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1. OVERVIEW

The University of Calgary has over 1000 laboratories and workshops across multiple buildings on multiple campuses. Many of the laboratories and workshops use or generate hazardous materials that must be disposed of properly to protect people, property and the environment. The information provided in this manual is a resource to accomplishing that goal.

If you have questions about anything related to hazardous materials not directly addressed by this manual, please contact Hazardous Materials Services (hazmat@ucalgary.ca) before taking any action.

1.1. Purpose

This manual is a reference for **all** faculty, students and staff of the University of Calgary that generate or use hazardous materials in the course of their work, studies or operations. This manual addresses the procedures for the collection and disposal of unused, leftover, unwanted or waste hazardous materials.

This manual lists the specific packaging, labelling and documentation requirements to facilitate the transportation and disposal of hazardous materials. The specific requirements are identified within various Acts and Regulations, including but not limited to: the Canadian Nuclear Safety and Control Act & Regulations, the Transportation of Dangerous Goods Act & Regulations, the Alberta Environmental Protection & Enhancement Act, and the Alberta Fire Code.

1.2. Hazardous Materials Services

Hazardous Materials Services (HMS) is a division of the Department of Environment, Health and Safety.

1.2.1. Responsibilities

HMS is responsible for the safe and timely collection, transportation, consolidation, and disposal of all chemical, biological and radiological hazardous materials generated by University of Calgary laboratories, facilities and operations. This is done in accordance with occupational health and safety, transportation, and environmental laws and regulations for hazardous materials.

HMS acts as a resource on issues encompassing hazardous materials and Transportation of Dangerous Goods (TDG).

HMS also recycles chemicals and other materials through our Surplus Chemical Store and external recycling companies.

1.2.2. Contacting Hazardous Materials Services

You can contact HMS with questions via email at hazmat@ucalgary.ca. Someone will respond by the end of the next business day.

Please do not use the hazardous materials collection telephone line for inquiries as these are typically only reviewed just prior to waste collection.

1.3. University Staff Responsibilities

Personnel at the University of Calgary are required to store use and dispose of hazardous materials in a manner that protects people, property and the environment. Hazardous materials are NOT to be disposed of into the sanitary sewer (sinks or toilets) or into the regular

garbage. All hazardous materials are to be prepared and disposed of through HMS as described in this manual.

There are two methods for contacting HMS for collection of hazardous materials depending on the University department or location: Chematix (online waste disposal system) or the hazardous materials collection phone line. Refer to Chapter 5 for information on these systems.

1.3.1. Hazardous Material Spills

It is expected that laboratory and workshop personnel will manage minor spills appropriately within their work areas.

If you are involved in the release of a hazardous material, please report the incident using the Online Accident Reporting System (OARS) through the My UofC portal. It can be found in the menu on left side under Campus Services → EHS Tools → On-line Accident Reporting System.

If you experience any symptoms due to exposure to a hazardous material, seek medical attention.

More information can be found in the Spill Response Procedures online at <https://www.ucalgary.ca/emergencyplan/emergency-instructions/hazardous-materials-spill>.

1.3.2. Hazardous Material Minimization Practices

HMS encourages the following practices for reducing the quantities of hazardous materials generated in the course of activities using hazardous materials and operations.

- Review protocols regularly to ensure hazardous reagents are used efficiently and that excess purchases are minimized.
- Conduct microscale experiments to minimize the amount of hazardous materials used and generated.
- Use less hazardous substitutes when feasible.
- Check the HMS surplus chemical list in Chematix before ordering your chemicals.

1.3.3. Not Accepted for Disposal

In some cases HMS cannot accept certain types of material for disposal.

- Unknowns

HMS cannot accept unknown chemicals of any kind. Identification of the material is the responsibility of the waste generator, or the department responsible for the laboratory where the owner is not known or has departed. This can take the form of an analysis within the lab/department to identify the waste, or using a commercial laboratory to perform the analysis. In either case all costs incurred for identification are the responsibility of the lab/department involved. Please store unknown chemicals in a safe manner until such time as the chemical is identified.

- Forbidden for Transport

Some chemicals are Forbidden (e.g. 2,4-dinitrophenyl hydrazine) for transport under Transportation of Dangerous Goods regulations. HMS cannot accept these chemicals

since HMS cannot transport or consign these chemicals for transport. Chemically reacting these specific forbidden materials in the laboratory to form a less hazardous, acceptable compound is usually the solution to this problem.

- Potentially Explosive Chemicals (PECs)

Some chemicals can deteriorate over time to become potentially very highly reactive, or potentially explosive. This results in some chemicals being classified as 'Forbidden for Transport'. For this reason HMS cannot accept chemical believed to have deteriorated into PECs (e.g. dry picric acid). Please refer to the chemical Materials Safety Data Sheet (MSDS) for information about PEC hazards. Responsibility for rendering PECs safe rests with the owner of the chemical or where the owner is not known or has departed, the department responsible for the laboratory space.

To prevent the development of PECs, there are a few precautions that can be taken to minimize the risk. The Chematix program will assist with most of these.

- 1) Identify all chemicals that have the potential to form PECs in your inventory.
- 2) Record the opening date and expiry date on the label. Dispose of chemicals before the expiry date.
- 3) Check the state of these chemical containers monthly.
- 4) Train laboratory personnel in the safe storage methods, conditions to avoid, the hazards of the chemical, and disposal procedures.

1.3.4. Clean Glass and Plastic Disposal

Clean glass and plastic is any container that is free of visible contamination that has been rinsed with an appropriate solvent to remove chemical residue or biohazard contamination. Labels on the container must be defaced with a marker or similar, have lids removed, and then put into a blue glass and plastic buckets.

