LABORATORY HAZARDOUS WASTE

MANAGEMENT MANUAL

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1.0 INTRODUCTION

A variety of hazardous wastes may be produced at the University and College from research and teaching laboratories. The University and College are committed to the proper and safe management of these wastes in order to protect employees, students and the public and to comply with all applicable legislation.

. This manual and the procedures contained herein apply to all laboratory operations within the University and College which generate hazardous chemical, biological, radioactive or sharp wastes. The objective of the manual is to provide information and instructions to handle safely, and in an environmentally responsible manner all the hazardous wastes produced in University and College laboratories.

The basic elements of the Hazardous Waste Management program are:

- Waste minimization
- Packaging requirements
- Labeling requirements
- Storage requirements

Waste generators are responsible for proper identification, segregation, packaging and labeling of all hazardous wastes which originate from their operations.

The procedures in this manual are mandatory when preparing waste for disposal. Waste not prepared according to these procedures will not be accepted for disposal by the University and College.

2.0 GENERAL REQUIREMENTS

2.1 Legislation

The proper handling, transport and disposal of hazardous wastes are governed by a variety of provincial and federal legislation and local by-laws These include:

- Ontario Environmental Protection Act
    - Air Pollution – General regulation
    - Waste Management – General regulation
    - Waste Management – PCB regulation
    - Guideline C-4. The Management of Biomedical Waste in Ontario

- Transportation of Dangerous Goods Act (Federal)

- Environmental Protection Act (Federal)

- Environmental Contaminants Act (Federal)
    - Guidelines for the Management of PCB Wastes

- Nuclear Safety and Control Act (Federal)
    - Packaging and Transport of Nuclear Substances regulation
    - Canadian Nuclear Safety Commission Regulatory Guides

- Pest Control Products Act (Federal)

- Pesticides Act and regulations (Ontario)

- City of Oshawa By-Law 95-95 “To regulate the discharge of water and waste into the public storm sewer system”.

2.2 Responsibilities

2.2.1 Waste Generator and Laboratory Supervisor

(1) Preplanning experiments to include provisions for handling of hazardous wastes generated as a result of the work;
(2) Preplanning experiments to minimize the amounts of waste generated;
(3) Identifying, classifying and segregating wastes according to the procedures outlined in this manual;
(4) Proper packaging of the wastes according to the procedures outlined in this manual;
(5) Proper labeling of the wastes and maintenance of the records required by this manual;
(6) Safely storing the wastes in the laboratory or other appropriate area according the procedures outlined in this manual;
(7) Identifying to their local waste coordinator, the need for pickup and disposal of hazardous waste.
(7) Safely transporting the wastes to the designated pickup locations according to the procedures and schedules outlined in this manual; and
(8) Promptly disposing of unwanted materials so that they do not accumulate in the laboratory.

2.2.2 Hazardous Waste Coordinators

The Hazardous Waste Coordinators for the University and College are listed in Appendix 2. They act as a local resource to coordinate waste pick-up and disposal and provide assistance in interpreting the requirements of this manual and in dealing with unusual wastes. They have the following responsibilities:

(1) Receive the waste at the central storage or pick-up location and ensure that it is properly labeled and the classifications are accurate.
(2) Retain the “Waste Collection Inventory” forms as a record of the generator and the types and quantities of wastes.
(3) Review the waste inventory and coordinate with the other waste coordinators the pickup of the waste by the external contractor.
(4) Enter the required information into the chemical waste database.
(5) Sign copies of the waste manifest as completed by the disposal contractor and forward them the appropriate authority for final authorization.

2.2.3 The University and College

(1) Arranging for external contractors to pick up and properly dispose of hazardous wastes;
(2) Providing waste generators and laboratory workers with appropriate procedures for managing hazardous wastes;
(3) Verifying compliance and enforcing the use of the appropriate procedures;
(4) Auditing the effectiveness of the hazardous waste management program.
(5) Funding the costs of disposal of hazardous wastes.

2.3 Waste Minimization

Disposing of hazardous wastes is very costly. It is therefore very important the waste generators take all reasonable steps to minimize the generation of hazardous wastes. The following steps should be actively considered at all times.

2.3.1 Purchasing

- Purchase hazardous materials in the smallest quantities needed. Stockpiling hazardous materials creates additional problems with respect to security and usually results in excessive disposal costs for unused material.
- Donations in bulk of hazardous materials should be avoided. This can result in the receipt of unwanted hazardous materials with the resultant liability for costly disposal. Accept only those donations which will be used within one year. Due to regulatory requirements, donations involving radioactive materials or biological agents will require prior approval from the UOIT Radiation Safety Committee or and the Biosafety Committee.
- Before purchasing chemicals, prepare a written procedure detailing the method of disposal of the chemical and any reaction products.

2.3.2 Process Modification

- Examine experimental protocols to, if possible, eliminate materials that would result in the generation of hazardous wastes, or would generate the least hazardous product.
- Review experimental protocols to determine whether quantities of hazardous materials can be reduced by, for example, use of microscale methods.

2.3.3 Product Substitution

- Evaluate experimental protocols to determine if a less hazardous material may be used. e.g.

    - Toluene substituted for benzene
    - A thermocouple thermometer instead of a mercury thermometer
    - Alcohol thermometers instead of mercury thermometers
    - Non-flammable liquid scintillation cocktails instead of flammable ones
    - Short-lived radionuclides instead of longer-lived ones
    - non-radioactive DNA labeling instead of radioactive DNA labeling.

