

SPECIAL OPERATIONS

Treatment

Drugs

Procedures

Eye Emergencies

HX	PE	DDX
Mechanism of injury	Visual Acuity (each eye separately)	Penetrating
Timing of the injury	External Exam (upper and lower eyelids)	Corneal burns
Current vision (can they see?)	Extraocular movements	Corneal abrasion / foreign body
Status of vision prior to injury (e.g. eyeglasses, contacts, glaucoma etc)	Eye	Blow out fracture to eye
Eye protection	Sclera (obvious penetration)	
First aid rendered	Cornea (blood, cloudy)	
If chemical burn, what was the material or product.	Blood in anterior chamber	
	Pupils	

Treatment:

- A. In order to decrease intraocular pressure, patients should be transported sitting at least a 30 degree angle unless contraindicated.
- B. Monitor vital signs.
- C. Treat specific injuries as follows:
 1. Chemical Exposure
 - a. Administer proparacaine.
 - b. Irrigate from the center of the eye towards the eyelid with lactated ringer's (preferred), isotonic saline or tap water for at least 30 minutes.
 - c. Do not attempt to neutralize acids or bases.
 2. Direct Trauma to Eye (Suspected Rupture/Penetration of Globe)
 - a. Protect affected eye with a hard shield or similar device and cover the other eye.
 - b. Follow Pain Protocol, as indicated and consider ondansetron per *Nausea and Vomiting* Protocol.

3. Superficial Foreign Body Sensation
 - a. Do not wipe eye
 - b. Administer proparacaine
 - c. Consider irrigation with Lactated Ringer's, isotonic saline or tap water for 30 minutes, or until foreign body is removed

Proparacaine Administration:

Class:

Local anaesthetic

Pharmacology and Actions:

Proparacaine hydrochloride is a short-acting local anaesthetic of the ester type with an onset of action within 30 seconds. Duration is up to 15 minutes.

Indications:

Superficial foreign bodies or chemical burns to the eye.

Precaution:

Systemic effects are rare with topical use.

Adult			
Indication	Dose	Route(s)	Notes
Foreign body or burn to eye	One drop in the affected eye. If effect is not felt within one minute, three additional drops, one drop at a time, may be given at one minute intervals. For transports longer than 15 minutes, if eye pain returns, 1-4 additional drops may be given.		
Pediatric			
Indication	Dose	Route(s)	Notes
Same as adult			

Side Effects:

Instillation of proparacaine in the recommended concentration and dosage produces little or no initial irritation, stinging or burning; these effects may occur several hours after use.

Specific Precautions:

Document blurring, double vision, perceived flashes of light or other visual changes. Contact lenses should be removed, if possible.

Hydrogen Cyanide (HCN)

Identification:

CAS 74-90-8 UN 1051

Synonyms include formic anannonide and formonitrile. Aqueous solutions are referred to as hydrocyanic acid and prussic acid.

Hydrogen cyanide is very volatile, producing potentially lethal concentrations at room temperature. At temperatures below 78°F, hydrogen cyanide is colorless or pale blue liquid (hydrocyanic acid); at higher temperatures, it is a colorless gas. It has a faint bitter almond odor and a bitter burning taste. It is soluble in water.

Precautions:

- A. Persons whose clothing or skin is contaminated with cyanide containing solutions can secondarily contaminate personnel by direct contact or through off-gassing vapor.
 - 1. Avoid dermal contact with cyanide contaminated victims or with gastric contents of victims who may have ingested cyanide containing materials.
 - 2. Victims exposed only to hydrogen cyanide gas do not pose contamination risks to rescuers.
 - 3. Duty uniforms and nitrile or latex gloves offer no protection from cyanide.
- B. Hydrogen cyanide is a volatile flammable liquid at room temperature; as a gas, it is flammable and potentially explosive.
- C. Hydrogen cyanide is absorbed by inhalation and can produce death within minutes.
 - 1. Substantial absorption can occur through intact skin if vapor concentration is high.
 - 2. Exposure by any route may cause systemic effects.

Health Effects:

- A. Hydrogen cyanide acts as a cellular asphyxiant. By binding to mitochondrial cytochrome oxidase, it prevents the utilization of oxygen in cellular metabolism.
- B. Hydrogen cyanide may cause abrupt onset of profound CNS, cardiovascular, and respiratory effects, leading to death within minutes.

Routes of Exposure:

- A. Inhalation
 - 1. Hydrogen cyanide is readily absorbed from the lungs; symptoms of poisoning begin within seconds to minutes.

70.020
Hydrogen Cyanide (HCN)
Special Operations Treatment

2. **The odor of cyanide does not provide adequate warning of hazardous concentrations.** Perception of the odor is a genetic trait (20% to 40% of the general population cannot detect hydrogen cyanide); also rapid olfactory fatigue can occur.
 3. Hydrogen cyanide is lighter than air.
- B. Skin/Eye Contact:** Exposure to hydrogen cyanide can cause skin and eye irritation.
1. More importantly, skin or eye absorption can contribute to systemic poisoning.
 2. After skin exposure, onset of symptoms may be delayed.
- C.** Ingestion of hydrogen cyanide solutions or cyanide salts can be rapidly fatal.

Acute Exposure:

A. CNS

1. Signs and symptoms usually develop rapidly.
2. Initial symptoms are nonspecific and include:
 - a. Excitement
 - b. Dizziness
 - c. Nausea and vomiting
 - d. Headache
 - e. Weakness
3. Progressive signs and symptoms may include:
 - a. Drowsiness
 - b. Tetanic spasm
 - c. Lockjaw
 - d. Convulsions
 - e. Hallucinations
 - f. Loss of consciousness
 - g. Coma

B. Cardiovascular

1. Abnormal heartbeat can occur in severe poisoning, resulting in:
 - a. Bradycardia
 - b. Shock
 - c. Death
2. High blood pressure and a rapid heartbeat may be early transient findings.

C. Respiratory

1. As systemic poisoning begins, victims may complain of shortness of breath and chest tightness.
2. Pulmonary findings may include rapid breathing and increased depth of respiration.
3. As poisoning progresses, respirations become slow and gasping; cyanosis may be present, and pulmonary edema may develop.

- D. Metabolic:** An anion-gap, metabolic acidosis occurs in severe poisoning from increased blood levels of lactic acid.

