

State of Tennessee
Hazardous Materials
Protocol Guidelines

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Ammonia

Ammonia is a colorless, water-soluble alkaline gas that is most commonly used a cleaning agent, fertilizer, and industrial refrigerant. The life threat of ammonia exposure is from pulmonary edema and hypotension.

DECON: Airway protection via SCBA and chemical protective clothing may be required of the rescuer and should be performed only by properly trained personnel. The patient should be removed from the contaminated area. Remove and bag their clothing and any jewelry. Brush away any dry particles and blot excess liquids. Wash patient with a mild soap and warm water.

Assessment: The following are not all inclusive and may not be present in all patients, but include the most common signs and symptoms.

Cardiovascular: 1) Ventricular Arrhythmias
 2) Hypotension

Respiratory: 1) Laryngeal Edema
 2) Pulmonary Edema
 3) Bronchospasm
 4) Stridor
 5) Cough
 6) Dyspnea

CNS: 1) Lethargy
 2) Coma

Gastrointestinal: 1) GI Bleed

Eye: 1) Chemical Conjunctivitis

Skin: 1) Burns
 2) Frostbite

Treatment-Standing Order:

- 1) 100% O₂ and airway maintenance appropriate for pt. condition
- 2) Pulse Oximetry
- 3) Cardiac Monitor
- 4) I.V. NS
- 5) Treat underlying signs and symptoms per your local EMS Protocols.
- 6) Tetracaine, 2drops each affected eye, for eye exposure
 Flush eyes for 15 min with sterile water or saline

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- 7) Large bore IV of NS
- 8) Tetracaine ophthalmic solution, 2 drops in each affected eye
- 9) Treat respiratory, cardiovascular and other signs and symptoms as appropriate per your local EMS protocols.

Treatment-Protocol

- 1) If burning persists titrate half strength adult sodium bicarbonate (3.75% or 4.2%) and administer 5 cc via the nebulizer. This is made by diluting 2.5-3 cc of adult strength sodium bicarbonate in 2.5 cc sterile water.
- 2) This is the only time a chemical will be neutralized in or on the body by field medical personnel.
- 3) 3ml Sodium Bicarb in 2ml NS nebulized for severe respiratory distress. **DO NOT MIX WITH BRONCHODILATOR**

Cyanide

Cyanide may be found as a pale blue liquid, white solid crystal or colorless gas. It is used in many industrial settings such as paper manufacturing, blueprinting, engraving and metal treatment. Cyanide is also used as a fumigant and is a byproduct of combustion of synthetic materials. This is one of the fastest acting poisons, and is taken into the body through all routes. It has a bitter almond smell to those who can smell it, but the olfactory response fades quickly. Cyanide prevents the uptake of oxygen into the blood stream and further halts cellular respiration, thus causing chemical asphyxiation. Pulse-oximetry will indicate FALSELY high, due to the fact that the cyanide binding to the hemoglobin.

DECON: Airway protection via SCBA and chemical protective clothing may be required of the rescuer and should be performed only by properly trained personnel. The patient should be removed from the contaminated area. Remove and bag their clothing and any jewelry. Brush away any dry particles and blot excess liquids. Wash patient with a mild soap and warm water.

Assessment: The following are not all inclusive and may not be present in all patients, but include the most common signs and symptoms.

- Cardiovascular:
- 1) Bradycardia
 - 2) Hypertension which may be followed by hypotension
 - 3) Palpitations
 - 4) Ventricular arrhythmias
 - 5) Cardiac arrest
- Respiratory:
- 1) Respiratory rate and depth increase initially
 - 2) Respirations may become slow and labored as poisoning progresses
 - 3) Pulmonary edema
 - 4) Respiratory arrest
- CNS:
- 1) Weakness
 - 2) Headache
 - 3) Confusion
 - 4) Lethargy
 - 5) Seizure
 - 6) Coma
- GI:
- 1) Nausea and vomiting
 - 2) Excessive salivation
- Eye:
- 1) Redness
 - 2) Edema
 - 3) Dilated pupils

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- Skin:
- 1) Inflammation
 - 2) Ulcers
 - 3) Cyanosis may or may not be present

For exposure by means other than smoke inhalation:

Treatment-Standing Order:

- 1) 100% O₂ and airway maintenance appropriate for pt. condition
- 2) Cardiac Monitor
- 3) IV N.S.
- 4) Administer Cyanokit, 5g, IV over 15 min.

