

An Introduction to Laboratory Safety



School of Biological Sciences



The HSNO Act

The Hazardous Substances and New Organisms (HSNO) Act 1996 controls the use, transportation and storage of all hazardous substances in New Zealand.

Section 33 of the Act provides that small scale use of hazardous substances for research and development or teaching, is exempt from some provisions of the Act

Provided the lab complies with the *Code of Practice for CRI and University Exempt Laboratories.*

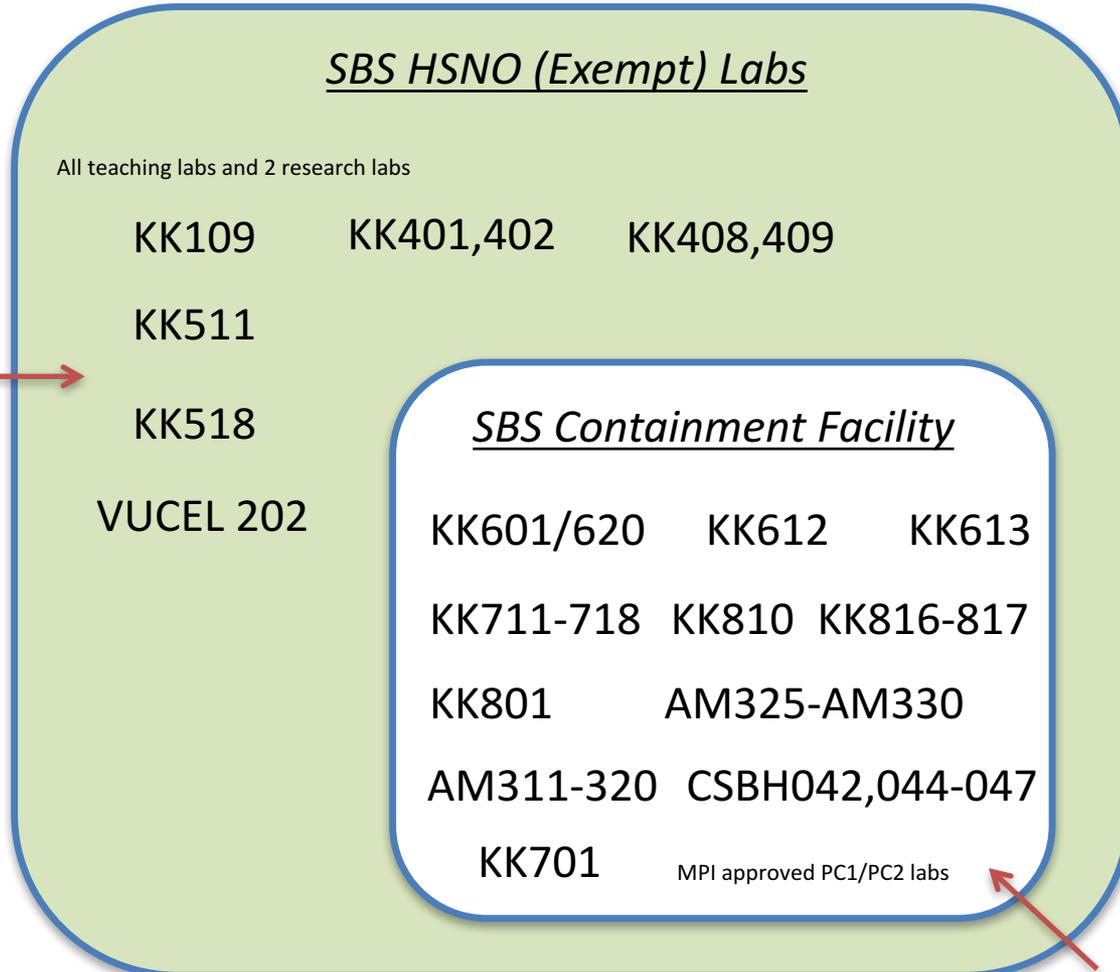
The advantages of complying with the *Code of Practice* are:

1. Use of unapproved substances in laboratories, without application to the EPA for prior approval
2. Approved handler training for each chemical or chemical class is not required for staff and students working in laboratories with hazardous substances

