HAZARDOUS WASTE

Contents

1 INTRODUCTION

The University of Sydney is committed to the safe and environmentally responsible management of hazardous waste. Where possible, the generation of hazardous waste will be actively avoided. Where this is not possible, the volume of hazardous waste generated will be minimised and the waste will be handled in accordance with relevant legislation and established best practice.

2 PURPOSE

This guideline describes the collection and disposal program that operates at the University of Sydney. The purpose of the program is to protect the health and safety of personnel generating or handling hazardous waste, their colleagues, the community and the environment.

3 WHAT IS HAZARDOUS WASTE?

Hazardous waste can be broadly defined as any material that cannot be used further, or is unwanted and poses a risk to the community or to the environment if not properly handled. These materials include, but are not limited to:

- Chemical waste
- Biological waste (clinical, infectious and anatomical)
- Radioactive waste
- Sharps
- Contaminated glassware.

Each hazardous waste stream requires special handling to protect the health and safety of workers generating and handling the waste, their colleagues and the wider community who may be affected by the waste.

4 RESPONSIBILITIES

4.1 HEAD OF SCHOOLS AND ADMINISTRATIVE UNITS

Ensure that all workers under their direction actively avoid and minimise the generation of hazardous waste.

4.2 SUPERVISORS

Supervisors are also required to establish local procedures that are consistent with these guidelines, and ensure that all staff and students under their direction are familiar with and follow procedures.

4.3 WASTE GENERATORS

All generators are required to actively avoid and minimise the generation of hazardous waste. Where this is not possible, generators must ensure that all hazardous waste is segregated from incompatible materials, collected in a suitable container, labelled, documented and stored appropriately pending collection, as described in these guidelines.

4.4 SAFETY HEALTH AND WELLBEING

Safety Health and Wellbeing provides technical advice about the classification and disposal of hazardous waste; coordinates the routine collection and disposal of chemical, biological and radioactive waste; and liaises with and provides reports to the relevant regulatory authorities on hazardous waste issues.

4.5 CAMPUS INFRASTRUCTURE SERVICES

Campus Infrastructure Services (CIS) funds the disposal of all routine hazardous waste. The disposal of waste arising from facility maintenance or construction work is coordinated by CIS. For example pumping out of balancing/dilution pit waste, asbestos removal and some waste products generated during building maintenance, construction and demolition works.

Note: The disposal of stockpiled hazardous waste (eg. large laboratory or workshop cleanouts prior to renovation or a change of ownership) is user funded. In this situation CIS will obtain a quote from the hazardous waste contractor and an account code from the generating school/administrative unit prior to collection.

5 WASTE REDUCTION

Avoid and minimize the generation of waste	The handling, treatment and disposal of hazardous waste is expensive and has a significant impact on the environment. All hazardous waste generators are required to **minimise** the generation of hazardous waste associated with their activities.
Plan a project to produce less waste	The following questions should be considered during the project planning process: • Is the process necessary? • Can the process be substituted with another? • Can a hazardous material be substituted with a non-hazardous or less hazardous material? • Can the process be carried out on a smaller scale? • Can a smaller volume or lower concentration of material be used to achieve the required result? • Is more sensitive equipment available? For work involving radiation: • Can a radionuclide with a shorter half-life be used? • Are the lowest possible activity and energy levels used? • Will the waste output have an activity < 100 Bq/g?
Only purchase what you will use	Purchase chemicals in small quantities, only as required. The cost of disposal far exceeds any cost saving achieved by purchasing in bulk. Some chemicals have a limited life span, and may deteriorate and become unstable with age.
Recycle and reuse	Consider whether the waste materials can be used in another process or treated for re-use.
Dispose or transfer unused or unwanted chemicals	At the completion of any research project all hazardous materials that remain unused or reaction mixtures that have not yet been disposed of must be identified. Any hazardous materials of no further use should be disposed of immediately, while other useful materials should be formally handed over to an active research group.
Dispose of waste regularly	Do not allow waste to accumulate in the work area. Plan for times when large amounts of waste may be generated.

Waste generators should follow the general principles:

- **Minimise** waste and do not accumulate large amounts in your work area (Refer 4.1 waste reduction).
- **Wear appropriate personal protective equipment** (PPE) when handling waste. Know the hazards of the waste.
- **Segregate** waste and have a **separate** container if you are generating a large amount of one particular type of waste. If combining waste ensure that it is compatible and will not react.
- **Label** the waste container.
- **Store and secure** the waste in an appropriate area whilst awaiting collection. Regularly inspect storage areas for spills and accumulation of waste.
- Have effective **spill response procedures** by ensuring there is a spills kit in close proximity to a waste store and that workers are trained to respond to a spill.

5.1 GENERAL WASTE & RECYCLING

The removal, recycling and disposal of general waste (e.g. office waste, packaging, food scraps, e-waste) from the University is managed by the Campus Infrastructure & Services. This service is not intended for the collection of hazardous waste. The disposal of hazardous waste in the general waste stream is strictly forbidden, unless specifically stated elsewhere within these guidelines.

