

Guidelines for the Safe Disposal of Chemical Waste from Laboratories

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TABLE OF CONTENTS

1. PURPOSE.....	2
2. SCOPE.....	2
3. ABBREVIATIONS.....	2
4. DEFINITIONS.....	2
5. GENERAL REQUIREMENTS.....	3
6. CURRENT DISPOSAL PRACTICES	3
7. CHEMICAL WASTE TO SEWER	4
8. LABELLING.....	4
9. PACKAGING/CONTAINERS	5
10. SEGREGATION.....	5
11. TREATING WASTE AT THE SOURCE	5
12. WASTE CATEGORIES.....	5
13. STEP BY STEP GUIDE ON HOW TO DISPOSE OF WASTE	10
14. REFERENCES.....	11
15. FURTHER INFORMATION	11

1. PURPOSE

The purpose of these guidelines is to provide information to assist the Faculty of Science staff and students in classifying prescribed waste prior to collection by licensed waste contractors.

Chemical waste is collected regularly from the Faculty of Science Store limiting the need for it to accumulate in laboratories. It is also recognised that some staff and students without a strong chemistry background may require additional information in order for waste to be categorised appropriately before disposal.

Disposal of laboratory waste must be regarded as an integral part of all research projects and teaching programs. Subsequently adequate cost allowances for its appropriate disposal must be made when developing any experimental program.

In the event that you cannot classify your waste using these guidelines, please seek advice from your Supervisor, Safety Officer or OHS&E Manager Science Faculty.

2. SCOPE

These guidelines apply to the staff and students within the Faculty of Science on the Clayton campus who are required to use, store and dispose of laboratory chemical waste. It is expected, with help of these guidelines, that all generators of chemical waste will be familiar with categorising types of waste generated in the laboratory. The assumption has been made that generators know what dangerous goods are and how they match the waste stock categories. It also assumes knowledge about incompatible materials. If you still require more information that what is provided here please contact the store staff or your safety officer.

3. ABBREVIATIONS

EPA	Environmental Protection Authority
HBr	Hydrogen Bromide
HCl	Hydrochloric acid
HCN	Hydrogen Cyanide
NO₂	Nitrogen Dioxide
OH&S	Occupational Health and Safety branch
OHS	Occupational Health and Safety
PCBs	Polychlorinated biphenyls
TDS	Total dissolved solids

4. DEFINITIONS

4.1 HEAD OF ACADEMIC/ADMINISTRATIVE UNIT

Head of academic/administrative unit is used to denote the head of the area that is undertaking the activity. For academic areas, this term includes head of faculty, school, department, institute or centre. For administrative areas, the term includes head of division, branch, centre or unit.

4.2 SUPERVISOR

Supervisors are those who are responsible for overseeing:

- The work program of other staff;
- The study program of honours and postgraduate students; and
- Undergraduate students in lectures, tutorial and practical classes and on field trips.

The supervisor of staff or students has a particular responsibility for safeguarding the occupational health and safety of those in their charge. The supervisor can delegate the supervision or training of a staff member or student to a suitably qualified and/or experienced person, as appropriate for the task. The supervisor is, however, responsible for ensuring that the staff member or student has received appropriate training and has gained sufficient competence to undertake the task.

5. GENERAL REQUIREMENTS

- All waste should be disposed of in an environmentally responsible way. It is the responsibility of the generator of chemical waste to consider how it will be disposed of prior to conducting any experimental work and manage it until the waste contractor collects and disposes of it or it is treated in-house as appropriate.
- Risk Assessments should include procedures for disposing of all chemical waste and ensure that all waste is properly labelled, in a suitable container and stored appropriately.
- It should not be assumed that ALL chemical waste can be disposed of by contractors. They may not have the relevant licence and/or facilities. Therefore the generator **MUST** investigate alternative ways to dispose of the material – if this cannot be done the experiment should not be performed.
- In the case of high odour compounds such as Thiols and Mercaptans, these must be oxidised by Sodium Hypochlorite Solution (5 -10%) or similar according to well documented procedures prior to placing in a suitable waste container. (refer to Safety Officer-
- School of Chemistry for further information)
- Under no circumstances should containers of liquid waste be left open in a fume-cupboard (other than when in use – i.e. during experimental work) to evaporate. This is environmentally unsound and potentially hazardous.

