

North Carolina Office of the State Fire Marshall



Rescue North Carolina

Present



RESCUE TECHNICIAN GENERAL PROTECTIVE EQUIPMENT

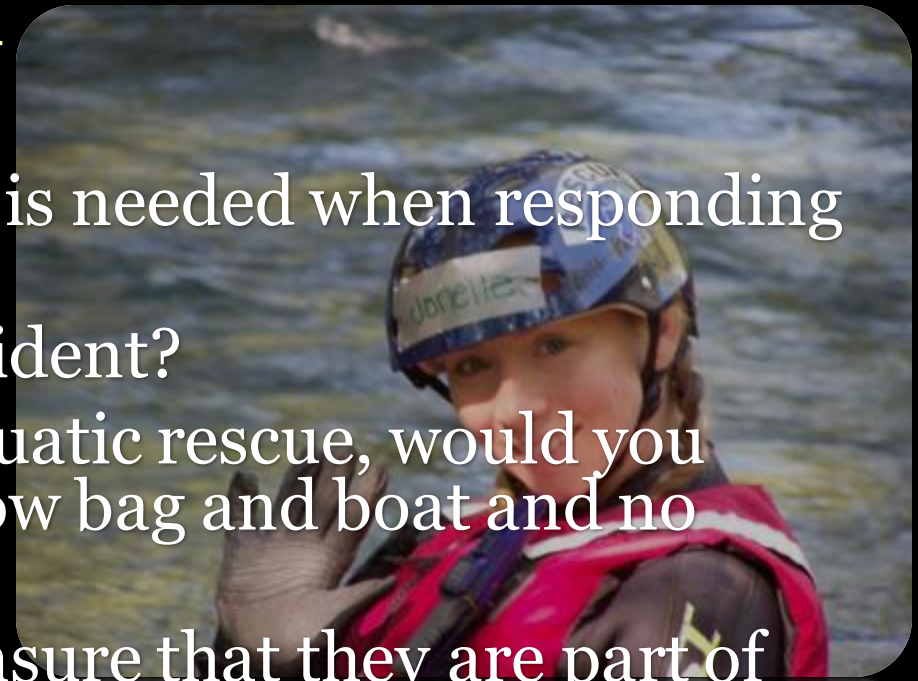
TERMINAL OBJECTIVE

- Describe appropriate personal protective equipment associated with incidents involving the different rescue environments,
- Demonstrate the proper donning and doffing techniques of PPE associated with incidents involving the different rescue environments.

MOTIVATION

- What rescue equipment is needed when responding to a wreck?
- Or, a confined space incident?
- When performing an aquatic rescue, would you respond with only a throw bag and boat and no proper PFDs?
- How does the rescuer ensure that they are part of the solution and not part of the problem?
- Proper PPE (PPPE) is imperative to ensuring a safe rescue.
- Use of PPE to balance the risk / benefit equation.

“Rescuers will risk their lives to save another, but it does not have to be at the expense of their own.”



- Why is it important to understand the need for basic and specialized PPE when conducting a risk analysis of any rescue incident?



- List reasons why the need and proper use of typically required PPE should be used at all rescue incidents.
- Such as :
 - Proper outerwear
 - Gloves,
 - Helmets
 - Eye & Ear protection
 - Boots...





Basic Personal Protective Apparel

There are 11 different NFPA standards that address PPE.

They vary from station work uniforms to medical emergencies.



Various Rescue Disciplines & List PPE

- Confined Space
- Vehicle Extrication
- Water Rescue
- Structural Collapse
- Wilderness Rescue
- Trench Rescue
- Rope Rescue
- Machinery Rescue
- Cave Rescue
- Dive Rescue
- Agriculture Rescue
- Tower Rescue

RESPIRATORY PROTECTION



Self Contained Breathing Apparatus

- SCBA Familiarization
- Air Consumption
 - Resting Time
 - Working Time
- Rate of Consumption varies based upon user and work effort.
- Do not rely on “minute amount capacity”
- *30 minute bottle does not last 30 minutes....*

BREATHING TECHNIQUES

4B-9

Controlled Breathing:

1. Inhale.
2. Force exhalation from mouth.
3. Inhale naturally through nose.

Skip Breathing:

1. Inhale.
2. Hold breath as long as it would take to exhale.
3. Inhale again.
4. Exhale.

Physical Requirements of the Rescuer

- Controlled Breathing techniques
 - The average person breaths 100psi. Per minute.
 - “Walk, don’t run”
 - Energy Management
 - Breathe through nose not mouth
 - At 12% Oxygen, rescuers could become unconscious

Four hazardous atmospheres for which respiratory protection is needed

- Oxygen Deficient Atmosphere
- Elevated Temperatures
- Smoke Atmospheres
- Toxic Atmospheres

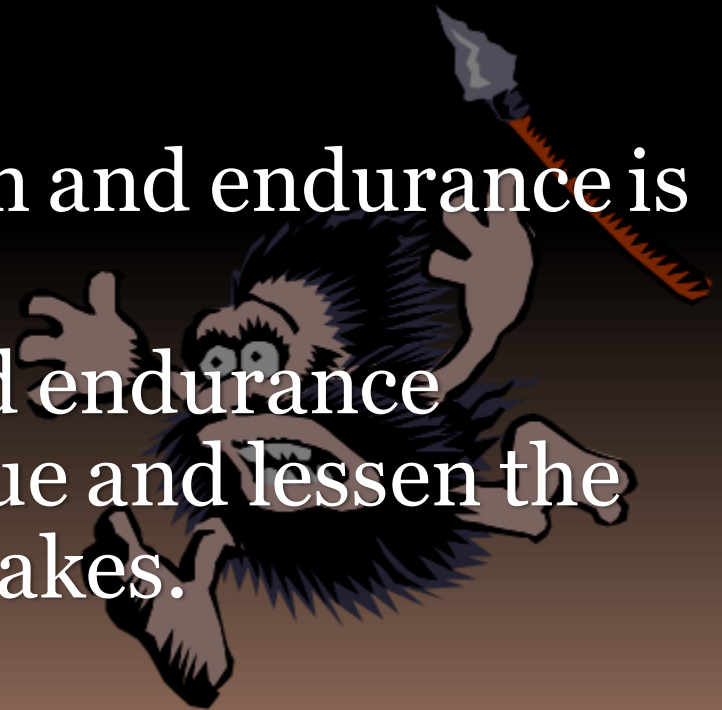
Physical Requirements of the Rescuer

- Body's reaction to wearing an SCBA.
 - Overexertion results in increased respiratory rate
 - Hyperthermia
 - Blood Pressure
- Mental fitness while wearing SCBA
 - Claustrophobia
 - Breathing Control
 - Panic



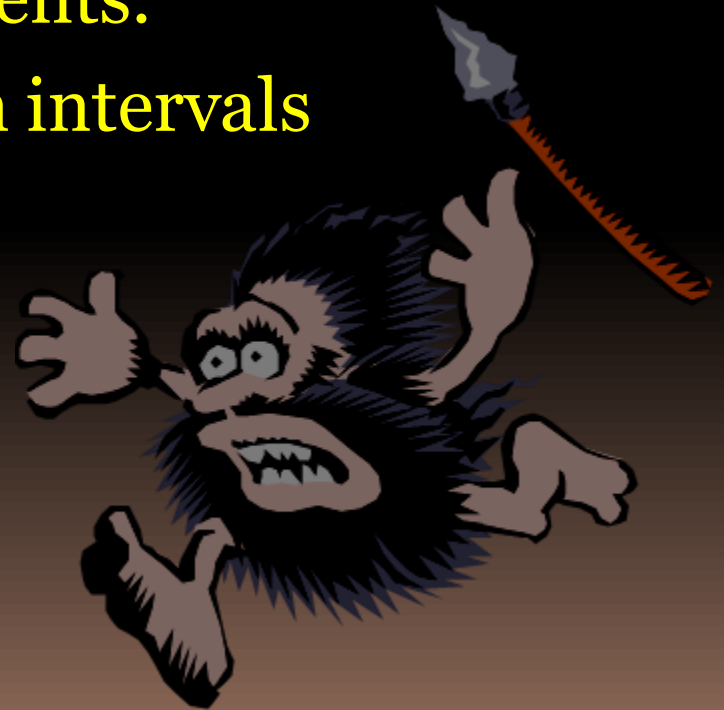
Physical Requirements of the Rescuer

- Physical requirements and limitations of SCBA usage include:
 - physical stress
 - medical considerations
 - mental stamina.
- Above average strength and endurance is required.
- How does strength and endurance minimize mental fatigue and lessen the chance of making mistakes.