Section 33 Exemption

- **Labs for research and teaching are able to use the *Code of Practice* if:**
 - Laboratory meets prescribed standards
 - Does not involve a substance that has been declined under the Act
 - Importation, storage and transport meets prescribed requirements
 - Does not involve the sale of any such substance
- **To meet the *Code of Practice* we need to have:**
 - Properly designed labs (PC1 and PC2 standards meet the requirements)
 - Good record keeping
 - Appropriate handling and storage practices
 - Personnel that are authorized and trained.
 - A laboratory emergency response plan
- **What is a HSNO-exempt Lab?:**
 - A VUW room, vehicle or boat where a hazard substance is held and/or used
 - If you take a hazard substance into the field then it is not HSNO-exempt

The Containment Facility is a Subset of the SBS Laboratories



No GMOs or Restricted Biological Imports can be taken into these labs

Containment Facility labs:

- Built to PC1 or PC2 standards
- Secure operating procedures
- User training
- Regular audits
- Approval from MPI

GMOs and Restricted Biological Imports can only be kept/used/constructed in a lab approved by MPI as part of the Containment Facility

Laboratory Entrance



- Hazards in the lab (HSNO class label)
- A lab in the Containment Facility (Biosecurity)
- The name of the laboratory manager

Locked entrance: never leave the doors open and unattended

The different classes of hazardous substances in the lab



the Code of Practice (COP)

SBS COP Compliance Manual

Laboratory Safety Manual



<http://www.epa.govt.nz/Publications/COP1.pdf>



School of Biological Sciences
HSNO Exempt Laboratories
Compliance Manual

SBS, HSNO Exempt Laboratory Compliance Manual, Version No 4 February 2012. 1

KK612

**Laboratory Safety
Manual**

Lab Manager: Peter Ritchie (office KK622 and phone ext. 8105)
Deputy Manager: Joe Zuccarello (office KK619 and phone ext. 6414)

Kirk Building, School of Biological Science
Victoria University of Wellington

IN AN EMERGENCY CALL CAMPUS CARE ON ext. 8888

For more information about laboratory safety in SBS or if you need assistance with an accidental chemical spill, minor accident or to talk about a potential hazard in the laboratory, contact Stephen Meyer (SBS Health and Safety Officer, ext 5578) or Derek Heath (ext. 5580), or any SBS technician.

Version: 20 December 2016

All NZ Universities and CRIs → Everyone in SBS → Everyone in your lab

The ChemWatch Inventory System

The screenshot displays the ChemWatch Inventory System interface within a Windows Internet Explorer browser. The browser address bar shows the URL <http://jr.chemwatch.net/chemwatch.web/Manifest>. The interface features a navigation menu on the left with options like 'Materials', 'Folders', 'Manifest', 'Risk Assess.', 'D-Gen Lab', and 'Credo'. The main content area shows a table of chemicals with columns for TRACK, HAZARD, MATERIAL_NAME, VENDOR, PREFERRED NAMES, CLASSIFIED BY, VOLUME/WEIGHT, DSG, DGS1, DGS2, PKG, and APPROV. The table lists various chemicals such as 1-chloro-2,4-dinitrobenzene, 2-naphthol, 3-hydroxybenzylhydrazine dihydrochloride, 5,5'-dithiobis(2-nitrobenzoic acid), atropine, atropine sulfate, barbitone, bromophenol blue, caffeine, chloramphenicol, and copper sulfate. The interface also includes a search panel, a toolbar with options like 'Simple', 'R Code', 'Total', 'Metric', 'No Hazards Filter', 'Product View', 'Dashboard', 'Print', 'Send to', 'Save', and 'Report Generator', and a footer with the text 'Backward by ChemWatch - All rights reserved 2014'.

TRACK	HAZARD	MATERIAL_NAME	VENDOR	PREFERRED NAMES	CLASSIFIED BY	VOLUME/WEIGHT	DSG	DGS1	DGS2	PKG	APPROV.
	A	1-chloro-2,4-dinitrobenzene R23/24/25 R36/38 R50/53 R43 R33 R5			CW	100.0 g	6.1	None		II	?
	A	2-naphthol R20/22 R50 R21?			CW	105.0 g	9	None		III	?
	A	3-hydroxybenzylhydrazine dihydrochloride R36/37/38 R52 R20/22? R33? R40(3)? R42?			CW	10.0 g	None	None			?
	A	5,5'-dithiobis(2-nitrobenzoic acid) R36/37/38 R50/53 R33?			CW	5.0 g	9	None		III	?
	A	atropine R26/28 R43 R51 R27? R33? R36?			CW	10.0 g	6.1	None		I	?
	A	atropine sulfate R26/28 R43 R51 R27? R33? R36?			CW	15.0 g	6.1	None		I	?
	A	barbitone R20/22 R52/53 R33? R38? R63?			CW	500.0 g	None	None			?
	A	bromophenol blue R50/53 R33? R61?			CW	40.0 g	9	None		III	?
	A	caffeine R22 R40(3)? R20? R33?			CW	500.0 g	6.1	None		III	?
	A	caffeine R22			Consolidated Chemical	0.0 L	6.1	None	None	III	✗
	A	chloramphenicol R42/43 R50/53 R63(3) R46(2) R45(2) R22 R33?			CW	31.0 g	9	None		III	?
	A	copper sulfate									

