In order for PSFA personnel to administer emergency oxygen using a nasal cannula, non-rebreather face mask, or BVM, or utilize NPAs/OPAs, they must:

- Be part of the organized EMS system, functioning under the oversight of an S-SV EMS approved BLS optional skills provider
- Be authorized by the approved BLS optional skills provider to utilize these optional skills
- Have received adequate training on utilization of these optional skills
Purpose

- To enable authorized PSFA personnel to administer emergency oxygen using a nasal cannula, non-rebreather face mask, or BVM, and utilize NPAs/OPAs

Objectives – describe/demonstrate the following

- Indications, contraindications and administration of emergency oxygen using oxygen delivery devices
- Indications, contraindications and insertion of NPAs
- Indications, contraindication and insertion of OPAs
Emergency Oxygen Administration
• **Key concepts**
  
  o Every cell in the body needs oxygen (O₂) to live
  
  o In a medical emergency, the body may inspire (inhale) or deliver lower levels of oxygen
  
  o Hypoxia (inadequate O₂) leads to organ and brain damage
  
  o Providing supplemental oxygen during an emergency may prevent/delay damage to vital organs
• **Key concepts (cont.)**
  
  o **The air we breath contains:**
    - 21% oxygen
    - 78% nitrogen
    - 1% other elements
  
  o **The body only uses about 5% of inhaled oxygen**
    - Our exhaled air contains **16% oxygen**, enough to keep someone alive with rescue breaths for a short time
• **Key concepts (cont.)**
  
  o **Oxygen perfusion** is when cells receive oxygen-rich blood.
  
  o Depending on the type of emergency, the victim may be able to breathe but can’t perfuse oxygen.
  
  o **Emergency oxygen** is a higher concentration of oxygen than the air we breathe.
  
  o **Emergency oxygen** can increase oxygen concentrations in the lungs, which may allow more oxygen to be absorbed (perfused) into the bloodstream.
• Key concepts (cont.)
  o Respiration
    ▪ Exchange of carbon dioxide (CO$_2$), the waste product from breathing, with fresh air from the atmosphere
  o Ventilation
    ▪ Moving air in and out of the lungs for respirations
Key concepts (cont.)

Anatomy
- Larynx
- Trachea
- Right Lung
- Left Lung
- Alveoli
- Capillary beds
- Diaphragm
• Key concepts (cont.)
  o Alveoli
    ▪ Small air sacs in the lower lobes of the lungs where the exchange of $O_2$ and $CO_2$ is accomplished through fenestrations (tine holes) along the alveoli and capillary beds
Key concepts (cont.)

- Deoxygenated blood
  - Pumped from right ventricle of heart to lungs, down into alveoli
  - $\text{O}_2$ & $\text{CO}_2$ is exchanged

- Newly-oxygenated blood
  - Pumped back to left side of heart then out to the rest of the body
Emergency Oxygen Administration

- Oxygen information
  - Compressed gas
  - Classified as a drug – regulated by the FDA
  - 100% pure oxygen stored in a cylinder
    - Also known as a ‘tank’ or ‘bottle’
    - Labeled “For emergency use only”
    - Made of metal, aluminum or composite
    - Highly pressurized
Emergency Oxygen Administration

• Oxygen information (cont.)
  o Each cylinder is filled to approx. 2000 psi
  o D, jumbo D and E cylinders are small/portable – utilized on scene
  o Cylinder capacities:
    ▪ D cylinder: 425 liters of $O_2$
    ▪ Jumbo D cylinder: 640 liters of $O_2$
    ▪ E cylinder: 680 liters of $O_2$
Oxygen information (cont.)

