



11. Chemical Inventory, Labelling and Storage

Chemical Inventory

BACKGROUND

Proper inventory and a smooth ordering process ensures that lab users have the correct chemicals when they need them, that chemicals are used within their expiry dates and that your lab is in compliance with appropriate legislation & policy. An annual inventory of hazardous materials is required. According to the WCB Health and Safety Regulation, Part 5, Section 5.98, “an inventory must be maintained which identifies all hazardous substances at the workplace in quantities that may endanger workers in an emergency including controlled products covered by WHMIS, explosives, pesticides, radioactive materials, hazardous wastes, and consumer products.

A current chemical inventory must be kept at all times. In case of emergency, a current inventory will help emergency responders provide the correct response.

Annual inventories allow for the following:

Annual inventories allow for the following:	A good system should:
<ul style="list-style-type: none">• Check chemicals with limited shelf life• Remove surplus and old chemicals• Know what you have• Cleanup containers and shelves• It's the Law!	<ul style="list-style-type: none">• <i>Direct you quickly to the chemical</i>• Be easy to use• Be easy to maintain• Be updated annually

INVENTORY PROCESS

While there are many different formats that can be used to track inventory, any format should contain the same information as the example inventory sheet attached to the end of this document. If your lab only has a few chemicals on hand, you may wish to use the example sheet as your inventory.

In this laboratory the inventory is maintained here:

- Put exact location here

In order to efficiently use the inventory:

- Maintenance of the inventory is everyone's responsibility.
- The inventory should be checked by the person responsible for ordering.
- When a chemical is getting low or is all used up, notify one of the people listed below; they are responsible for checking the inventory and ordering:
 - Put name here
- Date chemicals once received and opened (on the bottle and in the inventory)



Inventories of hazardous materials are required to be updated annually. The required categories of information in a chemical inventory include the following:

- | | |
|---------------------------------------|---------------------------------|
| 1. Department | 5. Quantity (kg or L) |
| 2. Principal Investigator | 6. Date Received |
| 3. Chemical Name (per supplier label) | 7. Date Opened |
| 4. Location (Building & Room Number) | 8. WHMIS Class (primary hazard) |

1. Location of Safety Data Sheets (SDS) Department and Principal Investigator

The title of the inventory should include the department which the lab is part of as well as the Principal Investigator's (PI) name. This is needed to identify who the chemical inventory belongs to.

2. Chemical Name and Supplier

The inventory should include a column for the chemical name (written as shown on the supplier packaging) and a column for supplier information (to help with finding the chemical). The CAS number can also be included and is especially helpful for those chemicals that have several common names (ie. 2-propanol, isopropanol, isopropyl alcohol). Some inventories may also include the product number for ease of future ordering (this ensures that the exact product is re-ordered).

3. Location (Building and Room number)

The location of the chemical must always be included, and is particularly important in labs that have more than one room where chemicals are stored. Location at the very least should include building and room number, but could also include more specific location information such as 'acid cabinet'.

4. Approximate Quantity

The approximate quantity (kg or L) must be recorded on the inventory. This is not the container size, unless the container is full. Otherwise, the quantity must be estimated.

5. Date Opened and Received

It is best practice to write the date the chemical was received **and** the date the chemical was opened directly on the bottle. It is also good practice to include this information in the inventory.

6. WHMIS Class (Hazard Identification)

The inventory should also include a line in which the WHMIS class, or TDG class is recorded. This will help both with proper storage and segregation, as well as understanding the risk associated with the chemical you are looking for.

7. Location of the Safety Data Sheet (SDS)

Location of the SDS must be included in the inventory. In the event of an emergency, the SDS may be required to evaluate the situation.



8. Other information as needed

The chemical inventory must include the aforementioned information, but should also include any additional information as needed for the lab. For example, some inventories may also include container size along with approximate quantity to help in locating the chemical bottle.

9. Example Inventory

Chemical Name	CAS	Supplier	Amount	Date Received	Date Opened	Room	Area	SDS location	WHMIS Class (TDG)
Sodium Hydroxide	1310-73-2	Sigma-Aldrich	300 g	Dec 2018	Jan 2019	SCI 456	Base Cabinet	SCI 456	Corrosive (8)

If your lab has very few chemicals, the example inventory on the next page can be used

SAFETY DATA SHEETS (SDS)

SDSs must be readily available to users of hazardous materials, and **should be read before using any such materials**. SDSs must be updated at least every 3 years (annually is best). SDSs may be available in hard copy or on an accessible, working computer system (ie. accessible to everyone who handles those materials and accessible during a power outage). Some SDS websites are provided below. See the [Health, Safety & Environment](#) website for more information.

