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Table of Contents

1	Purpose	2
2	Scope	2
3	Definitions	2
4	Responsibilities	3
5	Training	3
6	General Chemical Storage Requirements	3
7	Containers	4
8	Secondary Containment	5
9	Shelving	5
10	Chemical Safety Cabinets	5
	10.1 <i>Flammable Cabinets</i>	6
	10.2 <i>Corrosion Proof Cabinets</i>	7
	10.3 <i>Venting</i>	8
11	Refrigeration	8
	11.1 <i>Refrigerators and Freezers</i>	8
	11.2 <i>Flammable Refrigeration</i>	8
12	Labs	9
13	Storage Rooms	10
	13.1 <i>Flammable Storage Room</i>	10
14	Segregation	11
	14.1 <i>Multiple Hazard Classes</i>	13
15	Additional Storage Requirements	14

16 References14

17 Document History14

1 Purpose

The proper storage of chemicals is an essential part of workplace safety. A chemical is considered to be in storage at all times where it is not directly in use. This document outlines the requirements and best practices for chemical storage as found in safety regulations or defined by the University of Manitoba to ensure the protection of people and the environment.

2 Scope

This document applies to all chemicals at the University of Manitoba, including lab samples or preserved specimens where a chemical is known to be present.

It covers relevant health, safety, and environmental legislation, but does not include requirements explicitly outlined in the Manitoba Fire Code or Manitoba Building Code.

3 Definitions

Chemical	Any product, mixture, material, or substance – other than biological substances – that meets the criteria to be classified in one or more hazard class in the Canadian <i>Hazardous Products Regulations</i> . This includes compressed gases, and flammable and combustible, oxidizing, poisonous, corrosive, and dangerously reactive materials.
EHSO	Environmental Health and Safety Office
Flammable Storage Room	Storage rooms that were purpose-built for the storage of flammable liquids and have been designated as such. For rooms that also qualify as labs, this will be noted on placarding.
Chemical Storage Room	A room used for the storage of chemicals. For rooms that also qualify as labs, this will be noted on placarding.
Lab	A room or area that contains hazardous materials subject to EHSO permitting for the purpose of teaching or research. This includes X-ray rooms, workshops, storage areas, and research and instructional laboratories.
Storage	Temporary placement for chemicals until they are used in the course of research or for administrative purposes. A chemical is considered to be in storage at all times where it is not directly in use.
SDS	Safety data sheet
SWP	Safe Work Procedure
Worker	Any employee, student, or visitor who is performing work that is applicable under this document.

4 Responsibilities

It is the responsibility of a **person working with chemicals** to:

- Store chemicals such that they meet the requirements of this document.
- Report hazards, incidents, and near misses involving chemicals and chemical storage to their supervisor and Environmental Health and Safety Office (EHSO).

It is the responsibility of the **supervisor directing work with chemicals and their department or faculty** to:

- Provide appropriate storage equipment and facilities and ensure that they are used properly.
- Conduct risk assessments and take all practicable steps to eliminate or reduce risks.
- Ensure that workers are appropriately trained and follow the practices and procedures within this document, any associated training, and specific to the workplace.
- Ensure that any incidents or near misses are reported to EHSO.

It is the responsibility of **EHSO** to:

- Develop and offer applicable training.
- Assist in assessing risks, choosing equipment, and developing safe work procedures, as requested.
- Review and update this document to maintain compliance with regulatory and University standards.

5 Training

All University of Manitoba employees, students, and volunteers who work with or manage work with chemicals are required to complete *WHMIS Training*, available for self-enrollment on UM Learn.

6 General Chemical Storage Requirements

The following requirements must be met for all chemical storage:

- Keep chemicals in secure room or area so that only those trained to handle the chemicals properly can access them.
- Minimize the total quantity of chemicals by only ordering quantities needed for planned use and disposing of chemicals that are no longer needed or that are not in good condition.
- Where possible, minimize the quantities of chemicals kept in the work area and keep most chemicals in a separate chemical storage room or an isolated area so that chemical handling is physically separated from chemical storage areas.
- Ensure adequate ventilation is present to prevent the build-up of dangerous fumes or vapours.
- Provide adequate lighting to prevent improper handling and spills under regular conditions, and emergency lighting is available to allow for safe evacuation in case of a power outage.
- Keep chemicals away from direct sunlight and heat sources, as well as any adverse weather or conditions that could affect the integrity of the container or chemical.

