Health, Safety & Well-being

Human Resources

Hazardous Materials and Waste Management Handbook

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Contents

1. Introduction

At an institution as diversified as Western, there are many types of waste that require special handling with respect to how it is collected; stored; transported; treated; recovered; and, disposed of to reduce adverse effects to human health and the environment. These requirements are regulated and enforced by the municipal, provincial and federal governments. Therefore, proper waste disposal is not only a safe and responsible thing to do, but is also a legal requirement.

The Canadian Environmental Protection Act and the City of London's Waste Discharge Bylaw prohibit the discharge of hazardous waste into the sewer system or the disposal of with municipal waste. Organizations and individuals can be, and have been, held responsible for environmental damage as well as any injuries to individuals working on plumbing or sewer lines. Convicted violators of the abatement regulations could face individual penalties plus jail terms. Other legislative requirements are identified within various Acts and Regulations, including but not limited to Transportation of Dangerous Goods Act & Regulations; Occupational Health and Safety Act and Regulations; Environmental Protection Act and Regulations; Canadian Nuclear Safety and Control Act & Regulations; and, Fire Code.

This handbook is intended for use by those who produce hazardous waste as a result of their work, study or operational activities at Western. It is the responsibility of all individuals at the University to store and handle the generated hazardous waste in a manner that protects people, property and the environment. The flow chart in Appendix A illustrates the processes for managing different types of hazardous waste at Western. All hazardous materials will be accepted for disposal provided that they meet the requirements covered in this handbook. The waste disposal program at Western is convenient, flexible, and easy to use. The handbook addresses the most common types of hazardous waste generated on campus. It is recognized that there will always be unique situations that will require the assistance of the specialists in Western's Health, Safety & Well-being (HS&W) office.

2. Hazardous Waste

2.1. Chemical Waste

A high percentage of chemical waste at Western consists of unopened containers, so try to resist the temptation of large volume purchases. Before purchasing chemicals, estimate your maximum possible use and buy accordingly. Sharing chemicals that might otherwise be sent for disposal, minimizes waste volume and provides an inexpensive source of chemicals.

Some chemicals have characteristics that preclude long-term storage. Therefore, purchase chemicals in volumes that will ensure usage within the manufacturer's recommended shelf-life. Date chemicals that have characteristics that cause them to become hazardous with age and dispose of them before they become a dangerous item to handle (e.g. peroxide formers, certain compressed gas cylinders).

Unknown chemicals create an unsafe situation in the laboratory. Be sure to replace aging labels. Also, ensure that all products made in the laboratory are clearly identified; it is the safe thing to do as well as being the law.

2.1.1 Labelling Containers for Disposal

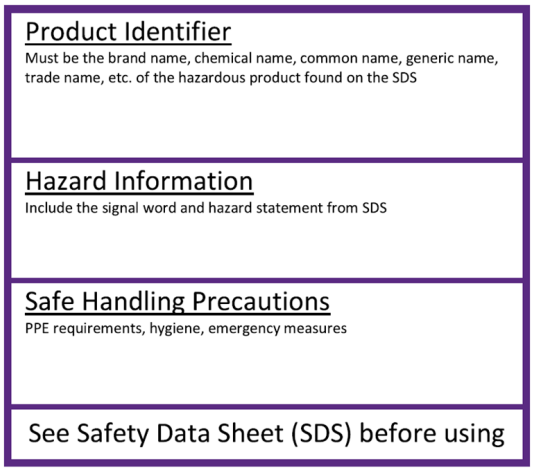
All containers in a laboratory must be properly labelled. The appropriate labelling is the responsibility of the individual laboratory or department. Each item must be labelled with one of the following:

- Original Supplier's (manufacturer) Label,
- WHMIS Workplace Label,
- Any label with full chemical name (for containers less than 100ml), or
- Material for Disposal Label

When disposing of hazardous waste, one of the below labels must appear on the container, unless its original manufacturer's label is an accurate reflection of its contents. All required information must appear on the label. Use the full chemical name, as short forms or acronyms are confusing for proper identification. For example, use trichloroacetic acid instead of the abbreviation "TCA".

Hazardous Material for Disposal – Package and Container Label

To be used on each container of generated waste and on exterior of all packaged waste cartons.



WHMIS Workplace Label

To be used on stock solution containers, for decanted materials or as a replacement for a damaged supplier label.

Waste Material for Incineration

To be used on any material bagged for incineration. These are primarily used for biohazardous waste.

For inventory update purposes, remove the Western Chemical Inventory barcode from a container once that container becomes empty and affix it to the “Barcode Disposal” sheet posted in your lab.

2.1.2 Packaging

All chemical waste containers must be packaged to ensure that the contained materials cannot spill in the case of an accident. The following should be considered when packaging waste:

- All chemicals for disposal must be in intact containers, suitable for holding the chemical, with a tightly fitting lid that prevents leakage
- Each container must be labelled appropriately (see section 2.1.1).
- All containers of less than 22 liters (5 gal) must be packed upright in a cardboard strong enough to support the contents. Sufficient packing material must be used to prevent the containers from tipping or breaking against each other. Finally, the box must be taped closed.
- Each box must have an attached Hazardous Waste Disposal Form, Appendix B
- Each box must be small enough to be easily carried by one person.
- Incompatible and highly reactive chemicals must always be packaged separately to minimize fire and explosion hazards in case of accidental breakage, (see section 2.1.3).

  Example: Inorganic salts which liberate poisonous gases must be separated from:

  - Acids - e.g. Potassium Cyanide
  - Oxidizing agents - e.g. Potassium Permanganate
  - Pyrophoric chemicals - e.g. Phosphorus
- All sharps contaminated with hazardous chemicals must be placed in a Western approved sharps container with a ‘Hazardous Material for Disposal’ label (see section 2.1.1) completed and affixed to the container.