2.3.4 Good Laboratory Practices

- Plan for hazardous waste disposal as part of all experimental protocols.
- Record the date on all containers when they are received so that older ones can be used first.
- Avoid storing excessive quantities of hazardous materials.
- Ensure that all containers are properly labeled with the proper scientific name of the material. Unused materials must follow the WHMIS requirements. Waste materials do not require WHMIS labeling, but they must be labeled according the requirements in this manual.

- Do not mix hazardous with non-hazardous products. Such mixed materials must be disposed of as hazardous waste thereby increasing costs.
- Do not mix solid and liquid waste; the disposal methods for the two are different and mixing them may increase costs.
- On termination of a research project ensure all hazardous materials and containers are labeled and those no longer required are disposed of.

Remember, all containers of hazardous waste must be identified with the materials they contain. Unknowns will not be accepted by contractor for disposal.

It is extremely expensive to dispose of unknown materials and the costs to analyze and dispose of such material will be charged back to the generator.

2.4 Packaging

Waste materials must be packaged in a manner that will allow them to be stored or transported without the danger of spillage, explosion of hazardous vapours escaping.

The detailed requirements for the different categories of waste materials are given in the appropriate sections of this manual.

The waste generator bears the primary responsibility for proper packaging.

Any hazardous waste that is improperly packaged will not be accepted for disposal.

2.5 Labeling

Waste materials must be labeled in a manner that will allow the hazards to be clearly and accurately identified. **Any unlabeled containers will not be accepted for disposal and the generator will bear the cost of identifying the material prior to disposal.**

- Appropriate waste labels must be attached to each waste container (See Figure 1);
- An accurate inventory must be maintained of the material being added to each waste container using the appropriate label.

2.6 Storage

- Containers must be in good condition and should remain closed unless waste is being added.
- Hazardous waste must be stored in a safe location outside of the normal work area of the laboratory;
- Hazardous waste should be removed from the laboratory on a regular basis and not allowed to accumulate;
- Liquid hazardous waste containers stored in laboratories should be periodically inspected for leaks;

2.7 Disposal

- Hazardous materials must never be disposed of in the regular garbage. Such practice is dangerous and illegal.

- Hazardous materials must not be flushed down drains as a method of disposal. This practice is illegal according to provincial legislation and the by-laws of the Regional Municipality of Durham. It may also lead to dangerous reactions, damage to the drainage system, dissemination of odours to other areas of the building and create a potential hazard to personnel working on the system.

2.8 Releases to Sanitary Sewer

The following are specifically prohibited from discharge to the sanitary sewer system:

- pH less than 6.0 or greater than 10.5;
- two or more separate liquid layers;
- a temperature greater than 60 degrees Celsius;
- total mercury greater than 0.01 mg/L;
- acute hazardous waste chemicals;
- combustible liquids;
- fuel;
- dyes or colouring materials which could pass through a sewage works and discolour the sewage works effluent;
- hazardous waste chemicals;
- ignitable waste;
- pathological waste;
- pesticides;
- reactive wastes;
- severely toxic waste;
- PCBs;
- Radioactive waste, unless in accordance with a license issued by the Canadian Nuclear Safety Commission

Table 2.1 lists discharge limits into the sanitary sewer for a number of parameters as set out by the Regional Municipality of Durham By-law 41-2009. Note that it is prohibited to deliberately add water to the discharge for the purposes of dilution in order to meet these limits.

Table 2.1 – Limits for Sanitary Sewer Discharge

Parameter	Limit (mg/L)	Parameter	Limit (mg/L)
Biochemical Oxygen Demand	300	Benzene	0.01
Cyanide (total)	2	Chloroform	0.04
Fluoride	10	1,2-dichlorobenzene	0.05
Total Kjeldahl Nitrogen	100	1,4-dichlorobenzene	0.08
Oil & Grease – Animal & Vegetable	150	cis-1,2-dichloroethylene	4
Oil & Grease – Mineral & Synthetic	15	trans-1,3-dichloropropylene	0.14
Phenolics (4AAP)	1	Ethyl benzene	0.16
Phosphorus (total)	10	Methylene chloride	2
Suspended solids (total)	350	1,1,2,2-tetrachloroethane	1.4
Sulphates	1500	Tetrachloroethylene	1
Aluminum (total)	50	Toluene	0.27
Antimony (total)	5	Trichloroethylene	0.4
Arsenic (total)	1	Xylenes (total)	1.4
Cadmium (total)	0.7	Di-n-butyl phthalate	0.08
Chromium (total)	2	Bis(2-ethylhexyl) phthalate	0.012
Cobalt (total)	5	Methyl Ethyl Ketone	8
Copper (total)	3	Styrene	0.2
Lead (total)	1		
Manganese (total)	5	PCBs	0.001
Molybdenum (total)	5		
Nickel (total)	2	Nonylphenols	0.02
Selenium (total)	1	Nonylphenol ethoxylates	0.2
Silver (total)	5		
Tin (total)	5		
Titanium (total)	5		
Zinc (total)	2		

Regional Municipality of Durham By-law 43-2004 as amended by By-law 41-2009.

3.0 CHEMICAL WASTES

Chemical wastes are collected for disposal by a licensed chemical waste contractor as required. The generator is responsible for contacting their local waste coordinator to identify the need for a waste pickup and for bringing the waste to the central collection location at a specified date and time. At that time the waste will be inspected and, if appropriately packaged and labeled, accepted for disposal.

Any waste not appropriately packaged and labeled will not be accepted for disposal and the generator will be required to return it to their laboratory.

Chemical wastes must be kept in the generating laboratory or other designated storage area in a safe location between scheduled pickups. If material is generated which requires special handling or immediate disposal contact the local Waste Coordinator (see Appendix 2)

3.1 Definition

Generally, waste is defined as any surplus, unneeded or unwanted material. It is usually the laboratory worker or supervisor who decides whether to declare a given laboratory material a waste.