Combustible materials should be minimised within a laboratory. Cardboard boxes and paper based packaging should be folded flat and then placed in the cardboard recycling bins. Styrofoam or polystyrene packaging materials should NOT be placed in recycling bins but can be put in general waste bins.

5.2 STORM WATER

Hazardous waste must not enter the storm water system. All hazardous waste, particularly liquids, must be well contained to ensure that an onsite spill will not result in storm water contamination.

5.3 SEWER SYSTEM (DISCHARGE TO SINK)

The disposal of hazardous chemical waste “down the sink” is prohibited. It is expected that residual quantities of chemicals may enter the sewer system as the result of rinsing or washing. Therefore, laboratory sinks are often plumbed to balancing/dilution pits that are designed to minimise the impact of this contamination.

Waste must have the following criteria for acceptance to discharge to sewer:

- No physical hazards, i.e. no risk of fire or explosion, corrosive
- Not hazardous to health, i.e. not toxic
- Not environmentally hazardous, i.e. not eco-toxic
- Miscible in water
- pH 7-10
- Limited suspended solids
- Low odour
- Concentration less than or equal to acceptance standards listed by Sydney Water.

6 HAZARDOUS WASTE STREAMS

Several different hazardous waste streams are generated at the University of Sydney. Specialist hazardous waste contractors are used to collect, re-pack (if necessary), transport, treat and dispose of the hazardous waste in accordance with legislative requirements. The procedures for the disposal of the University's main waste streams are detailed below.

6.1 CHEMICAL WASTE

Chemical waste includes solvents, acids, alkalis, toxic materials, photographic chemicals, paints, contaminated glassware and consumables, and laboratory chemicals that are no longer required or have deteriorated with age.

Waste products derived from hazardous workplace chemicals often have similar hazard characteristics to the chemicals from which they were derived. Appropriate consideration must be given to the packaging, labelling, handling and storage of waste products.

For advice on the disposal of pharmaceuticals refer to the Working with Scheduled poisons guideline.

6.1.1 COLLECTION AND SEGREGATION

Incompatible chemical wastes must be segregated to reduce the risk of a dangerous reaction. It is also desirable to segregate large volumes of compatible materials (where practical) to improve the potential for reuse or recycling. For further information about chemical compatibilities, consult the product label, safety data sheet (SDS), laboratory texts or incompatible chemicals infosheet.

Compatible non-halogenated solvents (e.g. acetone, ethanol, methanol) may generally be collected in the same container. However, halogenated solvents (e.g. dichloromethane, chloroform) must be separated from the non-halogenated solvents.

Different waste categories submitted to the contractor are listed in Appendix A.

6.1.2 PACKAGING AND LABELLING

Approved dangerous goods containers are supplied for the collection of liquid hazardous wastes by the waste contractor. These can be ordered using the chemical waste manifest. Hazardous waste labels are provided by Safety Health and Wellbeing. Complete and affix the label to each waste container. Indicate the type of hazardous waste, the generator's name and contact details. Liquid and solid reagents will also be accepted for collection in the supplier's original packaging so long as the label is intact.

Figure 1: A typical 5 L waste residue container

Chemically contaminated consumables (e.g. bench covers, heavily contaminated PPE) and gels (e.g. electrophoresis or acrylamide gels) must be collected in strong leak- proof bags and labelled as above. Chemically contaminated glassware and plastic-ware (e.g. disposable pipette tips) should be placed in sturdy, rigid containers lined with a plastic liner and labelled.

Waste that is inadequately packaged or labelled may be rejected by the hazardous waste contractor and not collected for disposal.

Figure 2: Container for contaminated glassware or plastic

6.1.3 TRANSPORT AND STORAGE

If it is necessary to transport waste containers from the work area to the pickup point, ensure that fit for purpose trolleys are used and that containers holding liquids are placed in secondary containment (spill tray or tub) during transport. Refer to Chemical Transport infosheet.

The requirements for the storage of chemical waste are similar to the requirements for the storage of workplace hazardous chemicals (refer Chemical Storage guideline). Chemical waste is usually temporarily stored within the laboratory or workshop where it was generated, or in a dedicated hazardous waste depot.

The storage area should provide adequate spill containment, chemical security and allow for the separation of incompatible waste streams and be secure from the general public.

Figure 3: Appropriate transportation of waste

Spill containment takes the form of secondary packaging, spill trays or bunding. The capacity of the bund should be equivalent to the volume of the largest package stored plus 25% of the total storage capacity. Areas where large volumes of waste are routinely collected and stored should have an appropriate spill kit.

The majority of chemical waste generated is:

- Class 3 – Flammable Liquids (e.g. acetone, ethanol, ether, hexanes, xylene)
- Class 6.1 – Toxic Substances (e.g. dichloromethane, chloroform, phenol)
- Class 8 – Corrosive Substances (e.g. acids, alkalis)

Segregate incompatible classes of dangerous goods by using separate chemical storage cabinets, bunding trays or distance (variable and dependent on the volumes of waste).