For exposure by smoke inhalation:

Treatment-Standing Order:

Mild Exposure (CAO, no serious signs or symptoms):

- 1) 100% O₂ and airway maintenance appropriate for pt. condition
- 2) IV N.S.
- 3) Cardiac Monitor

Moderate to Severe exposure (ALOC, Severe Resp. or cardiac symptoms, coma):

- 1) 100% O₂ and airway maintenance appropriate for pt. condition
- 2) IV N.S
- 3) Cardiac Monitor
- 4) The starting dose of Cyanokit for adults is 5 g, (two 2.5 g vials) administered by IV infusion over 15 minutes.
- 5) Depending upon the severity of the poisoning and the clinical response, a second dose of 5 g may be administered by IV infusion for a total dose of 10 g.

- The rate of infusion for the second 5 g dose may range from 15 minutes (for patients in extremis) to 2 hours based on patient condition.

- There are a number of drugs and blood products that are incompatible with Cyanokit, thus Cyanokit may require a separate intravenous line for administration.

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-WARNINGS AND PRECAUTIONS-

- Use caution in the management of patients with known anaphylactic reactions to hydroxocobalamin or cyanocobalamin. Consideration should be given to use of alternative therapies, if available.
- Allergic reactions may include: anaphylaxis, chest tightness, edema, urticaria, pruritus, dyspnea, and rash.
- Blood pressure increase: Substantial increases in blood pressure may occur following Cyanokit therapy.

--ADVERSE REACTIONS--

Most common adverse reactions (>5%) include transient chromaturia, erythema, rash, increased blood pressure, nausea, headache, and injection site reactions.

Heavy Metals

“Heavy Metals” is a loosely defined term used to include elements that exhibit metallic properties. Although there are many elements that can be defined as “heavy metals”, these SOP’s are intended to apply specifically to arsenic, mercury, lead and copper. You should provide supportive care and contact medical control if you encounter poisoning from any other metallic compound.

DECON: If the exposure has occurred inside of a structure or an area with limited ventilation, the appropriate personnel should remove the victim from the area while wearing full PPE and SCBA. Remove the patients clothing and jewelry and place them in a bag. The patient should be washed with a mild soap and warm water.

Assessment: The following are not all inclusive and may not be present in all patients, but include the most common signs and symptoms.

Cardiovascular:

- 1) Tachycardia
- 2) Weak pulse
- 3) Hypotension
- 4) Ventricular arrhythmias
- 5) Prolonged QT segment and T wave changes (Arsenic)

Respiratory:

- 1) Cough
- 2) Acute bronchitis
- 3) Tachypnea
- 4) Dyspnea
- 5) Apnea
- 6) Chest Pain
- 7) Pulmonary edema

CNS:

- 1) Headache
- 2) Fatigue
- 3) Vertigo
- 4) Syncope
- 5) Anxiety
- 6) Seizure
- 7) Coma

Gastrointestinal:

- 1) Abdominal pain
- 2) Nausea
- 3) Vomiting
- 4) Cramps
- 5) Bloody diarrhea

Eyes:

- 1) Chemical conjunctivitis
- 2) Ocular edema

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- Skin:
- 1) Irritated, red
 - 2) Pale, cool, clammy (Copper)
 - 3) Cyanotic, cold (Arsenic)

Treatment – Standing Order:

- 1) 100% oxygen and airway maintenance appropriate for pt. condition
- 2) Pulse oximetry
- 3) Large bore IV NS
- 4) Cardiac Monitor
- 5) Treat shock and arrhythmias per your local EMS SOP's
- 6) Continuous flush of affected eyes with NS
- 7) Give 4 – 8 oz of water for ingestion

Treatment – Protocol:

- 1) If patient is unstable, administer Dimercaprol (BAL), 3mg/kg deep IM

Hydrogen Fluoride

Hydrogen fluoride is a colorless, fuming liquid or gas with a strong, irritating odor. Hydrogen fluoride is used as a cracking catalyst in oil refineries, and for etching glass and enamel, removing rust, and cleaning brass and crystal. The primary life threat from Hydrogen Fluoride and Hydrofluoric Acid is from severe burns and pulmonary edema.