- Protect containers from being struck or knocked over (e.g. off the floor or in secondary containment, away from exits and common passageways, not under tables or workbenches).
- Store liquid chemicals at or below eye level (approximately 5 feet).
- Keep an accurate inventory of all chemicals kept in storage – see *Chemical Safety – Inventory Management and WHMIS*.
- Inspect stored chemicals regularly for expiration, deterioration, and chemical and container integrity.
- Ensure a spill kit is easily accessible and stocked with appropriate materials to clean up the chemicals in the area. See the *Chemical Spill Response Procedure* for more information on spill kits.

Consideration should be given to the following:

- Larger containers should be stored on lower shelves to minimize lifting distance and the extent of splash or spill in case a container falls or breaks.
- Spill protection should be installed, or included in the spill kit, where there is risk of liquid chemicals entering drains or endangering other workspaces.
- The route and distance of travel between a storage location and the workspace where a chemical will be used may require special transport equipment or extra spill protection to prevent injury or incident.

7 Containers

The following requirements must be met for chemical containers:

- Keep containers closed unless you are dispensing from or adding to the container.
- All containers must be labelled with a supplier or workplace label – see *Chemical Safety – Inventory Management and WHMIS*. Where a container is reused, the supplier label must be removed or defaced and then the container can be relabelled appropriately for the new contents.
- Where possible, remove any packaging used for shipping so the primary container and chemical are visible.
- If a chemical must be decanted from its original container, the new container must be made of appropriate material for the chemical it will hold.

Maximum storage times:

- For untreated chemicals that degrade to unstable forms, storage must be limited to one year from purchase or six months from first use. Write both the date received and the date opened directly on these materials.
- For other chemicals, use the manufacturer's recommended storage time, where one exists, or other indications of degradation (e.g. discolouration of liquid).

8 Secondary Containment

Secondary containment, such as trays or bins, can provide chemical segregation or spill protection wherever a risk assessment deems it necessary. It is recommended for use with all liquid chemicals, but it is required to be used for the following:

- Corrosives and solvents,
- Near drains, and
- If conditions exist to necessitate storage of chemicals on the floor.

9 Shelving

Shelving used for the storage of chemicals must meet the following requirements:

- Level, stable, and sufficiently able to hold the quantity of chemicals stored on them.
- Secured sufficiently (i.e. to the wall).
- Sufficient clearance maintained for sprinkler heads (18 inches).

Consideration should be given to the following:

- Use cabinets with doors or edge lips/guards that prevent chemicals from sliding off.
- Liquids should not be stored above solids.
- Ensure shelves are not overcrowded.

10 Chemical Safety Cabinets

Chemical safety cabinets are specifically designed to store chemicals in a manner that provides temporary protection from fire. They can also be used in areas where incompatible chemicals need to be segregated to prevent unintentional mixing and to restrict access for unqualified personnel. There are different types, designed specifically for the storage of different hazards. Regardless of cabinet type or size, they all must be used in accordance with the Manitoba Fire Code, the manufacturer's instructions, and meet the following requirements:

- Cabinet doors must be kept closed, with the door latched.
- Cabinets must be kept in good condition, those with rusty or corroded door mechanisms should be replaced.
- Unless the cabinet is vented outside the building, vent covers must be kept closed.
- Containers inside must be closed.
- The cabinet must be labeled to indicate the type of chemical family or hazard class found inside.

Good practices for chemical safety cabinets generally use specific colours for cabinets that match the hazards stored inside. Chemical safety cabinets on campus should also follow this colour-code, but may be used for other hazards if labelled properly:

- Blue – corrosive liquids and solids
- Red – paints, inks, and other combustible liquids
- Green – pesticides, insecticides, or fertilizers
- Yellow – flammable liquids

10.1 Flammable Cabinets

Cabinets used for flammable liquids are typically yellow and are specifically designed to provide temporary protection in case of a fire. While flammable cabinets are always recommended for the storage of flammable liquids, they are required in the following locations:

- In labs or lab-related chemical storage rooms that are not designated as flammable storage rooms, where the quantity of flammable liquids exceeds:
 - a) The supply necessary for normal operation, or
 - b) 300 L of flammable liquids, of which not more than 50 L may have a flash point below 37.8°C.
- In automotive shops where the quantity of flammable liquids exceeds 75 L of flammable liquids, including not more than 25 L of materials with a flash point is below 37.8°C.
- In all other rooms where the quantity of flammable liquids exceeds 10 L of flammable liquids, including not more than 5 L of materials with a flash point is below 37.8°C.