Site Name	Site Address
Canadian Centre for Occupational Health & Safety*	http://www.ccohs.ca/
Vermont Safety Information Service Inc	http://hazard.com/msds/
Fisher Chemical Catalogue**	https://www.fishersci.ca/ca/en/home.html
Sigma Aldrich**	https://www.sigmaaldrich.com/CA/en

* SDS from this address are free for all UBC personnel with UBC Internet addresses


** At these sites, search for chemicals in the Fisher and Acros Chemical Catalogues. Once you find the chemical, click on it, and then scroll down to the SDS icon.

[illegible]



Chemical Labelling

All WHMIS Controlled products must have a **legible** label. There are two main types of WHMIS labels: supplier labels, and workplace labels¹

Supplier Label	
When is it required?	What does it need?
Suppliers are responsible for labelling hazardous products that they provide to customers. Labels should be affixed to, printed or written on, or attached to the hazardous product or container and remain legible	<ol style="list-style-type: none">1. <i>Product identifier</i> (brand name, chemical name, common name, general name, or trade name of the hazardous product)2. <i>Initial supplier identifier</i> (name, address, telephone number of either the Canadian manufacturer or Canadian importer)3. <i>Pictogram(s)</i> (a hazard symbol with a red “square set on one of its points”)4. <i>Signal word</i> (used to alert the reader to a potential hazard and to indicate the severity of the hazard)5. <i>Hazard statement(s)</i> (describe the nature of the hazard posed by the product)6. <i>Precautionary statements</i> (describe measures to be taken to minimize or prevent adverse effects results from exposure to the product or resulting from improper handling or storage of the product)7. <i>Supplemental Label Information</i> (may be required based on the classification of the product)
<div><div><p>Product K1 / Produit K1</p><p>Danger Fatal if swallowed. Causes skin irritation.</p><p>Precautions: Wear protective gloves. Wash hands thoroughly after handling. Do not eat, drink or smoke when using this product.</p><p>Store locked up. Dispose of contents/containers in accordance with local regulations.</p><p>IF ON SKIN: Wash with plenty of water. If skin irritation occurs: Get medical advice or attention. Take off contaminated clothing and wash it before reuse. IF SWALLOWED: Immediately call a POISON CENTRE or doctor. Rinse mouth.</p><p>Compagnie XYZ, 123 rue Machin St, Mytown, ON, N0N 0N0 (123) 456-7890</p></div><div><p>Danger Mortel en cas d'ingestion. Provoque une irritation cutanée.</p><p>Conseils : Porter des gants de protection. Se laver les mains soigneusement après manipulation. Ne pas manger, boire ou fumer en manipulant ce produit.</p><p>Garder sous clé. Éliminer le contenu/récipient conformément aux règlements locaux en vigueur.</p><p>EN CAS DE CONTACT AVEC LA PEAU : Laver abondamment à l'eau. En cas d'irritation cutanée : Demander un avis médical/consulter un médecin. Enlever les vêtements contaminés et les laver avant réutilisation. EN CAS D'INGESTION : Appeler immédiatement un CENTRE ANTIPISON ou un médecin. Rincer la bouche.</p></div></div>	
Workplace Label	
When is it required?	What does it need?
When: <ul style="list-style-type: none">• A hazardous product is made at the workplace and used in that workplace• A hazardous product is decanted / transferred into another container• A supplier label becomes illegible	<ol style="list-style-type: none">1. <i>Product identifier</i> (brand name, chemical name, common name, general name, or trade name of the hazardous product)2. <i>Safe handling information</i> (PPE or engineering controls to be used, for example, lab coat, gloves, goggles, fume hood etc)3. <i>A reference to the safety data sheet (SDS)</i> (refers to location of SDS)
<div><p>ACETONE</p><p>No smoking, sparks, or flames Wear eye, face, and hand protection Use in well-ventilated area, or wear NIOSH-approved respirator with organic vapour cartridges</p><p>Safety data sheet available</p></div>	



1. There are only two situations when a workplace label is not necessary. They are when a hazardous product is:

- a) Poured into a container and it is going to be used immediately; or
- b) “under the control of the person who decanted it” (example: the person who poured the product into another container will be the only person who will use it, and the product will be used during one shift, a full workplace label may not be required. **HOWEVER**, the container must still be identified with the product identifier (name).