70.020
Hydrogen Cyanide (HCN)
Special Operations Treatment

E. Dermal

1. Contact with liquid hydrogen cyanide causes skin irritation.
2. Dermal absorption can occur leading to systemic toxicity.

F. Ocular

1. When splashed in the eye, hydrogen cyanide can cause eye irritation and swelling.
2. Eye contact with cyanide salts has produced systemic symptoms in experimental animals.

Treatment:

- A.** Patients who rapidly regain consciousness and who have no other signs or symptoms may not require antidote treatment.
- B.** Patients who remain comatose or develop shock should be treated as soon as possible with a cyanide antidote.
1. Administration of an antidote is a higher priority than establishment of definitive airway or other ALS procedures.
 2. Hydroxocobalamin is the preferred antidote.
 3. Hydroxocobalamin and sodium thiosulfate may be administered to the same patient but NOT simultaneously.
 4. **In cases of ingestion:**
 - a. **Do not induce emesis.**
 - b. **Do not administer activated charcoal.**
 - c. **If the victim is symptomatic, immediately institute emergency life support measures, including use of a cyanide antidote kit.**
- C.** Hydroxocobalamin (Cyanokit®)
1. Adult dose 5 gram of Hydroxocobalamin IV/IO over 7-15 minutes.
 2. Pediatric dose is 70 mg/**kg** IV / IO over 7-15 minutes.
 3. See Hydroxocobalamin (Cyanokit®) for precautions and repeat dosing.
- D.** Sodium Thiosulfate
1. Adult dose is 50 mL of 25% solution IV/IO infused over 10-20 minutes.
 2. Pediatric dose is 1.65 mL/**kg** IV / IO infused over 10-20 minutes.

Transport to Medical Facility:

- A.** Report to OLMC: the destination hospital, the condition of the patient, treatment given, and the ETA to the destination hospital.

Multiple Casualty:

- A.** Consult with OLMC for advice regarding triage of multiple victims.
- B.** Patients who have only brief inhalation exposure and mild or transient symptoms may be discharged from the scene after:
1. Their names, addresses and telephone numbers are recorded, and,
 2. They are advised to seek medical care promptly if symptoms develop or reoccur.

70.020
Hydrogen Cyanide (HCN)
Special Operations Treatment

Precautions:

- A.** Hydrogen cyanide is a volatile flammable liquid at room temperature; as a gas, it is flammable and potentially explosive.
- B.** Risk to patients by routes of exposure
 - 1.** Exposure by any route may cause systemic effects.
 - 2.** Hydrogen cyanide is absorbed by inhalation and can produce death within minutes.
 - 3.** Substantial absorption can occur through intact skin if vapor concentration is high.
- C.** Contamination risk to rescue personnel
 - 1.** Victims exposed only to hydrogen cyanide gas do not pose contamination risks to rescuers.
 - 2.** Persons whose clothing or skin is contaminated with cyanide containing solutions can secondarily contaminate personnel by direct contact or through off-gassing vapor.
 - 3.** Duty uniforms and nitrile or latex gloves offer no protection from cyanide.
 - 4.** All patients and personnel should be decontaminated following HAZMAT or Oregon Poison Center recommendations. When present, HAZMAT paramedic will provide recommendations for care and method of transport of patients (packaging of patient and use of isolation bag if available).

Hydrogen Fluoride

Identification:

CAS: 7664-39-3 UN: 1052 (Anhydrous) UN: 1790 (Solution)

Synonyms include hydrogen fluoride, fluoric acid, hydrofluoric, hydrofluoric acid, and fluorine monohydride.

Hydrogen fluoride is a colorless, fuming liquid or gas with a strong irritating odor. It is usually shipped in cylinders as a compressed gas. Hydrogen fluoride readily dissolves in water to form colorless hydrofluoric acid solutions' dilute solutions are indistinguishable from water. It is present in a variety of over-the-counter products at concentrations of 6% to 12%.

Precautions:

- A.** Hydrogen fluoride is a corrosive chemical that can cause immediate or delayed onset of deep tissue penetration. Absorption of fluoride ion can cause hypocalcemia, hypomagnesemia, and hyperkalemia, which may result in cardiac arrest.
- B.** Victims exposed only to hydrogen fluoride gas or vapors do not pose substantial risks of secondary contamination to personnel outside the Hot Zone.
- C.** Victims whose clothing or skin is contaminated with hydrogen fluoride liquid, solution or condensed vapor, can secondarily contaminate response personnel by direct contact or through off-gassing vapor.
- D.** Inhalation hazards result not only from exposure to hydrogen fluoride gas but also from fumes arising from concentrated hydrogen fluoride liquid. Even fairly low airborne concentrations of hydrogen fluoride produce rapid onset of eye nose and throat irritation.
- E.** Most hydrogen fluoride exposures occur by cutaneous contact with the aqueous solution. The fluoride ion, which penetrates tissues deeply, can cause both local cellular destruction and systemic toxicity.
- F.** Ingestion of even a small amount of hydrofluoric acid is likely to produce systemic effects and may be fatal.
- G.** Rapid decontamination is critical. Calcium containing gels, solutions and medications are used to neutralize the effects of hydrogen fluoride.

Health Effects:

- A. The toxic effects of hydrogen fluoride are due primarily to the fluoride ion, which is able to penetrate tissues and bind intracellular calcium and magnesium.
 - 1. This results in cell destruction and local bone demineralization.
 - 2. Systemic deficiency of calcium and magnesium and excess of potassium can occur.
 - 3. The adverse action of the fluoride ion may progress for several days.
- B. Hydrofluoric acid is weak compared with most other mineral acids.
 - 1. It can produce serious health effects when exposure occurs by any route.
 - 2. Effects are due to the fluoride ions' aggressive destructive penetration of tissues.

Routes of Exposure:

- A. **Inhalation**
 - 1. Inhalation hazards result not only from exposure to hydrogen fluoride gas but also from fumes arising from concentrated hydrogen fluoride liquid.
 - 2. Even low airborne concentrations of hydrogen fluoride produce rapid onset of eye, nose and throat irritation.
- B. **Skin/Eye Contact**
 - 1. Most hydrogen fluoride exposures occur by cutaneous contact with the aqueous solution.
 - 2. The fluoride ion, which penetrates tissues deeply, can cause both local cellular destruction and systemic toxicity.
- C. **Ingestion:** Ingestion of even a small amount of hydrofluoric acid is likely to produce systemic effects and may be fatal.