Provision of blue buckets for collection and removal of clean glass and plastic disposal is the responsibility of Facilities Management & Development, and each laboratory or workshop is entitled to one bucket with additional buckets purchased for a cost. Please submit an ARCHIBUS request online via <http://my.ucalgary.ca> for an extra collection or additional buckets.

2. CHEMICAL WASTE

Hazardous Materials Services will collect and dispose of any mixed or pure chemical waste generated by University of Calgary teaching, research or operations.

If the processes described in this section are not followed, HMS cannot accept your hazardous materials for removal and disposal until the error is corrected.

2.1. Pure & Mixed Chemicals

Pure Chemicals are any partially used or unused chemical with a single chemical constituent. Aqueous solutions of pure chemicals are also considered pure chemicals. Compressed gases are considered pure chemicals.

Mixed Chemicals are any mixture of two or more chemicals not including water. Mixed chemicals should contain like states of either liquid or solid chemicals. Some precipitate due to

mixing of chemicals is allowable, but HMS may request that some mixed phase chemicals be separated if there are concerns about the mixture.

2.2. Compatibility

All chemical waste must be segregated according to chemical compatibilities. *Whenever possible keep solids and liquids separate.* Some of the categories to consider when segregating your hazardous materials include:

- Corrosives – Acids
- Corrosives – Bases
- Oxidizers
- Organic Peroxides
- Compressed Gases (non-returnable)
- Flammable Liquids – Halogenated
- Flammable Liquids – Non-halogenated
- Flammable Solids
- Toxic Materials
- Environmentally Hazardous Materials

The MSDS should always be referred to prior to mixing any chemical wastes in a container. If you have any questions about segregating your chemical wastes for disposal, contact HMS for assistance.

Figures 1 & 2 demonstrate the result of a reaction between incompatible chemical wastes. The 210L drum became pressurized and burst with enough force to crush ½” drywall and metal wall studs. A review of the listed chemicals on the waste disposal forms did not reveal the presence of any chemicals that would have caused this type of reaction between incompatible chemicals.



Figure 1



Figure 2

2.3. Documenting Chemical Waste Accumulation

Laboratories and workshops are required by the Alberta Fire Code to identify the chemical wastes stored in individual containers by quantity. List the most common chemicals.

If you are collecting more than one type of chemical hazardous material in similar containers, each container should be labelled with the chemical constituents being collected.

For the purpose of disposing of chemical waste HMS highly recommends keeping a log with names and quantities of all chemicals being stored in each container. A Chemical Waste Log

Sheet is provided in Appendix B on p. 26. Tracking volumes will also help avoid overfilling a container.

2.4. Selecting Chemical Waste Containers

Laboratories and workshops should select waste containers for compatibility with the waste chemicals and the volumes of waste chemicals generated by experiments. In some cases HMS will provide containers, and in other cases HMS will recommend containers easily available within the laboratory or workshop.

Whenever there are distinct solid and liquid phases in a container, it is always preferable to separate them into liquid and solid components for disposal as a single phase.

2.4.1. Chemical Waste Storage

Chemical waste should be stored separately from other chemicals and in a location that controls the hazard present. For example, flammable wastes should be stored in a flammable cabinet.

If you have questions about where to store your chemical waste container, you can contact your Faculty EHS Consultant for assistance.

2.4.2. Reusable Waste Containers

Four different reusable waste containers are provided by HMS. Please do not write on or mark these containers directly.

If there is need to label the container for any reason, please use a piece of tape or paper attached with a small piece of tape.

All of these containers are provided to laboratories with a demonstrated need for regular disposal of large quantities of wastes. HMS prefers to issue these containers where they are collected every 1-3 weeks (with the exception of chemically contaminated gels). Reusable containers will not normally be issued to locations where collection does not occur on a routine basis (at least monthly). Due to cost and safety considerations HMS may discontinue the use of these containers in locations not meeting these guidelines.

All reusable containers have an identifying code for the laboratory it is assigned to. If your laboratory is moving and has reusable containers, please contact HMS prior to the move so that your laboratory has the correctly coded container.

Each mixed waste container must have a list of contents as per the requirement of Section 2.3.

18 litre Red Liquid Chemical Waste Containers

HMS issues 18 litre red liquid chemical waste containers (Figure A1, p. 24) to laboratories generating liquid chemical waste in large quantity. These waste containers are opaque, and there is a metal spark arrestor inside. The lid is spring loaded to allow for the release of any excess pressure.

The maximum liquid volume for red liquid chemical waste containers is 18 litres.

The spark arrestor prevents direct visual inspection of the liquid level. If liquid is visible within the spark arrestor, the waste container is overfilled, and some of the contents will

need to be removed before HMS will collect the waste. Overfilling the waste container reduces head space in case of gas generation, and increases the chances of spillage if the container is tipped since the lid is not a liquid tight seal.

Attempt to make as accurate an accounting of the waste contents removed from an overfilled container as possible.

20 litre White Liquid Chemical Waste Containers

HMS issues 20 litre white liquid chemical waste containers (Figure A2, p. 24) to laboratories that generate aqueous or low-volatility organic waste (with exceptions as determined by HMS) in quantity.

The maximum liquid volume for 20 litre white liquid chemical waste containers is 20 litres.

A maximum fill line is indicated on the exterior of the container.

10 litre White Liquid Chemical Waste Containers

HMS issues 10 litre white liquid chemical waste containers (Figure A3, p. 24) to users that generate smaller quantities of aqueous or low-volatility organic waste (with exceptions as determined by HMS) where larger or smaller container options may not be appropriate. HMS will also issue these containers where there are no smaller containers suitable for the chemical waste being collected.