Secure hazardous waste storage areas from general public access through the use of a key or swipe card particularly if the area is unsupervised.

6.1.4 CHEMICALS THAT MAY BECOME UNSTABLE

Regularly monitor chemicals that can become unstable or explosive during storage (e.g. picric acid, diethyl ether). If a chemical is not required, then recycle or dispose of it as soon as possible.

Any chemicals identified as potentially unstable or explosive should be left in-situ and immediately reported to Safety Health and Wellbeing, so that professional advice can be sought regarding safe disposal. Do not move or open the container! Refer Picric Acid infosheet.

6.2 CLINICAL & BIOLOGICAL WASTE

Clinical waste includes:

- human tissue (other than hair, teeth and nails)
- bulk body fluids or blood
- visibly blood-stained body fluids, materials or equipment
- laboratory specimens or cultures
- animal tissue, carcasses or other waste from animals used for medical research.

It is waste resulting from biological, medical, nursing, dental, veterinary research involving skin penetration or other related clinical activity and includes waste that has the potential to cause injury, infection or public offence

Clinical waste usually includes the following sub-categories:

- **Laboratory and associated waste** directly involved in specimen processing (human or animal);

- **Human tissues** including materials or solutions that contain free-flowing or expressible blood or other body fluids;
- **Animal tissue or carcasses** that are contaminated or suspected to be contaminated by pathogenic organisms; and
- **Prion waste**

6.2.1 LABORATORY AND ASSOCIATED WASTE

This category includes all human or animal specimens used for laboratory testing; cultures or suspensions of micro-organisms in tissue cultures; used Petri dishes; culture bottles; disposable equipment, used gloves etc.

All unwanted wastes potentially containing live microorganisms must be either be:

6.2.1.1 STERILISED BY PRESSURE STEAM STERILISATION (AUTOCLAVED)

Laboratory and associated waste that has been thoroughly decontaminated in an autoclave via pressure steam sterilisation**,** may be disposed of as general waste as follows:

Once decontaminated, the autoclave bag may be placed inside an unlabelled strong black plastic bag, sealed securely and placed into a general waste bin. Liquid cultures that have been decontaminated via pressure steam sterilisation may be disposed 'to sewer' (flushing down the sin.

In order to ensure that waste is thoroughly decontaminated via pressure steam sterilisation, monitoring of the autoclave sterilisation cycles and annual autoclave calibrations must be carried out in accordance with AS/NZS 2243.3 Section 10.6. Refer to the Guidelines for the decontamination of Clinical/Biological waste for further information on autoclave requirements.

All clinical/biological waste generators are required to commence monitoring autoclave sterilisation cycles as soon as reasonably possible. If these procedures are not in place, then solid waste considered to be 'sterilised' must be placed into yellow bags, displaying the biological hazard symbol (Figure 4) then into a yellow Clinical Waste Bin for collection.

Figure 4: Biological hazard symbol

6.2.1.2 DECONTAMINATED USING A CHEMICAL DISINFECTANT

Laboratory and associated waste that has been thoroughly decontaminated with an appropriate chemical disinfectant must be disposed of chemical waste – see chemical waste disposal guidance in Section 5.1 of these guidelines.

Refer to the Guidelines for the decontamination of Clinical/Biological waste for further information on choosing the right chemical disinfectant.

6.2.2 HUMAN TISSUE AND FLUIDS

Human tissue includes tissue, organs, limbs, free-flowing or expressible blood, and other body fluids that are removed during surgery and autopsy. The management and disposal of these types of wastes needs to be conducted with public perception and aesthetic considerations in mind. Human tissues, blood or body parts must **never** be placed in the ordinary garbage stream, even if decontaminated.

Any waste classified as human tissue waste should be autoclaved then placed into yellow bags. Yellow bags containing unrecognisable tissue samples must be placed into a Yellow Clinical Waste Bin for collection. Yellow bags containing recognisable body parts must be placed into a Burgundy Anatomical Clinical Waste Bin for collection.

6.2.3 ANIMAL TISSUE OR CARCASSES

This category of waste comprises tissue, carcasses and other waste arising from animals used in laboratory investigation, or for medical or veterinary research. Animal tissues, blood or body parts must never be placed in the general waste stream, even if decontaminated.

- **Clean animal waste** is bagged and placed into a Burgundy Anatomical Clinical Waste Bin for collection and disposal by high temperature incineration.
- **Animal tissue contaminated with microorganisms or GM microorganisms** must be autoclaved, placed into yellow bags and placed into a Yellow Clinical Waste Bin for collection and disposal by high temperature incineration.
- **Animal carcasses contaminated with microorganisms or GM microorganisms** must be autoclaved (where practical), placed into yellow bags and placed into a Burgundy Anatomical Clinical Waste Bin for collection and disposal by high temperature incineration.

