HAZARDOUS WASTE MANAGEMENT MANUAL

July 2014

Table of Contents

About this manual

This manual was prepared by UBC Risk Management Services (RMS) to provide UBC hazardous waste generators with information regarding pollution prevention and waste minimization, as well as detailed hazardous waste disposal procedures.

Section A – **Pollution Prevention and Waste Minimization** is a guideline document designed to support your waste minimization efforts and to promote the sustainable reduction of UBC's research footprint on the environment. This section is mostly geared towards research laboratories, since labs generate about 95% of the University's hazardous waste. However, these waste reduction measures are applicable to other operations that generate hazardous waste.

Section B – **Hazardous Waste Management** contains detailed procedures describing the appropriate methods for the disposal of hazardous waste.

Emergency Contact Information

Emergency Numbers UBC Campus

Fire, Police, Ambulance..... 911
First Aid (staff & faculty)..... 604-822-4444
UBC Hazardous Materials (HAZMAT) Response..... 911
BC Drug & Poison Information Centre..... 604-682-5050
Campus Security..... 604-822-2222
Building Operations Service Centre..... 604-822-2173
UBC Hospital Urgent Care (8am-10pm)..... 604-822-7222

Non-Emergency Numbers

UBC Risk Management Services..... 604-822-2029
Vancouver Fire Department Hall 10..... 604-665-6010
R.C.M.P. Non-emergency..... 604-224-1322
UBC Biosafety..... 604-822-9527
UBC Chemical & Radiation Safety..... 604-822-7052
UBC Emergency Planning..... 604-822-1237
UBC Environmental Services..... 604-822-9840
UBC Occupational Hygiene..... 604-822-6098
UBC Safety Programs..... 604-822-6513

Ensure all relevant emergency information (i.e. nature of emergency, building name and address, phone number, and exact location of the emergency in the building) is provided to the operator before hanging up.

Situations requiring immediate emergency response may include:

- First aid emergency
- Hazardous materials spill
- Bomb threat
- Fire
- Civil demonstration
- Natural disaster (e.g. earthquake, flood)

In the event of an emergency, contact the appropriate response agency (using phone numbers from this manual) and initiate response activities if it is safe to do so.

Section A – Pollution Prevention and Waste Minimization

1. Introduction

1.1 Pollution Prevention and Waste Minimization

UBC's Policy #6 (Environmental Protection Compliance) and Policy #9 (Hazardous Materials Management) among other commitments, require UBC's research community to adopt practices to prevent pollution and reduce the amount of dangerous substances in University research activities.

UBC has more than 400 laboratories across campus and all those research activities require a significant amount of energy, water and materials. Campus labs account for about 50% of the total energy consumption, about 25% of the total water consumption, and generate more than 95% of UBC's hazardous waste.

Waste minimization is any action that reduces the amount and/or toxicity of chemical wastes that must be shipped off-site for disposal as hazardous waste. Every member of the University's community needs to be aware of the environmental and financial impacts of hazardous waste and to actively seek to minimize the amount of waste generated. The success of the University's Waste Minimization efforts is dependent on the participation of every individual at the University.

The following guide was designed to provide hazardous waste generators with information that will support their laboratory waste minimization efforts and their research endeavours. By using the waste reduction measures listed here, generators can adopt specific procedures for their particular laboratory setup.

This guide deals primarily with hazardous materials that are used in a chemistry or biology laboratory. It explains how hazardous wastes and other chemical pollution generated by experiments can be minimized.

Specifically, the guidelines will help you to:

- Generate less waste and pollution
- Save money by purchasing chemicals effectively
- Design experiments with waste minimization in mind
- Design a lab specific waste minimization plan
- Save water and energy

1.2 Environmental Ethics and Green Research

In the laboratory, an environmental ethic means taking responsibility for the by-products of research and teaching, and the waste that is generated. A researcher conducts green research when they understand the environmental impacts of their work and minimize it where and when they can.

Take the following steps to "green" your laboratory:

- Train new personnel in chemical and environmental safety, including methods of pollution prevention and waste minimization
- Prepare for leaks and spills
- Review the chemicals in use to understand their hazards
- Design your experiments with waste minimization in mind
- Use the information in this guide and develop and implement a waste minimization plan for your laboratory
- Dispose of waste in a responsible manner by following documented protocols

1.3 Waste Management Hierarchy

There are varieties of methods to deal with the problem of hazardous wastes. The waste management hierarchy addresses these methods in order of preference. The most preferable option on the hierarchy is to **reduce** the amount of waste that is produced in the first place. This approach is known as source reduction. This is the cornerstone of pollution prevention.

Unfortunately, not all waste can be eliminated, and the waste that is generated must be dealt with. The second best option for managing this waste includes **recycling**, refining, or **recovering** the waste for **reuse** so that new raw materials are not required and resources are conserved, so that waste pollutants never reach the land (e.g., a landfill), the water, or the atmosphere.

If that is not possible, the next best option would be to **treat** the waste to reduce its toxicity and its potential for harming the environment. The least preferred management methods for hazardous wastes (and non-hazardous wastes) are shipping to a certified waste facility or incineration.

While each of these options may be necessary for managing waste at certain times, at the top of the hierarchy, source reduction should be the focus of waste management efforts.

1.4 The 4 R's of Waste Minimization

Simple best management practices can minimize laboratory hazardous waste, and reduce the environmental impact of research. Implement the 4 "R"s of waste minimization.

RETHINK & REPLACE: Improve or change laboratory processes to reduce waste

- Include detoxification or neutralization steps in your experiments
- Design for energy efficiency. Conduct experiments at ambient temperature and pressure
- Monitor reactions closely, add chemicals only as necessary
- Purchase electronic equipment free of lead, mercury, and other hazardous substances that complies with the **RoHS** (Restriction of Hazardous Substances in Electrical and Electronic Equipment) and **WEEE** (Waste Electrical and Electronic Equipment) guidelines
- Use products with less environmental impact: tubes and dishes with less plastic, glassware that can be decontaminated and reused, refillable pipette racks
- Consider the quality and quantity of waste produced when purchasing new equipment; purchase the type that produces less waste

REDUCE: Eliminate waste at its source by reducing its quantity and toxicity

- Reduce the scale of laboratory processes

- Use the Green Alternatives Wizard to replace hazardous chemical and chemical processes with safer options
- Use the EPA Green Chemistry guidelines to hazardous waste management and substitution
- Use mercury-free thermometers and other equipment in the laboratory
- Use non-hazardous, biodegradable liquid scintillation counting fluids
- Consider digital process instead of wet photographic processes
- Use traps on your oil pumps to prevent oil contamination
- Maintain and update chemical inventories annually
- Ensure you have spill response materials, equipment and procedures to address potential spills of hazardous materials. Take care to minimize spills
- Keep volatile chemicals capped and sealed
- Use catalysts as opposed to stoichiometric reagents

REUSE: Find new uses for old chemicals and share what you no longer need

- Get free surplus chemicals, unused and in good condition via the UBC Chemical Exchange program
- Donate surplus, uncontaminated chemicals to nearby labs, free of charge. Use department mailing list servers to offer unused chemicals

RECYCLE: Convert used items back into raw materials which can be reused

Use UBC recycling and recovery programs:

- Solvent Recovery - This program recovers acetone and methanol from organic waste solvents. Solvent recovery allows UBC faculty and staff to save on purchasing costs and the university saves on disposal costs.
- Silver Recovery Program – Photographic waste is recovered and reused by a silver refinery, and the corrosive liquid is neutralized before disposal.
- Battery Recycling – This program recycles both rechargeable and non-rechargeable batteries free of charge. The service is provided by Call2Recycle.
- Paint recycling – Paint is collected by ESF and sent to Product Care where the paint is reused, recycled, or used for energy value.
- Oil recycling – Oil is collected by ESF and sent to M&R Environmental to be recycled.

2. Source Reduction of Laboratory Waste

2.1 Source Reduction in the Laboratory

Changing practices and processes to prevent pollution at its source is referred to as source reduction. Source reduction methods include: Process Modification, Operational Improvements, Material Substitution, and Administrative Steps.

Redesign and Modify Laboratory Processes
Pollution can be prevented or reduced by changing the laboratory process in which the pollution is created:

- Reduce the scale of laboratory processes:
  - Do micro scale work
  - Reduce the amounts of materials used
  - Scale reduction also has the benefits of reduced cost, quicker run, and reduced risk and severity of accidents
- Assess the possibility of including a detoxification or waste neutralization step in your experiments
- Avoid the use of reagents containing heavy metals such as arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver
- Consider the quantity and type of waste produced when purchasing new equipment; purchase equipment that produces less waste
- Check if equipment modification is possible to reduce waste
- When solvent is used for cleaning purposes, use spent solvent for initial cleaning and fresh solvent for final cleaning
- Use computer simulations and modeling which eliminate nearly all environmental impacts when substituted for wet laboratory experiments
- Review method and technique for potential change in operating conditions (temperature, pressure)

Improve Laboratory Operations
Pollution can be prevented by improving laboratory operations:

- Chemical releases and inappropriate disposal affect the environment
  - Review proper disposal procedures
  - Keep volatile chemicals capped and sealed
  - Take care when weighing or transferring chemicals between containers to minimize spills
  - Segregate your waste
- Storing excess chemicals takes up valuable lab space and increases the risks of a fire or spill. Some chemicals become reactive or explosive with age.
  - Label all laboratory reagents to eliminate unknown substances
  - Regularly review your laboratory chemical stocks and dispose of surplus, or donate to the UBC Chemical Exchange Program.

Substitute with a Safer Chemical

- One of the most successful ways to reduce pollution is by substituting hazardous materials with safer chemicals

Take Administrative Steps

- Control your laboratory chemical inventory
- Improve purchasing techniques by ordering the absolute minimum required to complete the experiment with in a short time period
- Include pollution prevention and waste minimization as part of student/employee training
- Develop incentive programs

Once all source reduction options are reviewed and implemented, assess and implement appropriate **reuse and recycle measures**.

2.2 Reduce Your Solvent Waste Stream

Solvents represent a very large proportion of the volatile organic compounds (VOCs) released into the atmosphere. Organic solvents can be poisonous, carcinogenic, ozone-depleting and/or smog-forming*. To minimize these health and environmental impacts avoid or reduce use of solvents in the first place. If this is not possible substitute hazardous solvents with ones that show better environmental, health and safety properties.

The ideal solvent will:

- present minimal health and safety hazard (low toxicity and flammability, low peroxide formation, lower vapour pressure)
- have minimal environmental impact (increased biodegradability, reduced ozone depletion potential, reduced toxicity, less air emission)
- have the reactivity that fits the reaction
- allow for control of phase (easy precipitation/separation of product)
- safely degrade/evaporate after use

Use "green" solvents

- Solvents produced from renewable resources (not derived from petrochemicals) such as ethanol (produced by fermentation of sugar, starch, or cellulosic based materials) or ethyl lactate (derived from corn)
- Ionic liquids which are non-volatile, non-flammable, and have high thermal stability, low vapour pressure/high boiling point and thus less emissions to air
- Solvent-less reactions in which the reagents serve as the solvent as well, or conduct reactions in the solid state
- Water-based solvents; water is the environmentally benign solvent
    - Note, however, that some water-soluble substances are very hazardous
    - Also, product separation and by-product formation may render effluent more hazardous than conventional solvents

Commercially available "green" solvents:

- Both InTech Environmental (a local supplier) and Sigma-Aldrich offer green solvent products. For more information related to solvent assessment refer to "What is a green solvent? A comprehensive framework for the environmental assessment of solvents" (Green Chemistry, Issue 9, 2007).

Substitute with less hazardous solvents*

- Substitute benzene with xylene or hexane (many solvent uses)
- Substitute carbon tetrachloride with cyclohexane (qualitative test for halides)
- Substitute halogenated solvents with non-halogenated solvents (extractions and other uses)

Recycle acetone and methanol

UBC can successfully recover acetone and methanol from organic waste solvents. Visit the Solvent Recovery website for more information on this program

***Solvents: Health and Environmental Hazards**

Many organic solvents are poisonous if swallowed or inhaled in sufficient quantity. High concentrations of most solvents can cause narcosis (dizziness, nausea, fatigue, loss of coordination, and coma). Some organic solvents are carcinogens (e.g., benzene, carbon tetrachloride, trichloroethylene), reproductive hazards (e.g., 2-ethoxyethanol, 2-methoxyethanol, methyl chloride), and neurotoxic (e.g., n-hexane, tetrachloroethylene, toluene).

Many Chlorofluorocarbons (CFC's) are ozone depleting chemicals (e.g., trichlorofluoromethane) causing degradation of the earth's stratospheric ozone layer and its ability to shield ultraviolet radiation from the earth's surface. The more reactive Volatile Organic Compounds (VOCs) combine with nitrogen oxides to form smog, a toxic inhalant.

2.3 Reduce Your Chemical Waste Stream

Take the following measures to reduce your chemical waste stream:

- Segregate hazardous from non-hazardous waste
- Reduce the scale of your experiment
- Add a neutralization/detoxification stage to your experiments (See Section A – 3.4 Implement In-Lab Chemical Waste Treatment)

2.3.1 Inventory Control

- Get free surplus chemicals by using the UBC Chemical Exchange Program
- Keep an up-to-date inventory of your lab chemicals, including where the chemicals are located (mandatory WHMIS/WorkSafeBC requirement)
- Rotate stock; follow the principle of first-in, first-out
- Keep track of expiration dates and storage times, especially for peroxide-forming and other degradable chemicals
- Purchase only the chemicals and amounts you need in the immediate future
- Borrow small amounts from other labs
- Purchase smaller containers that are easier to handle; large containers often become waste when half full
- Accept only gifts or samples you plan to use in the immediate future, do not accept more than you need
- Keep Material Safety Datasheets (MSDS) and disposal procedures for chemicals used and produced in your laboratory

2.3.2 Materials Substitution

Substitute hazardous with less hazardous chemicals

- MIT Green Chemical Alternatives Purchasing Wizard
- EPA Green Chemistry
- Sigma Aldrich "Greener Alternatives"
- See Section A – 5.5 Green Purchasing

Use alternatives to mercury

Mercury is a toxic metal that is difficult and costly to dispose of safely. Mercury waste from broken thermometers and manometers (e.g. blood pressure monitors) is commonly generated in UBC labs.

- Use alternatives to mercury thermometers: alcohol (red liquid) thermometers, thermocouples and other electronic temperature devices
- Consider using Teflon coated thermometers that will contain the mercury in the event the capillary is broken

Avoid using chromic acid solution for glass cleaning

Chromic acid solutions (mixtures of sulfuric acid and dichromates) are used to clean laboratory glassware. Chromic acid is a strong corrosive and strong oxidizer that reacts violently when combined with oxidizable materials. It contains chromium (VI), which is a known human carcinogen, it is very toxic to humans and the environment. Try the alternatives to chromic acid solutions listed below (in order of increasing hazard).

- Non-hazardous cleaning solutions (e.g. ultrasonic baths; Alconox or similar detergents; Pierce RBS-35 or similar detergents; biodegradable surfactants)
- Strong corrosive solutions (e.g. potassium hydroxide/ethanol solutions; dilute hydrochloric acid)
- Strong oxidizing acid solutions not containing chromium or other toxic metals (e.g. potassium persulfate and sulfuric acid; aqua regia, NOCHROMIX®)

2.3.3 Lecture Bottles of Hazardous Gases

Lecture bottles are small compressed gas cylinders, typically 2-3 inches in diameter and 12-18 inches in height. While many gas suppliers offer lecture bottles for purchase, most will not accept the empty or partly full cylinders back for disposal. Before purchasing new lecture bottles try to share the ones available in your department. In order to avoid costly disposal fees, purchase only returnable lecture bottles or small size cylinders.

These vendors offer returnable lecture bottles/small size cylinders:

Company	Details	Contact information
Linde Gas LLC	Offers EcoCyl portable refillable calibration gas cylinder. ○ Extremely low, highly consistent flow rate ○ Controlled by cylinder main valve ○ Does not require researcher to stand over valve to monitor and adjust flow rate ○ Eliminates hazardous waste disposal charge of $300 per lecture bottle. Offers small portable cylinders, non-refillable lecture bottles 2" diameter x 12" height, as a solution to larger cylinders wherever small gas quantities are required. Will take back empty or partly empty lecture bottles.	10097 201st Street Langley, BC V1M 3G4 Tel: 604-882-7642 langley.lg.ca@linde.com
Praxair Canada	Offers a small size refillable cylinder (N9) which is 4.4 in diameter, 17.4 in height. Refer to Praxair Canada for the type of gases available.	2080 Clark Dr, Vancouver, BC V5N 3G7 Tel: 604-255-6007 All sales inquiries or information: Tel: 1-800-722-9247
Air Liquide Canada Inc.	Accepts small refillable cylinders, size 1A or 2. Small fee to return Calgaz small disposable cylinders.	1490 Boundary Rd, Burnaby, BC V5K 4V3 Tel: 604-606-4310 Orders.West@AirLiquide.com

2.3.4 Potentially Explosive Materials

Most chemicals that are used in research and teaching laboratories are stable and non-explosive at the time of purchase. Over time, some chemicals can oxidize, become contaminated, dry out, or otherwise destabilize to become Potentially Explosive Chemicals (PEC) (e.g. isopropyl ether, sodium amide and picric acid).

PECs are particularly dangerous as they may explode if subjected to heat, light, friction, or mechanical shock. The special care and procedures required for these chemicals result in high disposal costs (more than four hundred dollars for each container).

Before ordering new chemicals, review the chemical's MSDS. If the material you are about to purchase is a potentially explosive material:

- Consider substituting it with a less hazardous material
- Purchase the smallest amount possible
- Limit storage duration
- Share with others
- Check-Test-Timely Dispose
  - Observe expiration dates - certain chemicals deteriorate to a dangerous condition with age
  - Routinely test peroxide forming chemicals for peroxide levels
  - Inspect containers - certain chemicals may explode due to over-pressurized container

Contact UBC's Environmental Services Facility (ESF) at 604-822-6306 to arrange for special disposal.