Physical Requirements of the Rescuer

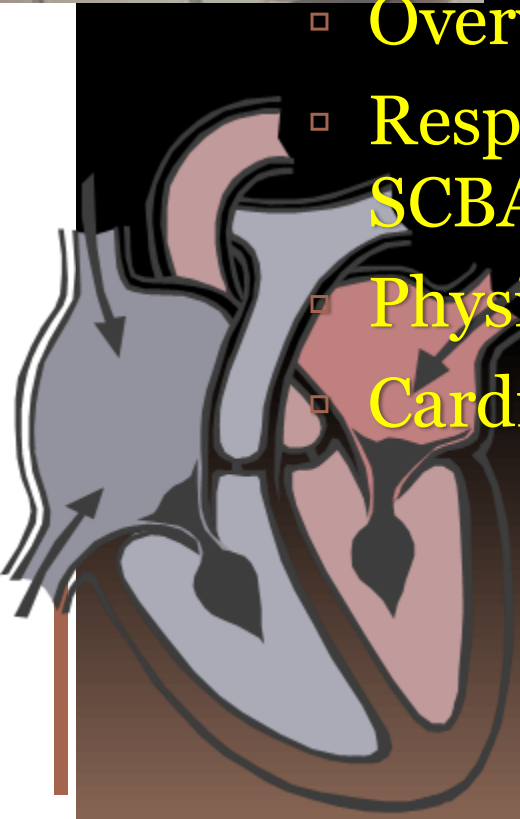
- Limitations of SCBA in various rescue environments.
 - Large profile not suitable for some Confined Space Rescue environments.
 - 30 minute air limitation intervals



Physical Fitness Considerations

- Risks to the user include:

- Smoking
- Overweight
- Respiratory problems should avoid use of SCBA
- Physical handicaps
- Cardiovascular systems



- ❖ Respiratory protection devices will depend on the atmospheric conditions of the environment the rescuer(s) are working.
 - To filter dust and non-toxic particulates in an open clean atmosphere (19.5-23.5 % oxygen), a **simple dust mask** may be adequate but will not filter out toxins.
- ❖ Self-contained breathing apparatus (SCBA) or supplied air respirators (SAR) must be available for use during technical rescue operations.

SCBA AIR-SUPPLY LIMITATIONS

4B-3

Hard Labor
Approximately 20 Minutes



Mild Labor
Approximately 30 Minutes



Duration of air supply is affected by:

- Physical condition of user,
- Degree of physical exertion,
- Emotional stability of user,
- Condition of apparatus,
- Cylinder pressure before use, and
- Training and experience of user.

Limitations of the SCBA

- Weight
- Size
- Ease of Donning and Doffing
- Construction of harness
- Facepiece comfort
- Buddy Breathing system
- Compatibility with refilling systems
- Low Pressure
 - 2500psi
- High pressure
 - 4500 psi

Physical Requirements of the Rescuer

- **Panic Behavior**
 - **Increased Respiratory rate**
 - Hearing another person breathing may cause the wearing to increase their breathing rate.
 - **Confusion & Disorientation**
 - **Why do people Panic?**
 - Sense of impending doom
 - All exits cut-off
 - Lack of Information
 - Anxiety



SCBA Systems

- ❖ Closed circuit systems
 - Oxygen cylinder re-breathing unit
 - Self generating type
- ❖ Open circuit systems
 - Pressure demand type
 - Positive-pressure type – (what we use)

Closed circuit devices

- Self-generating type – uses the principle of re-breathing but has no mechanical operating components.
- Has chemical canister that evolves oxygen and removes the exhaled carbon dioxide.



Closed circuit devices

- Air is re-breathed after the exhaled carbon dioxide has been removed and the O₂ content is restored.
- Oxygen cylinder re-breathing unit consists of the following components
 - Relatively small cylinder of compressed oxygen
 - Reducing and regulating valve
 - A breathing bag
 - Facepiece or mouthpiece plus nose clip.
 - A chemical container to remove carbon dioxide from the exhaled air.



Open circuit devices

- Air supply from 5 to 60 minutes.
- Pressure demand:
 - does not provide a positive pressure atmosphere inside the face piece during inhalation.
- Positive pressure :
 - provides a positive pressure during inhalation and exhalation



COMPONENTS OF HIGH PRESSURE POSITIVE PRESSURE SCBA'S

Sizes Of Air Cylinders

- 30 minute - 2216 psi.
- 30 minute - 4500 psi.
- 30 minute- 5500 psi.
- 45 minute - 3000 psi.
- 45 minute - 4500 psi.
- 60 minute - 4500 psi.
- 45 minute- 5500 psi.

SCOTT AIR-PAK

- Model AP-50
- Designation 4.5
- Operating Pressure 4500 psi
- Cylinder
Aluminum / Carbon Fiber
- Duration 30 minutes
- Weight 24.5 Lbs.



User - Limitations for respirators

- Facial hair interferes with the face-piece-to-face seal and should not be permitted.
- According to OSHA General Industry Standard, “Wearing of contact lenses in contaminated atmospheres with a respirator shall not be allowed”.
- Physiological limitations – normal functions of the body, need to be in shape.
- Psychological limitations – thoughts, behavior and mental processes.

Facial Hair & SCBA's

- In NIOSH'S words:
 - *“Facial hair that lies along the sealing area of a respirator, such as beards, sideburns, or mustaches will interfere with respirators & nose cups that rely on a tight facepiece fit to achieve maximum protection. The areas of the skin, which contact the face or neck seal and nose cup seal, must be free of any hair.”*

Mask/Regulator



Console



Shoulder strap



EBSS hose



Regulator holder



PASS device



Waist strap

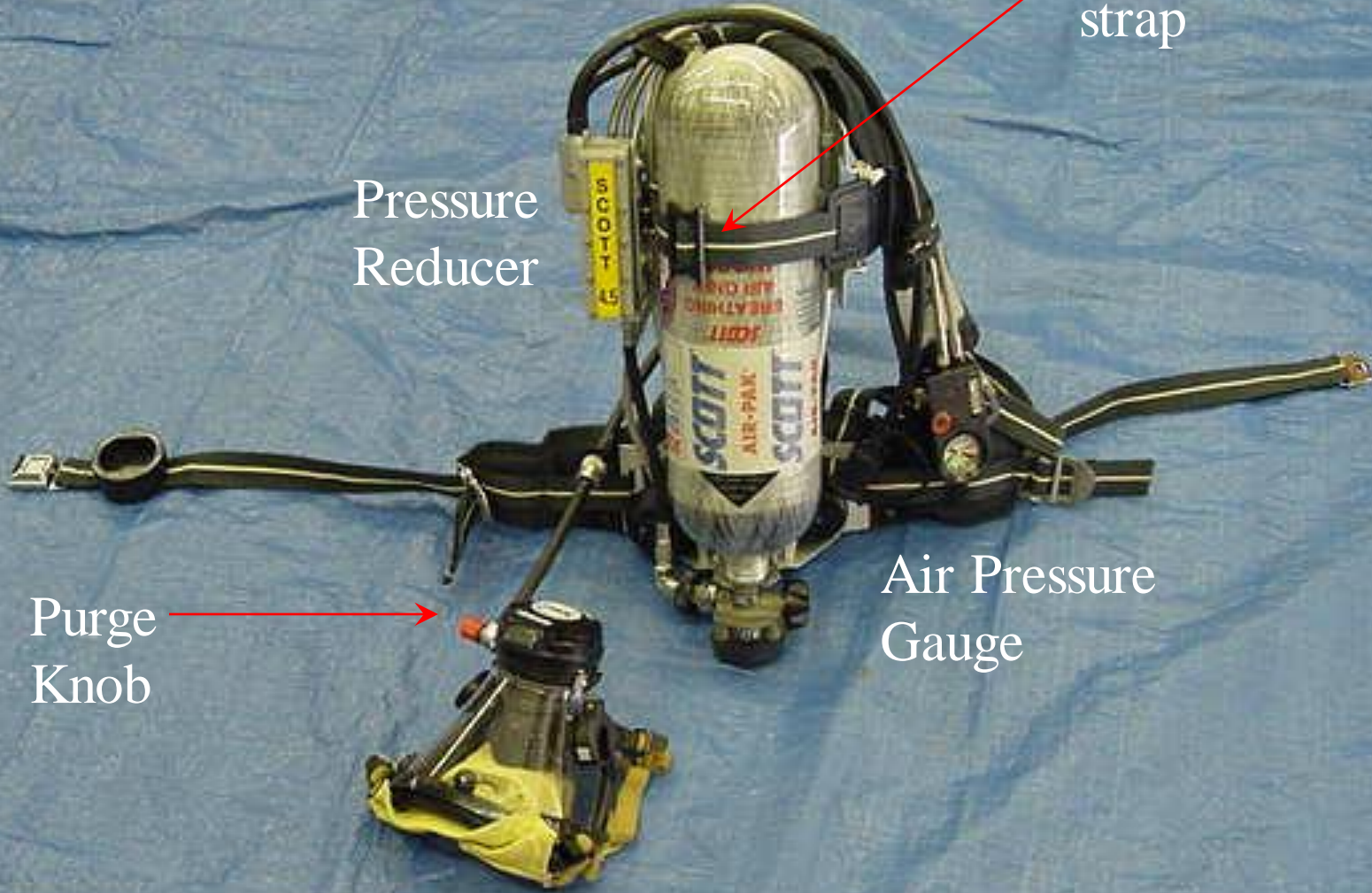


Cylinder retention strap

Pressure Reducer

Purge Knob

Air Pressure Gauge



Features of an SCBA backpack assembly.

- Designed to hold the air cylinder on the rescuer's back.
- Adjustable shoulder straps
- Waist strap helps distribute the weight of the cylinder to the hips.
- Removal or non-use of the waist strap voids the NIOSH and the MSHA certification.
- Swapping manufacturer parts voids the above certifications.
- Weights vary according to Mfg. and ensemble.