Note that if a chemical is not a waste, then the WHMIS requirements apply. Once the material has been declared a waste, then the waste labeling and storage requirements outlined in this manual apply.

Chemical waste includes solids, liquids or gases containing or contaminated with any of the following:

- Flammable or combustible liquids (organic solvents)
- Corrosives (strong acids and bases)
- Reactives (oxidizers, cyanides, sulphides, explosives, unstable materials, water reactive materials)
- Toxic materials (mutagens, carcinogens, acutely toxic materials)
- Polychlorinated biphenyls (>50 ppm concentration)
- Leachate toxic materials (heavy metals, pesticides)
- Non returnable gas cylinders

3.2 Packaging

- Wastes must be stored in containers which are compatible with the material stored. For example corrosive materials should be stored in glass or plastic containers, not metal ones. Hydrofluoric acid must not be stored in glass containers.

- Do not completely fill containers of liquid waste. Leave between 20-25 % of air space to allow for vapour expansion and to reduce the potential for spills when moving containers.

- Compatible wastes can be accumulated within a common container, however care must be taken to ensure that the chemicals are compatible.

- **Never mix incompatible chemicals together in a single container. This has the potential to cause heat generation, gas evolution or other reaction and a subsequent explosion.**

- Flammable and combustible solvents shall be segregated and packaged separately into two categories:

    - Halogenated solvents
    - Non-halogenated solvents

  The two should not be mixed as there is a premium cost for disposal of halogenated solvents.

- Solvent safety cans should be used to collect and temporarily store large volumes (>10-20 L) of flammable organic waste solvents. The generating laboratory is responsible for providing these containers and they will be returned to the laboratory when the material is bulked at the time of waste collection.

3.3 Labeling

Attach a Chemical Waste Label directly to each waste container. These labels are available from UOIT Chemical Stores or from the Waste Coordinators.

All information requested on the label must be provided. Chemical generic names of the chemicals must be listed. No abbreviations, acronyms or trade mark names are to be used. Vague categories such as “solvent waste” are not acceptable.

See Figure 1 for an example of the chemical waste label.

3.4 Storage

In addition to the general storage requirements, these specific requirements for chemicals must be followed:

- Chemical waste is to be stored in a safe, out-of-the-way location in the generator’s laboratory or other designated area between scheduled collection days.
- Flammable solvents should be stored in a flammable storage cabinet. If circumstances require that they be stored in fumehood, they should be limited to small amounts and be kept in a location such that they do not interfere with work in the fumehood or obstruct the airflow and decrease the fumehood efficiency.
- Waste should be segregated according to compatibility groups such as acids, bases, flammables, oxidizers and water reactives.
- Dispose of aging containers promptly. Some chemicals are time sensitive and may degrade into very hazardous by-products. e.g. ethers may degrade to form explosive organic peroxides. Where safety considerations would indicate not waiting until the scheduled collection day, contact the local Waste Coordinator.

FIGURE 1 – CHEMICAL WASTE LABEL

Durham College ☐
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CHEMICAL WASTE

Name of Generator | ID#

Building and Room Number | Phone #

Major Chemical Constituents | Approximate %

NO SHARPS, BIOHAZARDS OR RADIOACTIVES

Check the appropriate boxes

☐ Halogenated Solvents
☐ Non-halogenated Solvents
☐ Unstable/Explosive
☐ Air/Water Reactive
☐ Other (specify)

☐ Acid
☐ Alkali
☐ Aqueous Inorganic
☐ Organic Peroxide

WASTE WILL NOT BE ACCEPTED IF THIS LABEL IS INCOMPLETE

3.5 Chemical Compatibility

When preparing chemical waste for disposal it is the generator's responsibility to ensure that incompatible chemicals are not mixed in the same container. The first step in determining chemical incompatibilities is to review the Material Safety Data Sheet where incompatibilities will be listed in the section on reactivity.

Some general examples are:

- Acid-reactive compounds (e.g. cyanides, sulphides) which liberate gaseous products when acidified should not be mixed with any inorganic acid (e.g. sulphuric or hydrochloric acid).
- Organic acids (e.g. glacial acetic acid) should be segregated from inorganic acids. Generally inorganic acids are oxidizing agents while some organic acids may be either reducing agents or combustible.
- Water reactive materials (e.g. sodium, potassium) should be kept well away from any water sources.
- Oxidizers (i.e. any inorganic compound that assists fire such as hydrogen peroxide, lead nitrate) should never be mixed with organic materials (e.g. organic bases such as pyridine, aniline, amines, flammable solvents such as toluene, acetone) or reducing agents (e.g. water-reactive chemicals such as sodium).
- Perchloric acid, although an inorganic acid, is a powerful oxidizing agent and should be considered a powerful oxidizer in its concentrated form.

Appendix 1 of this manual provides a table giving general classes of incompatible chemicals. For specific chemicals, consult the material safety data sheet.

3.6 Special Cases

The preceding procedure deals with most common teaching and research chemical wastes. On occasion some wastes may be generated which require special handling. Some of these are:

3.6.1 Asbestos

Asbestos containing materials such as gloves, heating pads etc. should be placed in a plastic bag, sealed, and marked "asbestos containing waste". Asbestos waste must be managed according to the requirements of Ontario Regulation 347 - General Waste Management under the Environmental Protection Act.

Contact the local Waste Coordinator to arrange disposal.

3.6.2 Explosives

Do not handle explosive materials. Examples of explosive materials include trinitrated compounds, dry picric acid (<29% by weight water content), fulminated mercury, heavy metal azides. These materials require special handling for disposal. These materials must be checked frequently for signs of deterioration and aging. Such signs include "sweating" of a container, bulging, crystal formation around the cap. Deteriorating explosive materials are potentially more dangerous to handle than new explosives.

