Tufts University Standard Operating Procedures (SOP) for Cyanide Salts and Hydrogen Cyanide

CAS #: 143-33-9 & 151-50-8
Sodium Cyanide, Potassium Cyanide.
NFPA 4 Health, 0 Fire, 0 Reactivity, HMIS 4-most hazardous poison.

This information should be incorporated into a safety plan for experiments involving cyanide compounds.

Toxicity:
Sodium and potassium cyanide are odorless white, noncombustible solids. Both chemicals can react with atmospheric moisture (humidity) to produce hydrogen cyanide gas (HCN). Reaction with liquid water can produce dangerous amounts of HCN in confined spaces. They are both soluble in water.
Reaction with acids quickly produces large quantities of toxic, flammable hydrogen cyanide gas.

Sodium and potassium cyanide are both highly toxic via inhalation, ingestion and skin absorption. Exposure to salts or aqueous solutions to eye (mucous membranes) or skin to as little as 50-150 mg can cause collapse and death. Aqueous solutions of HCN are readily absorbed through the skin and eyes, absorption of 50 mg can be fatal. OSHA has a permissible exposure limit (PEL) of 10 ppm (11 mg/m3) skin. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends threshold limit value (TLV-TWA), time weighted average over an 8 hour day, of 5 mg/kg (KCN) skin. The oral rat lethal dose 50 (LD50), where 50% of the population of test animals died, is 6.4 mg/kg for sodium cyanide and 5 mg/kg for potassium cyanide.

Hydrogen cyanide gas has a bitter almond odor which is detectable at 1-5 ppm. However, 20-60% of population can't detect this odor. It is highly toxic with an inhalation toxicity of LC50 (rat) 63 ppm (40 min). Inhalation exposure to low levels, 18-36 ppm for several hours, can cause weakness, headache, confusion, dizziness, rapid breathing, nausea and vomiting. It is also a flammable gas.

Symptoms of acute exposure are:
- Weakness, difficulty breathing
- Headache, confusion, dizziness, vertigo
- Nausea, vomiting
- Skin goes pink/cherry red from cyanide-hemoglobin complexes
- Continued exposure can cause coma, pulmonary edema, cardiac arrest

Safe Work Practices and Personal Protective Equipment (PPE):
- Chemical registration with Tufts University Environmental Health and Safety (TEHS)
- Work in a fume hood
- Wear splash goggles, nitrile gloves, lab coat
- Store salts in cool dry location away from acids
- Prevent spills; store in secondary containment, make sure container is secure and screw cap is tight
- Work below eye level

Storage of Cyanide Salts:
Sodium and potassium cyanide reacts with acids to produce cyanide gas. Do not store near acids. Keep container tightly closed in a dry well-ventilated place. Never allow salts to get in contact with water during storage. Reaction with atmospheric moisture can produce hydrogen cyanide gas.

Spills:
If a spill occurs:

- Small spills of dry salts could be safely cleaned up with a broom and dustpan.
- Small spills of solutions could be safely cleaned up if the spill is contained in the fume hood
- DO NOT attempt to clean up a large spill of cyanide solution outside the fume hood by yourself. Evacuate the laboratory. Close and lock all entrances to the laboratory and notify Tufts Police (6-6911).

Accidents/Exposures:
Treat any exposure (ingestion, skin or inhalation) seriously no matter how slight it may seem at the moment.
If ingested, rinse mouth with water and seek medical attention. In case of eye contact flush eyes with water for 15 minutes and consult a physician.

- Skin Contact; immediately wash with soap & water, remove contaminated clothing
- Eye Contact; wash with copious amounts of water for 15 min. occasionally lifting upper & lower lids.
- Inhalation; move to fresh air and immediately seek medical attention.
- Call 6-6911 & seek medical attention
- Bring Safety Data Sheet (SDS) to physician

Medical treatment

- Low dose treatment is oxygen therapy; liver metabolizes cyanide
- High dose; inhale amyl nitrite, followed by IV sodium nitrite & IV sodium thiosulfate

Disposal:
Cyanides are RCRA listed hazardous waste regulated by the US Environmental Protection Agency. Any discarded excess, off specification species, container residues or spill cleanup material, must be managed as a hazardous waste.

Do not mix cyanide waste streams with other waste streams. Waste cyanide salts and solutions must be placed in a separate compatible container, labeled with the hazardous waste tags provided by the safety office and the tags need to be properly filled out. On the back of the waste tag, check off the box marked "toxic." Place the waste container in the satellite accumulation area in secondary containment. Make sure the waste bottle is fitted with a proper screw cap and notify the TEHS for disposal.

References:
-MSDS for Sodium Cyanide, Sigma Aldrich 2011.
-Genium's handbook of safety, health, and environmental data for common hazardous substances. 1999.

-Krister Forsberg, S.Z Mansdorf. *Quick Selection Guide to Chemical protection Clothing 3rd edition*. 1997.
- *Occupational Safety and Health Topics for Sodium Cyanide.*
- U.S. Department of Health and Human Services, *NIOSH Pocket Guide to Chemical Hazards*, Publication No. 90-117, Cincinnati, Ohio, June 1990.