

TML\MSH Microbiology Department Policy & Procedure Manual	Policy # MI\LS\12\v02	Page 1 of 13
Section: Laboratory Safety Manual	Subject Title: Handling Chemicals	
Issued by: LABORATORY MANAGER	Original Date: April 20, 2001	
Approved by: Laboratory Director	Revision Date: October 22, 2003	

Policy:

All laboratory personnel must be able to safely handle chemicals belonging to the six different hazard classes recognized by WHMIS regulations.

Purpose:

This policy will help to maintain a safe and healthy workplace.

Responsibility:

Management and employee

Key Elements:

- Class A Chemicals - Compressed gas
- Class B Chemicals - Flammable and Combustible material
- Class C Chemicals - Oxidizing Material
- Class D1 Chemicals –Poisonous and Infectious Material: Causing Immediate and Serious Toxic effects
- Class D2 Chemicals- Poisonous and Infectious Material: Causing Other Toxic Effects
- Class D3 Chemicals- Poisonous and Infectious Material: Biohazardous and Infectious Material
- Class E Chemicals – Corrosives
- Class F Chemicals - Dangerously Reactive Material

Related Documents:

GENERAL CHEMICAL SAFETY	MI\LS\11\v01
LABELLING CHEMICALS	MI\LS\13\v01
BULK DISPENSING OF FLAMMABLE LIQUIDS - 45 GALLON DRUM	MI\LS\14\v01
BULK DISPENSING OF FLAMMABLE LIQUIDS - 20 L DRUM	MI\LS\15\v01
DISPOSAL OF CHEMICAL WASTE	MI\LS\16\v01



Class A Chemicals - Compressed gas

A compressed gas includes any product, material or substance contained under pressure greater than atmospheric pressure. This includes gases liquified by compression or refrigeration. Compressed gases may represent many hazards depending on the type of gas, i.e. toxic, flammable, corrosive, oxidizer or frostbite in the case of cryogenic gases. Compressed gas cylinders may also pose a serious physical hazard if handled improperly. Dropped or damaged cylinders may become missiles if they rupture or valves are knocked off.

GENERAL PRECAUTIONS FOR COMPRESSED GAS CYLINDERS

Identification of Contents	<ul style="list-style-type: none"> Identify the contents of any compressed gas cylinder clearly so as to be easily, quickly, and completely determined by any laboratory worker. Provide a durable label that can not be removed from the cylinder. Do not accept any compressed gas cylinder for use that does not identify its contents legibly by name. Do not rely on colour coding as a means of identification; cylinder colors vary from supplier to supplier, and labels on caps are not reliable because many caps are interchangeable. Attach tags to the gas cylinders on which the names of the users and dates of use can be entered. If the labeling on the gas cylinder becomes unclear or defaced so that the contents can not be identified, mark the cylinder "contents unknown" and contact the manufacturer regarding removal.
Transportation	<ul style="list-style-type: none"> Before moving a cylinder, close the cylinder valve, remove the regulator, and replace the protective valve cap. <ul style="list-style-type: none"> Do not transport cylinders with the regulator attached to the cylinder. Do not transport cylinders without safety caps. Screw the cylinder cap all the way down on the cylinder's neck ring. Transport cylinders on a gas cylinder transport dolly and secure the cylinder with a strap or chain. Do not use the protective valve cap for moving or lifting cylinders. The cap is for valve protection only. Do not allow cylinders to drop or to strike other cylinders violently.
Leaking cylinder	<ul style="list-style-type: none"> Tag leaking cylinders or cylinders with stuck valves and move to a safe, secure outdoor location. If the contents are flammable, keep away from any source of ignition. Inform the supervisor who will make the necessary arrangements with the supplier for removal. Do not attempt to repair cylinder valves or their relief devices while a cylinder contains gas pressure.