Contact the local Waste Coordinator to arrange disposal.

3.6.3 Gas Cylinders

Gas cylinders should be treated as high energy sources. Use the smallest size necessary to do the work. Prior to purchasing, check if empty cylinders can be returned to the supplier. Disposing of gas cylinders is extremely expensive and difficult.

3.6.4 Mercury

All free liquid mercury should be collected in a leak-proof container. Mercury contaminated solids such as glassware, gloves and cleanup materials should be packaged separately.

3.6.5 Peroxidizable Compounds

Peroxidizable compounds should be ordered in small quantities (less than 6 months' supply) and dated when the container has been opened. Even if a commercial inhibitor has been added by the manufacturer, organic peroxide formation can begin within 6 months following exposure to air. Organic peroxides are explosive. The ordering of smaller quantities and the reduction of the volume of these materials in storage encourages the quick turnover of inventory and reduces the likelihood of peroxide formation.

The following materials have the potential to form organic peroxides:

- Ethers such as Isopropyl ether, dimethyl ether, diethyl ether
- Acetal
- Decahydronapthalene
- Dicyclopentadiene
- Diethylene glycol
- Dioxane

3.6.6 Polychlorinated Biphenyls (PCBs)

The handling of PSC contaminated material requires special consideration for handling, storage and disposal. In Ontario, any waste material with a concentration of PCBs in excess of 50 ppm is considered to be PCB-contaminated. Sources of PCBs include transformers containing askarels. PCBs were also used in capacitors, hydraulic equipment, electromagnets, heat transfer equipment and vapour diffusion pumps.

If material is suspected to contain PCBs it should not be mixed with other wastes. For testing of the material, contact the local Waste Coordinator.

3.7 Collection Schedules

Collection and disposal will be arranged by the Waste Coordinators as required. There will normally be at least two scheduled collections per year, at the end of the fall term in December and the end of the spring term in May.

Special pickups may be arranged by contacting the local Waste Coordinator.

4.0 BIOHAZARDOUS WASTES

4.1 General

Materials contaminated with hazardous biological agents must be collected in the appropriate containers and sterilized or disinfected before disposal.

The following general principles must be followed with respect to the generation and disposal of hazardous waste:

(1) Minimize the generation of hazardous waste by reducing, reusing and recycling where possible.
(2) Segregate biohazardous and non-biohazardous waste at the point of generation.
(3) All biohazardous waste must be rendered harmless by either chemical decontamination or heat sterilization before disposal.
(4) Steam sterilization is generally not recommended for laboratory waste contaminated with or containing a combination of viable **biological** agents and significant amounts of hazardous **chemical** or **radioactive** materials.

Biological waste includes:

- liquids such as used cell culturing media, supernatant, blood or blood fractions (serum), etc., which contain viable biological agents;
- materials considered pathological, including any part of the human body, tissues and bodily fluids, but excluding fluids, extracted teeth, hair, nail clippings and the like that are not infectious;
- any part of an animal infected [or suspected to be infected] with a communicable disease;
- non-sharp, solid laboratory waste (empty plastic cell culture flasks and petri dishes, empty plastic tubes, gloves, wrappers, absorbent tissues, etc.) which may be, or is known to be, contaminated with viable biological agents;
- all sharp and pointed items used in medical care, diagnosis, and research, including the manipulation and care of laboratory animals, which should be considered potentially infectious;
- laboratory glassware which is known or suspected to be contaminated with hazardous biological agents.

4.2 Packaging and Treatment of Liquids

- Collect liquids in leak-proof containers such as flasks or bottles.
- Liquid waste containers designed to withstand autoclaving temperatures must be used when steam sterilization is utilized. To allow pressure equalization, they **should not be** sealed.
- Containers of liquid waste must be placed into an autoclavable tray or pan of sufficient capacity to contain all liquid in the event of vessel failure or breakage inside the autoclave chamber. Use extreme caution when handling autoclaved liquids since they are hot and may boil over.
- Following steam sterilization, innocuous liquids may be disposed of via the laboratory drainage system. Flush with sufficient clean water to purge the drain immediately after disposal of all liquids.

NOTE: If the liquid contains hazardous chemicals or radioactive material, it may not be disposed of via the laboratory drainage system. In this case the liquid should be disposed of as either radioactive or chemical waste as the case may be.

4.3 Packaging and Treatment of Solids

- Non-sharp, solid laboratory waste (empty plastic cell culture flasks and petri dishes, empty plastic tubes, gloves, wrappers, absorbent tissues, etc.) which may be, or is known to be, contaminated with viable biological agents should be collected in autoclavable bags. These plastic bags display the biohazard warning symbol and are available from Fisher Scientific.
- Autoclavable bags of solid waste should be closed but not sealed airtight to allow steam penetration before they are placed into the autoclave chamber. After autoclaving and cooling, these bags of autoclaved waste must be placed into a black plastic garbage bag which will conceal the biohazard symbol which is no longer applicable.
- For laboratories generating large volumes of **agar gel** in disposable petri dishes and tubes requiring sterilization, such waste should be collected in a white plastic 20 litre pail in the laboratory. Autoclavable bags filled with plasticware containing agar gel tend to leak fluids during and after the sterilization process. The pail will contain the liquids released by the agar gel. After autoclaving and cooling, the pail must then be placed beside other waste awaiting removal by caretaking staff.
- Do not pour melted agar into sink or floor drains. Allow it to cool and solidify for disposal as a solid waste.