NIOSH- National Institute for Occupational Safety & Health

MSHA- Mine Safety & Health Administration

2 Low pressure hoses

Bell alarm

Back frame

CFD Patch

Label

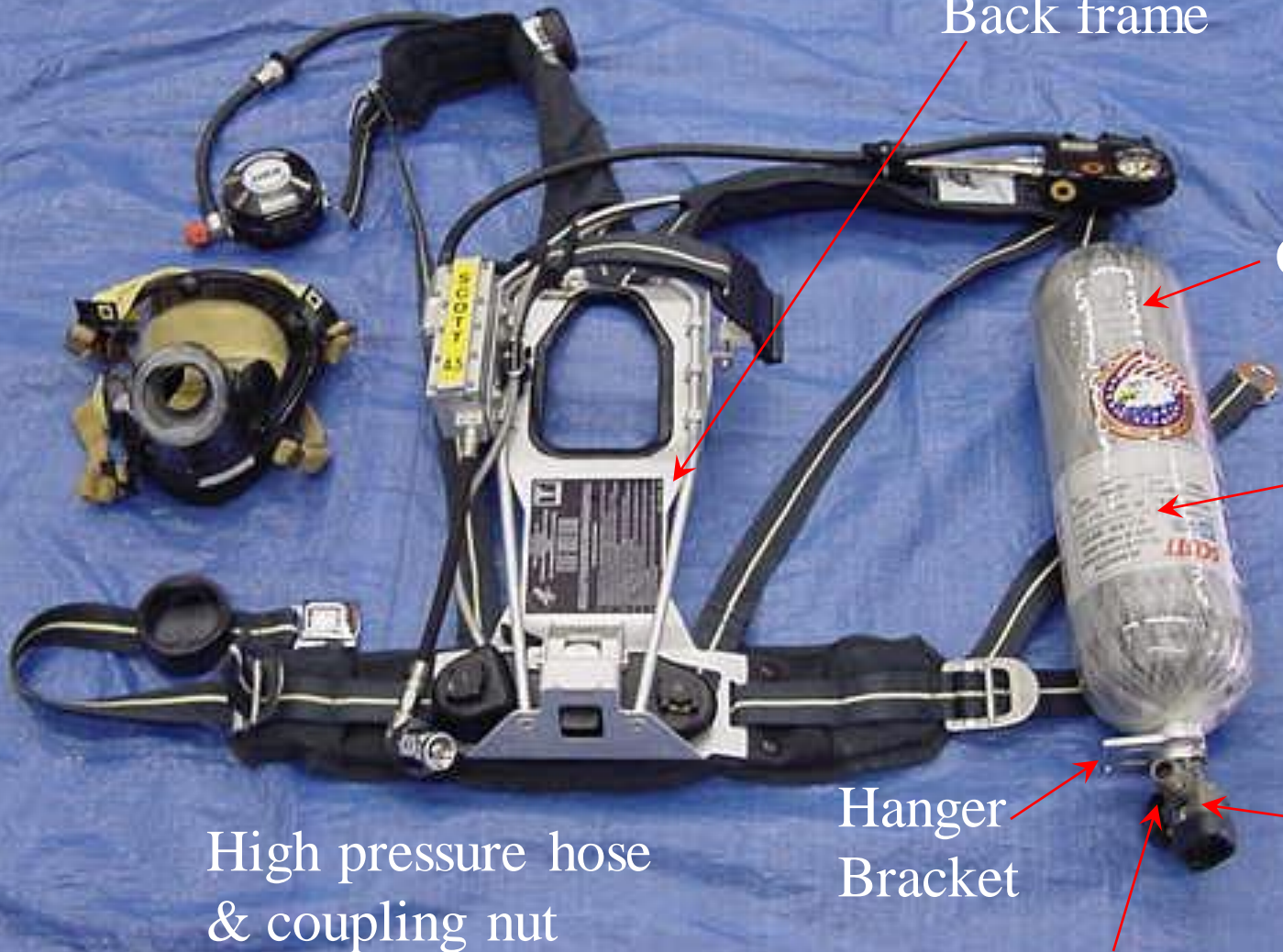
Cylinder

Hanger
Bracket

Cylinder
Valve

High pressure hose
& coupling nut

Handwheel



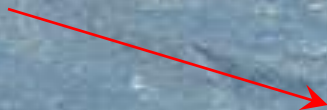
Features Of The Regulator Assembly

- Air from cylinder passes through the high-pressure hose to the regulator.
- The regulator reduces the pressure of cylinder air to slightly above atmospheric pressure and controls the airflow to meet the wearer's requirements.
- Some regulators are mounted to the face piece.
- Two control valves;
 - Mainline valve
 - By-pass valve.
- During normal operations;
 - Mainline valve should be open
 - By-pass valve closed.

Features Of The Regulator Assembly

- The by-pass valve should be opened when there is a malfunction of the mainline valve or the rescuer feels the need for a little extra flow.
- Remote pressure gauge;
 - Located on the harness straps.
 - The gauge reading should read within 100 psi of the cylinder gauge reading. When in doubt, use the lower reading to determine your actions.
 - A low-pressure alarm will activate when the cylinder pressure reaches approximately one-fourth of the cylinder's maximum rated pressure.