TRAINING

All individuals working with, or supervising those who work with, hazardous materials must have WHMIS education and site-specific training (WCB). Education is available through the HSE [Chemical Safety Course](#) and on-site training.

RESOURCES

Visit the Health, Safety & Environment website for the [Laboratory Chemical Safety](#) and [Pollution Prevention Manuals](#) or to contact the HSE Office.

Chemical Storage

GENERAL

Hazardous chemicals should be stored under the correct condition and segregated from other incompatible chemicals as a proactive means to minimize the formation of unstable or toxic products. In general:

- Store in central, properly ventilated area that includes forced ventilation from floor to ceiling and with exhaust above roof level.
- Know the location of the master control shut-off valves for gas, water and electricity
- Smoke detector is required.
- A communication system to the main office or emergency system is recommended (at UBCO, these are the landline phones in each lab).
- Shelving should be accessible with chemicals at eye level or lower; no high shelf chemical storage.
- Avoid floor chemical storage (even temporary).
- Shelf assemblies are firmly secured to walls. Avoid island shelf assemblies.
- Provide anti-roll lips on all shelves.
- Shelving assemblies must be constructed of wood except for storing oxidizers.
- Avoid metal, adjustable shelves supports and clips; use fixed, wooden supports.
- For emergencies, have:
 - Fire extinguishers of the approved type positioned near an escape route
 - ABC fire extinguishers can be found in hallways close to labs. Specific fire extinguishers (such as Class D) should be kept in the lab close to the hazard.



- Spill control and clean-up materials
- Approved eye/face wash and shower

LABORATORY

Laboratories are not storerooms particularly as it applies to chemicals and solvents. Chemicals in laboratories should be stored in areas away from experimental activities, and limited to the requirements of 12 months or less. Excess stock should be kept in a proper chemical storage facility. The following basic rules apply particularly to chemicals stored in laboratories.

1. Small Amounts (not stockpiled)

Ordering 1 kg because it is cheaper than the 100 g size is often false economy. The result:

- It takes up more valuable space
- It presents a greater potential hazard
- It may eventually become a disposal problem

Order only what you can use in 12 months

2. Secure

- Do not overcrowd shelves.
- Do not store too high; provide a proper kickstool or ladder where necessary.
- Chain compressed gas cylinders.
- Store lecture bottles upright and chain, or secure in a proper holder.
- Store solvents in a proper flammable cabinet, and keep door closed.
- Use appropriate containers for solvents and waste.
- Store highly toxic or controlled materials in a secure cupboard.

3. Labelled properly

- Contents are labelled clearly.
- Labels are intact and legible.
- Labels are not overwritten; old labels are removed or completely covered.
- Solvent stills are labelled.
- Regularly check and label peroxidizable materials with test results.

Proper WHMIS labelling is used.

4. Sealed

- Keep solvent containers closed
- Ensure chemical containers are intact
- Regularly vent materials capable of building up pressure (eg. formic acid)

Ensure container lids are intact and closed



5. Segregated

Waste should be segregated according to WHMIS hazard class and BC Fire Code Separation of Dangerous Goods for Storage (next section).

SPECIFIC STORAGE REQUIREMENTS

Chemical storage, whether in a laboratory or central storeroom, should be under the supervision of a qualified person; storerooms must have adequate security.

1. Acids and Bases

- Store acids and bases separately.
- Store acids in dedicated acid cabinet.
- Store oxidizing acids (eg. nitric acid) away from organic acids (e.g. acetic acid).
- Store organic acids away from inorganic acids (use different areas or secondary containment)
- Store organic bases away from inorganic bases (use different area or secondary containment)
- Store hydrofluoric and perchloric acids in secondary containers made from compatible materials.
- Safety showers and eye wash facilities must be within easy access.
- Protective equipment must be inspected regularly to ensure proper working order, especially in corrosive atmospheres.

