INFORMATION ON CYANIDE COMPOUNDS

Cyanide compounds that can easily release the cyanide anion (CN^-) or are easily metabolized to release it in the body are considered highly toxic and particularly hazardous. Commonly encountered cyanide compounds at Stanford include salts such as potassium cyanide and sodium cyanide; these compounds typically come in the form of white granular or crystalline solids, but may also be dissolved in a solution. Other cyanide compounds used at Stanford may be liquids, such as trimethylsilyl cyanide.

Cyanide compounds can be inhaled as a powder or volatile liquid, absorbed through the skin, or accidentally injected or ingested. Cyanide compounds can react with water or acids to produce highly toxic hydrogen cyanide gas, an inhalation hazard.

Cyanide can kill within minutes to hours[1], with latency dependent upon the form, concentration, and route of exposure. Some cyanide compounds (and hydrogen cyanide gas) have a faint, bitter almond-like odor. However, the odor does not provide adequate warning of hazardous concentrations, and a large proportion of individuals cannot detect it due to a lack of the necessary genetic trait.

PLANNING THE EXPERIMENT

- If possible, eliminate cyanide compound use or replace with a less toxic chemical.
- Consult with your principal investigator (PI) prior to using cyanides.
- Consult the Safety Data Sheet (SDS) for the hazards associated with the specific cyanide compound you are using. Keep a copy in your lab at all times.
- Develop a standard operating procedure (SOP) for your experiment that describes in detail how to perform the experiment safely and effectively. Information on SOP development can be found at: http://chemtoolkit.stanford.edu/TemplateSOP.
- Minimize the amount of cyanide compounds used during experiments.

⚠ Contact EH&S at (650) 723-0448 if you are considering using hydrogen cyanide gas.

TRAINING

Lab-specific training for cyanide users must include:

- Instructions for safe usage
- Signs and symptoms of cyanide exposure
- Emergency response procedures
- Review of lab specific SOP

SAFE HANDLING

- Establish a designated area for working with cyanide compounds. Clearly mark with signs identifying the chemical hazard and include an appropriate warning.
- Handle cyanide compounds (including weighing and/or transferring between storage containers) in a certified laboratory fume hood.
- Keep acids out of the fume hood unless needed for the experiment. If needed, keep quantity to a minimum.
  - Be aware that many cyanide compounds will react with acids to form hydrogen cyanide gas.
- Ensure the nearest emergency safety shower/eyewash is accessible and has been tested within the last month.
- **Do NOT work alone** when using cyanide compounds; limit work to normal working hours (8:00 AM – 5:00 PM).

STORAGE

Store cyanide compounds in a cool, dry, and well-ventilated area, out of direct sunlight and heat. They must also be stored according to the correct storage group: http://chemtoolkit.stanford.edu/ChemStorage.

PERSONAL PROTECTIVE EQUIPMENT

Minimum Personal Protective Equipment (PPE) must be worn when working with cyanide compounds and includes the following:

- Lab coat
- Chemical-resistant gloves (double gloving recommended)
- Safety glasses (use safety goggles and a faceshield where a potential splash or dust hazard exists)
- Proper street clothing: long pants and closed toe shoes

DECONTAMINATION

- To clean fume hood surfaces, utensils, and glassware contaminated with cyanide compounds, first use a pH 10 buffer solution, followed by cleaning with a freshly prepared 10% bleach solution.
- Conduct cleaning activities within the fume hood only.

WASTE MANAGEMENT

- If your lab has cyanide compounds that are no longer in use, dispose of them as surplus chemicals or hazardous waste.
- Manage cyanide-containing wastes as hazardous waste.
- Store cyanide wastes in dedicated waste containers used only to store cyanide waste.
- Solid (all contaminated gloves, matting, paper towels, etc.) and liquid cyanide wastes must be stored separately.
- EH&S provides waste containers for solid waste; contact your Safety & Compliance Advisor for more information.
- Create hazardous waste tags and request pick up at http://wastetag.stanford.edu. Attach completed tags to containers.

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[1] Gosselin, R.E., R.P. Smith, H.C. Hodge, *Clinical Toxicology of Commercial Products*, 5th ed., Williams and Wilkins, Baltimore, 1984, p. III-126.

SPILL RESPONSE

- For spills of cyanide compounds **inside a fume hood**, ensure all contaminated surfaces are cleaned first with pH 10 buffer solution followed by cleaning with a freshly prepared 10% bleach solution. The contaminated solution/wipes must be disposed of as cyanide-containing hazardous waste. Contact EH&S if large quantities are spilled or if the researcher is unsure on how to proceed (650-725-9999).
- For spills of cyanide compounds or release of hydrogen cyanide gas **outside of a fume hood** (such as from spills of sodium cyanide solutions) follow the procedures below:

1. Evacuate the area and any affected personnel.
2. Alert emergency personnel by calling 911 from a cell phone or 9-911 from a campus phone (x286 in School of Medicine).
3. For any affected personnel, follow procedures in "Onsite Response Instructions" section on the following page
4. Alert people in the vicinity and/or activate local alarm systems.
5. Remain nearby to advise emergency personnel**.**
6. Once personal safety is established, call EH&S at 725-9999 (or in the School of Medicine, x286)

ONSITE EXPOSURE RESPONSE KITS

- **When Response Kits Are Required:**

In cases of severe exposure to cyanide, amyl nitrite inhalants, in the form of ampoules, are standard first-aid treatment that can be easily administered by nonmedical personnel before emergency medical services arrive. Labs or departments with potential severe exposure to cyanide must purchase amyl nitrite ampoules and maintain a kit for rapid, first-aid response in an area readily accessible to potentially exposed laboratory personnel.