- Each box must contain only one stream of waste material. Chemical, biohazardous and radioactive waste streams are handled in different areas on campus and cannot be stored together.
- Gas cylinders must be first checked for leaks before sending them to disposal.
- The twenty-liter pails must be sealed. Pour-spout must have an intact cap.

2.1.3 Chemical Compatibility

Chemical compatibility is an important factor when handling chemicals and packaging chemical wastes, please see the chemical compatibility chart in Appendix C. Unexpected reactions due to incompatibility have caused serious injuries and severe damage to equipment and buildings in the past. A well-maintained inventory and labelling system is the best method of ensuring hazardous materials are being managed effectively and safely. The inventory process allows one to check whether chemicals are being stored properly, and if not, provides an opportunity to segregate according to their respective hazard classes.
https://uwo.ca/hr/safety/topics/lab/chem_inventory.html

Container labels and Safety Data Sheets (SDSs) are the principal source of information on hazard classes and storage practices. One technique to convey this hazard information is the use of colours to categorize materials. This method places chemicals with a similar hazard class in the same colour-code group. All materials of the same colour-code may be stored together without fear of an incompatible reaction occurring should the materials become accidentally mixed. Several chemical manufacturers (e.g. JT Baker, Fisher, and BDH) use this method to convey hazard information.

In general, chemicals can be grouped into the following hazard classes:

1. Flammable liquids
2. Oxidizers
3. Reducers
4. Concentrated acids
5. Concentrated bases
6. Water-reactives
7. Toxic
8. Peroxidizables
9. Pyrophorics
10. Compressed gas cylinders
11. Inorganic solids
12. Organic solids
13. Non-flammable liquids

Ideally, each group above should be stored on a separate shelf with the most hazardous combinations spaced well apart. Flammable liquids must be stored in an approved flammable storage cabinet or explosion proof refrigerator.

Incompatible materials are kept segregated in the waste disposal process as well. Chemical waste must be kept separate by placing waste appropriate labelled container (s) and submitted for disposal.

Do not collect the wastes from a series of different experiments or procedures into one large container. This increases the risk of mixing incompatible chemicals together. There are numerous examples of incompatible chemical reactions between relatively unreactive materials (e.g. oxidizer + organic solvent, DMSO + halogenated solvent).

2.1.4 Organic Solvents

Separate your organic solvent waste into halogenated and non- halogenated solvents and list the full chemical names. The reason for this request is that halogenated solvents disposal costs are almost ten times higher than non-halogenated.

2.1.5 Unknown Chemicals

For safety and compliance reasons, the hazardous waste contractor will not accept any unidentified substances at any time. Every effort must be made to properly identify all waste before submitting for disposal. If identification of the "unknown" cannot be made, then a characterization of the waste based on physical and chemical properties is required prior to acceptance of the material by the contractor. Please contact Health, Safety and Well-Being Hazardous Waste Co-ordintator, hazardouswaste@uwo.ca, if you require assistance with an unidentified substance. If unknown cannot be internally characterized, it must be subjected to a series of analytical tests by the hazardous waste contractor until an appropriate identification is accomplished.

Any information on the unknown material is critical. This information may greatly reduce the hazards involved in handling and testing the material. Examples of useful information: name of research group, contact name, telephone number, type of research, storage method, approximate age of container, your best guess (e.g. organic, acid, air reactive, pH, oxidizer, etc.).

2.1.6 Shock-Sensitive / Explosive Materials

These compounds must be handled with the utmost care to protect them from shock, friction and heat. Compounds that are suspected of containing unstable peroxides should be considered extremely dangerous. **DO NOT OPEN** a suspect container and contact HS&W for disposal arrangements.

There are two main factors in the creation of a shock sensitive or explosive material: time and desiccation. Many types of ether have the tendency to slowly form organic peroxides once exposed to air. To prevent the formation of explosive peroxides, determine the recommended disposal date and write it on the container, see table below. This container must be submitted for disposal prior to this date. If this date has been exceeded the assumption must be made that it is now unstable and should be handled as a shock sensitive item. Items such as Picric Acid must be kept wet and should be inspected monthly and additional water should be added if the level appears to be dropping.

*Note: **NEVER** attempt to open a dry container of Picric Acid or a container with dry Picric Acid on the lid.*

Disposal Condition	**Examples**
3 months after opening	Isopropyl ether, Divinyl acetylene
12 months after opening	Diethyl ether, Tetrahydrofuran, Dioxane
Substance has been allowed to dry out	Picric Acid, Dinitrophenylhydrazine

2.2. Controlled Substances and Goods

Due to special handling procedures, substances controlled under the Controlled Drugs and Substances Act, and Defence Production Act, specifically, the Controlled Goods Regulations will continue to be handled directly by HS&W office. If you require disposal of any controlled substances, please contact Please contact Health, Safety and Well-Being Hazardous Waste Co-ordintator, hazardouswaste@uwo.ca, so that a special pickup can be arranged.

