1. **Introduction/Purpose**

The following procedures have been established to ensure faculty, staff and students know the necessary protective measures in teaching and research laboratories. Many different chemicals are usually associated with different hazards. It also outlines specific procedures for shared storage locations.

For responsibilities and training, additional equipment, personal protective measures, and other general inquiries go to York University Laboratory Safety program: [http://www.yorku.ca/dohs/documents/YU_Lab_Safety_Program_2012.pdf](http://www.yorku.ca/dohs/documents/YU_Lab_Safety_Program_2012.pdf)

2. **Definitions, Abbreviations**

**Bonding:** elimination of electrical potential between two or more objects. This is accomplished by attaching a conductive wire between the objects to allow a free flow of charge. Bonding does not eliminate static discharge – it simply allows it to equilibrate.

**Combustible Liquids:** any liquid that has the ability to burn and has a flashpoint that is at or above 37.8 °C. Combustible liquids are referred to as Class II (flashpoint at or above 37.8 °C but less than 60 °C) or Class III (flashpoint at or above 60 °C) liquids.

**Flammable Liquid:** any liquids which has a flash point of less than 37.8 °C. Flammable liquids are divided into 3 subclasses as follows:

<table>
<thead>
<tr>
<th>Class of Flammable Liquid</th>
<th>Flash Point</th>
<th>Boiling Point</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class IA</td>
<td>&lt; 22.8 °C</td>
<td>&lt; 37.8 °C</td>
<td>acetaldehyde, diethyl ether</td>
</tr>
<tr>
<td>Class IB</td>
<td>&lt; 22.8 °C</td>
<td>&gt; 37.8 °C</td>
<td>acetone, acetonitrile, ethanol, hexane</td>
</tr>
<tr>
<td>Class IC</td>
<td>22.8 °C - 37.8 °C</td>
<td></td>
<td>amyl acetate, butanol, xylene</td>
</tr>
</tbody>
</table>

**Flashpoint:** the minimum temperature at which a liquid within a container gives off vapour in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. Note, it is the vapour which ignites, not the liquid.

**Grounding:** a means for continuously discharging a charged object to earth. Unlike bonding, grounding removes static charge as quickly as it is produced.

**LC₅₀:** Quantity of toxic material in the air needed to cause death in 50% of the test subjects.

3. **Equipment and Facilities:**

**Facilities**

Volatile Chemical Storage Rooms: There are volatile chemical storage rooms for products sold in the Farquharson (G105) and Petrie (030H) Science stores. These are rooms with exhausted ventilation for container storage and dispensing, as per the Ontario Fire Code.

**Equipment (as applicable)**

Fumehood: used to remove toxic and harmful vapours from the user. (see section 6 of this SOP for details on fumehood maintenance and usage).

Grounding/Bonding wires: Used to remove electrical potential or static charge from equipment or containers.
4. Storing Chemicals

General Chemical Storage

- Chemicals stored above eye level (keep in mind that not everyone has the same eye level) should be stored on a shelf with a lip or within an enclosed cabinet.
- All chemicals should be stored in a closed container with a proper label.
- Any chemicals being stored should have an up to date MSDS near by.

Storing Flammable Chemicals

- No more than 10 litres of flammable & combustible liquids combined may be stored outside of a storage cabinet. Of the 10 litres, no more than 5 litres may be Class I flammable liquids.
- Flammable liquids must be stored in an approved flammable storage cabinet. The cabinet should have the follow label: FLAMMABLE – KEEP FIRE AWAY
- The Ontario Fire Code permits a total of 500 litres of flammable and combustible liquids in closed containers to be stored in an approved flammable storage cabinet of which no more than 250 litres are of Class I flammable liquids. These volume amounts must take “waste” liquid/solvent into account as well.

Storing Chemicals in Fridges

- Refrigerated storage used for flammable or combustible liquids must be clearly identified as such and all electrical equipment within the refrigerator must conform to the Electrical Safety Code made under the Electricity Act.
- Flammable liquids must be kept in a closed container.
- The fridge should have a label indicating the types of substances stored within (i.e. alcohols, fluorinated gases, enzyme assays).
- Do not put foods in fridges that contain chemicals

Storing Toxic Chemicals

- Toxic chemicals should be stored within an exhausted, enclosed area.
- Highly toxic chemicals should be stored separately from other hazard classes.
- Maintain the lowest possible quantities of highly toxic chemicals.