Note: **Autoclavable bags should be used for solid, non-sharp, hazardous biological waste only and disposed of appropriately. They should not be used for the collection of other solid hazardous or nonhazardous waste that may require other treatment or disposal methods.**

4.4 Packaging and Treatment of Sharps

The term "***sharp***" is often used as a catch-all expression for any and all sharp or pointed items such as broken glassware, scalpel and razor blades, lancets, hypodermic syringes with needles, etc., which can cause cuts or puncture injuries. In this manual, sharp waste is subdivided into two categories:

- Needles and blades
- Glass and other sharp or pointed waste

4.4.1 Needles and Blades

Needle and blade waste is hypodermic, surgical, suture, or IV needles, syringes with needles, lancets, scalpels, blades and similar metallic sharp or pointed items for disposal that are capable of causing punctures, cuts, or tears in skin or membranes.

- according to the principles of universal blood and body fluid precautions, all needles and blades used in medical care, diagnosis, and research, including the manipulation and care of laboratory animals, should be considered potentially infectious. Needles and blades pose a risk to those who use them and needle and blade waste may pose a health risk to those involved in its handling, transportation, and disposal.

- All needle and blade waste for disposal must be carefully collected in an approved needle and blade waste container. These autoclavable, yellow plastic containers with a biohazard symbol must comply with CSA Standard Z316.6-95. They are available in different capacities and the laboratory should select the smallest size compatible with the size and amount of the waste being generated. The containers must be sized so that they can be placed into the autoclave and subsequently into a 20 litre pail for disposal. Examples of such containers are yellow plastic containers (B-D Guardian 300439, 300460, and 300466).
- If the needle and blade waste is contaminated with or contains viable biological agents, it must be treated to inactivate the biological agents. The designated yellow containers for needle and blade waste are autoclavable. The filled container may be steam sterilized along with other laboratory waste.

4.4.2 Glassware and Plasticware

Glassware and plasticware waste is any disposable intact or broken laboratory containers such as flasks, beakers, bottles; small glass containers, ampoules and tubes; glass and plastic pipettes and micropipette tips.

Where such waste is contaminated with biological agents it must be sterilized or disinfected prior to disposal.

- Glassware waste must not be placed into regular office garbage containers or plastic bags of solid waste.
- Do not put laboratory glassware into the general recycling bins. Its composition may differ from that of recyclable glass containers.
- Glassware for disposal must be placed into a cardboard container after any necessary disinfection or decontamination. The glassware must be fully enclosed by the cardboard container.
- The cardboard container must be closed, taped shut and labeled **"GLASS for DISPOSAL- CAUTION"**.
- The sealed labeled cardboard container may be placed beside other waste awaiting removal by building service workers. Laboratories using large amounts of bottled cell culturing media and animal serum should reserve the divided shipping carton, repack it with the empty bottles, clearly label the carton as "**GLASS FOR DISPOSAL - CAUTION**", and place it beside other waste awaiting removal.

4.5 Labeling

- Once the waste has been decontaminated no special labeling is required unless the material contains hazardous chemicals or radioactive materials..
- The biohazard warning symbol should be removed or covered once the material has been sterilized. Yellow plastic bags should be placed in black garbage bags so that the yellow is not visible.
- Caretaking staff will remove unlabelled black garbage bags.
- Caretaking staff will not remove bags of waste displaying the biohazard warning symbol and will not remove bags of solid waste containing glass or sharp objects

4.6 Special Pick up and Disposal of Untreated Biological Laboratory Waste

- Where on-site functioning autoclaves (steam sterilizers) are not available and the conventional use of chemical disinfectants for the inactivation of hazardous biological agents in laboratory waste is not practicable or not efficacious, other waste handling and disposal methods must be considered.
- To provide another alternative, the University has negotiated a contract with a commercial firm which is licensed to remove and transport biologically contaminated laboratory waste to a designated disposal site. The cost of this service is passed on to the principal investigator of the laboratory generating this waste. To arrange a special pick up, contact the local Waste Coordinator.

5.0 RADIOACTIVE WASTES

Radioactive wastes require special handling and must never be mixed with other wastes.

There two methods of dealing with radioactive wastes:

1. Radioactive materials with short half-lives (i.e. of the order of 90 days or less) are held in storage until the amounts of radioactivity have decayed below the levels approved for release to landfill.
2. Radioactive materials with long half-lives for which storage is not feasible must be sent to Atomic Energy of Canada Limited for disposal.

   The latter is very expensive and hence every effort should be made to use radioisotopes of half-lives less than 90 days and to minimize the amount of radioactive material being used.

Procedures for disposal of radioactive waste are provided in the UOIT Radiation Safety Manual and specific requirements are outlined in the Radioisotope Permit issued to individual users.

5.1 Liquid Scintillation Counting Vials

Liquid scintillation counting vials may contain both hazardous chemicals and low levels of radioactivity. These vials must be segregated and clearly marked for disposal. Vials must have caps that are securely fastened and the vials must not be leaking or show evidence of leaking. They should be placed in containers specifically identified for LSC vials only. The container must be such as to withstand normal handling and contain any potential leakage. LSC vials must not contain any viable biohazardous agents. Such agents must be inactivated prior to disposal.

Disposal methods for LSC vials will depend on the levels of radioactivity in the vial and the particular chemical cocktail used. Disposal procedures should be arranged with the Radiation Safety Officer before commencing any experiments. Disposal procedures will be specified as part of the radioisotope permit conditions.

