Cyanide Awareness for Emergency Responders
Sodium Cyanide Awareness Outline

- Introduction
- Health Hazards
- Symptoms of Exposure
- First Aid
- Physical & Chemical Characteristics
- Chemical Incompatibilities
- Safe Handling
- Emergency Response
What is “Cyanide”?

- Hydrogen Cyanide ↔ HCN
  - Gas
  - Liquid (<35°F)
- Sodium Cyanide ↔ NaCN
  - Solid
  - Liquid
Cyanide Occurs Naturally

- Apple Seeds
- Lima Beans
  - Almonds
- Elder Berries
- Cassava Root (used to make Tapioca)
- Cigarette Smoke
Sodium Cyanide Industrial Uses

- Mining
- Insecticides
- Chicken Feed
- Dyes
- Electroplating
- Pharmaceuticals
Cyanide Shipping Placards

- DOT UN Identification #
  - Liquid = 3414
  - Dry = 1689
- NFPA Designation
  - Health = 3
  - Fire = 0
  - Reactivity = 1
What type of health hazard is sodium cyanide?

- **Chronic**
  - Long-term Health Effect
    - Asbestos
    - Coal dust
- **Acute**
  - Short-lived Health Effect
    - Cyanide
CYANIDE POISONING
Metabolic Asphyxiation

• Inhibits Body’s Ability to Use Oxygen.
• Reversible with:
  - Use of Cyanide Antidote Kit
  - Oxygen
  - Amyl Nitrite
  - Time
Routes of Exposure

• **Inhalation**
  • HCN Gas
  • NaCN Dust

• **Ingestion**
  • NaCN Liquid
  • Solid

• **Absorption (skin or eye contact)**
  • NaCN Liquid
  • Solid (Dust)
Symptoms of Exposure

Mild to Moderate Overexposure

• Headache
• Dizziness
• Confusion
• Nausea
• Shortness of Breath
• Palpitations
Symptoms of Exposure

Severe Overexposure

- Gasping for Air
- Collapse
- Unconsciousness
- Convulsions
- Respiratory Arrest
- Cardiac Arrest
TOXICITY SUMMARY

- Acutely Toxic
- Inhibits Cellular Respiration
- No Long-Term Effects
- Not Carcinogenic
- Not a Developmental Toxin
- Relatively Rapidly Metabolized
FIRST AID FOR CYANIDE EXPOSURE

• Call for help
• Protect yourself from exposure
• Move victim
• Flush with large amounts of water
• Quickly determine victims condition.
• Give first aid immediately
• Send for medical help
FIRST AID FOR CYANIDE OVEREXPOSURE

• **Fully Conscious**
  Give Oxygen and Monitor Victim

• **Unconscious/Not Fully Conscious**
  Give Oxygen and Amyl Nitrite

• **Not Breathing**
  Give Oxygen and Amyl Nitrite Immediately, Force Deep Breathing w/ Oxygen Resuscitator or Protected Artificial Respiration.
Injectable Cyanide Antidotes

- Sodium Nitrite
- Sodium Thiosulfate
  - Used in conjunction with Amyl Nitrite
- CYANOKIT
  - Hydroxocarbolamin
Cyanide Shipping Placards

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Solid Cyanide

- Dry Crystalline Granules or Briquettes
- Water Soluble
- Very Low Vapor Pressure
- Dust Potential
Solid Cyanide - Common Shipping Container

Bag / Box:

- Polypropylene, Woven Sack
- Polyethylene Bag
- Certified Plywood Box
Sodium Cyanide Solution

- Clear Liquid
- 30% Solution (Commercially)
- Odor: Slight Ammonia or Bitter Almonds
- Boiling Point: 220°F
- Flash Point: NaCN won’t burn (HCN gas is flammable)
HCN Formation

Sodium Cyanide + Acid $\rightarrow$ HCN

OR

Sodium Cyanide + Water $\rightarrow$ NaCN Solution

NaCN Solution less than 11.5 pH $\rightarrow$ HCN
Sodium Cyanide Solution

• Rate of HCN generation increases as the pH decreases

• At pH 9.3, half of original cyanide is HCN.

• At pH above 11.5, no HCN IS FORMED.
pH of Common Liquids

- **NaOH**
- **NaCN**
- **Bleach**
- **Milk**
- **Water Neutral**
- **Lemon Juice**
- **Acid**
Chemical Incompatibilities

- Acids and Oxidizers
- Toxic Gasses
- Protection from exposure to fumes
- Supplied air required
Safe Response & Handling

• Proper PPE
• Know Wind Direction
• Know Evacuation Routes
• Don’t Rely on Odor

• Don’t Consume or Chew
• Avoid Touching Your Mouth
• Store Away from Acid or Oxidizers
PERSONAL PROTECTIVE EQUIPMENT

Hazmat Response

• 2-Piece Chemical Suit or Better
• SCBA
Spill Control - General

• Keep People Away
• Assess Situation
• Prevent Spread
• Cover Solid Cyanide
• Dike, Dam, Channel Liquid Cyanide
Solid Cyanide Spill

- Non-volatile if Dry
- PPE
- Avoid Contact
- Sweep/Shovel
- Containerize
- Decontaminate
Fire Fighting

- NaCN Not Flammable
- HCN is Flammable
- Molten NaCN (1000°F) Plus Water ➔ Explosion and HCN
- Use Dry Chemical
- If Water, then Collect Run-off
Cyanide Detoxification and Decontamination

- Cyanide + Oxidizer $\rightarrow$ Cyanate
- Dilute Bleach
- Dilute Hydrogen Peroxide
- PPE
- Well Ventilated
- HCN Monitoring
Cyanide 24 Hour

RESPONSE NUMBERS

USA – (24 Hour)
Chemtrec 800-424-9300
DETER 251-443-1634
Cyanco – NV Plant 775-623-1214
Cyanide Response Summary

• Health Hazard
  • Acute Toxicity
  • HCN Generation at Less Than 12 pH
• PPE
  • Full Chemical Splash Suit, Gloves, Goggles, Boots, etc. **OR** Better
  • Supplied Breathing Air
• Containment and Collection