Relief valve



Manifold

Pressure Reducer



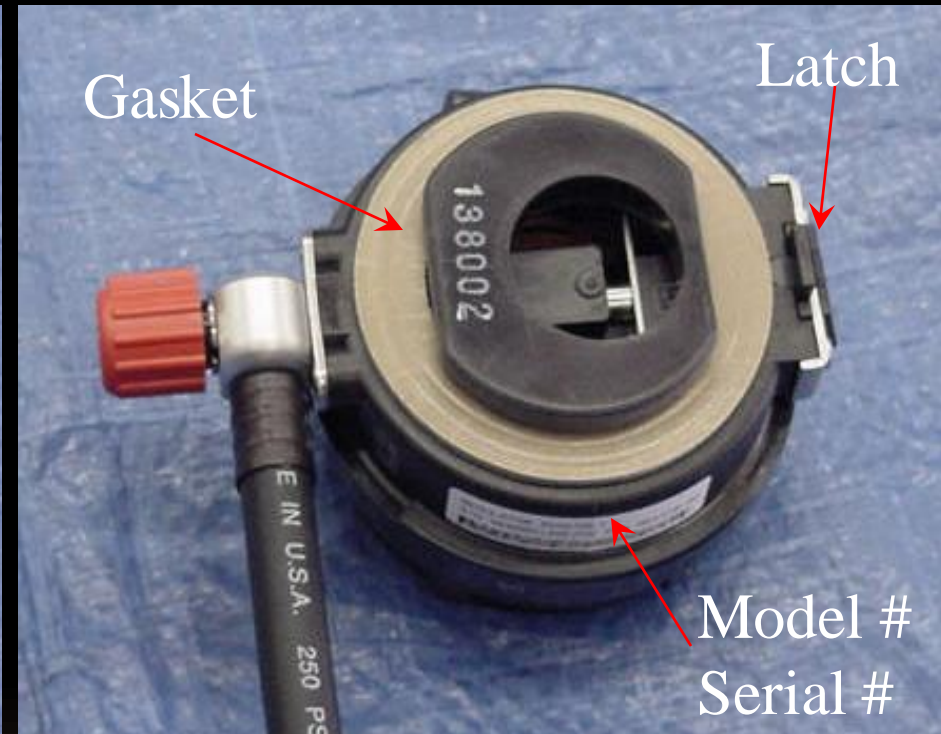
Cylinder retention strap



Tri-slide buckle



EZ-Flow Mask Mounted Regulator





LED window

PASS
reset / off

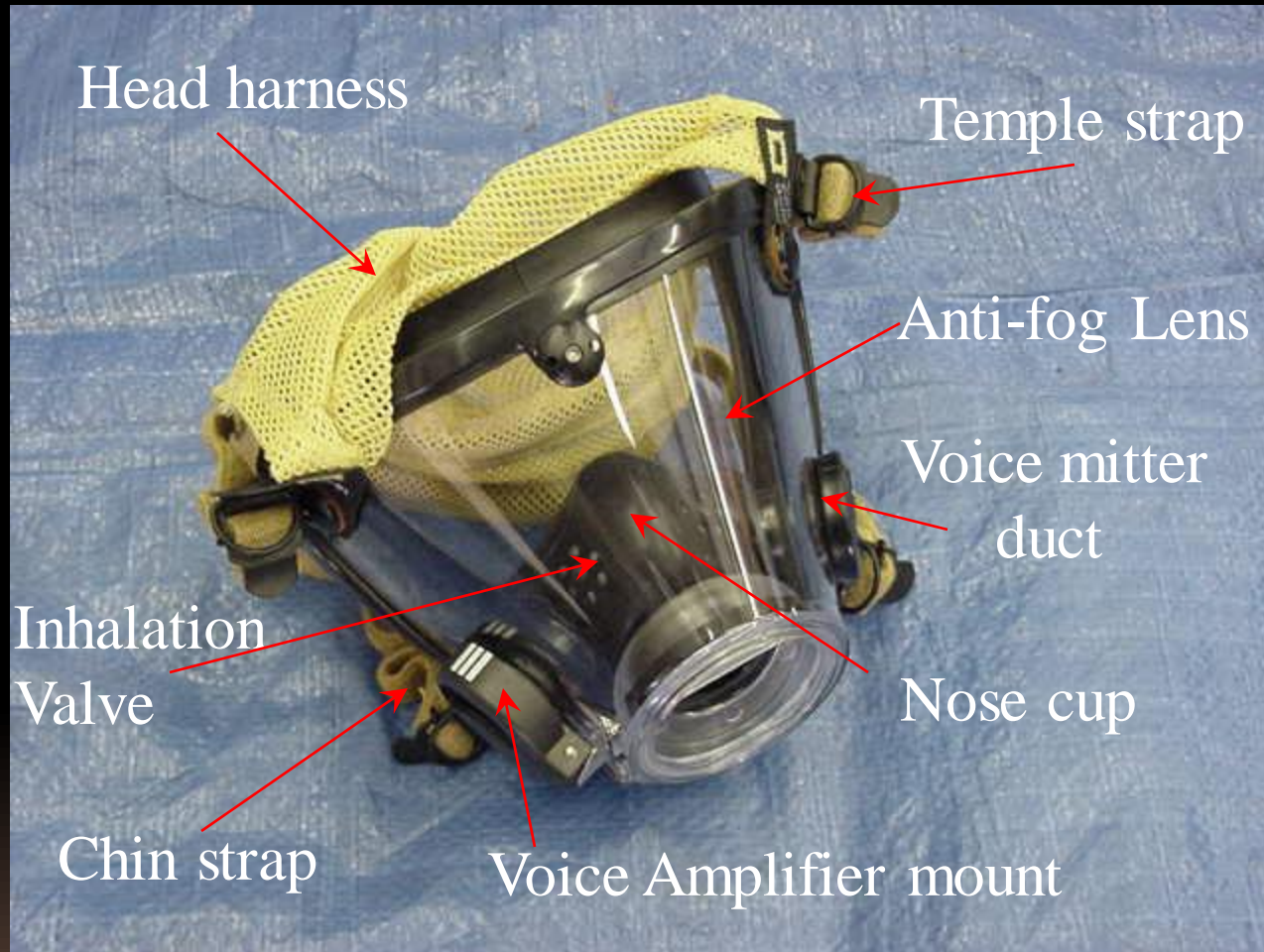
Manual
alert

Air pressure gauge

Facepiece

- The face piece holds in cool breathing air.
- It affords some protection against facial and respiratory burns.
- The exhalation valve is a one-way valve.
- Fogging of the mask can be reduced by using a nose cup, and the application of an antifogging solution.

AV-2000 Mask



Each member will be issued his/her own individual mask with voice amplifier mount - \$160



Voice Amplifier









1

2

3

4

SAFETY







1

2

4

PRELIMINARY
SCOTT
RESPIRATOR

SCOTT

SCOTT





Depress button to manually place PASS in full alert



Depress button twice to reset Pre-Alert condition.
After turning off air and opening purge knob, depress twice to turn PASS
off.





Push up on white thumb release; pull latch away from frame



Depress thumb release latch; slide cylinder towards top of harness



SAR & SABA Units



SAR backpack assembly

- A breathing apparatus consisting of a harness, harness mounted regulator, and a small escape cylinder of compressed air.
- Streamlined with a lightweight Low-Profile design.
- Designed for entry into or escape from confined spaces or hazardous atmospheres.
- Both 5 and 10 minute air configurations are available.
- Most also have options for communication systems.

Limitations for SAR's

- Air line hose must not exceed 300 ft (some are only rated up to 100 ft)
- Supplied air respirators should only be used in conjunction with a five minute (8 cu. Ft.) escape bottle.
 - Escape bottle should only be used in the event of a failure if the primary air supply to escape from atmospheres dangerous to life or health.
- The wearer should not enter areas requiring durations greater than 5 minutes for escape.

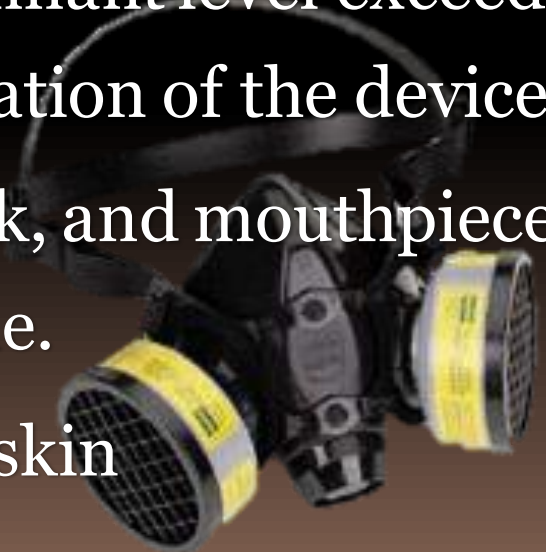
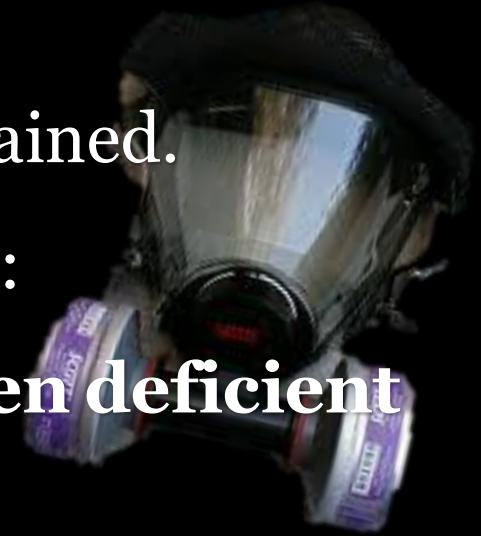
Air purifying respirators (APR)

- Protect against dust, mists, fumes, gases, and vapors.
- Mechanical filter respirators.
- Chemical cartridge respirators
- Combination of chemical cartridge and mechanical filter respirators.
- Gas masks.



APR's

- Small, inexpensive, and easily maintained.
- Limitations of respiratory protection:
 - **APR's cannot be used in Oxygen deficient atmospheres.**
 - Cannot be used when air contaminant level exceeds the specified concentration limitation of the device.
 - Seals on quarter-mask, half-mask, and mouthpiece respirators are not always reliable.
 - APR's do not protect the eyes or skin



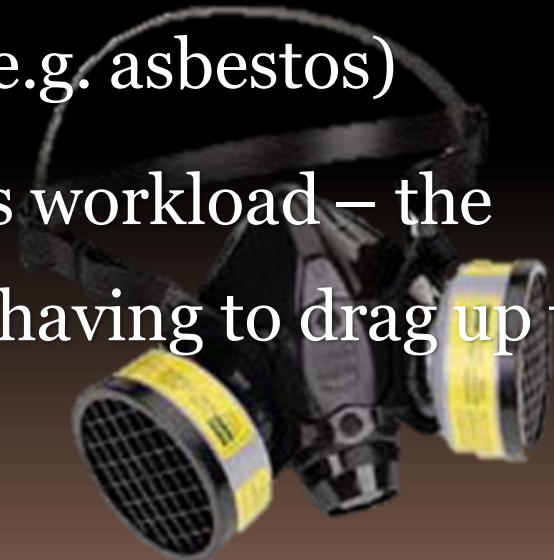
User - Limitations for respirators

- Emphysema
- COPD
- Bronchial asthma
- Evidence of reduced pulmonary function
- Coronary artery disease.
- Sever or progressive hypertension
- Epilepsy
- Diabetes
- Claustrophobic or anxiety when wearing a respirator.
- Abnormal EKG results from resting, or stress test.



User - Limitations for respirators

- Punctured or ruptured eardrum
- Dyspnea when wearing respirator
- X-ray evidence of pneumoconiosis (disease caused by inhalation of metallic dusts, e.g. asbestos)
- Significant increase of the user's workload – the bulk and weight of an SCBA, or having to drag up to 300 ft of hose with a SAR.



WATER RESCUE PPE

PERSONAL PROTECTIVE EQUIPMENT



Protective Equipment



- **Head Protection**
- **Flotation Considerations**
- **Thermal Protection**
- **Foot & Hand Protection**
- **Throw Bags & Other Stuff**

Use of turnout gear

- **DO NOT USE !!!!**
- “You don’t wear your drysuits to your fire so don’t wear your turnouts to your water rescues!”
- No Flotation
- Becomes weighted down
- Prohibits ability to swim
- Larger surface area of fire helmets



PPE

- NO Turnouts!!
Layered clothing.
- Vented lightweight helmet with interior padding.
- Wet Suit.
- Dry Suit.
- Waterproofed boots or river boots
- Throw Bag, Ring Buoy, Cans or Life Rings.
- Boogie Board, Surf Board or Kick Board
- Wool or polypropylene socks.

Head Protection

- Helmets must have holes for draining water.
- Multi-point chinstraps
- Adjustable ratchet
- Capable of mounting headlamp
- Different colors for training levels
- No Fire Helmets!!!