6. CURRENT DISPOSAL PRACTICES

The Faculty of Science store (Building 23 western end Room G 54, School of Chemistry) has a system in place where laboratory waste categories are listed in alphabetical order. The categories and quantities of waste have been developed in consultation with existing users and like most matters relating to the store, are subject to continual improvement.

6.1 DISPOSAL SCHEDULE

- Chemsal (an EPA licensed waste contractor) collects laboratory waste on the **second and fourth Tuesday of every month**. Generators are requested to submit requests for waste disposal via Scimitar no later than **midday (12pm) on the Friday before** and are to take waste to the store on the Monday prior to pick up.

- An Excel spreadsheet is submitted to Chemsal on the Friday after collating the stores transaction records for the relevant period.
- Chemsal generate a manifest from this that is brought out by the drivers on the collection day. This manifest serves as the document from which a subsequent invoice is generated.

6.2 TREATMENT

Chemical waste is generally treated by waste disposal companies according to its physical and chemical characteristics. For example Acetone, a flammable liquid (class 3) has properties that make it a fuel as well as a solvent and hence, when it is treated as a waste stream, it is blended with other flammable chemicals and its energy value is then recovered as a fuel. Toxics (class 6.1) are generally diluted and fixed within a block of concrete material and are in essence immobilized so that there is no leaching to the environment.

6.3 INCOMPATIBLE MATERIALS

The mixing of incompatible materials can result in unwanted reactions such as the evolution of gases and in some cases explosions. For example, if Nitric acid (a Corrosive chemical (class 8) and an Oxidising chemical (class 5.1)) is combined with Ethanol (a Flammable liquid (class 3)), it is most likely that Nitrites will be formed resulting in a potentially explosive mixture.

7. CHEMICAL WASTE TO SEWER

There are limits to and specific conditions placed upon a variety of chemicals which are discharged to the sewer and these are subject to the Trade Waste Agreement between Monash and Yarra Valley Water. Parameters considered under this agreement are temperature, pH, radioactivity, TDS, nutrients etc. **Under NO circumstances should hazardous waste be allowed to enter drains.** Dilution is not considered an acceptable means of overcoming appropriate disposal.

Whilst some chemicals may inadvertently find their way to the sewer during clean up operations, generally only non-hazardous aqueous solutions within a pH range of 6 to 10 are permissible. Typical examples include Sodium and Magnesium Sulfate and Calcium Chloride.

For more information contact: Environmental Advisor, Office of Environmental Sustainability extension x 51018.

8. LABELLING


It is critical that all labels accurately reflect the contents of the container.

Waste labels must contain the following details (see example below):

- **Name of generator and contact details: department and contact number**
- **Description of contents of container (including estimates of concentrations where possible)**
- **Dangerous goods class and coloured diamond sticker (a photocopied version is not acceptable)**
- **Date of generation**

Example of label:

USER/LAB NAME/CONTACT DETAILS HERE:
Description of contents and concentration here

WASTE		DG class diamond here	
EPA CODE			
UN NO			
PK GRP			
HAZCHEM			
CONTAMINANT S			

9. PACKAGING/CONTAINERS

- Plastic containers for waste (eg. 5L, 10L and 20L pails) can be purchased from the Faculty Store via the online system.
- Containers of flammable and volatile chemical waste must be contained in plastic containers unless there is a significant incompatibility issue – due to the potential hazard of glass containers rupturing.
- It is not wise to overfill any container of liquid, 80% of total capacity is a reasonable fill point. This allows for expansion and contraction (pressure changes) of contents.
- Please note that all packages have to be handled to check contents for category, condition and quantity. The greater the amount of handling, the greater the cost may be – in particular, for unknown/unidentifiable materials.

10. SEGREGATION

It is **essential** to separate/segregate materials that are incompatible. Containers should be protected from harsh environmental conditions (stored at ambient temperature 14 – 30 ° C) and protected from impact.