- **Pressure regulator**
  - Connects cylinder valve to \( \text{O}_2 \) tubing
  - Controls rate of \( \text{O}_2 \) flow (liters-per-minute or ‘LPM’)
  - Gauge displays amount of pressure per square inch (psi)
    - 2000 psi = full
    - 1000 psi = half full
    - 500 psi = time to refill

*Oxygen Wrench*
Opens cylinder valve to begin \( \text{O}_2 \) flow into regulator
Emergency Oxygen Administration

- Oxygen information (cont.)
  - O-ring gasket
    - Creates tight seal between cylinder valve and regulator
    - Normally replaced with each cylinder change
  - Oxygen tubing
    - Connects regulator to $O_2$ delivery device
    - Normally pre-connected to $O_2$ delivery devices
• Oxygen information (cont.)
  
  o Connecting the pressure regulator
    ✓ Inspect regulator, attach new o-ring
    ✓ Line up pins on regulator with holes on cylinder valve
    ✓ Twist thumbscrew hand tight
    ✓ Open cylinder valve with toggle or $O_2$ wrench and read gauge to determine contents
    ✓ Listen for airtight seal
Emergency Oxygen Administration

• Oxygen safety
  o 100% oxygen is very reactive and can cause other materials to catch fire
  o Keep away from heat sources and flammable items
  o Never combine with an ignition source (cigarette, etc.)
  o Avoid alcohol, aerosol sprays, solvents, perfumes and petroleum products (oil, grease, etc.)
• Oxygen safety (cont.)
  
  o If using oxygen with an AED:
    ▪ Ensure good chest-to-pad contact
    ▪ Move oxygen delivery device at least 3 feet from victim before delivering shock
    ▪ Only deliver shock when rescuers and oxygen delivery device are clear
Emergency Oxygen Administration

- Oxygen safety (cont.)
  - Oxygen equipment storage, handling and maintenance
    - Store cylinders in a well ventilated area, away from heat sources
    - Do not subject cylinders to temperatures greater than 125°F
    - Store spare cylinders upright and properly secured to prevent falling
    - Avoid storing different types of compressed gasses in the same area
Emergency Oxygen Administration

- Oxygen safety (cont.)
  - Oxygen equipment storage, handling and maintenance
    - Regularly inspect oxygen equipment and keep clean – dirt/debris can be a fire hazard
    - Do not use a cylinder or regulator that appears damaged
    - Use regulator to check cylinder contents – do not rely solely on a tagging system
    - Do not slide, drag or roll cylinders
    - When on scene, lay the oxygen cylinder on the floor so it does not accidently get knocked over
Emergency Oxygen Administration

• Why use emergency oxygen
  o Primary use:
    ▪ Correct mild – moderate hypoxia (inadequate oxygen to organs and tissues)
    ▪ Reduce the work of the heart
  o Use to treat breathing difficulty based on:
    ▪ Patient’s condition
    ▪ Patient’s respiratory rate and effort
• When to use emergency oxygen
  o Respiratory rates that are too slow or too fast
    ▪ Adult: < 12 or > 20/minute
    ▪ Child: < 15 or > 30/minute
    ▪ Infant: < 25 or > 50/minute
  o Not breathing
  o Cyanosis
  o Suspected heart attack/stroke
  o Difficulty breathing/respiratory distress from other causes
  o Shock or significant trauma
Emergency Oxygen Administration

- When to use emergency oxygen (cont.)
  - Assess effort of breathing
    - Labored breathing
      - Using accessory muscles in neck and back
      - Speaking in broken sentences
    - Noisy breathing
      - Coughing
      - Wheezing/stridor
    - Tripod position
    - Cyanosis
• Oxygen delivery devices
  
  o Four basic types
    
    ▪ Patients breathing on their own
      - Nasal cannula (NC)
      - Non-rebreather mask (NRM)
      - Blow-by
    
    ▪ Patients who need assisted ventilation
      - Bag-valve-mask (BVM)
  
  o Different sizes are available for infant, child and adult patients
Oxygen delivery devices (cont.)

