HAZARDOUS WASTE STORAGE AND DISPOSAL

Lash Miller's applicable Policies:

1) Chemical waste should NEVER be stored on the floor.
2) Never mix incompatible materials in a single container.
3) Always package halogenated and non-halogenated waste separately

1. Purpose:

To provide guidance to safely store and dispose of chemical waste.

2. Scope:

Applies to all users.

3. Prerequisites:

WHMIS & Chemical Safety training. Reference the Chemical Compatibility & Storage SOP

4. Responsibilities:

Researchers should be cognizant of the types of chemical waste generated and ensure proper disposal guidelines are followed to protect staff and the environment. In order to minimize the total amount of chemical waste, avoid overstocking chemicals and order only what is needed. It is everyone's responsibility to follow this SOP and to report any deficiencies to the Director of Operations & Technical Services..

5. Personal Protection Equipment (PPE):





6. Storage of Hazardous Chemicals and Hazardous Chemical Waste

6.1 Definition

Chemical waste includes solids, liquids or gases containing or contaminated with any of the following:

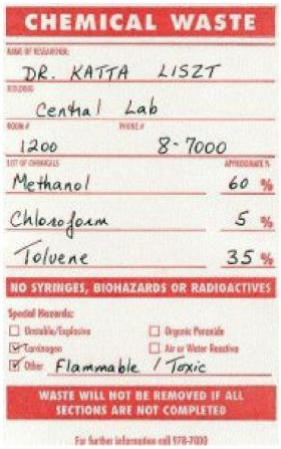
- Flammable solvents **(e.g. acetone, alcohols, acetonitrile);**
- Leachate toxic materials **(e.g. heavy metals, pesticides);**
- Corrosives **(e.g. hydrochloric acid, potassium hydroxide pellets);**
- Reactives such as oxidizers, cyanides, sulphides, explosives, unstable materials and water-reactive materials **(e.g. sodium metal, benzoyl peroxide);**
- Toxic materials including mutagenic, carcinogenic, acute or chronic toxicity materials **(e.g. chloroform, ethidium bromide)**;
- polychlorinated biphenyls (> 50 ppm concentration);
- Non-returnable gas cylinders.

Hazardous waste **must be stored safely prior to removal from the laboratory** and **should not be allowed to accumulate**. All safety precautions required for handling and storage of hazardous chemicals should also be observed for chemical waste.

6.2 Chemical Waste Collection and Storage

- Know the hazards! Consult the SDS and identify the primary and secondary hazard
- class to determine the appropriate storage group.
- Store chemical waste compatibly according to hazard groups to avoid explosions, fires and spills (refer to the Chemical Compatibility Section 6.4 and Appendix A: chemical storage flowchart & Appendix B: chemical storage table) (from U of T, EHS web-site).
- Ensure chemical waste is stored in an appropriate primary container.
- A waste container's material must be compatible with the hazardous waste it stores:
    - Sharps must be in puncture-resistant containers.
    - Hydrofluoric acid cannot be stored in glass containers.
    - Piranha solution must have a lid that allows for vapours to vent.
    - Solvent safety cans should be used to collect and temporarily store large volumes (10-20 litres) of flammable organic waste solvents.
- Containers must be in good condition and should remain closed unless waste is being added.
- Liquid chemical waste should only be filled to approximately 75% capacity to allow for vapour expansion and to reduce probability of spills.
- Package halogenated and non-halogenated solvents separately. The University pays a premium for disposing of halogenated solvents (e.g. chloroform, dichloromethane).
- Do not insert precipitates, solids or other non-fluid wastes into safety cans.

- Use secondary containment such as trays, dividers or distance.
- Storage locations should be properly labeled and be compatible with the type of waste it is housing:
    - Flammables in flammable cabinets.
    - Hazardous chemicals below eye level and on shelves with lips.
    - Acids in lined cabinets to prevent cabinet corrosion.
- Do not overcrowd storage or place chemical waste close to shelf edges where they can be knocked or pushed off.
- All containers for storing chemical waste must be properly sealed and undamaged.
- Hazardous waste containers stored in laboratories should be periodically inspected for leaks. Dispose of aging containers **promptly**.
- The container MUST be labeled:
    - Waste labels are free of charge in Chemical Stores (Room LM20).
    - Label in a manner that will allow the hazards to be clearly and accurately identified.
    - Maintain an accurate inventory of the waste materials being added to the waste container using the appropriate waste labels.
    - Use generic chemical names, not abbreviations or acronyms.
    - Approximate concentrations are required.



PLEASE NOTE: The Environmental Protection Services staff responsible for removing hazardous wastes from buildings rely on properly labeled packaging. Their safety is dependent on the accurate identification of the contents and the labelling of the waste containers.

