

3.22. Chemicals with Moderate Chronic and High Chronic Toxicity- Procedures for Safe Handling and Storage

The Occupational Safety and Health Administration (OSHA) Laboratory Standard recommends that the Chemical Hygiene Plan include standard operating procedures for handling and storage of 1) chemicals with moderate chronic or high acute toxicity and 2) chemicals with high chronic toxicity. Procedures for chemicals of high acute toxicity are found in [SOP 3.8, Particularly Hazardous Substances](#).

This procedure provides information for the handling chemicals with moderate chronic or high chronic toxicity. Chronically toxic chemicals may include reproductive toxins, those that cause chronic organ damage, other human carcinogens or substances with high carcinogenic potency in animals. Some of these, such as human carcinogens and reproductive toxins, may also be considered “particularly hazardous substances” and must be handled in accordance with [SOP 3.8](#).

3.22.1. Definitions

Acute – Sudden effects that occur rapidly as a result of a single exposure or several exposures over a short period of time.

Chronic - Gradual effects that occur as a result of frequent exposure over a long period of time.

Toxicity – The ability of a substance to damage an organism including a description of the effect and the conditions or concentration under which the effect takes place.

Using the National Fire Protection Associations (NFPA) health hazard classifications, chemicals with “high toxicity” can generally be identified as those having an NFPA health hazard rating of 3 and 4 and chemicals with “moderate toxicity” as those having an NFPA rating of 1 or 2. Chemicals of “low toxicity” can be identified as those having an NFPA health hazard rating of 0.

Route of Entry	NFPA 704 Health Hazard Classifications				
	4	3	2	1	0
Oral LD ₅₀	0-5 mg/kg	>5-50	>50-500	>500-2000	>2000
Skin Contact LD ₅₀	0-40 mg/kg	>40-200	>200-1000	>1000-2000	>2000
Inhalation LC ₅₀	0-1000 ppm	>1000-3000	>3000-5000	>5000-10,000	>10,000

Comparing the former OSHA definition to the Globally Harmonized System (GHS) of chemical classification and labeling, the GHS acute toxicity ratings of 1 and 2 account for the chemicals with ‘high acute toxicity’. Therefore, the GHS acute toxicity ratings of 3 and 4 can generally be used to identify chemicals that are considered “moderately toxic.” Those with toxicity ratings greater than those found under GHS category 4 (i.e. > 2000 mg/kg, etc.) as chemicals of “low toxicity.”

Route of Entry	GHS Acute Toxicity Ratings			
	1	2	3	4
Oral LD ₅₀	0-≤5 mg/kg	>5-<50	50-<300	300-<2000
Skin Contact LD ₅₀	0-≤50 mg/kg	>50-≤200	>200-≤1000	>1000-≤2000
Inhalation (gas) LC ₅₀	0-≤100 ppm	>100-≤500	>500-≤2500	>2500-≤5000
Inhalation (vapors) LC ₅₀	0-≤0.5 mg/l	>0.5-≤2.0	>2.0-≤10.0	>10.0-≤20.0
Inhalation (dust & mist) LC ₅₀	0-≤0.05 mg/l	>0.05-≤0.5	>0.5-≤1.0	>1.0-≤5.0

3.22.2. Procedures for Chemicals with Moderate Chronic Toxicity

- Minimize exposure to these toxic substances by any route using all reasonable precautions.
- Consult one of the standard compilations that list toxic properties of known substances and learn what is known about the substance that will be used. Follow the specific precautions and procedures for the chemical.
- Use and store these substances only in designated (restricted access) areas placarded with appropriate warning signs.
- Use a hood or other containment device for procedures which may result in the generation of aerosols or vapors; trap released vapors to prevent their discharge with fume hood exhaust.
- Avoid skin and eye contact by using gloves, safety glasses, and lab coats.
- Always wash hands and arms immediately after working with these materials.
- Maintain chemical inventories, amounts used, and the names of the personnel involved.
- Be prepared for accidents and spills. At least two people should be present at all times if compounds in use are highly toxic or of unknown toxicity.
- Store breakable containers in chemically resistant trays.
- Work and mount apparatus above trays or absorbent, plastic backed paper.
- If a major spill occurs outside the hood evacuate the area and call for assistance.
- Assure that cleanup personnel wear suitable protective apparel and equipment.
- Thoroughly decontaminate or dispose of contaminated clothing or shoes. If possible, chemically decontaminate by chemical conversion to a less toxic product.
- Store contaminated waste in closed, suitably labeled, impervious containers.

3.22.3. Procedures for Work with Chemical of High Chronic Toxicity

The following supplemental procedures are provided, in addition to those mentioned above, for work with substances of known high chronic toxicity (in quantities above a few milligrams to a few grams, depending on the substance):

- **Access:** Conduct all transfers and work with these substances in a “controlled area”: a restricted access hood, glove box, or portion of a lab, designated for use of highly toxic substances, for which all people with access are aware of the substances being used and necessary precautions.
- **Approvals:** Prepare a plan for use and disposal of these materials and obtain the approval of the principle investigator, lab manager, or laboratory supervisor.
- **Decontamination:** Protect vacuum pumps against contamination using scrubbers or HEPA filters and vent them into the hood. Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area. Decontaminate the controlled area before normal work is resumed there.
- **Exiting:** On leaving a controlled area, remove any protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck.
- **Housekeeping:** Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance was a dry powder.
- **Medical surveillance:** If frequently using such a substance on a regular basis (e.g., 3 times per week), consult a qualified physician concerning desirability of

regular medical surveillance. [See Section 5.0 for additional information.](#)

- **Records:** Keep accurate records of the amounts of these substances stored and used, the dates of use, and names of users.
- **Signs and labels:** Assure that the controlled area is conspicuously marked with warning and restricted access signs and that all containers of these substances are appropriately labeled with identity and warning labels.
- **Spills:** Assure that contingency plans, equipment, and materials to minimize exposures of people and property in case of accident are available.
- **Storage:** Store containers of these chemicals only in a ventilated, limited access area in appropriately labeled, unbreakable, chemically resistant, secondary containers.
- **Glove boxes:** For a negative pressure glove box, ventilation rate must be at least 2 volume changes/hour and pressure at least 0.5 inches of water. For a positive pressure glove box, thoroughly check for leaks before each use. In either case, trap the exit gases or filter them through a HEPA filter and then release them into the hood.
- **Waste:** Use chemical decontamination whenever possible; ensure that containers of contaminated waste (including washings from contaminated flasks) are transferred from the controlled area in a secondary container.