5. Handling Chemicals

- Users that are handling any chemicals must have received WHMIS II training. Users that are handling large volumes of chemicals (larger than 4L) must have received Volatile Room/Chemical Handling training.
- Refer to MSDS before transporting, handling or dispensing of chemical.

Transporting Chemicals

- All glass and plastic bottles must be transported through public corridors in an approved bottle carrier, which is a secondary container capable of holding all materials in the event of accidental breakage and spills.
- When transporting heavy drums or multiple bottles of chemicals you should use a cart.
- When transporting chemicals, on a cart, between buildings or over a steep ramp (i.e. volatile storage rooms), bottles must be contained within a barrier that is at least ⅓ the height of the bottle.
Dispensing Flammable Liquids

- All dispensing and collection of flammable liquids in a laboratory must be conducted in a properly functioning fume hood. Dispensing of flammable liquids inside fume hoods should be done slowly (no rapid or splash filling) to prevent the accumulation of static electricity as the liquid is dispensed.
- When dispensing flammable liquids to or from containers of greater than 5L, the container must be grounded/bonded.
- Proper bonding and grounding techniques must be in place before dispensing of a flammable liquid begins.
  - The drum must be grounded via a conductive wire to a metal structure (e.g. metal shelf in Petrie/Farquharson Volatile Storage Rooms).
  - A safety can larger than 5L has to then be bonded via a conductive wire to the flammable liquid drum.
  - See illustration below.

Dispensing of flammable liquids into large plastic containers should be avoided since plastic is prone to static electricity. Use glass bottles or metal pails. Exceptions are the small 'squirt bottles' and the use of a plastic funnel.

Using the Volatile Chemical Storage Rooms (030H PSE & G105 FB)

- Chemicals available through Science Stores are stored within the volatile chemical storage rooms. A key can be signed out from Science Stores.
- Before entering volatile rooms, you should have received Volatile Room/Chemical Handling and WHMIS II training.
- To minimize the risk of spillage, all substances which are in glass bottles must be transported in a safety container or on laboratory carts.
  - If the cart does not have a barrier that is at least ½ the height of the bottle, the bottles must be transported in or out of the volatile storage room individually.
- You should not enter the volatile rooms alone, especially when dispensing solvents or getting multiple bottles; use the ‘buddy system’.
- If the door is shut while you are inside, keep the key in the door to allow others access in case assistance be needed.
- The door may be left open while you are transporting chemicals into or out of the room. The door must be kept closed when you are not in the room. An open door compromises the effectiveness of the fire system.
- These volatile rooms are protected by a CO\textsubscript{2} Fire Suppression System. Upon annunciation (audible bell and visible strobe light), vacate the room immediately. 20 seconds after annunciation has been initiated, CO\textsubscript{2} will be discharged into the room.
6. Using Chemicals

Fumehood Maintenance and Usage

- Fumehoods should be certified on an annual basis.
- Fumehoods should not be used for chemical storage.
- Before each use, verify it is in working order, if not contact Facilities Services at 22401.
  - Check the flowmeter, which should be between 80-120 fpm (ideally 100 fpm).
    - If the flow rate is below 80 fpm, close the sash and affix a sign indicating the fumehood should not be used.
- Do not stick your head into fumehood when chemicals are within the fumehood.
- Keep the sash as low as possible when working with chemicals in the fumehood (18 inches max) and keep the sashes closed when not in use.
  - Be mindful of possible disruptions to the airflow:
    - putting hands over open containers hinders removal of fumes
    - quick or sudden hand/arm movements can alter the airflow
    - a brisk walk in front of the fumehood can have an effect on airflow
  - After any rapid movement in or around the fumehood, allow the airflow to return to normal before continuing to work in the fumehood
- You should not heat perchloric acid in a fumehood. Special fumehoods and ductwork are required when heating perchloric acid.

Using Flammable/Combustible Chemicals

- A portable class B fire extinguisher has to be kept available in the laboratory. The extinguisher must be clearly visible, accessible, operational and fully charged.
- Care must be taken when working with combustible metals (e.g. magnesium, titanium, potassium, sodium). When working with these substances, it is advisable to have a Class D fire extinguisher or a sand bucket present.