- Enables us to know what chemicals we have, how much, and where they are stored
- Easy access to MSDS and useful for identifying trackable chemicals

<http://jr.chemwatch.net/chemwatch.web/account/autologinbyip/>

Account: vicuniwell
Login: guest
Password: guest

Material Safety Data Sheet (MSDS)

or

Safety Data Sheet (SDS)

NZ POISONS CENTRE 0800 764 766 | NZ EMERGENCY SERVICES: 111 - THIS IS A SUMMARY ONLY - FULL REPORT AVAILABLE

PHENOL

INGREDIENTS	CAS NO	%	TWA
phenol	108-95-2	>=99	5 ppm

GHS **DG**

UN No: 1671
 Hazchem Code: 2X
 DG Class: 6.1
 Subsidiary Risk: Not Applicable
 Packing Group: II

HEALTH HAZARD INFORMATION

Gazetted by EPA New Zealand
 6.1B (inhalation), 6.1C (dermal), 6.1C (oral), 6.6A, 6.8B, 6.9A (dermal), 6.9A (oral), 8.2B, 8.3A, 9.1D (algal), 9.1D (crustacean), 9.1D (fish), 9.2D, 9.3B

Signal word: Danger

Hazard statement(s): Not Available Not Available

PRECAUTIONS FOR USE

Appropriate engineering controls: General Exhaust Ventilation adequate.

Glasses: Consider chemical goggles. Consider full face-shield.

Gloves: 1.BUTYL 2.BUTYL/NEOPRENE 3.PVA

Respirator: Type A-P Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

Storage and Transportation: Store in cool, dry, protected area. Dispose of this material and its container at hazardous or special waste collection point. Keep locked up. Keep out of reach of children. Keep away from living quarters. Keep away from food, drink and animal feeding stuffs.

Fire/Explosion Hazard: Vapours/gas heavier than air. Toxic smoke/fumes in a fire. Dispose of this material and its container at hazardous or special waste collection point. In case of fire and/or explosion, DO NOT BREATHE FUMES.

Environment: Harmful to aquatic organisms.

PROPERTIES

Solid. Mixes with water. Combustible.

EMERGENCY

FIRST AID

Swallowed: Give water (if conscious). URGENT MEDICAL ATTENTION.

Eye: Wash with running water (15 mins). Medical attention.

Skin: Remove contaminated clothing. Swab with glycerin, PEG or methylated spirit.

Inhaled: Fresh air. Rest, keep warm. If breath shallow, give oxygen. Medical attention.

Advice To Doctor: Vegetable oils retard GI absorption. Saline catharsis or activated charcoal. Consider methylene blue for poisoning.

Fire Fighting: Water spray/ fog. Foam - alcohol type.

Spills and Disposal: Eliminate ignition sources. Avoid dust. Prevent from entering drains. Contain spillage by any means. Sweep shovel to safe place. Dispose of this material and its container at hazardous or special waste collection point. This material and its container must be disposed of in a safe way. To clean the floor and all objects contaminated by this material, use water.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

x — Must not be stored together
 0 — May be stored together with specific preventions
 + — May be stored together