Refer to OHS documents relating to using chemicals and dangerous goods in laboratories:

<http://www.adm.monash.edu.au/ohse/assets/docs/safety-topics/dangerous-goods-storage.pdf>
<http://www.adm.monash.edu.au/ohse/assets/docs/others/using-chemicals.pdf>

11. TREATING WASTE AT THE SOURCE (IN YOUR LAB)

It is quite possible to safely treat certain types of chemical waste within the lab soon after you have carried out an experiment but only if the materials convert to a non-hazardous product. For example, the destruction of solvent drying agents such as Sodium under Diethyl Ether is a well documented procedure and providing such operations are carried out correctly and without haste, they are perfectly safe.

Advice should be sought from your supervisor and safety officer before doing this.

12. WASTE CATEGORIES (AS CURRENTLY USED BY CHEMSAL)

The most frequently generated waste streams are listed below. All of these types of waste can be disposed of via Chemsal. Generators should ensure all waste is categorised correctly.

12.1 NON-HAZARDOUS (NO DG CLASS)

This category covers all waste that has no Dangerous goods class allocated. Typical examples include Inorganic salts such as Sodium Sulfate and Ammonium

Chloride. Other wastes included are Photographic waste and sharps in proper containers, Alkaline and Nickel batteries.

12.2 VACUUM PUMP OIL (No DG CLASS)

This could also include oil from water baths; however, as some of these are silicone based, these should be separated into type so that the disposal company can carry out the appropriate treatment.

12.3 SILICA GEL (No DG CLASS)

Providing this material is not contaminated with Toxics. If contaminated use class/ category of chemical that it is contaminated with.

12.4 EMPTY AND PARTLY EMPTY GAS CYLINDERS (DG CLASS 2.1, 2.2 AND 2.3)



All gas cylinders are regarded as having some residual material (properly identifiable) within unless they have the end valves removed and have been flushed out.

Class 2.1 are gases which can ignite in air on contact with source of ignition. Most flammable gases are heavier than air, and will flow to low areas. Examples include Acetylene (dissolved), LP gas and Propane.

Class 2.2 the compressed and sometimes liquefied gases in this class are not flammable when exposed to ignition sources. However many can cause suffocation by diluting or displacing oxygen in the air. Some of these gases are also oxidising agents (see Class 5.1) so have a subsidiary danger. Examples include Carbon Dioxide, Oxygen (compressed), air (refrigerated liquid) and Nitrogen.

Class 2.3 These are gases which are likely to cause death or serious injury if inhaled. Most toxic gases have an unpleasant odour which alerts to their presence. Examples include Chlorine (gas) and anhydrous ammonia. This category is charged on a per l/Kg basis.

12.5 FLAMMABLE LIQUIDS (DG CLASS 3)



- The vapours from these liquids can ignite in air on contact with a source of ignition. These liquids have a flashpoint not greater than 60.5°C. Includes common solvents such as Acetone, Ethanol, Hexane, Acetonitrile, Diethyl Ether, Toluene, and Tetrahydrofuran and related.
- Possible mixtures and products & by products from synthetic reactions should be included here as these are included during clean-up /washing/rinsing process after reactions are completed.
- In the case of Diethyl Ether and Tetrahydrofuran that you suspect has been stored for some time (longer than 6 months), you need to check for peroxides. Test strips/kits are available commercially.
- Sometimes, volatile solvents are mistakenly thought to be flammable, you need to check the MSDS'.

The store waste system currently has three categories, 10lt, 5lt and per litre up to 2.5lt.



12.6 FLAMMABLE SOLID (DG CLASS 4.1)

These solids are easily ignited by external sources, such as sparks or flames. They are also readily combustible and are likely to cause or contribute to fire when subjected to friction. They may also be self-reactive (see Class 4.2). Examples include Sulfur, Red Phosphorus and Activated Carbon. This category is charged on a per Kg basis.

12.7 SPONTANEOUSLY COMBUSTIBLE (DG CLASS 4.2)



These substances are likely to heat spontaneously and ignite. These materials may give off harmful fumes when present in a fire. Examples Include White/Yellow Phosphorus, Carbon and a number of other Pyrophoric materials such as Metal alkyls and some Carbonyls.

This class of chemical should be treated with extreme caution and advice sought from your supervisor or Safety Officer.