2.3. Radioactive Waste

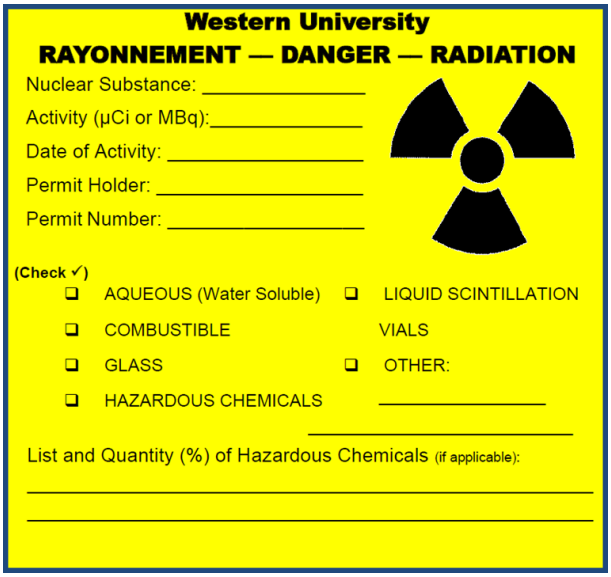
Disposal of all radioactive wastes must be in accordance with regulations under the Nuclear Safety and Control Act. Waste must be handled and disposed of in a way that prevents unreasonable risk to the public or the environment. Canadian Nuclear Safety Commission (CNSC) Regulations and Internal Permit Conditions require appropriate and specific disposal for each radio nuclide, and require records be retained for each method of disposal. Annual reporting of usage and waste disposal quantities is required.

Radioactive waste must be kept secured while in the laboratory. Do not leave any container labeled as radioactive waste at the loading dock or any public area, unattended while waiting for pick-up. It is the responsibility of a Permit Holder to release all nuclear substances for disposal from his/her designated laboratories.

Estimate the quantity of radioactivity used and disposed of according to experimental protocols. Record the quantity and method of disposal, date of disposal and the username on the Hazardous Waste Disposal Form. The forms must always be completed and kept current as well as signed and dated when disposal is complete.

Radioactive wastes (liquid scintillation vials, solids, liquids, etc.) are normally submitted to the hazardous waste contractor in a special radioactive pail for disposal. These wastes must not contain any viable bio-hazardous agents. Each radioactive pail must have the following:

- A completed Radioactive Waste Label Form on liquid waste container, solid waste bag or liquid scintillation vials bag. The radioactive labeled waste container or radioactive labeled bag must be contained in a radioactive pail. All radioactive waste must be pre-approved by the Radiation Safety Consultant prior to submission.
- A radioactive pail must be checked for non-fixed contamination on surfaces (mainly outside) using a wipe test procedure then complete a Safe Transport of Radioactive Material form.
- A completed Hazardous Waste Disposal Form.
- The below Radioactive Waste Label should be displayed on pail.



Note: no radioactive waste shall be disposed to a sewer or regular campus garbage.

2.3.1 Liquid Scintillation Vials

Solvent liquid scintillation vials and environmental biodegradable scintillation vials must be collected separately in the laboratory. Vials must be placed in a **clear** plastic bag in the radioactive waste pail. Vials must have caps that are securely fastened. Vials must not be leaking or show evidence of leaking. Environmentally safe biodegradable scintillation fluid is highly recommended for wipe test and experimental procedures if possible.

Non-contaminated solvent vials from the wipe test can be submitted to the hazardous waste collection team as regular chemical waste. Vials are disposed of as chemical waste if they are within the CNSC limit for solid waste.

2.3.2 Liquid Radioactive Waste

Aqueous (water soluble) liquid waste and organic solvent liquid waste must be collected separately in the laboratory. All liquid radioactive wastes must be collected in 4-liter plastic containers with a Radioactive Waste Label on it. Close the cap tightly on the container when not being used and place it behind an appropriate shielding material if required.

When close to full and/or prior to disposal, count an aliquot of the solution and determine the radiation activity in Millicurie (mCi) or Megabecquerel (MBq). The outside of containers must be free of any contamination before submitted to the hazardous waste collection team.

No liquid containing radioactive materials shall be discharged to the laboratory sanitary sewer. However, the wash water from the normal, daily, clean-up of radioactive-use utensils, glassware may be disposed via the sewer.

2.3.3 Radioactive Stock Shipment Vials

All stock vials must be collected and submitted to the hazardous waste collection team. Ensure that the bar code number is on the vial at the time of disposal. All shipment vial radioactive labels must be defaced or destroyed. All environmentally hazardous materials such as lead, used in shielding containers, should be disposed of as hazardous waste.

All vials with some residual activity must have a radioactive waste label, indicating the date and the amount of activity remaining in the vial.

2.3.4 Solid Combustible Radioactive Waste

All solid combustible radioactive waste must be collected in a **clear** plastic bag and contained in a radioactive pail or behind an appropriate shielding material, if required. Radioactive warning signs/labels must be destroyed or defaced before discarded into the clear plastic bag.

No sharp waste (glassware, needles and blades) shall be discarded into combustible waste containers. Non-contaminated materials must not be discarded into solid waste containers.

2.3.5 Radioactive Sharps (Needles and Syringes)

All sharps used for dispensing radioactive materials must be placed in a Western approved sharps container with a Radioactive Waste Label on it. The container must be monitored and shielded if necessary.

The outside of sharps containers must be free of any contamination before submitted for disposal.

2.3.6 Radioactive Glass

All radioactive glass waste (e.g. glass test tubes, glass pipettes, etc.) from radioactive experiments must be collected in a **clear** plastic bag and contained in a radioactive pail. Radioactive warning signs/labels must be destroyed or defaced before discarded into the clear plastic bag.

2.3.7 Radioactive Animal Carcasses and Tissues

All radioactive contaminated animal carcasses and tissues must be frozen, held for the appropriate decay period and then incinerated. It is the responsibility of the researcher to provide freezer space for the animal material during this decay period. Animal materials may be incinerated when the activity is decayed or well below CNSC regulatory limits. For more information, contact the Radiation Safety Consultant (RadSafety@uwo.ca).