- **What Is Required:**

When assembling an amyl nitrite first-aid kit, the following items must be kept together at the same location:

- Amyl nitrite ampoules
- Gauze pads (for administering amyl nitrite)
- Chemical-resistant gloves (to prevent responder skin exposure to cyanide)
- Instructions for use (refer to the following page of this document)
- SDS of the cyanide compound(s) used in the lab

- **How to Purchase and Store:**
  - Because a prescription is required, the amyl nitrite ampoules must be purchased through the Stanford University Occupational Health Center (OHC), 650-725-5308.
  - The amyl nitrite ampoules must be refrigerated (between 36 and 46 degrees Fahrenheit) and restocked upon expiration of the medication.
  - Amyl nitrite ampoules must be stored in a secure location and regularly inventoried by the lab or department.
  - Ensure that the ampoules are readily available to laboratory personnel prior to beginning work with cyanide compounds and returned to a secure location upon completion of work.
- **Disposal:**
  - Unused ampoules must be disposed of as surplus chemicals when they are no longer needed or when past the expiration date.

If responding onsite to a potential cyanide exposure, see the "Onsite Response Instructions" section on the following page.

Stanford University
Environmental Health and Safety
Occupational Health and Safety Program: (650) 723-0448
Occupational Health Center: (650) 725-5308

STANFORD UNIVERSITY

CYANIDE EXPOSURE ONSITE RESPONSE INSTRUCTIONS

POST THIS SHEET IN THE ROOM WHERE THE CYANIDE COMPOUND IS USED OR HANDLED

Location/Expiration Date of amyl nitrite ampoules and safety data sheet (SDS):

Building and Room: _____

Exact Location in Room: _____

Expiration Date:_____

Location of Safety Data Sheet (SDS):_____

SYMPTOMS OF CYANIDE EXPOSURE

The symptoms of cyanide exposure vary depending upon the degree and route of the exposure. Early symptoms of cyanide exposure may include some or all of the following: *headache, lightheadedness, dizziness, nausea, vomiting, agitation, drowsiness, and irritation of the eyes, nose, throat and respiratory tract, as well as rapid breathing with sense of suffocation*.

Severe cyanide exposure symptoms are *convulsions, stupor, paralysis, unconsciousness, and coma*. Death may occur within minutes.

ONSITE EXPOSURE RESPONSE INSTRUCTIONS

⚠ For an **ACTUAL or SUSPECTED** exposure to cyanide, do **NOT** wait for symptoms to develop to contact emergency services.

- **For actual or suspected exposures to cyanide, follow the steps below:**

1. Call 911 from a cell phone or 9-911 from a campus phone (286 from campus phone at school of medicine); inform them that a cyanide exposure has taken place. Contact the Occupational Health Center (650-725-5308) as they can provide an intravenous antidote kit to the hospital, if needed.
2. Ensure onsite responders wear PPE (including lab coat, double nitrile gloves, and eye protection) to prevent potential skin and eye contact with cyanide compounds.
3. Remove the affected individual(s) from the environment containing cyanide.
4. Remove all contaminated clothing.
5. For skin and hair contact, thoroughly rinse affected areas (such as at the emergency shower) with water for 15 minutes.
6. For eye contact, flush using the emergency eye wash or saline water for 15 minutes.

⚠ Do **NOT** delay transport if the affected individual is unconscious .

⚠ Do **NOT** perform mouth-to-mouth/mouth-to-nose CPR for unconscious individuals with inhalation exposure, to prevent the rescuer from becoming exposed. If trained in the proper procedures, perform chest compressions only.

⚠ Bring the amyl nitrite ampoules and a copy of the SDS for the cyanide compound with the affected individual(s) to Stanford Hospital Emergency Room.

- **To administer amyl nitrite emergency first-aid treatment, follow the steps below:**

⚠ If the individual is awake and fully conscious, they **MUST NOT** receive any amyl nitrite. Amyl nitrite must **ONLY** be used if the individual displays the following symptoms: impaired consciousness, convulsions, or unstable vital signs post-exposure.

1. Ensure that the affected individual is in a clean air environment away from the cyanide contaminated area
2. Ensure that the affected individual is laying face-up on the ground or a bed, as amyl nitrite can cause a sudden drop in blood pressure and fainting.
3. Break an ampoule of amyl nitrite onto a gauze pad and place under the nose, or place under the lip of a face mask.
4. Hold amyl nitrite-containing gauze pad in place for 15 seconds, remove for 15 seconds, and repeat this process until arrival at the emergency department. A new ampoule must be used every 3 minutes.

Contact the Stanford Occupational Health Center (OHC) if there are any questions regarding symptoms or first-aid treatment of cyanide exposure. (Hours: Monday - Friday, 8:00 AM - 5:00 PM, Phone: 650-725-5308, After Hours: 650-725-9999)