HARVARD
Campus Services
ENVIRONMENTAL HEALTH & SAFETY

LABORATORY SAFETY GUIDELINE

Cyanide / Cyanide Anion [CAS No. 57-12-5]

All individuals at Harvard who use compounds that contain cyanide or that can generate cyanide must review this document and should contact their EHS Laboratory Safety Advisor and department safety officer prior to using these substances. Cyanide-containing compounds can exist in various forms, such as a colorless gas (e.g., hydrogen cyanide or cyanogen chloride) or a crystalline substance (e.g., sodium cyanide, cyanogen bromide or potassium cyanide). Cyanide is sometimes described as having a "bitter almond" smell, but it does not always give off an odor and not everyone can detect this odor.

HAZARDS

	Cyanide compounds are toxic if swallowed, inhaled, or absorbed through the skin. They can cause severe and irreversible health effects, including death. Certain cyanide containing compounds like cyanogen bromide, when exposed to moisture results in formation of hydrogen cyanide (HCN) gas which is highly toxic.
	People exposed to smaller amounts of cyanide compounds (generally by swallowing, inhaling, or absorbing them through skin) may have some or all the following signs and symptoms within minutes: dizziness, headache, nausea/vomiting, rapid breathing, rapid heart rate, restlessness, and muscle weakness. People exposed to larger amounts of cyanide compounds may experience the above health effects along with convulsions, loss of consciousness, low blood pressure, lung injury, slow heart rate, and respiratory failure leading to death. Survivors of severe cyanide poisoning may develop heart, brain, and nerve damage over time.
	Cyanide compounds may be corrosive to metals.
	Cyanide compounds can be very toxic to aquatic life.

PRECAUTIONS

Never work alone when using cyanide. Always use the buddy system. Another lab member "buddy" should always be present and available to assist in the event of a cyanide emergency. Both the user and "buddy" should have a thorough understanding of these guidelines, cyanide hazards, and their protocols prior to beginning work.

- Notify EHS (Cambridge 617-496-3797, Longwood 617-432-1720) and provide the location (building and room number) where you will be working with cyanide. In addition, contact EH&S when your lab stops using cyanide.
  - For Boston labs, EHS will notify Boston Emergency Medical Services (EMS - 617-343-1125) so they can generate a "Premise Warning" (The EMS Premise Warning will prompt EMS to dispatch an antidote-kit-trained Advanced Life Support unit in the event of an emergency involving cyanide).
  - For Cambridge labs – all EMS units have antidote kits on hand.

Before starting work:

- Determine if you can use a less hazardous substance in place of cyanide compounds;
- Order the most dilute solutions available that will meet experimental needs. Order only the quantity that you need;
- Review the manufacturer's Safety Data Sheet for the specific cyanide compound and additional chemical information at http://www.ehs.harvard.edu/safety-data-sheets-sds;

- Ensure that a written experimental protocol including safety information is available;
- Be familiar with general University emergency procedures in the EHS Lab Emergency Response Guide;
- Identify the location of the nearest eyewash and shower and verify that they are accessible;
- Always remove cyanide from its secondary container in a chemical fume hood to safely vent any accumulated vapor.
- Locate and verify that appropriate cyanide spill cleanup materials are available, including the following:
  - For liquids
    - polypropylene absorbent pads or equivalent; and
    - polypropylene containers that can hold the pads and be sealed tightly.
  - For solids
    - disposable dust pan and brush; and
    - polypropylene containers or bags that can hold the waste material and dust pan/brush and be sealed tightly with a cover or zip ties.
- Post a sign in the work area (fume hood): "Danger: Cyanide used in this Area"; and
- Do not work alone! Use the buddy system as described above.

Training:

- Each employee working in a lab that handles cyanide (or procedures that generate cyanide) must receive lab-specific instruction on the dangers of cyanides and be trained on:
  - Exposure routes (e.g., ingestion, inhalation, and skin absorption) and the associated short- and long-term adverse health effects;
  - Prevention of exposure (e.g., proper lab protocol, use of laboratory apparatus and chemical fume hoods, personal protective equipment);
  - Emergency evacuation procedures;
  - Recognizing cyanide exposure and poisoning;
  - Medical response procedures for a suspected cyanide exposure; and
  - Buddy System requirements for work with cyanide.
- Upon request, the EHS Department will assist the lab in providing cyanide-specific lab safety training for persons that are at risk for exposure to cyanide. Contact your EHS Laboratory Safety Advisor for more information.