DECON: Airway protection via SCBA and chemical protective clothing may be required of the rescuer and should be performed only by properly trained personnel. The patient should be removed from the contaminated area. Remove and bag their clothing and any jewelry. Brush away any dry particles and blot excess liquids. Wash patient with a mild soap and warm water.

Assessment: The following are not all inclusive and may not be present in all patients, but include the most common signs and symptoms.

Cardiovascular: 1) Tachycardia
 2) Weak Pulse
 3) Arrhythmias
 4) Hypotension

Respiratory 1) Acute Bronchitis
 2) Dyspnea
 3) Pulmonary Edema

CNS: 1) Headache
 2) Lethargy
 3) Altered LOC

Gastrointestinal: 1) Nausea
 2) Vomiting
 3) Burns to the mouth and oropharynx

Eye: 1) Intense Pain
 2) Chemical Conjunctivitis

Skin: 1) Severe Pain
 2) Burns may or may not be visible
 3) White areas of discoloration may be present

Treatment-Standing Order

- 1) 100% O₂ and airway maintenance appropriate to pt. condition
- 2) Pulse Oximetry
- 3) I.V. NS in unexposed extremity if possible

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- 4) Cardiac Monitor – Watch for signs of hypocalcemia (prolonged QT interval)
- 5) Inhalation: Administer nebulized Calcium Gluconate, 2.5ml in 10cc NS if pt. is displaying signs and symptoms of inhalation (sore throat, coughing, bronchospasm)
- 6) Skin Exposure: make a mixture of 2.5g Calcium Gluconate and 100ml of water soluble lubricant (KY Jelly) and massage onto affected area.
- 7) Ingestion: If pt. is conscious and gag reflex is present, administer 2-4 glasses of water.
- 8) DO NOT induce emesis
- 9) Eye Exposure: Irrigate with 1% aqueous solution of Calcium Gluconate (50ml of 10% Calcium Gluconate in 450 ml of NS)

Hydrogen Sulfide

Hydrogen Sulfide is a colorless, flammable, highly toxic gas that is used in gas and crude oil operations. It is also a naturally occurring by-product of decaying organic matter (AKA sewer gas) and has the odor of rotten eggs to those who can smell it, and be aware that the olfactory nerve may become fatigued and less responsive with exposure! It is heavier than air. This also is a chemical asphyxiant that interferes with cellular respiration. This is taken into the body through all routes.

DECON: Airway protection via SCBA and chemical protective clothing may be required of the rescuer and should be performed only by properly trained personnel. The patient should be removed from the contaminated area. Remove and bag their clothing and any jewelry. Brush away any dry particles and blot excess liquids. Wash patient with a mild soap and warm water.

Assessment: The following are not all inclusive and may not be present in all patients, but include the most common signs and symptoms.

Cardiovascular: 1) Tachycardia or Bradycardia
 2) Arrhythmias
 3) Circulatory Collapse

Respiratory: 1) Cough
 2) Dyspnea
 3) Tachypnea
 4) Acute Bronchitis
 5) Pulmonary Edema

CNS: 1) Headache
 2) Confusion
 3) Dizziness
 4) Altered LOC
 5) Seizure
 6) Coma

Gastrointestinal: 1) Nausea
 2) Vomiting
 3) Profuse Salivation

Eye: 1) Chemical Conjunctivitis
 2) Lacrimation
 3) Photophobia

Skin: 1) Irritation
 2) Local Pain

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- 3) Excessive Sweating
- 4) Cyanosis

Treatment-Standing Order:

- 1) 100% O₂ and airway maintenance appropriate for pt. condition
- 2) Do Not induce vomiting
- 3) Pulse Oximetry
- 4) Cardiac Monitor
- 5) I.V. NS
- 6) Flush eyes with copious amounts of water for eye exposure
- 7) Tetracaine, 2 drops each eye after flushing for eye exposure
- 8) Valium, 10 mg if seizing

Treatment-Protocol:

- 1) Administer Amyl Nitrite, 1 ampule every 5- 10 minutes
- 2) Administer Sodium Nitrite, 300mg I.V. over 5 minutes
(Flush I.V. line after administration)

Methyl Bromide

Methyl Bromide is a colorless liquid or gas that is used as an insecticide and as a fumigant for grain elevators and greenhouses. It is also used in refrigerants and solvents. Methyl Bromide is a neurotoxin that can cause severe respiratory irritation, pulmonary edema, and respiratory failure as well as seizures, coma and death.