Flammable cabinets must meet the following requirements:

- Must be ULC approved according to ULC/ORD C1275 Standard for Safety for Flammable Liquid Storage Cabinets, it will be noted on the cabinet if it meets these standards.
- Must be labelled clearly to indicate that the cabinet contains flammable liquids, and that open flame must be kept away.
- The maximum amount of flammable liquids stored in a flammable cabinet is 500 L, and split between all flammable cabinets when there is more than one cabinet in the same room, is 1500 L.
- Cabinets must not block access to an exit.
- Excess combustible materials, such as packing materials or boxes, may not be stored inside a flammable storage cabinet.

A flammable cabinet must be grounded if:

- The cabinet is constructed of metal or other conductive material, AND
- Flammable liquids with a flashpoint below 37.8°C are being dispensed inside the cabinet.



Figure 1 Example of a yellow flammable cabinet.

10.2 Corrosion Proof Cabinets

Safety cabinets for corrosives are typically blue and specifically designed for the storage of corrosive materials. ULC-approved corrosive safety cabinets provide fire protection and are made of metal with a corrosive-resistant powder coating. This type of cabinet should be used for the storage of flammable corrosives.

There are plastic options that stand up to corrosive degradation longer but are not fire-rated and so not intended for the storage of flammable corrosives. This type of corrosive storage cabinet does not have to meet any specific regulatory requirements.

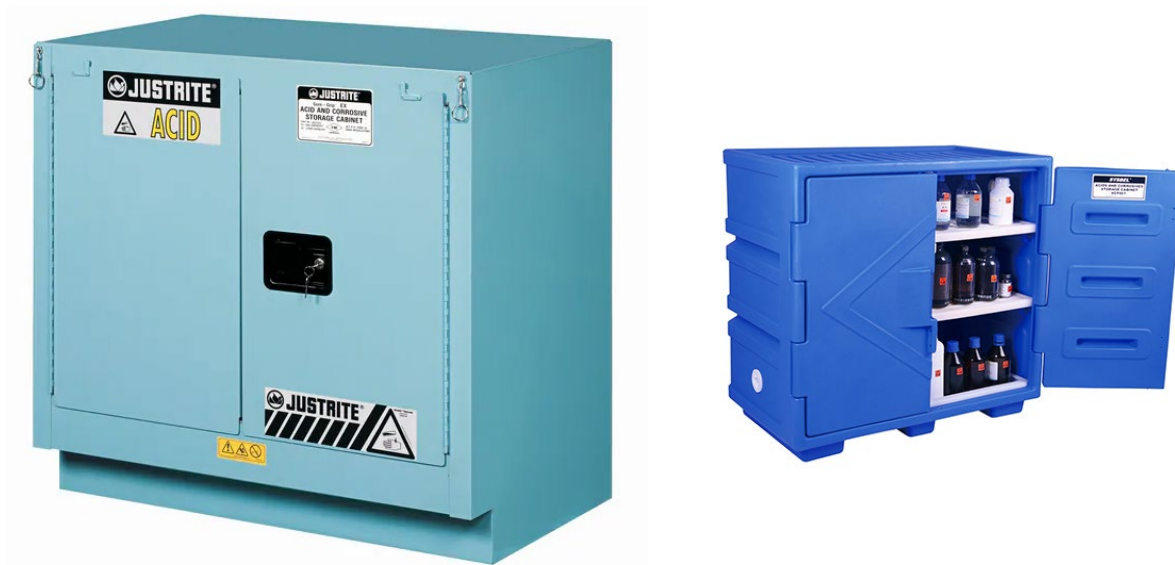


Figure 2 Example of a fire-rated blue corrosive storage cabinet (left) and a blue polyethylene corrosive storage cabinet (right).

10.3 Venting

Chemical safety cabinets are not required to be vented, and it is not recommended to do so in most cases. However, ventilation should be considered for the following:

- Toxic or very toxic chemicals
- Chemicals that decompose and release flammable or toxic gases,
- Very corrosive chemicals, or
- Gas cylinders or containers (may be required under the Manitoba Fire Code).

A chemical safety cabinet must either vent directly out of the building or have the vents closed. It may not vent into the room. Where not vented, the vents on a safety cabinet are required to be sealed with the manufacturer supplied bungs or with a material that offers the same fire protection level as the cabinet.

Where venting is required or chosen, it must:

- Be vented outdoors with vent pipes,
- Have piping that have at least an equivalent fire rating to the cabinet and resistant to the chemical hazard present in the cabinet, and
- Be vented out from the bottom, with makeup air supplied from the top.