12.8 DANGEROUS WHEN WET (DG CLASS 4.3)



These solids or liquids can produce dangerous quantities of flammable gases when in contact with water. The heat produced from this reaction may cause these gases to spontaneously ignite. Some of these substances also give off toxic gases when in contact with moisture, water or acids. Reactive metals such as Sodium and Potassium generate Hydrogen when wet and are often coupled with sufficient heat to ignite the Hydrogen. Metal Hydrides such as Lithium Aluminium Hydride and Butyl Lithium in solution also react vigorously with water and need to be treated with care. This category is charged on a per Kg basis

12.9 OXIDISING AGENT (DG CLASS 5.1)



Typical Oxidising agents are Nitrates such as Ammonium nitrate and Chlorates such as Calcium hypochlorite. This category is charged on a per Kg basis.

12.10 ORGANIC PEROXIDES (DG CLASS 5.2)



Organic peroxides may either be solid or liquid. They are typically thermally unstable and likely to react dangerously with other substances. Some substances in this class need to be kept under controlled temperature conditions and some are sensitive to impact or friction. An example of this class is Benzoyl Peroxide. This category is charged on a per Kg basis.

12.11 HEAVY METALS SOLUTION (DG CLASS 6.1)



This category of waste is generally aqueous with some Organics but mostly metals such as Thallium, Nickel, Iron and Mercury. These must be clearly identified on the label as there are different treatment requirements for different metals. The store waste system currently has two categories, 10lt and per litre up to 2.5lt.

12.12 UNIDENTIFIED CHEMICALS SAMPLES (DG CLASS 6.1) 

This category applies mostly to research samples that have been kept and are sometimes not readily identifiable often because of inadequate labelling. Because these are generally in small containers, there is a lot of handling required to determine the most appropriate treatment and hence a greater expense. This category is charged on a per Kg basis.

12.13 CONTAMINATED GLASS OR CONTAINERS (DG CLASS 6.1) 

These must be sealed in plastic containers or pails. This category is charged on a per Kg basis.

12.14 HALOGENATED SOLVENT (DG CLASS 6.1) 

Generally speaking these have chloro-, bromo- or fluoro- atoms attached. The bulk of waste in this category is Dichloromethane and Chloroform. Any contaminants must be identified on the label. The store waste system currently has three categories, 10lt, 5lt and per litre up to 2.5lt.

12.15 TOXIC (DG CLASS 6.1) 

This is the broadest class of waste and includes streams specific to some laboratories. Examples included on the store waste system include: Acrylamide, Ethidium Bromide, Phenol/Chloroform, Cadmium and Mercury batteries, Mercaptoethanol waste, Paraformaldehyde solid and other toxic wastes. This category is charged on different volumes depending on the type of waste.

12.16 AQUEOUS PRESERVED SAMPLES (ETHANOL/FORMALDEHYDE) (DG CLASS 6.1) 

This stream includes Biota samples in Ethanol, Formaldehyde or similar biological fixative. (Samples that are in Ethanol (30% or higher) should be included as class 3 flammable liquids). This category is charged on a per litre basis.

12.17 AQUEOUS FLUORIDE WASTE (BASIC) (DG CLASS 6.1) 

This stream is for waste that is clearly basic (pH >7). Concentrations should be identified on the label. This category is charged in 10lt volumes only.

12.18 BIOHAZARDOUS SOLID AND LIQUID (DG CLASS 6.2)  

All Biohazardous waste must be placed in the appropriate yellow containers available from the Faculty of Science Store. This includes gloves, pipette tips and contaminated paper towel. Categories included on the waste system are: Biohazardous waste (including sharps) 1.5 and 2.5 lt, Biohazardous liquid per lt and solid per Kg (in plastic bags or pails). Biohazardous bins for autoclaved waste (which are also collected by Chemsal) are available by contacting your Safety Officer or Biosafety Officer (if applicable).

12.19 CORROSIVES, SOLID AND LIQUID (DG CLASS 8)



These solids or liquids are sufficiently volatile to give off vapour irritating to the eyes and nose. Class 8 includes acids and alkalis which react violently when mixed. Acids and bases should be separated. Examples of this class include Hydrochloric acid, sodium hydroxide, acetic acid and lead batteries. Care should be taken to ensure that materials generating toxic gases such as HCl, HBr, NO₂, HCN, are NOT included with any of this waste. Liquid waste is charged per lt and solid per Kg. Lead/Acid batteries are included in this category and are charged per Kg.

