



# Laboratory Safety Guideline

## Phenol [CAS 108-95-2]

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## Overview

**Synonyms:** Carbolic acid, phenic acid, phenylic acid, hydroxybenzene, monohydroxybenzene

**Physical Description:** Colorless to light pink, crystalline solid or thick liquid with a characteristic sweet, tarry odor detectable at 0.06 parts per million (ppm).

Phenol is a highly toxic and corrosive chemical commonly used in labs for nucleic acid extractions and tissue preservation, often in mixtures containing chloroform, isoamyl alcohol, guanidine thiocyanate, or a combination of these chemicals. It is designated as a Particularly Hazardous Substance (PHS).


This document outlines minimum expectations for use of phenol in Harvard labs.

Labs should develop a written lab-specific Standard Operation Procedure (SOP) for any procedures involving phenol. The lab-specific SOP should include safety precautions for each step in the procedure and detailed information on what to do in case of a spill or personal exposure.




## Hazards

Phenol is readily absorbed through the skin, causes localized chemical burns, and can cause systemic effects including central nervous system, liver, and kidney damage leading to severe illness or death. Toxic or fatal amounts of phenol can be absorbed through relatively small areas of skin. Initial skin exposure may go unnoticed due to a numbing effect.

When feasible, alternatives to the use of phenol should be considered.

Hazard Symbol	Hazard Description
	Toxic if swallowed, in contact with skin or if inhaled.



Hazard Symbol	Hazard Description
	Suspected of causing genetic defects. May cause damage to organs including the nervous system, kidney, liver, and skin through prolonged or repeated exposure.
	Causes severe skin burns and eye damage.
	Toxic to aquatic life with long lasting effects.

## Other Chemical Hazards

Typically, phenol is used in combination with other hazardous chemicals for nucleic acid extractions. Personnel should review the Safety Data Sheets (SDS) for any hazardous chemicals they use to better understand the hazards and appropriate precautions.

The most common chemicals used in combination with phenol include:

- **Guanidine thiocyanate**, which is corrosive and acutely toxic.
- **Chloroform**, which is acutely toxic, a potential carcinogen, suspected mutagen and teratogen, and an irritant. It enhances the ability of phenol to be absorbed by the skin.

Refer to the [Laboratory Safety Guideline - Chloroform](#) document for chloroform-specific guidelines.

- **Isoamyl alcohol**, which is flammable, can cause serious eye damage, and is an irritant.
- **Ethanol**, which is flammable.



## Training

Lab personnel working with phenol must complete applicable EH&S training and keep it up to date.

- [General Lab Safety](#) – renewed annually.
- [Laboratory Biosafety](#) – if using biological materials; renewed annually.
- [Laboratory Safety Orientation Checklist](#) – completed once for each person and kept on file by the lab.

In addition, phenol users and those working in spaces where this chemical is used should review this document and be familiar with phenol-specific emergency procedures.

## Precautions

### Personal Protective Equipment

Proper Personal Protective Equipment (PPE) and attire are important whenever working with phenol. Each space should have a lab-specific PPE Assessment for reference by lab personnel. Personnel should also wash their hands with soap and water before leaving the lab.

The following are basic requirements. More information can be found on the EH&S [Lab PPE webpage](#).

PPE Type	Requirement
Attire	Wear a combination of clothing and shoes that fully cover the legs and feet.
Eye and Face Protection	Wear safety glasses with side shields at a minimum. Safety goggles are recommended. A face shield over safety goggles may be needed when working with larger volumes or where there is a greater splash risk.



PPE Type	Requirement
Gloves	<p>Wear compatible chemically resistant gloves when handling potentially hazardous chemicals. Neoprene gloves are recommended.</p> <p>At a minimum, double-glove with nitrile or nitrile and neoprene combination gloves (example: Ansell 93-260) when performing low-risk work with phenol. Immediately remove the gloves if they become contaminated and discard as hazardous solid waste.</p> <p>For spill cleanup, work with larger volumes, or where there is a greater splash hazard, use a more resistant glove such as Ansell 2-100 liners or SilverShield gloves. These can be worn under nitrile or nitrile and neoprene gloves for better dexterity.</p> <p>Glove compatibility with other chemicals used in combination with phenol must also be considered. Refer to each chemical's SDS and the <a href="#">EH&amp;S Lab Glove Selection Guide</a> for help in identifying compatible gloves.</p>
Lab Coat	<p>Lab coats are required when handling phenol, such as when carrying stock bottles or hazardous waste to a mini-main accumulation area.</p> <p>Contact EH&amp;S for guidance on lab coats and other protective clothing if large volumes of phenol will be used.</p>
Respiratory Protection	<p>Respiratory protection should not be needed if using engineering controls such as fume hoods or local exhaust ventilation. If work with phenol is conducted without engineering controls, contact EH&amp;S for an assessment.</p>

## Before Starting Work

- Determine if a less hazardous substance can be used instead of phenol.
- Review the manufacturer's SDS and additional chemical safety information available on the [EH&S website](#).
- Be familiar with the general emergency procedures in the [EH&S Lab Emergency Response Guide](#).



- Identify the location of the nearest eyewash and shower and verify that they are accessible.
- Locate and verify that appropriate spill cleanup materials are available.