It is highly recommended for a cabinet to have mechanical exhaust. Consult with Physical Plant and EHSO to have appropriate ventilation installed.

11 Refrigeration

11.1 Refrigerators and Freezers

Most chemicals do not require refrigerated storage, but it may be required to maintain the integrity of a chemical for a longer period or when the chemical is used as part of a lab sample.

Refrigerators and freezers that are used for the storage of chemicals, including samples that have chemicals in them, must meet the following requirements:

- Never used for food or drink for human consumption.
- Defrosted occasionally to prevent chemicals from becoming trapped in ice formations.
- Contents inspected regularly.
- Clearly labelled on the front of the door with the hazards present and the words “No food or drink.”

11.2 Flammable Refrigeration

Where flammable materials are refrigerated, domestic refrigeration units may not be used. These units may cause vapour accumulation inside and they can have intrinsic sources of ignition in the thermostat, light switches, etc. These materials must be stored in units that are either “explosion-proof”, or “laboratory-safe”, depending on the conditions present.

1. Explosion-Proof Refrigerators

Explosion-proof units are designed to be operated in a hazardous atmosphere, such that all sources of ignition, both internal and external, are eliminated or enclosed. The compressor, relays, thermostat and other electrical connections and devices are sealed; the power is supplied to the unit in a sealed metal conduit that is gas tight, and the power connection is hard-wired and sealed. These units are designed for use in rooms where the atmosphere could have a build-up of explosive gases or vapours. This degree of protection is not necessary for most academic settings or laboratories.

If your operations require an explosion-proof refrigerator, please contact EHSO for help with risk assessments and choosing an appropriate unit.

2. Laboratory-Safe Refrigerators (Explosion-Safe)

Laboratory-safe refrigerators are intended for typical lab environments. They differ from the explosion-proof type in that they do not have necessary modifications to operate in a room that has a potentially explosive atmosphere but all ignition sources (e.g., light, door switch, thermostat etc.) have been removed from inside the storage compartment. They still have the design features that minimize damage should an explosion occur inside such as a magnetic or friction door catch and self-closing doors. They are connected to a power source in the normal way and have the compressor and its circuits and controls at the top of the unit, away from any potential vapour build-up.

In addition to the requirements listed above, refrigerators and freezers that are used for flammable storage must meet the following requirements:

- Purpose-built for the safe storage of flammable materials.
- In conformance with CSA C22.1, “Canadian Electrical Code, Part I”.
- Clear labelling on the front of the door with the words “No food or drink” and “Flammable storage, Keep all sources of ignition away”.
- All chemicals inside must be in closed, well-sealed containers to minimize vapour release.

12 Labs

Under the Chemical Safety Lab Permit program, all spaces containing threshold quantities of chemicals meant for research or teaching must be permitted. Full requirements for lab spaces can be found in *Chemical Safety – Lab Permits*, with the following requirements applying directly to spaces containing chemical storage:

- Access to the room must be restricted to authorized personnel only.
- Do not store chemicals in a fume hood. Where needed, ventilated storage units may be used instead.

Consideration should be given to the following:

- Chemicals should not be stored in teaching labs, closets, or unoccupied rooms.
- Amounts of chemicals kept on-hand should be as small as practical.

- Avoid storing chemicals on bench tops, except for those currently in use.

13 Storage Rooms

Chemical storage rooms are dedicated rooms used only to store chemicals. Where practical, these rooms can be used to effectively separate chemical storage from chemical handling areas.

The following requirements must be met for all chemical storage rooms:

- Access to the room must be restricted to authorized personnel only.
- Adequate ventilation must be provided.
- Appropriate smoke detectors and fire fighting equipment must be made available, considering compatibility with chemicals present.
- Appropriate temperature control for the hazards present.
- No food or drink permitted.
- Protection provided for any machinery or equipment that could damage containers (e.g. forklift).
- Spill kit provided.
- Stored chemicals inspected at least annually to ensure that inventory is accurate, and that expired or deteriorated chemicals or containers are disposed.
- Mechanisms or procedures provided to ensure that no one can be accidentally locked in the room.
- If used for chemicals associated with research or teaching, room must be permitted under the Chemical Lab Safety Permit program.

Consideration should be given to the following:

- Provision of a sprinkler or self-contained fire extinguishing system, or emergency lighting.
- Dedicated air ventilation that does not return air back to other building areas.
- Minimize the amount of combustible materials.
- Transportation routes between chemical usage areas and storage areas. Travel through public areas must be minimized and special transportation equipment and spill protection may be required.
- Location of the nearest emergency shower or eye wash station.