Acute Exposure:

- A. **Respiratory**
 - 1. The toxic effects of hydrogen fluoride are due primarily to the fluoride ion, which is able to penetrate tissues and bind intracellular calcium and magnesium.
 - 2. This results in cell destruction and local bone demineralization.
 - 3. Systemic deficiency of calcium and magnesium and excess of potassium can occur.
 - 4. The adverse effect of the fluoride ion may progress for several days.
 - 5. Inhaled hydrogen fluoride mist or vapor affects initially the nose, throat and eyes.
 - 6. Mild clinical effects include mucous membrane irritation and inflammation, cough and narrowing of the bronchi.
 - 7. Severe clinical effects include almost immediate narrowing and swelling of the throat, causing upper airway obstruction.
 - 8. Lung injury may evolve rapidly or may be delayed in onset for 12 to 36 hours.
 - 9. Accumulation of fluid in the lungs, constriction of the bronchi and partial or complete lung collapse can occur.
 - 10. Pulmonary effects can result even from slashes on the skin.

70.030

Hydrogen Fluoride

Special Operations Treatment

B. Dermal

1. Depending on the concentration and duration of exposure, skin contact may produce pain, redness of the skin, and deep slow healing burns.
2. Acid concentrations of more than 50% (including anhydrous hydrogen fluoride) cause immediate severe, throbbing pain and whitish discoloration of the skin, which usually forms blisters.
3. Hydrogen fluoride solutions from 20% to 50% may produce upon and swelling which may be delayed for up to 8 hours.
4. Hydrogen fluoride solution of less than 20% cause almost no immediate pain on contact, but may cause delayed serious injury 13 to 24 hour later.

C. Ocular

1. Mild effects of hydrogen fluoride exposure include rapid onset of eye irritation.
2. More severe effects, which may result from even minor hydrofluoric acid splash include, sloughing of the surface of the eye, swelling of the structures of the eye, and cell death due to lack of blood supply.
3. Potentially permanent clouding of the eye surface may develop immediately or after several days.

D. Gastrointestinal

1. Ingestion of hydrofluoric acid may cause corrosive injury to the mouth, throat, and esophagus.
2. Inflammation of the stomach with bleeding occurs commonly.
3. Nausea, vomiting, diarrhea and abdominal pain may occur.
4. Systemic effects are likely and acid-base imbalance can occur after acute ingestion.
5. Pulmonary aspiration may lead to respiratory complications.

E. Electrolyte disturbances

1. Exposure by any route may result in systemic effects, namely low levels of calcium and magnesium and high levels of potassium in the blood.
2. Low blood pressure, irregular heartbeat, involuntary muscle contraction, seizure and death may ensue.

Treatment

- A. ABC Reminders:** Severe HF exposure results in acid burns but can also lead to systemic toxicity resulting in severe electrolyte abnormalities including hypocalcemia, hypomagnesemia and hyperkalemia which can lead to a prolonged QT interval and cardiac rhythm abnormalities.
- B. Inhalation Exposure:** Calcium gluconate may be administered to victims who have severe respiratory distress using oxygen by nebulizer:
1. 3 mL of calcium gluconate 10%. Administer continuously.

C. Skin Contact

1. Treatment
 - a. Continuously massage the burned area with calcium gluconate gel (2.5 gram in 100 mL water-soluble lubricant such as K-Y[®] Jelly) until the pain is relieved.
 - b. Wear 2 sets of rubber gloves to protect from secondary contamination.
 - c. If some relief of pain is not obtained within 30 to 60 minutes, consider calcium gluconate 10% injections.

D. Eye Contact

1. Do not use oils, salves, or ointments for injured eyes.
2. Do not use Zephiran or the gel form of calcium gluconate in eyes, as described for skin treatment.
3. Irrigate exposed eyes with a 1% aqueous solution of calcium gluconate (50 mL of 10% solution in 450 mL of sterile saline) using a nasal prong or Morgan Therapeutic Lens[®]
 - a. Up to 500 mL over 1 to 2 hours may be used.
 - b. If calcium gluconate is not available, use normal saline for irrigation.
4. A topical anesthetic can minimize the tendency for eyelid closure and facilitate insertion of an irrigation lens. One or two drops of Proparacaine or Tetracaine will usually provide rapid-onset ocular anesthesia for 20 minutes to an hour.

E. Ingestion Exposure

1. **Do not give emetics or activated charcoal.**
2. If the patient is conscious and alert, and treatment has not been administered previously, immediately give 4 to 12 ounces of water to dilute the acid.
3. Orally administer a one-time dose of 2-3 ounces of Mylanta, Maalox, or Milk of Magnesia; the magnesium in these products may bind the fluoride in the stomach.
4. Extreme throat swelling may cause airway obstruction, which may require endotracheal intubation or cricothyroidotomy.

F. Systemic Toxicity

1. Treat suspected hypocalcemia using calcium gluconate (10 mL of 10% solution) over 2-3 minutes. Repeat doses may be required.
2. Boluses can be repeated until improvement of ECG (QT), or symptoms improve.
3. Administer 2 grams of magnesium over 20 minutes.

Transport to a Medical Facility

A. If hydrofluoric acid has been ingested:

1. Prepare the ambulance in case the victim vomits toxic material.

Organophosphates

Identification:

CAS 56-38-2 UN 2783

Synonyms include a variety of trade names: Alkron, Alleron, Danthion, DNTP, DPP, Ethyl Parathion, Etilon, E-605, Stathion, Sulphos, and Thiophos.

Precautions:

A. Organophosphates are highly contaminating:

1. Victims whose skin or clothing is contaminated with liquid or powdered organophosphate can secondarily contaminate response personnel by direct contact or off gassing of solvent vapor.
2. Clothing and leather goods (e.g., belts or shoes) cannot be reliably decontaminated; they should be incinerated.

