



Health and Safety Training

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3

Contents

- **Legislation**
- **Information on chemical products**
 - WHMIS 1988
 - WHMIS 2015 (based on GHS)
 - NFPA 704
- **Protective equipment**
- **Storage**
- **Waste elimination**
- **Emergency procedures**

TEST...

4



Risk assessment and legislation

Types of hazards in a laboratory

- **Mechanical:** sharp material, tools...
- **Ergonomic:** excessive rates, high and heavy loads...
- **Biological:** infection risks...
- **Physical:** heat, noise, UV light, laser...
- **Chemical:** CHEMICAL COMPOUNDS

Spot them in your work environment!

Risk: chance or probability that a person will be harmed or experience an adverse health effect if exposed to a hazard.

http://www.ccohs.ca/oshanswers/hsprograms/hazard_risk.html ⁶

Risk assessment

- Spot the hazards;
- Learn how to avoid the accident!
- Report incidents.

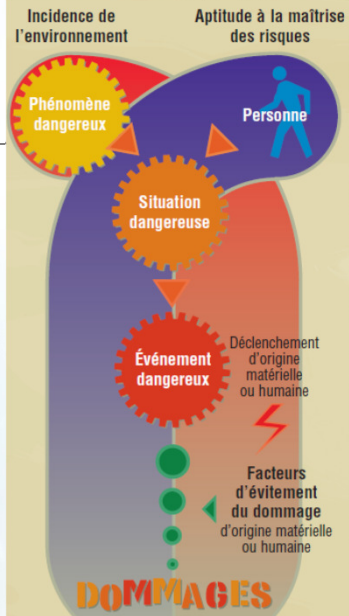
Les accidents nous parlent

Entraîné dans un tour

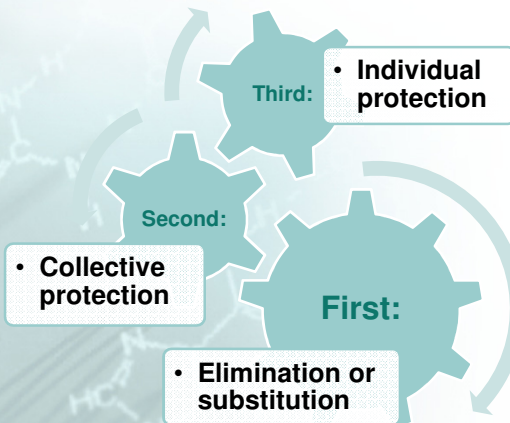
Un travailleur d'une quarantaine d'années meurt coincé et écrasé dans un tour conventionnel à métal.



http://www.csst.qc.ca/NR/rdonlyres/69832CB9-C3FA-4321-856D-E3CAE331C7FA/2294/dc_900_337_2.pdf



Protection levels



http://www.ccohs.ca/oshanswers/hsprograms/hazard_control.html

Before starting

To avoid a possible accident:

1. Plan your experiment.
2. Identify hazards.
3. Assess risks.
4. Follow safe work procedures.
5. Wear the appropriate protective equipment.
6. Take training and information.



http://www.ccohs.ca/oshanswers/hsprograms/hazard_control.html

9

Statistics

« Accidents in academic laboratories are 10 to 50 times more frequent than in industry. Much remains to be done to improve safety.»

James Kaufman,
Laboratory Safety Institute



10

Risk assessment

Before starting a new protocol, ask yourself these **four simple questions**:

- What are the hazards?
- What are the worst things that could happen?
- What do I need to do to be prepared?
- What are the prudent practices, protective facilities, and protective equipment needed to minimize the risk?

<http://www.labsafetyinstitute.org/>

<http://www.usherbrooke.ca/immeubles/sante-et-securite/evaluation-des-risques/documentation/>

11

Few statistics

- In Quebec, in 2012 only:
 - ✓ Over 600 work accidents involving chemical products
 - ✓ 4 fatalities in the chemical industry
- At the Université de Sherbrooke in 2012:
 - ✓ 32 known accidents (spills, contamination, fires...) involving chemicals.

http://www.csst.qc.ca/a_propos/rapports_annuels/Documents/AppendiceStatistique_2012_web.pdf

12

Few statistics

- In Quebec, every year for young people (less than 24 year old) :
 - ✓ 150 % more accidents than usual
 - ✓ 55 accidents a day
 - ✓ 2 amputations a week
 - ✓ 1 deceased a month
 - ✓ 1 000 permanent injuries per year...

Source : http://www.csst.qc.ca/en/young_people_work.htm
http://www.ccohs.ca/youngworkers/for_young_workers/ 13



Legislation

- ✚ **Employers :**
 - Act respecting occupational health and safety (inform your employees)
 - Hazardous Products Act and Hazardous Products Regulations
- ✚ **Employees, students, trainees :**
 - Act respecting occupational health and safety (protect yourself and the others around, inform yourself and the others around, minimise the risks)
 - Hazardous Products Act and Hazardous Products Regulations
- ✚ **Supervisors :**
 - Law C-21 (criminal negligence can be punished by a fine and even prison)

14

Deadly accident at UCLA

In a chemistry research lab at UCLA:

- December 29th, 2008 : fire in a hood that spreads to the clothes of Sheri Sangji, 23 years old. She dies from the burns 18 days later.
- Civil lawsuits and criminal proceedings against the UC and against Prof. Harran.



<http://cen.acs.org/articles/91/i18/Patrick-Harran-Face-Felony-Trial.html>

Law C21: diligent supervision

How can one exercise due diligence?

- **Duty of foresight:** Identify the dangers et analyze the risks;
- **Duty of efficiency:** Put in place good prevention (training, personal and collective protection equipment, etc.);
- **Duty of authority:** Enforce safety regulations.

New addition to the study regulations concerning the infringement of OH&S rules: <http://www.usherbrooke.ca/programmes/references/reglement/discipline/>

UdeS SSMTE policy

- New policy adopted in 2013;
- It defines the **rights and obligations** of the University and the **rights and obligations** of the university community, based on the *Act respecting occupational health and safety*.
- The **roles and responsibilities** of the different academic levels are described.

<http://www.usherbrooke.ca/accueil/fileadmin/sites/accueil/documents/direction/politiques/2500-004.pdf> 17

UdeS SSMTE policy (1 of 2)

« The achievement of the objectives of this policy is only possible through the **involvement of all members** of the university community. Therefore, the **employees, students and trainees** must:

- propose ways to eliminate the risks to health and safety inherent to their workplace or study environment;
- report any situation presenting a potential risk to the health and safety of employees, students and trainees;

UdeS SSMTE policy (2 of 2)

The employees, students and trainees must:

- use tools and equipment safely and properly;
- wear clothing and protective equipment when required;
- report any accident, injury or illness as a result of the execution of a task or learning activity;
- meet safety standards when performing tasks or learning activities. »