13.1 Flammable Storage Room

There are some storage rooms at the University of Manitoba that were purpose-built for the storage of flammable liquids. They must pass stringent safety, MB Fire Code, and MB Building Code requirements to carry this designation. These rooms are identified by the words “Flammable Storage Room” on placarding located at all entrances.

Any chemical handling or other activity permitted in these spaces must be pre-approved through EHSO and Physical Plant, including any decanting of chemicals.

14 Segregation

When storing chemicals, those that can react dangerously with each other need to be segregated to prevent accidental mixing. Dangerous or violent reactions that could result from improper segregation include:

- Combustion or evolution of considerable heat,
- Evolution of flammable, corrosive, toxic, or asphyxiant gases,
- Formation of corrosive substances or unstable substances,
- Neutralization involving the evolution of corrosive mists or heat,
- Violent decomposition (e.g., explosives), or
- Polymerization with evolution of heat, increase in volume, and potential rupture of container.

The following methods can be effective means of segregating incompatible chemicals:

- Physical distance or separate shelves
- Secondary containment
- Chemical storage cabinets
- Separate rooms



This list is not exhaustive and not intended to reflect a hierarchy. Chemical properties, quantities, and type of handling must be considered when deciding how to store incompatible chemicals.





While all chemical properties need to be considered, generally chemicals can be segregated according to their GHS hazard class and then further by specific compatibility. For all chemicals, consult Sections 7 (Handling and Storage) and 10 (Stability and Reactivity) of the Safety Data Sheet (SDS) for specific storage requirements.







Label storage areas with the hazard present to prevent incompatible materials from being inadvertently stored in the wrong area.

Compatible chemicals may be stored alphabetically to allow for further organization.

Table 1 Chemical Segregation Chart

Cat.	GHS Symbol	Chemical Hazard	Common Examples	Storage	Incompatibles
Reactives		Explosives	Acetone peroxide Tri-nitro compounds Heavy metal azides	Secure location Away from all other chemicals, including other highly reactive chemicals Protect from falls, impacts, friction, and shocks Contact EHSO for specific guidelines <i>Check the SDS</i>	Flammable liquids Oxidizers Corrosives
		Flammable Liquids Flammable Solids	Acetone Benzene Methanol Ethanol Glacial Acetic Acid Phosphorous Carbon Charcoal	Flammable cabinet recommended, required where volumes exceed threshold Cool, dry area away from open flame or ignition sources Away from oxidizers and corrosives	Corrosives Oxidizers Acute Toxins Self-, water-, or air-reactive chemicals that are capable of generating heat

Cat.	GHS Symbol	Chemical Hazard	Common Examples	Storage	Incompatibles	
			Paraformaldehyde Magnesium	Where refrigeration is required, must be rated appropriately for hazardous storage		
		Oxidizers	Hydrogen peroxide Potassium dichromate Halogens Nitrate compounds	Cool, dry area away from open flame or ignition sources Away from flammables and combustibles Where refrigeration is required, must be rated appropriately for hazardous storage	Reducing agents Flammables Organic materials	
	No GHS symbol	Water Reactive	Sodium metals Potassium metals Lithium metals Sodium borohydride	Dry, cool location, away from potential spray from fire sprinklers and other water sources	All aqueous solutions Oxidizers	
	No GHS symbol	Peroxide Forming	Ethers Acetals	Dry, cool, and dark location Airtight containers Must be dated when opened Old or expired containers must be disposed of Do not use or move a chemical showing signs of crystallization or discoloration – Contact EHSO	Check the SDS	
Corrosives		Inorganic Acids	Hydrochloric acid Sulfuric acid Sulfuric acid Phosphoric acid Perchloric acid Hydrofluoric acid	Separate corrosion proof cabinet recommended Use chemically resistant secondary containment Metal shelves not recommended due to corrosion	Flammables Bases Oxidizers Organic acids Active metals	
		Organic Acids	Acetic acid Formic acid Lactic acid Picric acid Trichloroacetic acid	Separate corrosion proof cabinet recommended Use chemically resistant secondary containment Metal shelves not recommended due to corrosion	Flammables Bases Oxidizers Inorganic acids Active metals	
		Oxidizing Acids		Nitric acid Perchloric acid Chromic acid	Separate corrosion proof cabinet recommended Use chemically resistant secondary containment Away from flammables and other acid types Metal shelves not recommended due to corrosion	Flammables Inorganic acids Organic acids Bases Active metals
		Inorganic Bases	Ammonium hydroxide Potassium hydroxide Sodium hydroxide	Separate corrosion proof cabinet recommended Separate from all acids Separate from organic bases Use chemically resistant secondary containment	Flammable liquids Oxidizers Acute Toxins Acids Organic bases	
		Organic Bases	Hydroxylamine Tetramethylethylamine Diamine Triethylamine	Separate corrosion proof cabinet recommended Separate from all acids Separate from inorganic bases Use chemically resistant secondary containment	Flammable liquids Oxidizers Acute Toxins Acids Inorganic bases	
Compressed Gas		Flammable		Methane Butane Acetylene Propane Hydrogen	Cool, dry area away from open flame or ignition sources Well-ventilated area 20 ft. away from oxidizing gases or separated by fire wall Secure cylinders upright with bracket and chain	Oxidizers Toxic gases