A Project must have a Risk Assessment before starting

School of Biological Science - Molecular Ecology Lab KK612			Student: Jana Wold - 300340721			Supervisor - Dr. Peter Ritchie					
Risk Number & Category	Description of Risk	Description of Consequences	Raw risk. (Uncontrolled risk) 1 = lowest. 5 = Highest			Mitigation/controls	Sources of assurance	Residual risk. (After mitigation actions and controls)			
			Likelihood (L) 1-5	Consequence (C) 1-5	Raw risk (LxC)			Likelihood (L) 1-5	Consequence (C) 1-5	Residual risk (LxC)	Date
1 Hazardous Chemical	<ul style="list-style-type: none"> . Exposure to Buffer saturated Phenol (CAS # 108-95-2, Acid DG Class: 6.1 toxic and 8 corrosive) as a result of Phenol Chloroform DNA Extraction (method adapted from Sambrook et al. 1989). 	<ul style="list-style-type: none"> . High consequence if in case of skin,corrosive, irritant; and eye contact, irritant; or ingestion, and inhalation. . As a result of over-exposure lung damage, choking, or death may occur. . This substance may be toxic to kidneys, liver, and the central nervous system. . Phenol is flammable in the presence of open flames, sparks, or Oxidizers 	4	4	16	<ul style="list-style-type: none"> • Only be used in a laboratory that complies with AS/NZS 2982 (equivalent to "PC1/2") and meets the requirements of the Code of Practise • Follow the instructions in the MSDS and the Safe Method of Use (SMOU) documents • Exposure is minimised by the use of a fume hood, splash goggles, lab coat, and nitrile gloves • Keep away from oxidizing agents, heat and ignition sources. • Acid: Store in secondary containment. • Only used during regular work hours (8am - 6pm weekdays) when others are available to assist if needed. • Trained in use by competent person. • Polyethylene Glycol (PEG) is near by to apply to any skin exposure before seeking medical advice (have printed MSDS for health professional if necessary) • Emergency eye wash station and shower are nearby for use prior to seeking a health professional 	<ul style="list-style-type: none"> • Lab safety briefing • Weekly and six month audits of the lab • Visual checks by staff for correct PPE and lab worker behaviour • Must have approval from supervisor/lab manager prior to use • Regular contact with supervisor to ensure the controls are in place and being followed. 	2	4	8	

The student prepares the risk assessment (use MSDS, Lab and COP compliance manual, and previous Risk Assessments) and the supervisor approves it

<http://www.victoria.ac.nz/healthandsafety/risk-management>

Some of the Typical Hazards in a Laboratory

1. Physical Hazards

Sharp objects (e.g. scalpels and needles)

Hot plates (exposed hot surfaces)

Centrifuges

UV light sources

Glassware

Electrical



2. Chemical Hazards

A substance is regarded as a ***hazardous chemical*** if it is: **flammable**, **reactive** (including radioactivity), **toxic** and/or **corrosive**.



3. Biological Hazards

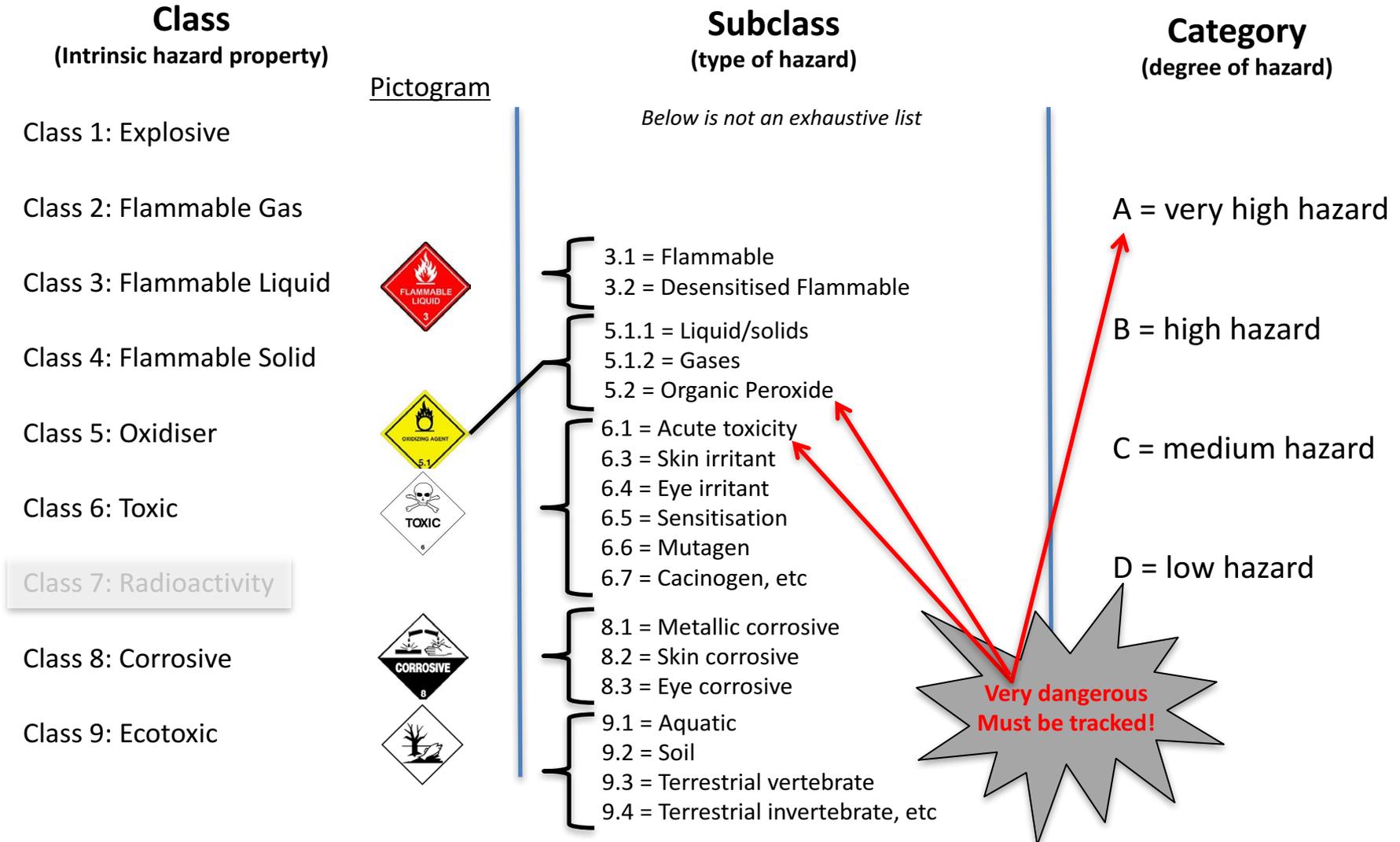
Exposure to soil, human/animal blood, other body fluids, animal tissue, or microorganisms.