- Wastes must not be packaged in containers that improperly identify other non-existing hazards. For example, chemical wastes **cannot** be packaged in biohazard bags if no biohazard is present.
- Temporary storage of chemical waste must be in the generator's laboratory. Chemical waste is stored for longer periods of time in the Central Waste-Holding Facility located in **LM705**.

Materials with special storage requirements include organic peroxides, PCBs (polychlorinated biphenyls), non-returnable gas cylinders and explosives. **Before** disposing of these materials, contact Environmental Protection Services at 416-978-7000 or email hazwaste.ehs@utoronto.ca.

6.3 Chemical Waste Drop Off

- Chemical waste drop off is every Friday from 3:00 - 4:00 pm.

- Empty chemical bottles can be used as waste containers. Barcodes must be removed (see Section 6.6 for Barcode Removal procedure). Note: the barcode label on the bottle should have been crossed out as proof of removal.
- Liquid waste:
    - Flammable solvents can be consolidated in 10 or 20L red safety cans. These safety cans must be picked up directly from the laboratory by Environmental Protection Services, which can be scheduled by contacting the Manager of Technical Support and Services at chem.safety@utoronto.ca.
    - Acidic, Basic, Halogenated and Aqueous waste can be consolidated in 4L bottles.
- Solid waste:
    - Lightly contaminated waste should be collected in green pails.
    - Powders should be collected in separate green pails.
    - Sharps will only be accepted in yellow puncture proof containers.
- All lightly contaminated waste shall be consolidated into 200L open-head steel drums located by the loading dock. Green pails can be reused for waste collection in labs.

- When a green pail is highly contaminated it can be replaced during waste drop off.
- Liquid and solid hazardous waste must be transported to the Central Waste-Holding Facility in LM705. All hazardous waste must be segregated according to the signage within the room:
    - Flammable liquids and solids must be placed within the flammable cabinets.
    - Green pails and 20L closed-head drums must be placed on the spill containment pallets. o Sharps must be placed in the biohazard totes.
    - Acids, bases, oxidizers, reducers and aqueous waste bottles must be placed on the corresponding dedicated shelves.

- Chemical waste can only be transported on the freight elevator.
- Waste should only be transported using either a cart or chemical carriers. Carts should have a lip to prevent leaks and spills. Utilize secondary containment if needed.
- Improperly labeled waste **will be refused**.

6.4 Chemical Compatibility (please refer to SOP)

When preparing chemical waste for disposal, it is the generator's responsibility to ensure that incompatible chemicals are not stored in the same container. Waste containers should be stored according to their compatible chemical reactivities. A few general examples are:

- Acid-reactive compounds (e.g. cyanides, sulphides) which liberate gaseous products when acidified should not be mixed with any inorganic acids (e.g. sulphuric or hydrochloric acid)
- Organic acids (e.g. glacial acetic acid) should be segregated from inorganic acids. Generally inorganic acids are oxidizing agents while some organic acids may be either reducing agents or combustible.
- Water reactive materials (e.g. sodium) should be kept away from any water source.
- Oxidizers (e.g. any inorganic compound that assists fire such as hydrogen peroxide) should never be mixed with organic materials (e.g. organic bases such as pyridine, aniline, amines, flammable solvents) or reducing agents (e.g. water-reactive chemicals).

Note: Perchloric acid, although an inorganic acid, is a powerful oxidizing agent and should be considered a powerful oxidizer in its concentrated form.

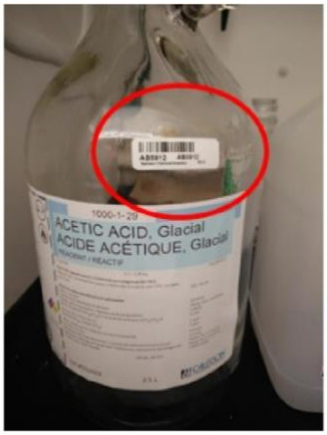
6.5 Re-use of an Empty Chemical Bottle as a Chemical Waste Container

- Confirm that the depleted chemical has been removed from the inventory. If thebar code has been crossed out, it has been removed.
- Vent the bottle open inside a fume hood for 24 hours **BEFORE** re-use or disposal.
- If you wish to dispose of, do so according to the bottle's material: a) Glass b) Plastic and place in appropriate drum during waste disposal.
- If you wish to re-use the bottle as a waste receptacle, cover the original supplier label with a "WASTE" label.
- Keep an accurate qualitative inventory of chemicals that are collected in the receptacle.
- Store the chemical waste container in the designated waste storage area in your lab.

6.6 Barcode Removal

- When a bottle of a hazardous chemical has been depleted, you can choose to dispose of the bottle or to re-use to collect chemical waste.