6.2.4 PRIONS

Prions (including Gerstmann-Straussler syndrome, Kuru and Creutzfeldt-Jakob agents) are resistant to most traditional methods of inactivation/decontamination used for other microorganisms. Prions should be thoroughly decontaminated in accordance with the decontamination guidelines for prions and then treated as cytotoxic waste to ensure the material will be incinerated.

Solid prion waste that has been pressure **steam sterilised** should be placed into a Purple Cytotoxic Clinical Waste Bin and the **autoclave bag** labelled with the words:

PRION WASTE – INCINERATE AT 1100 CELSIUS.

Prion material that has been **chemically decontaminated** should be treated as chemical waste and disposed via the University hazardous waste program as cytotoxic waste. The **waste drum** should be labelled with the University hazardous waste label which contains the words

PRION WASTE – INCINERATE AT 1100 CELSIUS.

All liquid cytotoxic waste for incineration should be in pack sizes less than 2.5 L.

6.2.5 COLLECTION, TRANSPORT AND STORAGE OF CLINICAL/BIOLOGICAL WASTE

Plastic bags for the **collection** of clinical and biological wastes other than sharps should:

- Have sufficient strength to safely contain the waste class they are designated to hold;
- Be suitable for the purpose, i.e. if to be heat sterilised they must be able to withstand high temperatures and allow steam to penetrate;
- Not be filled to more than two-thirds of their capacity;
- Allow for secure final closure when the bag is filled to a maximum of two-thirds of its capacity or 6kg, whichever is lesser; and
- Not be secured with staples or any other closure devices with sharp points or edges.

Waste sometimes need to be **transported** around the University, either from the facility to an autoclave area or from the autoclave to the clinical waste bin. Transport routes should be planned to minimise possible exposure to the wastes by consideration of activity levels and population densities at various times of day and places on the routes. Transport of microorganisms must be wholly contained within a primary sealed container (e.g. an autoclave bag) and the primary sealed container must be packed in a secondary sealed unbreakable container (e.g. Tupperware container or garbage bin with a sealable lid). The secondary container must be unbreakable (as per AS/NZS 2243.3) and easily decontaminated.

The **storage** of clinical and biological wastes prior to disposal should be minimised. Wastes should be treated as soon as possible after generation. When storage is required it should minimise potential exposure to the waste and prevent increases in the numbers of potentially harmful organisms present. For this reason refrigeration may be required. The waste storage area should also be kept secure at all times, be vermin-free, and be regularly cleaned and disinfected. A suitable **spill kit** and spills procedure must be readily available at any area where waste is stored.

Clinical Waste Bins must be kept locked whenever they are not being accessed and where possible stored internally. Business units that require a clinical waste bin for the regular disposal of clinical and related wastes should contact Safety Health and Wellbeing.

6.3 CYTOTOXIC WASTE

The term cytotoxic is used to describe materials that are destructive to cells. Cytotoxic drugs are pharmacological agents that inhibit the reproduction of cells, primarily used for the treatment of cancer.

Cytotoxic waste includes any unwanted cytotoxic drug preparations; disposable laboratory consumables and sharps that may have been contaminated with cytotoxic material; and the carcasses of animals treated with cytotoxic drugs and associated animal bedding.

Cytotoxic waste must be segregated from all other waste streams and packaged in purple cytotoxic waste bags or cytotoxic sharps containers displaying the telophase cytotoxic symbol (Figure 5) and the words:

CYTOTOXIC WASTE – INCINERATE AT 1100 CELSIUS.

Figure 5: Cytotoxic symbol

All liquid cytotoxic waste for incineration should be in pack sizes less than 2.5 L. Bags and sharps containers must be placed into a Purple Cytotoxic Clinical Waste Bin.

6.4 RADIOACTIVE WASTE

Low level radioactive waste has a specific activity less than 100 Becquerels per gram (Bq/g). This waste can be disposed of via the University's Hazardous Waste program with request for disposal supported by a signed Radiation Waste Activity Statement.

Waste that exceeds the 100 Bq/g limit must be stored locally pending decay.

Radioactive waste with a specific activity greater than 100 Bq/g, but a total actively less than the Schedule Limit for the specific radionuclide (Refer to Appendix B) is referred to as **acceptable total activity radioactive waste**.

Whilst disposal options may be available for acceptable total activity radioactive waste, formal approval has to be granted by University's Radiation Safety Committee (RSC), in consultation with

Safety Health and Wellbeing. Contact the University Radiation Safety Officer, Safety Health and Wellbeing in the planning phase.

6.4.1 PROJECT PLANNING

The generation of radioactive waste must be considered during project planning. It is important to identify all forms of waste (e.g. solid or liquid), the specific radioisotopes and the associated half-life, volume and activity of waste, as well as shielding and storage requirements.

Consideration must always be given to the elimination of tasks involving the use of radiation, alternative methods and the use of the smallest possible activity levels.

A radiation project clearance form is required to be completed prior to commencement of all projects involving work with radioactive material. This includes an assessment of the anticipated waste streams. Completed project clearance forms must be submitted to the University Radiation Safety Officer for consideration by Radiation Safety Committee (RSC).