B. Mild organophosphate poisoning can cause:

1. Headache
2. Nausea
3. Vomiting
4. Abdominal cramps
5. Diarrhea

C. Moderate organophosphate poisoning can result in:

1. Generalized muscle weakness and twitching.
2. Slurred speech
3. Pinpoint pupils
4. Excessive secretions
5. Shortness of breath

D. Severely poisoned patients may develop:

1. Seizures
2. Skeletal-muscle paralysis
3. Respiratory failure
4. Become comatose

E. **Treatment consists of** thorough decontamination, cardiorespiratory support, and administration of antidotes.

F. **Commercial organophosphate products may contain hydrocarbon solvents** such as xylene or toluene, which themselves can cause toxicity.

G. Organophosphates

1. At room temperature, Organophosphate is a combustible liquid that may be difficult to ignite.
2. In commercial products, organophosphate is usually dissolved in hydrocarbon solvents such as toluene or xylene, which are flammable.

H. At room temperature, organophosphates are a yellow-to-brown liquid with an odor of garlic.

1. It is often dissolved in a hydrocarbon solvent before use.
2. Organophosphate itself is not volatile.
3. It is almost insoluble in water, slightly soluble in petroleum oils, and miscible with many organic solvents.

I. Persons whose skin or clothing is contaminated with liquid or powdered organophosphate can cause secondary contamination by direct contact.

J. Because organophosphates have a low vapor pressure, significant inhalation is unlikely at ordinary temperatures.

1. However, the hydrocarbon solvents in commercial preparations can be inhaled.
2. Organophosphates are rapidly absorbed through intact skin, resulting in acute systemic toxicity.

Routes of Exposure

A. Inhalation

1. Toxic inhalation of organophosphate vapor is unlikely at ordinary temperatures because of its low volatility, but toxic effects can occur after inhalation of organophosphate sprays or dusts.
2. The hydrocarbon solvents (most commonly toluene and xylene) used to dissolve organophosphate are more volatile than organophosphate itself, and toxicity can result from inhalation of solvent vapor as well.

B. Skin/Eye Contact: Organophosphates are rapidly absorbed through intact skin or eyes, contributing to systemic toxicity.

C. Ingestion: Acute toxic effects, including rapidly fatal systemic poisoning, can result from ingestion of organophosphates.

Health Effects:

A. Prominent manifestations of organophosphate poisoning include:

1. Abdominal cramps
2. Vomiting
3. Diarrhea
4. Pinpoint pupils
5. Excessive sweating
6. Wheezing
7. Excessive tracheo-bronchial secretions
8. Agitation
9. Seizures
10. Muscle twitching
11. Weakness

- B. Commercial pesticides may contain xylene or toluene as solvents, and some of the toxicity of pesticides may be related to these hydrocarbons.

Acute Exposure:

A. Introduction

1. Organophosphates alter cholinergic synaptic transmission at neuroeffector junctions (muscarinic effects), at skeletal myoneural junctions and autonomic ganglia (nicotinic effects), and in the CNS.
2. Signs and symptoms of poisoning vary according to age, dose, and concentration.
 - a. Muscarinic effects include: pinpoint pupils; blurred vision; hypersecretion by salivary, lacrimal, sweat, and bronchial glands; narrowing of the bronchi; nausea, vomiting, diarrhea, and crampy abdominal pains; urinary and fecal incontinence; and slow heart rate.
 - b. Nicotinic effects include: Muscle twitching, cramping, and weakness.
3. Nicotinic stimulation can obscure certain muscarinic effects and produce rapid heart rate and high blood pressure.

B. CNS

1. CNS effects are often the earliest manifestations of poisoning in adults and constitute the major signs and symptoms in children.
2. CNS effects include: Irritability, nervousness, giddiness, fatigue, lethargy, impairment of memory, confusion, slurred speech, visual disturbance, depression, impaired gait, convulsions, loss of consciousness, coma, and respiratory depression.

C. Respiratory

1. Narrowing of the bronchi and markedly increased bronchial secretions can occur.
2. Respiratory failure results from respiratory depression coupled with paralysis of the respiratory muscles and progressive airway obstruction from bronchorrhea.
3. Pulmonary aspiration of the hydrocarbon solvent can cause inflammation of the lungs.

D. Cardiovascular

1. Most exposure victims experience bradycardia, but pulse rate may be increased initially and tachycardia is more common in very severe poisoning.
2. Irregular heartbeat may occur.

E. Gastrointestinal: Nausea, vomiting, abdominal cramps, diarrhea, and fecal incontinence are common manifestations, regardless of the exposure route.

F. Metabolic: Profuse sweating is likely to occur and may lead to profound dehydration.

G. Dermal

1. Organophosphates are readily absorbed through the skin.
2. Dermal contact can result in systemic poisoning.

H. Ocular

1. Systemic poisoning typically causes pinpoint pupils-and spasm of the muscle of visual accommodation (i.e., ciliary muscle) leading to blurred vision and aching pain in the eye.
2. Organophosphate poisoning may still be present without pinpoint pupils, and dilation of the pupils may even be noted occasionally.
3. Eye irritation, if it occurs, is most likely caused by the hydrocarbon solvents used in commercial pesticide preparations.

I. Potential Sequelae

1. Complete recovery should occur within 10 days unless severe lack of oxygen has caused residual brain damage.
2. CNS effects such as confusion, fatigue, irritability, nervousness, and impairment of memory can occasionally last for several weeks.
3. Six to twenty-one days after acute exposure to some organophosphate compounds, onset of nerve disorders of mixed sensory-motor type may occur, peripheral nerve recovery may never be complete.
4. It is uncertain if organophosphate produces this delayed polyneuropathy.

Basic Decontamination:

- A. Victims who are able and cooperative may assist with their own decontamination.
- B. Remove and double-bag contaminated clothing and personal belongings.
- C. Clothing, especially leather items, is extremely difficult to decontaminate; in most cases, contaminated clothing should be incinerated as directed by hazardous materials experts.
- D. Flush exposed skin and hair with plain water for 2 to 3 minutes, then wash twice with mild soap.
 - 1. Be certain to clean under fingernails and in all skin folds.
 - 2. Rinse thoroughly with water.
 - 3. Irrigate exposed or irritated eyes with plain water or saline for 5 minutes.
 - a. Remove contact lenses if present and easily removable without additional trauma to the eye.
 - b. Continue eye irrigation during other basic care and transport.
- E. **In cases of ingestion.**
 - 1. **Do not induce emesis.**
 - 2. If the victim is alert and able to swallow, consult OLMC for activated charcoal.
- F. As soon as basic decontamination is complete, move the victim to the Support Zone.