2.4 Minimize Biohazard and Biomedical Waste Streams

You can reduce the volume of bio-hazardous, biomedical, and pathological waste and hence reduce environmental impact and disposal costs by implementing the following practices for the waste categories below:

a) Biohazard waste - laboratory cultures, stocks of micro-organisms, vaccines, cell cultures, and solid waste contaminated with the above:
- Segregate non-hazardous solid waste from hazardous waste
- Use products with less environmental impact
  - Use Petri dishes with 35% less plastic
  - Use shorter serological pipettes with less plastic
  - Use reusable, recyclable products - pipette tips reloadable systems. These systems contain less packaging. Reusable/recyclable boxes reduce package waste by 50-80%

b) Biomedical waste - human anatomical, blood and body fluids:
- Segregate uncontaminated solid waste from hazardous waste
  - Uncontaminated gloves used to handle containers of blood or body fluids;
  - Paper towels and bench paper on which containers of blood or body fluids have been placed but did not spill
  - Empty specimen containers and tubing (no visible blood contamination)

c) Pathological waste - animal carcasses, tissue, fungi, insects, parasites:
- Segregate any non-hazardous solid waste from pathological waste
- Dispose non-hazardous solid waste through the trash
- Pack all pathological materials for incineration according to approved protocols
- Contact ESF at 604-827-5389 if you have fresh uncontaminated carcasses, this waste may be diverted to animal feed processing

d) Solid waste contaminated with ethidium bromide:
- Segregate non-hazardous solid waste from toxic waste
- Replace ethidium bromide with non-mutagenic non-cytotoxic dyes: SYBR® Safe, GelRed™, GelGreen™, EvaGreen®, EZ Vision®.

2.5 Radioactive Waste Reduction

Segregate uncontaminated solid waste from radioactive waste (i.e. uncontaminated: gloves, paper towels, bench paper, empty containers and tubing).

Minimize the mixing of chemical and radioactive waste:
- Substitute the chemical or the radioactive source contributing to the mixed waste
- Use 2.5 mL scintillation vials ("minivials") rather than 10 mL vials.
- Eliminate the use of acetic acid/methanol mix for electrophoresis gel fixing when not required
- Line lead containers with disposable plastic, or use alternative shielding materials, to prevent lead contamination by radioactivity
- Use the minimum activity necessary and select the radionuclide with the most appropriate decay characteristics
- Substitute with shorter-half-life radionuclides such as 32P (t1/2 = 14 days) for 33P (t1/2 = 25 days) in orthophosphate studies, and 33P or 32P for 35S (t1/2 = 87 days) in

nucleotides and deoxynucleotides. In many uses, 131I (t1/2 = 8 days) can be substituted for 125I (t1/2 = 60 days)

- Use nonignitable scintillation fluid (e.g., phenylxylylethane, linear alkylbenzenes, and diisopropylnaphthalene) instead of flammable scintillation fluid (e.g., toluene, xylene, and pseudocumene)
- Use nonradioactive substitutes such as:
  - Scintillation proximity assays to substitute for 32P or 35S sequencing studies or 3H cation assays
  - Enhanced chemiluminescence (ECL) as a substitute for 32P and 35S DNA probe labeling and southern blot analysis

3. Reuse, Recycle, and In-Laboratory Treatment of Wastes

3.1 Segregation of Non-Hazardous and Non-Regulated Waste

Many laboratories do not distinguish between waste that is hazardous and waste that neither poses a hazard nor is regulated as hazardous. If these different types of waste are combined, then the total must be treated as hazardous waste and the price for disposal of the non-hazardous portion increases markedly.

When safe and allowed by regulation, disposal of non-hazardous waste via the normal trash or sewer can substantially reduce disposal costs. This is the kind of waste segregation that makes economic as well as environmental sense.

The common wastes usually not regulated as hazardous include: certain salts (e.g., potassium chloride and sodium carbonate), many natural products (e.g., sugars and amino acids), and inert materials used in a laboratory (e.g., non-contaminated chromatography resins and gels).

These materials can be disposed of safely and legally in the normal trash or down the drain. This type of waste is not regulated because it does not exhibit any of the hazardous characteristics (ignitability, corrosivity, reactivity, or toxicity) as defined by BC Hazardous Waste Regulation, and is not listed as restricted or prohibited by the Metro Vancouver Sewer Use Bylaw, Consolidated.

For a list of chemicals that are considered non-hazardous visit the Non-Hazardous Chemical Disposal Guide.

3.2 Reuse

3.2.1 UBC Chemical Exchange Program

The Chemical Exchange Program was developed to identify chemicals on campus that are no longer of use to the original user and to divert them from disposal. Instead, these chemicals are tracked and marketed to other potential users on campus. See the list of free chemicals available to any UBC laboratory. To obtain any of these chemicals contact an ESF Technician at 604-822-6306.

The Chemical Exchange Program is a free service provided to the campus and not only reduces purchasing costs, but also reduces disposal costs. We encourage all labs to participate in this program.

Should you have any excess chemicals in usable condition that could potentially be utilized elsewhere on campus, please forward the chemical name, amount, grade, manufacturer and your contact details to an ESF Technician.

ESF **cannot** accept chemicals that are:

- Open
- Past their expiry date
- Explosive
- Radioactive
- Required to be refrigerate

3.3 Recycle

3.3.1 UBC Solvent Recovery Program

The Solvent Recovery Program was launched in 1994 and has continually expanded since then. Organic waste solvents are identified, segregated and purified for re-use on campus. The purified, distilled product is technical grade.

The Solvent Recovery Program is successful in recovering acetone and methanol. The recovery laboratory consists of two spinning band distillation units which are capable of distilling up to 60 litres of solvents per day. Purified products are analyzed on the gas chromatography unit. Gas chromatography analysis ensures the quality of the product.

The program allows UBC faculty and staff to save on purchasing costs and the University saves on disposal costs. Staff and faculty are encouraged to use this program. For more information on the Solvent Recovery Program, contact an ESF Technician at 604-822-1285.

3.3.2 Silver Recovery from Photographic Waste

Photographic waste containing greater than 5 ppm of silver is considered hazardous waste and prohibited from entering the sewer system. Silver, if introduced into the water system, is toxic to fish.

ESF developed the Silver Recovery Program to comply with the Metro Vancouver Sewer Use Bylaw. Silver is recovered by running the fixer through an ion exchange column. The silver is recovered and reused by a silver refinery, and the corrosive liquid is neutralized before disposal.

For more information on the Silver Recovery Program, contact an ESF Technician at 604-822-1285.

3.3.3 Oil Recycling

Waste oils are collected by ESF and sent to M&R Environmental in Burnaby, BC to be recovered and reused for a variety of purposes. For more information on oil recycling, please contact an ESF Technician at 604-822-1285.

3.3.4 Paint Recycling

Industrial paint is sent for disposal as hazardous waste and all other left over paint is sent to Product Care for recycling by ESF. For more information on paint recycling, please contact an ESF Technician at 604-822-1285.

3.4 Implement In-Lab Chemical Waste Treatment

Concerns about environmental impact, bans on landfill disposal of hazardous waste, and limited access to sewer disposal have encouraged the development of laboratory hazardous waste reduction strategies.

The small-scale treatment and deactivation of products and by-products as part of the experiment plan is one approach that can be used by researchers to address this problem at the laboratory level. In-lab waste chemical treatment reduces transport and handling risks, and reduces the cost of collecting, storing and disposing of chemical wastes.

Below are some treatment suggestions for use in the laboratory. **Use only the procedures specific to the waste you intend to neutralize.** Note that some reactions in the examples below may produce hazardous compounds. Choose the safest method available and work carefully.

With the exception of neutralization, these processes are intended for treatment of small quantities, not more than a few hundred grams. Larger quantities should be treated only in small batches. The generator must ensure that the procedure safely eliminates the regulated hazard(s) before the products are disposed of as non-hazardous waste. In addition, if the procedure suggests disposal of the product into the sanitary sewer, it must comply with the Metro Vancouver Sewer Use Bylaw No. 299, 2007 Consolidated prohibitions and restrictions.

If you have any questions regarding disposal contact the Advisor, Environmental Services at 604-822-9840.

Acids and Bases
In most laboratories, both waste acids and waste bases are generated. Collect them separately and neutralize one with the other. If additional acid or base is required, sulfuric or hydrochloric acid and sodium or magnesium hydroxide, respectively, can be used. Sodium bicarbonate can also act as a neutralizer. If the acid or base is highly concentrated, first dilute it to a concentration below 10%. Non-toxic neutralization products may be disposed of through the sanitary sewer. Toxic products such as ones containing heavy metals and toxic ions such as cyanide and sulphide should be disposed of according to approved protocols.

Acyl Halides and Anhydrides
Acyl halides, sulfonyl halides, and anhydrides react readily with water, alcohols, and amines. They should never be allowed to come into contact with waste that contains such substances. Most compounds in this class can be hydrolyzed to water-soluble products of low toxicity.

Aldehydes
Many aldehydes are respiratory irritants, and some (formaldehyde, acrolein), are quite toxic. Some can easily be oxidized to the corresponding carboxylic acids, which are usually less toxic and less volatile. Hydrogen peroxide can be used for some oxidations.

Alkali Metals
Alkali metals react violently with water, common hydroxylic solvents, and halogenated hydrocarbons. The metals are usually destroyed by controlled reaction with an alcohol. The final aqueous alcoholic material can usually be disposed of in the sanitary sewer.

Amines
Acidified potassium permanganate efficiently degrades aromatic amines. The mixture is then flushed down the drain.

Inorganic Cyanides
Inorganic cyanides can be oxidized to cyanate using aqueous sodium hypochlorite (bleach). Hydrogen cyanide can be converted to sodium cyanide by neutralization with aqueous sodium hydroxide, and then oxidized.

Organic Peroxides and Hydroperoxides
Peroxides can be removed from a solvent by passing it through a column of basic activated alumina, by treating it with indicating Molecular Sieves®, or by reduction with ferrous sulfate. (These procedures do not remove dialkyl peroxides, which may also be present).

Metal Azides
Heavy metal azides are explosive and should be handled by trained personnel. Sodium azide, which is highly toxic, is explosive only when heated to near its decomposition temperature (300°C), thus heating it should be avoided. Sodium azide should never be flushed down the drain since the azide can react with lead or copper in the drain lines to produce an azide that may explode. Azides can be destroyed by reaction with nitrous acid.

Metal Hydrides
Most metal hydrides react violently with water with the evolution of hydrogen, which can form an explosive mixture with air. Some are pyrophoric. Most can be decomposed by gradual addition of methyl alcohol, ethyl alcohol, n-butyl alcohol, or t-butyl alcohol to a stirred, ice-cooled solution or suspension of the hydride in an inert liquid, under nitrogen. Although these procedures reduce the hazard of reactive metal hydrides, the products from such deactivation may be hazardous waste that must be treated as such on disposal.

Thiols and Sulfides
Small quantities of thiols (mercaptans) and sulfides can be destroyed by oxidation to a sulfonic acid with sodium hypochlorite (bleach).

*This information was extracted from: Prudent Practices in the Laboratory: Handling and Disposal of Chemicals, National Research Council (1995).

3.5 Solid Waste Recycling at UBC

UBC is striving towards zero waste through innovative solutions to conserve, reuse, recycle, and redesign. Composition of disposed non-hazardous waste in UBC laboratories shows that nearly all items that are trashed could stay out of the landfill: organics, paper, and plastics. UBC also has many inventive programs to reduce hazardous waste generated by UBC laboratories. See where you can minimize the waste in your laboratory using the following UBC initiatives.

3.5.1 Reuse-it! UBC
Reuse-it! UBC is an online resource that can be used by all UBC employees at the Point Grey campus to find and exchange low-value items between departments such as furniture, audio-visual equipment, office supplies, and more.

3.5.2 Battery Recycling Program
Every year millions of batteries make their way into normal landfills. The heavy metals and toxic chemicals from the decomposition of these batteries have the potential to contaminate the soil and pollute our waterways.

Through the Battery Recycling Program UBC recycles both rechargeable and non-rechargeable batteries free of charge with the help of Call2Recycle. Lead-acid batteries are recycled through Metalex.

3.5.3 Laboratory Plastics Recycling Program

Recycle empty non-hazardous material plastic containers in your laboratory through the Laboratory Plastics Recycling Program.

3.5.4 Styrofoam Recycling Program

Styrofoam is harmful to the environment both in disposal and in the chemicals and processes used to create it. Styrofoam takes over 500 years to degrade in normal landfills, and has been piling up for years to make up nearly 30% of garbage by volume found in landfills today. Along with filling up our landfills, when Styrofoam is burned over 57 different chemical by-products are released into the environment.

The goal of the Styrofoam Recycling Program is to see no Styrofoam enter our landfills from UBC by providing a convenient and environmentally responsible way to reduce and recycle Styrofoam across the UBC-Vancouver campus.

3.5.5 Soft Plastic Recycling Program

The Soft Plastic Recycling Program aims to reduce the amount of soft plastic waste sent to landfills from UBC labs. This Green Labs Program initiative was developed based on a similar program run by UBC Food Services. The program invites participation from all buildings and departments. The collection points are located in several campus buildings. Contact UBC Waste Management to find out the closest location to your building.

3.5.6 e-Waste Recycling

Why is it important to recycle e-waste through a reputable source like UBC? Watch the UBC documentary Ghana: Digital Dumping Ground to find out. Electronic waste is collected by UBC Waste Management and recycled responsibly.

3.5.7 Solid Waste Recycling Resources

Recyclopedia

This A – Z resource is your "one-stop shop" for on-campus waste reduction and recycling information, listing specific how-tos for anything from batteries, compost and solvents to paper products, light bulbs and cell phones.

Sustainability Coordinators Toolkit

The Sustainability Coordinators Toolkit provides UBC-specific resources associated with waste minimization for both offices and laboratories, among other resources to foster sustainable practices across UBC.

UBC Building Operations Waste Management

UBC Building Operations is responsible for non-hazardous waste pick-up, recycling programs, composting, e-waste, litter reduction and other waste services.

4. Planning and Running Experiments

4.1 Design Experiments with Waste Minimization in Mind

Waste minimization in the laboratory begins at the stage of experiment planning. Measures may range from implementing basic efforts to be more efficient with experimental procedures, to completely re-designing the way experiments are performed.

Here are some ways to set up your experiments with waste minimization in mind:

- Think about the environmental consequences of your laboratory activities
- Design your experiments to use and generate substances that possess little or no hazard to human health and the environment
- Consider the kind and quantity of waste that will be generated and adjust the experimental design to minimize it
- When possible replace chemicals with less hazardous materials
- Use solvents and other hazardous materials sparingly
- Monitor experimental reactions closely and add additional chemicals only as necessary
- Be alert for opportunities to save electricity (see Section A – 5.3 Energy Saving in the Laboratory)
- Design experimental set-ups to save water (see Section A – 5.4 Water Saving in the Laboratory)
- Where feasible, include a step that destroys or inactivates any hazardous products in experimental protocols
- If your experiment is designed at a macro scale level, try to scale it down to 1/100th or 1/1000th of the original quantities. For more information refer to:
  - National Microscale Chemistry Center (NMC2) (housed at Merrimack College)
  - National Small-Scale Chemistry Center (housed at Colorado State University)
  - If you cannot convert to micro-scale, try decreasing experimental quantities by a third or one half. This can usually be achieved with conventional glassware

4.2 Develop a Generator Specific Waste Minimization Plan

Identify:

- The type and quantity of waste disposed from your lab
- The processes from which waste was generated
- The available reduction and recycling options

Review:

- Your laboratory's annual hazardous waste report and chemical waste inventory forms
- Experimental processes, procedures and protocols

Consider:

- Potential waste reduction options
- Feasibility and cost benefit of suggested waste minimization measures
- Other aspects related to hazardous waste diposal: TDG training, waste manifests, BC Generator ID (BCG#)

Implement:

- The most environmentally friendly, safe and effective reduction options

STEPS:

Determine the sources of waste generated by your laboratory

Review all your lab protocols and processes. For each protocol, process, operation and activity generating wastes, indicate the following:

- Waste type (i.e. biohazard risk group 1 & 2, pathological, biomedical, sharps, solvents, chemical waste, non-hazardous solid waste, non-hazardous liquid waste, etc.)
- Main components/reagents that cause the waste to be hazardous
- Hazard class (i.e. toxic, corrosive, flammable, reactive, etc.)
- Quantity of waste generated
- Frequency of waste generated

Select applicable waste reduction options for specific processes

Choose protocols and processes for reduction and look for those generating large quantities of waste or very hazardous waste; these are easy to reduce. Use the guidelines below.

Consider the following criteria:

- Resultant change in amount of hazardous waste
- Technical feasibility
- Economic evaluation
- Health and safety implications

Evaluate potential waste minimization measures:

- Process redesign
- Equipment modifications
- Process, method, technique changes
- Operating conditions changes
- Materials changes
- Operation efficiency improvements
- Training requirements
- Inventory management
- Reuse and recycle options

Select an experimental process or protocol for reduction measures including:

- Waste stream for reduction
- Proposed waste minimization method(s)
- Expected/estimated reduction

Develop an implementation plan including:

- Responsibilities
- Target dates
- Required resources

5. Minimize Other Environmental Impacts

5.1 Reduce Laboratory Air Emissions

UBC research can impact air quality through accidental release of toxic chemicals, ozone-depleting substances, emissions of volatile organic compounds, and emission of **greenhouse gases** (primarily CO_2), or **acid rain** gases (primarily NO_x). For more information on air contaminants, also refer to Environment Canada's Criteria Air Contaminants and Related Pollutants.

Although laboratory emissions are not regulated at this time, it is reasonable to expect that releases to the atmosphere will be controlled. The release of vapours to the atmosphere, via evaporation in a fume hood, for example, is not an acceptable disposal method. Apparatus for operations expected to release vapours should be equipped with appropriate trapping devices.

Fume hoods, the most common source of laboratory releases to the atmosphere, are designed as safety devices to transport vapours away from the laboratory in case of an emergency, not as a routine means for volatile waste disposal. Units containing absorbent filters (chemical scrubbers) have been introduced into some laboratories, but have limited absorbing capacity, and the air from these units cannot be reintroduced into the laboratory.