DECON: Airway protection via SCBA and chemical protective clothing may be required of the rescuer and should be performed only by properly trained personnel. The patient should be removed from the contaminated area. Remove and bag their clothing and any jewelry. Brush away any dry particles and blot excess liquids. Wash patient with a mild soap and warm water.

Assessment: The following are not all inclusive and may not be present in all patients, but include the most common signs and symptoms.

Cardiovascular: 1) Arrhythmias
 2) Circulatory Collapse

Respiratory: 1) Throat Irritation
 2) Tightness of the chest
 3) Dyspnea
 4) Tachypnea
 5) Bronchospasm
 6) Pulmonary Edema

CNS: (Symptoms may be delayed)
 1) Headache
 2) Weakness
 3) Confusion
 4) Dizziness
 5) Slurred Speech
 6) Seizures
 7) Coma

Gastrointestinal: 1) Nausea
 2) Vomiting
 3) Abdominal Pain

Eye: 1) Chemical Conjunctivitis
 2) Blurred Vision

Skin: 1) Chemical Burns
 2) Cyanosis
 3) Pain

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Treatment-Standing Orders

- 1) 100% O₂ and airway maintenance appropriate for pt. condition
- 2) Pulse Oximetry
- 3) Cardiac Monitor
- 4) I.V. NS
- 5) Irrigate eyes with sterile water or NS for 5 minutes, remove contact lenses, and apply 2 drops of Tetracaine in each affected eye if exposure to eyes has occurred.

There is no antidote for Methyl Bromide poisoning. EMS personnel should provide supportive measures for underlying signs and symptoms according to your local EMS ALS SOP's and contact medical control for further guidance.

Nitrogen Oxides

Nitrogen Oxides are a mixture of gases that are composed of nitrogen and oxygen that are most commonly released into the air by vehicle motor exhaust, burning coal, oil, and natural gas. People are most often exposed to excessive nitrogen oxides levels by close proximity to combustion sources. These chemicals are also commonly found in fertilizers, paints, inks, and dyes and changes the hemoglobin into methemoglobin, which is non-oxygen carrying compound and leads to chemical asphyxiation.

DECON: Airway protection via SCBA and chemical protective clothing may be required of the rescuer and should be performed only by properly trained personnel. The patient should be removed from the contaminated area. Remove and bag their clothing and any jewelry. Brush away any dry particles and blot excess liquids. Wash patient with a mild soap and warm water.

Assessment: The following are not all inclusive and may not be present in all patients, but include the most common signs and symptoms.

- Cardiovascular: 1) Rapid, Weak Pulse
 2) Hypotension
- Respiratory: 1) Dyspnea
 2) Bronchospasm
 3) Pulmonary Edema
 4) Glottic Edema
- CNS: 1) Fatigue
 2) Altered LOC
- Gastrointestinal: 1) Nausea
 2) Vomiting
 3) Abdominal Pain
- Eye: 1) Chemical Conjunctivitis
- Skin: 1) Irritation
 2) Pallor
 3) Cyanosis
 4) Burns if exposed to liquefied NO_x

Presentation: Cyanosis, unresponsive to oxygenation, headache, nausea, vomiting, tachycardia, arrhythmias, syncope, dyspnea, seizures, coma.

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Treatment-Standing Order

- 1) 100% O₂ and airway maintenance appropriate for pt. condition
- 2) Pulse Oximetry
- 3) Cardiac Monitor
- 4) I.V. NS
- 5) Treat underlying signs and symptoms per your local EMS ALS SOP's
- 6) Administer Methylene Blue, 1-2mg/kg IV over 10 min. if pt. has severe hypoxia and cyanosis that does not respond to other treatments

Organophosphates

Organophosphates are among the most poisonous compounds that are used for pest control. They may be found as liquids, dusts, wettable powders, concentrates and aerosols. These are taken into the body through all routes. Some of the highly toxic organophosphates are: tetraethyl pyrophosphate, fensulfothion, mevinphos, ethyl parathion, sulfotep, cyanofenphos, and methyl parathion. Some moderately toxic organophosphates are: leptophos, ethion, chlorpyrifos, diazinon, malathion, and seven.