ABC Reminders:

- A. Quickly ensure a patent airway.
- B. If trauma is suspected, maintain cervical immobilization manually and apply a cervical collar and a backboard when feasible.
- C. Ensure adequate respiration.
 - 1. Administer supplemental oxygen as required.
 - 2. Apply pulse oximeter.
- D. Ensure a palpable pulse.
- E. Establish intravenous access, if necessary.
- F. Attach a cardiac monitor.
- G. Airway suctioning may be required for excessive bronchial secretions.

Additional Decontamination:

- A. Continue irrigating exposed skin and eyes, as appropriate.
- B. In cases of ingestion, **do not induce emesis.**
- C. If the victim is alert and able to swallow, consult OLMC for activated charcoal (1 gram/**kg**) if not given previously.

Advanced Treatment:

ABCs

- A. Symptom classification:
 1. **Mild:** Excessive upper airway secretions, moderate difficulty breathing.
 2. **Moderate:** Severe weakness, inability to stand, sit up, or lift arms or legs against gravity.
 3. **Severe:** Life threatening weakness; compromise of ventilatory muscles and inadequate tidal volume.
- B. The initial treatment doses (see below) of Duodote/ Mark 1 should be administered via IM route and based on the severity of the symptoms.
 1. Mild poisoning, (one Duodote™ or one Mark 1 auto-injector)
 2. Moderate poisoning, (two Duodotes™ or two Mark 1 auto-injectors)
 3. Severe poisoning, (three Duodotes™ or three Mark 1 auto-injectors)
 4. In children, refer to dose cards.

Subsequent *atropine* doses (2 - 5 mg adults/ 0.05 mg/**kg** IV or IO) should be repeated every 3-5 minutes until excessive secretions and sweating have been controlled. Alterations of pulse rate and pupillary size are unreliable indicators of treatment adequacy. Very large doses of atropine (10 - 20 mg) may be required in seriously poisoned patients.

Grading of Severity of Poisoning:			
	Mild	Moderate	Severe
Motor	Walks and talks	Unable to walk, sitting	Unable to sit
Mental Status	Awake and alert	Drowsy	Confused, unconscious Convulsions
Respiratory	Mild SOB	Moderate SOB	Severe SOB Rales, rhonchi
Skin	Mild sweating	Moderate sweating	Profuse sweating
GI	Nausea Abdominal pain	Nausea and vomiting Abdominal pain	Continuous nausea and vomiting
Secretions	Salivating Rhinorrhoea	Secretions but able to maintain airway	Frothing, unable to maintain secretions
Duodotes/ Mark I (Adult)	One	Two	Three

70.040
Organophosphates
Special Operations Treatment

- C. Patients with severe symptoms can have seizures. Treat with midazolam per seizure protocol.
- D. Consult OLMC or HAZMAT paramedic for further pralidoxime (2PAM) treatment, if profound weakness or paralysis present.
- E. Patients who are comatose, hypotensive, have seizures, or cardiac dysrhythmias should be treated according to ALS protocols.

Side Effects/Special Notes:

- A. For severely symptomatic patients, initiate antidotes (Duodotes™ or Mark 1) as soon as possible (including before decontamination).
- B. Secure protected airway in cases of respiratory compromise.
 - 1. There is no contraindication to the use of paralytic agents in this setting.
 - 2. Succinylcholine will have a significantly sustained duration of paralysis in the presence of organophosphates.

Transport to Medical Facility:

- A. **Report to OLMC:** the receiving medical facility, the condition of the patient, treatment given, and estimated time of arrival at the medical facility.
- B. If organophosphate has been ingested:
 - 1. Prepare the ambulance in case the victim vomits toxic material.
 - 2. Prepare several towels (or other absorbent material) and open plastic bags to quickly clean up and isolate vomitus.

Multi-Casualty Triage:

- A. **Consult with OLMC** for advice regarding triage of multiple victims.
- B. Patients who have histories or evidence suggesting substantial exposure and all persons who have ingested organophosphate should be transported to a medical facility for evaluation.
 - 1. Others may be discharged from the scene after their names, addresses, and telephone numbers are recorded.
 - 2. They should be advised to seek medical care promptly if symptoms develop or recur.

Field Amputation

Indications:

- A. Patient has an entrapped extremity, extrication will not occur rapidly, the patient is in shock (life before limb).
- B. The patient has an entrapped extremity, extrication will not occur rapidly and the patient is in the situation where further structural collapse or bodily injury is imminent if they are not rapidly extricated.

Procedure:

- A. Perform initial physical assessment.
- B. Ensure the patient's airway is patent and obtain IV or IO access.
- C. Once the decision has been made to perform a field limb amputation, obtain verbal consent, if possible, from the patient undergoing the limb amputation.
- D. Provide analgesia and sedation for the patient.
- E. Ensure you have proper body substance isolation and protective gear on.
- F. Identify which saw you are going to use.
- G. Place tourniquet(s) on the affected extremities as far distally as possible but proximally to the site of the proposed amputation.
- H. Apply clean pads around the amputation site.
- I. Apply betadine solution to the skin and allow drying for 2 minutes.
- J. Tighten the tourniquets and record the time on the tourniquet.
- K. With a scalpel, make an incision medially and extend it laterally as far as possible.
- L. Incise all the soft tissue, down to bone.
- M. Isolate the neurovascular bundle (Optional).
 - 1. Place a hemostat or McGill forceps underneath the bone, using a back and forth motion to allow for further dissection of the tissue.
 - 2. Place a Kerlix in the jaws of the hemostat or McGill's and pull the Kerlix underneath the bone.
 - 3. Grab both ends of the laparotomy pad and move the laparotomy pad back and forth to allow for further dissection and retraction.
- N. Take the safety off the battery operated bone saw and test the saw.
- O. Place the saw blade perpendicular to the bone and begin sawing. You will feel release of the bone when you are completely through.
- P. Place the safety back on the saw and put the saw down.
- Q. Using the scalpel, cut the remaining soft tissue to complete the amputation.
 - 1. If you have continued bleeding, confirm that the tourniquet is properly applied or apply another tourniquet just above or below the first tourniquet and tighten.