Projects involving the use of radioactive material must not commence without approval from the Radiation Safety Committee.

Where possible, secure a disposal route for "leftover" radioactive material via their supplier at the time of purchase.

6.4.2 SEGREGATION

Highly radioactive and long-lived radioactive waste must be segregated from low level and short-lived radioactive waste. A small volume of highly radioactive or long lived radioactive waste should not compromise the disposal of a larger volume of less radioactive or shorter lived radioactive waste.

6.4.3 PACKAGING AND LABELLING

Liquid radioactive waste must be packaged in approved dangerous goods drums. These can be supplied through the hazardous waste program. Sealed scintillation vials may also be placed inside the approved dangerous goods containers. Solid waste (e.g. bench covers, used gloves) must be collected in strong leak proof plastic bags or sharps containers as appropriate.

On the standard University hazardous waste label, Low Level Radioactive Waste (<100 Bq/g) must be labelled with the name of the radioisotope and other waste constituents, date, radioactivity at that date (total activity and specific activity) and the generator's name. Low level waste for disposal must not be labelled with a radiation trefoil symbol.

Waste that exceeds the limits for disposal must be labelled as described below 5.4.4 Storage.

6.4.4 STORAGE

Radioactive waste, that is stored pending decay, must be labelled with:

- Name of the radioisotope
- Date
- Radioactivity at that date
- Date after which the waste may be disposed of
- Generator's name
- The radiation trefoil symbol (Figure 6).

Figure 6: Radiation trefoil symbol

The storage location must provide adequate security and shielding of the radioactivity. Radioactive waste that is in storage must be regularly reviewed to check whether the materials are suitable for disposal, and if not, whether the storage facility remains adequate.

6.4.5 SEALED SOURCES

Prior to the disposal of sealed source equipment the radioactive source must be removed. This can normally be arranged with the manufacturer. Once the radioactive source has been removed and the equipment checked for any contamination, it may be disposed of as general waste.

6.5 SHARPS

Sharps are defined as discarded objects or devices capable of cutting or penetrating the skin, e.g. hypodermic needles, pasteur pipettes, broken glass and scalpel blades. Various hard plastic items, such as broken plastic pipettes and disposable plastic pipette tips, are also classified as sharps.

In addition, many sharps are contaminated with blood or body fluids, microbiological materials, toxic chemicals or radioactive substances, thereby posing a risk of infection or illness if they penetrate the skin. It is therefore essential to follow safe procedures when using and disposing of sharps.

Figure 7: Sharps containers

Sharps must be placed into an approved sharps container immediately after use (Figure 7). To avoid needle-stick injuries, needles must **not** be re-capped and sharps containers must not be filled above the marked fill line.

Sharps containers need to be rigid and impervious, and conform to Australian Standards[1].

The disposal route for a sharps container depends upon the type of contamination (Table 2).

Hazard	Disposal Route
Biologically contaminated sharps	Place in a yellow sharps container (with biohazard symbol). When full, the sharps container must be sealed and placed in a Yellow Clinical Waste Bin for disposal. Decontamination is not required before disposal unless genetically modified microorganisms are involved.
Cytotoxic	Place in a purple cytotoxic sharps container. When full, the sharps container must be sealed and placed into a Purple Cytotoxic Waste Bin for disposal.
Hazardous chemical	Place in a yellow sharps container and dispose of as non-dangerous goods, solid waste type through the University hazardous waste program.

[1] AS4031-1992 Non-reusable containers for the collection of sharp medical items used in health care areas, or to Australian/New Zealand Standard AS/NZS 4261:1994 Reusable containers for the collection of sharp items used in human and animal medical applications

Radioactive	Place in yellow sharps container, labelled (as required for radioactive waste) and stored pending decay to a level below 100 Bq/g. Ultimate disposal will depend on the other characteristics of the waste. Refer 5.6 Mixed Waste Streams.

Table 2: Disposal routes for contaminated sharps

6.6 MIXED WASTE STREAMS

Hazardous waste often presents multiple hazards (e.g. radioactive & biological, biological and chemical). Where possible, work should be planned to prevent the generation of mixed waste streams. Table 3 details some strategies for dealing with mixed waste streams

Mixed Waste	Action
Radioactive & Biological	Store until the radiation has decayed to less than 100 Bq/g (in freezer) and then dispose of as clinical/biological waste.
Radioactive & Chemical	Store until the radiation has decayed to less than 100 Bq/g and then dispose of as chemical waste.
Biological & Chemical	Treat primarily as biological waste. Caution must be taken when planning to autoclave this type of waste as some chemicals cannot be autoclaved eg hypochlorite/bleach.
Radioactive, Biological & Chemical	Store until the radiation has decayed to less than 100 Bq/g (in freezer) and then dispose of as clinical/biological waste.

Table 3: Processes for mixed waste streams

6.7 OILS

Oil and oil/water mixtures are not suitable for disposal to sewer or general waste. Oils can often be recycled. Small volumes (< 50 L) should be disposed through the University hazardous waste program. Generators of larger volumes of oil or oil/water mixtures should seek advice from Safety Health and Wellbeing.