DECON: Airway protection via SCBA and chemical protective clothing may be required of the rescuer and should be performed only by properly trained personnel. The patient should be removed from the contaminated area. Remove and bag their clothing and any jewelry. Brush away any dry particles and blot excess liquids. Wash patient with a mild soap and warm water.

Assessment: The following are not all inclusive and may not be present in all patients, but include the most common signs and symptoms.

Cardiovascular: 1) Bradycardia (Tachycardia is possible)
 2) Ventricular Arrhythmias
 3) A-V Blocks
 4) Hypotension

Respiratory: 1) Bronchoconstriction
 2) Profuse Pulmonary Secretions
 3) Acute Pulmonary Edema (Severe Exposure)
 4) Respiratory Failure (Severe Exposure)

CNS: 1) Anxiety
 2) Headache
 3) Dizziness
 4) Weakness
 5) Disorientation
 6) Slurred Speech
 7) Seizure (Severe Exposure)
 8) Coma (Severe Exposure)

Gastrointestinal: 1) Nausea
 2) Vomiting
 3) Abdominal Cramps
 4) Defecation

Eye: 1) Lacrimation
 2) Blurred Vision
 3) Miosis

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- Skin:
- 1) Pale
 - 2) Cyanotic
 - 3) Diaphoresis

Minor Exposure: shortness of breath, chest pain, headache, nausea, watering eyes, throat and nose, blurred vision slightly diaphoretic and slight in coordination, or no presentation.

Moderate Exposure: Headache, nausea, vomiting, and sludge syndrome, very diaphoretic, in coordination, blurred vision, wheezing focal motor seizures, and tachycardia

Severe Exposure: Sludge syndrome, diaphoretic, pulmonary edema, bradycardia, seizures, coma, and paralysis.

Treatment-Standing Order

Mild Exposure

- 1) Treat underlying signs and symptoms per your local EMS ALS SOP's

Moderate Exposure

- 1) Administer (1) Mark 1 Kit and re-evaluate after 5-10 min. Additional doses of Atropine may be needed (Monitor for arrhythmias). If no improvement, administer a second Mark 1 kit.
- 2) 100% O₂ and airway maintenance appropriate for pt. condition
- 3) Pulse oximetry
- 4) Cardiac Monitor
- 5) I.V. NS

Severe Exposure

- 1) Administer (3) Mark 1 Kits
- 2) Valium, 10 mg I.M., if seizing
- 3) 100% O₂ and airway maintenance appropriate for pt. condition
- 4) Pulse Oximetry
- 5) I.V. NS
- 6) Cardiac Monitor

Note: IV atropine with hypoxic patients may cause ventricular fibrillation Atropine should be stopped when the patient "Dries up" or symptoms stop. Atropine may be given as a nebulizer treatment if severe wheezing occurs.

Age related Protocol

Treatment of severe presentation:

Atropine:

Infant IM	0.5mg
Infant IV	0.02mg/kg
Child 2-10 IM	1.0mg
Adolescent IM, IV	2.0mg
Elderly IM	1.0mg

2-PAMCL

Infant to 70kg IM, IV	1.5mg/kg
Elderly	7.5mg/kg

Crush Syndrome

A crush injury results from muscle cell disruption due to compression. Compartment syndrome is crush injury caused by swelling of tissue inside the confining fibrous sheath of muscle compartments. Compartment syndrome symptoms include; pain, paresthesia, pallor, poikilothermy, and pulselessness. Crush syndrome is the systemic manifestations of muscle crush injury and cell death. This occurs when the crushed muscle is released from compression. Crush injury syndrome should be suspected in patients with an extensive area of involvement of large muscle groups such as legs, buttocks, entire upper extremity and pectoral areas. The syndrome can begin within an hour if severe compressive forces are involved constricting the venous return. Time of onset is directly related to muscle mass involved versus force applied.