The maximum liquid volume for 10 litre white liquid chemical waste containers is 10 litres.

A maximum fill line is indicated on the exterior of the container.

White Chemically Contaminated Gel Waste Container

HMS issues a white waste container (Figure A4, p. 24) to laboratories for disposal of gels contaminated with ethidium bromide or other chemicals. These are lined with a clear plastic bag and come with a cable tie to seal the bag when full.

Please drain excess liquid from the gels prior to placing the gels in the bag in the gel waste container. When you are ready to contact HMS for collection, seal the bag with the cable tie and close the lid. If there is any solid waste other than gels in the container, it will be rejected. Ethidium bromide liquids are toxic, and can be disposed with other toxic liquid waste.

Any non-gel solid (gloves, paper, pipette tips, etc.) waste contaminated with ethidium bromide must be segregated and prepared as chemically contaminated solid waste (Section 2.6.1).

2.4.3. Single Use Containers

Laboratories are permitted to use other containers for collecting liquid and solid chemical wastes. All containers should have at least 10% to 20% empty space to allow for expansion and gas formation. The containers must be capable of sealing completely to prevent leakage of the contents.

Please mark the container with the last four digits of the Chematix waste card. If not using Chematix use the building and room number (e.g. PP250), and if you have more than one

container please add a dash and an identifying number to the room number (e.g. PP250-1, PP250-2, etc)

Each mixed waste container must have a list of contents per the requirement of Section 2.3.

4 litre Glass Bottles

Laboratories that use solvents or other chemicals from 4 litre glass bottles (Figure 3) can reuse these bottles to collect liquid or solid chemical waste that is *compatible with the bottle's original content, or the bottle is thoroughly cleaned before use*. Please ensure that the original label is defaced to prevent confusion about the bottle's contents.

For users that do not have access to 4 litre bottles, HMS can provide bottles on request. HMS will provide replacement 4 litre bottles to users that are regular chemical waste generators. Please remember to request replacement bottles when contacting HMS for collection.

The maximum liquid volume for 4 litre glass bottles is 3.5 litres.

HMS will not accept more than three 4 litre bottles containing the same waste per visit.

20 litre White Polyethylene Pails

HMS can provide 20 litre white polyethylene pails for certain types of liquid or solid waste. Please contact HMS for a consultation.

Polyethylene Drums

In some cases HMS can provide polyethylene drums for large quantities of liquid chemicals. Please contact HMS for a consultation.

Steel Drums

In some cases HMS can provide steel drums for large quantities of solid chemicals or contaminated materials. Please contact HMS for a consultation.

Other Containers

There are a wide range of potential new or used containers that could be used to store liquid or solid chemical waste. Whether it is an empty chemical bottle, a new glass bottle or a small plastic container, in all cases check the chemical MSDS to ensure that the container material is compatible for the safe storage of the chemical. Any container needs to be in good physical condition – not cracked, brittle or have a loose fitting lid. If you have any questions or concerns about appropriate containers for chemical waste, please contact HMS.

Liquid or solids should be no higher than the start of the curve to the neck of the bottle as indicated on the example (image right).



2.5. Liquid Chemicals

HMS will issue containers to laboratories that produce enough waste to fill a container every one to three weeks. For safety reasons, HMS encourages laboratories that do not generate more than 10 litre or 20 litre of waste during a one to three week period to use a smaller

container and dispose of it regularly to reduce the potential of adverse chemical reactions or releases taking place, and to reduce the chances of the materials becoming unidentified over time.

If the laboratory generates large volumes of liquid chemical waste on a seasonal or occasional basis, HMS can provide temporary 18 litre red liquid chemical waste containers on a short term basis for the collection of chemical waste.

If the laboratory is producing two or more compatibility categories of waste (Section 2.2 above), please inform HMS so that HMS can issue your laboratory the appropriate containers for the volume and type of waste generated. Please contact HMS if you are unsure of what kind of container is compatible with the waste your laboratory is producing.

Please be aware that at all times external contamination of a container is a safety concern for all University staff. Any container used should be free of visible external contamination. Please remove excessive dust to allow for assessment of external condition.

2.6. Solid Chemicals

Any waste that is predominately solid matter is disposed of as solid chemical waste. This could include chemically contaminated gloves, wipes, pipette tips, glass or plastic that CANNOT be decontaminated. If you have questions about whether it is appropriate to dispose of certain items as solid chemical waste, please contact HMS for assistance.

Please be aware that at all times external contamination of a container is a safety concern. Any container used should be free of visible external contamination. Please remove excessive dust to allow for assessment of external condition.

Each mixed waste container must have a list of contents per the requirement of Section 2.3.

2.6.1. Chemically Contaminated Solid Waste

Anything that is **not a syringe or other sharp**, and has come into contact with chemicals (such as paper towel, bench coat, weighing boats, gloves, etc.) that cannot be cleaned, is considered chemically contaminated solid waste. Collect chemically compatible waste in a plastic bag, and place in a cardboard box sealed with tape.

Please indicate the presence of any glass (intact or broken) on the Chematix Waste Card or Non-Chematix Authorization Form.

Please mark the container with the last four digits of the Chematix waste card. If not using Chematix use the building and room number (e.g. PP250), and if you have more than one container, please add a dash and an identifying number to the room number (e.g. PP250-1, PP250-2, etc.).

HMS will only accept boxes with a maximum total size of 122 centimetres/48 inches in all three dimensions, and that weigh a maximum of 12 kilograms/25 pounds.

Chemically Contaminated Syringes and Sharps

Chemically contaminated syringes and other sharps (e.g. blades) are disposed of in 20 litre yellow biomedical waste containers if they are used in large quantities. Refer to Chapter 3 for information on disposing of biomedical waste containers. For small quantities of sharps, please purchase an approved sharps container of the appropriate size.

