



Standard Operating Procedure



PARTICULARLY HAZARDOUS SUBSTANCES

This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with Particularly Hazardous Substances. This SOP is generic in nature and some instances, several general use SOPs may be applicable for a specific chemical. Users must familiarize themselves with the specific hazards of the compounds they are working with, which can be found on the chemical's Safety Data Sheet (SDS). SDSs are available through the Safety Data Sheet link on Yale's EHS webpage (ehs.yale.edu).

The OSHA Laboratory Standard (29 CFR 1910.1450) defines a Particularly Hazardous Substance (PHS) as a select carcinogen, reproductive toxin, or a substance with a high degree of acute toxicity. They define PHSs as chemicals meeting any of these criteria:

Carcinogens – A carcinogen is a substance capable of causing cancer. Carcinogens are chronically toxic substances; that is, they cause damage after repeated or long-duration exposure, and their effects may become evident only after a long latency period. A chemical is considered a carcinogen if it is included in any of the following carcinogen lists:

- OSHA-regulated carcinogens as listed in Subpart Z of the [OSHA standards](#).
- Under the category "known to be carcinogens" in the *Annual Report of Carcinogens* published by the [National Toxicology Program \(NTP\)](#) latest edition
- Group 1 ("carcinogenic to humans") of the [International Agency for Research on Cancer \(IARC\)](#), latest edition. Chemicals listed in Group 2A or 2B ("reasonably anticipated to be carcinogens") that cause significant tumor incidence in experimental animals under specified conditions are also considered carcinogens under the OSHA Laboratory Standard.

Reproductive Toxins – Reproductive toxins are substances that have adverse effects on various aspects of reproduction, including fertility, gestation, lactation, and general reproductive performance. When a pregnant woman is exposed to a chemical, the fetus may be exposed as well because the placenta is an extremely poor barrier to chemicals. Reproductive toxins can affect both men and women. Male reproductive toxins can in some cases lead to sterility.

Substances with a High Acute Toxicity – High acute toxicity includes any chemical that falls within any of the following OSHA-defined categories:

- A chemical with a median lethal dose (LD₅₀) of 50 mg or less per kg of body weight when administered orally to certain test populations.
- A chemical with an LD₅₀ of 200 mg less per kg of body weight when administered by continuous contact for 24 hours to certain test populations.
- A chemical with a median lethal concentration (LC₅₀) in air of 200 parts per million (ppm) by volume or less of gas or vapor, or 2 mg per liter or less of mist, fume, or dust, when administered to certain test populations by continuous inhalation for one hour, provided such concentration and/or condition are likely to be encountered by humans when the chemical is used in any reasonably foreseeable manner.

Common Examples of PHSs:

- Carcinogens: benzene, formaldehyde, methylene chloride
- Reproductive toxins: arsenic, glycol ethers, lead & mercury compounds
- Acutely toxic: acrolein, cyanide salts, osmium tetroxide, sodium azide

Requirements for the Use of PHSs

Personal Protective Equipment (PPE)

The University's Personal Protective Equipment Policy can be found on the EHS website.

Eye Protection

Safety glasses must be worn whenever handling PHSs. When there is the potential for splashes, goggles must be worn.

Hand Protection

Gloves must be worn when handling PHSs. Exam style nitrile gloves (minimum 4mil thickness) should be adequate for handling small quantities of some PHSs. However in instances where skin contact is likely or the chemical poses a hazard through dermal exposure, a utility grade glove should be worn over the exam style nitrile. To ensure that the appropriate utility grade glove is selected, refer to the chemical's SDS, use a glove manufacturer's selection guide or contact EHS.

Skin and Body Protection

Long pants or clothing that covers the body to the ankles and closed-toe solid top shoes must be worn when these compounds. Lab coats must be worn. If skin contact is likely, then additional protective clothing (i.e., apron, oversleeves) is required.