6.8 BATTERIES

In many cases batteries are recycled. Collection for battery recycling (e.g. alkaline, Ni-Cd, lithium, lead-acid) can be requested through the University hazardous waste program. Contact the Sustainable Campus team for further information.

6.9 COMPRESSED GAS CYLINDERS

Compressed gas cylinders, whether empty, partly full or full must be returned to the supplier when no longer required. This will stop the ongoing cylinder rental fees charged by the supplier and will also prevent unsafe storage or disposal.

If you are purchasing specialty gases or small lecture bottles, check that the supplier will accept a return of the cylinder. Some gases cylinders are very expensive to dispose or are not accepted by the hazardous waste contractor.

6.10 GLASS

6.10.1 CONTAMINATED GLASS

Contaminated glass is that which cannot be washed or vented and still retains residues of hazardous materials. Procedures to be followed include:

- **Small pieces of broken glass** may be placed into Australian Standards approved sharps container.
- **Microbiologically contaminated** broken glassware that cannot be safely decontaminated must be disposed of as sharps for disposal as clinical/biological waste.
- **Chemically contaminated** broken glassware that cannot be safety decontaminated must be collected in a sturdy container (eg rigid cardboard box) with a plastic liner and disposed of as chemical waste.

6.10.2 DECONTAMINATED OR CLEAN GLASS

Large items of intact or broken glassware which are not contaminated may be disposed of as general waste. Decontaminated laboratory glass should be collected in a sturdy container with a lid and plastic liner.

Glass reagent bottles from laboratories (Figure 8) may only be discarded into the general waste if:

- There are no hazardous residues (triple rinsing and/or evaporate flammable residue in the fume cupboard)
- Labels are removed or defaced
- Lids are removed.

Figure 8: Decontaminated empty reagent bottles

There are three options for the disposal of non-contaminated glass:

- **Recycle** - some areas of the University have organised a glass recycling service. Where this exists, glass can be collected into a dedicated local bin or container and transferred to the recycling bin. Borosilicate glassware (e.g. pyrex) cannot be recycled.
- **Skip Bin** - where no recycling service is available, glass can be collected into a dedicated local bin or container and directly transferred to the nearest industrial waste bin (to avoid the cleaners handling broken glass).
- **Normal Waste** – a small amount of glass can be wrapped in paper or otherwise packaged to prevent contact with sharp edges and placed into the normal garbage bins.

6.11 ASBESTOS

Small volumes of pure asbestos and items such as asbestos heat mats may be disposed via the University hazardous waste program. Larger items or materials that contain asbestos, such as appliances and building fabric, are not managed via the hazardous waste disposal service. Contact Campus Infrastructure and Services (CIS) for advice.

6.12 WASTE TRAPS

Many laboratory and workshop sinks and floor wastes are flushed to Balancing/Dilution pits. These are designed to both separate solid materials and non-miscible liquids from the waste water, and dilute aqueous waste water before it enters the Sydney Water sewer system.

Balancing/Dilution pits are periodically cleaned out in accordance with the University's Commercial Trade Waste Agreement with Sydney Water. This waste is handled as controlled aqueous liquid

waste. The collection and disposal is coordinated by the Campus Infrastructure and Services (CIS).

Campus Infrastructure and Services also manages the cleaning and regular maintenance of the University's grease traps.

6.13 FLUORESCENT LIGHT TUBES

Fluorescent light tubes contain a small concentration of mercury. The University intentionally purchases low mercury tubes, but to ensure that this mercury does not leach into the environment, it is recommended that the mercury in these tubes be either fixated or extracted and recycled prior to going to landfill. Campus Infrastructure & Services manages the disposal of this waste stream.

6.14 PCBS CONTAINED IN ELECTRICAL EQUIPMENT

Polychlorinated biphenyls (PCBs) are chemically stable compounds that are fire resistant and very good electrical insulators. For this reason PCBs were often mixed with mineral oil and used as the insulator in electrical equipment such as the capacitors used in fluorescent light fittings, ceiling fans and air conditioners.

PCBs are now known to be highly persistent, bio-accumulative chemicals and are regulated by a Chemical Control Order under the Environmentally Hazardous Chemicals Act 1985. Electrical equipment manufactured prior to 1976 may contain PCBs.

Campus Infrastructure Services progressively removes building fixtures and fittings suspected of containing PCBs from service during regular building and maintenance work. These materials are then disposed of as hazardous waste.

All business units are responsible for reviewing any electrical equipment under their control and identifying any potential PCBs for disposal. For further information, contact Safety Health and Wellbeing.