2.6.2. Contaminated Silica Gel

Contaminated silica gel should be collected separately from other debris. A list of solvents used with the media is required on the disposal paperwork. Solvents should be collected separately as liquid waste. A single use container (Section 2.3.2) is the best choice for collecting contaminated silica gel.

2.6.3. Empty Chemical Containers

There are two options for disposing of empty chemical containers. Please contact HMS if you would like assistance in determining which option is best for your situation.

Option 1 (Preferred)

Rinse the container thoroughly with small quantity of water or appropriate solvent. Dispose of the rinse liquid with your compatible liquid chemical waste. Deface the container label and dispose as clean glass and plastic.

Containers that would generate a significant amount of contaminated liquid to clean should be disposed of using Option 2.

Option 2

Dispose of the container as Chemically Contaminated Solid Waste. (Refer to Section 2.6.1 above.)

2.7. Mercury

Mercury waste is disposed based on how well the mercury is contained. Please contact HMS if you would like assistance in determining how to best package mercury wastes for disposal.

2.7.1. Contained Liquid Mercury

Mercury contained within an *intact* plastic (preferred) or glass container, *intact* instruments (such as a thermometer or manometer) or *sealed* equipment can be disposed of as contained liquid mercury.

Plastic or Glass Containers

Plastic containers do not require any special preparation.

Glass containers should be placed in a clear plastic bag and then put into a box of sufficient size to enclose the item. Label the box with the wording "mercury items".

Chematix users should use the *Pure Chemicals in Individual Containers Waste Card* when disposing mercury in containers.

Intact Instruments

Intact instruments containing mercury **MUST** be stored in a position that prevents spillage during transport if it is not sealed. Breakable instruments (such as thermometers) should be placed in a clear plastic bag and then put into a box of sufficient size to enclose the item.

Use the *Contaminated Materials Waste Card* when submitting instruments containing mercury.

Sealed Equipment

Instruments containing mercury should be stored in an upright position or in an orientation that will allow easy transport.

Use the *Contaminated Materials Waste Card* when submitting sealed instruments containing mercury.

2.7.2. Mercury Contaminated Materials

Materials are most often contaminated as a result of a mercury spill. Collect any materials contaminated by mercury in a heavy weight plastic bag (or double bag with garbage bags) and seal it. Place the bag into a box and label the box with the wording "mercury waste".

Any instrument or equipment drained of mercury is considered mercury contaminated waste. Please contact HMS to make arrangements for the removal of the instrument or equipment.

Use the *Contaminated Materials Waste Card* when submitting mercury contaminated materials.

2.8. Batteries

HMS collects all types of batteries (lead-acid, alkaline, lithium, nickel-metal hydride, etc.) for recycling or disposal. For laboratories, workshops and offices a single use container (Section 2.3.2) is the best choice for collecting batteries.

Terminals on 9V batteries need to be taped to prevent an electrical short that could cause a fire.

2.9. Compressed Gases

HMS collects small compressed gas cylinders (e.g. lecture bottles, propane) and aerosol cans for disposal.

Aerosol cans need to be segregated into paint or non-paint aerosols (eg. spray adhesives).

Effective July 1, 2012 charges apply for the disposal of all non-returnable gas cylinders (lecture bottles, bottles from out of business companies, etc.). These charges will reflect only the actual expense incurred for disposal of the cylinders. There will be no mark up or handling charges added to the cost. This change is necessary due to the escalating cost of disposal for these items.

There is one exception to this change. Propane, torch gas cylinders and non-regulated calibration gas cylinders will continue to be disposable without charge.

Please contact HMS with questions about whether or not the compressed gas is subject to const recovery.

2.10. Chemical Waste Collection

When HMS collects the hazardous materials please ensure that:

- The waste location is accessible to HMS, or HMS has the contact information of someone that can open the room or lab.
- The paperwork is completed accurately and located with the waste. All chemical containers must have a properly completed Chematix waste card or Chemical Waste Disposal Authorization as described in Section 5.1.
- The containers are identified with a Chematix barcode number.
- The containers' exterior is free of contamination.
- The containers are not overfilled.

- The containers are appropriate for the type of waste contained.

Refer to Chapter 5 for details on contacting HMS for collection when the chemical waste is ready.

2.10.1. Chemical Waste Rejections

When chemical waste is rejected the HMS technician will advise laboratory occupants (if available) about correcting the error. HMS will remove the waste if the error can be corrected immediately. If the error cannot be corrected at that time, a yellow waste rejection form detailing the reason for rejection is placed with the waste container. An electronic rejection will also be issued for waste submitted via Chematix. Please correct the error and resubmit the collection request for the next waste collection day according to Section 5.2 (p. 22). If you have questions about the waste rejection or require further assistance, please contact HMS or visit our website at http://www.ucalgary.ca/hazmat/waste_disposal.

2.11. Large Quantity Disposals

When disposing of large numbers of *pure chemicals* (10 or more), there are some preparatory steps that will ensure efficient collection of your waste. If your laboratory or workshop is closing or relocating, please ensure that there is sufficient time for all the steps below to be completed before closing or relocating.

HMS may visit the laboratory to determine the number of overpacks needed for transportation, and to check that segregation and paperwork are properly completed prior to performing the actual collection.