At disposal, the animal material must be double bagged in an opaque bag and labelled with a “Waste Material for Incineration” label. Bags must not weigh more than 20 kg each.

2.3.8 Sealed Sources

Contact the Radiation Safety Consultant (RadSafety@uwo.ca) for the disposal of all sealed sources and radiation devices containing sealed sources. Permit Holders must inform the Radiation Safety Consultant after the disposal of sealed sources. Sealed sources are normally transferred to a radioactive waste company.

2.3.9 Smoke Detectors

A smoke detector contains a small radioactive source; therefore, do not place the detectors into the regular laboratory garbage. For disposal, coordinate with HS&W office for collection service of smoke detectors, if needed.

2.4. Biological Waste

The Public Health Agency of Canada requires that all contaminated materials, solid or liquid, must be decontaminated before disposal or reuse. Disposal must also comply with existing federal, provincial and local municipal legislations. The purpose of this section is to guide individuals on a safe and environmental-friendly procedure for biohazardous wastes disposal using the available resources.

Hazardous biological materials include biotoxins and biomaterials capable of infecting or causing harm to persons, animals or plants. A new category that falls under this classification are some genetically modified organisms. Infectious agents are any biomaterial capable of transmitting disease to persons, animals or plants.

Waste material treated correctly is rendered non-infectious and may be discarded through the sewer for liquid waste, or through the regular garbage for solid waste. Should any unusual situations arise, please contact the Biological Safety Officer, biosafety@uwo.ca.

It is the responsibility of the research unit to develop suitable procedures for treating the biohazardous waste it produces; bearing in mind that each research program has unique requirements and problems. The method used in each lab should be proven effective in that lab, rather than assumed correct because it is satisfactory in another lab using another agent.

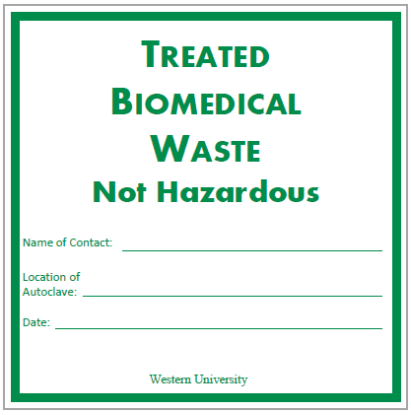
2.4.1 Decontamination Methods

There are four main categories of physical and chemical means of decontamination: heat, liquid disinfection, vapors and gases, and radiation. Heat decontamination (autoclaving and incineration) and disinfection are the adopted decontamination methods at Western.

2.4.1.1 Autoclaving

All autoclave users must first be trained by their supervisor or designate. Detailed Western Standard Operating Procedure (SOP) are posted at each autoclave and must be adequately adhered to.

For autoclaving to be effective, the steam must be saturated, penetrate the load and the temperature must reach a minimum of 121°C (250° F) for a minimum of 15 minutes. Although autoclaving is generally regarded as the most reliable method of sterilizing biological wastes, the efficiency of autoclaving routines should not be taken for granted. The time necessary to achieve decontamination will vary with the volume of the material and the density and nature of the biological agents in the sample. Acceptable decontamination will be confirmed with the results from the spore test vial placed in the waste container. Waste cannot be discarded unless test results are negative. Bags must be stored in an appropriate place until test is complete.



Prior to disposal as decontaminated solid waste, the autoclave bag must be placed in a clear garbage bag specifying biohazard waste or an opaque garbage bag with a label affixed indicating that the bag contains Treated Biomedical Waste. It can then be place in the regular garbage.

Kindly remember that biological and radioactive waste **must not** be autoclaved to avoid radioactive contamination of the autoclave. This waste may be autoclaved only when its radiation activity is below the CNSC regulatory limits. Autoclaving SOP and Autoclave Cycle Verification procedure can be found in Appendix D and Appendix E, respectively.

2.4.1.2 Disinfection

Disinfection is the use of germicidal (germ-killing) chemicals to destroy the infectivity of the material. This may not imply sterilization (kills all forms of microbial life). Chemical agents often provide the only practical means of effective inactivation of biological material.

When used with knowledge of mode of their action and limitations, chemical disinfectants are recommended in the following situations:

- Decontamination of reusable glassware before washing and reuse,
- Decontamination of surgical instruments before washing and reuse,
- Decontamination of waste biohazardous liquids if an autoclave is not available
- Spill or accident clean up,
- Cleaning and decontamination of work surfaces,
- Cleaning and decontamination of equipment which cannot be autoclaved, and
- Decontamination of radioactive or carcinogen containing liquids.

You must determine the recommended disinfectant for your particular situation based on SDSs, literature or recommendations from professional resources such as Health Canada. The disinfectant must be proven to be effective against organisms or cells in use. The correct dilution must be used with sufficient contact time must be allowed.

After decontamination by suitable disinfectants, wastes are rendered as non-hazardous and may be disposed of in the normal waste stream; liquids into the sanitary sewer provided that the concentration of disinfectant is not toxic, and solids can be handled by standard garbage disposal. Safety precautions should be taken by personnel when handling concentrated solutions of disinfectants, as these can be very toxic and corrosive. These precautions include wearing protective gloves and eye protection as described in the SDS of the disinfectant.

2.4.1.3 Incineration

The following categories of biohazardous waste should be disposed of by incineration:

- All human tissues,
- All small animal carcasses, both infected and non-infected,
- Disposal of large animal carcasses must be according to the instructions of the Animal Care Facility,
- Animal tissue and body parts, both infected and non-infected, and
- Contaminated sharps (needles, syringes, blades), special arrangements must be made for any glass items that need to be incinerated (i.e. Vacutainers)

Note: needles, syringes and blades must be placed in an approved sharps container prior to disposal and this must be securely closed before it leaves the laboratory.