19

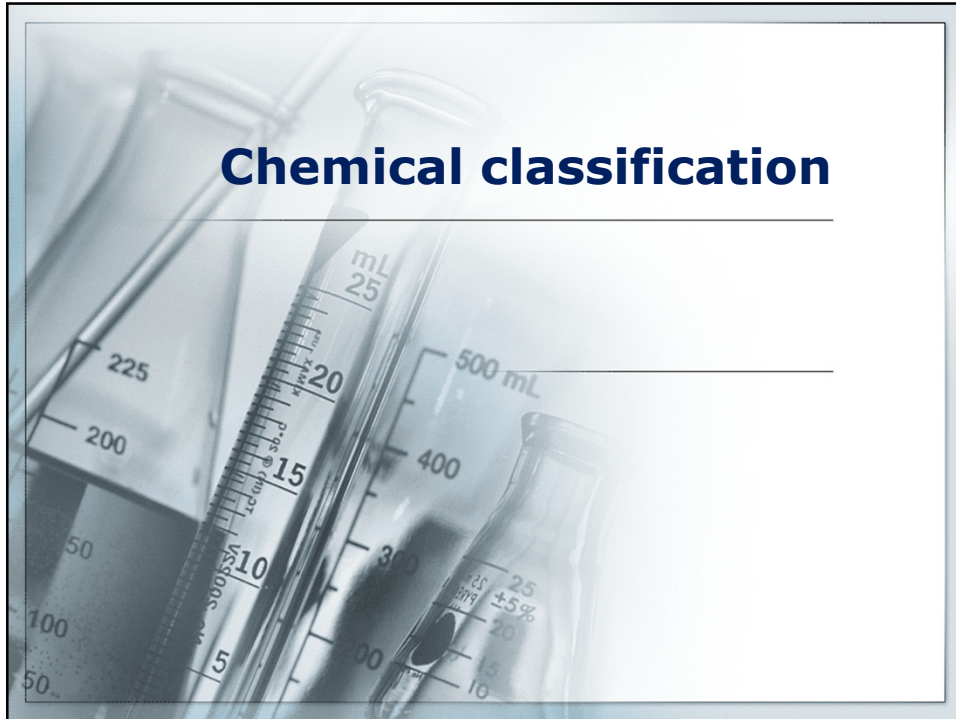
UdeS SSMTE Directive

- New Directive adopted in August 2014;
- It defines **rules for safe work in laboratories and shops**:
 - **General rules** (working alone, need for risk analyses...)
 - **Rules on PPE** (personnel protective equipment)
 - **Rules related to training** (laboratory health and safety training every five years)

https://www.usherbrooke.ca/accueil/fileadmin/sites/accueil/documents/direction/directives/2600-042_EN.pdf

20

Chemical classification



WHMIS

WHMIS is a pan-canadian information system, implemented through coordinated federal, provincial and territorial legislation and regulation. Its goal is the safe storage, handling, use and disposal of dangerous products in the workplace.




3 key elements: training, labelling and safety data sheets

<http://whmis.org>

22

WHMIS 1988 Classification

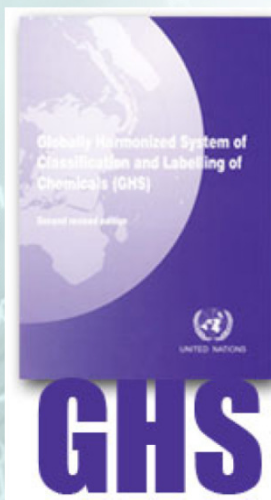
Recognize these symbols:

<p>CLASS A</p>  <p>Compressed Gas</p>	<p>CLASS B</p>  <p>Flammable and Combustible Material</p>	<p>CLASS C</p>  <p>Oxidizing Material</p>
CLASS D		
 <p>1. Materials Causing Immediate and Serious Toxic Effects</p>	 <p>2. Materials Causing Other Toxic Effects</p>	 <p>3. Biohazardous Infectious Materials</p>
<p>CLASS E</p>  <p>Corrosive Material</p>	<p>CLASS F</p>  <p>Dangerously Reactive Material</p>	

WHMIS Classes and Hazard Symbols















WHMIS 2015 (GHS) Classification



- General Harmonized System (GHS) developed by UNO since 1992;
- In place in several European countries;
- Implemented in the USA in fall 2011, in place at June 15th, 2015;
- Implemented in Canada as **WHMIS 2015** in February 2015, transition till December 1st, 2018.







http://www.ccohs.ca/oshanswers/chemicals/whmis_ghs/general.html 24

Comparison WHMIS/ GHS Pictograms

Compressed gases	Class A		
Flammable material	Class B (6 divisions)		
Oxidizing material	Class C		
Toxic and infectious material (3 divisions)	Class D		
			
			

25

Comparison WHMIS/ GHS

Corrosive material	Class E		
Highly reactive material	Class F		
Explosives	Not part of WHMIS 1988		
Hazardous to the aquatic environment	Not part of WHMIS 1988		

26

WHMIS transition

The transition from WHMIS 1988 to WHMIS 2015 goes until December 1st, 2018.

Phase	Timing	Suppliers		Employer*
		Manufacturers and Importers	Distributors	
Phase 1	From February 11, 2015 to May 31, 2017	WHMIS 1988 or WHMIS 2015	WHMIS 1988 or WHMIS 2015	Consult F/P/T regulator
Phase 2	From June 1, 2017 to May 31, 2018	WHMIS 2015	WHMIS 1988 or WHMIS 2015	WHMIS 1988 or WHMIS 2015
Phase 3	From June 1, 2018 to November 30, 2018	WHMIS 2015	WHMIS 2015	WHMIS 1988 or WHMIS 2015
Completion	December 1, 2018	WHMIS 2015	WHMIS 2015	WHMIS 2015

WHMIS 2015: Hazard Classes

The hazards are classified between:

- Physical hazards
- Health hazards
- Environmental Hazards (*not adopted in US + Canada*).

Each class is divided in categories: **the lower the number, the more dangerous the category!**

Example: A product identified **Acute toxicity, Oral (Category 3)** is **less dangerous** than another one with **Acute toxicity, Oral (Category 1)**.

WHMIS 2015: Physical Hazard Classes

19 classes:



Gases under pressure



Flammables (gases, aerosols, liquids, solids);
Pyrophoric (liquids, solids, gases);
Self-reactive substances and mixtures;
Self-heating substances and mixtures;
Substances and mixtures which, in contact with water, emit flammable gases;
Organic peroxides.



Oxidizing (liquids, solids, gases)



Corrosive to metals



Self-reactive substances and mixtures;
Organic peroxides.

Physical Hazard Not Otherwise Classified.

29

WHMIS 2015: Health Hazard Classes

12 classes:



Acute toxicity (fatal or toxic)



Acute toxicity (harmful);
Skin irritation;
Eye irritation;
Skin sensitization;
Specific target organ toxicity – single exposure.



Aspiration hazard;
Carcinogenicity;
Germ cell mutagenicity;
Reproductive toxicity;
Respiratory sensitization;
Specific target organ toxicity – single exposure;
Specific target organ toxicity – repeated exposure.



Serious Eye damage;
Skin corrosion.



Biohazardous infectious materials.

Health Hazard Not Otherwise Classified.

30

WHMIS Classification

Goals:

- Reduce the number of occupational illnesses;
- Reduce the number of accidents due to the handling of chemical compounds.



31



Class A: compressed gases



= Any material that is normally a gas, which is placed under pressure or chilled, and contained in a cylinder.

Examples: argon, nitrogen, CO₂...

acetylene, propane, hydrogen...

oxygen, chlorine...

CO, hydrogen sulfide, arsine...



32



Class A: compressed gases



General risks:

- Projection of the gas cylinder;
- Explosion if heated or after a hard impact;
- Asphyxia (simple or chemical).

General precautions :

- Manipulate with care;
- Do not drop the cylinder;
- Store the flammable gases away from sources of ignition;
- Always keep the cylinders attached;
- Only move them with a suitable cart.

33

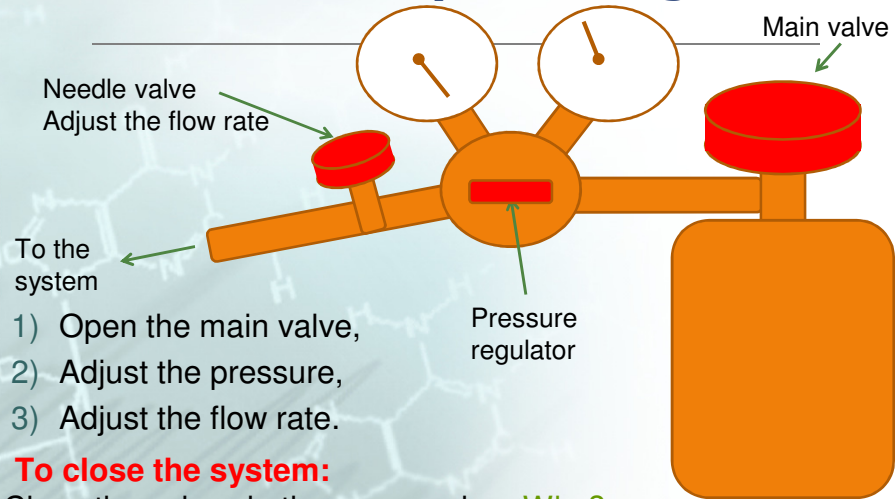
Why ALWAYS attach a cylinder??



