Working Safely with Chloroform

ENVIRONMENTAL HEALTH AND SAFETY
UNIVERSITY OF TENNESSEE
Overview

This training covers:

- Properties of Chloroform
- Routes of Exposure and Health Effects
- Protecting Yourself
- Handling and Storage
- Spills and Exposures
- Waste Disposal
- Chloroform Spill/Exposure Kit
Properties of Chloroform

- Chloroform is a clear, colorless, and volatile liquid with a pleasant, sweet odor
- Chloroform is:
  - slightly soluble in water
  - soluble in alcohol, ether, acetone, benzene, and petroleum ether
- Chloroform has a high vapor pressure
  - Evaporates readily
Properties of Chloroform (cont.)

- **Exposure Limits**
  - OSHA permissible exposure limit (PEL) for chloroform is 50 ppm, as a ceiling limit. NIOSH recommends a STEL (short term exposure limit) of 2 ppm.
    - Ceiling: a worker's exposure to chloroform shall at no time exceed this level [29 CFR 1910.1000, Table Z-1]
  - Air odor threshold concentrations ranging from 85 to 307 ppm have been reported for chloroform.
    - If you smell it, you are over the PEL!
    - If you can’t smell it, it doesn’t mean that you are safe!
  - OSHA IDLH (immediately dangerous to life or health) limit is 500 ppm
Routes of Exposure and Health Effects

♦ Chloroform:
  o Is a suspected human carcinogen and reproductive toxin
  o Affects the central nervous system (depressant)

♦ Routes of exposure:
  o Inhalation
  o Skin absorption
  o Eyes
  o Ingestion
Routes of Exposure: Inhalation

- Acts as a relatively potent anesthetic
- Irritates respiratory tract and causes central nervous system effects, including headache, drowsiness, dizziness
- Exposure to higher concentrations may result in unconsciousness and even death
- May cause liver injury and blood disorders
- Prolonged exposure may lead to death due to irregular heart beat and kidney and liver disorders
- Inhalation of significant amounts of vapor is possible because of its high vapor pressure
Routes of Exposure: Skin

- Causes skin irritation resulting in redness and pain.
- Removes natural oils from skin.
- Readily absorbed through the skin
  - Absorption is accelerated when the skin is hydrated
- Caution! When used with phenol, chloroform will enhance the absorption of phenol into the skin (chloroform is volatile, phenol is not)
Routes of Exposure: Eyes

- Vapors cause pain and irritation to eyes.
- Splashes may cause severe irritation and possible eye damage.
- Wear safety goggles at all times when working with chloroform and know where your eyewashes are located.
Routes of Exposure: Ingestion

- Causes severe burning in mouth and throat, pain in the chest and vomiting.
- Large quantities may cause symptoms similar to those caused by inhalation of vapors.
Protecting Yourself

- Three ways to protect yourself:
  - Engineering controls
  - Personal protective equipment
  - Specific lab safety practices
Protecting Yourself: Engineering Controls

- Always use chloroform in a properly functioning chemical fume hood
- Conduct all work at least 6” inside sash
- Keep sash as low as possible (even lower than the posted maximum operating sash height)
- Conduct all work in a plastic tray for spill containment
Protecting Yourself:
Personal Protective Equipment (PPE)

- Long pants and long-sleeve shirt with reasonably high neck (no low cut shirts)
- Closed-toe shoes or rubber boots
- Chemical resistant lab coat (NOT the standard cotton-poly ones) or chemical resistant apron
- Splash goggles and face shield (in addition to fume hood sash)
- Gloves: If using nitrile gloves use a heavier weight (8 mil) nitrile gloves (incidental contact) or use 15 mil or heavier nitrile gloves; (Polyvinyl alcohol (PVA) or laminate barrier (Silver Shield®))
- Additional PPE may be required, depending on the specific procedures used in your lab
Specific Lab Safety Practices

- Use caution when centrifuging chloroform.
  - Centrifugation produces aerosols enhancing exposure via inhalation.
  - If you suspect a tube has broken or a rotor has failed, wait 10 minutes prior to opening the centrifuge and/or rotor lid (in the fume hood!) This allows aerosolized chloroform to settle out.
- Review your protocol prior to beginning the procedure (every time)
- Inspect your PPE for cracks, holes, signs of wear
Specific Lab Safety Practices (cont.)