TML\MSH Microbiology Department Policy & Procedure Manual	Policy # MI\LS\12\v02	Page 3 of 13
Laboratory Safety Manual		

Storage of Cylinders	<p>Appropriate storage conditions:</p> <ul style="list-style-type: none"> • Secure empty and full cylinders at all times to a fixed support (solid wall, cylinder truck, cylinder rack, or post) by use of chains or other substantial restraining devices • Well-ventilated areas designated and marked only for cylinders. • Away from flames, sparks or any source of heat or ignition. • In an upright position. • Away from sources of heat and ignition (e.g., open flames) or to any temperature above 125 °F • Away from electrical circuits and electrical wiring where the cylinder could become part of the circuit • Away from dampness, salt, corrosive chemicals or corrosive vapors. Corrosion may damage cylinders and cause their valve protection caps to stick. • If stored outdoors, protect cylinders from the ground to prevent bottom corrosion, and protect from the direct rays of the sun. • Store cylinders in compatible groups. Identify them by signs to prevent confusion. <ul style="list-style-type: none"> • Store flammables separately from oxidizers • Store corrosives separately from flammables • Store full cylinders separately from empties • Mark empty cylinders EMPTY or MT. • Keep valves closed on empty cylinders. • Keep protective valve caps in place when the cylinder is not in use. • Store liquefied flammable gas cylinders in an upright position or such that the pressure relief valve is in direct communication with the vapor space of the cylinder. • Do not store flammable gas cylinders with oxygen or nitrous oxide cylinders or adjacent to oxygen charging facilities. • Keep oxygen cylinders a minimum of six metres from flammable gas cylinders or combustible materials. If this can not be done, separate by a non-combustible barrier at least 1.5 metres high having a fire-rating of at least one-half hour.
----------------------	---

Use of Compressed Gas Cylinders	<ul style="list-style-type: none"> • Do not use cylinders for rolling, supports, or any purpose other than the transportation and supply of gas. • Do not charge, ship or use any cylinder which is not provided with a legible decal that identifies its contents. • Wipe the outlet with a clean, dry, lint-free cloth before attaching connections or regulators. The threads and mating surfaces of the regulator and hose connections should be cleaned before the regulator is attached. • Always use the proper regulator for the gas in the cylinder. Always check the regulator before attaching it to a cylinder. If the connections do not fit together readily, the wrong regulator is being used. • Before attaching cylinders to a connection, be sure that the threads on the cylinder and the connection mate are of a type intended for the gas service. • Do not permit oil or grease to come in contact with cylinders or their valves. • Attach the regulator securely before opening the valve wide. Always use a cylinder wrench or another tightly fitting wrench to tighten the regulator nut and hose connections. • Stand to the side of, and face away from, the regulator when opening the cylinder valve. • Open cylinder valves SLOWLY. Do not use a wrench to open or close a hand wheel type cylinder valve. If it cannot be operated by hand, have the valve repaired by the manufacturer. • Shut off gas cylinder valves when cylinder not in use
---------------------------------	---



Class B Chemicals - Combustible and flammable material

I. Sub-divisions

Combustible and flammable materials include the following sub-divisions;

- B1 Flammable gases
- B2 Flammable liquids
- B3 Combustible liquids
- B4 Flammable solids
- B5 Flammable aerosols
- B6 Reactive flammable materials

Flammables or combustibles are materials that under standard conditions can generate sufficient vapor to cause a fire in the presence of an ignition source.

TML\MSH Microbiology Department Policy & Procedure Manual	Policy # MI\LS\12\v02	Page 5 of 13
Laboratory Safety Manual		

Special Precautions - Flammable Liquids

The use of flammable liquids in a laboratory is regulated under the Occupational Health & Safety Act and Part 4 of the Ontario Fire Code.

Flammable liquids	Materials which generate sufficient vapors to ignite at temperatures below 100 °F (38 °C)
Combustible liquids	Materials which require temperatures above 100 °F to provide sufficient vapors for ignition

Flammable and combustible liquids are classified into 3 categories. Care should be used in applying these classifications where the liquid is processed, used or stored at temperatures above ambient conditions. Increased temperatures can have the effect of moving the liquid into a classification higher than would be appropriate under ambient conditions. For example, a Class II liquid processed at higher temperatures could require application of Class I requirements.