Thermal Protection

■ Wetsuits

- Neoprene
- Thicker neoprene ... warmer
 - 5mm+ is optimal
- Less expensive
- Difficult to don / doff
- Poor for wind protection
- Poor for haz-mat protection
- Good for impact protection



Thermal Protection

- Drysuits:
 - More Expensive
 - Requires under garment thermal protection
 - Poly Propylene
 - Thin neoprene
 - Adequate for haz mat protection
 - Material breathability



Hand Protection

- Neoprene 3mm+
- Leather palm
- Kevlar
- Suitable for rope work and paddling
- Suitable for swimming
- Tight fit for warmth



Foot Protection

- Neoprene Work boots
- Neoprene Socks
- Wool Socks
- Old Tennis Shoes
- River Shoes w. laces
- Covered toes sandals



Personal Flotation Devices (PFD)

- Fit is essential
- USCG approved type III, type V
- Blow-out strap operation one locking d-ring to strap
- Cinch strap on bottom
- Minimum 22-25 lbs. of flotation



PFDs

- Minimum Floatation 15.5 lbs.
 - **Type I: Off-Shore use**
 - Most buoyant of all types. Designed for
 - Rough water, remote areas, and/or extended
 - Periods of time when rescue may be delayed.
 - Designed to help roll an unconscious victim to a
 - Face-up position.
 - Extended rescue
 - Rolls victims to face-up position
 - **Type II:**
 - For **recreational use.**
 - Designed for inland water,
 - Good flotation capability where quick rescues are imminent.
 - May roll an unconscious victim to a face-up position.



PFDs

- **Type III:**
- Calm inland waters
- Conscious victims
- Most comfortable to work in
- Will not automatically roll an unconscious victim to a faceup position..



PFDs

- Type IV:

- Throwable devices
Cans, ring buoys, Disk, cushions.



- Type V:

- Rescue PFD's with quick release straps
- "Mustang suits" Gumby Suits
- Cold Water Survival Suits.



PFDs

- All rescuers working within 15' of the shoreline should be wearing a rescue helmet and appropriate PFD.
- PFD'S will keep a person from sinking but not necessarily from drowning.
- PFD'S of any kind must have a United States Coast Guard rating tag of approval before they are acceptable for rescue work.



PPE

- Type III or V PFD's w/reflective material
- Quick Release type belts and rings are recommended for swimmer belayed type operations.
- Flashlight (Chem-stick, strobe).
- Whistle (waterproof).
- Sheathed Knife (secured to PFD).
- Carabiners (2, non-locking).
- 5mm. X 4 feet long prussic cords (2).

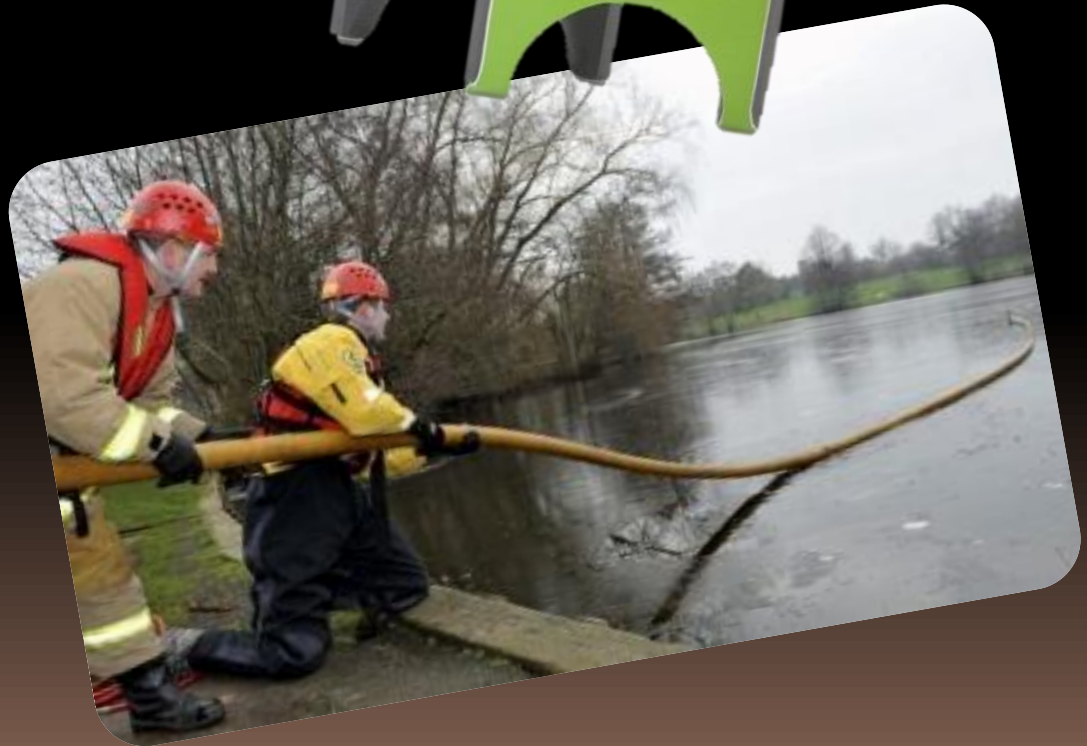
- Besides wearing a PFD on the water, all rescuers working within 15' of the shoreline should be wearing a rescue helmet and appropriate PFD.
- PFDs will keep a person from sinking but not necessarily from drowning.
- PFD's of any kind must have a United States Coast Guard rating tag of approval before they are acceptable for rescue work.
- Follow manufacturer's recommended guidelines for use, inspection and maintenance.
- Improper maintenance and cleaning can lead to rapid deterioration of the PFD

Other Stuff



Other Rescue Aids

- Inflated Fire Hose
- Rescue Board “Boogie Board”
- Pike Poles.
- Ladders.
- Brooms.



High Visibility Vests


- November 24, 2008, a new federal regulation (23 CFR 634) went into effect mandating that anyone working in the right-of-way of a federal-aid highway must be wearing high-visibility clothing that meets the requirements of ANSI / ISEA 107; Class 2 or 3
- Applies to all emergency responders.
- "All workers within the right-of-way of a Federal-aid highway who are exposed either to traffic (vehicles using the highway for purposes of travel) or to construction equipment within the work area shall wear high-visibility safety apparel."



High Visibility Vests

- "High-Visibility Safety Apparel" is defined to mean personal protective safety clothing that is intended to provide conspicuity during both daytime and nighttime usage, and that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107-2004



- 
- when conducting a risk analysis of any rope rescue incident, the importance of specialized PPE must be stressed. Rescuer safety is essential and rescuer comfort is a must.

Rescue Helmets

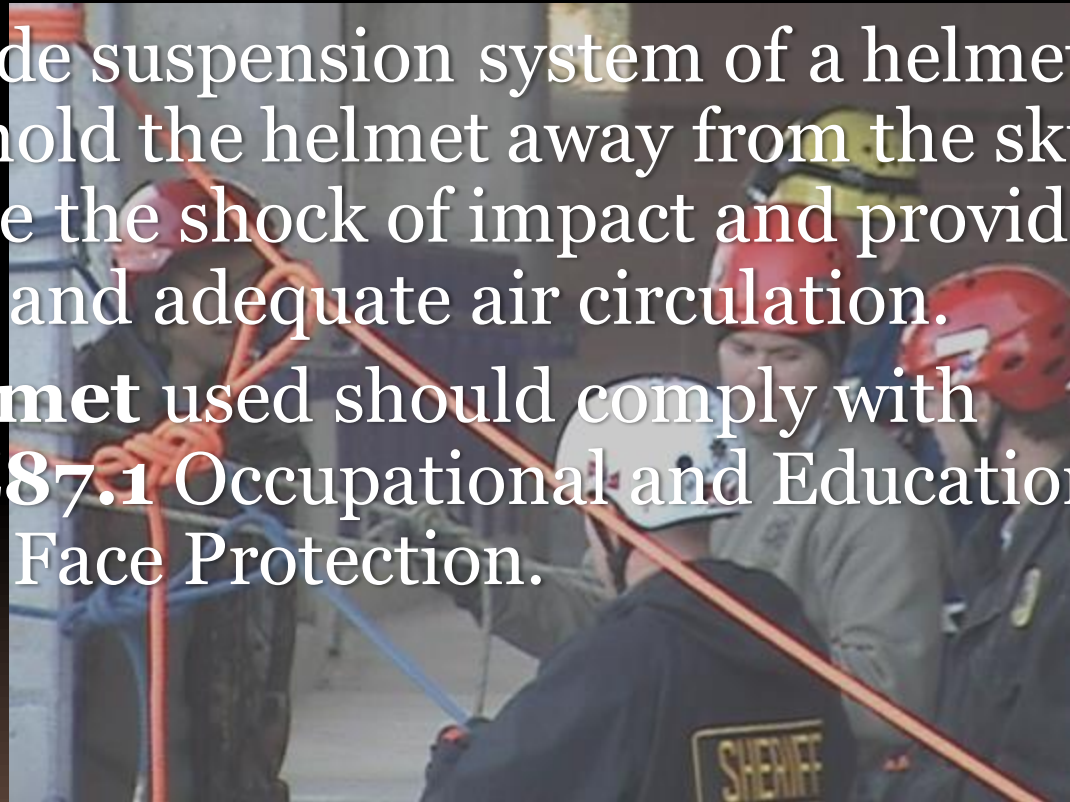
- Fire helmets, construction helmets, motorcycle helmets, and helmets used for sport activities are NOT suitable for most rescue activities.
- Rescue helmets should have a three-point suspension type chin strap. A single chinstrap is inadequate!
- Polycarbonate helmet with damage to the shell must be removed from service.
- The shell should be constructed of material that will resist impacts and penetration by sharp objects.
ie. Kevlar or fiberglass composites.



