

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

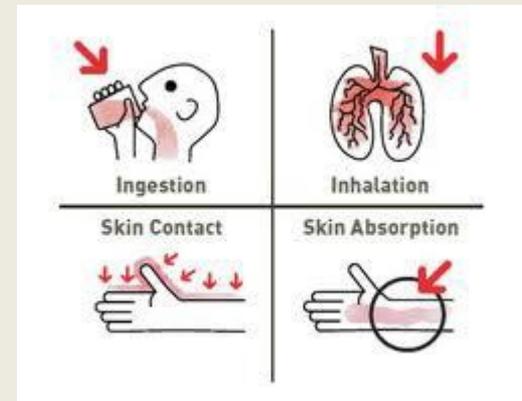


◆ Chloroform:

- Is a suspected human carcinogen and reproductive toxin
- Affects the central nervous system (depressant)

◆ Routes of exposure:

- Inhalation
- Skin absorption
- Eyes
- 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)

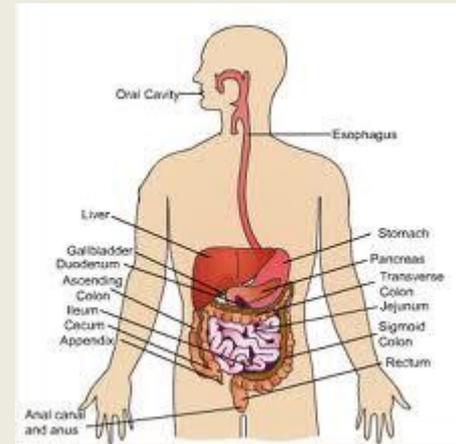
Routes of Exposure: Eyes

- ◆ 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.

Spills and Exposures: Skin/Eye



- ◆ 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

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◆ 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

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To complete the **Working Safely with Chloroform** Training Module, please [click here](#) for the quiz