- Clearly label ALL bottles (stocks and wastes)
- Use the smallest amount possible
- Have a copy of the SDS in the lab Chemical Hygiene Plan notebook and review it before working with it.
- Ensure that there is unobstructed access to a functioning eye wash and safety shower
- Have a chloroform spill kit readily available (discussed at end of training module)
Storage and Handling

- Containers of chloroform should be stored away from direct sunlight and kept cool in a dry, well-ventilated area.
- They should be stored separately from oxidizing compounds and strong bases.
- Containers should not be made of aluminum.
- Pure chloroform is unstable. Check the label to find if it has been stabilized with ethanol or amylene.
  - Always use chloroform that has been stabilized with ethanol.
  - Hazardous phosgene gas may form in chloroform stabilized with amylene.
    - Note: Chloroform preserved with amylene has a 1 year shelf life due to phosgene hazard.
Spills and Exposures

- Spills not involving contact with a person
  - If you do not feel comfortable cleaning up the spill, call EHS for help (never put yourself at risk!)
  - Always wear your PPE when cleaning up a spill.
  - If a spill occurs, absorb chloroform with a nonflammable material such as vermiculite, earth, sand, or Solusorb™
  - Although it is practically nonflammable, remove all sources of heat, because fire can liberate hydrogen chloride, chlorine, phosgene, and carbon monoxide
  - Pick up spill and place in a sealed container or double plastic bags for proper disposal as hazardous waste. Do not dump down the drain or into a waste basket.
If assisting the victim, the responder should don PPE (gloves, goggles, lab coat) to avoid being exposed themselves.

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing. Get medical attention immediately.

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.
Spills and Exposures: Ingestion/Inhalation

- If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

- If inhaled, victim should be moved to fresh air if it is safe to do so. Get medical attention immediately.
Spills and Exposures

If you are ALONE...

- Remain calm...
- Remove contaminated clothing
- Wash yourself in the emergency shower for 15 minutes
- Use eyewash for eye exposures for 15 minutes
- Call 911 and tell them you have been exposed to chloroform, and give your exact location. Make sure you have a copy of the MSDS for chloroform.
Dry Solid Chloroform Waste

- Pipet tips, gloves and other contaminated debris should be collected as hazardous waste.
- Bags are ok for dry solids, as long as the bags are sealed closed and labeled properly and there are no free-flowing liquids.
- Sharps (needles) must go in puncture-resistant containers.
- Do not place dry solids cont. with chemicals in red or orange biohaz bags.
- If the waste is both chemically and biologically contaminated, please contact EHS or Office of Biosafety with questions.
Waste Disposal

- Collect all chloroform containing wastes in a well-labeled, clean container or double bag
  - No chloroform should ever be put down the drain or in the trash
  - Clearly label container with UT hazardous waste label
  - Store waste in closed containers.

- When the container is full, please bring to one of the Waste Rooms or contact EHS at 974-5084.
Waste can be brought to the following locations for disposal:

- Walters Waste Room WLS M-209
  Wednesdays 1:00-2:00 p.m.
- SERF Waste Room @ loading dock 2nd Floor
  Wednesdays 2:00-3:00 p.m.
- Do not leave waste unattended!!!!
Chloroform Spill/Exposure Kit

- A Chloroform spill kit should contain the following items:
  - Sand, vermiculite or other noncombustible absorbent material such as Solusorb™
  - 2 bags or a clean container with lid for hazardous wastes
  - 2 bags for contaminated clothing
  - Hazardous waste labels for bags or containers
Questions?

- Contact EHS at 974-5084 if you have any questions or concerns, or need assistance.
- Visit the EHS web-site at: www.ehs.utk.edu
Quiz Time

To complete the Working Safely with Chloroform Training Module, please click here for the quiz