12.20 MERCURY WASTE IN SEALED CONTAINERS (DG CLASS 8)



All Mercury waste is to be kept in sealed containers. This stream generally comes from broken thermometers, Vacustats and manometers and should include all gloves, papers and pipettes used during a spill clean up. This category is charged per 200g.

12.21 AQUEOUS WASTE EX TEACHING LABORATORIES (ACIDIC) (DG CLASS 8)



This stream is usually specific to teaching laboratories (acid baths) and should include details (name and concentration) of the major contaminants (if any). This category is charged in 10lt volumes only.

12.22 LABORATORY WASTE MISCELLANEOUS (DG CLASS 9)



This class generally is for environmentally sensitive materials but can also include substances not covered by other classes. This category is charged on a per Kg basis.

12.23 AQUEOUS WASTE CONTAMINATED WITH ORGANICS (DG CLASS 9)



Describe all contaminants and their relative concentration – to ensure the most appropriate treatment method can be determined. This category is charged on a per litre basis.

12.24 ASBESTOS CONTAINING MATERIAL IN SEALED BAGS ONLY (DG CLASS 9)



This category can include old drying ovens that have Asbestos-containing seals and insulating tapes etc. Items must be double sealed in appropriate bags. This category is charged on a per Kg basis.

12.25 BATTERIES (DG CLASS 9)



This category includes Lithium batteries only (charged per 100g). See Class 8 for Lead/Acid batteries and class 6.1 for Cadmium and Mercury batteries. Alkaline and

Nickel Batteries have no DG class and are included under No DG class category (see 12.1above).

13. STEP BY STEP GUIDE ON HOW TO DISPOSE OF WASTE THROUGH FACULTY OF SCIENCE STORE

The Faculty of Science Store provides an online service (Scimitar) for users within the Science Faculty at the Clayton campus. The Store is located in the south wing of Building 23 (School of Chemistry, western end) Room G 54 at the Clayton campus.

For more information or to request access to the system, please fill in the self registration web form at: <http://webapps.monash.edu.au/science/SCIMITAR/registration/index.cfm>

For non-Monash University users, please email Richard.Carlton@sci.monash.edu.au.

1. Obtain authorisation to use online store system
2. Find an appropriate container for your waste (containers are available for purchase from the Faculty Store)
3. Label your waste as outlined in this document (labels are available for purchase from the Faculty Store)
4. Using Scimitar:
 - 1) You will need your username and login information to access the system
 - 2) Log on to the system
 - 3) Select stock category – in this case Laboratory Waste
 - 4) Select most appropriate category of waste – DG class ie. 3,6.1 etc
 - 5) Estimate amount of waste and select appropriate category of volume and whether solid or liquid
 - 6) Select box – quantity to order
 - 7) Click add to cart once you have selected the waste
5. Remember entries must be made by midday on the Friday before the next week's pick up
6. Take your waste to the store on the Monday before pick up during opening hours:
10:30am - 1:00pm and 3:00pm – 4:00pm, Monday to Friday
(Note: there is no waste collection in January)
7. Check that you list of waste corresponds with the list the Store have generated

For more information please contact one of the following people:

For stock, ordering and general queries: Faculty Store exts: 54592 or 53991

For finance and charging queries: Faculty Resources and Finances Manager ext. 54609

For management queries: Faculty Resources and Finances Manager Ext. 54609 or your School Resource Manager

14. REFERENCES

MONASH UNIVERSITY OHS DOCUMENTS

Monash University policies are available from the Occupational Health and Safety web site: (<http://www.adm.monash.edu.au/ohse/documents/index.html>).

Relevant OHS documents:

- Dangerous goods in laboratories, studios & workshops
- Using chemicals at Monash University
- Disposal of liquid radioactive waste
- Disposal of low level, solid radioactive waste
- General chemical storage guidelines
- Poisons - purchase & storage of schedules poisons
- Syringes, needles & syringe barrels-use & disposal at Monash University
- Using Biologicals and animals at Monash University
- Weighing hazardous substances
- Risk Management at Monash University

14. FURTHER INFORMATION

For further information please contact Occupational Health and Safety on extension 510216 or alternative below

- Safety officer
- Biosafety officer
- Radiation Safety officer
- Environmental officer
- OHS&E Manager Science Faculty ext: 51627
- Office of Environment and Sustainability