- NFPA 1951 for the use of helmets in a rope rescue environment.
 - Helmets worn in high angle rescue should be designed to withstand the rigors of the environment.
 - A narrow brim and a non-stretch chin strap are essential.
 - The chin strap should have three non-stretch suspension points, one on each side of the helmet, and one in the rear.
 - Materials used for rescue helmets include plastic, Fiberglass and Kevlar composites.
 - The shell should be rigid enough to withstand impact and penetration by sharp objects.
 - The inside suspension should keep the shell from touching the skull.

Rescue Helmets

- The helmet should protect the head from falling objects and side impacts.
- The inside suspension system of a helmet should hold the helmet away from the skull to reduce the shock of impact and provide comfort and adequate air circulation.
- The **helmet** used should comply with **ANSI Z87.1 Occupational and Educational Eye and Face Protection**.



Maintenance

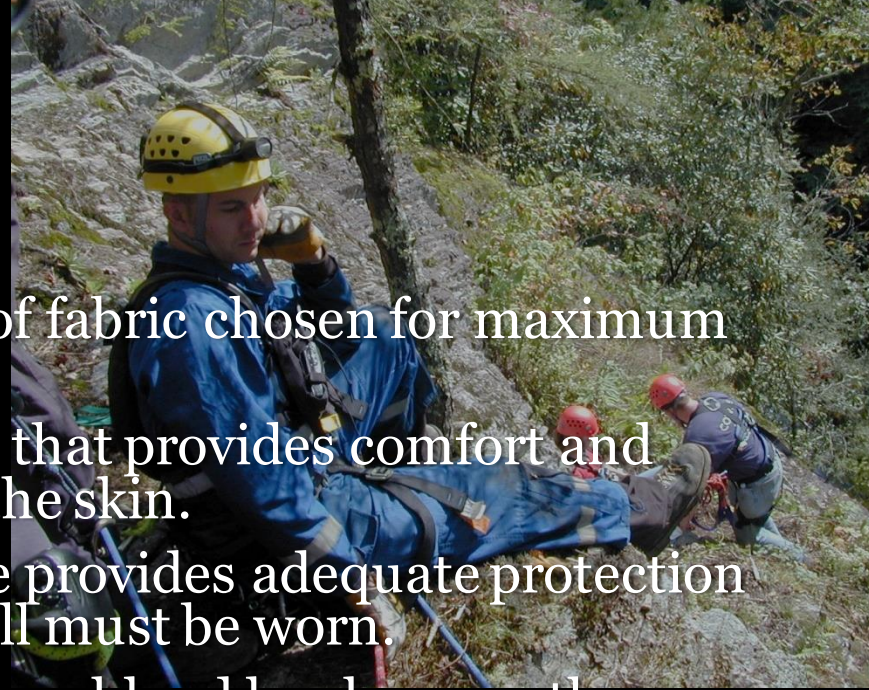
- Keep helmet clean.
- Remove chemicals, oils, and petroleum products as soon as possible, these agents can soften the shell material and reduce impact effectiveness.
- Repair and or replace damaged helmets or helmet components.
- Inspect suspension systems such as headbands, chinstraps, integrated face shields / safety glasses frequently for deterioration.
- Remove from service polycarbonate helmets that have come into contact with hydraulic oils.
- Hydraulic oils will weaken the helmet.

Outerwear

- Outerwear must fit snugly in order to reduce the likelihood of entanglement in the rope system, but must be loose enough to allow for optimum body movement.
- Must be tough enough to resist tearing and abrasion damage.
- Having a waterproof outer shell that has wicking capabilities is critical for protecting the rescuers from perspiration, wind and rain.
- A criterion for selecting the appropriate waterproof material is if you can stand under a shower for 1/2 hour without getting soaked through.
- An insulating layer of clothing should be worn under the waterproof shell.
- Cotton is the least desirable fabric in wet and cold environments.
- Wool is the traditional choice of fabric chosen for maximum warmth.

Outerwear

- Wool is the traditional choice of fabric chosen for maximum warmth.
- Polyester pile is another fabric that provides comfort and warmth when in contact with the skin.
- Neither wool nor polyester pile provides adequate protection from the wind, so an outer shell must be worn.
- Polypropylene or a polypropylene blend has become the material of choice for underwear when participating in outdoor activities.
- Underwear made of flammable material may not be suited for personnel working in helicopters or other environments subject to flash fires.
- Emphasize the fact that structural firefighting gear is seldom appropriate for rope rescue operations.
- Structural firefighting PPE would only be used when the operation would place rescuers in close proximity to fire or potential fire and in extremely cold or wet environments.



Clothing

- Clothing should be sized so as not to bind when arms are extended above the head or when legs are raised. Avoid binding at the wrists and ankles.
- Cotton is the least desirable material for wet and cold environments.
- Gore-tex is not a fire retardant material. It allows for the breathability of the clothing.

Clothing

- Layer clothing for various environmental conditions.
 - The first layer is underwear.
 - The second layer is for insulation.
 - The third layer is the outer shell

Station Uniforms & Maintenance

- NFPA 1581 Standard on Fire Department Infection Control Program requires that personal protective clothing be cleaned and dried, minimally, every six months in accordance with manufacturer's guidelines.
- OSHA 1910.130
- NFPA 1975 identifies station work uniforms to include trousers, shirts, jackets, and coveralls.
- Underwear is not included.



Station Uniforms & Maintenance

- They should be fire resistant.
- Components of the garments should not ignite, melt, drip, or separate when exposed to a temperature of 500 degrees for a period not to exceed five minutes.
- Wildland PPE used by many rescue departments, depending on design, may be worn over station uniforms or directly over undergarments

Footwear

- Should provide adequate support to the ankle
- Protect the feet from impact loads, bruises, scrapes, and cuts.
 - Boots usually fill this requirement well.
 - The soles of the boot should have a good adhesion surface.
 - Socks should provide the ability to wick moisture away from the feet to keep the feet dry and warm, and decreases the formation of blisters.



Footwear

- Criteria include comfort, protection and adhesion.
- Leather composition affords the best qualities needed for a rescue boot.
- Boots should provide support to the ankles and protect the feet from penetrating injuries.
- The boot sole should have a reasonable amount of adhesive quality.
- A good choice of socks is important for warmth, comfort and prevention of blisters.
- A two-sock combination consisting of a lightweight inner polypropylene sock that reduces friction on the skin, and a thick wool outer sock that increases warmth, and provides good comfort.

Gloves



- Comfortable
- Protection from body fluids. (Moisture Barrier)
- Protect from abrasions, cuts, and ease of use for rope handling activities.
- Should allow a sense of feeling so the fingers can manipulate equipment.
- Leather work gloves provide good flexible hand protection and are relatively inexpensive.
 - Fire service gloves are often bulky and not the best choice.
 - Gloves for Extrication, rope work, and firefighting never mix.

Gloves

- Criteria include comfort, protection and adhesion.
- Leather composition affords the best qualities needed for a glove.
- Deerskin or goatskin offers the best protection.
- Gloves should shield the hand and prevent discomfort.
- Commercial gloves with reinforced palms are available for purchase.

Eye Protection:



- Should prevent dust and flying debris from entering the eyes.
 - The eyewear should be OSHA approved close fitting goggles or safety glasses.
 - No face shields!!

ROPE RESCUE PPE

Characteristics Of The Escape Belt

- Intended use is to provide emergency escape capability to a firefighter from an immediate life-threatening emergency above the ground floor of a structure.
- Escape belts do not have leg loops to prevent the belt from rising up the torso of the user.
- The firefighter using an escape belt should always be able to maintain foot contact with the surface of the structure during descent or use a life safety harness.

Class II Rescue Harness.

- Life safety harness shall be designed and designated in accordance with the requirements for either Class II or Class III.
- A harness that fastens around the waist and around thighs or under buttocks and is designed for rescue with a design load of 2.67 kN (600 lbf) shall be designated as a Class II life safety harness.
- Class II life safety harness shall be permitted to consist of one or more parts.
- It is designed for rescue operations.
- Has a minimum breaking strength of design load is 600 lbf.
- The harness fastens around the waist and thighs, or under the buttocks.

Class III Rescue Harness

- A harness that fastens around the waist, around thighs, or under buttocks, **and over shoulders** and is designed for rescue with a design load of 2.67 kN (600 lbf) shall be designated as Class III life safety harness.
- Class III life safety harness shall be permitted to consist of one or more parts.
- It is designed for fall protection and rescue operations where the potential for inversion may occur.
- It has a minimum design load is 600 lbf.
- It fastens around the waist and thighs or under the buttocks and over the shoulders.