Simple laboratory practices can minimize air emissions:

- Keep containers of volatile chemicals tightly capped. The best container seals have an even rim on the bottle and an appropriate fitting cap with polyethylene or Teflon liner
- Minimize the number of volatile chemicals in your lab; order and store only what you need in the immediate future
- Do not store chemicals in the fume hood
- Keep laboratory experiments involving volatile chemicals as self-contained as safely possible
- Redirect fume hood vapours to a common trapping device to eliminate discharge into the atmosphere
- Keep waste solvent collection containers capped at all times, unless adding waste
- Keep the amount of waste solvents in your lab to a minimum
- Do not dispose of any chemical by evaporation; it is illegal to evaporate hazardous chemical waste for the purpose of disposal
- Do not dispose of hazardous gases by venting. Scrub or filter experiments' hazardous emissions

Fume hoods

- A typical fume hood uses 3.5 times more energy than an average home
- Operate hoods with sash at proper height for safety
- Close sashes when fume hoods are not in active use

Purchasing Decisions that have Big Energy Impacts

- Consider adding flow restrictors to lab faucets to minimize water use (especially hot water).
- Replace old, large refrigerator/freezers with smaller, newer refrigerator-only units where appropriate.

- Purchase energy-efficient equipment during lab renovations or when older pieces of equipment stop working. Many lab equipment vendors are starting to install power save modes, efficient motors, and other strategies for reducing energy use of plug load lab equipment. Look for the ENERGY STAR® label and ask your vendor for energy usage information or to supply more sustainable products at a reasonable cost. Here are some pieces of equipment that have readily available energy efficient options:
  - Biosafety cabinets
  - Fume hoods
  - Centrifuges
  - - 80°C Freezers
  - Fridges and freezers
  - Ice machines
  - Heat blocks
  - Incubators
  - Ovens
  - Mixers and shakers
  - Vacuum pumps

5.1.1 Ozone-Depleting Substances Tool

Ozone-depleting substances (ODS) only become a threat to the ozone layer when they escape into the environment. For a list of ODS and the protocol pertaining to environmental release of ODS please refer to the UBC Ozone Depleting Substances Procedure. More information can be found on the RMS Ozone Depleting Substances webpage.

5.2 Prevent Sanitary and Storm Water Contamination

Metro Vancouver's Sewer Use Bylaw Consolidated prohibits disposal of hazardous waste through the sanitary sewers. Refer to the Sewer Use Bylaw Guidelines (or Pollution Prevention and Sanitary Sewer Procedure) and the Sanitary Sewers webpage for more information.

For an easy-to-use list of chemicals that may be disposed down the drain under this bylaw visit the RMS Waste Disposal Guide.

Contact the Advisor, Environmental Services at 604-822-9840 for assessment and consultation regarding specific waste streams (complete the Aqueous Waste Profile). Implement the following best practices:

- Make sure containers of liquids are not leaking
- Make sure laboratory equipment and experiments that create wastewater do not leak
- Make sure liquids are stored in secondary containment: trays, sealable containers or segregated (dammed) areas, with no floor drain so that spills are contained
- Do not dispose of any waste into a storm sewer
- If a laboratory process is connected to a water supply, do not connect it to a sewer or use contaminated or toxic liquids unless a backflow prevention device is included
- Control and contain spill to prevent any hazardous materials from entering the sewer

Discharges to the storm sewer system must comply with several regulations and guidelines such as: BC Hazardous Waste Regulation, BC Contaminated Sites Regulations, CCME Water Quality Guidelines for the Protection of Aquatic Life, BC Water Quality Guidelines and Municipal Water Use Guidelines.

5.3 Energy Saving in the Laboratory

Energy is used in nearly every process performed in the laboratory including heating, cooling (water condensers, water circulators), distillation, running of the equipment, facilitating photochemical and microwave reactions, and more.

A survey of UBC's laboratory energy use was done in 2010 to provide researchers with an understanding of the energy consumption of their current equipment as well as purchasing information to select the most efficient equipment in the future. Refer to the "Carbon Neutral for All?" Laboratory Equipment Energy Efficiency Survey" for details.

Recommendations regarding energy saving measures are listed below:

General Lab Operations

- Wait until you have a full load before running glassware washers or autoclaves.
- Turn lights off when rooms are not in use and take advantage of natural light where possible.
- Turn equipment off when not in use.
- Keep the lab door and windows shut; it helps keep the building air system in balance.
- Use energy efficient pumping systems.
- Adjust blinds and window coverings on windows that receive direct sun to utilize natural light when possible.
- Electrical devices draw energy 24/7, even when switched off. Plug all radios, cell phone chargers, fans and other personal electronics into a power strip that can be turned off when not in use.

Chemical Processes

- Know the actual time and temperature needed to run your reactions. Many reactions are run overnight for convenience potentially wasting energy, reagents and water
- Determine the time required for the reaction to go to completion or to get to a maximum yield
- Whenever possible, conduct synthetic methods at ambient temperature and pressure
- Consider using microwave energy to power your reaction. Studies have shown microwave energy to be very efficient, using lower amounts of energy with higher yields
- Changes to process design can reduce energy input requirements (mechanical and thermal)
- Using new solvents, such as supercritical carbon dioxide (TSC=31.1°C), greatly affects the ease of separation, lowering energy input
- Using a catalytic system rather than a stoichiometric process lowers the activation energy required for the reaction

Refrigeration

- Combine contents of laboratory refrigerators and freezers. Unplug unused refrigerators or freezers
- Set temperatures as low as necessary for current lab work
- Dust coils on back of refrigerators and clean door seals
- Replace deteriorating door seals
- Defrost units regularly

Fume hoods

- A typical fume hood uses 3.5 times more energy than an average home
- Operate hoods with sash at proper height for safety
- Close sashes when fume hoods are not in active use

Purchasing Decisions that have Big Energy Impacts

- Consider adding flow restrictors to lab faucets to minimize water use (especially hot water).
- Replace old, large refrigerator/freezers with smaller, newer refrigerator-only units where appropriate.
- Purchase energy-efficient equipment during lab renovations or when older pieces of equipment stop working. Many lab equipment vendors are starting to install power save modes, efficient motors, and other strategies for reducing energy use of plug load lab equipment. Look for the ENERGY STAR® label and ask your vendor for energy usage information or to supply more sustainable products at a reasonable cost. Here are some pieces of equipment that have readily available energy efficient options:
  - Biosafety cabinets
  - Fume hoods
  - Centrifuges
  - - 80°C Freezers
  - Fridges and freezers
  - Ice machines
  - Heat blocks
  - Incubators
  - Ovens
  - Mixers and shakers
  - Vacuum pumps

5.4 Water Saving in the Laboratory

Most laboratory buildings use significantly more water per square foot than standard commercial buildings do, primarily to meet their larger cooling and process loads. This greater need also provides laboratories with more opportunities to make cost-effective improvements in water efficiency.

Each of the following conservation tips can have an impact on resource conservation. Many tips cost nothing, only requiring a change in occupant behavior.

General

- Consider reusing water where appropriate in lab processes
- Consider recycling water from some lab machines into appropriate processes
- Establish procedures for sampling, testing and clean-up that minimize the amount of water required. Post these procedures and emphasize compliance

Faucets

Install more efficient faucets. Consider:

- Aerators
- Vacuum pumps rather than aspirators
- Pressure-reducing valves
- Automatic sensors

Washing and Cleaning

- Only run full loads in dishwashers
- Consider replacing an old dishwasher with a new, more efficient model
- Minimize the use of hoses as a cleaning tool; as an alternative, use dry cleaning method (sweep or vacuum clean instead of hosing)
- Establish cleaning procedures that minimize the amount of water required. Post these procedures and emphasize compliance

Equipment

- Replace old lab equipment with new, more efficient models
- Reduce water use for laboratory equipment
- No domestic water at a flow rate greater than 2 gallons per minute shall be used "once-through" for any laboratory equipment
- Use closed-loop cooling water for equipment cooling instead of open-loop (once-through)
- Use vacuum pumps instead of aspirator fittings on cold-water faucets
- Evaluate the necessity of water heaters and water softeners
- For necessary water heaters and softeners, set backwash frequency to a lower setting
- Turn off ice machines when they are not needed

5.5 Green Purchasing

Green purchasing is the selection and acquisition of products and services that most effectively minimize negative environmental impacts over their life cycle of manufacturing, transportation, use and recycling or disposal. Making purchasing decisions that exemplify UBC's commitment to sustainability is made easy with the UBC Sustainability Purchasing Guide and the following resources. For more information also refer to Green Your Lab.

5.5.1 Order Green

You can reduce your environmental impact simply by the way you place your laboratory orders.

Consolidate orders

Combine purchases so that each order is $500 or more.

- Reduces multiple deliveries and greenhouse gases on campus
- Saves on freight charges
- Saves time

Purchase multiple-item packs instead of singles

- Reduces waste from packaging materials

Increase item lines per order

- Saves paper and energy
- Reduces multiple shipments

Purchase as many lab supplies as possible from one source

e.g. buying PCR enzymes, bundle with tubes, pipette tips, bench covers, etc.

- Provides a way to consolidate orders

Place orders/do transactions online

- Eliminates paper waste
- Reduces order processing time
- Minimizes ordering mistakes

Support institutional supplier consolidation initiatives

- Avoid multiple shipments from multiple vendors
- Eliminates loss of potentially hazardous materials via common couriers

Avoid air shipments where possible

- Reduces CO2 emissions
- Avoids expensive freight charges

Use the UBC BuySmart guide to find suppliers which are designated as **Sustainable Partners**, who in turn support the university in providing green alternatives and funding to green labs initiatives.

5.5.2 Green Products

Many companies are now offering "greener" alternatives to their consumable products. Replacing some of the consumables used in your laboratory with their green counterparts is an effective way to reduce the environmental impact of your research.

a) Green Product Labels and Certifications

An easy way to find greener alternatives is to look for green product labels and certifications when purchasing. These labels are symbols that indicate a product has been certified to a specific environmental standard. Product certification labels can also help consumers to combat "greenwashing". Visit the Green Product Labels and Certifications Guideline to learn more.

b) Green Products List

As the demand for greener laboratory products rises, the variety of environmentally friendly merchandise also grows. The Green Products List outlines greener alternatives to traditional laboratory products and equipment and what benefits they provide to the user and environment. Also refer to VWR Green Leaf Products (Environmentally Preferable Products) and Sigma Aldrich "Greener Alternatives" (Greener Products and Programs).

6. Green Laboratory Checklist

The Green Laboratory Checklist was created to provide more practical ways to cultivate sustainable laboratories at UBC. This checklist includes many ideas, both big and small, for you to minimize waste and environmental impacts in your laboratory.

Section B – Hazardous Waste Management

1. Introduction

Hazardous waste is any product, substance, or organism that is dangerous to the environment and/or to human health, and that is no longer used for its original purpose at the time of disposal, or in storage/transportation prior to treatment or disposal. Hazardous waste is dangerous because of its quantity, concentration, physical, chemical, or infectious characteristics. Thus it may require special disposal techniques to eliminate or reduce the hazard. The disposal of hazardous waste is governed by strict local, provincial, and federal regulations as well as UBC policies and procedures. Canada's current Transportation of Dangerous Goods (TDG) Regulations, section 2, is used to classify the hazardous waste in this manual.

The current manual and procedures can be found under the RMS Environmental Hazardous Waste Management webpage.

RMS operates the Environmental Services Facility (ESF) which manages and handles the hazardous waste generated by UBC core research, education and operational activities. The facility safely manages hazardous waste in accordance with local, provincial, and federal regulations. For more information, please contact the Advisor, Environmental Services at 604-822-9840.

1.1 Disclaimer

This manual is intended for use by those who produce hazardous waste as a result of their work at the University of British Columbia. The material contained in this manual is correct to the best of knowledge of the UBC Risk Management Services. The disposal procedures are compliant with applicable local, provincial, and federal legislation.

Updates to procedures are made occasionally. If you use procedures older than two years, please check with RMS for the most current update.

1.2 Risk Management Services Contacts

Noga Levit	Director, Environmental Services	604-822-9280
Ligia Gheorghita	Advisor, Environmental Services	604-822-9840
Bang Dang	Technician, Environmental Services Facility	604-822-1285
Valeriy Kichenko	Technician, Environmental Services Facility	604-822-6306
Wegland Sit	Technician, Environmental Services Facility	604-827-5389
Satish Maharaj	Technician, Environmental Services Facility	604-822-1281

2. Environmental Services Facility (ESF)

The Environmental Services Facility (ESF), located at the South Campus of UBC manages the transportation, storage, disposal and recycling of hazardous materials. ESF deals with over 1000 waste generators and handles approximately 100 tonnes of solid hazardous waste and 30,000 L of liquid hazardous waste per year. This waste includes biological waste, hazardous chemicals, solvents, photographic waste, batteries and waste oil. As much as possible, hazardous waste is diverted to ESF's waste minimization program which includes solvent recovery, chemical exchange and silver recovery from photographic waste. Otherwise, waste is stored or treated on-site prior to disposal via external contractors.

2.1 Generators

2.1.1 Permissible Generators

ESF is approved by the Ministry of Environment to handle and manage only wastes which originate from generators and independent companies affiliated with UBC activities. All waste generators are required to apply to ESF for confirmation of their official waste generator status. Approved waste generators will be assigned a waste generator number that is to be associated with all shipments of waste originating from their respective locations.

UBC's permissible waste generators may be located on-campus or off-campus (e.g. research centres located at the various hospitals). Off-campus hospital sites include: Centre for Heart Lung Innovation (St. Paul's Hospital), Child & Family Research Institute, Centre for Molecular Medicine & Therapeutics, Jack Bell Research Centre (VGH) and ICORD. Although these waste disposal procedures apply in all their details to the on-campus facilities, the general methods described in the procedures are applicable to all facilities. Off-campus generators dispose of their biohazardous and biomedical wastes directly via the hospital waste streams. For chemical wastes (i.e. hazardous chemicals and experimental byproducts, solvents, oils, non-regulated solids and photographic) they have to contact ESF for disposal. ESF then arranges for an external contractor (i.e. Clean Harbors) to pick-up the waste. Controlled substances are not picked-up. Unknowns, potentially explosive, gases can be picked up directly at the cost of waste generator. Off-campus generators must have current TDG certification (i.e. Danatec TDG Online Training), as well as waste manifest awareness training (i.e. RMS Hazardous Waste Manifest Training) in order to sign the waste manifests when the hazardous waste is picked-up.

2.1.2 Non-Core UBC Waste Generators

The Environmental Services Facility also offers for-fee disposal services to Non-Core UBC waste generators, to non-UBC generators located on the Point Grey Campus, and to tenants of UBC property.

Hazardous waste disposal costs for these generators will be charged as per price list in Appendix C. The invoice will also include a charge for transportation, chemist, and manifest. For an accurate quote, a complete chemical inventory must be submitted to ESF. Due to the nature of the environmental services industry and factors beyond our control, prices may be subject to change without notice.

For more information on the disposal, recycling, treatment, or exchange of your hazardous waste, please contact an ESF technician at 604.822.1285 or 604.822.6306.

2.2 Waste and Waste Pick-Up

2.2.1 Acceptable Hazardous Waste

General hazardous waste classifications, as per current Transportation of Dangerous Goods (TDG) Regulations, permitted at ESF are as follows:

Class 2.1: Flammable Gases (propane & butane only)

Class 3: Flammable Liquids

Class 4
- Class 4.1 – Flammable Solids
- Class 4.2 – Substances Liable to Spontaneous Combustion
- Class 4.3 – Water Reactive Substances

Class 5: Oxidizing Substances
- Class 5.1 – Oxidizers
- Class 5.2 – Organic Peroxides

Class 6: Toxic and Infectious Substances
- Class 6.1 – Toxic Substances
- Class 6.2 – Infectious Substances

Class 8: Corrosives

Class 9: Miscellaneous Products, Substances or Organisms

Hazardous Waste Not Accepted by ESF

IMPORTANT NOTE: There are some wastes that are outside of ESF's mandate or cannot be accepted because of the restrictions in its operating plan. The cost of disposal for these wastes must be borne by the generator (e.g. compressed gases, unknowns, explosives).

ESF cannot manage or handle the following, and therefore, these procedures do **NOT** include:

- **Unknown solid or liquid chemicals** (any TDG class). Refer to "Disposal of Unknown Chemicals" for further instructions.
- **Compressed gases** (TDG class 2). Send returnable cylinders to suppliers; see Section A – 2.3.3 Lecture Bottles of Hazardous Gases for lecture bottles approved contractor contact information.
- **Explosives and potential explosives** (TDG class 1). Refer to "Disposal of Explosive Chemicals" for further instructions.
- **Radioactive chemicals** (TDG class 7)**.** Refer to Management of Radioactive Waste for further instructions.

2.2.2 Hazardous Waste Pick-up

ESF picks up hazardous waste throughout UBC on a scheduled basis. Pick-ups are scheduled Monday to Friday. Each building has a designated location for hazardous waste storage and Pick-up. These areas should be secured (such as locked rooms or cages).

Most buildings are on a schedule for routine collection. If you are unsure as to whether your building is on this schedule or if you require special pick-up, contact ESF at 604-822-1285 (general), 604-822-6306 (chemicals) or 604-827-5389 (biological waste).

IMPORTANT NOTE: In order to comply with the BC Hazardous Waste Regulations, all hazardous waste accumulation/storage areas must be regularly inspected by the Local Safety Committees. Refer to Appendix B for a detailed inspection checklist.

2.3 Recycling Programs

2.3.1 Solvent Recovery

The Solvent Recovery Program identifies, segregates, and purifies organic waste solvents for re-use on campus. The purified, distilled product is technical grade. Solvent wastes that are acceptable at the facility for recovery include methanol and acetone. Prior to waste solvents being sent to ESF for recovery, segregation procedures must be set up with the solvent recovery technician to ensure waste streams are compatible for recovery. Contact the ESF Solvent Recovery Technician at 604-822-1285 for more information.