Mythbusters' experiment: <https://www.youtube.com/watch?v=C4kb-8CjVYg>;
<https://www.youtube.com/watch?v=X7hOlsBZTPE>



Class A: compressed gases



- 1) Open the main valve,
- 2) Adjust the pressure,
- 3) Adjust the flow rate.

To close the system:

Close the valves in the same order. Why?

Close the main valve, remove the pressure, empty the regulator.

35



Class A: compressed gases



Before manipulating a gas cylinder, ask!

- Choose the right regulator;
- Carefully open the regulator;

Inert gas : clockwise



: counter clockwise
with a groove



: reversed thread



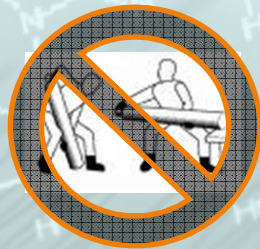
36



Class A: compressed gases



- Check that there is no leak;
- Always move the cylinder with a suitable cart, keep the cylinder standing, safely attached.



37



Class A: compressed gases



Special cases: **cryogenics**:

Dry Ice

- - 78°C : Risk of frostbites or burns;
- 1 litre of solid gives **845** litres of gas;
- Critical point : 31°C



Liquid cryogenics (liquid N₂, etc.)

- N₂ : - 196°C !! **Danger of severe burns!!**
- 1 litre of liquid gives **696** litres of gas;
- Critical point : -147°C





Class A: compressed gases



Special risks :

- Risk of frostbites or severe burns;
- Explosion if put in a closed container;
- Simple asphyxia.

General precautions :

- Wear special gloves for cryogenics;
- Use in a well ventilated area;
- Never use sealed containers;
- Do not store them in cold rooms.



39



Class B: flammable and combustible material



Energy source →

Avoid it!!!

← Often : O₂
from air

WHMIS :
Class C



Oxidizer

Combustible or
flammable



WHMIS :
Class B

To stop a fire, eliminate one of the sides.

41



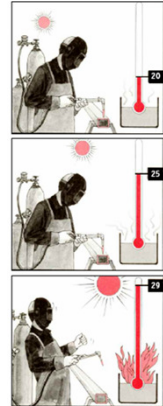
Class B: flammable and combustible material



Definitions: **Flash point** = temperature, at which a liquid ignites in contact with a source of energy : flame, spark...
Fires stops if the source is removed.

Flash point examples :

- Butanol: 29 °C
- Acetone : -18 °C
- Diethyl ether : -45 °C
- Ethanol (100%): 13 °C
- Ethanol (10%): 49 °C
- Fuel (super) : -40 °C (auto-ignition at 400 °C)



42



Class B: flammable and combustible material



Risk: FIRE

Six sub-categories:

- B1** Flammable gases (acetylene, propane...)
- B2** Flammable liquids (ethanol, acetone...)
- B3** Combustible liquids (glacial acetic acid, kerosene...)
- B4** Flammable solids (naphthalene, SDS, silicium...)
- B5** Flammable aerosols (WD40, paints...)
- B6** Flammable reactive solids (metallic powders...)

43



Class B: flammable and combustible material



Precautions:

- Know the flash point and the relative density (vapors);
- Keep away from oxidizers;
- Keep away from sources of ignition;
- Ground the containers when transfilling;
- Keep the containers tightly closed in a dry and well-ventilated place;
- **B4**: Avoid friction and exposure to heat;
- **B6**: Keep away from water and air.

Flammable vapor demonstration:

<https://www.youtube.com/watch?v=rMdc1t7bBk8>

Vapor density demonstration:

<https://www.youtube.com/watch?v=Aqb9jNvxZCo>

44



Class C: oxidizing material



Cause or promote the combustion of another material by generating oxygen or other oxidizing substance.

Examples: oxygen, nitric acid, chlorine, peroxides...

Risks:

- Can cause a fire or an explosion;
- Are incompatible with organic materials, and all combustible and flammable products.

45



Class D1: materials causing immediate and serious toxic effects



General risks :

- Cause severe, immediate and possibly fatal effects;
- Can leave permanent damage;
- Can be quickly absorbed through the skin and cause burns.

Examples: methanol, formol, chlorine, hydrochloric acid...

General precautions :

- Avoid any contact with the skin, eyes or respiratory tract;
- Wear the personal protective equipment (PPE) recommended by the supplier.

46

Class D2: materials causing other toxic effects



A : VERY TOXIC

- Substances that cause a reaction serious enough to threaten the life or cause serious permanent disability.



Examples: lead, mercury, asbestos, benzene, fuel, petroleum ether, PCB, xylene...

B : TOXIC

- Substances which cause irritation, burns or sensitization in a chronic toxicity assay.



Examples: Acetone, ethanol, hexane, kerosene, vinylstyrene, aluminium sulfate...

47

Class D2: materials causing other toxic effects

Risks:

D2A: Carcinogenicity, teratogenicity and embryotoxicity, reproductive toxicity, respiratory sensitization;

D2B: Irritation of the skin and eyes; skin sensitization, proven mutagenicity in animals.

General precautions :

- Avoid any contact with the skin, eyes or respiratory tract;
- Wear the personal protective equipment (PPE) recommended by the supplier.

48

Class D3: infectious material

= Organisms and their toxins, if it has been demonstrated that the organism causes a disease in humans or animals or is the likely cause.

Risks :

- Infections (for pathogens), by direct or indirect contamination;
- Intoxications (for toxins), by direct or indirect contamination.

Precautions :

- Requires an appropriate training for handling this type of material;
- Always apply the "universal precautions" (gloves, lab coat, safety glasses, etc.).

49

Class D3: infectious material

In Canada, possession and use of human pathogens and / or toxins is regulated by the *Human Pathogens and Toxins Act*.

Examples: Virus (HIV-1, influenza virus, etc.), bacteria (*Clostridium difficile*, etc.), parasites (*Plasmodium malariae*, etc.), biological fluids (blood, etc.), clinical samples...

50



Class E: corrosive material

= materials with the following characteristics :

- Corrosive effect on **metal**: steel or aluminum
- Corrosive effect on the **skin**: causes necrosis of human tissues.

**In general : acids and bases are corrosive
if $\text{pH} \leq 2$ and if $\text{pH} \geq 11,5$**

51



Class E: corrosive material

Risks :

- Corrosion, burns of the skin, the eyes and the respiratory tract, reactions with other products, etc.

Precautions:

- Wear the appropriate PPE;
- Work in a good ventilated place.

Examples: sulfuric acid, sodium hydroxide, phenol, chlorine, Portland cement...

52



Class F: dangerously reactive material

= materials with one of the following characteristics:

A) subject to a vigorous polymerization, decomposition or condensation reaction;

A) Methyl acrylate
Hydrogen cyanide

B) self-reactive in case of a shock or an increase in pressure or temperature;

B) Picric Acid
TNT
Diazomethane

C) reacts violently with water and gives off toxic gas.

C) Phosphorus pentachloride
Aluminium chloride

54



Class F: dangerously reactive material



Risks:

- Fire, explosion, incompatibility with other products...

Precautions:

- Keep away from heat, store safely;
- Open the container with care, in the chemical hood;
- Wear the appropriate PPE, if necessary a face shield;
- Verify the container regularly and dispose of the old products.

55

WHMIS Classification

Ask yourself:

1. To which class(es) belongs the product I have to use?
2. What risks are associated to each class?
3. How can I protect myself?