Improvised Harnesses

- Minimum guidelines for webbing to be used as improvised rescue harnesses for humans.
- Must be 1 3/4" wide for any improvised harnesses. Swiss seats, Rescue knots

Safety Check's and Harnesses

- Check Class II and III rescue harness straps and buckles.
- Check for frayed stitching and damaged metal.
- Rust
- Bent Buckles or Cracks
- Follow the manufacturer's guidelines for use, inspection, and maintenance.

Harness Suspension Pathology

- Serious problems can occur when rescuers suspend motionless for a long period of time.
- The compression created by the straps reduces the venous flow to the legs.
- This reduction in flow also affects the right side of the heart that causes reduction in overall cardiac output.
- This pathology can result in unconsciousness or death.
- A potential medical consequence of harness suspension is **crush syndrome** that can lead to **renal failure** and other life threatening conditions.

Inspecting, Service, Maintenance

- Importance of proper maintenance of all types of PPE.
- Importance of developing proper SOGs for maintaining PPE.
- Importance of proper record keeping of all types of PPE.

Care And Maintenance Of Helmets.

- Keep helmet clean.
- Remove chemicals, oils and petroleum products as soon as possible.
 - **These agents can soften the shell material and reduce impact effectiveness.**
- Repair and or replace damaged helmets or helmet components.
- Inspect suspension systems such as headbands, chinstraps, and integrated faceshields/safety glasses frequently for deterioration.
- Denote the absence of any of the components and taking necessary action to remedy the problem.
- Remove from service polycarbonate helmets that have come into contact with hydraulic oils. Some hydraulic oils will weaken the helmet. Refer to helmet manufacturer's guidelines.

Maintenance Of Personal Protective Clothing Including Gloves And Boots.

- The shell of turn-out gear should be cleaned regularly according to manufacturer's guidelines. See clothing label for cleaning instructions.
- Dirty shells absorb more heat.
- NFPA 1500 requires that protective clothing be cleaned by a cleaning service or cleaned in house provided the facilities are equipped to process contaminated clothing.
- Gloves and boots should be cleaned and maintained according to manufacturer's guidelines.
- NFPA 1581 Standard on Fire Department Infection Control Program requires that personal protective clothing be cleaned and dried, minimally, every six months in accordance with manufacturer's guidelines.
- NFPA 1975 identifies station work uniforms to include trousers, shirts, jackets, and coveralls. Underwear is not included.

Guidelines For Station Work Uniforms Established By NFPA

- They should be fire resistant.
- Components of the garments should not ignite, melt, drip, or separate when exposed to a temperature of 500 degrees for a period not to exceed five minutes.
- Wildland PPE used by many rescue departments, depending on design, may be worn over station uniforms or directly over undergarments.
- OSHA CFR-1910.1030 regulations on the cleaning of Personal Protective Equipment.

MAINTENANCE & INSPECTIONS OF SCBA'S



Care And Maintenance Procedures For SCBA's

- NFPA 1404 and NFPA 1500 require all SCBAs to be inspected after each use, weekly, monthly, and annually.
- A weekly inspection includes cylinder full, all gauges work, low pressure alarm is operational, all hoses are tight and free of leaks, facepiece is clean and functioning properly, harness system is in good condition, all valves are operational, and PASS device is functional.
- SCBA should be cleaned and sanitized after each use.

Care And Maintenance Procedures For SCBA's

- Facepieces should be washed with warm soapy water, sanitized, and lens dried with a lint free cloth or air-dried.
- Monthly inspections include checking all components for deterioration, check for leaks around valves and air cylinder connections, check operation of gauges, valves, regulator, exhalation valve, and low air alarm.
- Annual inspection and repairs should be made by a factory certified technician and in accordance with manufacturer guidelines

Care And Maintenance Procedures For SCBA's

- Air cylinders are stamped with the date of manufacture and the last hydrostatic test date.
- Steel and aluminum cylinders must be tested every five years.
- Composite bottles are tested to the standard in which they were purchased. Could be 3 or 5 years depending on the standard.
- Note that hydrostatic testing must be performed in compliance with the U.S. Department of Transportation guidelines.

OSHA CFR-1910.1030

- Regulations on the cleaning of Personal Protective Equipment
- Applies to all occupational exposure to blood or other potentially infectious materials

Inspection

- Inspect all components
 - Daily
 - Weekly
 - Monthly
 - Yearly



SCBA Weekly Maintenance

- Guidelines for inspections and after each use.
 - Make sure the cylinder is full.
 - Compare all gauges are accurate and in operating order.
 - Low-pressure alarm is working.
 - No leaks in the hoses and all connections are tight.
 - The face piece is clean and functional. No cracks. Do not use paper products to clean face piece as it may scratch the lens.
 - The harness system is in good working order.
 - All valves are operational.
 - Check for proper function of PASS device.
 - Hydrostatic test date?

Inspection

- Inspect:
 - Cylinder
 - Cylinder pressure
 - Should be within 100 psi of the regulator pressure
 - Hydrostatic test date
 - Fiberglass
 - Excessive wear
 - Scrapes
 - Hydrostatic testing must be performed in compliance with the U.S. Department of Transportation guidelines.

Inspection

- **Inspect:**

- **Harness:**

- Loose screws, nuts, washers

- **Straps**

- Burns

- Fraying

- Snugness

- Components cleanliness

Inspection

- Inspect:
 - **Regulators**
 - Operations
 - Bypass valve operations
 - Cleanliness
 - Spring Condition
 - Low air alarms

Inspection

- Inspect:
 - Facepiece
 - Fit
 - Straps
 - Lens
 - Cleanliness
 - Operations

Inspection

- Inspect:
 - PASS device (personal alert safety system)
 - Activation time
 - Manual activation
 - Automatic activation
 - Noise level
 - Battery level

Emergency Operations

- Low air alarm
 - Sounds at 1000 psi on high psi
(1/3 capacity on 5500 psi)
(1/4 capacity on 4500 psi)
 - 500 psi on Low Psi
 - Immediately begin exiting when it sounds
(NFPA 1404)
 - Exercise controlled breathing when low air alarm activates.

Safety Checks

- Check the low-pressure alarm.
- Procedure for what to do when it does not activate.
- Check the pressure regulator gauge.
- Compare it to the cylinder gauge for accuracy.
- Check all harness straps and buckles, frayed stitching, and damaged metal.

SCBA **Monthly** Inspections

- Check all components for deterioration.
- Check for leaks around valves and cylinder connection.
- Verify that all gauges, valves, regulator, exhalation valve, and low-pressure alarm are functional.

Annual Inspection

- The Annual Inspection Should Be Conducted By A Factory Certified Technician.
- Steel And Aluminum Cylinders Must Be Tested Every Five Years.
- Composite Cylinders Must Be Tested Every Three Years.

Guidelines for SCBA weekly inspections, and before and after each use

- It is imperative to keep good records of inspections.
- Make sure the cylinder is full.
- All gauges are in operating order.
- Low-pressure alarm is working at approx. $\frac{1}{4}$ maximum rated pressure.
- No leaks in the hoses and all connections are tight.
- The face piece is clean and functional. Do not use paper products to clean face piece as it may scratch the lens.
- The harness system is in good working order.
- All valves are operational.
- PASS device is working properly.

Guidelines for an annual inspection

- It is imperative to keep good records of such inspections.
- A factory certified technician should conduct the annual inspection. Not firefighters!
- Steel and aluminum cylinders must be tested every five years.
- Composite cylinders must be tested every three years