The decision process for disposal of liquid scintillation counting vials is as follows:

1. Do not empty the vial. Keep the cap securely fastened.

2. If the vial contains viable biohazardous agents, inactivate the agents or dispose of as biohazardous material.
3. Determine if the activity in the vial is above or below the radioactive release criterion (see the Radiation Safety Manual). If the activity is above the release criterion then depending on the isotope, the vial is either stored until the material has decayed below the release criteria or disposed of as radioactive waste.
4. If the activity is below the radioactive release criterion, then the vial is disposed of as chemical waste.
4. LSC vials for disposal should be kept in a separate container, identified as "LSC vials for disposal". They should not be mixed with other biological, chemical or radioactive waste..

6.0 SHARP WASTES

The term "sharp" encompasses any and all sharp or pointed items which can cause cuts or puncture injuries. These are subdivided into two categories:

- Needle and blades
- Broken glassware and other sharp or pointed waste

Sharp waste must **never** be placed in office garbage containers, plastic bags or other containers other than the approved sharps containers.

6.1 Needles and Blades

Needle and blade waste includes hypodermic, surgical, suture or IV needles, syringes with needles, lancets, scalpels, blades and similar metallic sharp or pointed items for disposal that are capable of causing punctures, cuts or tears in skin or membranes.

6.1.1 Packaging

- All needle and blade waste for disposal must be carefully collected in an approved needle and blade waste container. These containers must comply with CSA Standard Z316.6-07 and must be colour coded:
    - yellow for biohazardous metal sharps, and
    - red for cytotoxic medical sharps and any other sharps requiring or intended for incineration

  They are available in different capacities and the laboratory should select the smallest size compatible with the size of the waste being generated.

- All liquids must be drained from disposable syringes before placing in the container. If the liquids contain hazardous biological or chemical agents or radioactive material, the liquids should be disposed of according the procedures for that agent.

- Where any potentially hazardous biological, chemical or radioactive material adhering to needles and blades is present in **trace amounts**, such needles and blades may be placed in the same container.

- The containers for needle and blade waste must not be filled beyond capacity in order to prevent injuries due to overfilling. Needles and blades must never be forcibly pushed into a container.

- Needles should not be recapped, purposely bent or broken by hand, removed from disposable syringes or otherwise manipulated by hand.

6.1.2 Treatment of Biologically Contaminated Needles and Blades

According to the principles of universal blood and body fluid precautions, all needles and blades which may have come into contact with human or animal blood or body fluids should be considered potentially infectious. If the needle and blade waste is contaminated with or contains viable biological agents it must be treated to inactivate the biological agents.

- The designated yellow containers for needle and blade waste are autoclavable and the container may be steam sterilized along with any other laboratory waste.

- Steam sterilization may not be appropriate for laboratory waste contaminated with or containing a combination of viable biological agents and significant amounts of hazardous chemicals or radioactive materials. Disinfection of such materials should be determined on a case-by-case basis in consultation with the Biosafety Officer.

- Chemical disinfection of needle and blade waste is generally not recommended since it requires additional handling, thereby increasing the potential risk of injury.

6.1.3 Treatment of Radioactively Contaminated Needles and Blades

- Needle and blade waste containing only trace amounts of radioactive material may be collected together in the same container as non-contaminated needles and blades. Liquids should be drained from disposable syringes (and the syringes rinsed if appropriate) before placing them in the sharps container. The liquids should be disposed of according the procedures for radioactive liquid waste.

- Needle and blade waste contaminated with significant quantities of radioactive material must be segregated into separate sharps containers and disposed of as radioactive waste. In this case the container must be clearly labeled to indicate that it is radioactive material giving the isotope, the activity, the date and permit number. Any chemical solvents must also be noted on the label.

6.1.4 Treatment of Chemically Contaminated Needles and Blades

- Needle and blade waste containing only trace amounts of hazardous chemicals may be collected together in the same container as non-contaminated needles and blades. Liquids should be drained from disposable syringes (and the syringes rinsed if appropriate) before placing them in the sharps container. The liquids should be disposed of according the procedures for liquid chemical waste.

- Needle and blade waste contaminated with significant amounts of hazardous chemicals may need to be chemically treated before disposal. In this case contact the appropriate waste coordinator.

6.1.5 Labeling

- The yellow container for the collection of needle and blade waste is normally supplied with an affixed standard biohazard warning symbol. In this case no additional biohazard warning label is required,

- If the yellow container is to be treated as radioactive waste, then a radioactive warning label must be affixed to the container.

- If the container contains hazardous chemical or radioactive waste, a waste tag must be completed and attached to the container listing the chemicals and the radioactive isotopes and the quantities.

6.1.6 Storage and Disposal

- The yellow sharps containers are to be kept in the laboratory until such time as they are full.
- They may be disposed of at the same time as the general chemical waste pickup.

6.2 Glassware and Plasticware

Glassware and plasticware waste is any disposable:

- intact or broken laboratory containers such as flasks, beakers, bottles;
- small glass containers, ampoules and tubes;
- glass and plastic pipettes and micropipette tips.

Where such waste might cause cuts or puncture injuries if improperly disposed of, the waste should be placed into cardboard boxes reserved for glassware and plasticware.

Plastic pipettes and micropipette tips can puncture a plastic garbage bag. Broken plastic pipettes in a plastic garbage bag may present an unnecessary risk of injury to persons handling the garbage. These items should be regarded as potentially sharp or pointed objects and placed into the cardboard boxes along with glassware.

Glass and plasticware waste must **never** be placed in office garbage containers, plastic bags or other containers other than the approved containers.

6.2.1 Packaging

Glassware and plastic must be free of chemical contamination, i.e.

- it must be rinsed to remove any chemical residue
- it must not contain liquid

Glassware and plastic must be packaged in the designated cardboard boxes.
The box must not be overfilled and must be able to be closed.

