Benzene

Standard Operating Procedure

Revision Date: 01/22/24

This standard operating procedure (SOP) outlines the handling and use of benzene. Review this document and supply the information required in order to make it specific to your laboratory. Describe the process, concentration, quantity required and approximate frequency of use.

In accordance with this document, laboratories should use appropriate controls, personal protective equipment, and disposal techniques when handling benzene. *All laboratory workers must read and understand the*[Laboratory Emergencies SOP](https://ehs.umich.edu/wp-content/uploads/2022/05/LaboratoryEmergencyProceduresSOP.docx)*prior to commencing any work in a laboratory.*

# Description [Provide additional information as it pertains to your research protocol]

Benzene (CAS # 71-43-2) is a colorless liquid with a sweet, aromatic (“gasoline-like”) odor. Most individuals can begin to smell benzene in air at concentrations of 1.5 to 4.7 ppm (AIHA 1989). Benzene is highly flammable and is often used in the manufacture of many organic chemicals and as a solvent for waxes, resins, etc. It is a natural component of gasoline and crude oil.

Synonyms include: Benzol, benzole, benzolene, coal naptha, cyclohexatriene, phenyl hydride, pyrobenzol

## Process [Write the steps for using the chemical in your research protocol]

# Potential Hazards [Provide additional information as it pertains to your research protocol]

* **Benzene is a confirmed human carcinogen**.
* Chronic exposure to benzene harms bone marrow and can result in leukemia. It can also damage the immune system by changing blood levels of antibodies and causing the loss of white blood cells.
* Inhaling high doses of benzene can acutely affect the nervous system, which can lead to drowsiness, dizziness, headaches, tremors, confusion, and/or unconsciousness.
* Direct exposure to the eyes, skin or lungs can cause tissue injury and irritation.
* Benzene may damage fertility or the unborn child.
* Benzene liquid and vapor are highly flammable.
* Consult the SDS for benzene for more information.

## Occupational Exposure Limits (OELs):

* MIOSHA: **1 ppm**, **8-hour** PEL MIOSHA: **5 ppm,** **15-minute** STEL
* ACGIH: **0.5 ppm, 8-hour** TLV ACGIH: 2.**5 ppm,** **15-minute** STEL
* NIOSH: **0.1 ppm, 10-hour** REL NIOSH: 1 ppm, **15-minute** STEL

Contact EHS for assistance in performing an exposure assessment.

# Engineering Controls [Provide additional information as it pertains to your research protocol]

* Work with open containers of benzene must be conducted only in a fume hood.
* If your research does not permit the handling of benzene in a fume hood or glove box, you **must** contact EHS.
* Where the eyes or body of any person may be exposed to carcinogens, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use. Bottle type eyewash stations are not acceptable.

# Work Practice Controls [Provide additional information as it pertains to your research protocol]

* Designate an area for working with benzene, and label it as such.
* Keep containers closed as much as possible. Handle open containers only in a chemical fume hood.
* Use the smallest practical quantities for the experiment being performed.
* Typical laboratory use of benzene should not put employees at risk of overexposure, but labs using large amounts of benzene should contact Environment, Health & Safety (EHS) at **(734) 647-1143**for an exposure assessment.
* Once work with benzene is complete, wipe down work area with soap and water solution.
* Keep away from ignition sources.
* Benzene reacts exothermically with strong oxidizers and metals.
* Wash hands thoroughly after use. Do not eat, drink or smoke in areas where benzene or other chemicals are used.

# Personal Protective Equipment [Provide additional information as it pertains to your research protocol]

* Benzene **readily penetrates through standard nitrile, natural rubber and polyvinyl chloride laboratory gloves**. Therefore, **Viton**, **Neoprene** or **polyethylene** **vinyl** **alcohol** **(PVA) gloves are recommended**. Check the manufacturers glove compatibility charts for specific breakthrough times when selecting a glove.
  + EHS Glove Compatibility Charts: <http://ehs.umich.edu/research-clinical/planning-safe-research/glove-compatibility-chart/>
* Use disposable gloves beneath the Viton, Neoprene or PVA gloves. If working with minimal (i.e. milliliter) quantities of benzene, wearing two pair of disposable gloves may be adequate for incidental splash protection. Should any benzene splash on the gloves, **immediately** remove and discard them in a hazardous waste container, wash hands and re-glove.
* Safety goggles must be worn when a splash hazard exists; safety glasses with side shields (both that meet the requirements of ANSI/ISEA Z87.1) are required at a minimum when benzene is used in a closed system.
* A laboratory coat must be worn when working with chemicals. A chemically resistant apron should be used if transferring or using large quantities of benzene in open containers.
* Shoe covers should be worn when working in areas where confirmed human carcinogens are handled. Remove and discard into properly labeled hazardous waste containers prior to leaving the area.

# Transportation and Storage [Provide additional information as it pertains to your research protocol]

* Transport benzene in secondary containment, preferably a polyethylene or other non-reactive acid/solvent bottle carrier.
* Keep container in a flammable liquid storage cabinet.
* Keep container tightly closed and sealed until ready for use.
* Avoid heat and ignition sources.
* Do not store with oxidizers.

# Waste Disposal [Provide additional information as it pertains to your research protocol]

Benzene and solid materials contaminated with benzene are considered hazardous wastes and **must be collected within 90-days** by EHS Hazardous Materials Management (EHS-HMM) for proper disposal. **Do not dispose of benzene and benzene-contaminated solid wastes by dumping them down a sink, flushing in a toilet or discarding in regular trash containers**. Contact EHS-HMM at (734) 763-4568 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also refer to EHS' [Hazardous Waste](http://ehs.umich.edu/haz-waste/) Web page for more information.

**Spill Procedure [Provide additional information as it pertains to your research protocol]**

**\*\*Do not attempt to clean up *any* amount of benzene that is spilled outside of a chemical fume hood**

**or other ventilated enclosure.\*\***

# Training of Personnel

All personnel shall read and fully adhere to this SOP when handling benzene.

**References**

CDC

*Facts About Benzene*: <https://emergency.cdc.gov/agent/benzene/basics/facts.asp>

CDC

Benzene: Systemic Agent: <https://www.cdc.gov/niosh/ershdb/emergencyresponsecard_29750032.html#:~:text=Most%20individuals%20can%20begin%20to,inadequate%20for%20more%20chronic%20exposures.>

MIOSHA General Industry Safety and Health Standards

*Part 311 – Benzene*: <https://www.michigan.gov/leo/-/media/Project/Websites/leo/Documents/MIOSHA/Standards/Combined/CS_GI_311/CS_GI_311__04-26-2021.pdf>

National Library of Medicine

*PubChem: Benzene*: https://pubchem.ncbi.nlm.nih.gov/compound/241

American Industrial Hygiene Association (AIHA) [1989]. Odor thresholds for chemicals with established occupational health standards. Fairfax, VA: American Industrial Hygiene Association.

# Certification

I have read and understand the above SOP. I agree to contact my Lab Director if I plan to modify this procedure.

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### Major Revisions (Tracking purposes only -- Do not print as part of SOP)

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| Date | Revision |
| 09-13-18 | EHS name and logo were added, updated the formatting, and revised the content under Exposure/Unintended Content (AKJ). |
| 03-04-19 | Reviewed and updated. |
| 04-14-22 | Reviewed and updated links and spill procedures. (LGS) |
| 01-22-24 | Reviewed and revised the content under Description, Potential Hazards, spill Procedure, and References. Removed sections: Exposure/Unintended Contact, Treatment Facilities, and Emergency Reporting. |