2.3.2 Chemical Exchange

The Chemical Exchange Program was developed to share chemicals on campus that are no longer of use to the original user and divert them from disposal. Instead, these chemicals are tracked and marketed to other potential users on campus. See the **list of free chemicals** available to any UBC laboratory. This is a free service provided to the campus and not only reduces purchasing costs, but also disposal costs. Contact the ESF Technician at 604-822-6306 for more information.

2.3.3 Silver Recovery

Photographic waste containing greater than 5 ppm of silver is considered hazardous waste and prohibited from entering the sewer system. Silver, if introduced to the water system, is toxic to fish. ESF developed the Silver Recovery Program to comply with the Metro Vancouver Sewer Use Bylaw No. 299, Consolidated. Silver is recovered by running the photographic fixer through an ion exchange column. Contact the ESF Silver Recovery Technician at 604-822-1285 for more information.

2.3.4 Other Recycling Programs

Recycling programs for batteries, oil, paint, as well as laboratory plastics, are available through ESF.

3. Sink and Normal Garbage Disposal

Corrosive chemicals (e.g. acids or bases), displaying no other hazard characteristics, **MUST** be appropriately neutralized (pH = 5.5-10.5) and then poured down the drain with copious amounts of water. Toxic chemicals (e.g. ethidium bromide) or biological materials that have been deactivated using bleach **MUST** also be neutralized for sink disposal. Refer to the RMS Sanitary Sewers webpage and the Aqueous Waste Disposal Procedure for more information.

Waste that is not regulated as hazardous waste as defined by BC Hazardous Waste Regulation, and is not restricted or prohibited by Metro Vancouver bylaws, WHMIS, and NFPA can be disposed of via the normal trash or sewer. Refer to Section A - 3.1 Segregation of Non-Hazardous and Non-Regulated Waste for more details and to see a list of non-hazardous chemicals.

4. Spill Reporting

As required by law, RMS Environmental Services alerts the appropriate authority to external releases of dangerous goods to air, water and/or land (refer to the detailed Spill Reporting Procedures). Report any hazardous spills to RMS by completing the UBC Spill Reporting Form as soon as possible. This ensures that all hazardous material spills are reported as required. In the event of a spill or release of hazardous material, persons in the immediate area should act to ensure their personal safety. For cleaning up a spill refer to the RMS Spill Clean Up Procedure. Refer to RMS Spills and Accidental Releases for additional information and updated forms.

5. Frequently Asked Questions

1. What types of waste does the Environmental Services Facility handle?

ESF only disposes of hazardous wastes produced by registered waste generators. Non-hazardous wastes (such as garbage, glass, scrap metal, wood, packaging, etc.) are handled by UBC Waste Management (contact Building Operations Service Centre at 604-822-2173). Procedures for the wastes that ESF can manage are included in this manual. If you have any questions, please contact the RMS Environmental Advisor 604-822-9840 or an ESF Technician 604-822-1285.

2. What are UBC hazardous waste tags and generator barcode stickers and how do I get them?

For repeated waste streams such as: solvents, oils, non-regulated contaminated solids, and biological waste UBC has implemented a serialized, colour-coded, tag system that identifies the type of waste and allows for specific waste package or container tracking. The barcode sticker is a self-adhesive label that must be affixed to the UBC Hazardous Waste Tags on each container of waste sent to ESF. The barcode allows ESF to identify the Hazardous Waste Generators for waste tracking and legal purposes. Without the barcode sticker affixed to the tag, ESF may refuse collection and disposal of hazardous waste. In order to register as a UBC Hazardous Waste Generator and receive barcode stickers, tags, or waste containers, contact an ESF Technician at 604-827-5389.

3. How should I dispose of pharmaceutical drug waste?

ESF does handle pharmaceutical drug waste as per the requirements of "Disposal of Pharmaceuticals and Controlled Substances" in this manual.

4. What is cytotoxic waste and how should I dispose of it?

Cytotoxic waste is any medicinal product, chemical or chemically contaminated waste that possesses one or more of the hazardous properties ***toxic, carcinogenic, toxic for reproduction*** or ***mutagenic***. This waste may include drugs such as: antineoplastic agents, antivirals, immunosuppressants, a range of hormonal drugs, and others. The term "cytotoxic" refers to the toxin target (i.e. the cell) but is not defined as a specific waste stream under both the BC Hazardous Waste Regulation and the Transportation of Dangerous Goods Regulations. In general, this term refers to "chemical" toxins rather than "biological" toxins. The RMS case-by-case assessment of this waste stream is based on the toxicity (e.g. LD_{50}), concentration and volume of the cytotoxics. Unused cytotoxic medicines and drugs may be returned to the pharmacy/vendor, or disposed of per Disposal of Pharmaceuticals and Controlled Substances procedure. Other cytotoxic chemicals should be disposed of as chemical waste (refer to the Chemical Waste Disposal Procedure). If your waste is also biohazardous please address that contamination first: i.e. decontaminate by employing a chemical or other appropriate method. If your human anatomical/blood and body fluids, animal pathological waste or animal bedding is contaminated with cytotoxic drugs refer to the Disposal of Biomedical Waste Procedure or the Disposal of Animal Bedding procedure.

5. What should I do with <u>empty</u> glass solvent bottles?

Empty solvent bottles should be triple rinsed and disposed of as laboratory glass waste. Note that these bottles are not accepted for recycling. Refer to the detailed procedure "Disposal of Laboratory Glass Waste".

6. What should I do with chemically contaminated glassware and plasticware (tubes, plates, containers, pipette tips, etc)?

If you need to dispose of glassware and plasticware contaminated with small amounts or traces of chemicals (e.g. phenol, chloroform, trizol, cytotoxic drugs), you must rinse the glassware or plasticware carefully with an appropriate organic solvent (e.g. methanol, acetone, etc). Then dispose of the glass or plastic plates, tubes and containers as solid waste. Also refer to the detailed procedure "Disposal of Laboratory Glass Waste". However, the waste solvents used for rinsing must be collected into a solvent waste red jerry can and disposed of as hazardous waste according to the "Disposal of Organic Solvent Waste" procedure. Dispose of pipette tips in dedicated sharps containers per "Disposal of Sharps" procedure. For questions, contact an ESF Technician at 604-822-6306.

7. What are the procedures governing the disposal of propane cylinders?

For information on how to dispose of empty propane cylinders, refer to "Disposal of Propane and Butane Gas Cylinders" or, call an ESF Technician at 604-822-6306.

8. Can I send "road-kill" to ESF for disposal?

No, please contact Building Operations Service Centre at 604-822-2173 to arrange for pick-up.

6. Hazardous Waste Disposal Procedures

All wastes sent to the facility must be accompanied by waste identification information as summarized below. Also refer to the **UBC Hazardous Waste Management Procedures Poster** in Appendix A. If you have any questions, please contact an ESF Technician at 604-822-1285 or 604-822-6306.

a. **Biological Waste:** All transport of biological waste (includes biohazards, sharps, human blood/fluids, and pathological waste) must be accompanied by a serialized Biological Waste Disposal tag (obtained from ESF) attached to each bag. A generator barcode sticker (obtained from ESF) must be affixed to the tag and the waste composition completed.

b. **Chemical Waste**: All shipments of chemical wastes must be accompanied by a completed Chemical Waste Inventory Form (approved forms are e-mailed to generators by ESF technician). This inventory must identify the generator, their location, phone number, chemicals to be disposed and hazard classes.

c. **Flammable Liquids**: All transport of solvent wastes must be accompanied by a serialized Flammable Liquids Disposal tag (obtained from ESF) attached to each container. The generator barcode sticker (obtained from ESF) must be affixed to the tag and the waste composition completed.

IMPORTANT NOTE: Due to the health and safety of the workers handling the hazardous waste, labelling and packaging requirements are **strictly** enforced. **If the packages are not prepared as specified, ESF staff will refuse collection of the waste.** In the event that a shipment is not suitable, all attempts will be made to contact the generator from the information provided on the package. If ESF is unable to pick-up packages due to non-compliance with packaging requirements, ESF technicians will leave a tag explaining the reasons for refusal (see below).

Tag Describing Refusal of Pick Up from UBC Environmental Services Facility

a place of mind

Environmental Services Facility
6025 Nurseries Road, Vancouver, BC V6T 1W4

Date: ____/____/_____
Ticket Number: _____

ESF is unable to pick up this package because of the following reason(s):

- ☐ Weight of package is over 15 Kg
- ☐ Package is oversize
- ☐ Leakage
- ☐ Unsafe for transport
- ☐ Chemical approval form is missing
- ☐ Disposal Tag (Missing / No Barcode / Unidentified Waste Type)
- ☐ Other : _____

Should you have any questions, please contact ESF staff at _____

Thank you for your cooperation,
ESF Staff

Treatment & Disposal of Biohazardous Waste (NEW)

Purpose

This protocol describes the autoclave treatment conditions and requirements for laboratory solid waste contaminated with Risk Group 1 and 2 Biohazardous Materials (Category B Infectious Substances) in Laboratories at UBC Point Grey Campus. This treatment will allow the safe management of the resulting waste as non-hazardous solid waste in accordance with the waste delisting approved by the Ministry of Environment (MOE).

Scope

This procedure applies to all biohazardous materials/agents in Risk Groups 1 and 2, which may include the following:

- Human or animal cell cultures used in research
- Stocks of specimens of micro-organisms including Bacteria, Viruses, Fungi, Parasites, Rickettsiae and Chlamydiae
- Live or attenuated vaccines
- Plant viruses, bacteria and fungi
- Laboratory material that has come into contact with any of the above

The BC Hazardous Waste Regulations define this waste stream as *Microbiological Laboratory Waste*.

IMPORTANT NOTES:

- Changing the autoclave parameters (time, temperature and pressure) for waste treatment is not acceptable as it contravenes with the MOE specific conditions for UBC's waste delisting permit.
- Laboratory plastic containers that have not come into contact with biohazards and are acceptable for recycling should be recycled according to the Lab Plastic Recycling guidelines.
- This procedure does NOT apply to the disposal of:
  - biohazardous waste of Risk Group 3 biological agents and prions, as defined in the most recent *Canadian Biosafety Standards and Guidelines,* published by the Public Health Agency of Canada, for which special procedures apply (for more information contact the Biosafety Advisor at 604-822-9527).
  - toxins of infectious substances, including toxins defined by the Human Pathogens and Toxins Act, 2009 and listed under Schedule 1 (refer to the "Disposal of Human Toxins Waste" procedure).
  - biomedical waste, which consists of human anatomical parts, or human blood and body fluids, as defined in the most recent *Canadian Biosafety Standards and Guidelines,* published by the Public Health Agency of Canada (refer to the "Disposal of Biomedical Waste").
  - pathological waste including animal tissues, organs, body parts, and carcasses (refer to the "Disposal of Uncontaminated Pathological Animal Waste")
  - laboratory glass waste (refer to the "Disposal of Laboratory Glass Waste")
  - invasive plants waste (refer to the "Disposal of Non-Indigenous Species")
  - animal beddings (refer to the "Disposal of Animal Bedding")
  - genomic DNA/RNA and DNA/RNA contaminated solid waste (refer to the guidelines listed under the "Non-Hazardous Chemical Disposal" webpage). Recombinant DNA/RNA must be chemically treated before garbage disposal.

Background

- In contrast to chemical agents, infectious biological agents have the ability to replicate, thus giving rise to the potential of large populations in nature when small numbers may be the norm.
- Unlike chemicals, where "safe" levels are often allowed to be released into the environment, there is no "safe" level of a non-contained pathogenic organism. This procedure follows the guidelines set by the most recent *Canadian Biosafety Standards and Guidelines,* published by the Public Health Agency of Canada. Refer to UBC Risk Management Services, Laboratory Biosafety Reference Manual, 6th Edition, 2009 for further details on definitions, procedures, management of biohazardous materials, and Risk Group classifications, or contact the Biosafety Advisor at 604-822-9527.
- Disposal of untreated biohazardous waste to landfills is prohibited by the BC Hazardous Waste Regulations, 2009 and the Metro Vancouver Tipping Fee and Solid Waste Disposal Regulation Bylaw No. 263, 2012.
- All biohazardous organisms MUST be rendered harmless by approved methods before being released into the environment.

Procedure

General

- Laboratory waste that is NOT biohazardous, as defined in this procedure, can be disposed of in the regular garbage. Examples of such waste include uncontaminated gloves, wrappers, packaging material, plastics and labware.
- Proper segregation of biohazardous versus non-biohazardous waste is essential in reducing the volume and the cost of handling biohazardous waste.

Treatment

- Collect laboratory solid waste contaminated with RG1 and RG2 bio-hazardous materials and place in transparent autoclave bag[1] with no marking
- Loosely close using autoclave tape (i.e. chemical indicator)
- **Autoclave all waste for 60 minutes at 121°C and 15 psi**
- At the end of the autoclave cycle:
  - check to ensure the chemical indicator had turned black at the end of the autoclave cycle
  - affix biohazard waste disposal tag (red) on the bag
  - indicate "Autoclaved Risk Group 1 or 2" as appropriate on the tag (refer to sample tag at the end of this procedure)
  - attach a generator barcode sticker on the tag
- Each bag must not weigh more than 10 kg
- Place the bag in your building hazardous waste collection area
- Record the autoclave cycle details on the autoclave log: i.e. treatment date, autoclave cycle duration, temperature and pressure. (Refer to sample "Autoclave Log", Appendix 1). Keep your autoclave chart readouts on file.

Monitoring Protocol

[1] Use suggested Bag Biohazard, Autoclave, Fisherbrand, Polypropylene, Plain, Clear, thickness 2mil, Size: 24"x30", Cat. 01-826-6; VWR Brand, Cat. 95042-556, or equivalent. Other sizes are available.

Treatment Process Monitoring:

- The treatment of each individual bag shall be verified by chemical indicator.
- Autoclave treatment efficiency shall be verified by monthly testing with biological indicator[2].
- The autoclave room shall be inspected monthly to ensure area is free of spill, kept clean and tidy, autoclave logs are accurately kept, and autoclave efficiency is tested and recorded (refer to sample "Monthly Inspection Checklist", Appendix 2)

NOTE: The biological indicator testing and monthly inspections will be performed by the autoclave room responsible person.

Waste Characterization Monitoring:

At the time of collection, waste packaging and labeling will be inspected for integrity and accuracy of accompanying information by ESF technicians. Waste packages that do not meet requirements will be sent back to generator for correction and further treatment. Only packages that meet requirements will be collected for disposal.

[2] Use *Self-Contained Biological Indicators for Steam Sterilization*, such as EZTest® BIs by Mesa Labs, or equivalent that fit the prescribed treatment

Biological Waste Disposal Tag

BIOLOGICAL WASTE DISPOSAL
The University of British Columbia, Environmental Services Facility

B08110000001

Parcel Identification No:

BIOLOGICAL WASTE DISPOSAL

B08110000001

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓)

- ☐ Uncontaminated Animal Carcasses

BIOMEDICAL (TDG Class 6.2, 6.1)

- ☐ Anatomical - Human
- ☐ Blood & Body Fluids *
- ☐ Primates **
- ☐ Sharps ***
- ☐ Pharmaceuticals (Non-narcotic)

BIOHAZARDOUS

- ☐ Pathological
- ☐ Autoclaved Risk Group 1
- ☐ Autoclaved Risk Group 2
- ☐ Autoclaved Risk Group 3 **

Other **** _____

NOTES:

* Human or Animal
** Special arrangements must be made for Primates and RG 3 (Contact ESF)
*** Scalpel/razor blades, needles, syringes (no glass)
**** Contact ESF

Office use only:

Weight _____ Kg

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

August 2011

Appendix 1: Sample Autoclave Log

Autoclave Location **Building** **Room Number**	
Make and Model of Autoclave	
Autoclave Serial Number	

Date	**Cycle number**	**Temp** (121°C)	**Pressure** (15 psi)	**Sterilizing hold time** (60 min)	**User Name**	**Signature**

DO NOT forget to keep your autoclave chart readouts on file!

Appendix 2: Autoclave Facilities Sample Monthly Inspection Checklist

Building name: Room #:	
Autoclave Brand & Model: Unit Serial #:	
Inspection date	
Inspector's contact information: • Name • Phone • E-mail	

Instructions:

1. Complete inspection on a monthly basis.
2. Inspect each item on the checklist and check **Yes** box (✓) if satisfactory or **No** if unsatisfactory.
3. For unsatisfactory items, describe the deficiency in the Comments section.
4. Take actions or make necessary recommendations to correct the deficiencies.
5. Submit a copy of the completed checklist to RMS at the end of each month, through the autoclave.report@ubc.ca email

Check List Items	Yes	No	Comments
Does the room have a controlled Access?	☐	☐	
Room is open but area/floor is controlled	☐	☐	
Is the area inspected monthly?	☐	☐	
Record of inspection is up-to-date?	☐	☐	
The area is free of spills and leaks?	☐	☐	
Autoclave cycles are recorded on autoclave logs?	☐	☐	
Autoclave Charts are kept on file?	☐	☐	
Written autoclave logs contain all required information?	☐	☐	
Has the autoclave unit been tested with biological indicators (BI) monthly?	☐	☐	
Was the test successful this month?	☐	☐	
Were the BI test parameters (temperature=121°C, time=60min, pressure=15psi) noted on the autoclave log?	☐	☐	

Inspector's signature: _____

Disposal of Human Toxins Waste (NEW)

Purpose

Certain toxins are regulated by the Human Pathogens and Toxins Act (HPTA), 2009. HPTA Regulations address safety and security risks associated with several aspects of human pathogens and toxins, whether imported or domestically acquired. The Public Health Agency of Canada (PHAC) sets the requirements for their disposal. Toxins are classified as toxic substances under Canada's current Transportation of Dangerous Goods Regulations, while the WHMIS classification is D1 (materials causing immediate and serious toxic effects) and D3 (biohazardous infectious material). The proper disposal of toxins poses special challenges but is a vital step towards the protection of laboratory and service personnel.

Scope

According to HPTA and for the purpose of this procedure, toxins are substances produced by, or derived from, a micro-organism that is able to cause disease in humans. This procedure specifies the safe and proper disposal of toxins and it applies to disposal of human toxins from UBC research laboratories.