Bagging Procedures for Incineration

The biohazardous waste that needs to be incinerated should be:

1. Waste must be securely bagged in an opaque plastic bag or a clear garbage bag specifically for biohazardous waste and double bagged to prevent leakage before leaving the laboratory or animal housing area.
2. The bags must be labelled with a fully completed “Waste Material for Incineration’ label on the outside. These labels are provided by Western’s HS&W office.
3. For carcasses and anatomical wastes: These must be frozen or refrigerated if disposal is not to be immediate. For preserved carcasses, the preserving liquid must be separated and submitted as chemical waste. Bags must not weigh more than 20 kg unless approved by HS&W team.

2.4.2 Mixed Biological and Radioactive Waste

When applicable, any biological hazard must be treated first prior to submitting as radioactive waste. The waste must be decontaminated by disinfection. For additional information, please refer to section 2.4.1.2.

In some special cases, it may be necessary to incinerate contaminated biological/radioactive waste providing that the radiation activity of the waste is within the CNSC limit for solid waste. For more information, contact the Radiation Safety Consultant (RadSafety@uwo.ca).

Note: never autoclave contaminated radioactive, biological waste.

2.5. Contaminated Glassware and Containers

Empty glass containers of water-soluble inorganic acids and caustic residues must be rinsed prior to disposal. Rinsing must be performed three times with water to eliminate residues. Refer to the organic solvent compatibility for guidance. Prior to disposal, empty, uncapped bottles must be placed in the fume hood for at least 24 hours to allow remaining residues to evaporate.

All glassware contaminated with a biohazardous agent must be rendered non-infectious before disposal.

Containers that have small amounts of highly toxic liquids or solids, not eligible for treatment as above, should be handled by following labelling and packaging requirements in sections 2.1.1 and 2.1.2.

Each laboratory must have a labelled puncture resistant container (plastic or metal pail or an approved glass disposal box) to dispose of broken glassware and empty glass containers. The objective of isolating glass from regular garbage is to protect caretaking staff from possible glass cuts and injuries.

2.6. Sharps

- Chemically contaminated sharps; as per section 2.1
- Radioactively contaminated sharps; as per section 2.3
- Biohazard contaminated sharps; as per section 2.4
- Non-contaminated sharps (not contaminated by chemical, biological, radioactive agents) are not considered as hazardous waste. Such sharps must be placed in an approved sharps container prior to disposal, securely closed and labelled as ‘Sharps, Non-contaminated’. These may be disposed of in the regular waste stream.

2.7. Asbestos

Asbestos Containing Materials (ACM) may be found in many locations on campus. Due to its unique properties, it was used in numerous and varied applications. However, ACM is only hazardous when it becomes friable (breaks apart releasing fibres). ACM is best left undisturbed unless it has become friable and is releasing fibres or could release fibres.

It is important that ACM be treated with caution. Users must be familiar with the location of asbestos in instruments and other materials. Asbestos may be found in insulation. It may be sprayed on ceilings or on walls. It has also been used in offices and laboratories in many different applications:

- Fume hood enclosures
- Heating mantels and pads
- Ceiling tiles
- Furnace insulation
- Lab bench tops
- Floor tiles
- High temperature gloves
- Pipe insulation
- Drywall compound

Small quantities of ACM (that can be removed and packaged without releasing asbestos fibres) can be submitted as hazardous waste. More unstable asbestos

insulation or larger quantities of material must be removed by professional asbestos abatement individuals. Western Facilities Management has an in-house abatement team that is trained and adequately equipped to handle most asbestos removal tasks that will occur on campus. Contact Client Services of Facilities Management at extension 83304 to arrange for asbestos disposal.

2.8. Electronics and Fluorescent Light Bulbs

With the introduction of new waste classification testing, several types of waste that traditionally went to the landfill are now considered hazardous waste. Old computers, monitors, fluorescent light bulbs and other electronic equipment are now classified as hazardous waste and must be diverted from the regular landfill garbage. These items are collected through Western's recycling program and shipped for recycling and/or treatment of all the hazardous components. Contact Client Services of Facilities Management at extension 83304 to arrange for collection and disposal.

2.9. Batteries

Labeled pails are distributed at Western locations listed below to collect all types of used batteries (lead-acid, alkaline, lithium, nickel-metal hydride, etc.) for recycling or disposal.

1. Siebens-Drake Research, Loading Dock, 1st Floor
2. Chemistry Building, Loading Dock, Basement
3. Robarts Research Institute, Loading Dock, 1st Floor
4. Spencer engineering Building, Loading Dock, Ground Floor
5. Biological & Geological Sciences, Loading Dock, Ground Floor
6. Support Services Building, Atrium, 4th Floor & 1st Floor
7. North Campus Building, Loading Dock, Ground Floor
8. Social Science Centre, Loading Dock, 1st Floor
9. Medical Sciences Building, Room m003, Basement
10. Physics & Astronomy Building, Loading Dock, 1st Floor

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

3. Spill Emergencies

Before using any hazardous material, you should carefully read its label and SDS. Understanding your material will allow you to make any emergency decisions should an accident occur.

