

Management of *Particularly Hazardous Substances* (PHSs)

Identification:

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*. Resources such as GHS-compliant Safety Data Sheets (SDSs), Chemtracker, a listing of known PHSs in the BSU Chemical Hygiene Plan, and other chemical hazard information databases are available to determine if substances meet the definition of a PHS under one or more of these classifications as defined below. The *Globally Harmonized System of Classification and Labeling of Chemicals* (GHS) has been adopted by OSHA and can be yet another means for identifying PHS chemical materials.

- **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. *Select carcinogens* are those that are listed by OSHA, the *International Agency for Research on Cancer* (IARC), and the *National Toxicology Program* (NTP) as known or suspected human carcinogens:



- IARC Group 1, or NTP Known to be Human Carcinogens;
- OSHA-listed carcinogens;
- NTP Reasonably Anticipated to be Human Carcinogens;
- GHS Carcinogenicity Category 1A or 1B; and,
- GHS Category 2 AND IARC Group 2 (A or B).

IARC	GHS	NTP RoC
Group 1	Category 1A	Known
Group 2A	Category 1B	Reasonably Anticipated
Group 2B	Category 2	(See Note 1)

- **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 as 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. Chemicals that may adversely affect male and female reproductive health and the developing fetus include:



- GHS Category 1A or 1B for reproductive toxicity
- **High Acute Toxicity** includes chemicals meeting or exceeding the following toxicity criteria:
 - 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 dermal 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.



Or, High Acute Toxicity can be defined using the **GHS classifications:**

- GHS Category 1 or 2 Acute Toxicity by Inhalation, Dermal, or Oral exposure
- GHS Category 1 Specific Target Organ Toxicity - Single Exposure
- GHS Category 1A Skin or Respiratory Sensitizer.



Acute Toxicity	Severe				Harmful
	Category 1	Category 2	Category 3	Category 4	Category 5
Oral (mg/kg)	≤5	>5	>50	>300	Criteria
Dermal (mg/kg)	≤50	>50	>200	>1000	• Anticipated oral LD ₅₀ between 2000 and 5000 mg/kg;
Gases (ppm)	≤100	>100	>500	>2500	• Indication of significant effect in humans;*
Vapors (mg/l)	≤0.5	>0.5	>2.0	>10	• Any mortality at class 4;*
Dusts & Mists (mg/l)	≤0.05	>0.05	>0.5	>1.0	• Significant clinical signs at class 4;*
					• Indications from other studies;*
					*If assignment to a more hazardous class is not warranted.

Chart showing the Acute Toxicity criteria with the associated GHS Hazard Classifications.



Requirements for the Use of Particularly Hazardous Substances:

If your laboratory is handling particularly hazardous substances, the following management practices are required:

- Maintain an accurate and clearly identified **Inventory** of your PHS items;
- Prepare and implement written, lab-customized **Standard Operating Procedure** (SOP) for PHS items as described in the Ball State University *Chemical Hygiene Plan*;
- Provide **documented training** covering the SOPs for appropriate laboratory staff.

The OSHA Laboratory Standard states that for work involving particularly hazardous substances, specific consideration be given to the following provisions and to be expressed in the applicable SOP:

- Establishment of a **Designated Area**;
- Use of **engineering controls/containment devices** such as fume hoods or glove boxes;
- **Training** of personnel in the SOPs and hazards involved;
- The provision and use of **Personal Protective Equipment (PPE)** as necessary;
- **Storage and transportation practices**;
- Procedures for safe removal of **contaminated waste**; and,
- **Decontamination** procedures.

General guidelines and recommendations for the safe handling, use, and control of hazardous chemicals, and *particularly hazardous substances*, can be found in the chemical's SDS.

Establishment of a Designated Area: For work involving particularly hazardous substances, laboratories must establish a designated area where *Particularly Hazardous Substances* wherein the use of PHSs is restricted. In some cases, a designated area could be an entire room out of a suite of rooms, one bench, a demarcated area of bench surface, a particular instrument, or could mean one particular fume hood within a laboratory. The idea is to designate one area that everyone in the laboratory is aware of where the particularly hazardous substances may be used.



The picture above shows the BSU *Designated Area* sign. The appropriate hazard characteristic(s) of the chemical(s) are to be checked and the adhesive label applied as necessary to demarcate the allowable area in which the chemical may be used or exposure may occur. The label may also be placed on cardstock or a tag for display. **Note:** The same sign may also be used to designate areas subject to Biosafety Level controls for infectious materials.