The toxins are listed in Schedule 1-Toxins or Schedule 5-Prohibited Human Pathogens and Toxins, Part 1 (no toxins listed there currently) of the HPTA (refer to Appendix 1 for this list).

This procedure is not intended for the disposal of "toxic chemicals" (refer to the Disposal of Laboratory Chemical Waste Procedure).

Background

Biological toxins (biotoxins) are poisonous substances that are a natural product of the metabolic activities of living organisms (plants, animals, fungi, bacteria). Some toxins can be artificially produced by chemical synthesis or by genetic engineering and rDNA technology. Toxins are neither living organisms, nor are they "classic" organic chemicals. Unlike most other biohazards, toxins do not replicate, are not infectious, and are not transmitted from person to person. In many senses, biotoxins are more analogous to toxic (poisonous) chemicals, and several of them have protein, polypeptide, and/or polysaccharide structures. Biotoxins have very low LD50s (in the ng/kg or ug/kg range) and can cause adverse (acute) health effects, severe incapacitation, or even death in humans or animals. Many commonly employed toxins have very low volatility and, especially in the case of protein toxins, are relatively unstable in the environment. Refer to the current Canadian Biosafety Standards and Guidelines (CBSG) and Biosafety Manual for more details.

Deactivation Methods:

Due to the wide variety of biological toxins with different physical properties, it is not possible to provide standard decontamination procedures that apply to all circumstances. It is the responsibility of the laboratory or facility where the toxins are handled and/or stored to determine the risks and how best to mitigate them, including the appropriate and effective inactivation method.

There are several variations in treatment method, temperature, concentration of reagents and contact time. The three main methods for toxin deactivation are summarized below.

1. **Moist-heat (steam autoclaving)** methods of inactivation with temperatures of at least 121°C, 15 psi for 1 hour. This method will permit adequate inactivation of most biological toxins, including protein-like (bacterial) toxins.

2. **Chemical decontamination (denaturing)** uses either sodium hypochlorite (bleach/NaOCl) or sodium hydroxide (NaOH) or a combination of both. A solution of 2.5% NaOCl and 0.25 N NaOH, with a contact time of at least 30 minutes, will adequately inactivate most biological toxins. Others need higher concentrations (e.g. 10% bleach, 2N NaOH). This method is suitable for low-molecular-weight, heat-stable toxins (e.g. anthrax toxins, perfringolysin O toxin, mycotoxins). Some toxins and toxin contaminated items require a much longer contact time (e.g. 1-8 hours for mycotoxins). In addition, select toxins are susceptible to other chemicals such as formaldehyde, glutaraldehyde and ethanol.

3. **Dry-heat (incineration)**, at temperatures of at least 815°C for 10 minutes, is effective for the inactivation of most biological toxins. Lower temperatures (>100°) are sometimes used for certain toxins.

Examples of some toxins commonly used in UBC research labs and their deactivation methods are listed in the table below:

Toxin Name	**Autoclaving** (>121°C, 15 psi, 60 min)	**Chemical denaturing** (NaOCl and/or NaOH, various conc ≥30 min)	**Incineration** (815°C, >10 min)	**Other methods or reagents**
Botulinum neurotoxin	Yes	Yes	Yes	
Cholera toxin	Yes	Yes	Yes	Boiling for 30 min
Diphtheria toxin	Yes	Yes	Yes	
E.coli enterotoxins (LT & ST)	Yes	Yes	Yes	UV, gamma irradiation (LT only)
E.coli lipopolysaccharide (LPS)	Yes (?) (>130°C)	Yes (?)	Yes	Formaldehyde Hydrogen peroxide
Pertussis toxin	?	Yes (10% NaOH)	Yes	Acids
Staphylococcal enterotoxin	Yes (?)	Yes (?)	Yes (?)	Formaldehyde

Procedure

Waste generators MUST review the Material Safety Data Sheet (MSDS) associated to a given toxin to determine the appropriate means of decontamination and/or follow approved disposal methods as listed under their Biosafety Approval Protocol. Alternatively, check the literature for the most appropriate deactivation method.

For additional questions contact the Biosafety Advisor (604-822-9527) and the Environmental Services Advisor (604-822-9840).

A. General Procedure (for all methods)

- Determine if the unused/waste toxin is a chemical or biological material. If this is chemical waste (toxic, flammable, corrosive, reactive) refer to the Chemical Waste Disposal Procedure for details.
- Complete all the required information on the Red Biological Waste Disposal Tag (shown in Appendix 1) and affix the generator barcode sticker. Under "Other" write "**Human Toxin for Incineration**" and include the exact name of the toxin.
- Check the LD50 (this is usually very low for biotoxins). Then check if it is a human toxin as per HPTA Schedule 1 (refer to Appendix 2).
- Assess the nature, quantity and concentration of the toxin waste and if it requires special disposal methods not listed in the biosafety approval protocol or this procedure.
- Deactivate toxins according to biosafety protocol and/or MSDS requirements.
- Ensure toxin vials are inside a secondary leak-proof plastic biological sharps waste container with a lockable/closeable lid.
- Document the destruction of "Toxin" the laboratory as part of the laboratory inventory records. In addition, ensure that the toxin is removed from your Biosafety Permit in the RISe system.
- Complete **Toxin Inactivation Declaration Label** (Appendix 3) and attach to the back of the red biological waste tag.
- Attach the red tag to the container and place for disposal in the designated waste location or wait for ESF technician to collect the container from your lab.
- Toxin waste failing to comply with any of the above requirements will not be collected.
- ESF will notify the PI or lab manager if special arrangements or packaging is required.
- Contact ESF (604-827-5389) to request biological waste disposal (red) tags, or toxin disposal labels.

B. Steam Autoclaving at 121°C, 15 psi for 60 minutes (liquid/slow exhaust cycle)

- In a fume hood or biological safety cabinet, loosen the cap of the primary toxin container to allow steam penetration.
- Place the primary toxin containers (vials) into a secondary biohazard sharps container.
- Place the sharps container in an autoclavable pan.
- Autoclave using steam at 121° C and 15 psi for 60 minutes on liquid (slow exhaust) cycle. (Refer to the safe **Autoclaving Procedure** in the current Biosafety Manual and the Treatment and Disposal of Biohazardous Waste Procedure for details.)
- Label correctly and send the sharps container for disposal to ESF as "**Autoclaved Human Toxin for Incineration"** (refer to the general procedure above for additional details).

Glassware:

Glassware contaminated with toxins must be autoclaved per procedure above (if this is the appropriate deactivation method) and may be reused.

Solid Waste:

All disposable materials (gloves, gauze pads, plasticware, etc) must be autoclaved per procedure above (if this is the appropriate deactivation method) prior to disposal. Refer to the Treatment and Disposal of Biohazardous Waste Procedure for details.

C. Chemical Inactivation using Sodium Hypochlorite (bleach/NaOCl) or Sodium Hydroxide (NaOH)

- Caution! Make sure that the chemical(s) in the original solution is/are compatible with bleach and/or NaOH.
- Make fresh bleach solutions and ensure that appropriate concentrations of NaOCl and/or NaOH are used.
- Use other safety precautions: work in a fume hood or biosafety cabinet; place plastic backed absorbent paper (bench diaper) on the work surface of the fume hood or biosafety cabinet.
- Open vials or containers and place directly into the bleach, sodium hydroxide or mixture solution, ensure they are covered and filled with liquid NaOCl/NaOH.
- Allow the solution to stand for at least **60min (1 hour).** Check the correct contact time in the lab protocol and MSDS.
- Secure the cap on the primary container (vial). Ensure toxin vials are inside a secondary leak-proof plastic biological sharps waste container with a lockable/closeable lid.
- Label correctly and send the sharps container for disposal to ESF as "**Chemically Deactivated Human Toxin for Incineration"** (refer to the general procedure above for additional details).

Glassware:

- Soak all toxin contaminated glassware in a mixture of 2.5 % NaOCl and 0.25N NaOH for 8 hours. Alternatively soak in 5% bleach for 8 hours (household bleach stock solutions are ~ 5%).
- Rinse in water, neutralize solutions (acceptable pH=5.5-10.5) before drain disposal and either reuse or dispose of glassware. Refer to the *Aqueous Waste Disposal Procedure* and the *Disposal of Laboratory Glass Waste Procedure* for additional details.

Solid Waste:

- Soak solid waste (gloves, gauze pads, plasticware, etc) in a mixture of 2.5 % NaOCl and 0.25N NaOH for ≥16 hours. Alternatively soak in 5% bleach for ≥16 hours.
- Safely separate waste from liquid and air dry in a fume hood or biosafety cabinet. Double bag the dried waste, label and dispose of per *Disposal of RG1/RG2 Waste Procedure*.

D. Dry Heat Method (Send for Incineration)

- If decontamination is impracticable (i.e. no other method of deactivation other than dry heat at temperatures that cannot be achieved by regular ovens), materials must be sent for incineration.
- Ensure toxins (vials) are inside a secondary leak-proof plastic biological sharps waste container with a lockable/closeable lid.
- Clearly label containers as per general procedure above.
- Waste generators must contact ESF (604-827-5389). ESF will make arrangements for direct pick-up by hazardous waste contractor.

Appendix 1 - Biological Waste Disposal Tag

BIOLOGICAL WASTE DISPOSAL

The University of British Columbia, Environmental Services Facility

B08110000001

Parcel Identification No:

BIOLOGICAL WASTE DISPOSAL

B08110000001

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓)

- ☐ Uncontaminated Animal Carcasses

BIOMEDICAL (TDG Class 6.2, 6.1)

- ☐ Anatomical - Human
- ☐ Blood & Body Fluids *
- ☐ Primates **
- ☐ Sharps ***
- ☐ Pharmaceuticals (Non-narcotic)

BIOHAZARDOUS

- ☐ Pathological
- ☐ Autoclaved Risk Group 1
- ☐ Autoclaved Risk Group 2
- ☐ Autoclaved Risk Group 3 **

Other **** _____

NOTES:

* Human or Animal

** Special arrangements must be made for Primates and RG 3 (Contact ESF)

*** Scalpel/razor blades, needles, syringes (no glass)

**** Contact ESF

Office use only:

Weight _____ Kg

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

August 2011

Appendix 2 – List of Toxins (HPTA, Schedule 1)

1.	Aerolysin
2.	Alpha toxin
3.	Anthrax toxins: Lethal Toxin and Oedema Toxin
4.	Bordetella pertussis Adenylate cyclase toxin
5.	Botulinum neurotoxin
6.	Cholera toxin
7.	Clostridium botulinum C2 and C3 toxins
8.	Clostridium difficile toxins A and B
9.	Clostridium perfringens Epsilon toxin
10.	Dermonecrotic toxin
11.	Diphtheria toxin
12.	Escherichia coli toxins: E. coli Cytotoxic Necrotizing Factor (CNF), Heat-labile E. coli enterotoxin (LT), Heat-stable E. coli enterotoxin (ST), Cytolethal distending toxin (CLDT), Enteroaggregative Shiga-like toxin 1 (EAST)
13.	Exfoliative toxin (also called Exfoliatin)
14.	Exotoxin A
15.	Hemolysin
16.	Listeriolysin O
17.	Pasteurella multocida toxin
18.	Perfringolysin O
19.	Pertussis toxin
20.	Pneumolysin
21.	Pyrogenic exotoxin
22.	Shiga-like toxin (verotoxin)
23.	Shigatoxin
24.	Staphylococcal enterotoxins
25.	Staphylococcus aureus Toxic shock syndrome toxin
26.	Streptolysin O
27.	Tetanolysin
28.	Tetanospasmin (Tetanus toxin)

Appendix 3: Toxin Inactivation Sample Label

Name of Toxin	
Vendor Name (if applicable)	
Catalog Number (if applicable)	
Lot Number (if applicable)	
Amount	
Deactivation Method (provide details or indicate if not deactivated)	
Date	
Generator initials	

NOTES:

- Please provide the above information before submitting any toxin waste to ESF.
- Append this label to the back of the red biological waste tag.
- These labels and red biological waste tags can be obtained from ESF (604-827-5389)

Disposal of Sharps

Purpose
This procedure specifies the method for proper disposal of sharps and needles to ensure the safety of disposal workers.

Scope
This procedure applies to the disposal of sharps that may be contaminated or uncontaminated by biohazardous agents (refer to scope defined in procedure Treatment & Disposal of Biohazardous Waste).

Sharps waste is a form of biomedical waste, as defined in Part 1 (j) of the BC Hazardous Waste Regulation. Clinical and laboratory sharps waste consists of needles, syringes, blades or laboratory glass **capable of causing punctures or cuts**. Thus, to avoid injuries sharps waste must be carefully handled.

Background
Disposal of sharps and needle waste to landfills is prohibited by Metro Vancouver and under the BC Hazardous Waste Regulation 2009.

Procedure
A. Sharps contaminated with biohazards
Sharps (including needles) present both a physical and potentially infectious hazard. To control these hazards, sharps waste **must** be collected in **APPROVED** red or yellow containers made of a rigid, puncture-resistant and impervious plastic that can be autoclaved. The containers **must** be labeled with a bio-hazardous label on the outside and they must be closable/lockable.

Only APPROVED containers may be used for these wastes and they must not be used for any other purpose. These containers must comply with Canadian standards CAN/CSA-Z316.6-07 (2007). Examples of acceptable brands include BD and COVIDIEN (formerly KENDALL/DEVON/TYCO). Approved, autoclavable containers can be purchased from Campus Stores (LSC, Chemistry, Zoology), laboratory suppliers or local medical products distributors (e.g. Bowers Medical Supply or Stevens Co.).

IMPORTANT NOTE: Not ALL commercially available sharps containers are autoclavable! Waste generators MUST ensure that the sharps containers they are using are autoclavable.

Follow the steps below:
1. Collect all sharps (including needles) in **approved plastic** "sharps containers".
2. Do not fill the container past the indicated "Full" line (i.e. **3/4 full**).
3. Chemically decontaminate (e.g. bleach) all infectious items prior to disposal into the container, **OR** autoclave the entire container once it is full.
4. Ensure that the pH is neutral after the chemical decontamination, by either rinsing with water or neutralizing the decontamination solution.
5. Securely close and snap the lid in place.
6. Take the full container to the building's designated area for pick-up and disposal.
7. Do **NOT** put sharps into plastic bags.
8. If there is more than one sharps container, place the containers in an unsealed open cardboard box.

9. Containers must be tagged with the **Biological Waste Disposal Tag (Red)** (shown below). Affix your waste generator barcode sticker (contact 604-827-5389 for either of these supplies). Identify waste content by checking the appropriate box on the tag and fill out the requested information.
10. Sharps containers MUST NOT be placed into the "Glass Waste Only" cans; they are to be taken to the building's designated area for hazardous waste disposal.

B. Sharps contaminated with traces of chemicals or cytotoxic drugs

1. DO NOT autoclave
2. Collect all sharps (including needles) in **approved plastic** "sharps containers".
3. Label using the red biological waste disposal tag. Check "Sharps" box under Biomedical waste. Write, e.g. "Sharps contaminated with (traces of) cytotoxics", under "Other".
4. Follow similar detailed procedure as above.

C. Uncontaminated Plastic Syringes

1. Syringe bodies (with needles removed) should be collected in clear plastic bags and will become Risk Group 1 waste. (For needles, refer to Sharps procedure above).
2. All Risk Group 1 waste must be contained in **CLEAR and UNLABELLED** autoclave bags. Bags **MUST NOT** be marked with biohazardous warning symbols or warning labels. The bags must then be autoclaved sufficiently to render the organism in question harmless. Autoclaved bags **MUST** be leak proof. To prevent leaks and breakage during storage or transportation, double bagging with a clear plastic bag is required.
3. Each bag must not weigh more than **10** kg.
4. Do not put glass or sharps in with Risk Group 1 waste.
5. After autoclaving, bags must be tagged with the UBC Environmental Services **Biological Waste Disposal tag (Red)** (shown below). Affix your waste generator number sticker where indicated. On the tag, check off the box marked "**Autoclaved Risk Group 1**" and place it in the building's designated area for pick-up by ESF (Contact an ESF Technician at 604-827-5389 if you require any of these supplies).

Biological Waste Disposal Tag

BIOLOGICAL WASTE DISPOSAL
The University of British Columbia, Environmental Services Facility

B08110000001

Parcel Identification No:

BIOLOGICAL WASTE DISPOSAL

B08110000001

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓)

- ☐ Uncontaminated Animal Carcasses

BIOMEDICAL (TDG Class 6.2, 6.1)

- ☐ Anatomical - Human
- ☐ Blood & Body Fluids *
- ☐ Primates **
- ☐ Sharps ***
- ☐ Pharmaceuticals (Non-narcotic)

BIOHAZARDOUS

- ☐ Pathological
- ☐ Autoclaved Risk Group 1
- ☐ Autoclaved Risk Group 2
- ☐ Autoclaved Risk Group 3 **

Other **** _____

NOTES:

* Human or Animal

** Special arrangements must be made for Primates and RG 3 (Contact ESF)

*** Scalpel/razor blades, needles, syringes (no glass)

**** Contact ESF

Office use only:

Weight _____ Kg

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

August 2011

Disposal of Biomedical Waste

Purpose

This procedure specifies the requirements for the handling and disposal of biomedical waste in accordance with all legislation and observing all safety precautions.

Scope

This procedure describes the handling, packaging and treatment required by the Environmental Services Facility (ESF) for disposal of all biomedical waste.

Biomedical waste at UBC includes the following:

- Human anatomical waste: This consists of human tissues, organs and body parts, but does not include teeth, hair and nails.
- Human blood and body fluid (BBF) waste: This consists of human fluids, blood and blood products, items saturated or dripping with blood, body fluids contaminated with blood and body fluids removed for diagnosis during surgery, treatment or autopsy. This does not include urine or feces.
- Contaminated animal pathological waste (including animal carcasses)

NOTE: This disposal procedure **does not** apply to:

- Primate Anatomical Waste (Refer to "Disposal of Non-Human Primate Pathological Waste")
- Animal Bedding (Refer to new procedure "Disposal of Animal Bedding")
- Sharps Waste (Refer to "Disposal of Sharps")
- Uncontaminated Pathological Animal Waste (Refer to "Disposal of Uncontaminated Pathological Animal Waste")

Background

This procedure is based on the Guidelines for the Management of Biomedical Waste in Canada, written by the Canadian Council of Ministers of the Environment in February 1992. These guidelines define what biomedical waste is, and how it should be handled.