Your priorities in the event of a spill are:

- The prevention and treatment of **injuries**
- The prevention of **environmental** contamination
- The protection of **property**

Your response to the spill should proceed as follows:

Step 1

- Immediately alert all laboratory occupants that you have had a spill.
- If in your opinion there is an immediate risk to room occupants, EVACUATE the laboratory and close the door behind you.
- If you feel the spill presents an immediate risk to individuals outside the laboratory, do not hesitate to use the nearest Fire Alarm pull station to EVACUATE the building.
- Wait outside the building and make the emergency responders aware that you were the one who activated the alarm and inform them of the nature of the emergency.
- Assist any injured individuals from the area only if it is safe to do so. If it is necessary to leave anyone behind, make certain that the emergency responders are aware of the individual's location and condition.

Step 2

- When you are certain you are in a safe area, ensure any injured individuals receive appropriate first aid.
- Contact Western Special Constable Service (WSCS) at 911 to request any necessary help (Hazmat, ambulance, first aid, etc.).

Step 3

NEVER open a window in your lab. While this will clear the atmosphere in your lab, it will allow any gasses or vapours to be distributed throughout the entire building. If applicable, place your lab fume hoods into emergency mode.

Step 4

If it is safe to remain in the lab, ELIMINATE any sources of ignition near the spill.

Take measures to prevent the spill from entering the floor or sink drains.

Step 5

Use your nearest spill kit to control and clean up the spill ONLY if you have the necessary personal protective equipment. If not, ask WSCS to contact the Hazardous Materials Spill Response Team.

<u>Spill Control Kits</u>

A universal spill kit includes the following items:

- Spill pads
- Spill sock
- Mercury sponge
- A bag of universal sorbent
- Latex or Nitrile Gloves
- Rubber gloves
- Dustpan and brush
- Paint scraper
- Roll of paper towel
- Garbage Bags

4. Hazardous Waste Collection Procedures

The Western hazardous waste collection program is handled by RPR Environmental. RPR Environmental provides Western with the services of technical and environmental specialists who provide a unique, hands-on approach to waste management.

RPR requires the submission of an inventory form with all hazardous waste for it to be accepted. Proper packaging, segregation, labelling and delivery by a knowledgeable representative from the laboratory is required.

For safety reasons, RPR will not accept "unknowns", at any time, so every effort must be made to properly identify all waste before submitting for disposal. If identification of the "unknown" cannot be made, then a characterization of the waste based on physical and chemical properties is required prior to acceptance of the material by RPR. Please contact Health, Safety and Well-Being Hazardous Waste Co-ordintator, hazardouswaste@uwo.ca, if you require assistance with an unidentified substance.

Due to special handling procedures, substances controlled under the Controlled Drugs and Substances Act, and Defence Production Act, specifically, the Controlled Goods Regulations, will continue to be handled directly by Health, Safety & Well-being. If you require disposal of any controlled substances, please contact Health, Safety and Well-Being Hazardous Waste Co-ordintator, hazardouswaste@uwo.ca, so that a special pickup by the department can be arranged.

Hazardous wastes are regularly collected every **Thursday** following the below schedule:

Pick-up Location	**Pick-up Time**
Siebens-Drake Research Loading Dock	9:00 am
Robarts Research Institute	9:25 am
Biological & Geological Sciences Loading Dock	9:40 am
North Campus Building Loading Dock	10:00 am
Medical Sciences - Room M003 (basement)	10:15 am
Chemistry Building Loading Dock	10:55 am
Engineering Sciences Loading Dock	11:30 am

In the event a pick-up is required at a location other than one on the regular schedule, a copy of the completed inventory form must be emailed to Health, Safety & Well-being (hazardouswaste@uwo.ca) so pick-up can be scheduled. Special requests must be received no later than 05:00 pm on the Tuesday preceding the next Thursday pick-up.

Note: all hazardous waste must be submitted in person and never left unattended at the pick-up site.

References

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- Ontario Regulation 558/00 amendment to Regulation 347 of the revised regulations of Ontario, 1990 made under the Environmental Protection Act
- Prudent Practices for Disposal of Chemicals from Laboratories, National Research Council, National Academy Press: Washington, DC., 1983.
- Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Research Council, National Academy Press: Washington, DC., 1981.
- Safety in Academic Chemistry Laboratories. 3rd ed., Committee on Chemical Safety, American Chemical Society: Washington, DC., 1979.
- Transportation of Dangerous Goods Regulations written in Clear Language, Transport Canada, Government of Canada, 2018.

Hazardous Waste Disposal Flowchart

Health, Safety & Well-being (HS&W)

Western

Chemicals (solids, liquids, gases, contaminated Containers)

- Known
- Unknown
  - Characterize

- Consult SDS
- Label the waste container with full name of the chemical. **Use hazardous waste disposal sticker**
- Remove inventory barcode from the original container and affix it to the "Barcode Disposal" sheet
- Segregate according to compatibility
- Pack and handle appropriately
- Ensure the integrity of the container to prevent spill
- Attached the completed Hazardous Waste Disposal form

Deliver waste to the nearest pick-up point as per the established schedule (**Do not leave waste unattended)**

Biohazardous (solid, liquid, contaminated items)

- To be incinerated
- Can be internally treated

* **DO NOT AUTOCLAVE** toxic, volatile, or radioactive waste or sharp items

- Effectively, decontaminate through; autoclaving* or disinfection
- Double bag treated waste
- Label with "Treated Waste, Not Hazardous"
- Dispose of in regular garbage

- Securely bag waste
- Label with fully completed "Waste Material for Incineration". Weight of the bag should not exceed 20 kg
- Store at an appropriate temperature.
- Attached the completed Hazardous Waste Disposal form

Deliver waste to the nearest pick-up point as per the established schedule (**Do not leave waste unattended**)

Internal storage and control

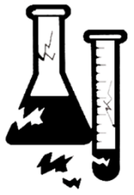
Radioactive (liquid, solid, vials, contaminated items)

- Fill Hazardous Waste Disposal Form and Radioactive Waste Label Form
- Pack radioactive waste in a labeled bag or container, as appropriate
- Keep the bag or container in a labelled radioactive pail
- Check for contamination on surfaces using a wipe test
- Complete Safe Transport of Radioactive Material form.