2. If bleeding continues, apply combat gauze and hold direct pressure over the site of bleeding.
 3. If this is not possible or fails to control bleeding, selective clamping of bleeding vessels is done with a hemostat.
- R.** Place sterile, saline soaked gauze over the end of the limb and cover with Coban followed by Ace bandage.
- S.** Amputated Limb.
1. If you are able to retrieve the amputated limb, place sterile, saline soaked gauze over the end and secure in place with an Ace bandage.
 2. Place the amputated limb in a clean bag and transport to the hospital with the patient.
 3. The decision on whether an amputated limb can be reimplanted must be left to the surgical team at the hospital.
 4. Again, if the limb can be retrieved in a safe and timely manner, transport it with the patient to the hospital.

Precautions:

- A.** The purpose of this protocol is to enable the paramedic to assist the trauma surgeon or EMS Medical Director in the procedure of field amputation.
- B.** The physician must make the decision whether to perform a field amputation.

Ventilator Management

Purpose:

To provide general guidelines for patients whose breathing is being assisted by mechanical ventilation.

Indications:

- A. Continuation of breathing support for chronic ventilator dependent patients.
- B. Ventilation of any intubated patient in respiratory failure/arrest that during transport to a care facility.

Adverse Effects/Complications:

- A. Increased intra-thoracic pressure leading to decreased venous return to the heart and decreased cardiac output (hypotension, tachycardia).
- B. Increased V/Q ratio (ventilation/perfusion ratio).
- C. Decrease blood flow to the kidney with resultant fluid retention (edema).
- D. Air trapping and intrinsic PEEP (auto PEEP) with secondary pulmonary barotrauma.
- E. Nosocomial infections of the lungs.
- F. Metabolic complications (acidosis/alkalosis).
- G. Agitation and increased respiratory distress.
- H. Increased work of breathing.

General Transport Ventilator Settings:

A. Mode:

Method of delivering different types of breaths

1. Control (CMV) – Preset volume or pressure at preset rate. Used only on patients with no intrinsic respiratory effort.
2. Assist Control (AC) – Preset volume or pressure at preset rate. Patient receives preset volume or pressure regardless of intrinsic or machine initiated breath.
3. Synchronized Intermittent Mandatory Ventilation (SIMV) – Preset volume or pressure at preset rate. Pt may take additional breaths independently at any tidal volume without assistance from ventilator.
4. Bi-level Positive Airway Pressure (BiPAP) – Provides both inspiratory and expiratory positive airway pressure support. Both inspiratory and expiratory pressures can be set.

B. Percent of inspired oxygen (FiO₂):

1. Amount of oxygen delivered to the patient. User adjustable from room air (21%) to 100%.

C. Respiratory rate (RR):

1. Number of breaths per minute.

D. Tidal Volume (V_t):

1. Volume of air moved in and out of the lungs with each normal breath. Normal adult is approximately 7 ml/kg ideal body weight (500 – 550 ml).

E. Inspiratory/Expiratory Ratio (I:E)

1. The ratio of the duration of inspiration to the duration of expiration. During spontaneous breathing normal I:E ratio is 1:2, indicating the expiratory time is about twice as long as inspiratory time.

F. Inspiratory Time (I:Time)

1. The length of the inspiratory phase of the breathing cycle. Setting the inspiratory time and rate determines the I:E ratio.

G. Peak Inspiratory Pressure (PIP)

1. The highest pressure that will be delivered in the ventilator circuit.

H. Pressure Support (PS)

1. Provides inspiratory gas flow to a preset pressure to support a patient's spontaneous respiratory effort.

I. Positive End Expiratory Pressure (PEEP):

1. The pressure that prevents the airway pressure from reaching ambient at the end of expiration to help decrease alveolar collapse.

Procedure:**Patients already on Ventilator**

- A. As part of your initial patient assessment, inquire if patient has any spontaneous respiratory effort or is 100% dependent on the ventilator.
- B. Make note of patient's vital signs before any change over occurs. This includes the pulse oximetry.
- C. Assess the ET tube or Trachea tube placement to assure they are properly secured.
- D. Acquire the patient's current ventilator settings, including what the patient's peak airway pressures have been, from the nurse or respiratory therapist caring for the patient. Match these settings on the transport ventilator to be used before patient is switched to transport ventilator. Crews should not take pt off ventilator until the respiratory therapist is there.
- E. Ensure patient is on cardiac monitor and pulse oximetry prior to switching ventilators.
- F. Depending on reason for transport and patient's condition, consider IV access if not already in place.
- G. Have BVM and suction available.
- H. Switch patient over to the transport ventilator and observe for any distress. It may take a minute or so for the patient to become accustomed to the new ventilator.
- I. Closely monitor pulse oximetry, end tidal CO₂, patient's work of breathing, chest rise, return of set tidal volumes, and peak airway pressures for any signs of hypoxia/distress. Remove patient from ventilator and assist respirations with and BVM if there are ANY concerns or problems with ventilation after patient was switched to transport ventilator.
- J. Once patient has been switched to the transport ventilator and is tolerating this well, then move patient over to the EMS stretcher for transport.

K. If alarm on ventilator sounds, immediately check patient.

Intubated patients not already on ventilator

- A. Ventilate patient with BVM until ventilator can be set up.
- B. Patient should be on heart monitor and pulse oximetry and have vascular access established. Suction should be immediately available.
- C. Initial ventilator settings (set as allowed on your device):

Condition	Rate	Vt	PEEP	I:E	I:Time	PS	Mode	FiO2
OD / Stroke / TBI	10-14	8	0-5	1:2	1-1.2		AC	1.0
COPD / Asthma	6-10	6	0-5	1:4	1-1.2	6-8	AC	1.0
CHF / Pneumonia	10-14	6	5-15	1:2	1-1.2		AC	1.0

o *Titrate FiO2 to maintain saturations between 92 – 95%*

- D. Closely monitor pulse oximetry, end tidal CO2, patient's work of breathing, chest rise, return of set tidal volumes, and peak airway pressures for any signs of hypoxia/distress. If any distress or concerns (e.g. unresolved alarms, patient condition deteriorates) remove from ventilator and assist respirations with BVM.
- E. Notify hospital early so they can have a ventilator set up on your arrival.
- F. Document ventilator settings, vital signs, pulse oximetry, patient response.