56

WHMIS 1988: label by supplier

- Product identification
- Supplier identification
- MSDS reference
- Hazard signs
- Mentions of risks
- Security measures
- First aid

METHANOL
DANGER
POISON
FLAMMABLE
VAPEUR HARMFUL
MAY CAUSE BLINDNESS IF SWALLOWED

Keep away from heat, sparks and flame. No smoking. Container must be grounded when being emptied. Vapour may travel long distance. Avoid contact with eyes and skin. Do not inhale vapours or mist. Do not take internally. Harmful if absorbed through the skin.

FIRST AID: In case of contact, immediately flush eyes and skin with plenty of water for at least 15 minutes. If swallowed, induce vomiting by sticking finger down throat, or by giving snappy water to drink. Repeat until vomit is clear. If affected by vapour, move to fresh air. If breathing has stopped, apply artificial respiration.

GET MEDICAL ATTENTION IMMEDIATELY.

PRECAUTIONS: Wear chemical goggles and resistant gloves. Wash thoroughly after handling. Use with enough ventilation to keep below TLV. Keep container closed. Never return to service.

**SEE MATERIAL SAFETY DATA SHEET FOR PRODUCT
VOIR FICHE SIGALETIQUE**

ABC Company
Anytown, Ontario Telephone 123-4567

MÉTHANOL
DANGER
POISON
INFLAMMABLE
VAPEURS NOCIVES
PEUT PROVOQUER LA CÉCITÉ, SI AVALE

Garder loin de la chaleur, des étincelles et des flammes. Ne pas fumer. Brancher le contenant à une prise de terre avant de le vider de son contenu. Les vapeurs peuvent y ténêdre sur de longues distances. Éviter tout contact avec les yeux et la peau. Ne pas respirer les vapeurs. Ne pas absorber. Nocif si absorbé par la peau.

PREMIERS SOINS: En cas de contact avec les yeux ou la peau, laver à grande eau pendant au moins 15 minutes. Si avalé, provoquer le vomissement en introduisant un doigt dans la gorge ou en faisant absorber de l'eau savonneuse à la victime. Répétez jusqu'à cessation du vomissement. Sortir au grand air, si indisposé par les vapeurs. Si la respiration est interrompue, recourir à la respiration artificielle.

OBTENIR DES SOINS MÉDICAUX IMMÉDIATS.

PRÉCAUTIONS: Porter des lunettes protectrices (pour produits chimiques) et des gants résistants. Se laver minutieusement après usage. Utiliser dans un endroit bien aéré, afin de maintenir un niveau de vapeurs tolérable. Garder le contenant fermé. Ne jamais user de récipients de retour.

WHMIS 2015: label by supplier

- Product identification
- Hazard pictograms
- Signal word (**Warning** or **Danger**)
- ~~MSDS reference~~
- Hazard statements
- Precautionary statements
- Supplier identification (more detailed)

Product J
(abc chemical)

Danger
Fatal if swallowed
Causes skin irritation

Precautions:
Wear protective gloves.
Wash hands thoroughly after handling.
Do not eat, drink or smoke when using this product.

IF ON SKIN: Wash with plenty of soap and water.
If skin irritation occurs: Get medical advice/attention.
Take off contaminated clothing and wash before reuse.

IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Rinse mouth.

Store locked up.
Dispose of contents/container in accordance with local regulations.

ABC Chemical Co., 123 Anywhere St., (123) 456-7890

WHMIS 1988: workplace label

- Product identification :
 - Chemical name, generic name, commercial name or code number.
- Guidelines for safe handling;
- Reference to MSDS.

Éthylène glycol

Irritant pour la peau et les yeux
En cas de contact avec la peau, rincer abondamment avec de l'eau et du savon
En cas de contact avec les yeux, rincer immédiatement avec de l'eau 15 minutes
Ne pas respirer les vapeurs

Mesures préventives 

Pour plus d'informations, consulter la fiche signalétique

 UNIVERSITÉ DE SHERBROOKE

WHMIS 1988 exemptions

- Wood and wood products;
- Tobacco and tobacco products;
- Manufactured items;
- Products transported or handled in accordance with TDG, during the phases of handling and transportation to the workplace:
 - No label, MSDS or WHMIS training required;
 - TDG training required.
- Products for laboratories (samples < 10 kg).

63

WHMIS 2015 workplace label

- 1) **Product Identifier**
- 2) **Hazard Pictograms** (optional)
- 3) **Precautionary Statements** (recommended measures to minimize or prevent adverse effects from exposure to the product, including protective equipment and emergency measures).
- 4) **Reference to SDS** (if available).

1 PRODUCT K1

2  

3 Fatal if swallowed
Causes skin irritation

4 See SDS for more information

64

WHMIS 2015 workplace label

Requirements in Quebec:

- 1) **Product Identifier**
- 2) **Precautionary Statements** (recommended measures to minimize or prevent adverse effects from exposure to the product, including protective equipment and emergency measures).
- 3) **Reference to SDS** (if available).

1. Nom du produit → **NETTOYEUR INDUSTRIEL 10 SOUS TOUT**

Ne pas respirer les vapeurs, les brouillards et les aérosols;
Utiliser seulement en plein air ou dans un endroit bien ventilé;
Utiliser seulement en plein air ou dans un endroit bien ventilé;
Se laver les mains soigneusement après manipulation;
Porter des gants de protection en caoutchouc naturel, de butyle, de nitrile ou de néoprène;

2. Les conseils de prudence → Porter des lunettes de sécurité ou une visière (écran facial) lorsqu'il y a possibilité d'éclaboussures;
Stocker dans un endroit bien ventilé. Maintenir le récipient fermé de manière étanche. Garder sous clef;
Éliminer le contenu et le récipient conformément à la réglementation locale;





EN CAS D'INHALATION : Transporter la personne à l'extérieur et la maintenir dans une position où elle peut confortablement respirer. Appeler immédiatement un médecin;
EN CAS D'INGESTION : Rincer la bouche. Ne PAS faire vomir;
EN CAS DE CONTACT AVEC LA PEAU : Enlever immédiatement tous les vêtements contaminés. Rincer la peau à l'eau ou se doucher. Laver les vêtements contaminés avant réutilisation;
EN CAS DE CONTACT AVEC LES YEUX : Rincer avec précaution à l'eau pendant plusieurs minutes. Enlever les lentilles de contact si la victime en porte et si elles peuvent être facilement enlevées. Continuer à rincer. Appeler immédiatement un médecin.

3. Référence à la fiche de données de sécurité → Pour plus de renseignements, consulter la fiche de données de sécurité

<http://www.csst.qc.ca/publications/500/Documents/DC500-118-3web.pdf>

MSDS (WHMIS 1988)	SDS (WHMIS 2015)
Product information	Product and company identification
	Hazards identification
Hazardous ingredients	Composition / information on ingredients
First aid measures	First aid measures
Fire and explosion hazards	Fire-fighting measures
	Accidental release measures
Preventive measures	Handling and storage
	Exposure controls / personal protection
Physical data	Physical and chemical properties
	Stability and reactivity
Toxicological properties	Toxicological information
	Ecological information
	Disposal considerations
	Transport information
	Regulatory information
Information on the preparation of the MSDS	Other information

Safety data sheet

- Sent by the supplier with the product.
- Available online (supplier), through the HECHMET database (inventory), or through our website: <http://www.usherbrooke.ca/immeubles/sante-et-securite/produits-chimiques/fiches-signaletiques/>
- It must be less than three year old (WHMIS 1988).

Example: [Methanol SDS](#)



SDS: access through HECHMET

The screenshot shows the 'Chemical View/Update' page in the HECHMET system. The interface includes a search bar, filters for Barcode #, Location, and CAS #, and a table of chemical inventory. The table columns include Chem Name, Barcode #, Location, Lot Number, QTY, Inventory, UOM, Stock Number, CAS #, PI, Group, PC Number, Account, and Storage. A red arrow points to the 'Chemwatch MSDS' link in the table header. Another red arrow points to the 'ACETIC ACID GLACIAL' product in the list.