Procedure

A. Biomedical Waste

The procedure for the disposal of biomedical waste is as follows:

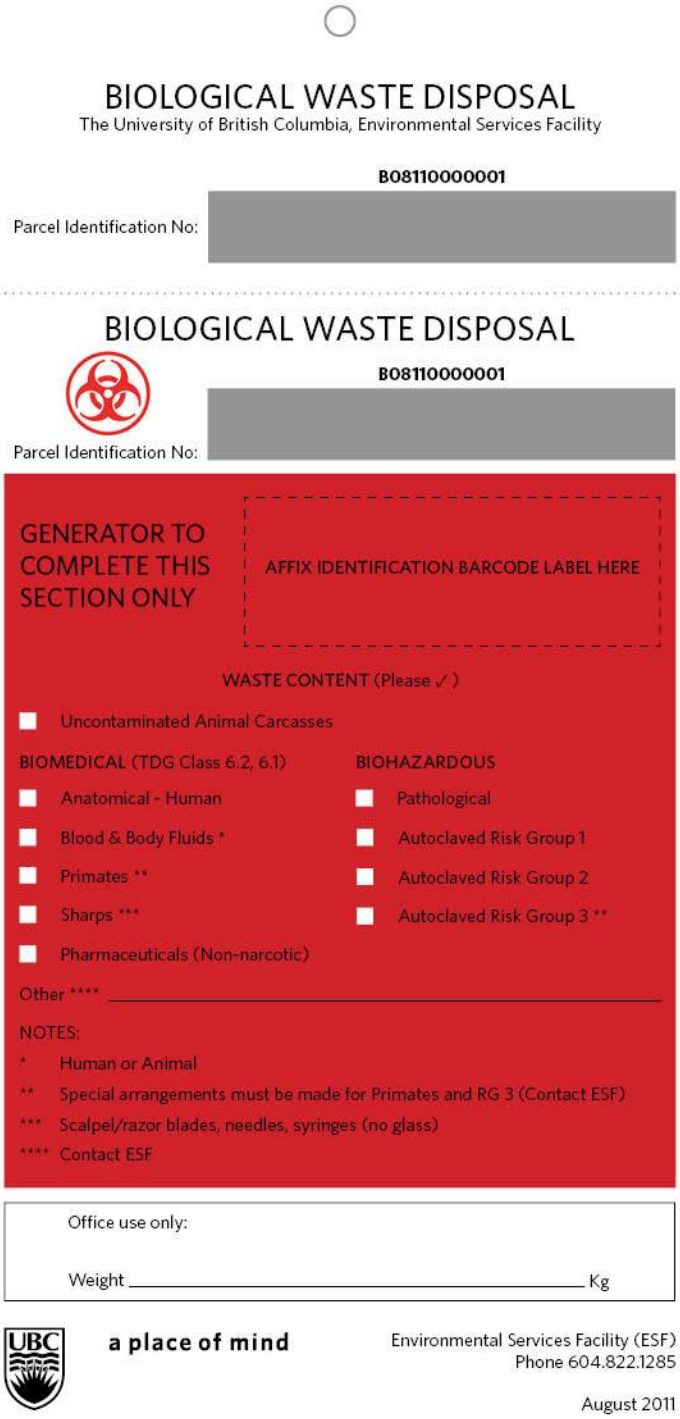
1. All biomedical waste **MUST** be contained in autoclavable **RED** bags bearing the **biohazard** symbol, which can be obtained from a laboratory supplier. The bag cannot leak. All packages must be **double bagged** to ensure that there is no possibility of leakage. Leaking bags will be refused for pick-up.
2. ESF must be able to package the red bag into a box (length=24", height=18", width=13") available from UBC's disposal supplier. Therefore, the maximum size of the bags must be less than the aforementioned box dimensions.
3. Note: **Blood Tubes** and **Blood Bags** must be contained inside a **plastic sharps container** to prevent accidental leaking and spillage during transportation.
4. Each bag must not weigh more than **10** kg.
5. Complete all the required information on the **Biological Waste Disposal Tag (Red)** (shown below), affix the barcode sticker, check the appropriate box, and fill out all requested information. Attach the tag to the bag.
6. Store in the freezer located in the building's designated area for scheduled pick-up by ESF.

B. Contaminated Animal Pathological Waste

The procedure for the disposal of contaminated animal pathological waste (including animal carcasses) is as follows:

1. Collect chemically contaminated animal carcasses or pathological waste in a black polypropylene bag (6 mil thick, 40 cm x 40 cm - available through Plant Operation Stores). These heavy duty black bags are used because this waste is typically too heavy for the red bags. All tubing, catheters, plastic clips, tags, etc. must be removed from the animal before packaging.
2. Each bag must not weigh more than **10** kg.
3. Bags **MUST** be tagged with the UBC Environmental Services **Biological Waste Disposal tag (Red)** (as shown below). Affix your waste generator number sticker where indicated. On the tag, check the box marked "**Pathological**" and place bags in the building's designated area for pick-up by ESF.
4. Bagged materials must be fully frozen prior to pick-up.
5. Bagged materials must be stored in a freezer for pick-up by ESF.

Biological Waste Disposal Tag



BIOLOGICAL WASTE DISPOSAL

The University of British Columbia, Environmental Services Facility

B08110000001

Parcel Identification No:

BIOLOGICAL WASTE DISPOSAL

B08110000001

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓)

- ☐ Uncontaminated Animal Carcasses

BIOMEDICAL (TDG Class 6.2, 6.1)

- ☐ Anatomical - Human
- ☐ Blood & Body Fluids *
- ☐ Primates **
- ☐ Sharps ***
- ☐ Pharmaceuticals (Non-narcotic)

BIOHAZARDOUS

- ☐ Pathological
- ☐ Autoclaved Risk Group 1
- ☐ Autoclaved Risk Group 2
- ☐ Autoclaved Risk Group 3 **

Other **** _____

NOTES:

* Human or Animal

** Special arrangements must be made for Primates and RG 3 (Contact ESF)

*** Scalpel/razor blades, needles, syringes (no glass)

**** Contact ESF

Office use only:

Weight _____ Kg

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

August 2011

Disposal of Non-Human Primate Pathological Waste

Purpose

This procedure specifies the requirements for the handling and disposal of non-human primate pathological waste, the entire carcass or parts, in accordance with all legislation and observing all safety precautions.

Scope

This procedure applies to the disposal of non-human primate pathological waste such as tissue, blood and body fluids of Macaques (monkeys of the genus *Macaca*).

Background

Macaques are widely used in biomedical research because of their genetic, anatomic, and physiologic similarities to humans. In this setting, human contact directly with macaques or with their tissues and fluids sometimes occurs. *Cercopithecine herpesvirus 1* (*herpesvirus simiae*, B virus), an alphaherpesvirus endemic in Asian macaques, is classified as a Risk Group 4 biohazard in its pure form. Most macaques naturally carry B virus without overt signs of disease. However, zoonotic infection with B virus in humans usually results in fatal encephalomyelitis or severe neurologic impairment. Although the incidence of human infection with B virus is low, a death rate of >70% before the availability of antiviral therapy makes this virus a serious zoonotic threat.

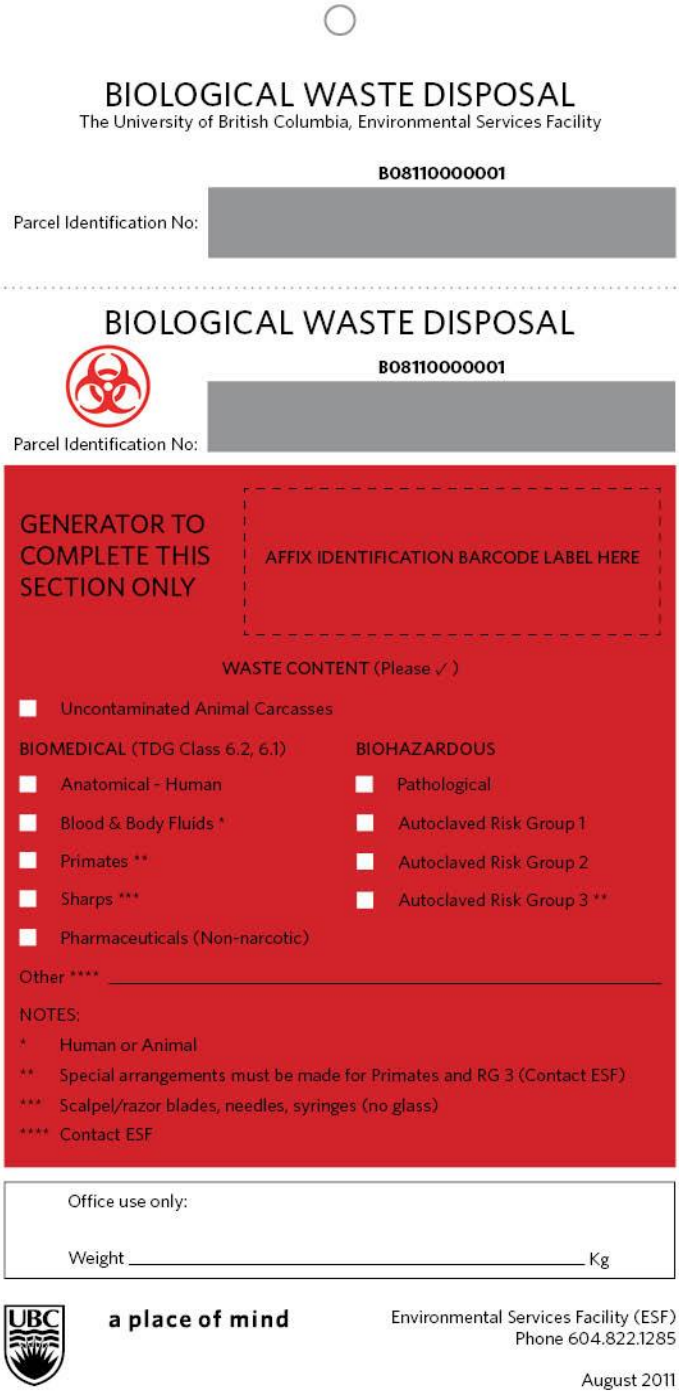
Stericycle is the UBC medical waste disposal contractor that collects and treats all of UBC's biohazardous and biomedical waste. Stericycle requires non-human primate pathological waste to test negative for *Cercopithicine Herpesvirus 1* prior to disposal and may also require a special license and ERAP from Transport Canada because the waste may contain this virus. However, if the non-human primate has tested negative by serological testing within one year of death, then it can be disposed of as biomedical waste. A copy of the tests results and a completed Principal Investigator (PI) or veterinarian declaration form should be forwarded to the ESF Technician prior to disposal.

Procedure

1. Generators of primate waste must have a serological test result for *Cercopithicine Herpesvirus 1* (B virus) for the animal dated within one year of animal death.
2. If the non-human primate has tested **negative** the waste generator must complete and sign the declaration form confirming that the animal was tested and shown to be negative for *Cercopithecine Herpesvirus 1*. Fax the form to ESF at 604-827-5087. This form and a copy of the most recent test results must be received by ESF staff prior to pick up arrangement. Refer to form at the end of this procedure.
3. All primates testing **positive** for *Cercopithecine Herpesvirus 1*, should be euthanized and autoclaved to be acceptable for disposal through Stericycle as anatomical waste. Waste generator must complete the declaration form, check the second option and fax form to ESF at 604-827-5087. This form must be received by ESF staff prior to pick up arrangement. Refer to form at the end of this procedure.
4. Animals that were not tested will be treated as if contaminated and will require autoclaving prior to disposal. Waste generators must complete the declaration form, check the third option and fax form to ESF at 604-827-5087. This form must be received by ESF staff prior to pick up arrangement. Refer to form at the end of this procedure.

5. Primate anatomical waste must be double-bagged securely in red bags.
6. ESF will provide a lined box or red pail. The bags must be placed in the lined box or red pail for storage.
7. On the Biological Waste Disposal tag, affix a barcode sticker and check the "**Primates**" box.
8. Place box in freezer. Contact ESF at 604-827-5389 for pick-up.

Biological Waste Disposal Tag



BIOLOGICAL WASTE DISPOSAL
The University of British Columbia, Environmental Services Facility

B08110000001

Parcel Identification No:

BIOLOGICAL WASTE DISPOSAL

B08110000001

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓)

- ☐ Uncontaminated Animal Carcasses

BIOMEDICAL (TDG Class 6.2, 6.1)

- ☐ Anatomical - Human
- ☐ Blood & Body Fluids *
- ☐ Primates **
- ☐ Sharps ***
- ☐ Pharmaceuticals (Non-narcotic)

BIOHAZARDOUS

- ☐ Pathological
- ☐ Autoclaved Risk Group 1
- ☐ Autoclaved Risk Group 2
- ☐ Autoclaved Risk Group 3 **

Other **** _____

NOTES:

* Human or Animal
** Special arrangements must be made for Primates and RG 3 (Contact ESF)
*** Scalpel/razor blades, needles, syringes (no glass)
**** Contact ESF

Office use only:

Weight _____ Kg

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

August 2011

Primate Disposal Declaration Form

Generator name _____

Generator ID _____

Contact phone number _____

I hereby declare that the primate waste for disposal:

- ☐ Was tested negative for *Cercopithecine Herpesvirus 1*
  A copy of the most recent test result (must be within one year of disposal) is attached
- ☐ Was tested positive for *Cercopithecine Herpesvirus 1* and was autoclaved prior to disposal
- ☐ Was **not** tested for the virus but autoclaved prior to disposal

Signature _____

Date _____

Disposal of Pharmaceuticals and Controlled Substances

Purpose

This procedure specifies the safe and proper disposal of pharmaceuticals and controlled substances. Controlled substances are regulated under the Canadian Controlled Drugs and Substances Act (1996) and the Food and Drugs Act (1985) in accordance with federal guidelines.

Scope

This procedure applies to disposal of Pharmaceuticals and Controlled Substances.

Background

A pharmaceutical drug (pharmaceutical) is any chemical compound used in the diagnosis, treatment, or prevention of diseases or other abnormal conditions. Pharmaceuticals can be non-narcotic or narcotic. Narcotics or hallucinogens affect the central nervous system causing changes in behaviour and often addiction.

A **"Controlled Substance"** is a drug or therapeutic agent which has been declared by federal law to be illegal for sale or use, but may be dispensed under a physician's prescription. Controlled substances, commonly understood to include (but not limited to) narcotics, are held under strict governmental control. The basis for control and regulation is the danger of addiction, abuse, physical and mental harm (including death), trafficking by illegal means, and dangers from actions of those who have used the substances.

Controlled substances are included in Schedules I-VIII of the Controlled Drugs and Substances Act (1996, c. 19) and the Schedule under the Narcotic Control Regulations:

- Schedule I
- Schedule II
- Schedule III
- Schedule IV
- Schedule V
- Schedule VI
- Schedule VII
- Schedule VIII

Disposal of controlled substances must comply with the Controlled Drugs and Substances Act, and Parts G (Controlled Drugs) and J (Restricted Drugs) of the Food and Drug Regulations (C.R.C., c. 870). Health Canada sets the requirements for their disposal. In general, if generators had to obtain a Health Canada permit in order to purchase a controlled substance then a permit is also required to dispose of it.

Procedure

A. Pharmaceuticals (NOT Regulated as Controlled Substance)

The procedure for the disposal of non-narcotic pharmaceutical waste (not regulated as controlled substances) is as follows:

1. Generators must first determine if the pharmaceutical waste is regulated under controlled substances or not regulated.
2. ESF collection strictly applies to pharmaceutical waste that is not ignitable, corrosive, or reactive. Pharmaceutical waste classified as any of the above will be forwarded to a licensed hazardous waste company for disposal as chemical waste.
3. Generators must determine the technical name of the most dangerous substance and must clearly print it on the Biological Waste Disposal Tag.

4. Pharmaceuticals waste failing to comply with any of the above requirements will not be collected.
5. Ensure pharmaceutical drugs are inside a leak-proof glass or plastic container (jar). For more than one container package pharmaceuticals in a cardboard box, like the chemical waste. For large quantities of pharmaceuticals generators can phone ESF at 604-827-5389 to request proper pharmaceutical waste containers (5 gallon white pails).
6. Complete all the required information on the **Biological Waste Disposal Tag (Red)** (shown below), affix the barcode sticker, check the "Pharmaceuticals" box, and fill out all the other requested information. Attach the tag to the container and place for disposal in the designated area.