Troubleshooting:

If problems arise with the patient or equipment during transport that cannot be immediately resolved remove from ventilator and assist respirations with BVM.

Common problems include:

- A. Displacement - Verify the ventilator tubing is connected to the endotracheal tube. Make sure that the ET is correctly placed.
- B. Obstruction - Mucus plug, blood, kink.
- C. Pneumothorax - Follow Tension Pneumothorax Decompression protocol.
- D. Equipment failure - Remove patient from ventilator and assist respirations with BVM.

Common Alarms:

- A. Low Battery/power source:
 1. Sounds when electrical supply to the ventilator is inadequate or the gas inlet pressure is low. It is corrected by restoring the proper power supply.
- B. Low-pressure alarm causes:
 1. Leak or disconnection (reconnect or tighten connections).
 2. Cuffed tube may be leaking.
 3. Check O2 supply.

High-pressure alarm causes:

- A. Bronchospasm.

- B. Secretions in airway that increase the resistance/pressure in the airway.
- C. Kinks in ET tube.
- D. Biting on ET tube.
- E. Coughing.
- F. Gagging.
- G. Breathing asynchronously or bucking the vent.
- H. Alveolar over distention.
- I. Improper ventilator settings (High or low tidal volumes, excessive rate causing stacking and auto PEEP).
- J. Water in the ventilator.
- K. Pneumothorax.
- L. Patient anxiety.

Notes and Precautions:

- A. Contraindications include ongoing CPR, suspected pneumothorax, and patients < 50 kg.
- B. There are many commercial ventilators on the market. Most of the ventilators used in the pre-hospital settings are fairly simple to use. Most if not all have built-in safety features, which prevent over inflating the lungs and causing barotrauma. Everyone must be properly trained and with the particular ventilator being used prior to operating it.

Impact Uni-Vent Model 73X

Purpose:

To provide prolonged ventilation.

Indications:

Need for prolonged ventilation.

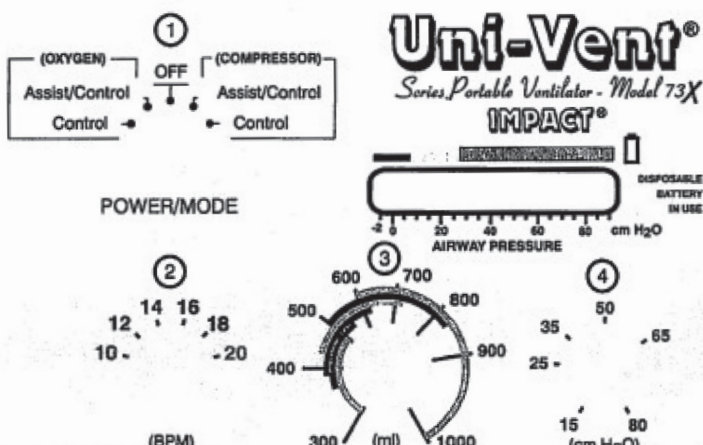
Procedure:

- A. O₂ operation.
 1. Secure O₂ hose to 55 PSI source and model 73x fitting marked "Oxygen In."
 2. If O₂ cylinder is used, slowly open the cylinder valve: Follow steps 3-8.
- B. Internal compressor operation: Follow steps 3-8.
- C. Connect the 3 ventilator circuit tubings (Gas Output, Transducer, and Exhalation Valve) to mating fittings on ventilator. Do not attach ventilator to patient until control settings are made and proper operation is verified.
- D. Select Operating Mode by rotating Power/Mode Switch (1) to appropriate setting.
 1. Control - used during transport when considerable motion artifact is present and patient is not spontaneously breathing.
 2. Assist/Control - for use with patients requiring mechanical support.
- E. Select: Breath Rate (2) between 10-12 breaths per minute. Set Tidal Volume (V_T) setpoints 3) between 6-10 mL/**kg** ideal body weight, (stay within the Tidal Volume color range), and Airway Pressure Limit / Alarm (4) setpoints (Default 35 cm H₂O for adults, 20-30 cm H₂O for children).
- F. Attach ventilator circuit to patient.
- G. Check hose connection for leaks.
- H. Verify "chest rise" during ventilation. Increase Tidal Volume (V_T) setpoint as required (3).
- I. If High Pressure Alarm activates, verify correct Tidal Volume setting (3). Also look for airway or ventilator circuit occlusion. If no occlusion, increase High Pressure Relief Alarm(4) Setpoint until relief mechanism "chatter during inspiration stops."
- J. Adjust settings to maintain PaO₂ > 90%, EtCO₂ between 35-40 mm Hg.

Impact Uni-Vent Model 73X Protocol Special Operations Procedures

Precautions:

- A. Contraindications include Active CPR, suspected pneumothorax, inability to maintain adequate oxygenation ($\text{PaO}_2 > 90\%$), pediatric patient under 30 kg (66 lbs).
- B. Initial settings should be 100% oxygen, ventilatory rate between 8-12 breaths per minute, and tidal volume 6-10 mL/kg ideal body weight. Attempt to decrease tidal volume to 6 mL/kg to minimize barotrauma.
- C. If patient becomes unstable or saturations $< 80\%$ disconnect from ventilator and bag patient with 100% FiO_2 .