Biosecurity: Some labs hold Genetically Modified Organisms (GMOs) and restricted imported biological products

HSNO Classification of Substances

Hazardous substances are classified in one or more of the following classes:

Radioactivity – Contact Janet Pitman BEFORE starting any work with radioactivity



e.g. 3.1A is an extremely flammable liquid, very high hazard (Tracked substance)

This number is very important – it lets you know which SMOU and which pieces of legislation apply to a particular hazardous chemical



A container holding a hazardous substance for longer than 24 hours must be labeled with a HSNO pictogram, which clearly shows the hazard class

HSNO CLASSIFICATION SYSTEM

6	3	A
CLASS	SUBCLASS	DEGREE OF HAZARD

The HSNO system uses numbered classes and subclasses to indicate the hazardous properties of a substance.

For example, for a substance classified as **6.3A**:

- 6 is the class, which indicates the substance is toxic to people
- 3 is the subclass, which indicates the type of toxicity, for example, irritating to the skin, and
- the letter A indicates the degree of hazard, with A being the highest hazard.

Therefore a hazardous substance classified as 6.3A is highly irritating to the skin.

- A substance can have more than one hazard classification
- The first class is its primary classification

Containers of Very High Hazard Substances must be Tracked

Hazardous Substances (Tracking) Regulations 2001



Use a unique ID to track and record of the location of containers holding very high hazard or acute toxic substances from their arrival at VUW through to their transfer or disposal.

These substances must be tracked:

- **Flammable liquids** (Classes 3.1A and 3.2A) - e.g. Diethyl Ether
- **Flammable solids** (Classes 4.1.2A, 4.1.2B, 4.1.3A, 4.2A and 4.3A)
- **Oxidisers** (Classes 5.1.1A, 5.2A and 5.2B)
- **Toxic substances** (Classes 6.1A, 6.1B and 6.1C) - e.g. Copper Sulphate, Acrylamide, etc
- **Ecotoxic substances** (Classes 9.1A, 9.2A, 9.3A and 9.4A)
- **Explosive substances** (Class 1) with some exceptions (e.g. emergency flares and signalling devices)
- **Unapproved hazardous substances** - Can search for approved items at Environmental Protection Agency website. (<http://www.epa.govt.nz/search-databases/Pages/controls-search.aspx>)



