Safety Guidelines for the use of Carcinogens, Teratogens and Highly Toxic Chemicals in Small Quantities in Labs

Scope

This guidance document is intended to cover the usage of carcinogens, reproductive toxins or highly toxic materials in small quantities in labs that are not primarily chemical labs. An example would be the use of formaldehyde as a fixative, or the use of anti-neoplastic agents and other toxic chemicals in animal models or in vitro. Labs using larger quantities, and which are more like a chemistry lab will require a High Hazard Chemical permit (Chem 3 permit). Highly toxic materials for the purposes of this document are materials with an LD50 less than or equal to 50mg/kg. Where an LD50 is not available a lowest observed adverse effect level can be consulted, if available. If unsure, consult with Environmental Health and Safety (EHS). In the event that extremely toxic materials are used (LD50<5mg/kg), please consult with EHS.

Responsibilities

Principal Investigator (PI)

The PI is responsible for:

- Identifying chemicals of concern.
- Developing safe practices and standard operating procedures (SOP's);
- Ensuring that needed safety equipment (e.g. fume hood or biosafety cabinet) is available for use, and;
- Ensuring that students and staff follow the established procedures.

Users

Users of carcinogenic or teratogenic materials in the lab must follow all established protocols and SOP's for the use of the hazardous materials.

Handling Small Quantities of Hazardous Chemicals

The hazard presented by the wide variety of cancer causing carcinogens, reproductive toxins like teratogens and highly toxic materials (LD50<50mg/kg) varies with each material, but the protective measures to prevent the harmful exposure are generally the same. Some toxins are covered by other regulations and should be used according to appropriate standards and guidelines e.g. cholera toxin, tetrodotoxin. Please see the Human Pathogens and Toxins Act, Schedule 1.

- Wear standard PPE per the UofT Lab Coat Guidelines and PPE assessment tool. Typically, this is a lab coat, gloves, safety glasses, leg covering to the top of the socks, and shoes that cover the whole foot.
- Use a fume hood for handling liquids or powders being transferred, handled or weighed. If weighing in the fume hood will result in inaccurate weights, or excessive loss of powder, the covered container can

be tared on the balance, and the material dispensed into the tared container, covered and then returned to the balance.

- Conduct regular cleaning of surfaces where materials have been used. Often small amounts of material end up on surfaces and can stay there unnoticed for months. Note that this is more of an issue for stable materials.
- Wash lab coats regularly per the UofT Lab Coat Guidelines.
- Ensure that all spills are as promptly cleaned up as possible.
- If the material is being used in an animal study, follow the SOP's used and training given in the animal facilities.

Examples of Chemicals

Material	Reproductive Toxin?	Carcinogen per IARC?†	LD50 or LC50‡	ACGIH TLV*	Comments	Exposure routes
Acrylamide bisacrylamide	Yes, both in males and females (animal studies)[4]	Group 2A probable human carcinogen[1]	150 to 413 mg/kg, rat	0.03 mg/m3[3]	Neurotoxin causing peripheral neuropathy (e.g. numbness in hands and feet) at high doses that are atypical of lab exposures	absorption through skin, inhalation of powder
Formaldehyde, paraformaldehyde	No[7]	Group 1 sufficient evidence in humans (nasopharyngeal cancer)	480 ppm, rat	0.1 ppm[3]	Respiratory (lung) and skin sensitisation (allergies)	Inhalation of vapours, skin contact for allergic reactions
Tamoxifen	Some evidence in animals, evidence in humans, but at therapeutic doses[9]	Group 1 sufficient evidence in humans (endometrial cancer)[9]	2150 mg/kg mouse, oral	N/A	Exposure to therapeutic doses unlikely in lab setting	Inhalation of powder, accidental ingestion from contam. hand to mouth

† International Agency for Research on Cancer

‡ Lethal Dose or lethal concentration that kills 50% of an animal population (if available).

* American Conference of Governmental Industrial Hygienists Threshold Limit Value for an 8 hour work day, 5 days a week.

References

1. 2006, The National Institute for Occupational Safety and Health (NIOSH), International Chemical Safety Card, Acrylamide
2. 1994, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 60, Acrylamide
3. 2018 TLV's and BEI's Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents, ACGIH
4. 2003, Friedman, Medel, Chemistry, Biochemistry, and Safety of Acrylamide. A Review, J Agric. Food Chem., 51(16)
5. 2012, Toxicological Profile for Acrylamide, Agency for Toxic Substances and Disease Registry (ATSDR), Atlanta, GA: U.S. Department of Health and Human Service, Public Health Service
6. 2012, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 100F, Formaldehyde
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8. 2002, IPCS Inchem, SIDS (Screening Information Data Set) Initial Assessment Report, Formaldehyde, UNEP, Paris, France
9. 2007, Tamoxifen [internet], TOXNET, National Toxicology Program, National Library of Medicine, Hazardous Substances Database, Bethesda, MD [accessed June 2018]