2.11.1. Chematix Users

1. Download the laboratory Chematix inventory file. The file can be exported as an excel spreadsheet. (Inventory -> View My Inventory)
2. Delete the items from the file that are not being disposed.
3. Submit the spreadsheet to HMS via email. (hazmat@ucalgary.ca)
4. HMS will classify the chemicals according to TDG regulation, physical state, and chemical compatibility before returning the spreadsheet to the person that submitted it. HMS will return the classified spreadsheet within 10 working days.
5. The edited spreadsheet will be subdivided into individual pages that indicate the primary class (e.g. 3, 4.1, 6.1, 9) of each chemical. Segregate the chemicals according to these spreadsheets.
6. Create a Pure Chemical Waste Card for each group of chemicals on the spreadsheet. Assistance in preparing waste cards is available in the Chematix User Training presentation.
7. Submit the waste cards for each group of chemicals on its own worksheet and enter the information about the primary class in the "Instructions" field. (e.g. 3, 4.1, 6.1, 9)

2.11.2. Non-Chematix Users

1. Download the Large Quantity Waste Excel spreadsheet from the HMS website. (http://www.ucalgary.ca/hazmat/large_volume)

2. Inventory the chemicals for disposal and enter the information for the chemical name, container size, quantity remaining and physical state into the spreadsheet.
3. Submit the spreadsheet to HMS via email. (hazmat@ucalgary.ca)
4. HMS will classify the chemicals according to TDG regulation, physical state, and chemical compatibility before returning the spreadsheet to the person that submitted it. HMS will return the classified spreadsheet within 10 working days or less depending on HMS work load.
5. The edited spreadsheet will have additional worksheets that indicate the primary class (e.g. 3, 4.1, 6.1, 9) of each chemical. Segregate the chemicals according to this information.
6. Print off two copies of the worksheet for each group of chemicals, and place with the segregated chemicals.
7. Complete and print off two copies of the Pure Waste Authorization indicating the attached list of chemicals and place with each group of segregated chemicals.
8. Contact HMS when the segregation and paperwork is complete to arrange a mutually agreeable time and date for the collection.

3. BIOHAZARD AND BIOMEDICAL WASTE

Please consult the *Biosafety and Procedures Manual* (http://www.ucalgary.ca/safety/biosafety_manual) for further details about handling and storing biohazardous and biomedical waste.

3.1. Clear Plastic Autoclave Bags for Biohazard Waste

Biohazard waste includes biohazard-contaminated items such as absorbent materials (e.g. paper towels), gloves, and/or plastics (e.g. microcentrifuge tubes, petri plates and tissue culture flasks containing small volumes of biohazards).

Biohazard waste must be placed in a clear plastic autoclave bag with dimensions no larger than 62x76 centimetres/24x20 inches (Figure B1, p. 24). Place biohazards in the bag; do not fill more than 2/3 the capacity of the bag. Secure the neck of the bag with tape allowing an opening for steam to penetrate the bag. Transport the bag in a tray on a cart to the nearest autoclave. Once autoclaved, place the autoclave bag inside a garbage bag for disposal with regular garbage.

Large volumes of liquid biohazard waste in glass or plastic containers must not be placed in an autoclave bag; these glass or plastic containers must be placed directly in the autoclave.

Syringes/sharps, glass, blood, items visibly contaminated with blood, biohazards symbols, radioactive waste and symbols, chlorine-treated items, and chemical waste are prohibited from clear plastic autoclave bags.

3.2. 20 litre Yellow Biomedical Waste Container

Twenty litre yellow biomedical waste containers (Figure B2, p. 24) are provided for the disposal of:

- All metal sharps;
- All blood or items visibly contaminated with blood;

- Glass sharps and broken glass contaminated with a biohazard if chemical decontamination is impossible; and
- Glass Pasteur pipettes.

HMS will reject containers weighing more than 15 kilograms. Please ensure the weight limit is observed as HMS members lift hundreds of buckets every year.

Twenty litre yellow biomedical waste containers are exchanged on a one-for-one basis or by special arrangement dependent on the department or location of the laboratory. If the laboratory requires additional 20 litre yellow biomedical waste containers due to increased waste generation, contact HMS via email to arrange for the delivery of additional containers.

Consult the HMS website for instructions on properly closing the 20 litre yellow biomedical waste containers . (<http://www.ucalgary.ca/hazmat/biowaste>)

3.3. Biomedical Waste Boxes

Biomedical waste boxes (Figure B3, p. 24) are provided for the disposal of:

- Metal sharps contained in a smaller sharps container (see below); and
- Non-sharp items visibly contaminated with dry blood (e.g. absorbent materials or dried tissue).

HMS will deliver biomedical waste boxes flat packed upon consultation regarding use. Users that have made prior arrangements with HMS will receive new boxes when HMS collects the full boxes.

HMS will reject boxes weighing more than 12 kilograms. Overloading a box may cause it to tear or fail.

Consult the HMS website for instructions on properly closing biomedical waste boxes. (<http://www.ucalgary.ca/hazmat/biowaste>)

3.4. Small Sharps Containers

Laboratories are encouraged to purchase small (less than 5L), commercially-available sharps containers for disposing of sharps. HMS will collect and dispose of these sharps containers. Please ensure that the outside of the container is free of external contamination. (Figure B4, p. 25)

3.5. Biomedical Waste Collection

When HMS collects the biomedical waste containers please ensure that:

- The room or laboratory the waste is stored in is accessible to HMS, or HMS has the contact information of someone that can open the room or lab.
- Each container has a Chematix Bio Hazardous Waste Card with the waste card barcode on the container or a Biomedical Waste Label.
- The exterior of the container is free of contamination or dust.
- The containers are not overfilled.

Refer to Section 5.1 and 5.2 for details on contacting HMS for collection when the biomedical waste is ready. More information is available on the HMS website.