Engineering Controls

Fume hoods, or other locally exhausted ventilation, must be used when handling these substances. This includes during transfers or manipulations of small amounts which may generate aerosols (i.e., pipetting) and during the weighing of solids. Analytical instruments or other laboratory equipment generating vapors and/or aerosols during their operation should be locally exhausted or vented in a chemical fume hood.

Storage/Handling

- Particularly hazardous chemicals that are volatile should be stored in a vented storage area in an unbreakable, primary or secondary container or placed in a chemically resistant tray to contain spills. Nonvolatile hazardous chemicals should be stored securely in cabinets or in drawers. Do not store these chemicals on open shelves or counters. Access to all of these chemicals should be restricted. Cyanide salts and some chemical listed as a chemical warfare agent must be stored in a locked cabinet or locked storage area.
- All hazardous chemicals should be transported between laboratories in durable outer containers or chemical carriers.
- All procedures with these chemicals should be performed in designated areas. The designated area can be the entire laboratory, an area within a laboratory, or a storage or containment device such as a laboratory fume hood. Others working in the area should be informed of the particular hazards associated with these substances and the appropriate precautions that are necessary for preventing exposures. All designated areas should be posted with a sign which reads:

WARNING

DESIGNATED AREA

for select carcinogens, reproductive toxins and high acute toxicity chemicals

AUTHORIZED PERSONNEL ONLY

- As an alternative, if the laboratory door sign has one of the following symbols, the entire laboratory is considered to be a designated area:



- Work surfaces on which these substances will be handled must be able to be easily decontaminated or protected from contamination with plastic trays or plastic backed paper.
 - After each use (or day), wipe down the immediate work area and equipment to prevent accumulation of chemical residue.
 - At the end of each project, thoroughly decontaminate the designated area before resuming normal laboratory work in the area.
- Upon leaving the designated area, remove any personal protective equipment worn and wash hands with soap and water.

Waste Disposal

PHSs must be collected as hazardous waste. Some PHSs require that any items which have come into contact with them, such as weigh boats, kimwipes, pipettes, and gloves, must also be collected as hazardous waste. Check with EHS for specific guidance.

Emergency Procedures

Fire Extinguishers

Both ABC dry powder and carbon dioxide extinguishers are appropriate for most fires involving PHSs.

Eyewash/Safety Showers

An ANSI approved eyewash station that can provide quick drenching or flushing of the eyes must be immediately available within 10 seconds travel time for emergency use. An ANSI approved safety drench shower must also be available within 10 seconds travel time from where these compounds are used. Ensure the locations of the eyewashes and safety showers, and how to activate them, are known prior to an emergency.

First Aid Procedures

If inhaled

Remove to fresh air. Contact 911 or Environmental Health & Safety Emergency Line (203-785-3555) as appropriate.

In case of skin contact

Go to the nearest emergency shower if contaminated. Quickly remove all contaminated clothing and footwear. Immediately flood the affected body area for at least 15 minutes. Remove jewelry to facilitate the removal of any residual material. Contact 911 or Environmental Health & Safety Emergency Line (203-785-3555) as appropriate.

In case of eye contact

Go to the nearest emergency eyewash. Yell for assistance and rinse for 15 minutes. Contact 911 or Environmental Health & Safety Emergency Line (203-785-3555) as appropriate.

Spills

Small Spill

If a small spill occurs inside a fume hood or near other local exhaust ventilation, lab personnel should be able to safely clean it up by following standard spill clean up procedures:

- Alert people in immediate area of spill
- Increase ventilation in area of spill (open fume hood sashes)
- Wear personal protective equipment, including utility grade gloves
- Confine spill to small area with adsorbent material (pads, vermiculite)
- Collect residue, place in container, label container, and dispose of as hazardous waste
- Clean spill area with soap and water

Larger Spill

- Call EHS for emergency assistance (203-785-3555)
- Evacuate the spill area
- Post someone or mark-off the hazardous area with tape and warning signs to keep other people from entering
- Stay nearby until emergency personnel arrive and provide them with information on the chemicals involved