Class I includes liquids with a flash point below 37.8 °C. These liquids are considered to have the highest risk of fire or explosion because in the summer time it is not uncommon for storage areas to reach a temperature of 37.8°C, which is the upper limit of flash points for this class of liquids.

Class I liquids are further subdivided as follows:

Class IA -flash point below 22.8°C and boiling point below 37.8°C

Class IB -flash point below 22.8°C and boiling point at or above 37.8°C

Class IC -flash point at or above 22.8°C and below 37.8°C

Under normal ambient temperatures both Class IA and Class IB liquids generate sufficient vapours to create vapour concentrations within the flammable range at all times.

In some areas and in closed spaces, the ambient temperature could exceed 37.8°C or only a moderate amount of heating would be required to heat the liquid to or above its flash point. As a result, an arbitrary division of 37.8°C to 60°C was established for liquids to be known as Class II liquids. Since liquids with flash points greater than 60°C would require considerable heating from a source other than ambient temperatures, they have been identified as Class III liquids. These combustible liquids are further subdivided as follows:

Class IIIA -flash point at or above 60°C and below 93.3°C

Class IIIB -flash point at or above 93.3°C

Since Part 4 of the Ontario Fire Code is limited to liquids with a flash point below 93.3°C, Class IIIB liquids which are not heated above their flash point do not fall within the scope of Part 4. These liquids are deemed to represent no greater fire hazard than other combustibles such as plastic, wood or paper products.

TML\MSH Microbiology Department Policy & Procedure Manual	Policy # MI\LS\12\v02	Page 6 of 13
Laboratory Safety Manual		

Both Class II and Class IIIA liquids are considered as combustible liquids under Part 4. Any combustible liquid, including a Class IIIB liquid, heated to or above its flash point must be handled with the same precautions as a flammable Class I liquid.

The **maximum** volume of flammable liquid that may be stored in a lab is 235 L provided;

- Individual container sizes do not exceed 23 L
- Individual containers must be sealed or in *ULC/ORD-C30-1995*, "safety containers" **UNLESS** purity would be affected. In such cases, glass or plastic containers may be used under the following restrictions:
Class I liquid, maximum container size is 1L

Class II or III liquids, maximum container size is 5L

- Dispensing of flammable liquids in the work area may only be done from an approved *ULC/ORD-C30* "safety container". Exception as noted above for purity reasons.
- A maximum of 235 L of flammable and combustible liquids, of which not more than 50 L of Class I liquids are permitted to be in the open area of a laboratory. Quantities in excess of this amount must be stored in an approved metal flammable liquid storage cabinet, *ULC/ORD-C1275-1984*.

Store bulk volumes of flammable liquids in one of the designated flammable storage room on each site.

Flammable storage room locations:

MSH	Bunker (by Receiving)
St. Patrick Site	Bunker (by Receiving)

Warning!

Dispensing of flammable liquids from the storage rooms is restricted to persons having a thorough knowledge and understanding of the dispensing procedures.

TML\MSH Microbiology Department Policy & Procedure Manual	Policy # MI\LS\12\v02	Page 7 of 13
Laboratory Safety Manual		

GENERAL PRECAUTIONS FOR FLAMMABLE & COMBUSTIBLE MATERIALS IN THE LAB

Use	<ul style="list-style-type: none"> • Know the location of the nearest Class B fire extinguisher and fire alarm pull station. • Use in well-ventilated area or in a chemical fume hood. • Eliminate ignition sources such as open flames, smoking materials, hot surfaces, sparks from welding or cutting, operation of electrical equipment and static electricity from areas in which flammable or combustible materials are used or stored. • Ensure that areas in which flammable/combustible materials are used have appropriate sprinkler systems or fire extinguishers. • Never dispose of a flammable or combustible material down a drain or sewer.
Storage in lab	<ul style="list-style-type: none"> • Minimize the quantity of these materials within the work area. See Special Precautions above for volume restrictions. • Use approved container with a spring-closing lid for storage of flammable liquids (except in exceptional and approved circumstances). Container is designed to safely relieve internal pressure when subjected to fire exposure • Store in grounded flammable liquid storage cabinets or in vented cabinets under a chemical fume hood. • Store any solvents which must be stored in glass bottles in the vented cupboard under a chemical fume hood • Never store flammable or combustible materials near oxidizing materials. • Label storage areas or cabinets clearly as DANGER - FLAMMABLE. Examples of such flammable liquids are acetone, ethanol, and glacial acetic acid • For storage of flammable liquids in refrigerators and freezers, use only explosion-proof refrigerators and freezers.
Bulk storage	<ul style="list-style-type: none"> • Ensure that areas in which flammable/combustible materials are stored have appropriate sprinkler systems or fire extinguishers. • Bond and ground metal containers whenever filling, dispensing or storing flammable liquids. • Use portable safety cans whenever possible for storing, transporting, and dispensing flammable liquids.