(<http://www.ucalgary.ca/hazmat/biowaste>)

3.5.1. Biomedical Waste Rejections

When biomedical waste is rejected, the HMS technician will speak to someone (if available) about correcting the error. If the error cannot be immediately corrected a yellow waste rejection form detailing the reason for rejection is placed on the rejected container. An electronic rejection will also be issued for waste submitted via Chematix. Please correct the error and resubmit the collection request for the next waste collection day according to Section 5.2 (p. 22). If you have questions about the waste rejection or require further assistance, please contact HMS or visit our website at http://www.ucalgary.ca/hazmat/waste_disposal.

4. RADIOACTIVE WASTE

The Radioisotope Permit Holder and Nuclear Energy Workers must dispose of all radioactive waste generated according to the procedures set out by the University of Calgary in this manual. Materials will be considered radioactive wastes when solids, liquids, animal carcasses, animal tissue, and equipment contaminated with radioisotopes are disposed. Radioactive sealed sources for disposal are considered as radioactive waste.

If the processes described in this section and the *Radiation Safety and Procedures Manual* are not followed, Hazardous Materials Services cannot accept your waste for removal and disposal until the error is corrected.

Additional information about handling radioactive material is available in the University of Calgary *Radiation Safety and Procedures Manual* (http://www.ucalgary.ca/safety/manual_radiation).

4.1. Documenting Waste Accumulation

Document the disposal of radioactive materials on the radioactive inventory sheet as wastes are placed in the radioactive waste containers. Refer to Section 7 of the *Radiation Safety and Procedures Manual*.

4.2. Radioactive Waste Containers

HMS, under the direction of the Radiation Safety Officer, provides radioactive waste containers to laboratories that have a valid radioisotope permit and are actively conducting research using radioisotopes. Laboratories that are not actively using radioisotopes should contact HMS to have their waste containers removed. HMS will supply new containers when the laboratory resumes radioisotope experiments. Plastic trays in which to place the liquid & solid waste containers are also available.

When a laboratory contacts HMS for radioactive waste collection, HMS will provide replacement containers.

Waste containers other than those provided by HMS MUST NOT be used for radioactive wastes unless approved in writing by the Radiation Safety Officer.

Glass containers are NOT acceptable for disposal of radioactive liquid waste.

4.2.1. Radioactive Liquid Waste Container

HMS issues radioactive liquid waste containers (Figure C1, p. 25) to laboratories for radioactive liquid waste. Radioactive liquid waste containers are opaque, and there is a

metal spark arrestor inside. The lid is spring loaded to allow for the release of any excess pressure.

The maximum liquid volume for radioactive liquid safety cans is 18 litres.

The spark arrestor prevents direct visual inspection of the liquid level. Keep a log of the chemical constituents and volumes, isotopes and activity added to the safety can.

If liquid is visible within the spark arrestor, the safety can is overfilled and some of the contents will need to be removed before HMS will collect the waste. Contact the Radiation Safety Officer for direction on tracking the radioisotope removed from the container.

4.2.2. Radioactive Solid Waste Container

HMS issues radioactive solid waste containers (Figure C2, p. 25) to laboratories for radioactive solid waste excluding animal carcasses. The radioactive solid waste container includes a white plastic liner with a black garbage bag. When full the garbage bag is closed with tape that does not display radioactive warnings or symbols. Take care to avoid overfilling the can. The lid must fit securely on the top of the can.

There is some variation in the size, but the basic appearance of solid radioactive containers is a yellow garbage can with the a radiation warning symbol with the wording "Caution Radioactive Material" on the can. They may not appear exactly as depicted in Appendix C.

4.2.3. Radioactive Scintillation Vial Container

HMS issues containers (Figure C3, p. 25) for laboratories to collect scintillation vials from swipe checks and experiment counts. The container is lined with a heavy weight, clear plastic bag. Additional plastic bags and cable ties are provided to the laboratory when the container is issued or by request to HMS.

It is the responsibility of laboratory personnel to seal the plastic bag with the cable tie. When HMS collects liquid scintillation vials the HMS technician will only remove the bag and the vial disposal tag. Laboratory personnel are to replace the plastic bag before placing any more vials into the Scintillation Vial Container.

4.2.4. Iodine Liquid Waste Container

HMS issues iodine liquid waste containers (Figure C4, p. 25) for iodine liquid wastes <1 litre.

4.3. Radioactive Waste Segregation

Please ensure that radioactive waste is segregated (Solid, Liquid, Liquid Scintillation Vials, Stock vials, Carcasses) according to the directions in the following sections. Failure to do so may result in rejection of your waste.

4.3.1. Radioactive and Biohazard Waste

Any radioactive waste, which contains *biohazards* as defined by Public Health Agency of Canada or Canadian Food Inspection Agency is required to be chemically disinfected (with a chemical appropriate for the biohazard - e.g. Virkon, bleach, etc.) before disposing as radioactive waste.

4.3.2. Liquid Waste

Liquid waste must be poured into the radioactive liquid waste container. The radioactive liquid waste container must not be filled above the useable capacity. The container has a

maximum capacity of 18 litre. The chemical constituents, including ALL buffers, must be recorded on the disposal form (Section 4.5, p. 21).

4.3.3.Solid Waste

Solid waste that is contaminated or possibly contaminated (scintillation vials not containing liquids, gloves, paper, small disposable equipment, gels, eppendorf tubes with small volumes < 2 ml) are to be placed in the labelled radioactive solid waste container,

Liquids must NOT be poured in the radioactive solid waste container. The container must have a clearance of eight (8) centimetres from the top. The material contents must be recorded on the disposal form (Section 4.5, p. 21).

Animal carcasses/tissues MUST NOT be placed in the radioactive solid waste container.