Labeled for tracking

Lab Tracking Form

ID #	Substance	CAS#	HSNO classification	Size	Loction			Date of transfer	Date of disposal
					Building	Room	Specific Location		
T-KK401-01	Diethyl Ether	60-29-7	3.1A	2.5L	New Kirk	KK401	Flammables cabinet		16/11/2008
T-KK401-02	Copper Suphate	7758-98-7	6.1C, 9.1A	500g	New Kirk	KK401a	Shelf 19		

Class 3 Flammable Liquids



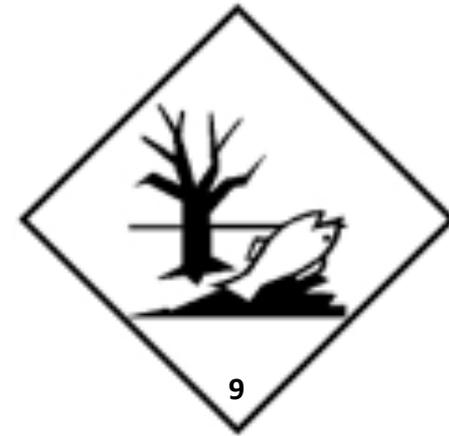
ALWAYS:

- Stored in a flame protected cabinet (with bunding)
- Storage refrigerators must be labelled and spark proofed (ie. thermostats have been externally mounted and light fittings removed)
- Not to be stored or used within 3 metres of any sources of ignition (Nb. Disable any natural gas taps near a flammable substance)



Check storage units for a HSNO pictogram. That indicates what type of hazard is inside

Class 6 Toxic & Class 9 EcoToxic



- Class 6 Acute toxicity: a single exposure might cause harm
- Class 6 Chronic toxicity: cause long-term harm, often by repeated or prolonged exposure

If using 6.1A substances (Very High Hazard) ALWAYS:

- Make others in the lab aware that a 6.1A toxic is being used
 - Appropriate training and backup procedures in place
 - At least one other person shall be present (first aid trained)
 - After hours use only with prior written permission
-
- Class 9 Ecotoxic: substances that are toxic to the environment
 - Dispose of ecotoxins properly (refer to MSDS and lab guidelines)

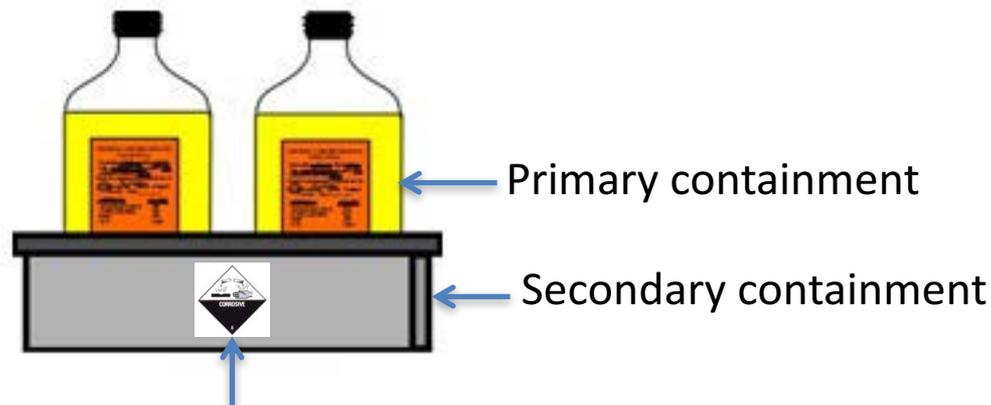
Class 8 Corrosives

- Cause severe burns on contact with any body tissue.
- Splashes to the eye may cause irreversible damage to the cornea.
- Inhalation causes severe damage to the respiratory system.



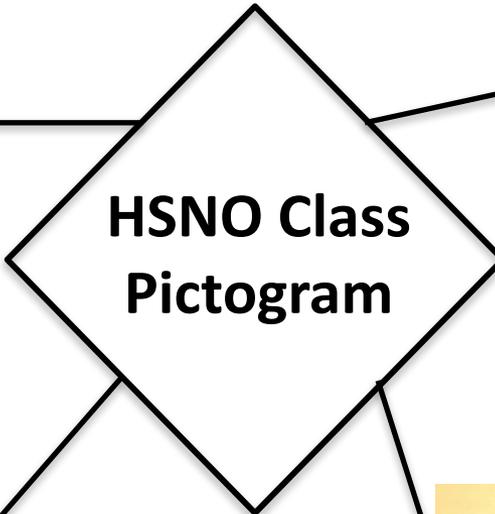
ALWAYS:

- Store in secondary containment
- Store below eye level (e.g. lower shelf)
- Store with earthquake protection



HSNO Class 8 pictogram

Cupboards, Fridges, Shelves, and Doors to Rooms that Contain Hazardous Materials Must have HSNO Labeling



Cupboard



Waste Containers must be Properly Labeled

If you reuse a container as a receptacle for hazardous waste then you must completely remove ALL of the previous labelling, this includes containers on the bench used for discarded pipette tips.