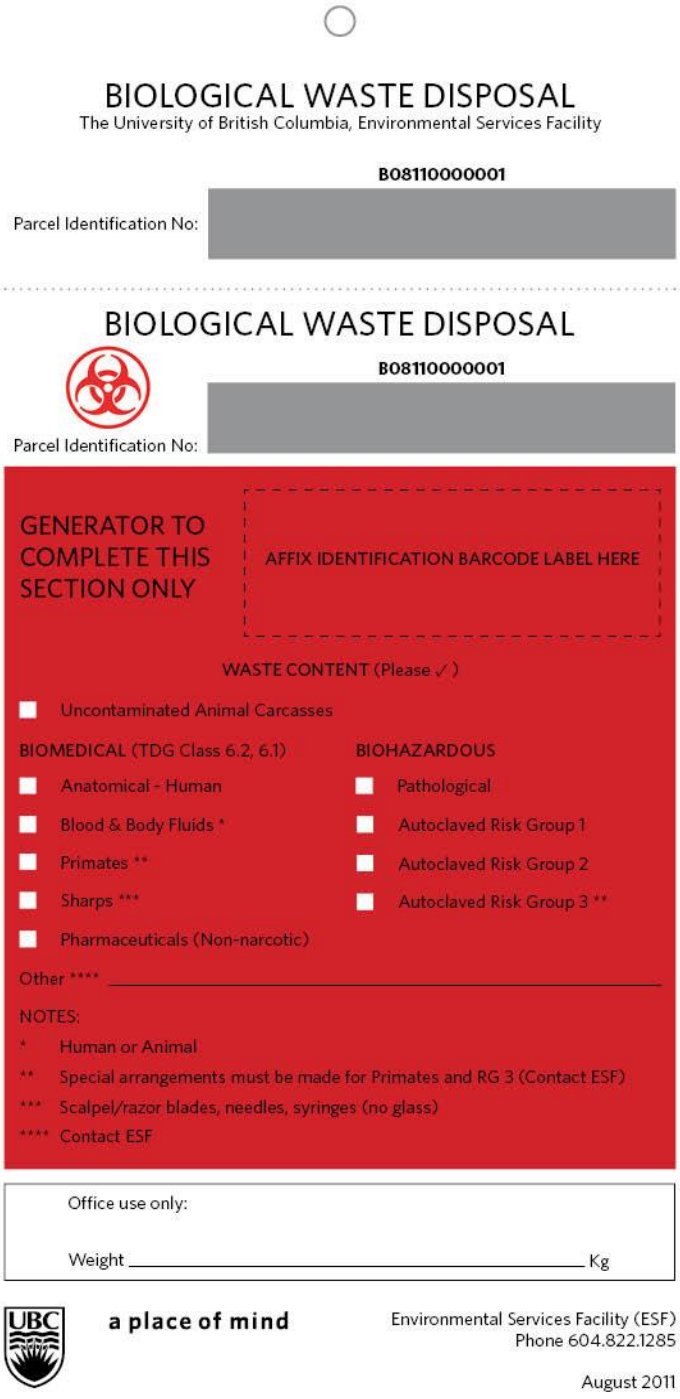
B. Controlled Substances

The procedure for the disposal of controlled substances (including narcotics) waste is as follows:

1. Obtain an AUTHORIZATION TO RETURN form from the manufacturer, if they will supply these forms, and then return the controlled substance to the manufacturer for credit. There is no need to obtain authorization from Health Canada if this method is used. Keep "Authorization to Return" records of materials that have been returned to the licensed dealer for a period of five years.
2. Alternatively, obtain an AUTHORIZATION FOR DESTRUCTION of the controlled substance from Health Canada.
   - Generators must request the authorization by contacting: Health Canada's Office of Controlled Substances:

   Destruction Authorization for Controlled Substances (Hospitals and Pharmacies): Tel: 613-954-1541, E-mail: national_compliance_section@hc-sc.gc.ca
3. Once authorization is received you will need to "denature" the substances by creating a slurry of the drug with soap and water. Add kitty litter if you have too much liquid. This process must be witnessed by another researcher (record the date/ time, the person performing the destruction and the person witnessing it) and keep your records.
4. Contact an ESF Technician at 604-827-5389 and request the proper pharmaceutical waste container (white pail). You will have to provide the ESF Technician with a copy of:
   - Authorization letter
   - Destruction record
5. Place the destructed controlled substances in a leak-proof container. Put a **Biological Waste Disposal Tag (Red)** with generator barcode on the container. Check-off the "**Pharmaceutical"** waste box and place for disposal. The waste will be shipped out as pharmaceutical waste for incineration.

Biological Waste Disposal Tag



BIOLOGICAL WASTE DISPOSAL
The University of British Columbia, Environmental Services Facility

B08110000001

Parcel Identification No:

BIOLOGICAL WASTE DISPOSAL

B08110000001

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓)

- ☐ Uncontaminated Animal Carcasses

BIOMEDICAL (TDG Class 6.2, 6.1)

- ☐ Anatomical - Human
- ☐ Blood & Body Fluids *
- ☐ Primates **
- ☐ Sharps ***
- ☐ Pharmaceuticals (Non-narcotic)

BIOHAZARDOUS

- ☐ Pathological
- ☐ Autoclaved Risk Group 1
- ☐ Autoclaved Risk Group 2
- ☐ Autoclaved Risk Group 3 **

Other **** _____

NOTES:

* Human or Animal
** Special arrangements must be made for Primates and RG 3 (Contact ESF)
*** Scalpel/razor blades, needles, syringes (no glass)
**** Contact ESF

Office use only:

Weight _____ Kg

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

August 2011

Disposal of Uncontaminated Pathological Animal Waste

Purpose

This procedure specifies the safe and proper disposal of uncontaminated animal pathological waste, in accordance to federal, provincial and municipal guidelines.

Scope

This procedure applies to uncontaminated animal pathological waste. As defined in the federal Transportation of Dangerous Goods regulations (TDG), Part 1 (1) (g) and (p), this animal waste MUST not contain any viruses or agents listed in Risk Group 2, 3 or 4.

This type of animal waste includes:

- Animal carcasses
- Animal body parts
- Animal organs
- Animal tissues

This procedure does **NOT** apply to the disposal of **contaminated animal pathological waste** (refer to the "Disposal of Biomedical Waste").

Procedure

1. Ensure that this animal waste does not contain any Risk Group 2, 3 or 4 viruses or agents (note that contaminated animals are treated as biomedical waste).
2. Collect uncontaminated anatomical animal waste in a black polypropylene bag (6 mil thick, 40 cm x 40 cm, available through Plant Operation Stores). All tubing, catheters, plastic clips, tags, etc. must be removed from the animal before packaging.
3. Each bag must not weigh more than **10** kg.
4. Bags **MUST** be tagged with the UBC Environmental Services **Biological Waste Disposal tag (Red)** (as shown below). Affix your waste generator number sticker where indicated. On the tag check the box marked "**Uncontaminated Animal Carcasses**".
5. Bagged materials must be fully frozen prior to pick-up.
6. Bagged materials must be stored in a freezer for pick-up by Environmental Services.

Biological Waste Disposal Tag

BIOLOGICAL WASTE DISPOSAL
The University of British Columbia, Environmental Services Facility

B08110000001

Parcel Identification No:

BIOLOGICAL WASTE DISPOSAL

B08110000001

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓)

- ☐ Uncontaminated Animal Carcasses

BIOMEDICAL (TDG Class 6.2, 6.1)

- ☐ Anatomical - Human
- ☐ Blood & Body Fluids *
- ☐ Primates **
- ☐ Sharps ***
- ☐ Pharmaceuticals (Non-narcotic)

BIOHAZARDOUS

- ☐ Pathological
- ☐ Autoclaved Risk Group 1
- ☐ Autoclaved Risk Group 2
- ☐ Autoclaved Risk Group 3 **

Other **** _____

NOTES:

* Human or Animal
** Special arrangements must be made for Primates and RG 3 (Contact ESF)
*** Scalpel/razor blades, needles, syringes (no glass)
**** Contact ESF

Office use only:

Weight _____ Kg

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

August 2011

Disposal of Non-Indigenous Species

Purpose

This procedure provides a protocol for the disposal of non-indigenous organisms or materials containing or potentially containing these organisms.

Scope

This protocol is applicable to all departments and administrative units with laboratories where non-indigenous species are used for research purposes.

Non-indigenous species can be defined as species that are not native (indigenous) to an area and have been introduced through human activities either on purpose or by accident. The term includes targeted species of organisms whether from a distant or nearby source (e.g., the Fraser Valley). Although a species of organism may occur naturally at a UBC site, the introduction of foreign populations of the same species can have a negative impact on local populations. Therefore, these organisms are also regarded as non-indigenous.

Materials that may contain non-indigenous species include:

- Soils – all types
- Single pass and re-circulating fresh and saltwater cooling or aquarium systems
- Algae and plants
- Terrestrials and aquatic plants and animals including those on baits, nets and sampling equipment
- Cultured organisms, microorganisms, and plants
- Cloned and genetically altered organisms – all types

Background

Numerous species and clones of microorganisms, plants and soils are used in research projects and in student laboratories at the University of British Columbia (UBC). Many are not native to this area and are classified as "Non-Indigenous" or "Exotic". Currently, there is very limited regulation of non-indigenous species or biological materials which have the potential to introduce non-indigenous species. Many potential non-indigenous species are tolerated in a wide range of environments and when accidentally or intentionally introduced, have the ability to colonize and displace existing native species. Since indigenous species are essential in maintaining a healthy, balanced ecosystem, non-indigenous species have the potential to cause significant ecological or financial damage.

There are many examples which clearly demonstrate the extensive damage that non-indigenous invaders may have on an ecosystem, such as purple loosestrife and the Norway maple. Purple loosestrife, introduced during the 19th century, made an explosive migration across the continents through marshy environments, displacing many native plants. The Norway maple was first introduced to North America from Europe in the mid-1700s for cultivation as an ornamental tree. It is a fast growing species, adaptable to a wide variety of urban sites and more tolerant to urban stresses than many native trees. Its ability to grow in deep shade makes it particularly threatening to native forest habitats. Examples such as these have resulted in increased regional, national, and international concern about the effects of non-indigenous species. As a result UBC has established a series of protocols for the disposal of non-indigenous organisms or material containing or potentially containing these organisms.

Procedure

Use the RMS **Environmental Biological Hazards Tool** to determine if the animal or plant species you are working with are invasive.

A. Non-Indigenous Animal Species

Refer to the **Uncontaminated Pathological Animal Waste** detailed procedure for details**.**

B. Non-Indigenous Plant Species

Some non-indigenous plant species any be autoclaved and then trashed.

- Generators must first determine if autoclaving is the appropriate method.
- Collect plant species in clear autoclave bag with no markings and loosely close using autoclave tape.
- **Autoclave all waste for 60 minutes at 121˚C and 15 psi.** Use other appropriate parameters if necessary (i.e. longer time and/or higher temperature).
- At the end of the autoclave cycle check to ensure the chemical indicator had turned black at the end of the autoclave cycle
- Dispose of bags in regular trash.

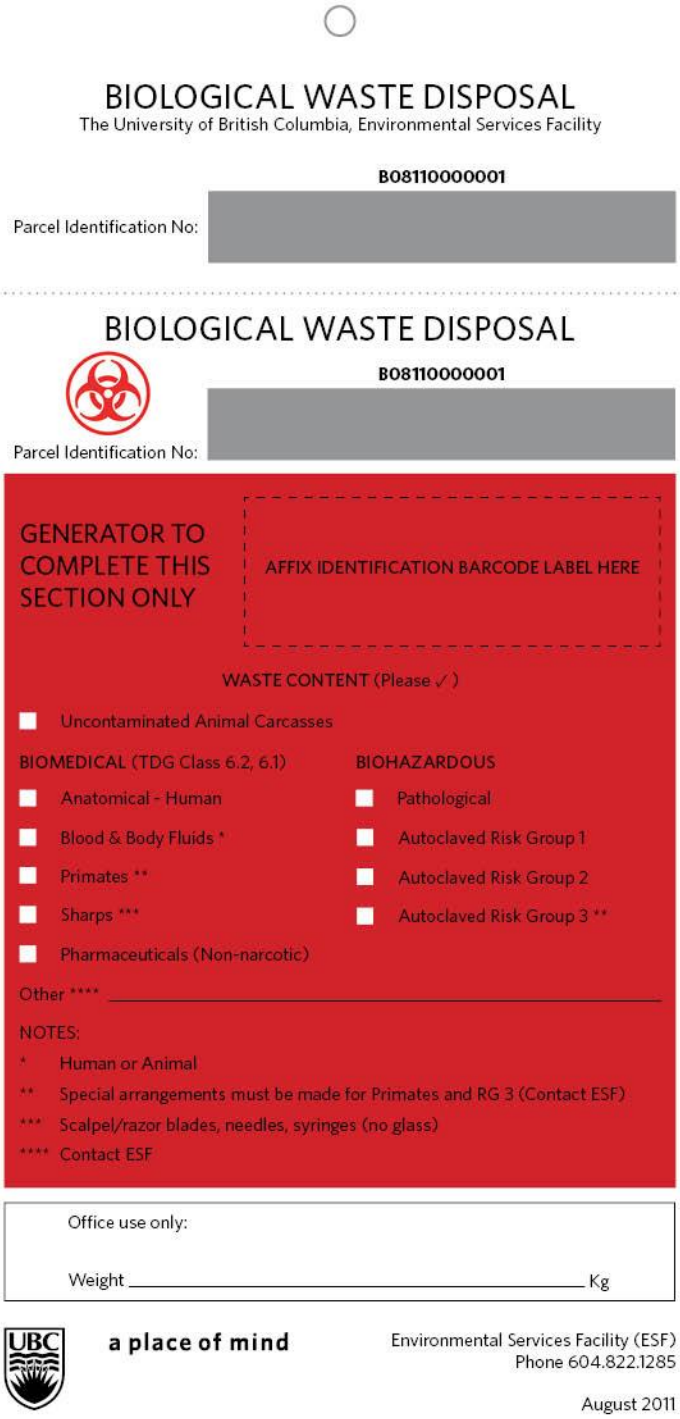
Note: autoclaves must be tested monthly for efficacy by using biological indicators. (Refer to the Treatment and Disposal of Biohazardous Waste for details).

C. Non-Indigenous Plant Species (resistant to autoclaving)

Non-indigenous plant species that are resistant to autoclaving will be sent for incineration in the same way as **Uncontaminated Animal Waste**, and therefore will be treated as such.

1. All Non-Indigenous Species **MUST** be contained in a black polypropylene bag (6 mil thick, 40 cm x 40 cm - available through Plant Operation Stores). Double bag to prevent leakage.
2. Ensure that each bag does not weigh more than **10** kg.
3. Do not put glass or sharps in with this waste.
4. Bags must be tagged with the UBC Environmental Services **Biological Waste Disposal tag (Red)** (as shown below). Affix the waste generator number sticker where indicated. On the tag, check off the box marked "**Uncontaminated Animal Carcasses**" and in the Other Section describe the waste (e.g. "non-indigenous plant"). Place bags in the building's designated area for pick-up by ESF. (Contact the ESF Technician at 604-827-5389 if you require more barcodes or Biological Waste Disposal Tags).

Biological Waste Disposal Tag



BIOLOGICAL WASTE DISPOSAL

The University of British Columbia, Environmental Services Facility

B08110000001

Parcel Identification No:

BIOLOGICAL WASTE DISPOSAL

B08110000001

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓)

☐ Uncontaminated Animal Carcasses

BIOMEDICAL (TDG Class 6.2, 6.1)

- ☐ Anatomical - Human
- ☐ Blood & Body Fluids *
- ☐ Primates **
- ☐ Sharps ***
- ☐ Pharmaceuticals (Non-narcotic)

BIOHAZARDOUS

- ☐ Pathological
- ☐ Autoclaved Risk Group 1
- ☐ Autoclaved Risk Group 2
- ☐ Autoclaved Risk Group 3 **

Other **** _____

NOTES:

* Human or Animal

** Special arrangements must be made for Primates and RG 3 (Contact ESF)

*** Scalpel/razor blades, needles, syringes (no glass)

**** Contact ESF

Office use only:

Weight _____ Kg

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

August 2011

Disposal of Animal Bedding

Purpose

The following guidelines are intended for animal facilities and laboratories generating animal bedding waste at UBC. They are designed to ensure compliance with BC Hazardous Waste Regulations bedding disposal requirements.

Scope

The following guidelines address the proper disposal of animal beddings, generated from animal facilities and laboratories at UBC. Guidelines are provided for the proper disposal of non-contaminated beddings, beddings contaminated with Risk Group 1 and Risk Group 2 Biohazards, and bedding contaminated with toxic materials.

Background

The guidelines are based on the following regulations:

1. BC Hazardous Waste Regulations
   - Part 1- Biomedical Waste (g) (i) and (p)
   - Part 1- Hazardous Waste (a) (i), (ii) and (b.1)
2. TDG regulations Part 2.31

Guidelines

Responsibility for Classification and Certification

Waste classification prior to disposal is the responsibility of the area supervisor or Principal Investigator (PI) and the waste generator.

All animal beddings are considered by the regulations as biomedical waste unless a "medical or infection control professional has certified that the waste does not contain a virus or agent listed in Risk Group 2". To comply with the certification requirement the area supervisor needs to certify ***that each load of bedding generated, to be disposed as solid waste, is not contaminated***. The "Non Contaminated Waste Certification Log" in Appendix 1 of this procedure, may be used for this purpose.

Additionally, an annual certification by each facility generating animal bedding waste is required. Use the sample "UBC Animal Facility Annual Certification Letter" in Appendix 2 and submit to RMS at the beginning of each calendar year. Contact the Environmental Services Advisor at 604-822-9840 for more information.

A. Uncontaminated Beddings

- After the certification log is signed by the area supervisor dispose as solid waste. For more information contact UBC Building Operations Service Centre (604-822-2173) or UBC Waste Management at 604-822-9619.

B. Beddings Contaminated with Toxic Waste

- Depending on the toxicity level of the contaminating chemicals; these beddings may need to be disposed as toxic waste through the Environmental Services Facility. For more information contact an ESF Technician (604-822-6306).
- Review the contaminant's MSDS. The following calculation needs to be implemented if:
  i) The material is listed as a TDG 6.1 substance (toxic)
  ii) The material LD_{50} is ≤ 1000 mg/kg (1000 mg/kg is the toxic limit as per TDG Regulation sec. 2.31)

To assess the level of contamination:

- Find the chemical's LD_{50} value in the MSDS
- Estimate the total weight of the chemicals in the bedding/chemical mixture
- Estimate the total weight of the beddings batch to be disposed
- Calculate the LD_{50} value of the mixture using the following equation:

$$LD_{50}\ (\text{mixture}) = \frac{LD_{50}\ (\text{chemical})}{\text{mass fraction of chemical in bedding}}$$

- If the resulted LD_{50} > 1000 mg/kg the mixture can be disposed as solid waste
- If the resulted $LD_{50} \leq 1000$ mg/kg the mixture should be treated for disposal as toxic chemical waste, and disposed as such through the Environmental Services Facility (see Appendix 3 of this procedure)
- In order to be accepted, the detailed calculation needs to be submitted as part of the request for disposal approval.

C. Risk Group 1 (RG1) Contaminated Beddings

After the certification log is signed by the area supervisor dispose as solid waste.

D. Risk Group 2 (RG2) Contaminated Beddings

All beddings contaminated with Risk Group 2 agents **MUST** be autoclaved prior to disposal.