Medical treatment should be on a case by case basis looking at the history, muscle groups involved, and the time and pressure involved.

PROCEDURE

1. Scene safety.
2. Primary patient assessment. Placement of appropriate hemodynamic monitoring equipment. If oxygen saturations are greater than 93% on room air, the use of high flow oxygen is discouraged due to free oxygen radical exchange. Caution should be used when introducing high flow oxygen into a confined environment. Risk/benefit analysis should be done with the rescue officer, safety officer and the incident commander prior to use.
3. Spinal immobilization as dictated by patient access/confinement.
4. Maintain patient in a dry, normothermic state. Hypothermia may cause a rapid deterioration in physiologic status as well as rapid utilization of glucose stores resulting in hypoglycemia. Hypoglycemia should be treated with administration of dextrose by the most appropriate route (IV, PO, NGT/OGT) as dictated by patient situation.
5. Intravenous access with large bore catheters, minimum of two sites.
6. Administration of normal saline 1000-2000 ml bolus (20 ml/kg) initially and then 1000 ml/hr. The aggressive administration of volume prior to extrication is important to minimize the potential for obstruction of the renal tubules with myoglobin. Lactated Ringers should not be used due to its potassium content.
7. Administer Sodium bicarbonate 50 meq IVP (pediatric 1meq/kg). A Sodium bicarbonate infusion of 150 meq/1000ml D5W should be initiated. The total IVF rate (NS+D5W) should total 1000ml/hr (pediatric 5ml/kg/hr). The IV fluid rate should be guided by urine output. Sodium bicarbonate should not be mixed in normal saline due

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to sodium overload. Alkalization prevents precipitation of myoglobin in the renal tubules which causes acute tubular necrosis and acute renal failure. Myoglobin precipitates in an acidic environment. Myoglobinuria is noted when the urine is a tea colored.

8. Consideration should be given to placing a urinary catheter to drainage bag to monitor urine output.
9. Analgesia and sedation should be administered per hemodynamic profile. This is also beneficial in facilitating ongoing rescue operations.
10. Prior to extricating the patient with moderate symptoms of crush injury from a confined space, the following medications should be administered.
 - a. 50% Dextrose 25 grams IVP (pediatric 0.5grams/kg)
 - b. Regular insulin 10 units IVP (pediatric 0.2 units/kg)
11. Administer Albuterol up to 5 mg via nebulizer. Albuterol lowers serum potassium by driving it back into the cells.
12. Life threatening Arrhythmias can occur following release of compressive force. EKG changes due to hyperkalemia are listed below from elevated to high potassium levels:
 - a. Tall peaked T waves.
 - b. Prolonged PR interval.
 - c. Small P wave, ST depression.
 - d. A V block, Bundle Branch Block.
 - e. Wide QRS with no P wave. *
 - f. Ventricular Fibrillation. *

*Life threatening arrhythmias such as wide QRS and ventricular fibrillation require immediate treatment with Calcium Chloride 1 gram IVP (pediatric dose 20mg/kg).

13. Consider the following in situations with prolonged entrapment:
 - a. The addition of Mannitol 1 gram/kg to the intravenous bag. Mannitol is thought to be useful in promoting diuresis of the circulating volume to reduce urine acidity~
 - b. The use of the ISTAT blood analyzer or similar device
 - c. Field amputation kit available on site at rescue. This can be obtained with a physician from the local trauma center or local hospital under prior MOU.

AUTHORIZATION FOR STANDING ORDERS

These Hazardous Materials Emergency Medical Services (EMS) Protocols are hereby adopted as Protocols as designated and appropriate to patient’s condition to be initiated by EMS personnel and within their scope of training and licensure whenever a patient presents with injury or illness covered by the orders. At the point in the protocols where it is indicated to contact Medical Control or “Treatment - Protocol”, the Paramedic must receive voice orders from Medical Control before proceeding with the protocol. Other orders may be obtained from Medical Control when the situation is not covered by the protocols or as becomes necessary as deemed by the EMT-Paramedic.

Effective date of these SOPs: _____

Signature of Medical Director _____

Medical Director

Date