Uni-Vent®
Series Portable Ventilator - Model 73X
IMPACT®

DISPOSABLE BATTERY IN USE

AIRWAY PRESSURE (cm H₂O)

BREATH RATE (BPM)

TIDAL VOLUME (V_T) (ml)

AIRWAY PRESSURE LIMIT/ALARM (cm H₂O)

ALARM CENTER

EXT POWER LOW/FAIL	LOW BATTERY (Less than 30 minutes of operating time remains)	LOW OXYGEN (Oxygen input pressure to ventilator is less than 41 PSI)	V _T SETTING (Tidal Volume setting is too high or too low based on breathing rate. Increase/decrease Tidal Volume setting as required)	PATIENT DISCONNECT (Low airway pressure detected. Check patient circuit for disconnect, leakage at airway, loose or disconnected hose/fitting)	HIGH AIRWAY PRESSURE (Airway Pressure Limit/Alarm setpoint exceeded on 4 consecutive breaths. Check airway, check patient. Check alarm setpoint)
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CONDENSED OPERATING INSTRUCTIONS

1. O₂ operation: secure O₂ hose to 55 PSI source and Model 73X fitting marked "OXYGEN IN". If O₂ cylinder is used, slowly open the cylinder valve. Follow steps 3 through 8.
2. Internal compressor operation: follow steps 3 through 8.
3. Connect ventilator circuit tubing to mating fittings on ventilator. DO NOT attach ventilator to patient until control settings are made and proper operation is verified.
4. Select Operating Mode by rotating Mode Switch ① to appropriate setting:
Control - use during transport when considerable motion artifact is present and patient is not spontaneously breathing.
Assist/Control - for use with patients requiring mechanical support.
5. Select: Breathing Rate ②, Tidal Volume setpoints ③ (stay within Tidal Volume color range), and Airway Pressure Limit/Alarm setpoints ④ (default 35 cm H₂O for adults, 20 to 30 cm H₂O for children).
6. Attach ventilator circuit to patient. Check hose connections for leaks.
7. Verify "chest rise" during ventilation - increase Tidal Volume setpoint ③ as required.
8. If High Pressure Alarm activates, verify correct Tidal Volume setting ③. Also look for airway or ventilator circuit occlusion. If no occlusion, increase High Pressure Relief/Alarm setpoint ④ until relief mechanism "chatter" during inspiration stops.

BATTERY CHARGE

— Charged
- - - - Charging

ALARM MUTE/CANCEL (30 Seconds)
- or - **TEST** (Rechargeable Battery Only)

DO NOT BLOCK

MCEMS Surgical Cricothyrotomy

Indications:

- A. When a patient's airway cannot be secured using nonsurgical methods (e.g. oral or nasal intubation and when rescue devices do not work.
- B. When an airway is required immediately in a patient who is not a candidate for orotracheal or nasotracheal intubation (i.e., in the case of severe facial trauma).

Contraindications:

- A. Relatively contraindicated in children less than 10 years of age (needle cricothyrotomy preferred).

Equipment needed:

- A. Scalpel
- B. Bougie
- C. Size 5.5 or 6-0 ETT
- D. Trach hook (highly recommended)

Procedure:

- A. Assemble equipment.
- B. Place the patient in the supine position.
- C. Hyperextend the patient's neck and straighten the airway by placing a blanket or similar object under the patient's neck or between the shoulder blades. Note that airway has priority over suspected c-spine injury.
- D. Locate and prep the cricothyroid membrane.
 - 1. Place a finger of the nondominant hand on the thyroid cartilage (Adam's apple) and slide the finger down to find the cricoid cartilage.
 - 2. Palpate for the "V" notch of the thyroid cartilage.
 - 3. Identify the cricothyroid membrane by sliding the index finger down into the depression between the thyroid and cricoid cartilage.
- E. Prep the skin over the membrane with povidone-iodine.
- F. With a scalpel in the dominant hand, make a 3-4 cm vertical (head to toe) incision through the skin exposing the cricothyroid membrane.
- G. Once skin incised, palpate cricothyroid membrane position and blunt dissect with fingers through subcutaneous tissue until the membrane is readily identifiable. Ignore bleeding until airway is secure (ETT placement usually has a tamponade effect)
- H. Relocate the cricothyroid space by touch and sight.

- I. Stabilize the larynx with one hand and make a 1 inch horizontal incision (arm to opposite arm through the cricothyroid membrane with the scalpel blade. Drag scalpel blade from one side to the other then turn knife through 180 degrees and extend to the other side (some prefer to extend the membrane with forceps). NOTE: A rush of air may be felt through the opening. Look for bilateral rise and fall of the chest.
- J. Dilate with gloved finger and palpate tracheal lumen, ideally identifying the cartilage of the posterior wall of the trachea/cricoid ring.
- K. If available, use the tracheal hook the on the inferior portion of the tracheal cartilage and increase the opening by raising the hook.
- L. Insert the bougie into the tracheal opening. Confirm bougie position with finger, ensuring it passes through membrane. Bougie usually holds up at carina <10cm from the skin (may feel tracheal rings as the bougie advances), do not force if hold up as may perforate carina.
- M. Insert the E T tube (5.5 or 6.0 F) or other airway tube over the bougie through the opening into the trachea at a 90° angle to the trachea. Ensure the ETT balloon is fully deflated and twist ETT as it passes the skin (hold up here is common). Once in the trachea, direct the tube toward the feet at a 45° angle. Only advance the ETT until the balloon is within the airway and no longer visible. Avoid inserting the airway more than 3 -4 inches to avoid mainstem bronchus intubation.
- N. Inflate the E T cuff if applicable. Do NOT let go of the ET tube until it is secured (see below).
- O. Connect BVM bag to the tube and inflate the lungs. Check breath sounds.
- P. Connect EtCO2 monitor to confirm placement.
- Q. If air flows freely, and the patient is breathing on his own, proceed to next step. If the patient is NOT breathing on his own, continue providing respirations via BVM.
- R. Secure the ET tube using tape or ET Tube holder.
- S. Suction the patient's airway, as necessary.
- T. Apply a dressing to further protect the tube or catheter and incision using one of the techniques below.
 1. Cut two 4 X 4 s or 4 X 8 s halfway through. Place them on opposite sides of the tube so that the tube comes up through the cut and the gauze overlaps. Tape securely.
 2. Apply a sterile dressing under the patient's tube by making a V-shaped fold in a 4 X 8 gauze pad and placing it under the edge of the catheter to prevent irritation to the patient. Tape securely.
- U. Monitor patient's respirations on a regular basis. Reassess air exchange and placement every time the patient is moved.

Precautions:

- A.** Troubleshooting ET placement.
 - 1.** Unilateral breath sounds and unilateral rise or fall of the chest indicate that the tube is past the carina or patient has a pneumothorax.
 - 2.** Air coming out of the patient's mouth indicates that the tube is pointed away from the lungs. Deflate the cuff on an ET tube, remove the tube, reinsert, inflate the cuff and recheck for air exchange and placement.
- B.** Control excessive bleeding with direct pressure. Apply combat gauze if necessary with direct pressure.