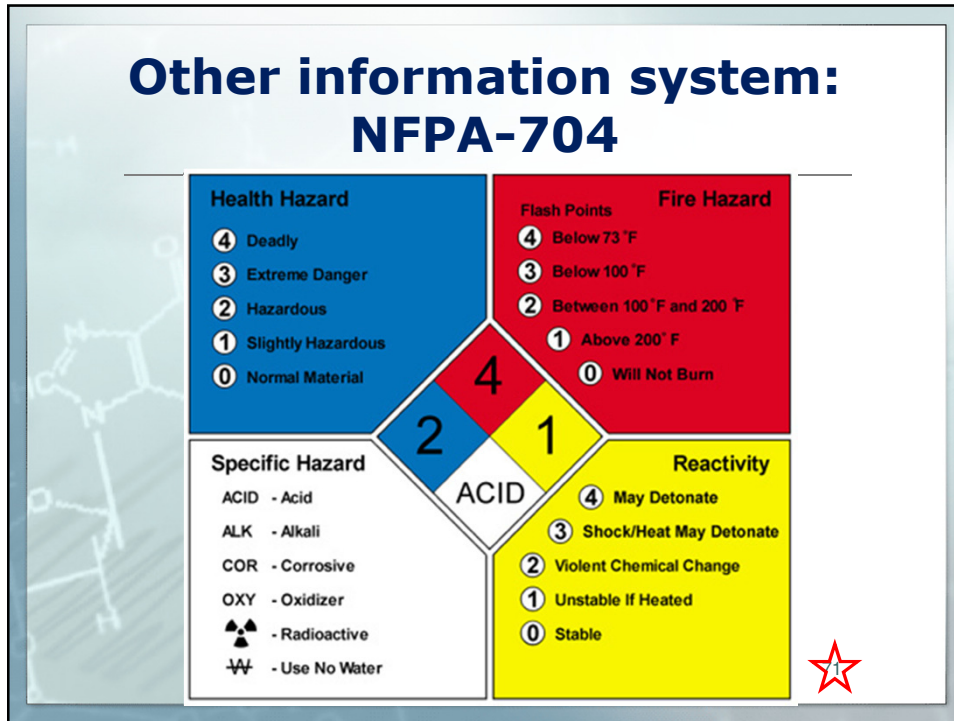
1. Sélectionner le produit

2. Cliquer Chemwatch MSDS

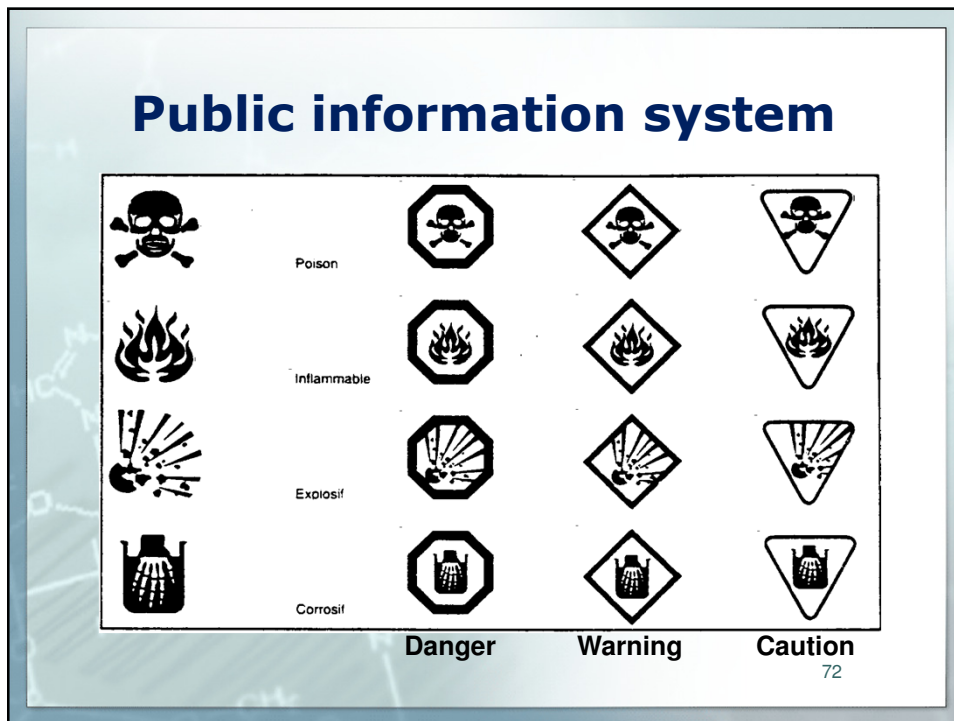
Safety data sheet

- Read and understand the (M)SDS **before** using a product!
- Be aware of the first aid and emergency measures **before** an accident happens!

Other information system: NFPA-704



Public information system



Other regulation: TDG



Transportation of Dangerous Goods Regulations



- Applies to ALL shipping of dangerous goods, by air, road, rail or sea.



- Application in parallel with the WHMIS.

- Requires another specific training.

- At UdeS, send the requested form to tmd@USherbrooke.ca



74

Other regulation: TDG



Transportation of Dangerous Goods Regulations



- Anyone transporting DG or offering DG for transport must have a proper training, or be under the supervision of a trained person.

- **Fines: up to 50,000\$ and 2 years in prison!**

- Consult

<http://www.usherbrooke.ca/immeubles/sante-et-securite/envoi-de-produits-dangereux/>



75




Protection

Chemical risks

Four ways of entry:

- Inhalation
- Ingestion
- Absorption through skin
- The eyes
- *Injection...*

A photograph of a syringe with a needle, set against a blue background. The syringe is white and has markings on the barrel. The needle is attached to the syringe. The background is a solid blue color.

Inhalation: respiratory protection

Different protections, depending on the risk:



Mask N95 or P100 for particles, no protection from chemicals

Half-mask or full-face mask with P100 filter and cartridges adapted for the contamination

SCBA, complete isolation from contamination

These protective equipment need to be fit-tested before use!

Risk of asphyxia

Laboratories can be equipped with detectors (O₂, LEL, VOC, toxic compounds...)

CONSIGNES DE SÉCURITÉ		URGENCE ☎ 811	
RISQUES PARTICULIERS		LOCAL D1-1117-1	Strobes inside and outside + reading pannel
PRÉSENCE D'UN DÉTECTEUR LOCAL D'OXYGÈNE SI ALARME NE PAS ENTRER		RESPONSABLE(S) jour: soir:	
LIQUIDE CRYOGÉNIQUE (AZOTE)		SHERBROOKE Service des interventions Division S&MTE ENRSO Date de révision: 06/06/2011	

Important definitions

OEV : Occupational Exposure Values: permissible exposure values for air contaminants (given in ppm or mg/m³)

- **OEV-Ceiling (C):** concentration never to be exceeded during any length of time whatsoever!
- **OEV-STEVE = Short Term Exposure Value:** OK for maximum 15 min, maximum four times a day.
- **OEV-TWA – Time-Weighted Average** concentration: OK for a normal shift (8h/day, 40h/week).
- **IDLH: Concentration Immediately Dangerous to Health or Life:** used for first aid responders.