Class C - Oxidizing Materials

Oxidizing materials include any compound that spontaneously evolves oxygen either at room temperature or under slight heating. Oxidizing materials pose a serious fire and/or explosion risk in the presence of flammable or combustible materials. Many oxidizers may be highly corrosive or toxic.

General Precautions For Oxidizing Materials In The Lab

1. Keep oxidizers away from combustible and flammable materials.
2. Store in designated areas only. Designated areas must be cool and dry.
3. Keep away from heat and sources of ignition.
4. Always wear proper personal protective equipment, including eye, face and hand protection.

Examples of strong oxidizers include:

Chromic acid	Potassium permanganate
Hydrogen or benzoyl peroxide (any peroxide)	Sodium perchlorate (any perchlorate)
Nitric acid	Sodium hypochlorite
Perchloric acid	Sulphuric acid

Examples of incompatible chemicals:

Flammable liquids such as	AND	Oxidizing materials such as
<ul style="list-style-type: none"> • Methanol • Organic acids such as acetic acid 		<ul style="list-style-type: none"> • Sulfuric, nitric or perchloric acids • Sodium hypochlorite • Benzoyl peroxide • Potassium permanganate



Class D1 - Chemicals, poisonous and infectious material: Immediate and serious toxic effects

Chemicals which may cause acute toxic effects are classified as D1 materials. Such materials may be fatal or cause permanent damage if they are inhaled or ingested, or if they enter the body through skin contact. Less toxic substances should always be selected if an alternative is available.

Examples of D1 Chemicals

Ammonium oxalate	Iodine
Chloroform	Methanol
Crystal violet	Oxalic acid dihydrate
Ethanol	Potassium hydroxide
Giemsa's stain	Sulfuric acid
Hydrochloric acid	

General precautions for acutely toxic materials in the lab

1. Handle with caution. Always wear appropriate personal protection equipment including lab coat, gloves, eye protection, masks, and respirators as required.
2. Avoid inhaling by working in a well ventilated area or in a chemical fume hood.
3. When possible, eliminate Class D1 materials from the workplace and use substitutes.
4. Keep controlled substances such as controlled drugs, and chemicals such as cyanides in a locked cupboard. Secure narcotics and inhalant anesthetic agents as required by legislation.
5. Solution containing class D1 substances should be dispensed with burettes or automatic dispensers at low pressure.
6. Cover work surfaces with dry, absorbent plastic-backed paper, as appropriate. Dispose of it after each procedure.
7. Wash thoroughly after handling.



Class D2 - Chemicals, poisonous and infectious material: Other toxic effects

Class D2 chemicals are materials that are not immediately dangerous to health; however, repeated exposures may cause death or permanent damage over time. Many D2 chemicals will cause cancer, birth defects and sterility. Other D2 chemicals may be sensitizers, which produce a chemical allergy.

Examples of D2 Chemicals

Hexane	Sodium phosphate dibasic
Petroleum spirit	Sodium phosphate tribasic
Isopropanol	Trichloroacetic acid
2-Methoxyethanol	Acetone
Depex mounting medium	Sodium azide
Boric acid	Xylene
Potassium ferrocyanide	

General precautions for toxic materials in the lab

1. Handle with caution. Always wear proper personal protective equipment, including eye, face and hand protection.
2. Avoid inhaling by working in a well ventilated area or in a chemical fume hood.
3. When possible, eliminate Class D2 materials from the workplace and use substitutes.
4. Cover work surfaces with dry, absorbent plastic-backed paper, as appropriate. Dispose of it after each procedure.
5. Wash thoroughly after handling.