CLEANING PROCEDURES

CLEANING SCBA AFTER USE

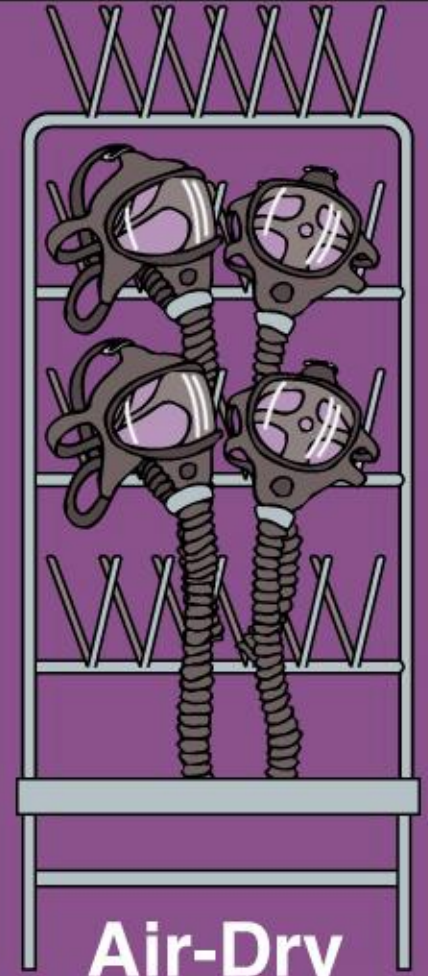
4B-14



Wash



Sanitize



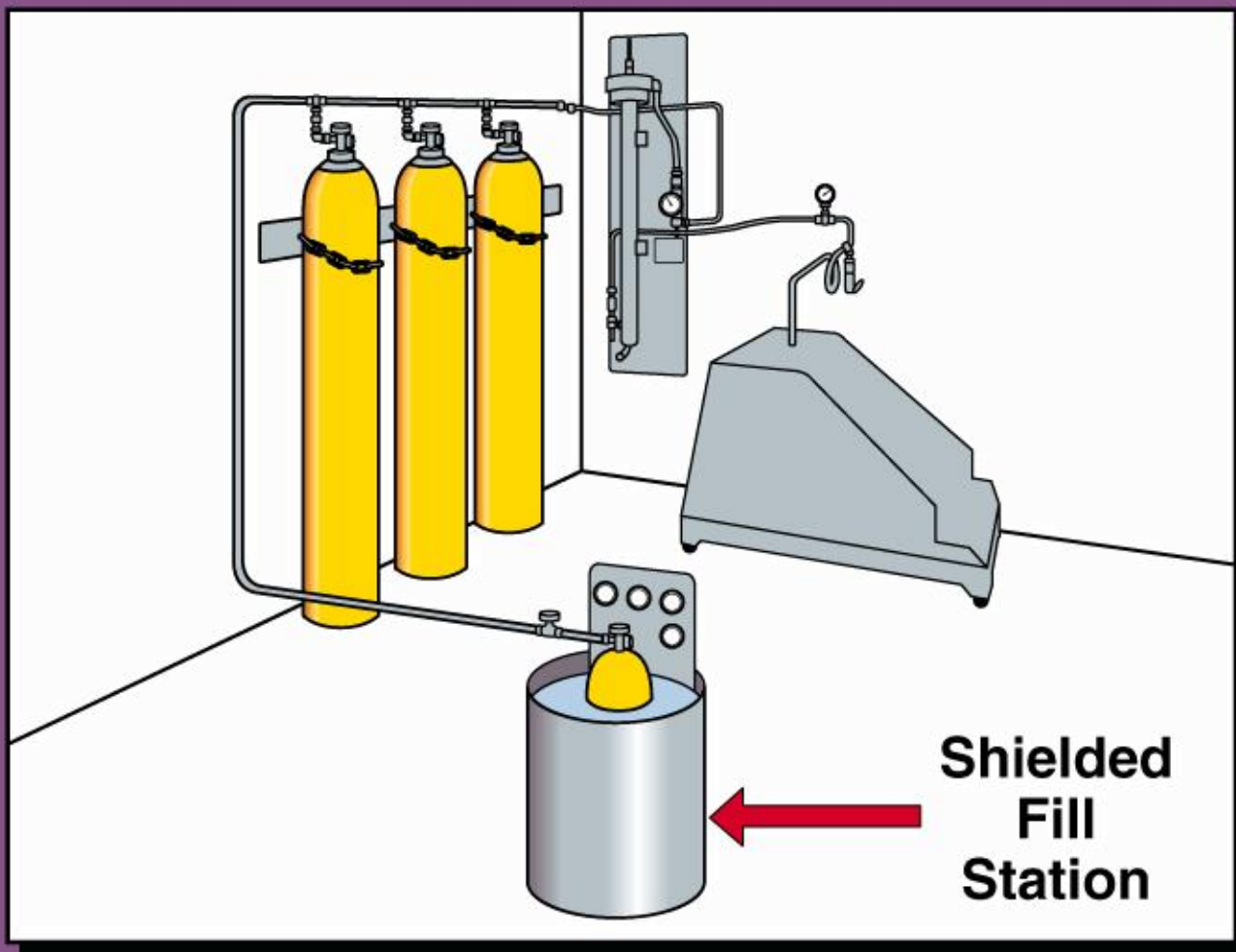
Air-Dry

Cleaning the SCBA

- Why Keep it clean?
- Use Warm Soap & Water
- Use brushes and rags to remove heavy soot or debris
- Clean after every use.
- DO NOT use solvents, bleaches or harsh chemicals to clean harness or cylinder.
- Sanitize masks to avoid spreading diseases.
- Refer to Manufacturer's recommendations for cleaning.

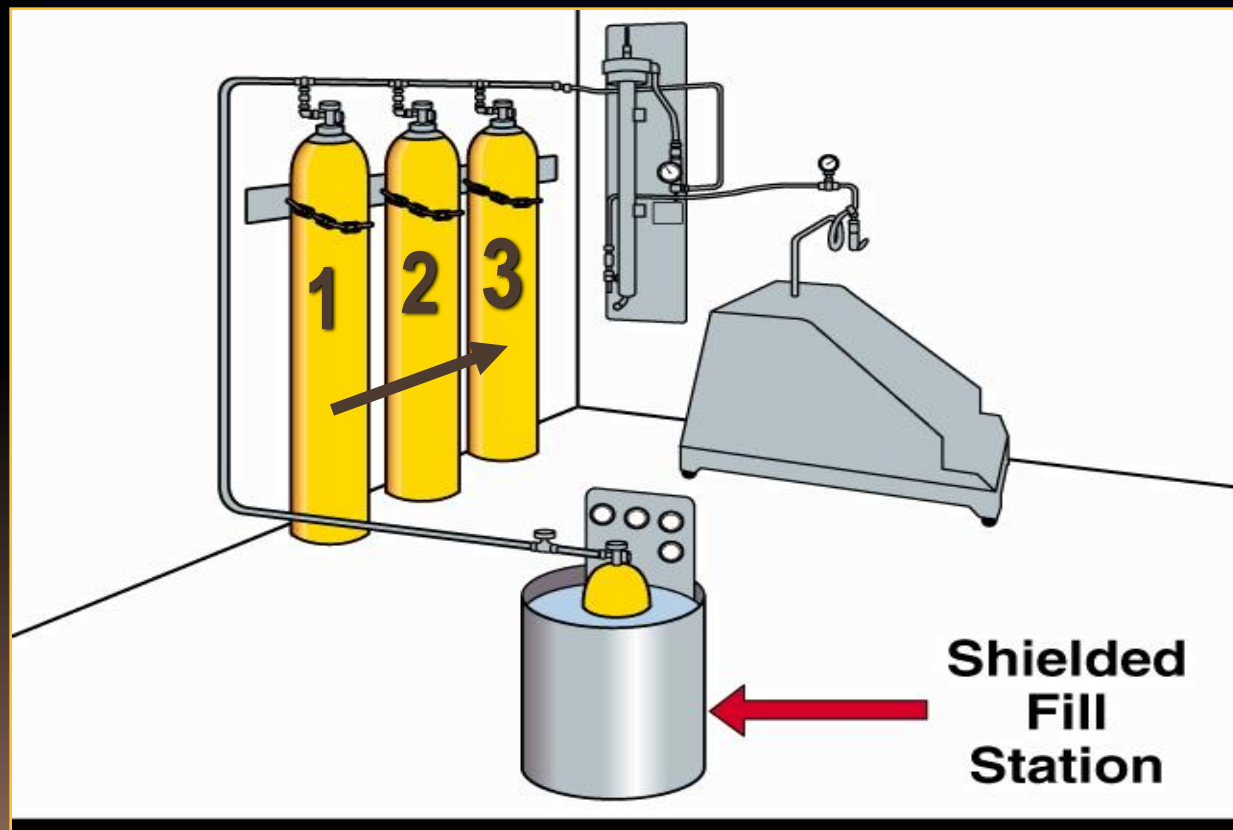
REFILLING AIR CYLINDERS

4B-12



Refilling Cylinders

- Refill after each use.
- Utilizing cascade systems, fill in the order of sequence.



DONNING/STORING METHODS

4B-11

Over
the
Head

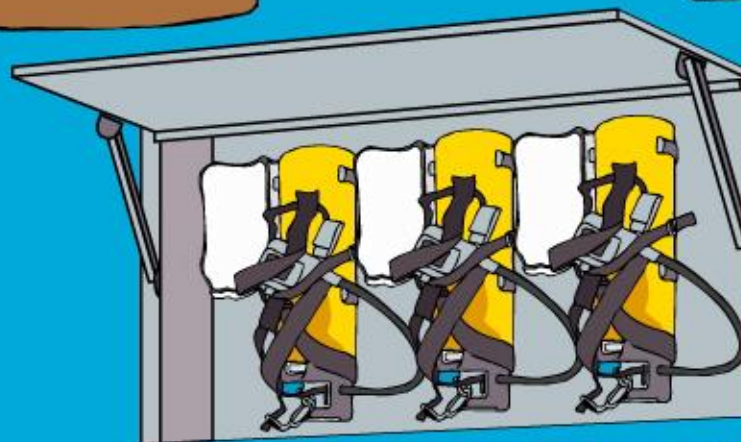
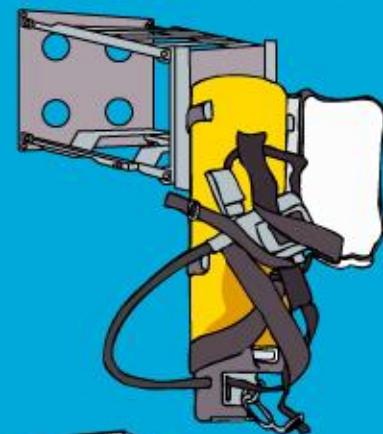


Coat

Seat Mount



Side or Rear Mount



Compartment Mount