<http://www.reptox.csst.qc.ca/Documents/SIMDUT/GuideAng/Htm/GuideAng13.htm>

80

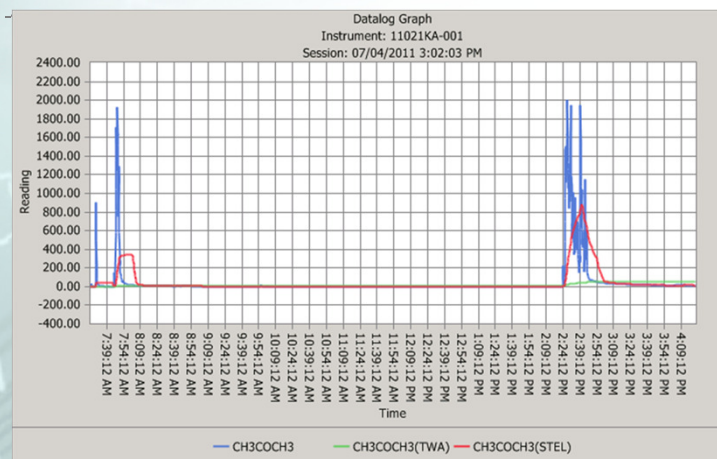
Examples of exposure values

Chemical	TWA	STEVE	Odour threshold
Acetone	500	1000	50
Benzene	1	5	2
Phenol	5	N.A.	0,1
Hexane	50	N.A.	N.A.
Ethanol	1000	N.A.	49
Methanol	200	250	Variable

Values given in ppm.

<http://www.csst.qc.ca/prevention/reptox/pages/repertoire-toxicologique.aspx>

Exposure to acetone



obs. max. EV: 2000 ppm, max. STEL : 881 ppm, max. TWA: 52 ppm.
CNESST: IDLH: 2500 ppm, STEL: 1000 ppm and TWA: 500 ppm

Chemical risks : different effects

1. Local

- Chemical burns
 - NaOH 1M (severe burn in less than 15 sec.)

2. Systemic

- Absorption of a product (through skin, eyes, respiratory or digestive system) that enters the bloodstream and spreads throughout the body
 - Chloroform (easily passes the placental barrier)
 - Acrylamide

Influence of the toxic effects

The concentration of the substance at the site of action depends upon:

- Physicochemical properties of the chemical;
- Route and rate of penetration;
- Speed of use, distribution, biotransformation and excretion of the toxin;
- Other variables dependent on the biological response.

84

Chemical hazards: protections

Protective aids:

- Inhalation: work under the hood, if necessary wear a mask, always keep the balance clean;
- Ingestion: do not bring food and drinks to the lab;
- Injection: wear appropriate gloves, do not recap a needle;
- Absorption through skin: wear long pants and closed shoes, a lab coat and gloves;
- The eyes: wear safety glasses or goggles.



Utility of the chemical hood

Alarm = safety, not pain



86

Personal protective equipment

- Lab coat
- Safety glasses or goggles
- Eventually a face shield
- **Adequate** gloves



Material	latex	nitrile	neoprene
Handling comfort	Good	Fair	Good
Mechanical resistance	Good	Good	Fair
Chemical resistance	Poor	Good - versatile	Good - versatile
Avoid these chemicals	All organic except carbonyle	Carbonyles, amines	Aromatic or halogenated solvents



87

Gloves

Different type of gloves exist to protect you from your work:

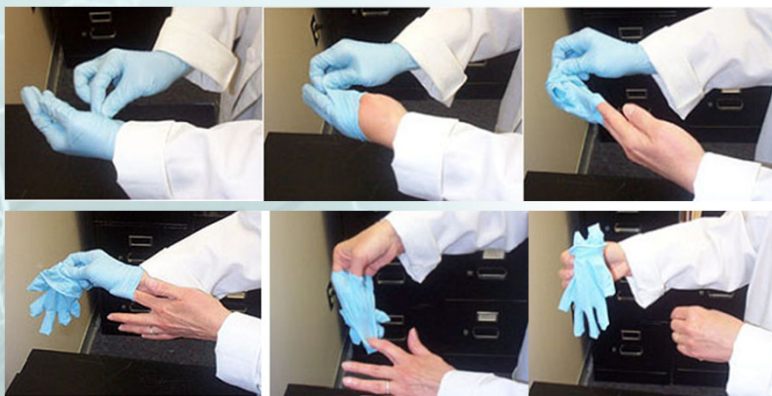


http://www.usherbrooke.ca/immeubles/fileadmin/sites/immeubles/documents/Securite_chimique/FSC1_Gants.pdf

88

Personal protective equipment

Learn how to remove your gloves without contamination:



Eye and face protection

Wear appropriate eye protection:



Prescription glasses are NOT safety glasses!

Contact lenses are allowed, but do not protect the eyes!

91

Comparison of Eye Protection Options

Science & Safety
CONSULTING SERVICES
Science IS...INTEGRITY...Safety

Safety Glasses With Vented Side Shields (Impact Only)



Safety Glasses With Nonvented Side Shields (Impact Only)



Visorgogs® (Impact Only)



Impact Safety Goggles (Impact Only)



Chemical Splash Safety Goggles (Impact and Splash Protection)



<http://cenblog.org/the-safety-zone/2010/06/eyes-in-the-lab/>

Splash zone (from UC San Diego):
http://www.youtube.com/watch?v=5TqQT9Pfh_Q&feature=player_embedded

AirClean Systems

92

Personal protective equipment

It should not leave the laboratory!

Beware of cross contamination...



94

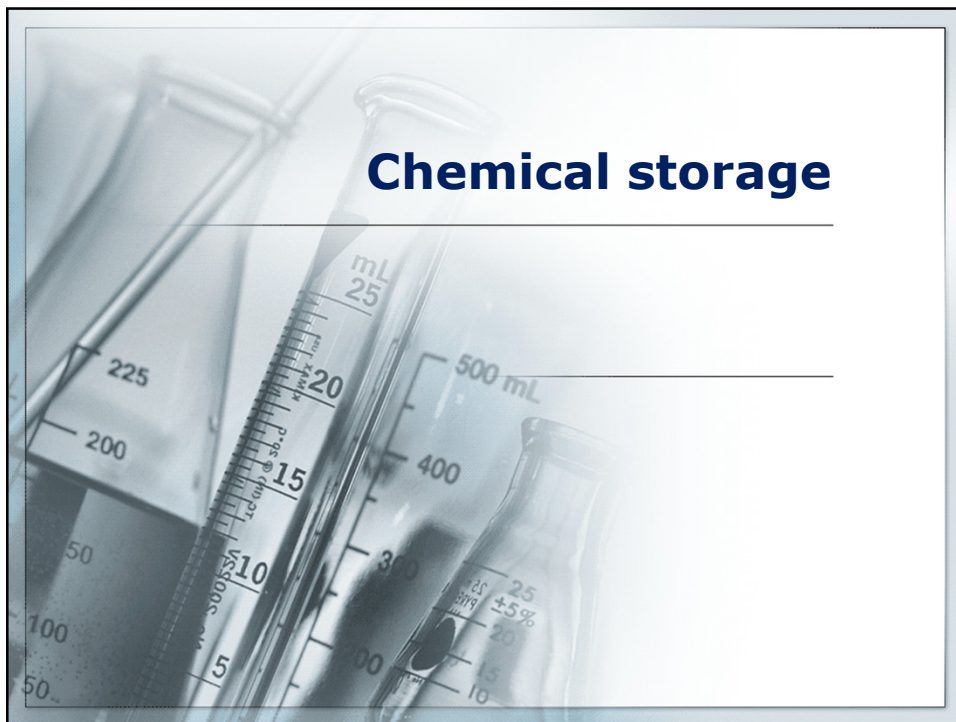
Safety material

Locate the following equipment before starting working with hazardous chemicals:
extinguisher, shower and eyewash.



