(1) Follow a hoseline out if possible(2)(3) Crawl in a straight line (hands on floor, move knee to hand)(4) Crawl in one direction (all left or right turns) in contact with a wall

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NOTES	STUDENT GUIDE
	<p>(5)</p> <p>(6) Break a window or breach a wall</p> <p>f. Lie flat on the floor close to a wall if exhausted or losing consciousness</p> <p>g. Control the door or close it, if not an escape route</p> <p>h. Place a flashlight on the floor with the light shining toward the ceiling</p> <p>7. Departments must establish a standardized evacuation signal to be used when emergency evacuation is needed</p> <p>a.</p> <p>b. A radio message may be broadcast several times notifying of the evacuation</p> <p>c. Sirens or air horns may be used in a designated manner for notification</p> <p>d. Following an evacuation signal all personnel must be accounted for by conducting a personnel accountability report (PAR)</p> <p>8. Operating in conditions of obscured visibility</p> <p>a. Many situations requiring SCBA will have poor visibility due to smoke</p>

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MISSOURI DIVISION OF FIRE SAFETY FIRE FIGHTER I & II

NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">b.<ul style="list-style-type: none">(1) Allows fire fighters to avoid heat accumulating at higher levels(2) Allows fire fighters to feel in front as they movec.d. Have a guideline back to the entrancee. Follow the walls<ul style="list-style-type: none">(1) Place the right hand on the right wall as entering the area and avoid losing contact with the wall(2) By following the same wall on the same side, fire fighters will move through the entire area and eventually be lead back to the entrance(3)9. Exiting through restricted openings in emergency conditions<ul style="list-style-type: none">a. In an emergency, fire fighters may have to exit through an opening that is too small to fit while wearing SCBAb. It may be necessary to slip out of the SCBA harness assembly while leaving the facepiece in place

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	<ul style="list-style-type: none">c. Remove only the SCBA parts needed to be fit through the openingd. Tank dump - used for small openings<ul style="list-style-type: none">(1) Loosen and unbuckle straps(2) Swing/roll unit to the left side, removing right arm first(3) Place unit on bottle with regulator toward face(4) Gather straps on top(5) Push SCBA through opening in front, always using caution not to dislodge face-piece(6) After clearing opening<ul style="list-style-type: none">(a) Place unit back in correct position(b) Retighten all straps <p>10. One-person cylinder change</p> <ul style="list-style-type: none">a. Place the SCBA on a firm surfaceb. Locate a full cylinderc. Close the cylinder valved. Bleed off pressuree. Disconnect the high pressure hose from the cylinder

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NOTES	STUDENT GUIDE
	<ul style="list-style-type: none">f. Release the cylinder securing deviceg. Replace the empty cylinder with a full cylinderh. Secure the full cylinder in the harnessi.j. Connect the high pressure hose to the cylinderk. Open the cylinder and check the operation of the gauges <p>11. Two-person bottle change</p> <ul style="list-style-type: none">a. Have the fire fighter either bend over or on hands and kneesb. Locate a full cylinderc. Close the cylinder valved. Bleed off the pressuree. Disconnect the high pressure hose from the cylinderf. Release the cylinder securing deviceg. Replace the empty cylinder with a full cylinderh. Secure the full cylinder in the harnessi. Check the "O" ring in the high pressure hose connection

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NOTES	STUDENT GUIDE
	<p>j. Connect the high pressure hose to the cylinder</p> <p>k.</p> <p>IV. Personal Protective Equipment Summary</p> <p>A. Fire fighters' lives and safety depend more upon their personal protective equipment than any other equipment they use</p> <p>B. They must be provided with the best PPE available and more importantly use all of the equipment properly</p> <p>C. It is also important that personnel understand the limitations of their PPE and not expect it to protect them from all hazards</p> <ol style="list-style-type: none">1. PPE must be properly maintained or its protective capabilities will be diminished and endanger fire fighters2. A fire fighter must be adequately trained and confident in his or her abilities with the use of SCBA3. It is important that a fire fighter be able to maintain control in high stress situations to reduce any chance of mistakes while wearing SCBA