Note: All waste of this class must be pre-approved. Contact Radiation Safety Consultant (Radiation Safety)

Deliver any approved waste to the pick-up point as per the established schedule (**Do not leave waste unattended**)

Internal storage and control



Glassware

Cleaned or Non-contaminated

Collect in glass disposal boxes and dispose of in regular garbage

- Collect in a cardboard box
- Label the box with hazardous waste disposal sticker

Contaminated

Attached a completed Hazardous Waste Disposal form

Deliver waste to the nearest pick-up point as per the established schedule (**Do not leave waste unattended**)

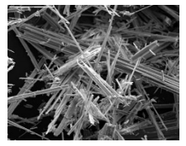
Contaminated Sharps

Collect in an appropriate container

Controlled Substances and Goods

Send a request to HS&W Office

Special pickup to be arranged by HS&W



Asbestos

Call FM Client Services at 83304 to arrange for asbestos disposal

May be only removed and packed by FM abatement Asbestos team

Electronics, Bulbs, and Batteries

- Tape off terminals of the batteries
- Segregate batteries by type
- Drop off at approved recycling locations on campus:
  - Siebens-Drake Research, Loading Dock, 1st Floor
  - Robarts Research Institute, Loading Dock, 1st Floor
  - Biological & Geological Sciences, Loading Dock, Ground Floor
  - North Campus Building, Loading Dock, Ground Floor
  - Medical Sciences Building, Room m003, Basement
  - Chemistry Building, Loading Dock, Basement
  - Spencer engineering Building, Loading Dock, Ground Floor
  - Support Services Building, Atrium, 4th Floor
  - Social Science Centre, Loading Dock, 1st Floor
  - Physics & Astronomy Building, Loading Dock, 1st Floor

Offsite treatment and recycle, reuse or disposal through accredited 3rd party

Appendix B: Hazardous Waste Disposal Form

The Hazardous Waste Disposal Form is available as a fillable form. Below is a screenshot of the form.

Western

Date: _____

HAZARDOUS WASTE DISPOSAL FORM

1) Source:

Bldg: _____ Room: _____ Lab Supervisor: _____

Submitted by: _____ Phone: _____

2) Package Contents: (check all that apply)

Physical Forms: Solid ☐ Liquid ☐ Gas ☐

Container Materials: Plastic ☐ Glass ☐ Metal ☐ Other: _____

Hazards: Flammable ☐ Oxidizer ☐ Corrosive ☐ Toxic ☐ Air/Water Reactive ☐

Biohazard ☐ Name of organism: _____

Disinfection?

YES, Autoclaved (each container tagged with 'Treated Biomedical Waste')

YES, Chemical (indicate chemical used_____)

NO, Bag must have Western Incinerator label with appropriate coloured tape

Radioactive ☐ Attach "Safe Transport of Radioactive Material Form"

3) Individual containers: Please note that each individual container in the package must have a label listing its contents (including water) in order of decreasing concentration. These labels are available from Western Health & Safety.

ITEM#	DESCRIPTION OF CONTENTS	CONTAINER SIZE
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Special Handling/Warnings: _____

Pick-up Location	Pick-up Time	Pick-up Location	Pick-up Time
Siebens-Drake Research Loading Dock	9:00 am	Medical Sciences - Room M003 (basement)	10:15 am
Robarts Research Institute	9:25 am	Chemistry Building Loading Dock	10:55 am
Biological & Geological Sciences Loading Dock	9:40 am	Engineering Sciences Loading Dock	11:30 am
North Campus Building Loading Dock	10:00 am		

May 2021

Chemical Storage Flowchart

Explosive or shock sensitive — YES → product covered by Explosives Regs e.g. black powder — YES → Secure / limit access to product - follow Explosives Regulations

product covered by Explosives Regs e.g. black powder — NO → Limit access to product Segregate from incompatible chemicals

Explosive or shock sensitive — NO → Highly reactive e.g. t-butyl lithium, lithium aluminium hydride, metallic sodium — YES → Water reactive — YES → Store in a specific cabinet away from sprinkler and potential source of water - segregate Reducers and Oxidizers in different secondary containers

Water reactive — NO → Air sensitive / pyrophoric — YES → Store under nitrogen and refer to SDS requirements

Air sensitive / pyrophoric — NO → Reducer — YES → Segregate from Oxidizing agents, use secondary containers

Reducer — NO → Oxidizer — YES → Segregate from Reducing agents, use secondary containers

Highly reactive e.g. t-butyl lithium, lithium aluminium hydride, metallic sodium — NO → Gas — YES → Highly toxic — YES → Store in ventilated cabinet / may require special ventilated gas cabinet e.g. K size cylinder of arsine

Highly toxic — NO → Flammable — YES → Segregate from Oxidizer gases Store in ventilated area

Flammable — NO → Inert - store in ventilated areas (e.g. normal lab ventilation)

Gas — NO → Flammable solid — YES → Organic — NO → Store in a specific cabinet away from sunlight and potential source of heat

Organic — YES → Store in flammable storage cabinet

Flammable solid — NO → Flammable / combustible liquid — YES → Store in flammable storage cabinet

Flammable / combustible liquid — NO → Corrosive — YES → Acid — YES → Mineral e.g. HCl, HNO3 — Oxidizer — YES → Store in corrosive cabinet for acids - segregate from organic acids and reducing agents