- Nasal cannula
  - Consists of a loop of oxygen tubing, two prongs for the nostrils and an adjusting band
  - Low-flow $O_2$ delivery device
  - Use 2 – 6 LPM
  - Delivers $O_2$ concentrations of 24% – 44%
Emergency Oxygen Administration

- Oxygen delivery devices (cont.)
  - Using a nasal cannula
    - Connect tubing to regulator and set flow rate at 2 – 6 LPM
    - Open cannula loop
    - Holding loop with thumb and forefinger, insert prongs into nostrils
    - Wrap sides of tubing around patient’s ears
    - Slide adjusting band up
    - Instruct patient to breath in through their nose
Emergency Oxygen Administration

- Oxygen delivery devices (cont.)
  - Non-Rebreather Mask
    - Consists of a mask, O₂ reservoir and tubing
    - High-flow O₂ delivery device
    - Use 15 LPM
    - Delivers O₂ concentrations up to 90%
**Emergency Oxygen Administration**

- **Oxygen delivery devices (cont.)**
  - Using a non-rebreather mask
    - Connect tubing to regulator and set flow rate at 15 LPM
    - Listen for flow of $O_2$
    - Briefly cover one-way valve inside mask to speed up filling reservoir bag
    - Place over patients mouth and nose and adjust elastic straps as necessary to hold securely in place
    - Ensure flow rate is at least 15 LPM, $O_2$ is flowing and the reservoir is inflated
Oxygen delivery devices (cont.)

- Tolerating a non-rebreather mask
  - The mask will completely cover the mouth and nose which can make it intolerable for some patients.
  - Patient may complain that flow of O₂ is restricted, even though they are getting high flow O₂ concentration.
  - Patient may have to be coached to help get used to the mask and be reassured that they are getting more oxygen than normal.
• Oxygen delivery devices (cont.)
  o Blow-by oxygen delivery
    ▪ For infants and small children who cannot tolerate a cannula or mask
    ▪ Use an oxygen mask and a high flow rate (at least 15 LPM)
    ▪ Allows supplemental oxygen to pass over patient’s mouth and nose to be inhaled
    ▪ Keep mask about 2 inches from patient’s face and allow parent to hold if necessary
Oxygen delivery devices (cont.)

- Bag-valve-mask (BVM)
  - Used for rescue breathing/CPR – uses positive pressure to push air into the lungs with each squeeze of the bag
  - Requires additional training to be used effectively
  - Delivers $O_2$ concentrations of 90% – 100%
Oxygen delivery devices (cont.)

- Using a BVM
  - May be used with or without $O_2$
  - Risks related to over-exposure to oxygen are low; it is reasonable to use high flow $O_2$ during resuscitation
  - Never delay resuscitation efforts/chest compressions in order to use emergency $O_2$
  - The use of emergency $O_2$ does not change how rescue breaths are delivered with a BVM
Oxygen delivery devices (cont.)

- Using a BVM with $O_2$
  - Assemble correct size mask, bag and tubing
  - Connect tubing to regulator and set flow rate at 15 LPM
  - Apply mask over mouth and nose – ensuring a good seal between face and mask
  - Squeeze bag to provide rescue breaths at appropriate rate – ensuring chest rise
  - Note: $O_2$ reservoir bag does not need to inflate
Emergency Oxygen Administration

- Potential risks associated with oxygen administration
  - Oxygen Toxicity
  - Retinopathy of Prematurity
  - Denitrogenation
  - COPD and the Hypoxic Drive
Oxygen Toxicity

- Occurs when there is too much oxygen in the blood
- Caused by prolonged exposure to high concentrations of oxygen – usually after 24 hours or more
- Not usually associated with the use of emergency oxygen in the prehospital setting
- Signs/symptoms: visual changes, ringing in ears, twitching, irritability, dizziness, seizure
• Retinopathy of Prematurity
  o Only occurs in premature infants
  o The retinas are immature before 34 weeks gestation, and can be damaged by high concentrations of oxygen
  o Not usually associated with the use of emergency oxygen in the prehospital setting
• Denitrogenation
  o Also known as absorption atelectasis
  o Occurs when naturally occurring nitrogen in the lungs is replaced with oxygen from over-saturation
  o Oxygen shares alveolar space with nitrogen – if nitrogen is ‘washed out’ by too much O2, the alveoli collapse
  o Can severely impair lung function (process known as atelectasis)
  o Not usually associated with the use of emergency oxygen in the prehospital setting
COPD and Hypoxic Drive