Cat.	GHS Symbol	Chemical Hazard	Common Examples	Storage	Incompatibles
				Post NO SMOKING signs around storage area or entrance to storage room	
		Oxidizing 	Oxygen Chlorine Fluorine mixtures Nitrogen oxides	Cool, dry area away from open flame or ignition sources Well-ventilated area 20 ft. away from flammable gases or separated by fire wall Secure cylinders upright with bracket and chain	Flammable gases Combustible materials
		Toxic 	Carbon monoxide Hydrogen sulfide Nitric Oxide	Cool, dry area away from open flame or ignition sources Well-ventilated area Away from flammable gases and liquids Secure cylinders upright with bracket and chain Consider need for air monitors	Flammable gases Oxidizing gases
		Compressed Gas	Carbon dioxide Nitrogen	Cool, dry area away from open flame or ignition sources Well-ventilated area Secure cylinders upright with bracket and chain	
Other		Acute Toxicity (fatal or toxic)	Chloroform Cyanides Heavy metal compounds	Cool, dry, and well-ventilated area	Reactives Corrosives <i>Check the SDS</i>
		Skin / Eye Irritants Acute Toxicity (harmful) Narcotic Effects Respiratory Tract Irritants	Tris base Dichloromethane Polyvinylpyrrolidone		
		Carcinogens Mutagens Respiratory Sensitizers Target Organ Toxicity Aspiration	Acrylamide Chloroform Formaldehyde	Secure location, limit access only to trained users Store separate from flammable and corrosive materials to avoid damage to container	Flammables Corrosives <i>Check the SDS</i>
	<i>No adopted GHS symbols</i>	None or Other	Agar Sodium bicarbonate Sodium chloride Other general stock chemicals	Sturdy shelves, preferably with a lip or glass doors	<i>Check the SDS</i>

14.1 Multiple Hazard Classes

Many chemicals belong to more than one chemical family or hazard class, potentially leading to a need for further segregation. Ideally, the guidelines for all categories are observed, but that may not always be possible. As a result, these chemicals will need to be evaluated case by case, considering the hazard classes and volumes involved as well as the options available for storage.

Where a risk assessment deems that it is not practical and/or necessary to combine all the segregation rules for all associated hazard classes or chemical families, it can be helpful to prioritize the hazards. The hazards list in Table 1, above, is prioritized for that reason and hazards can be considered from top to bottom as most severe to least.

A common example of this is glacial acetic acid, which is both an organic acid and a flammable liquid. This chemical must be stored away from bases (i.e. NaOH) and oxidizing acids (i.e. nitric acid). Ideally this chemical is stored in its own, small flammables cabinet, but storing small quantities in a flammable storage cabinet may also be appropriate, prioritizing flammability over corrosivity. If flammable storage space is at a premium, storage in a corrosive's cabinet would also be acceptable; however, it would need to be further segregated from the other incompatible corrosives by utilizing multiple cabinets or secondary containment.

15 Additional Storage Requirements

Table 2 Additional storage requirements for the following:

Chemical Type	Where to find more information
Compressed Gas Cylinders	Compressed Gas Storage Guideline or contact EHSO
Cryogenics	Contact EHSO
Explosives	Contact EHSO
Flammable Liquids	Contact EHSO
Hazardous Waste	Contact EHSO

16 References

Manitoba Workplace Safety and Health Act and Regulation, 2022

Canadian Hazardous Product Act (last amended 2023) and Regulations (last amended 2022)

Canadian Centre for Occupational Health and Safety (<https://www.ccohs.ca/>)

17 Document History

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1	2024-05-09	Initial release	N. Harris