6.2.2 Biologically Contaminated Glassware

Biologically contaminated glassware and plastic ware must be sterilized or disinfected prior to disposal in the cardboard boxes. See section 4.4.2

6.2.3 Radioactively Contaminated Glassware

If after rinsing there is still residual contamination above the allowable limits, package and dispose of as radioactive waste as per section 5.

6.2.4 Chemically Contaminated Glassware

Rinse the glassware to remove all chemicals and dispose of as waste glassware.

6.2.5 Labeling

Label the cardboard box as **"GLASS for DISPOSAL- CAUTION"**.

6.2.6 Storage and Disposal

Properly sealed and labeled boxes should be set by the regular garbage for pick-up by the caretaking staff.

7.0 MIXED WASTES

Occasionally, laboratory waste may contain or be contaminated with a combination of biological, chemical and radioactive materials. This type of waste can pose a challenge for disposal and may have to be considered on a case-by-case basis.

As a general rule for such materials the biological hazard should be inactivated first by autoclaving or chemical disinfection.

- Steam sterilization is generally not recommended for waste containing significant quantities of chemicals or radioactive materials.
- Waste containing both chemical and radioactive waste will be treated as radioactive waste.

APPENDIX 1

CHEMICAL INCOMPATIBILITIES

The table presented in this Appendix provides some guidance in determining chemical incompatibilities. It is taken from the book *Prudent Practices in the Laboratory, Handling and Disposal of Chemicals*. National Academy Press, 1995.

When dealing with any specific chemical reference should be made to the material safety data sheet.

TABLE 1.1
CLASSES OF INCOMPATIBLE CHEMICALS

CLASS	INCOMPATIBLE WITH
Alkali and alkaline earth Carbides Hydrides Hydroxides Metals Oxides Peroxides	Water Acids Halogenated Organic Compounds Halogenating Agents Oxidizing Agents
Azides, inorganic	Acids Heavy metals and their salts Oxidizing Agents
Cyanides, inorganic	Acids Strong Bases
Nitrates, inorganic	Acids Reducing Agents
Nitrites, inorganic	Acids Oxidizing Agents
Organic Compounds	Oxidizing Agents
Organic Acyl Halides	Bases Organic Hydroxy and Amino Compounds
Organic Anhydrides	Bases Organic Hydroxy and Amino Compounds
Organic Halogen Compounds	Group IA and IIA Metals Aluminum
Organic Nitro Compounds	Strong Bases
Oxidizing Agents Chlorates Chromates Chromium Trioxide Dichromates Halogens Halogenating Agents Hydrogen Peroxide Nitric Acid Nitrates Perchlorates Perchloric Acid Permanganates Persulphates Sulphuric Acid	Reducing Agents Ammonia, anhydrous and aqueous Carbon Metals Metal Hydrides Nitrites Organic Compounds Phosphorus Silicon Sulfur

Reducing Agents	Oxidizing Agents Arsenates Arsenites Phosphorus Selenites Selenates Tellurium Salts and oxides
Sulphides, inorganic	Acids

APPENDIX 2

CONTACT PERSONS WITHIN THE UNIVERSITY AND COLLEGE

UNIVERSITY WASTE COORDINATORS

1. Faculty of Science

Ed Courville
Science Storesperson
Extension 3447

2. Faculty of Health Sciences Med Lab

Joanne Free
Laboratory Technologist
Extension 3283

3. Faculty of Energy Systems & Nuclear Science

Sharman Perera
Laboratory Specialist
Extension 3451

4. Faculty of Engineering

Hidayat Shahid
Manager, Technical Service
Extension 2791

5. Clean Energy Research Laboratory

Ed Secnik
Research Laboratory Manager
Extension 3483

6. Automotive Centre Excellence

Mary Thompson
Financial & Admin. Coordinator
Extension 5701

DURHAM COLLEGE WASTE COORDINATORS

1. School of Science & Engineering Technology (Oshawa)

Stacey Oberg
Lab Technologist (Biology)
Extension 2210

Amy Lewis
Lab Technologist (Chemistry)
Extension 2210

2. School of Applied Sciences, Apprenticeship, Skilled Trades & Technology (Whitby)

Anne Nippard
Technician
Extension 4043

3. School of Health and Community Services

Wendy Aspin-Curran
Nurse Technologist
Extension 2871

4. Facilities Management

Patrick Ferren
Manager of Operations, Physical Resources
Extension 2756

APPENDIX 3

CHEMICAL WASTE HANDLING PROCEDURE

PURPOSE

The purpose of this procedure is to ensure the proper handling and disposal of laboratory generated hazardous waste in compliance with government regulations.

RESPONSIBILITIES OF THE WASTE GENERATOR

1. The waste generator has the primary responsibility for proper identification, segregation and packaging of laboratory waste according to the Laboratory Hazardous Waste Management Manual and this procedure.

2. Identify the type of waste according to the attached flowchart.

3. Ensure that the waste is segregated into proper containers and each container labeled. Appropriate labels can be obtained from the waste coordinators.

4. Do not completely fill containers of liquid waste. Leave between 20 and 25% of air space to allow for vapour expansion and to reduce the potential for spills when moving containers.

5. Complete the form “Request for Waste Collection” This form must accompany the waste when it is transferred to the Local Waste Coordinator.

6. Contact the appropriate waste coordinator to arrange delivery of the waste to the designated central location.

RESPONSIBILITIES OF THE WASTE COORDINATORS

1. Receive the waste at the central pick-up location and ensure that it is properly labeled and the classifications are accurate.

2. Retain the “Request for Waste Collection” forms as a record of the generator and the types and quantities of wastes.

3. Review the waste inventory and coordinate with the other waste coordinators the pickup of the waste by the external contractor.