4.3.4.Radioactive Contaminated Sharps

Radioactive contaminated sharps (syringes, needles, scalpels, and blades) must be disposed of in the following manner:

- **DO NOT USE GLASS CONTAINERS FOR SHARPS.**
- Needles must not be clipped.
- Needles must not be removed from syringes; syringe and needle should be disposed of as a unit.
- Needles must not be resheathed.
- All sharps must be placed in a puncture resistant container such as a metal can with a plastic or a metal lid or a plastic jar with a lid.
- Puncture resistant containers left on the bench for extended use must be labelled with radiation warning tape and the word "SHARPS" on the exterior of the container.
- Once sealed, the puncture resistant container must be placed in the radioactive solid waste container. The puncture resistant container must be sealed shut or taped in such a way to prevent opening.
- The material contents must be recorded on the Disposal form and the words "**SHARPS**" indicated on the form.

4.3.5.Iodine Liquid Waste

Iodine liquid waste must be poured into an iodine liquid waste container that is labelled and provided by HMS. The chemical constituents including ALL buffers, must be recorded on the disposal form (Section 4.5, p. 21).

4.3.6.Stock Vials

Stock vials must be kept out of the solid waste container for separate collection. Place the stock vial in its original outer container, or *in a lead pig if it arrived in one*, and place in a small sealable clear plastic bag beside your radioactive solid waste container for collection. Calculate the activity remaining in the stock vial, based upon the volume remaining in the vial. If the vial is empty (all of the liquid has been pipetted out of the vial) the activity for disposal is 1% of the original activity decayed to the day of collection from the laboratory. The Inventory sheet number from the stock vial must be recorded on the disposal form (Section 4.5, p. 21).

4.3.7. Spoiled Shipments

Place the stock vial from spoiled shipments in a plastic bag and complete the disposal form. Write the inventory number for the vial and the words "Spoiled shipment" on the form. The stock vial number must be recorded on the disposal form (Section 4.5, p. 21).

4.3.8. Liquid Scintillation Vials

Liquid scintillation vials are segregated by the type of vial. Ensure the lids on liquid scintillation vials are on tight to prevent leakage.

Vials that are counted using the Cerenkov counting technique without any liquid must be placed in the solid waste container.

Plastic liquid scintillation vials containing liquid scintillation fluid must be disposed of in the plastic lined radioactive scintillation vial container. It is the responsibility of laboratory personnel to seal the liner with the cable tie. *DO NOT MIX WITH GLASS VIALS.*

Glass liquid scintillation vials containing LS fluid must be placed in the original cardboard boxes and then slide into a plastic liner. *Keep vials in an upright position.* Plastic liners, cable ties, and vial disposal tags will be provided to the laboratory. It is the responsibility of laboratory personnel to seal the liner with the cable tie and attach the completed LS vial disposal tag to the bag prior to collection. *DO NOT MIX WITH PLASTIC VIALS.*

I-125 contaminated liquid scintillation vials must be disposed of in the plastic lined, black pail that is labelled with a LSC vial disposal label. Plastic liners, cable ties, and LS vial disposal tags will be provided to the laboratory. It is the responsibility of laboratory personnel to seal the liner with the cable tie and attach the completed LS vial disposal tag to the liner prior to collection. *DO NOT MIX WITH OTHER RADIOISOTOPE VIALS.*

4.3.9. Radioactive Gases

Radioactive gases collected or generated during an experimental procedure must be released into a fume hood.

4.3.10. Carcasses

Carcasses containing a radioisotope with a $T_{1/2} > 90$ days in a concentration greater than **ONE** exemption quantity ([Radiation Safety and Procedures Manual](#), Figure 3b) per kilogram will not be accepted. The University of Calgary does not have access to a disposal facility for these carcasses.

Carcasses ≤ 10 kilograms and animal tissue must be disposed of as follows:

- Place in a 5 mil opaque polyethylene bag(s).
- Maximum weight per bag is 10 kilograms.
- Carcasses that do not contain approximately the same body burdens must be bagged separately.
- Carcasses that contain a radioisotope with a $T_{1/2} \leq 90$ days in a concentration greater than **ONE** discharge quantity per kilogram must be bagged separately from those that are less than **ONE** discharge quantity per kilogram. Refer to the [Radiation Safety and Procedures Manual](#) (Figure 10-c) for Discharge Quantity table.
- Radioactive tape or stickers must **NOT** be placed on the carcass or bag. Bags must be tagged with a Radioactive Carcass Disposal (Section 4.5, p. 21). Tags are also available upon request from HMS.

- Carcasses must be placed in a freezer. It is the Radioisotope Permit Holders responsibility to obtain a freezer. HMS will not collect carcasses that are not frozen.

Carcasses > 10 kilograms must be disposed of as follows:

- Carcasses that contain a radioisotope concentrated in a particular organ may require special handling. Contact the Radiation Safety Officer.
- Carcasses that contain a radioisotope with a $T_{1/2} \leq 90$ days in a concentration greater than **ONE** discharge quantity per kilogram require special handling. Contact the Radiation Safety Officer.
- Carcasses that contain a radioisotope(s) in a concentration less than **ONE** discharge quantity per kilogram must be double bagged individually in 5 mil opaque polyethylene bags Refer to the [Radiation Safety and Procedures Manual](#) (Figure 10-c) for Discharge Quantity table.
- Radioactive tape or stickers must **NOT** be placed on the carcass or bag. Bags must be tagged with a Radioactive Carcass Disposal Tag (Section 4.5, p. 21). Tags are also available upon request from HMS.
- Carcasses must be placed in a freezer. The Radioisotope Permit Holders is responsible for obtaining a freezer. HMS will not collect carcasses that are not frozen.