First aid: rinse at least 15 min with warm water!
Except **HF**: Rinse with water + calcium gluconate cream;
For **phenol**: rinse with water, then use PEG for best removal.⁹⁵

Chemical storage



Chemical storage

Classify your chemicals to avoid incompatibilities:



105

SYCLAUN classification

SYstème de CLAssification UNiformisé developed at UdeS:

A	Acids		
B	Bases		
C	Organic solids (or aqueous solutions)		
D	Organic liquids		
E	Oxidizing agents		
F	Reducing agents		
I	Gases		
S	Inorganic compounds (solids and aqueous solutions)		
R	Reactive products (with air or water)		
X	Explosives		

SYCLAUN classification

SYCLAUN is based on the non-compatibility of chemicals:

	A	B	C	D	E	F	S	
A	O	X	X	X	X	X	X	
B	X	O	X	X	X	X	X	
C	X	X	O	O	X	X	O	O: OK X: not compatible
D	X	X	O	O	X	X	O	
E	X	X	X	X	O	X	X	
F	X	X	X	X	X	O	X	
S	X	X	O	O	X	X	O	

<http://www.usherbrooke.ca/immeubles/sante-et-securite/produits-chimiques/classification-et-entreposage-des-produits-chimiques/>

Chemical storage

- Do not store chemicals higher than your eyes.
- Store the 4 L containers lower than shoulder height.

Risks:

- Dropping the chemical(s);
- Hurting your hands;
- Ergonomic problems.



Flammable cabinet



Use a flammable-materials certified refrigerator or freezer for this type of chemicals.



Reactive compound storage



113

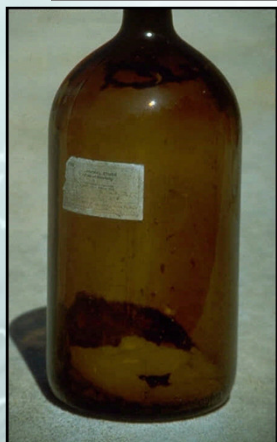
Identification

- Avoid trivial display (no « jokes » with false information...);
- Take care when transferring products to other bottles;
- Use appropriate containers;
- Home-made products and solutions:
 - Avoid acronyms and codes;
 - Do not rely on your memory...



114

Time sensitive chemicals



Di-isopropyl ether example:



http://www.usherbrooke.ca/immeubles/fileadmin/sites/immeubles/documents/Securite_chimique/FSC2_Produits_vieillissants_mal.pdf

119

Transport in the building

Secure products in safe containers or use carts with side rims:



121

Waste management



Hazardous waste management

Dangerous waste collected in 2010:

- Chemical waste: 61 000 kg
- Biological waste: 4 600 kg
- Radioactive waste: Decreasing



Hazardous waste management

Only non-toxic, non-flammable, non-corrosive products can be flushed down the drain (few diluted aqueous solutions)



124

Hazardous waste management

Producer responsibility :

- Foresee how to dispose of the waste before ordering or operating;
- If possible, reduce the quantities;
- Learn how to destroy the reactive products.

http://www.usherbrooke.ca/immeubles/fileadmin/sites/immeubles/documents/Se_curite_chimique/FSC4_Destruction_reactifs.pdf

125

Hazardous waste management

Pick-up in your laboratory

Analysis in the management center

Elimination as it is

Bulking

Recovery and transport (CRI Environment)



Analysis at the transfer center (Coteau-du-Lac)



- *Treatment and stabilisation*
- *Incineration*
- *Appreciation, recycling*

126

Hazardous waste management

Regular pick-up in your laboratory



6 to 10 persons

Final processing of your chemical waste

128

Hazardous waste disposal


Bulking or disposal as it is by a licensed company:



Liquid waste

Segregate into four classes, and clearly identify the contents:

- Aqueous acidic solutions;
- Aqueous basic solutions;
- Organic non-halogenated solvents;
- Organic halogenated solvents.

 UNIVERSITÉ DE SHERBROOKE	Service des immeubles Secteur SSEMTE	CLASSE BYOLAUN D
MATIÈRES RÉSIDUELLES CHIMIQUES		
SOLVANTS HALOGÉNÉS		
60% DICHLOROMÉTHANE		
40% ACÉTONE		
PRODUCTEUR M. SENEVILLE	DÉPARTEMENT chimie	LOCAL 1003
		DATE 13-05-08

130

Liquid waste

Separate:



Concentrated acids



Concentrated bases



Oxidizers

Toxic metals

Special Care


Cyanide

Mercury

131

Liquid waste

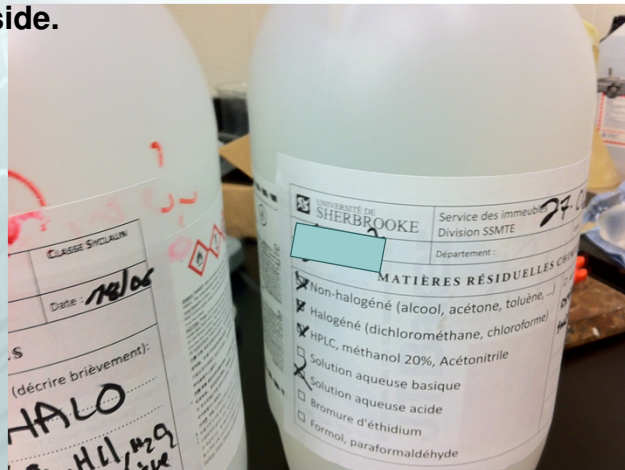
Stickers provided by SSMTE

 UNIVERSITÉ DE SHERBROOKE	Service des immeubles Division SSMTE	CLASSE SYCLAUN
MATIÈRES RÉSIDUELLES CHIMIQUES		
<input type="checkbox"/> Non-halogéné (alcool, acétone, toluène, etc.) <input type="checkbox"/> Halogéné (dichlorométhane, chloroforme, etc.) <input type="checkbox"/> HPLC, méthanol 20% <input type="checkbox"/> Solution aqueuse basique <input type="checkbox"/> Solution aqueuse acide <input type="checkbox"/> Bromure d'éthidium <input type="checkbox"/> Formol, paraformaldéhyde	<input type="checkbox"/> Autres (veuillez décrire brièvement):	
Producteur :	Département :	Local : Date :



Liquid waste

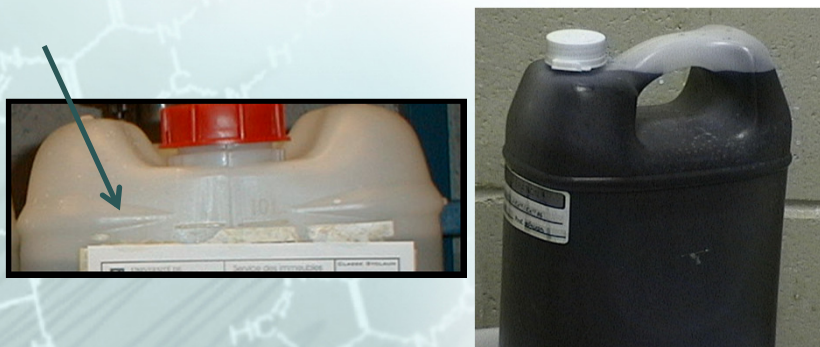
New sticker: choose **ONE** category, specify the content on the side.



133

Liquid waste

Do not overfill the containers :



134

Liquid waste

Always clearly identify the content of the bottles, before starting filling :



Choose the right container

- Use appropriate (if possible unbreakable) containers, with a safe stopper.
- Use containers corresponding to the volume of the residue.



136

Choose the right container



<http://www.coleparmer.ca/Chemical-Resistance> 137

Solid waste

Broken glass:



Contaminated needles:



138



Biological waste

Anatomic waste:

Put it in a bag;
Freeze in a dedicated freezer;
Eliminated by Stericycle.