7 ARRANGING FOR DISPOSAL

7.1 HAZARDOUS CHEMICAL WASTE

Hazardous chemical waste is collected fortnightly from the Camperdown and Darlington Campuses and as required from other campuses. Examples of hazardous waste collected via this method is given in Appendix A. The following process should be followed to arrange disposal:

1. Check the schedule for collection. The deadline for submission of a disposal request is 12 noon on the Friday prior to a Wednesday collection, unless otherwise agreed with Safety Health and Wellbeing
2. Download and complete a chemical waste manifest. For more information on how to complete a chemical waste manifest review the infosheet.
3. Create an online Service request on CampusAssist
4. Select **Problem Type** as *chemical waste disposal*
5. Upload the completed manifest (saved as an Excel file)
6. Submit the request.

7.2 CLINICAL, ANATOMICAL AND CYTOTOXIC WASTE

Clinical, anatomical and cytotoxic bins are regularly collected from different locations across the University's Camperdown, Darlington, Cumberland and Camden campuses according to a set schedule. In the majority of cases clinical waste is collected weekly or fortnightly.

If you are commencing a new research project or teaching activity that will generate clinical or biological waste, contact Safety Health and Wellbeing to discuss the arrangements for waste disposal.

7.3 LABORATORY CLEANOUT OR DECOMMISSIONING

The disposal of stockpiled hazardous waste is user funded (e.g. large laboratory or workshop cleanouts prior to renovation or a change of ownership). In this situation Safety Health and Wellbeing will obtain a quote from the hazardous waste contractor and an account code from the generating business unit prior to collection. Hazardous chemicals will need to be listed on the chemical waste manifest.

8 REVIEW AND EVALUATION

Guidelines are reviewed by Safety Health & Wellbeing at least once every two years to identify and implement opportunities for improvement.

9 REFERENCES

1. NSW Work Health and Safety Regulation 2017
2. NSW Radiation Control Regulation 2013
3. NSW Radiation Control Act 1990
4. NSW Environmental Hazardous Chemicals Act 1985
5. AS/NZS 2243.3-2010 : Safety in laboratories - Microbiological safety and containment
6. AS/NZS 2243.4 -1998 : Safety in laboratories – Ionising radiation
7. AS/NZS 3816-1998 : Management of clinical and related wastes
8. AS/NZS 4031-1992 : Non-reusable containers for the collection of sharp medical items used in health care areas
9. AS /NZS 4261-1994 : Reusable containers for the collection of sharp items used in human and animal medical applications

10. AS/NZS 4478-1997 : Guide to the reprocessing of reusable containers for the collection of sharp items used in human and animal clinical/medical applications

10 DOCUMENT CONTROL

Acknowledgements					
Related Documents		Biosafety and infection control [accessed September 2017] WHS_CHE_STD_1_Chemical Safety Standards WHS_CHE_FORM_1_Chemical Waste Disposal Manifest WHS_CHE_MTL_1 Chemical waste manifest instruction Radiation and laser safety [accessed September 2017]			
Version Control	Date released	Author/s	Custodian	Approved by	Amendment
1.0	13/9/17	WHS Specialist (Chemical) WHS Specialist (Biosafety) WHS Specialist (Radiation Safety)	Manager, Work Health & Safety Services	Director, Safety Health & Wellbeing	Transfer from web page

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11 APPENDIX A: EXAMPLES OF WASTE CLASSIFICATIONS

Waste Classification	Common chemicals examples
LIQUIDS WHICH ARE DANGEROUS GOODS	
Liquid - aqueous acid	Hydrochloric acid solution Sulphuric acid solution Acetic acid Nitric acid solution (Concentration < 7%) Iron Chloride solutions
Liquid - aqueous alkali	Sodium hydroxide solution Potassium hydroxide solution Concentrated Bleach (hypochlorite solutions ≥ 5%)
Liquid - aqueous ethidium bromide	Buffer solutions contaminated with ethidium bromide Ethidium bromide stock solution (concentration < 2%)
Liquid - aqueous heavy metal	Lead solutions (lead citrate) Cadmium, Zinc and Nickel 100mg/mL
Liquid -concentrated nitric acid	NOT diluted solutions
Liquid - corrosive other	Acetic anhydride Formic acid 4% bleach
Liquid - cyanides	Inorganic cyanide salt solutions e.g KCN
Liquid- flammable other	acetaldehyde histolene pyridine
Liquid - formaldehyde solutions	Formaldehyde solutions Formalin Solutions containing paraformaldehyde

Liquid - halogenated Solvents	Chloroform, Dichloromethane, Trichloroethylene
Liquid - mercury metal	
Liquid- mercury compounds	Mercury chloride in buffer Mercuric Oxide waste 3g/5L (25% NaOH)
Liquid - non-halogenated solvents	Acetone Diethyl ether Ethanol Butanol Acetonitrile Waste turps & thinners Isopropanol Methanol Hexane Xylene
Liquid- oxidisers Liquid - picric acid wetted (30%)	Hydrogen peroxide , Benzoyl peroxide Picric acid in up to a 30% solution
Liquid radioactive	< 100Bq/g tritium 3H or C14 solutions tritium in plastic scintillation vials A signed radiation activity statement must accompany this submission
Liquid- reactive acids	Perchloric acid
Liquid - toxic other	Phenol chloroform mix Osmium tetroxide solution (5%)
Liquid - unknown	Unknowns are very expensive to dispose. Please ensure every effort made to identify & categorise.
LIQUIDS WHICH ARE NOT DANGEROUS GOODS	
Liquid - low hazard	Although a substance may be hazardous at higher concentrations, dilute solutions are low hazard Dilute bleach solutions(sodium hypochlorite concentration <5%) Diaminobenzadine solution (DAB) Dimethylsulfoxide solutions (DMSO) Decontaminated biological waste (1% bleach) Potassium ferrocyanide solution Triton-X

