Laboratory-Specific Standard Operating Procedures

TITLE: SOP for the safe use of cyanide compounds

Date: **6/20/2018** Review Date: Revised:

Principal Investigator:

Authors (Names):

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This SOP must be kept on file for laboratory employee training and review.

Section 1: (Check One)
There are three methods that can be used to write SOPs. They are: by process (distillation, synthesis, chromatography, etc.); by individual hazardous chemical (benzene, phenol, arsenic, etc.); and by hazardous chemical class (flammable, corrosive, oxidizer, etc.).

_____ Process ___X__ Chemical _____ Hazard Chemical Class

Section 2: Describe Process, Hazardous Chemical or Hazard Class
This SOP presents guidelines and procedures for the safe use of cyanide compounds.
In addition to use of this SOP, persons working with cyanide compounds should be thoroughly familiar with general guidelines for high hazard chemicals identified in EHS 200.09, High Hazard Chemical Policy and all other applicable LSUHSC chemical safety policies. Observe all lab-specific safety procedures as well as guidance provided by the chemical supplier. The current chemical-specific Safety Data Sheet (SDS) must be available and reviewed prior to use.

The term cyanide refers to any compound that contains the cyanide ion (CN^-), consisting of a carbon atom triple bonded to a nitrogen atom. Cyanide is usually found joined with other chemicals to form salts. Examples of cyanide compounds are hydrogen cyanide, sodium cyanide, potassium cyanide, barium cyanide, calcium cyanide, copper cyanide, cyanogen chloride, lead cyanide, and silver cyanide.

Cyanide compounds can hydrolyze in aqueous media to evolve gaseous hydrogen cyanide, which is a severely toxic and flammable gas. Hydrogen cyanide (CAS ID # 74-90-8) is a colorless or pale blue liquid or gas with a faint bitter almond-like odor. It is used for organic synthesis in biomedical labs. Synonyms include formonitrile, hydrocyanic acid (aqueous), and prussic acid (aqueous).

Section 3: Potential Hazards

- Physical Hazards
  - Cyanide compounds are often flammable by chemical reaction with moisture or acid (hydrolysis evolves highly flammable and toxic hydrogen cyanide gas).
  - Acids cause the rapid evolution of hydrogen cyanide.
- Health Hazards
  - Many of these compounds are corrosive to tissue.
  - Exposure to lower concentrations of hydrogen cyanide may produce eye irritation, headache, confusion, nausea, and vomiting.
  - Hydrogen cyanide is absorbed well by inhalation and can produce death within minutes.
  - Substantial absorption can occur through intact skin with direct contact with solutions or if vapor concentration is high.
  - Cyanides prevent the utilization of oxygen in cellular metabolism by binding to the final molecule in the electron transport chain. Individuals poisoned with cyanide suffer from oxygen deprivation even though the atmosphere may have abundant oxygen.

Section 4: Personal Protective Equipment

Identify the required PPE. If a respirator is required, contact EH&S before using. Protective clothing and equipment is not a substitute for adequate engineering controls. PPE must be selected on the basis of the hazards present, the type of materials used, and the manner in which they will be handled. Always consult with the PI and lab-specific SOP to determine task appropriate PPE before carrying out any procedures. In addition to the general guidance below, basic laboratory PPE must be worn when working with cyanide compounds.

- Double-gloving is recommended or thicker nitrile rubber gloves if contact with skin is expected.
- Safety glasses (use safety goggles and a face shield if a potential splash or dust hazard exists).

For more information about general PPE requirements, refer to EHS-400.03, Personal Protective Equipment.

Section 5: Engineering Controls

Describe engineering controls that will be used to prevent or reduce employee exposure to hazardous chemicals.

All cyanide compounds must be handled within a fume hood.

Section 6: Special Handling and Storage Requirements
List storage requirements for hazardous chemicals involved with the SOP, including specific area, and policies regarding access to chemicals. Special procedures such as dating peroxide formers are appropriate here. Is a special "designated area" required?

- Handling Precautions
    - DO NOT work alone.
    - Conduct all work within operational laboratory ventilation, such as a chemical fume hood.
    - Establish a designated work area and mark clearly with signs that identify the chemical hazard and include appropriate warning.
    - Avoid heating any cyanide salt to decomposition, as it will release hydrogen cyanide gas.
    - Keep acids out of the fume hood unless needed for the experiment. If needed, keep quantity to a minimum.
    - Know the location of the nearest emergency safety shower and eyewash station.
- Storage Precautions
    - Cyanides must be stored in a tightly closed container in a cool, dry cabinet to which access is restricted.
    - Protect cyanide containers against physical damage.
    - Store cyanide compounds separately from incompatible chemicals.

Section 7: Spill and Accident Procedures
Indicate how spills or accidental release will be handled. List the location of appropriate emergency equipment. Any special requirements for protection of personnel from exposure should be identified here.

- For Accidents:
    - In the event of a fire, a dry chemical fire extinguisher must be available.
    - Skin contact – Thoroughly rinse affected areas in emergency shower with water for 15 minutes. Remove all contaminated clothing.
    - Eye contact – Flush using the emergency eye wash station or saline water for 15 minutes.
    - If inhaled – Remove the affected individual from the environment containing cyanide and monitor the person for respiratory distress.
    - DO NOT perform mouth to mouth CPR for unconscious individuals with inhalation exposure, to prevent the rescuer from becoming exposed.
    - In the event of personal contamination, call 911 or campus police (568-8999) and immediately seek medical attention.
    - Ensure responders wear proper PPE to prevent potential skin and eye contact with cyanide compounds.
    - Provide the medical team with the SDS. An antidote for treating cyanide exposure must be administered by properly trained personnel.

- For Spills:
    - Inside a fume hood – follow decontamination procedures specified in Section 8.
    - Outside a fume hood – evacuate and contact University Police (568-8999).
    - General procedures for chemical spills are addressed in EHS-200.02, Chemical Spill Response Policy and Procedures.

Incident and accident reporting must be done electronically via the on-line fillable forms located on the EHS website. For more information about appropriate form selection, refer to EHS-400.06, Incident and Accident Reporting and Investigation Policy.

Section 8: Decontamination Procedures
Specify decontamination procedures to be used for equipment, glassware, and clothing, including equipment such as hoods, lab benches, and controlled (special "designated area") areas within the lab.

- Decontaminate fume hood surfaces, equipment, utensils, and glassware contaminated with cyanide compounds. All cleaning activities must be conducted within the fume hood.
- First, clean with a pH 10 buffer solution.
- Follow by cleaning with a freshly prepared 10% bleach solution.
- Always wash hands immediately after work is complete or when gloves are removed.
- Dispose of the rinse, gloves, and wipes as hazardous waste.

Section 9: Waste disposal Procedures
Manage cyanide-containing waste as hazardous waste. For details on proper handling and disposal of hazardous chemical waste, refer to EHS-200.04, "Chemical Waste Management Procedures".

- Store cyanide wastes in dedicated waste containers used only for cyanide waste and clearly label the waste as "HAZARDOUS WASTE – cyanide", the date waste was generated, and "No Acids."
- Liquid and Solid (all contaminated gloves, matting, paper towels, etc.) cyanide wastes must be stored separately from each other.
- To request a pickup of chemical waste, authorized individuals must use the Facility Services online service request work order system.