- However, the chemical MUST first be removed from Vertére, the Departments' online inventory management system, and the barcode must be crossed out.
- To remove a chemical from Vertére, you may either email a picture of the barcode to chemistry.hechmet@utoronto OR you may so manually by following the steps below:
    - Sign into your online inventory
    - Select Chemical
    - Select View/ Update on the side panel o Scan the bar code under "Scan Tag" o Select the chemical that has been depleted from the list.
    - Click the "Dispose" Button
    - Complete the blank fields including: PI, Disposal Method and approved on
    - Select OK
    - Black out the bar code to indicate the chemical has been removed from the inventory.



Crossed-out barcode to indicate the chemical has been removed

6.7 Special Cases

The preceding procedure dealt with common teaching and research chemical wastes generated by the University. Occasionally chemical wastes are generated that require additional or special handling, as discussed below. For any wastes that require special handling such as organic peroxides, PCBs (polychlorinated biphenyls) or explosives, consult the Manager, Environmental Protection Services at 416.978.7000 or e-mail hazwaste.ehs@utoronto.ca.

Do not handle explosive materials

- Examples of explosives include materials such as trinitrated compounds (e.g. TNT), dry picric acid (<20% by weight water content), fulminated mercury, heavy metal azides (e.g. lead azide).
- These materials require special handling for disposal. These materials must be checked frequently for signs of deterioration and aging.
- These signs would include "sweating" of a container, bulging, crystal formation around the cap, etc.
- Deteriorating explosive materials are potentially more dangerous to handle than new explosives. Inform EHS immediately.

Gas Cylinders: All gas cylinders should be treated as high energy sources

- Use the smallest size required to do the work.
- Prior to purchasing the cylinder, check that empty cylinders can be returned directly to the supplier.
- Disposing of these materials elsewhere is extremely expensive and difficult.
- Contact the EHS Office for further information.

Mercury Thermometers

Mercury thermometers for disposal should be treated as chemical waste. Broken thermometers should be considered contaminated and all free liquid mercury should be collected and packaged in a leak-proof container, together with all contaminated solids such as glassware, gloves used during the clean-up, etc.

Peroxidizable Compounds
(Please refer to Peroxidable Compounds SOP for further information)

- These materials should be ordered in small quantities (less than 6 months supply) and dated when the container has been opened. Even if a commercial inhibitor has been added by the manufacturer, organic peroxide formation can begin within 6 months following exposure to air. The ordering of smaller quantities and the reduction of the volume of these materials in storage, encourages the quick turnover of inventory and reduces the likelihood of peroxide formation.
- Organic peroxides are explosive. The following materials are potential organic peroxide formers:
    - Acetal
    - Decahydronapthalene
    - Dicyclopentadiene
    - Diethylene glycol
    - Dioxane
    - Diethyl ether
    - Isopropyl ether

Polychlorinated Biphenyls (PCBs)

- The handling of PCB-contaminated waste materials requires special consideration for handling, storage and disposal.
- A concentration greater than 50 ppm is considered to be PCB-contaminated.
- Sources of PCBs include transformers containing the trade name Aroclor (or the generic fluid called askarel). PCBs can also be found in capacitors, hydraulic equipment, electromagnets, heat transfer equipment and vapour diffusion pumps.
- EHS staff can analyze samples to determine if they are PCB-contaminated. Special arrangements for disposal must be coordinated by the Office of Environmental Health and Safety.

Asbestos

- Asbestos-containing materials such as bunsen burner pads, gloves etc., are disposed of by Facilities and Services Trades staff trained in the proper handling of these materials. Contact the Director of Operations and Technical Services at chem.safety@utoronto.ca who will open a SOR.

Batteries

- Household batteries should be placed into battery recycling containers placed around campus. Drop-off containers are provided by Facilities and Services and located in Lash Miller, St. George lobby.
- All lithium batteries must has ends taped prior to disposal.
- For further information contact the **Recycling Coordinator** at 416.946.5711. All other batteries (i.e., 12 volt or larger) are collected directly by EHS staff.

Empty Drums

- Empty drums (20 to 205 litre capacity) will be removed by EHS staff.

Ethidium Bromide

- All materials contaminated with ethidium bromide, including solids (e.g. gloves) should be packaged in a secure container, labelled and treated as chemical waste.
- **Gels contaminated with ethidium bromide** should be left to dry-out inside a fume hood (exposing them to the fume hood air flow) for at least 24 hours. Once completely dry, dispose as solid chemical waste.

6.8 Environmental Considerations

- Chemical waste **MUST NOT BE FLUSHED** down drains as a method of disposal.
- It is illegal in accordance with the City of Toronto Sewers Bylaw and Provincial Legislation andmay lead to:
    - Dangerous chemical reactions
    - Damage to the drainage system
    - Potential hazard for trades personnel working on the system
    - Environmental exposure
- Warning labels are available free of charge to display at sink areas. Contact Environmental Protection Services at 416.978.7000 for labels.