Always use a new label that clearly identifies the new contents of the container - including the concentration of each substance - and stick on an appropriate HSNO pictogram label (e.g Class 6 Toxic)

Wrong ✘

- Previous label not removed
- Wrong HSNO classification
- Marker pen on old label might rub off
- Poor information about the new contents



✓ Right

- Previous label fully removed
- HSNO pictograms (both primary and secondary hazard classes)
- Clear information about the new contents and the concentration
- Dated and named

Rules for Storing Hazardous Substances

SEGREGATION – SEGREGATION - SEGREGATION

- **When storing chemicals, group together substance that share the same hazard class (e.g. put all the Class 8 Corrosives together) and not by alphabetically order!**
- **Store dry substances and liquids separately**
- **Flammable classes take storage precedence over the other classes and require a specially designed protective cabinet.**
- **When storing Flammables be careful not to allow mixing of incompatible substances. Flammable corrosives (e.g. acetic acid) need secondary containment.**
- **Don't store oxidizers above corrosives (or vice versa) in case of a spill**
- **Corrosive chemicals on shelves must be stored at waist height or below, not any higher. This reduces the chance of an injury to eyes and face.**
- **All corrosive substances must be stored using secondary containment (e.g. in a plastic tray)**

Safe Transport Between Laboratories

Never take an unprotected bottle containing a hazard substance out of the lab. If you trip on the stairs, for example, the result would be a dangerous chemical spill.

Always use an approved Secondary Containment system to minimise the chances of spillage, leaks or breakages when you are carrying a bottle (e.g. outer containers or safety bottle containers such as a BDH SafePak)

Wrong ✘



✔ **Right**

Bottle ready
for transport in
Secondary
Containment



Disposal of Hazardous Substances

1. General (or domestic) Waste: normal bins that take any waste that is not a biological or chemical hazard, for example, paper towels (not contaminated with hazardous waste), clean plastics, etc.

2. Bio-Hazard Waste: The large yellow wheelie bins only take hazardous waste of biological origin (e.g. bacteria, tissue samples, etc) and only when it has been rendered inactive first by bleach or autoclaving. Dispose of gloves in this bin.

3. Chemical Hazardous Waste (transfer to K019): Any chemical waste product that is classified as Flammable, Corrosive, Reactive or Toxic must enter the SBS Hazardous Waste stream. If a bio-hazard waste also contains a chemical hazard then it must also be disposed of through this waste stream (do not pretreat it using bleach or the autoclave).

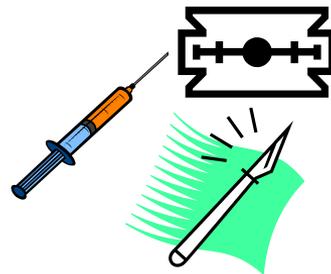
Biohazard waste only



What is a 'Sharp'?

A sharp is defined as any instrument, tool, or item that has rigid, acute edges, protrusions or corners capable of cutting, piercing, ripping or puncturing such as syringes, blades, and broken glass. Items that have the potential for shattering or breaking are also considered sharps.

Always dispose of 'sharps' into the yellow Sharps Container for proper disposal



Yellow means it is treated as biohazard waste

No LABELLED Food Containers in a Lab

Food Act (1981)

A food-labeled container in a laboratory contravenes the Food Act. The public has a legal right to expect that food labels are accurate and that the contents are safe for consumption. There is no guarantee that a container is safe and uncontaminated when it has been in a laboratory.

- **Never ever use food or drink containers to store chemicals or waste.** Why: it could be mistaken for a uncontaminated food or drink container. If you find a food-labeled container in the lab dispose of it immediately!

- **Always utilise containers that are designed to hold the particular substance and can be well sealed.** Why: the material that the container is made of, may not be compatible with the chemical that you are putting in it and their lids are not very secure, which could result in a spill.