## During Work

All work involving phenol must be done inside a fume hood to prevent inhalation exposure and reduce the risk of splash or splatter. The following are basic guidelines for working with phenol.

- Keep the fume hood sash as low as possible.
- Bring equipment to be used with phenol into the fume hood when possible.
- Secondary containment should be used when transporting or storing phenol outside the hood.
- Keep all containers tightly closed when not in use and during transport.
- Ensure work area is free of incompatible materials before and during all procedures involving phenol.

Contact with strong oxidizers may cause fire.

Incompatible materials include, but are not limited to, oxidizers, aluminum chloride, nitrobenzene, calcium hypochlorite, butadiene, halogens, formaldehyde, mineral oxidizing acids, isocyanates, and sodium nitrate. Heat will contribute to instability.

- Wash hands and forearms thoroughly with soap and water each time gloves are removed.

## After Completing Work

Clean work area. Return phenol and other chemicals to appropriate storage following the [Lab Chemical Storage Guide](#). Keep phenol physically separated from any incompatible materials in both stock and waste areas. Stock phenol solutions are often stored in 4° C refrigerators for increased stability. Do not store in cold rooms.

Liquid phenol waste is managed as hazardous chemical waste with hazardous waste tags and clear labeling. Solid materials potentially contaminated with phenol must also be handled as hazardous waste. Harvard EH&S



can provide waste drums for collecting solid waste. Mark “Toxic” and “Corrosive” as the chemical hazards on the waste tag. Other chemicals in solutions may have additional hazards.

Wash hands and forearms thoroughly with soap and water before leaving the lab.

## Emergency Procedures

Refer to the [Lab Emergency Response Guide](#) and the information outlined below to determine how to respond to emergencies.

Notify the Principal Investigator (PI) or supervisor of any exposures or incidents involving phenol. The PI or their designee must [report any exposures or injuries](#) within 24 hours.

## First Aid

Any exposure to phenol must be responded to immediately to prevent severe injury. Enlist the help of nearby lab members following exposure to assist with decontamination and medical follow-up. Responders must don appropriate PPE and collect any contaminated clothing or shoes as hazardous waste.

## Minor Skin Exposure

Skin contact is the most likely route of researcher exposure to phenol. Treatment starts immediately to limit skin burns and phenol absorption. Minor skin exposures are those where only a few drops have contacted the skin.

If NF-grade polyethylene glycol (PEG) 300 or 400 and gauze are available, do the following:

- Remove all potentially contaminated clothing and jewelry.
- Put on safety glasses and Silver Shield gloves (only on uncontaminated hands).
- Wipe all exposed skin with polyethylene glycol (PEG 300 or PEG 400).
  - Open a few packages of gauze pads.
  - Pour PEG liberally on one pad and gently wipe off excessive phenol from exposed skin.



- Place used gauze in a plastic bag.
- Repeat until all visible traces of phenol are gone and there is no phenol odor.
- Seek medical follow-up.

If PEG is unavailable, wash for at least 15 minutes in a safety shower with copious amounts of water. Do not scrub contaminated areas as this may spread contamination to other areas. Seek medical follow-up.

## Major Skin Exposure

If a major skin contamination occurs, immediately go under a safety shower for a minimum of 15 minutes, remove all contaminated clothing, and have the nearest person call 911 for emergency responders.

## Eye Contact

If eye contact occurs, remove any contact lenses, then rinse eyes at eyewash station for a minimum of 15 minutes. Have the nearest person call 911 for emergency responders.

## Inhalation

Inhalation hazards are less likely than skin or eye exposure due to the distinctive smell of phenol. If inhalation of hazardous amounts of phenol is suspected, remove to fresh air. Seek medical attention.

## Ingestion

Do not induce vomiting. Get medical attention immediately.

## Chemical Spills

Outside fume hood or ventilated enclosure.

- Alert others, evacuate to a safe distance, and prevent entry.
- Contact the Operations Center by calling 617-495-5560. Harvard Medical School (HMS) and Harvard Dental School of Medicine (HSDM) labs should call 617-432-1901.





- Remain in a safe location until EH&S or other response personnel arrive.

Inside fume hood or ventilated enclosure (less than 500 ml).

- If trained and confident, you may assist in the clean-up effort of small amounts, wearing PPE described in the [PPE section](#) and using appropriate spill supplies. Do not wear nitrile gloves due to the risk of direct or prolonged contact when cleaning up a spill. Collect debris in appropriate container and move it to your Satellite Accumulation Area (SAA). Label with appropriately completed hazardous waste tag and request a waste pickup.
- If not trained or if uncomfortable with cleanup, close the fume hood sash and contact the Operations Center by calling 617-495-5560. HMS and HSDM labs should call 617-432-1901.

## Fire

In the event of fire, evacuate and bar further entry. Activate the fire alarm using a pull station and leave the building. Once at a safe location, call 911 to notify them of the nature of the alarm.

## Supporting Documents

- [PubChem Phenol Laboratory Chemical Safety Summary \(LCSS\) Datasheet](#)
- [Laboratory Safety Guideline - Chloroform](#)
- [EH&S Lab Glove Selection Guide](#)
- [PPE Selection by Task or Activity Guide](#)
- [Safe Chemical Work Practices](#)
- [Chemical Waste](#)
- [EH&S Lab Emergency Response Guide](#)