Oxidizer — NO → Store in corrosive cabinet for acids

Mineral e.g. HCl, HNO3 — Organic e.g. glacial acetic acid — Flammable/ Combustible — YES → Store in flammable storage cabinet

Flammable/ Combustible — NO → Store in corrosive cabinet - segregate from oxidizers

Corrosive — NO → Toxic — YES → Volatile — YES → Store in ventilated or closed cabinet

Volatile — NO → Store in chemical storage cabinet or open shelving - segregate inorganic from organic substances, oxidizers from reducers

Toxic — NO → Non hazardous product → Stored in open shelving

Acid — NO → Base — YES → Mineral ex: NaOCl, KOH — Oxidizer — YES → Store in corrosive cabinet for bases - segregate from organic bases

Oxidizer — NO → Store in corrosive cabinet for bases

Base — YES → Organic — Flammable / combustible — YES → Store in flammable storage cabinet - segregate from organic acids

Flammable / combustible — NO → Store in corrosive cabinet for bases - segragate from oxidizer bases

WHMIS 2015

Explosive
Self-reactive (severe)
Organic peroxide (severe)

Oxidizer

Irritation (skin or eyes)
Skin sensitization
Acute toxicity
Specific target organ toxicity

Acute Toxicity (fatal or toxic)

Carcinogenicity
Respiratory sentisitization
Mutagenic
Specific target organ toxicity

Corrosive to metal
Serious eye damage
Skin corrosion

Flammable
Pyrophoric
Organic peroxide
Self-reactive
Self-heating
In contact with water, emits flammable gases

Gas under pressure

Western

October, 2024

Note:
WHMIS pictograms do not provide all information for storage. Refer to Section 7 of SDS for the necessary information for storage compatibility.

Chemical compatibility is an important factor when handling chemicals and packaging chemical wastes

STANDARD OPERATING PROCEDURES FOR AUTOCLAVING

Human Resources Health, Safety and Well-being
Western University, August 2024

Western

DO NOT autoclave liquids containing bleach, formalin or glutaraldehyde

1. **CHECK THAT STEAM IS ON**

2. **CHECK THAT JACKET TEMPERATURE HAS REACHED 121^0 C**

3. **CHECK CYCLE TYPE** - Liquids or dry goods?
   Liquids need slow venting to avoid boiling
   Do not process dry goods with liquids

4. **SET CYCLE TIME OR SELECT PRE-SET CYCLE** - previously verified by biological ampoules

5. **LOAD AUTOCLAVE CORRECTLY**
   Liquid containers MUST be inside a container to hold entire contents
   Bags MUST be placed in a plastic tray
   Bags should be loosely sealed or open

6. **CLOSE AUTOCLAVE DOOR**
   If applicable, ensure that radial arms engage firmly - do not wrench

7. **START CYCLE**
   Wait until autoclave reaches 121^0 C. The autoclave may then be left unattended until the end of the cycle. If steam is leaking from the door, abort cycle, re-close and tighten door further.

8. **AT COMPLETION OF CYCLE**
   Ensure that the pressure in the chamber is zero before opening door
   Stand behind door and loosen radial arms slowly
   Crack door open and wait for steam to dissipate before opening door wide
   Use insulated gloves to remove goods
   Use CAUTION when removing liquids.
   Ensure that the liquids have cooled so that flashing does not occur

9. **SPILLS AND BREAKAGE IN AUTOCLAVE**
   Remove pan containing spilled contents. Remove broken glass with tongs
   Re-autoclave spilled or broken items before disposal

Departmental Autoclave Contact: _____ **Western Ext.:**_____

Autoclave Cycle Verification and Validation Testing Using Biological Indicator Ampoules

Human Resources Health, Safety and Well-being
Western University, August 2024

Autoclave Verification: periodic test for decontamination to detect process or equipment failures. Frequency performed largely depends on the frequency of use of the autoclave and is determined by a local risk assessment

Autoclave Validation: more stringent than verification, intended to test the efficacy of the decontamination process under more challenging conditions. Uses representative loads consisting of the maximum quantity of material and is performed prior to initial use, **annually**, and following repairs/ modifications to the autoclave

INSTRUCTIONS:

1 Place ampoules in waste load

1.1 Solid waste: place ampoule in the middle of the contents but not in contact with contaminated material

1.2 Liquid waste: (e.g. Flasks containing liquid) ampoule must be suspend in such a way that the ampoule is not in the liquid

2 Perform autoclave run

Run load as per Standard Operating Procedures for Autoclaving

3 On completion of autoclave cycle

3.1 Retrieve the ampoules from waste and allow to cool

3.2 Follow instructions on Verify™ Wall Chart

3.3 Incubate at 55 – 59° C, for 24 hours (minimum).

Important Note: A control ampoule (an ampoule that has not been autoclaved) MUST be incubated with test ampoules.

4 Check the results

After 24 hours, check for a color change in ampoules. Refer to Verify™ Wall Chart to determine if positive or negative growth has occurred.

4.1 Negative growth in test ampoule: autoclaved waste can now be discarded as non-hazardous waste

4.2 Positive growth in test ampoule: autoclaved waste NOT to be thrown out. The waste must be re-autoclaved for a longer cycle time and must be re-tested with ampoules, using the procedures above, until a negative test is reached

4.3 Control ampoule: must show positive growth, if it does not, check the expiry date of the ampoules. Re-test the waste before discarding

5 Keep the records

5.1 Document test parameters and results on Biomedical Waste Decontamination record (provided)

5.2 Save cycle printout (if available)