What to do if a Chemical Spills

Chemical Spills can pose a serious threat to health and safety

- If possible identify the substance (label or HSNO pictogram)
- The MSDS includes information about dealing with a spill
- Minor Spills: if you are confident, mitigate the hazard using the Spill Response Kit and protective equipment. For powder spills dampen the dust with a misty spray of water before sweeping – first check MSDS for compatibility with H₂O
- Major Spills: verbally warn others in the lab, raise alarm if hazard could spread through the building, attend to affected persons and remove from exposure, if flammable turn off ignition/heat sources, call for assistance, and close off area.
- Notifying the safety officer, lab manager or technician, and fill out an incident report.



Laboratory Emergency Response

KNOW THE SAFETY EQUIPMENT. In each lab, check out the exits and evacuation routes, whether a telephone is installed, location of first aid kit(s), shower/eyewash stations, chemical spill response kit, fire blankets and fire extinguishers.

Know the hazardous substances. Read the MSDS and prepare for the possibility of a spill

HAZARDOUS CHEMICAL SPILL ON SKIN. In the best spill situation, a chemical lands on clothing that can be quickly removed. If you come into direct contact with a hazardous chemical, you should flush the effected area with water for 15 minutes.

However, check the MSDS because some hazardous substances need to be washed off using a particular solution (e.g. for Phenol wash off with Polyethylene Glycol - PEG).

Emergency Response Equipment

Emergency Drenching Shower

Eye Wash Stations



Labs NOT in the
Containment Facility
(floor drains)

Labs in the
Containment Facility
(NO floor drainage)





Infectious substance spill emergency

Biological Spills outside safety cabinets will generate aerosols that can be dispersed in the air. For highly infectious agents occupants should try to hold their breath and leave immediately. Wait 30 mins for the ventilation system to clear the room.

- Prepare for clean up: Use a long sleeved, back-fastening gown, and disposable gloves, shoe covers, safety goggles & mask or full face mask
- Minor Spills: cover spill with paper towels moistened with disinfectant and pour more disinfectant on the towels. After 30 mins remove towels with forceps and transfer to biohazard bag. Swab the area with disinfectant.
- Major Spills: verbally warn others in the lab and evacuate. Prevent access to lab. Trained people will prepared protective equipment and entering the lab to clean up.



Potential Earthquake Damage

The typical hazard after an earthquake is smashed glassware and chemical spills.

Damage is less likely when chemicals and equipment are stored properly, and more likely if an item/substance is in use during a seismic event



Don't let the lab become earthquake prone:

- Keep cupboards properly shut
- Keep earthquake restraints on shelves in place and report if not in a good state of repair
- Keep items (e.g. bottle of ethanol) away from edge of bench.

Wait until the lab manager or the H&S Officer has inspected the lab and given it the all clear before returning.

Working in the laboratory

What to expect from your supervisor/lab manager:



- Provide a lab-specific safety briefing and safety manual
- Ensure that research-specific hazards are evaluated and then controlled
- Arrange for training in accordance with the safe methods of use
- Provide training on the correct use of equipment
- Provide appropriate Personal Protective Equipment (PPE)

What to expect from lab workers:



- Follow all safe practice guidelines and rules
- Competent to use hazard chemicals and equipment correctly
- Help identify research-specific hazards and use appropriate controls
- Inform your supervisor of any relevant medical conditions
- Bring any safety concerns to the attention of the lab manager
- Limit hazardous lab activities to normal working hours (weekdays 8am-6pm)

Laboratories at VUW

- All laboratories at VUW are HSNO-exempt labs that follow the Code of Practise
- Access to laboratories is restricted to authorised users only
- All labs have a line management structure (e.g. Lab manager)
- All substances must be labelled and identified, and stored appropriately
- All containers holding hazardous substances must have a HSNO classification label
- Containers holding very high hazard substances must be tracked
- Containers in working spaces are limited to only 1 litre for very high hazard substance (category A) and 2.5 litres for all other categories per laboratory.
- Before using a hazardous substance the user must be familiar with the MSDS
- There are Safe Method of Use (SMOU) and disposal procedures for hazardous substances.

Accidents are usually preventable

Four Critical Errors

Mind not on task
Eyes not on task
Being in, or getting in, the line of fire
Losing balance, traction or grip

Four States

Rushing
Frustration
Fatigue
Complacency



- Know the hazards
- Learn the safe methods of use
- Use the lab properly

Preparing a project Risk Assessment