2. Flammable Materials

Flammable liquids should be stored in a dry, cool, well-ventilated area, preferably in a flammable materials storage cabinet or room.

Laboratory Storage

Flammables should be stored according to the BC Fire Code and best management practices:

- In listed approved metal safety cans, which meet the fire code requirements and are equipped with flash arrestor and self-closing lid
- In original glass bottles up to 5 litres
- In glass containers (or other compatible material) equal to or less than 1 litre when decanted
- In appropriate 4 - 10 L waste solvent containers that are capped with venting caps when not in active use
 - Waste can never go in metal containers

The maximum size of container allowed in lab is 5 L (unless in an original can)

Maximum total volume of flammable containers in open laboratories at UBC is 25 L

(this is container volume, not volume of liquid in the container)



Flammable Cabinets

An approved flammable cabinet may be used when quantities of flammables are near or exceed 25 litres. Flammable cabinets provide a safe means of storage over a short period of time as well as a time-saving method of storage by locating cabinets in, or adjacent to work areas which reduce the frequency of trips to a chemical storeroom. An approved flammable cabinet must:

- Be Underwriters Laboratories of Canada (ULC) listed and approved.
- Be closed at all times, with door latches operable.
- Have vents that are either plugged or vented directly to the outside.
- Be either wood (must meet specifications of fire code) or metal.
- Be suitably placed; ie. not located near an exit door or blocking access to an exit route.
- May have to be in a room which has a second exit depending on the quantity and hazards of flammable liquids in the room.

Control flammables by eliminating careless open storage of small containers

Flammable Storage Rooms

A properly designed flammable storage room must satisfy many requirements, e.g. location, ventilation, electrical equipment, fire protection, etc. It must also meet the needs of the user, e.g. adequate size, conveniently located, etc.

The flammable storage room should be easily accessible to fire fighting; i.e. located in corners of buildings over window openings and doors all providing sufficient entry. Explosion venting can then be incorporated into the exterior walls.

Specific guidelines for flammable storage rooms include: the maximum number of litres per square metre of floor space; maximum room size with and without a sprinkler system (or other automatic extinguishing system); fire resistance rating of the interior walls.

Additional requirements include: a raised liquid tight sill of at least 102 mm in height (a sunken floor or open grated trench is also permissible); floor drains which drain to a safe location; self-closing, listed, one and one-half hour Class B fire door (listed 3-hour Class A may be required for walls with a rating greater than 2 hours).

Rooms containing Class I flammables must have electrical equipment suitable for Class I, division 2; for Class II and Class III liquids, electrical fixtures must be approved for general use. The room must also have a gravity or mechanical exhaust ventilation (ICFM/sq.ft. of floor area) equipped with suitable interlocks.



Flammable Refrigerator Storage

Flammable refrigerators must be ULC approved for storage of flammable materials (explosion-proof). A number of typical refrigerators have exploded due to flammable vapours; thus, it is very important to store flammables only in an approved flammable refrigerator.

If cold storage is required for flammables, explosion-proof units are required

3. Compressed Gas Cylinders

Compressed gas cylinders are hazardous due to both the nature of the gas as well as the physical hazard of the compressed cylinder. Gas cylinders must be handled and stored with care.

Gas cylinder store rooms must:

- Have natural ventilation to outside wall; room must have no other purpose.
- Have segregation between flammable, oxidizing and poison gases.
- Be protected against mechanical damage
- Stored in a secure area
- Stored with protective caps on

Gas cylinders should not be stored in the laboratory. In the lab they must:

- Be in use (ie. attached to equipment)
- Be securely attached to the wall or lab bench
- Be regularly tested for gas leaks

Gas cylinders should not be stored in the lab

Flammable gas cylinders

Like other gas cylinders, flammable gas cylinders must be stored as described above, as well as:

- Kept separated from oxidizing and poison gases

Toxic gas cylinders

Toxic gas cylinders must be stored outside. When toxic gases are used in the laboratory, they must be used in appropriately ventilated cabinets.

Toxic gases must be stored outside. When in use, they must be in appropriately ventilated cabinets

4. Air-reactive Chemicals

Air-reactive chemicals must be stored in a secure location without danger of falling. Secondary containment is recommended.