**Class D3 - Chemicals, poisonous and infectious material:
Biohazardous and infectious material**

Biohazardous and infectious materials are any organism, or its toxins, that has been shown to cause disease or is believed to cause disease in animals or humans.

General precautions for use of biohazardous and infectious materials in the lab

Refer to LSM Section on Infectious Safety in this manual



Class E - Corrosives

Corrosives are materials which chemically react at the point of contact to cause visible (often burn-like) damage to tissue. Examples of corrosives include acids and bases. When handling these materials, the following precautions should be observed:

GENERAL PRECAUTIONS FOR USE OF CORROSIVE MATERIALS IN THE LAB

Transportation	<ul style="list-style-type: none"> • Use Neoprene bottle carriers or Styrofoam packing crates.
Use	<ul style="list-style-type: none"> • Wear appropriate PPE, including laboratory coat and goggles or a face shield. Consult MSDS. Additional PPE to be considered include gloves and an apron. • Limit the amount of corrosive chemicals at the bench to the amount required for testing. • Keep containers tightly closed. • Use strong corrosives in a chemical fume hood. • Always add acid to water (never the reverse), and do so slowly, to avoid a violent reaction and splattering. • Ensure that an eyewash and safety shower are readily accessible in areas where corrosives are used and stored. In the event of skin or eye contact with corrosives, immediately flush the area of contact with cool water for 15 minutes. Remove all affected clothing. Get medical help immediately.

Storage	<ul style="list-style-type: none"> • Store strong corrosives in well ventilated areas away from flammable and combustible liquids and oxidizing agents. Usually they are stored in one side of the cupboard under the fume hood • Label cabinet clearly as DANGER - CORROSIVE. • Do not store strong alkaline solutions in glass containers as glass will be etched and leachate will enter the solution. This will contaminate the solution and may dangerously weaken the container. • Because glacial acetic acid is flammable, store separately from other acids such as hydrochloric acid, nitric acid and sulphuric acid.
---------	--



Class F Chemicals - Dangerously Reactive Chemicals

Dangerously reactive chemicals are materials that react rapidly with themselves or other materials to release relatively large amounts of energy. In some situations, the reaction may be violent enough to produce a detonation.

General precautions for use of dangerously reactive materials in the lab

1. Indicate the date of purchase and date of opening on each container of peroxide forming chemicals.
2. Store reactive chemicals in a cool, well ventilated, flameproof space away from flammables and combustibles, oxidizes and corrosives.

A number of subcategories of this chemical class together with examples and precautions for handling are listed below:

	Subcategory	Hazard	Examples	Precautions
1	Pyrophorics	Ignite spontaneously upon contact with air.	Metal alkyls, phosphorus, fine powders of metals such as magnesium, aluminum and zinc.	Use or store in inert environments.
2	Oxidizers	React violently with organic materials or strong reducing agents.	Perchloric acid Chromic acid Fuming nitric acid	Use minimum amounts for procedures Store away from organic materials, flammable materials and reducers.

3	Peroxidizables	React with oxygen to form peroxides which can explode with impact, heat or friction.	Diethyl ether Tetrahydrofuran Isopropyl ether	Date all upon receipt and upon opening Dispose of within 6 months of opening or 12 months of purchase Never open a container with obvious crystal formation around the lid.
4	Water reactives	React with water to produce a flammable or toxic gas or other hazardous products.	Alkali metals such as lithium, sodium and potassium Acid anhydrides such as acetic anhydride	Avoid contact and handle away from water sources Use dry sand to smother fires Provide ventilation to disperse flammable gases

Do not store together:

Reactive materials such as those listed above	AND	Flammables, combustibles, oxidizers and corrosives
---	------------	--



Radioactive Chemicals

Follow the procedures outlined in the [Radiation Safety Manual](#).