	3% hydrogen peroxide 10% solution ethanol
Liquid - non hazardous	
Liquid - mineral oil	Vacuum oil, Engine oil
Liquid - soluble oil	
SOLIDS WHICH ARE DANGEROUS GOODS	
Solid - aerosol cans	
Solid clinical / biological	Small amounts only Tissue in preservative (ethanol or formalin)
Solid - corrosive	Iodine, imidazole
Solid - cyanide	Metal cyanides (Potassium cyanide, soduim cyanide) Not organic cyanides
Solid - cytotoxic	Small amounts only
Solid - dangerous when wet Class 4.3	Sodium borohydride Sodium hydride
Solid - ethidium bromide contaminated	Gloves, consumable contaminated with ethidium bromide
Solid - Flammable class 4.1	Paraformaldehyde, naphthalene
Solid - mercury compounds	Mercury chloride, Mercury oxide
Solid - mercury containing equipment	Mercury thermometers, barometers, lamps
Solid - oxidiser	Ammonium persulphate Silver nitrate, Ferric nitrate
Solid - radioactive (low level)	< 100Bq/g tritium contaminated gloves, paper, polystyrene, plasticware, cardboard in red plastic bags A signed activity station must accompany this submission
Solid- reactive metals	sodium, lithium, potassium metal
Solid-spontaneously combustible Class 4.2	Sodium hydrosulphite

Solid - toxic	Oxalic acid (S6 poison) - No DG class Pentobarbitone Sodium (S4 poison)- No DG class acrylamide 3-cyanobenzaldehyde potassium ferricyanide
SOLIDS WHICH ARE NOT DANGEROUS GOODS	
Solid-batteries-alkaline Solid-batteries-other	
Solid-chemically contaminated consumables	Chemically contaminated laboratory consumables Chemically contaminated broken glassware Contaminated sharps Chemical packaging containing residues Empty chemical contaminated glass bottle
Solid-lamps-HID	High intensity discharge lamps- mercury vapour, metal halide (MH), ceramic MH, sodium vapour, xenon
Solid-low hazard	Solid waste classified as a hazardous substance, but not a dangerous good. Chemical contaminated waste silica / alumina
Solid-non-hazardous	Sodium thiosulphate Used UV lamps
Solid-NOT chemically contaminated consumables	Decontaminated reagent containers
Solid-pharmaceutical	Commonly S4 Scheduled poisons S8 controlled drugs cannot be accepted, contact Safety Health and Wellbeing

- Use a safety data sheet to check the Dangerous Goods Class for a chemical
- If there is no specified Dangerous Goods class, check the health hazard information to determine level of toxicity
- For low level radioactive substances include the radiation activity statement

12 APPENDIX B: PRESCRIBED ACTIVITY OF A RADIOACIVE SUBSTANCE

Schedule 1 Prescribed activity of a radioactive substance

(Clause 3 (2))

Column 1								Column 2
Group 1								
Ac227	Am241	Am243	Cf249	Cf250	Cf252	Cm242	Cm243	40 kilobecquerels
Cm244	Cm245	Cm246	Np237	Pa231	Pb210	Po210	Pu238	
Pu239	Pu240	Pu241	Pu242	Ra223	Ra226	Ra228	Th227	
Th228	Th230	U230	U232	U233	U234			
Any alpha emitting radionuclide that is not included in any other Group in this Schedule								

Column 1								Column 2
Group 2								
Ac228	Ag110m	At211	Ba140	Bi207	Bi210	Bk249	Ca45	400 kilobecquerels
Cd115m	Ce144	Cl36	Co56	Co60	Cs134	Cs137	Eu152	
Eu154	Ge68	Hf181	I124	I125	I126	I131	I133	
In114m	Ir192	Mn54	Na22	Pa230	Pb212	Ra224	Ru106	
Sb124	Sb125	Sc46	Sr89	Sr90	Ta182	Tb160	Te127m	
Te129m	Th234	Tl204	Tm170	U236	Y91	Zr95		
Any radionuclide that is not alpha emitting and is not included in any other Group in this Schedule								

Column 1								Column 2
Group 3								
Ag105	Ag111	Ar41	As73	As74	As76	As77	Au196	4 megabecquerels
Au198	Au199	Ba131	Ba133	Be7	Bi206	Bi212	Br75	
Br76	Br82	Ca47	Cd109	Cd115	Ce141	Ce143	Cl38	