H-06 CYANIDE & HYDROGEN SULFIDE		First Responder EMT AEMT Paramedic

CYANIDE

Examples: Hydrogen cyanide, cyanogen chloride, potassium cyanide, sodium cyanide

Indication for concern/treatment:

- Possible exposure (**closed space fire**, occupational/industrial exposure, suicide attempt, etc.) AND
- Persistent hemodynamic instability (from severe acidosis) that **does not respond to typical resuscitation** (i.e. fluids & vasopressors).

HazMat Care/ Decontamination — E-01

Aggressive Respiratory & Hemodynamic Support:

- **100% O_2** & early **Endotracheal Intubation** if significantly altered mental status, per Airway/O2 Maintenance [A-01] and DAI/RSI [A-04].
- **IV/IO Access**, **Fluid Resuscitation and Vasopressors**, per IV Protocol [1-03] and Medical Shock [M-06].

HazMat Medic

Hydroxocobalamin (CyanoKit) 5 grams IV/IO over 15 minutes

Peds: 70 mg/kg (recommend discussion with Medical Control prior to administration)

- Reconstitute each vial (2.5 grams) with 100 ml sodium chloride → administer both vials in the kit.
- **Use a dedicated IV/IO line**. Not compatible with many drugs.
- For ingested or absorbed cyanide, additional doses may be required.

Alternative: **Lilly or Pasadena Kit**

Amyl Nitrite Pearls crushed and inhaled (or placed in a BVM), ***and/or***
Sodium Nitrite 300 mg IV/IO (10 mL of a 3% solution) over 2 minutes

THEN

Sodium Thiosulfate (50 ml of a 25% solution) over 10 minutes

Peds: **Amyl Nitrite**: same as adult, **Sodium Nitrite:** 0.33 mL/kg over 10 minutes, **Sodium Thiosulfate** 1.65 mL/kg *(recommend discussion with Medical Control prior to administration)*

STOP! Do NOT administer Amyl or Sodium Nitrite in cases of smoke inhalation (structure fires) or carbon monoxide poisoning. Administer only Sodium Thiosulfate or Hydroxocobalamin (as above).

H-06 CYANIDE & HYDROGEN SULFIDE		First Responder EMT AEMT Paramedic

CYANIDE NOTES:

- Cyanide is one of the most rapidly acting poisons.
- Reported to smell like “bitter almonds” (to those that are capable of detecting the odor)
- Interferes with cellular (mitochondrial) metabolism (disruption of oxidative phosphorylation through inhibition of cytochrome oxidase a3). This leads to cellular asphyxia, impaired adenosine triphosphate (ATP) production, and an anaerobic metabolism with lactate accumulation and metabolic acidosis.
- As oxygen is available but not able to be used, the patient will appear pink (i.e. not cyanotic) and pulse oximetry will indicate an unusually/unexpectedly high (i.e. normal) saturation.

TREATMENT NOTES:

- Hydroxocobalamin, a form of vitamin B_{12} binds cyanide to form the harmless cyanocobalamin form.
- Alternative (Methemoglobin Formers)
    - Methemoglobin binds cyanide (releasing it from the cell).
    - Methemoglobin (with or without bound cyanide or hydrogen sulfide) cannot carry oxygen and excessive methemoglobinemia lead to hypoxemia and acidosis.
    - Amyl Nitrite Pearls
        - Convert 3-5% of hemoglobin to methemoglobin
        - Administration: pearls should be broken and held on a gauze pad under the patient’s nose. Allow the patient to inhale the material for 15 to 30 seconds of every minute.
        - In general, give pearls first and then attempt IV/IO access.
    - Sodium Nitrite
        - Converts about 20% of hemoglobin to methemoglobin
    - Amyl Nitrite and Sodium Nitrite are a temporizing measure only, as Sodium Thiosulfate is then needed to convert cyanide into the relatively harmless thiocyanate.

H-06 CYANIDE & HYDROGEN SULFIDE		First Responder EMT AEMT Paramedic

HYDROGEN SULFIDE

Examples: Hydrogen sulfide, thioethers Hydrogen sulfide Sulfides, Thioethers, Mercaptans & Thiols

Indication for concern/treatment:	
• Possible exposure (**confined space accident involving sewers and wastewater systems**, occupational/industrial exposure, suicide attempt, etc.) AND • Persistent hemodynamic instability similar to Cyanide (above)	
Hydrogen Sulfide Treatment	
For patients <u>still conscious</u>: • Symptoms should resolve with supportive care.	For patients with <u>altered mental status or impaired cardiovascular function</u>: • Treat *as per Cyanide (above)* with **Amyl Nitrite and/or Sodium Nitrite** • Hydroxocobalamin and Sodium Thiosulfate have <u>not</u> been shown to……

HYDROGEN SULFIDE NOTES:

- High concentrations lead to a rapid loss of consciousness, seizures, and death occur after only a few breaths. H2S is the leading cause of death in confined space accidents involving sewers and wastewater treatment systems.
- Formed naturally by the decomposition of organic substances, and is heavier than air.
- It has also been used as an agent for a **chemically induced suicide**. Hydrogen sulfide can be made by mixing common household products.
- Same clinical effects as cyanide (interferes with cellular respiration), but unlike cyanide, the inhibition of cellular metabolism reverses rapidly when hydrogen sulfide exposure ceases.
- Treatment is similar to cyanide in that low-level methemoglobin formation may enhance conversion of sulfide to the less toxic sulfmethemoglobin.
- Sodium thiosulfate and hydroxocolalbumin are generally not necessary, and there is little evidence of benefit (though no evidence of harm).

H-06 CYANIDE & HYDROGEN SULFIDE		First Responder EMT AEMT Paramedic

NOTE: Poison Control may be contacted **[1-800-222-1222]** for **INFORMATION ONLY.** Treatment modalities must utilize these guidelines, or may be received received through online Medical Control.