4.4. Disposal of Shipping Containers and Packaging

Plastic wrapping around the stock vial must be disposed of into the solid radioactive waste container.

Styrofoam inserts that are free of detectable radioactive contamination may be recycled directly through the suppliers of radioactive materials or other University recycling program.

Shipment boxes that are free of detectable radioactive contamination may be disposed of into the recycling bin or normal garbage, once the Radiation and Transportation of Dangerous Goods markings and/or labels on the shipment boxes have been defaced and the box is collapsed.

Lead containers used for shipping the product should be used as shielding while storing the radioactive materials in the laboratory. The stock vials and the lead container should be disposed of as a unit. If the Laboratory has empty lead containers for disposal, the lead containers must be collected in a small box for recycling. Ensure the removable contamination does not exceed 0.3 Bq/cm². HMS will not pick up containers that are contaminated. Place the box of lead containers near radioactive waste containers for collection.

Lead containers must NOT be disposed of in the radioactive solid waste container.

4.5. Radioactive Waste Collection

Complete instructions for disposal of radioactive waste are found on the HMS website at <http://www.ucalgary.ca/hazmat/radioactive>.

Samples of how to complete the disposal forms for different types of waste are online in Section 10 of the [Radiation Safety and Procedures Manual](#).

4.5.1. Prior to Collection

Tasks to be performed prior to waste collection:

- Seal the bag in the radioactive solid waste container with unlabelled (*no radiation*)

warning symbol) tape.

- Swipe check the outside of the liquid and/or solid waste containers, and any other containers which are to be picked up, decontaminate as required. Attach swipe results to ONE of the completed disposal forms. (Preferably the solid waste form, if one is being completed that week.)
- Attach disposal forms or tags to corresponding liquid and solid waste containers, stock vial bag, and carcass bags.
- Seal the plastic bag in the Scintillation Vial Container and attach the completed disposal form.

4.5.2. Contact HMS for collection

Refer to Section 5.2 (see below) for details on contacting HMS for collection when the radioactive waste is ready

4.5.3. Radioactive Waste Rejections

When radioactive waste is rejected, the HMS technician will speak to someone (if available) about correcting the error. If the error cannot be immediately corrected a yellow waste rejection form detailing the reason for rejection is placed on the rejected container. An electronic rejection will also be issued for waste submitted via Radiologistix. Please correct the error and resubmit the collection request for the next waste collection day according to Section 5.2 (see below). If you have questions about the waste rejection or require further assistance, please contact HMS or visit our website at http://www.ucalgary.ca/hazmat/waste_disposal.

5. HAZARDOUS WASTE COLLECTION

Hazardous Materials Services conducts regular waste collection on Main, Foothills, and Spy Hill campuses. Other locations are collected when required. Users must contact HMS with the details of the waste being collected via the appropriate system.

(http://www.ucalgary.ca/hazmat/waste_disposal) All hazardous materials require completed waste documentation as dictated by your location.

5.1. Which System to Use

Chemical and Biomedical Waste

A current list of University departments and locations required to use Chematix for submitting waste collection requests to HMS is listed on the HMS website.

(<http://www.ucalgary.ca/hazmat/chematix>)

If your lab, workshop or office is not in Chematix, please contact HMS via email at hazmat@ucalgary.ca to receive a copy of the instructions and forms for your waste type.

Radioactive Waste

Complete instructions for disposal of radioactive waste are found on the HMS website at <http://www.ucalgary.ca/hazmat/radioactive>.

5.2. Collection Schedule

The HMS collection schedule and collection contact phone number is posted on the HMS website. (<http://www.ucalgary.ca/hazmat/schedule>) Any variation to this schedule dictated by

Statutory Holidays or other unforeseen circumstances will be posted to the website as soon as possible.

6. USER NOTES

A. APPENDIX A – WASTE CONTAINER PHOTO REFERENCE

18 LITRE RED LIQUID CHEMICAL WASTE CONTAINER



Figure A1

20 LITRE WHITE LIQUID CHEMICAL WASTE CONTAINER



Figure A2

10L WHITE LIQUID CHEMICAL WASTE CONTAINER



Figure A3

CHEMICALLY CONTAMINATED GEL WASTE CONTAINER

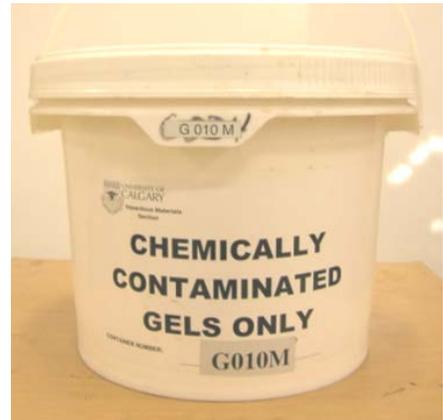


Figure A4

CLEAR PLASTIC AUTOCLAVE BAG WITH BIOHAZARD WASTE



Figure B1

20 LITRE YELLOW BIOMEDICAL WASTE CONTAINER



Figure B2

BIOMEDICAL WASTE BOX BIOMEDICAL BOX PICTURE



Figure B3

SMALL SHARPS CONTAINERS



Figure B4

RADIOACTIVE LIQUID WASTE CONTAINER



Figure C1

RADIOACTIVE SOLID WASTE CONTAINER



Figure C2

RADIOACTIVE SCINTILLATION VIAL CONTAINER



Figure C3

IODINE LIQUID WASTE CONTAINER



Figure C4

B. APPENDIX B – CHEMICAL WASTE LOG SHEET

| Chemical Name (No symbols or diagrams) | Quantity (mL) | | | | | |
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