Use a glove box or fill head space of the container with an inert gas before sealing the container.



CHEMICAL SEGREGATION

When it comes to chemical storage practices, the alphabet should be one of the last criteria used.

Examples of compatibility problems arising from storing chemicals alphabetically include:

- Alkanes and Ammonium Nitrate
- Hydrogen Peroxide and Hydrazine
- Ammonia and Bromine
- Nitric Acid and Phenol
- Aldehydes and Amines
- Sodium Cyanide and Sulfuric Acid
- Calcium Hypochlorite and Carbon

Chemicals should not be stored alphabetically

Regardless of state, chemicals should be segregated based on WHMIS hazard class




Even apparently safe storage can be a potential problem. The following are often stored together even though there are hazards if the materials should mix:

- Acetic Acid and Nitric Acid
- Perchloric Acid and Sulfuric Acid
- Concentrated Acids and Base









Suggested Storage Pattern – HAZARD CLASS

Regardless of state (gas, liquid, solid), the chemical should be stored appropriately for its hazard. WHMIS pictograms provide a review of hazards associated with the chemical, whereas the SDS will provide detailed information on hazards and storage requirements.

TDG Hazard Class	Hazard Description	Main Pictogram(s)	Example	Potential Storage Location ¹
Class 2 -Gases	Flammables, non-flammable, toxic, non-toxic, compressed gas cylinders		-Nitrogen	<ul style="list-style-type: none">• Not within 5 feet of an exit• Secured to a wall or lab bench• Use smallest, returnable size containers and quantities• If not in use, store in a gas storage room (long term storage in labs is prohibited)
Class 3 -Flammable Liquids	Substances that are expected to be able to catch fire at common temperatures		-Methanol	<ul style="list-style-type: none">• In ULC approved flammable cabinet or refrigerator• On bench top, if total flammable load in general lab space is < 25 L<ul style="list-style-type: none">◦ 25 litres is the maximum total volume of all containers, which may be in the open lab, not including liquids stored in an approved flammable liquid cabinet or safety cans.
Class 4 -Flammable Solids -Substances Liable to Spontaneous Combustion; -Substances That on Contact with Water Emit Flammable Gases (Water-reactive Substances)	These substances may cause fire (through friction), become explosive when in contact with water , become explosive even with contact with oxygen (air), or undergo a reaction that will result in a stronger exothermic reaction (a reaction that releases heat). For example, Class 4.2 Substances liable to spontaneous combustion includes substances		-Sulphur -Naphthalene -Calcium carbide	<ul style="list-style-type: none">• In ULC approved flammable cabinet or refrigerator• Away from water or air (if applicable)



	that will ignite within 5 minutes of coming in to contact with air.			
Class 5 -Oxidizing substances -Organic peroxides	These substances may explosively decompose, burn rapidly, be sensitive to impact or friction, react dangerously with other substances, or cause damage to the eyes.	 	-Hydrogen peroxide -Dibenzoyl peroxide	<ul style="list-style-type: none"> Store with oxidizers (in cupboard or on shelf). Store separate from flammable or combustible materials and reducing agents
Class 6 -Toxic and Infectious Substances	Substances are included in class 6 if they can cause death or serious injury or harm to human health if swallowed, inhaled, or in contact with skin. Medical or clinical waste may also be classified as an infectious substance if they contain regulated properties.	  	-Viruses -Bacteria -Phenol -Chloroform -Arsenic	<ul style="list-style-type: none"> Storage of biohazardous material is covered in BioSafety (6.2) Store toxic chemicals in a secure area in secondary containment marked as toxic or carcinogenic*
Class 8 Corrosive Substances	Substances are included in Class 8 if they are known to cause injury to the skin such as burns, destruction (thickness), or lesions.		-Acetic acid -Hydrochloric acid	<ul style="list-style-type: none"> Separate acids and bases* Separate organic and inorganic acids and bases* Store special acids (hydrofluoric acid, perchloric acid, nitric acid) separately from other acids* Store in acid / base cabinet

¹The described potential location may not be the most appropriate location depending on all of the hazards of the material.

*Separate by location or secondary containment. If using secondary containment, the containment should be able to hold the entirety of the chemical should it leak

For additional information, please contact Health, Safety & Environment at hse.ok@ubc.ca