7. Other:

Non-hazardous waste must not be placed in hazardous waste containers. Contact **Caretaking** or **Recycling** for information on disposing of non-hazardous waste. Disposing of hazardous waste materials is very expensive. It is the responsibility of each generator to ensure that wastes are properly segregated for disposal.

APPENDIX A

UNIVERSITY OF TORONTO

FACILITIES & SERVICES

LABPACK CODES AND PACKING CRITERIA

Labpack Code A: Inorganic Acids and Salts

A includes inorganic acids, elements and inorganic acidic salts that do not liberate gaseous products when acidified. (ie. solids of pH range 7-1, bifluorides, bismuthates, bisulfates, bisulfites, boric acid, molybates, monophosphates, selenates, stannates, sulfates, tungstates, vanadates, and higher valence chlorides such as ferric chloride and stannic chloride)

Labpack Code B: Inorganic and Organic Caustics

B includes inorganic alkaline chemicals, elements, mercury compounds and inorganic alkaline salts that liberate gaseous products when acidified. (ie. arsenates, arsenites, bicarbonates, borates, bromides, lower valence chlorides, diphosphates, hydroxides, iodides, oxides, silicates, sulphides, thiosulfates and triphosphates)

Labpack Code C: Solid Organic Compounds

C includes solid organics such as acetates, oxalates, phthlates, carboxylic acids and waxes

Labpack Code D: Organic Solvents and Organic Acids

D includes aromatic and aliphatic solvents plus organic acids. (ie. benzene, toluene, xylene, ketones, petroleum distillates, ethers, esters, formic acid, chloroform, dichloromethane, methylene chloride, carbon tetrachloride, trichloroethane, alcohols, butanol, pentane, hexane and oils)

Labpack Code E: Inorganic Oxidizing Compounds

E includes inorganic oxidizers including sulfites, bromates, chlorates, chromates, dichromates, dioxides, hydrogen peroxide, iodates, nitrates, nitrites, perborates, trioxides, permanganates, perchloric acid, perchlorates, persulfates, pyrophosphates, chromic acid and concentrated nitric acid.

Labpack Code F: Solid and Liquid Pesticides and Herbicides (excluding aerosols)

F includes solid and liquid pesticides, herbicides and rodenticides including Lead Arsenate, Pyrethins, Rotenone, Carbaryl, Propoxur, DDT 2,4-D, Chlordane, Lindane, Captan, Malathion, Methoprene, Tetramethrin and Warfarin

Labpack Code H: Mercury

H includes elemental mercury or containers containing free mercury as well as elemental mercury contaminated material

Labpack Code I #: Compressed or Liquefied Gases, Low Pressure

I includes compressed or liquified gases in low pressure cylinders including such compounds as propane

I1 - Compressed gas cylinders, non-flammable
I2 - Compressed gas cylinders, flammable

Labpack Code J: Inorganic Cyanides

J includes solid and liquid inorganic cyanides including cyanides, ferricyanides, ferrocyanides, nitroprussides and thiocyanides

Labpack Code : *Batteries*

- *Lead-acid batteries such as car batteries*
- *Alkaline batteries*
- *Lithium batteries*
- *Mercury batteries*
- *Nickel cadmium batteries (NiCad)*
- *Mixed batteries*

Labpack Code M: *Pharmaceuticals (excluding aerosols)*

M includes solid and liquid pharmaceuticals.

Labpack Code N#: *Aerosol Cans*

N1 - Aerosol cans (common)
N2 - Pesticide aerosol cans

Labpack Code P: *Paints and Varnishes*

P includes paints (alkyd, latex) and varnishes

Labpack Code Q: *Isocyanate Based Resins*

Labpack Code X#: *Air and Water Reactive Chemicals*

X1 includes moisture or air reactive inorganic chemicals which react violently with moisture to produce a corrosive gas. (ie titanium tetrachloride, thionyl chloride, aluminum chloride, phosphorous oxychloride, phosphorous pentoxide, chloro-sulphonic acid)

X2 includes moisture or air, reactive chemicals which ignite or produce a flame or flammable gas. (ie, magnesium, calcium, sodium metal, sodium dithionite, calcium carbide, phosphorous (white, yellow, red, black))

X3 includes moisture or air, reactive organic chemicals which react violently with air or moisture to produce a corrosive gas.(ie acetyl chloride, chlorosilanes)

X4 includes moisture or air reactive organic chemicals which can ignite or produce a gas that can spontaneously ignite in air or water. (ie. grignard reagents, methyl magnesium bromide, butyl lithium, triethyl aluminium, wetted picric acid (trinitrophenol))

X5 includes organic oxidizing compounds. (ie. methyl ethyl ketone peroxide, benzoyl peroxide, tert-butyl hydroperoxide)