- ‘Hypoxic drive’ is a condition associated with COPD
  - Normally, the body is stimulated to breathe when too much carbon dioxide is detected
  - COPD patients are stimulated to breathe by lower $O_2$ levels and to not breathe with higher $O_2$ levels
  - Concern that emergency oxygen can eliminate the hypoxic drive of a COPD patient, causing them to stop breathing
COPD and Hypoxic Drive (cont.)

- General rule:
  - Always administer emergency $O_2$ if indicated (even if patient has a history of COPD)
  - Difficulty breathing may be related to a condition other than COPD

- Hypoxic drive is rare – do not withhold emergency oxygen
Nasopharyngeal Airways (NPAs)

- **NPA function**
  - Restores airway patency by separating the tongue from the posterior wall of the pharynx

- **NPA indications**
  - Unresponsive patient with a gag reflex
  - Patient will not tolerate an OPA
  - Patient has clenched teeth
Nasopharyngeal Airways (NPAs)

- **NPA contraindications**
  - Responsive patient
  - Suspected head trauma or mid-face or skull fracture
  - Patient on blood thinners

- **NPA precautions**
  - Incorrect placement can worsen airway obstruction
Nasopharyngeal Airways (NPAs)

- NPA sizing
  - Measure from the patient’s earlobe to the tip of the nose

**INCORRECT**  ✓ CORRECT  **INCORRECT**
Nasopharyngeal Airways (NPAs)

- NPA insertion
  - Check the nostril for signs of fracture or obstruction
  - Apply water soluble lubricant to the NPA, taking care not to fill the tip with the lubricant
Nasopharyngeal Airways (NPAs)

- NPA insertion (cont.)
  - Orient the bevel end so that it will pass along the inside of the nasal cavity with minimal effort.
  - Insert the NPA until the flange (large end of the tube) is seated on the patient’s nose.
• NPA insertion (cont.)
  o If you meet resistance, gently rotate the NPA from side to side and continue to insert – If you continue to meet resistance, remove the NPA and try inserting in the other nostril
  o Initiate/resume supplemental oxygen or ventilations with a BVM following NPA insertion
Oropharyngeal Airways (OPAs)

- Types of OPAs (both approved for EMS utilization)
Oropharyngeal Airways (OPAs)

- OPA contraindications
  - Responsive patient or has a gag reflex

- OPA precautions
  - Incorrect placement can worsen airway obstruction
Oropharyngeal Airways (OPAs)

- OPA sizing
  - Measure from the corner of the mouth to angle of the jaw

[Incorrect Images] × INCORRECT × INCORRECT ✓ CORRECT
Oropharyngeal Airways (OPAs)

- **OPA insertion**
  - Using a head-tilt-chin-lift, modified jaw-thrust, or grasping the tongue and jaw by placing your thumb in the patient’s mouth, move the tongue forward.
  - Position the OPA with the tip in the patient’s mouth, and slowly insert the OPA – slight resistance will be felt.
Oropharyngeal Airways (OPAs)

- OPA insertion (cont.)
  - At the point resistance is met, continue insertion while simultaneously rotating the OPA $180^\circ$
  - Advance the OPA until the flange is resting on or just above the patient’s teeth
Oropharyngeal Airways (OPAs)

- OPA insertion (cont.)
  - Initiate/resume ventilations with a BVM following OPA insertion
  - If the patient gags or vomits, remove the OPA and clear the airway if needed
  - Thoroughly clean and reinsert the OPA only if the victim is still unconscious and does not have a gag reflex
Questions?