4. Enter the required information into the chemical waste database.

5. Sign and retain copies of the waste manifest.

UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY / DURHAM COLLEGE WASTE SORTING PROCESS

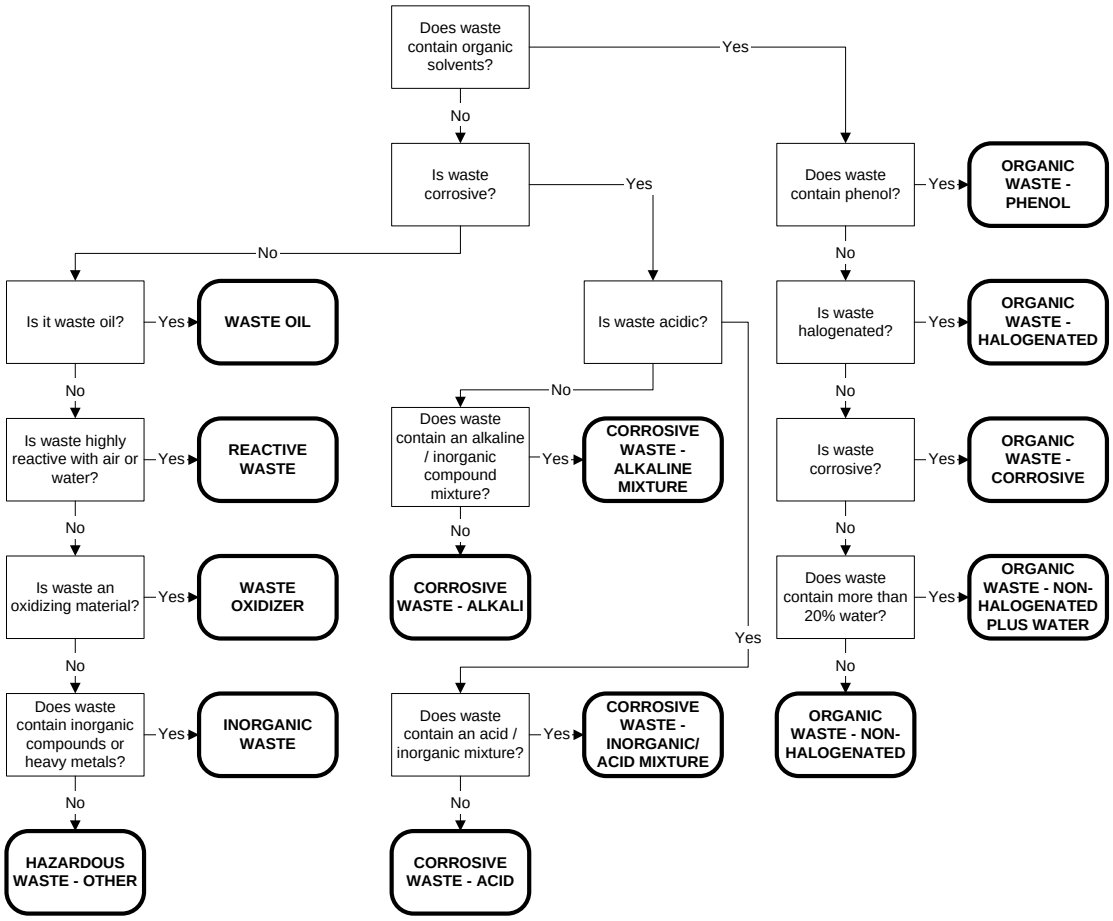

Table of Registered Ministry of Environment Waste Classifications

MOE Waste Class	Waste Class Name	MOE Waste Class	Waste Class Name
112-C	Corrosive acidic wastes	122-C	Corrosive alkaline wastes
131-L	Neutralized solutions containing heavy metals	145-H	Paint wastes and coatings
146-B	Inorganic sludges, slurries or solids	146-T	Inorganic sludges, slurries or solids
148-B	Miscellaneous waste inorganic chemicals	148-C	Miscellaneous waste inorganic chemicals
148-I	Miscellaneous waste inorganic chemcials	212-B	Aliphatic solvents and residues
212-L	Aliphatic solvents and residues	213-I	Petroleum distillates
232-L	Polymeric resins	241-B	Halogenated solvents and residues
242-A	Halogenated pesticides and herbicides	243-D	Polychlorinated biphenyls
252-L	Waste crankcase oils and lubricants	263-B	Miscellaneous waste organic chemicals
263-I	Miscellaneous waste organic chemicals	263-L	Miscellaneous waste organic chemicals
264-L	Photoprocessing wastes	264-T	Photoprocessing wastes
268-C	Amines	312-P	Pathological waste
331-I	Compressed gases including cylinders		

A = Acute Hazardous Waste Chemical
B = Hazardous Waste Chemicals
C = Corrosive
D = PCB Waste
H = Industrial Hazardous Waste
I = Ignitable
L = Liquid Industrial Waste
P = Pathological
T = Leachate Toxic

APPENDIX 4
WASTE COLLECTION INVENTORY FORM

PART 1 – TO BE COMPLETED BY THE WASTE GENERATOR

Name: _____

Faculty: _____

Location (Building and room #): _____

Telephone: _____

Date: _____

Waste Category (see list below)	Type of Container	Number of Containers	Physical State	List of Contents

List of Waste Categories

Halogenated Solvents
Non-halogenated Solvents
Aqueous Inorganic
Acid
Alkali
PCB
Air/Water Reactive
Unstable/Explosive
Other (list chemicals)

Originator's Signature: _____

Signature verifies that the above information is complete and accurate.

This form to be brought with the waste to the collection location.

PART 2 – TO BE COMPLETED BY THE WASTE COORDINATOR

Disposal Date: _____

Waste Manifest Reference #: _____

Waste Coordinator Signature _____