Using Corrosive Chemicals

- Always use corrosive chemicals in a fumehood.
  - When using corrosive chemicals that are harmful by inhalation and engineering controls are not effective in controlling exposure, a respirator shall be worn.
- Use care when diluting corrosive liquids and add reagents slowly. Dilution of inorganic acids produces a lot of heat that may cause the liquid to boil violently.

Using Toxic Chemicals

- Always use toxic chemicals in a fumehood.
  - When using toxic chemicals and engineering controls are not effective in controlling exposure, a respirator shall be worn.
  - Whenever possible substitute toxic chemicals with a less toxic chemical. Otherwise, use the smallest quantities possible.

Be aware of the typical symptoms of overexposure and appropriate first aid procedure.

Using Reactive Chemicals

- Reactive chemicals have distinct properties and associated hazards, depending on the chemical being used.
- Thoroughly review the procedures and risks before working with reactive chemicals.
- Take extra precaution when working with reactive chemicals. Additional or specialized PPE may be required
- Follow outlined procedures exactly.
- Do reactions with very small amounts of a reactive chemical.
7. Spill Response

For an outline of the procedure used to assess an emergency spill (spill response flowchart should be posted in the lab) go to: www.yorku.ca/dohs/documents/Emergency_Spill_Procedure.pdf

After assessment, if it is deemed that the worker can deal with the spill, the follow procedure should be followed:

Non-toxic Chemical Spills

1) Ensure any injured person seeks first aid or medical aid, but prevent spreading the spilled materials by washing exposed sites or removing contaminated lab coats.

2) Ensure adequate PPE is donned before cleaning up a spill.

3) Contain the spill:
   a) keep spilled chemicals out of the drains using an absorbent sock, a barrier of absorbent or an impermeable cover
   b) contain spill to as small an area as possible

4) Keep others out of the area affected by the spill (i.e. cordon off the spill area)

5) Neutralize/absorb the chemical spill
   → depending on your type of spill kit, this may be one step ('universal' spill kits – a) or separate steps (b)
      a) Add ‘universal’ (already contains neutralizing compounds) absorbent material. Leave for at least 10 minutes to allow for neutralization and absorption.
      b) i) Add appropriate acid or caustic neutralizer until the spill has been neutralized. It may take 5-10 minutes for neutralization (some have colour indicators).
         ii) Add absorbent material and leave for 10 minutes to allow for absorption.

6) If help is required, contact the Health & Safety Officer for FSc, or the Chemical Control Officer from DOHS, to help guide you through clean up procedures.

7) Survey the area and look for other sites that may have been splattered and contaminated.

8) Transfer the spilled materials and absorbent into a leak proof container.

9) Label the container as solid waste and dispose through Science Stores.

10) Once the situation is under control, you report the incident to the lab supervisor.

Volatile Toxic Chemical Spills

Additional considerations are required for toxic spills of volatile chemicals with a health hazard rating of 3 (1000 ppm > LC50 ≤ 3000ppm) or a health hazard rating of 4 (LC50 ≤ 1000 ppm). A few examples (this does not constitute a full list; check the MSDS for each chemical used) are acetic anhydride, acrylamide, boron tribromide, formaldehyde, halides, hydrofluoric acid, hydrogen cyanide, mercaptans, methylene chloride, nitrogen oxides, some heavy metal compounds (i.e. arsenic, cadmium, chromium, lead, mercury, tellurium, titanium), ozone, phosgene, pyridine.

- If spill is within the fumehood, close the sash immediately. Assess the spill and if help is required contact the Health & Safety Officer for FSc or the Chemical Control Officer from DOHS.

- If the building uses re-circulated air (all FSE buildings use re-circulated air to some extent) and the spill has occurred outside of the fumehood, use the following procedure:
  i. If the area is occupied by others, evacuate the area. Place a sign to keep others out of the area.
  ii. If necessary (i.e. a significant amount of spill material or it is located in a common area, like a hallway) pull the fire alarm to evacuate the building.
  iii. Contact Facility Services (ext. 22401) to shut down air handling system. Tell them the health hazard of the chemical spill, the building and location of spill within the building.
iv. Contact York Security immediately (ext. 33333 or 416-736-5333). Tell them the location of the spill, the type of chemical (include health hazard information), as well as any other relevant information.

8. Related References, Standards, Guidelines

i. Ontario Fire Code

ii. National Fire Code of Canada

iii. Electrical Safety Code

iv. NFPA 45 – Standards on Fire Protection for Laboratories Using Chemicals

v. Transportation of Dangerous Goods Act