Non-Anatomic waste :

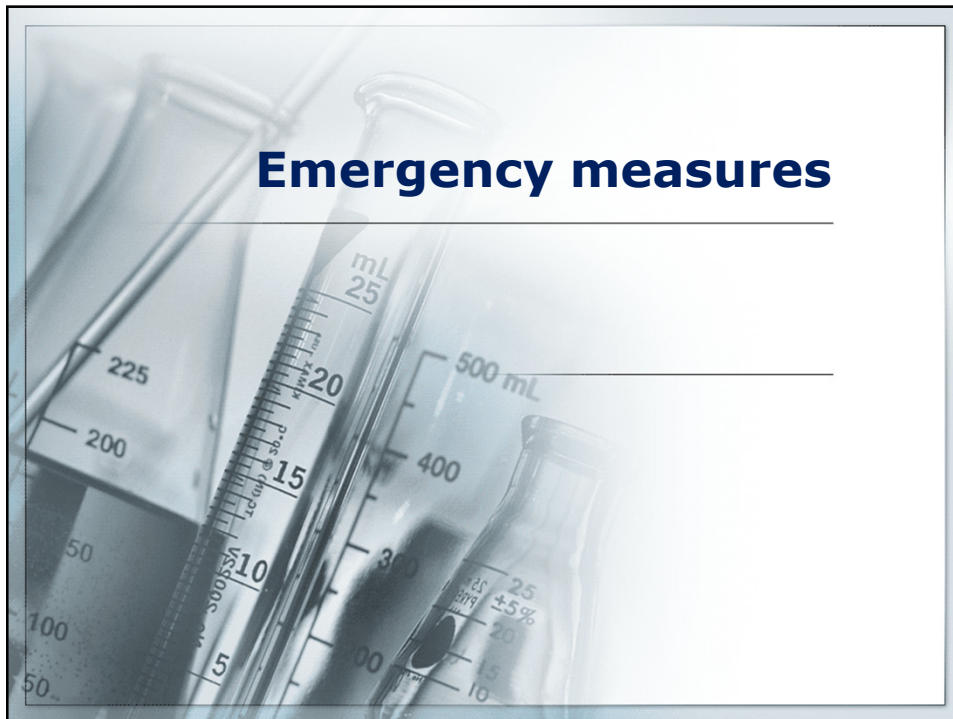
Chemical destruction,
or autoclave.



Check with your group who handles this waste in your building.

139

Emergency measures



Emergency

How to get prepared?

1. Identify each one's role and apply the emergency procedures;
2. Know the different procedures for evacuation and the assembly points;
3. Understand why and how a fire happens, and learn how to prevent it, and if necessary, how to intervene.

<http://www.usherbrooke.ca/urgence/>

141

Emergency

In case of an emergency, follow these steps :

A: Alert security (compose **811** on main campus, **511** on health campus) and colleagues;

C: Close the doors and windows;

E: Evacuate the room (if dangerous atmosphere);

I: Intervene (depending on the situation).



Laboratory fact sheet

URGENCE ☎ 811	CONSIGNES DE SÉCURITÉ
LOCAL D8-3028	RISQUES PARTICULIERS
RESPONSABLE(S)	
 [Redacted]	
jour: - nuit: -	
 UNIVERSITÉ DE SHERBROOKE Service des Immeubles Division SÉCURITÉ ☎ 271205 Date de révision: 2007-01-08	

Emergency

How to pull the alarm?

Hotline: 811 or 819-780-0811 (main campus)

511 (health campus)



144

Emergency

How to alert the security?

Use the App (communication in both ways)



<http://www.usherbrooke.ca/actualites/nouvelles/nouvelles-details/article/32713/>

145

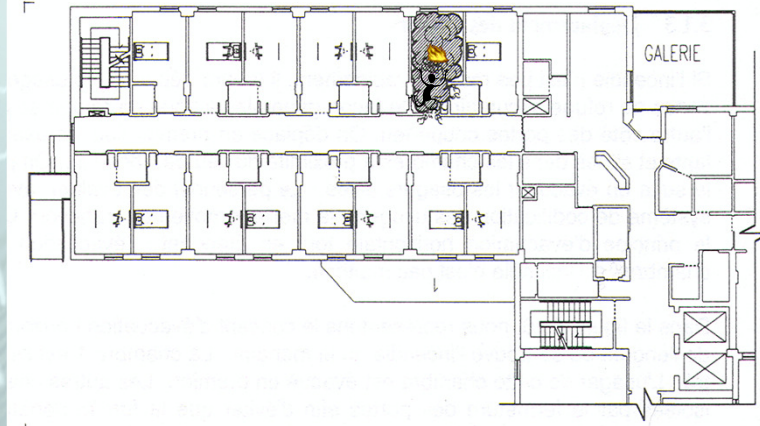
Emergency

If you see a **small fire**:

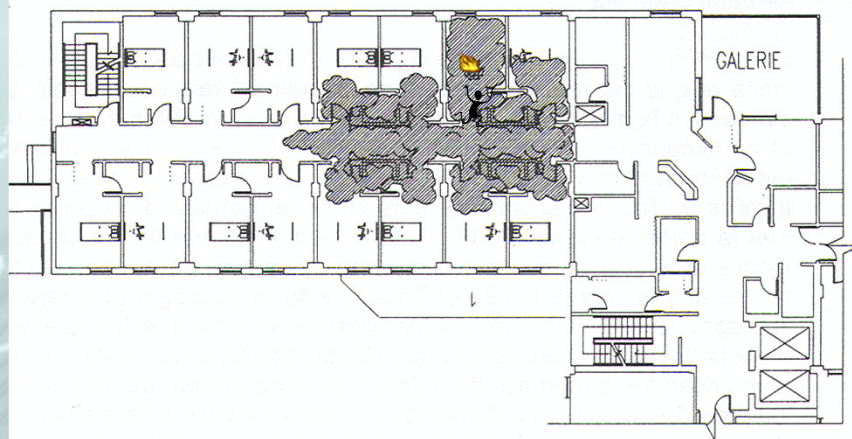
- Notify your colleagues, ask one of them to call security (**811** or **819-780-0811**; **511** on health campus);
- Try to stop the fire with an appropriate extinguisher;
- If you can not stop the fire, leave the room, close the door and pull the alarm in the hallway; talk to the security guards and leave the building.

146

Spread of smoke with a closed door



Spread of smoke with an opened door



Emergency : fire

Fire classes:



Paper, wood, solid combustibles...
Ordinary combustibles



Fuel, oil, paint, solvents...
Flammable liquids and gases



Electrical



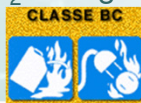
Mg, Na, K, powder Fe or Al...
Metals

149

Emergency : fire

Available extinguishers :

CO₂ extinguisher



Powder extinguisher



Use sand for class D fires

150

Emergency

Two steps for the warning signal:

1. Alert:

20/min. or 1/3sec.



- Get prepared to leave the room safely:
 - ✓ Stop the job you were doing safely;
 - ✓ Notify your colleagues;
 - ✓ Leave the laboratory and be ready to leave the building in case of a general alert (close the door of your room and in winter, wear your boots and coat).

151

Emergency

Two steps for the warning signal :

120/min. or 2/sec.

2. General alert = evacuation:



- Leave the building by the nearest safe exit, following the instructions given by the fire warden (orange or blue bib).
- Never use the lift. Take the stairs.
- Meet the other people in the parking lot, at least 50m away from the building.
- Wait the signal by the fire warden before re-entering the building.

152

Emergency

Be aware of the evacuation plan:

There are **fire wardens** on each floor.



153

Emergency

In case of a **large spill**:

- ✓ Call security;
- ✓ Notify your colleagues and **evacuate the room**;
- ✓ Close the windows and the door.

In case of **chemical spill on you**:

- ✓ Notify your colleagues and ask them to call security;
- ✓ Remove all contaminated clothing and rinse your skin or eyes for 15 minutes at least (shower or eyewash station).



Emergency

First aid in case of an **injury**:

- ✓ Send someone to get help from a rescuer, and someone to call security;
- ✓ Secure the person.

Know the **rescue workers** and the members of the **health and safety committee** in your department.

155

Conclusion

Before starting a procedure:

- **Assess the risks**, do not underestimate the hazards;
- Ask the **four simple questions** from slide **11**;
- Wear the appropriate PPE;
- Locate the emergency equipment;
- Minimise the exposure;
- Inform your colleagues and be informed of what they are doing;
- Follow the **good laboratory practices!**

156