During work:

- AVOID INHALATION! Perform all operations in a certified chemical fume hood. Sash lowered as much as possible. Always work at least 6 inches into the fume hood;
- AVOID CONTACT! Use appropriate personal protective equipment (PPE):
  - Wear a lab coat, long pants, shirt and closed-toed shoes.
  - Wear double-gloved 4-mil thick nitrile gloves.
  - Gloves must be thoroughly inspected prior to each use. Do not use damaged gloves;
  - Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with cyanide;
  - Change gloves (outer and inner) at least once an hour and immediately whenever you suspect cyanide has contacted your gloves;
  - Wash hands and forearms thoroughly with soap and water each time gloves are removed.
  - Always work behind fume hood sash;
  - Wear chemically protective goggles or safety glasses.
- Use materials and containers appropriate for cyanide use and remain aware of potential incompatibilities. Polypropylene works well with most cyanide compounds.
- Keep all containers tightly closed when not in use and during transport.

After completing the work:

- Dispose of waste cyanide and any empty containers that once contained cyanide compounds following Harvard University Hazardous Waste Procedures.
  - Hazardous Waste Classification: Toxic
- Return container to storage area following Harvard University Laboratory Chemical Storage Guide
  - Storage Group AT (High Acute Toxicity)
  - Store in original containers or other appropriate containers.
  - Store primary container in designated, sealable plastic (ideally polypropylene) secondary containers.
  - Store cyanide compounds in a secured area, separate from all acids, nitrites, nitrates, water, steam, heat, chlorates, and strong bases. In the case of cyanogen bromide, storage inside a desiccator is recommended.

- Amount in storage should be monitored by person in control of the cyanide compound. If any amount goes missing, contact HUPD and EH&S immediately.
- Wash hands and forearms thoroughly with soap and water before leaving the lab.

EMERGENCY PROCEDURES

Call 911 – specify that there was a cyanide exposure

- Seek immediate medical attention in the event of a cyanide exposure.
- If possible, send a bystander to meet EMS at the ground floor so they will find you promptly.
- When EMS arrives, notify them what actions have been taken so they can continue with proper first aid administration.

Early or Mild Cyanide Poisoning may be indicated by general weakness, heaviness of the arms and legs; difficulty breathing; headache; giddiness; nausea; vomiting; irritation of the nose, mouth, and throat.

Severe Cyanide Poisoning may be indicated by nausea, cyanosis; gasping for breath; unconsciousness or convulsions.

First Aid

SKIN CONTACT
- Wash with plenty of soap and water for at least 15 minutes. Will pass through unbroken skin. Exposures can be fatal.
- Remove any exposed clothing as well as any jewelry that may be trapping cyanide;

EYE CONTACT
- Using eyewash, flush eyes while holding eyelids open;
- Continue flushing eyes with water until emergency medical personnel arrive.

INHALATION
- If cyanide is inhaled, immediately move to get fresh air

INGESTION
- Do not induce vomiting;
- Never give anything by mouth to an unconscious person

Spill Response

IMPORTANT! DO NOT USE PLAIN WATER TO CLEAN UP A CYANIDE SPILL. WATER REACTS WITH CYANIDE COMPOUNDS TO FORM HIGHLY TOXIC HYDROGEN CYANIDE GAS.

OUTSIDE FUME HOOD OR VENTILATED ENCLOSURE
- Alert others and evacuate to a safe distance and prevent entry.
- Contact the University Operations Center at (617) 495**-5560** [HMS/HSDM (617) 432**-1901**]
- Remain in a safe location until EHS or other response personnel arrive.

INSIDE FUME HOOD OR VENTILATED ENCLOSURE (< 500 ml)
- Contact the University Operations Center at (617) 495**-5560** [HMS/HSDM (617) 432**-1901**]
- If trained and confident, you may assist in the clean-up effort of small amounts, wearing PPE described above and using appropriate spill supplies.
    - If solid, use dust pan and brush to collect materials. If solution, apply polypropylene absorbent pads as described above.
    - Double bag ALL spill cleanup materials and leave inside the fume hood (in an SAA if available). A clear plastic bag is ideal. Do not use a biohazard bag.
    - Wipe area with dilute bleach or hydroxide solution and place this cleanup material into the debris bag and close tightly.
    - Label with appropriately completed hazardous waste tag.
- Otherwise close the fume hood sash and await support.