After the certification log is signed by area supervisor autoclaved waste can be disposed as solid waste into a specially designated compactor at each facility. The waste is picked up by UBC Waste Management for disposal via external hazardous waste contractor. Contact Waste Management (604-822-9619) for questions regarding compactor pick-up.

To ensure and demonstrate autoclave efficiency, quality assurance testing (i.e. using both chemical and biological indicators) needs to be routinely performed and related records need to be kept as per the most recent *Canadian Biosafety Standards and Guidelines*, published by the Public Health Agency of Canada. Also refer to the "Treatment and Disposal of Biohazardous Waste" for additional details.

Landfill Disposal

Animal bedding waste is NOT accepted for disposal through the Metro Vancouver composting facilities.

Large quantities of animal bedding waste (e.g. collected in waste compactors) are not accepted for disposal via Metro Vancouver landfills. While currently small quantities of animal beddings waste can be disposed via local landfills, certain landfill restrictions may result in future landfill refusal to accept the waste. Thus alternative disposal arrangements have been evaluated. Most of the animal beddings waste is currently disposed of in a secure landfill in Alberta, via UBC's external hazardous waste contractor.

Refer to Metro Vancouver's Solid Waste "Banned & Prohibited Materials" or Metro Vancouver Tipping Fee and Solid Waste Disposal Regulation Bylaw No. 263, 2012.

Appendix 1: Non-Contaminated Waste Certification Form

I, _____ (enter name and position, print clearly) **certify that the bedding disposed per description below contained no Risk Group 2, 3, or 4 virus or agent.**

Date of Disposal	Waste Description	Estimated Weight	Area Supervisor Initials

Appendix 2: Sample UBC Animal Facility Annual Certification Letter

a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

UBC Letterhead

Animal Care Services

Address

Phone, etc

Date: _____

Attn: Facility Manager

Sumas Environmental Services

4623 Byrne Road

Burnaby BC V5J 3H6

This is to certify that the following load of soiled animal bedding originates from the _____ (ADD NAME HERE) facility at the University of British Columbia. As per requirements of the BC Hazardous Waste Regulations, it is certified that the waste does not contain a virus or agent listed in Risk Group 2, 3 or 4, as defined in the federal transportation of dangerous goods regulations.

Sincerely,

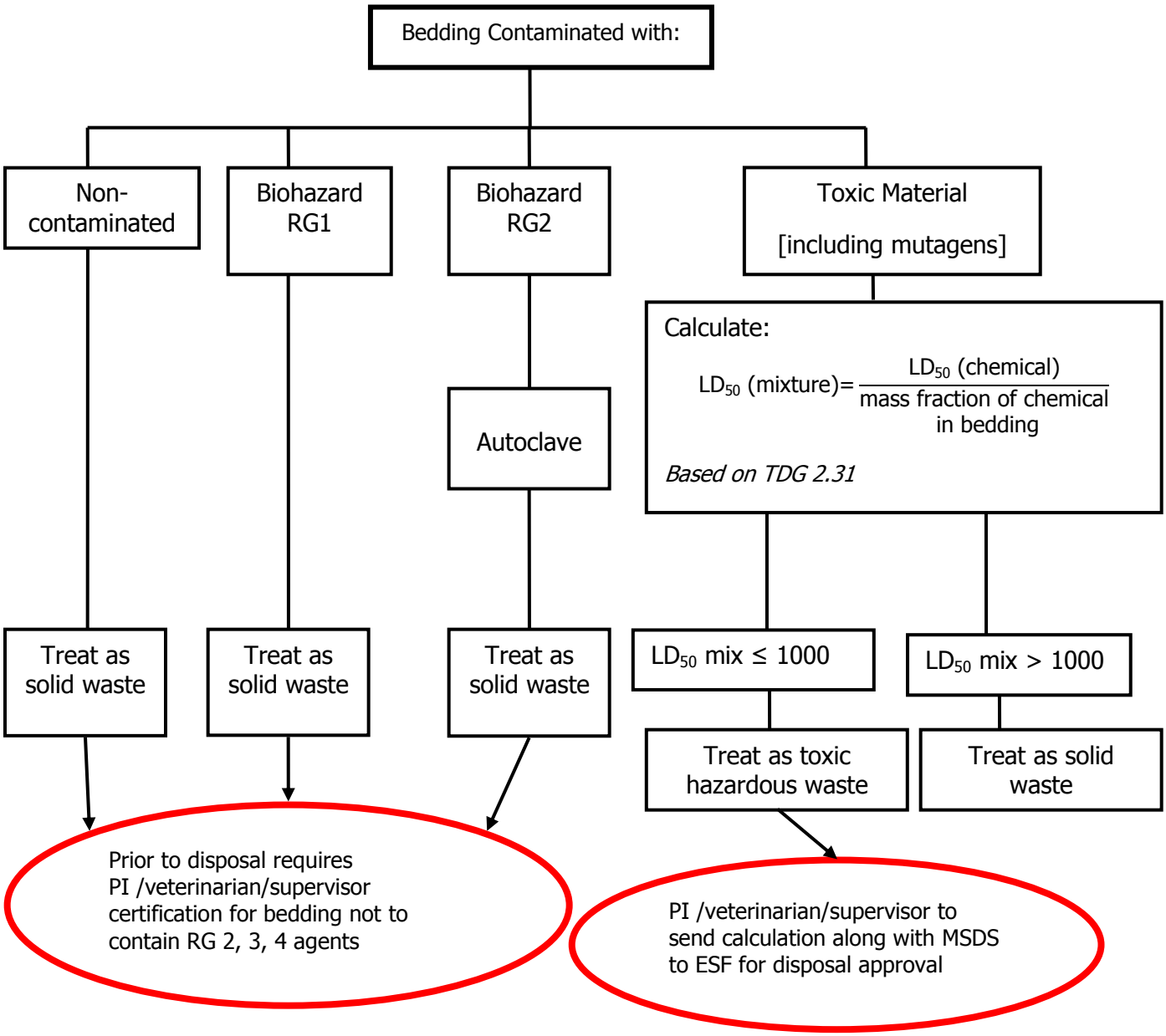
_____

Signature, Name, Title of Facility Manager or Veterinarian

Facility address if different than above for ACS

Contact info

Appendix 3: Bedding Disposal Decision Making Chart



Disposal of Chemical Waste

Purpose

This procedure ensures that chemicals are identified according to their chemical hazards and compatibilities, and then packaged safely for transportation to ESF.

Scope

This disposal procedure applies to hazardous laboratory chemicals in solid or liquid form which can be managed by the Environmental Services Facility (ESF). Hazardous laboratory chemicals may include the following:

- Waste Containing Polycyclic Aromatic Hydrocarbons
- Flammable Liquids
- Spontaneously Combustible
- Dangerous When Wet
- Oxidizers
- Poisonous/Toxic Substances
- Corrosives
- Environmentally Hazardous Substances
- Waste Containing Tetrachloroethylene
- Waste Pest Control Products
- Leachable Toxic Waste

Background

Hazardous Waste is defined as dangerous goods that are no longer used for their original purpose, and meet the criteria for Class 2, 3, 4, 5, 6, 8, or 9 of the Transportation of Dangerous Goods Regulations (TDG).

- Chemical packaging classes are based on the current Transport Canada Transportation of Dangerous Goods (TDG) Regulations Part 2, substances classification.
- Disposal of hazardous chemicals in the sewer or landfill is prohibited by Metro Vancouver Sewer Use Bylaw No. 299, 2007 Consolidated and by BC Hazardous Waste Regulations, 2009.

Procedure

IMPORTANT NOTE: ESF cannot manage or handle the following, and therefore, this procedure does not include:

- Unknown solid or liquid chemicals
- Gas cylinders and lecture bottles
- Radioactive chemicals

ESF reserves the right to refuse handling and disposal of improperly packaged and unidentified chemicals.

The procedures for the disposal of surplus hazardous chemicals or experimental byproducts are as follows:

1. Check to see if the chemicals you are disposing of are non-hazardous and non-regulated. These chemicals may be disposed of down the drain or in the normal garbage.
2. All chemicals for disposal must be pre-approved for disposal by an ESF Technician. Generator contact information and full chemical names (no abbreviations), must be listed through the online Chemical Waste Inventory System. For details on how to enter this information see below *.

3. ESF will process disposal requests and approved forms will be e-mailed back to generators. These forms include disposal authorization number, chemical hazard classification and date by which chemicals must be prepared for disposal.
4. After the coded form has been returned, package chemicals in strong cardboard boxes according to the chemicals hazard codes. Only chemicals with the same code are to be packed in the same box. Package all the chemicals as per their code.
5. The weight of each box of chemicals must not exceed 10 kg.
6. Once the box is full, secure the containers with appropriate packing material to prevent breakage and tape the box closed to prevent chemicals from spilling or falling out during transportation.
7. Place the approval form in an envelope and tape the envelope to the box. Write the department name, generator name, and contact information on the envelope. The inventory form must include all chemicals that are in the boxes. Write the chemical hazard classification code on the top of the box in large letters.
8. Place the boxes in the building's designated area for pick-up by ESF.

*** Notes on Using the Chemical Waste Inventory System:**

- Email addresses of generators and/or PI's are required. Use UBC email addresses.
- Find the best match to the name of your chemical from in the online inventory list and only add a new name/description if there is no entry.
- Complete chemical information includes: full chemical names, physical state, volume, quantity.
- Do not use abbreviations, formulae, acronyms, trade names, foreign names. **Remember** that chemicals often have synonyms, including IUPAC names.
- Do not include "waste" in the chemical name.
- List the most hazardous component of highest concentration first.

Disposal of Aqueous Waste (NEW)

Purpose

The purpose of this procedure is to prevent the pollution of UBC's sanitary sewer systems and the environment, by routine and planned discharges from research, operations, and maintenance activities. Following this procedure will also facilitate compliance with the applicable environmental requirements and guidelines:

- BC Hazardous Waste Regulation
- Metro Vancouver Sewer Use Bylaw No. 299
- Transportation of Dangerous Goods

Scope

This procedure applies to planned and routine discharges to the sanitary sewers from research, operations and maintenance activities in UBC Point Grey campus.

Background

Discharges of hazardous materials to the sanitary sewer can compromise the health and safety of staff managing the drain system; these and other materials, such as oil and grease, may also damage the operation of the sewers and sewage facilities, and adversely impact the efficiency and cost-effectiveness of the waste water treatment.

The Metro Vancouver Sewer Use Bylaw No. 299 Consolidated regulates pollutants that are discharged into sanitary sewers. The bylaw protects the environment as well as human health and safety. It specifies prohibited and restricted pollutant discharges and includes monitoring and permits requirements for non-domestic discharges. Refer to the RMS Sanitary Sewers webpage and Sewer Use Bylaw Guidelines for more detailed information.

Procedure

General Procedure for discharges from laboratory research operations

The following procedure addresses the proper disposal of small amounts of aqueous waste that can potentially be disposed via sanitary sewers from various laboratories on and off-campus. This type of waste is not regulated as hazardous (flammable, corrosive, reactive, toxic) as it cannot be classified under TDG or WHMIS, and it is not prohibited or restricted by Metro Vancouver Sewer Use Bylaw. Nonetheless, the waste can be toxic to aquatic life (but not regulated under TDG class 9), its discharge is ongoing, and it is either high volume and/or high frequency.

- Before disposing of any waste, lab personnel must review the RMS online list of non-hazardous chemicals. The waste may be eligible for drain disposal or regular garbage disposal under certain conditions.
- If the waste is not in the above list, it may be hazardous. Review the RMS Waste Disposal Guide for more information.
- Corrosive waste that does not exhibit any other hazards must be neutralized to an acceptable pH range (5.5-10.5) before going down the drain.
- Concentrated acids and bases need to be neutralized before drain disposal. Use appropriate and safe neutralizing agents, e.g. sodium bicarbonate or sodium carbonate for acids, citric acid for bases. Check the MSDS for more information.

Follow the specific guidelines below for some common waste streams:

A. Bleach

Bleach solutions can be quite damaging to plumbing if used in excess or if inappropriately disposed of. Bleach has a very high pH (12-14) and must be neutralized prior to sink disposal.

- A common tissue culture protocol requires decontamination of cells prior to disposal using 10% fresh bleach added to the culture and media.
- In general, culture media exhibits a buffering effect on bleach and the resulting pH is in the range of 6-8. However, this depends on the media and the pH must be tested for each new experimental set-up.
- Bleach is also used to deactivate and/or decontaminate human blood and body fluids.
- There are several options for bleach neutralizers: sodium bicarbonate ($NaHCO_3$), sodium metabisulphite ($Na_2S_2O_5$), sodium bisulphite ($NaHSO_3$), sodium sulphite (Na_2SO_3), sodium thiosulphate ($Na_2S_2O_3$), 3% hydrogen peroxide (H_2O_2). The use of ¼ to 1 teaspoon of solid neutralizer is typically sufficient to neutralize 1-4L of volume of 10% bleach solution.

B. Aqueous Chemical Waste (other than bleach)

Certain laboratory liquid chemical waste streams which are not hazardous (i.e. not toxic, corrosive, flammable, or reactive), **may** fit drain disposal under certain conditions. Complete the following **waste profile** to allow RMS Environmental Services to determine if the waste stream of concern can be disposed via sanitary sewers. Follow the steps below:

- If the waste is hazardous and it is very diluted generators must complete the online **aqueous waste profile** (see Appendix 1) and RMS will help determine if the waste can be disposed of via sanitary sewers.
- Many of these solutions must be assessed and tested first to determine if it meets the Hazardous Waste Regulations Schedule 1.2 effluent standards (toxicity test, i.e. limit bioassay- 50% survival of Rainbow trout after 96 hours) and is therefore fit for drain disposal. Some examples include: formalin aqueous waste (e.g. mixtures of< 4% paraformaldehyde, and phosphate-buffered saline solutions).
- Contact the Environmental Services Advisor (604-822-9840) and ESF (604-822-1285) if you have additional questions.

C. Paint Aqueous Waste

- Paint contaminated aqueous waste must be assessed and tested first to determine if it meets the Sewer Use Bylaw requirements and is therefore fit for drain disposal.
- If the waste is determined to be hazardous, refer to the "Disposal of Waste Paint Procedure" in this manual.
- Contact ESF (604-822-1285) for additional questions.

General Procedure for Discharges from Operations and Maintenance Activities

Definitions

Domestic Waste means waste produced on residential premises, or sanitary waste and wastewater from showers and restroom washbasins produced on non-residential property.

Non-Domestic Waste means all wastewater except domestic waste, sanitary waste, storm water, uncontaminated Water, and septic tank waste.

Examples of activities: pipes cleaning, surface cleaning, water main disinfection, neutralization and dilution tanks servicing or removal, etc.

Generators planning to discharge non-domestic waste water to the sanitary sewer system must apply for approval to discharge from RMS Environmental Services by completing the "UBC Planned Discharge to the Sanitary Sewer from Operation and Maintenance Activities" (Appendix 2).

RMS Environmental Services will assess the waste stream for its fitness for sanitary sewer discharge, or will determine that the effluent needs to be disposed as hazardous waste. RMS may require that the effluent will be tested as part of the assessment (testing costs are generator responsibility).

The generator will have to provide RMS Environmental Services no less than seven (7) working days prior to the anticipated discharge information regarding:

- Total expected volume of effluent
- Proposed discharge location
- Any chemicals additives contained in the discharge; their nature and concentration.
- MSDS for any material(s) to be mixed with the effluent including material's concentration
- Frequency of generation and discharge (for planned routine discharges)

Appendix 1: Summary of Aqueous Waste Profile

Aqueous Waste Profile							
Drain Disposal Assessment Tool: Certain laboratory liquid waste streams which are not hazardous (i.e. not toxic, corrosive, flammable, or reactive), **may** fit drain disposal under certain conditions. Complete the following **waste profile** to allow RMS Environmental Services to determine if the waste stream of concern can be disposed via sanitary sewers. ***Refer to summary of Excel worksheet below.***							
Contact Information							
Chemical Name(s)							
Contaminants (per HWR+Bylaw+WHMIS)	Conc %	Volume	Freq	pH	LD50	Health hazards, Marine pollutant	MSDS
Corrosive							
Toxic							
Phenols, BETX (benzene, toluene, xylene), PAH's (naphthalene), etc							
Flammable							
Oxidizing							
Dangerously Reactive							
Oil & Grease							
Metals (As, Cd, Hg, Pb, Ag, Zn, etc)							
Other (cyanide, sulphide, etc)							
Large particles							
NOTE: Dilution of waste for the purpose of meeting concentration limits is NOT ALLOWED.							
Definitions based on Metro Vancouver's Sewer Use Bylaw and WHMIS and additional information regarding drain disposal restrictions and prohibitions.							

Appendix 2: UBC Planned Discharge to the Sanitary Sewer from Operation and Maintenance Activities

Please complete this form and contact the RMS Environmental Services Advisor at 604-822-9840. Expect a response within 7 working days.

Requester/Discharger:	
• Name	
• Phone Number	
Date Discharge Request Submitted:	
Date(s) of Expected Discharge:	
Discharge Details	
Type of liquid to be discharged	
Proposed discharge location	
Purpose of discharge	
Approximate volume	
Expected duration of discharge	
The discharge is capable of obstructing the flow or causing interference (yes/no) ; if yes describe Examples: earth, sand, ash, glass, tar, asphalt, plastic, wood, waste portions of animals, fish or fowl, solidified fat, etc.	
The discharge has a temperature of ≥65°C (if yes provide temperature)	
The discharge contains conventional contaminants, such as: • Biochemical Oxygen Demand (BOD) • Total suspended solids (TSS) • Oil and Grease (if yes, provide details and concentration in mg/L)	
The discharge contains large particles (>0.5 cm)	
The discharge contains chemicals/contaminants (if yes provide) • Product MSDS • Quantity of chemical in use • Dilution factor of chemical in use • pH of chemical	
The discharge contains biological agents (if yes describe)	

Disposal of Organic Solvent Waste

Purpose

Most organic solvents are flammable and toxic. Waste solvents must be contained and segregated properly for recovery and disposal such that they do not pose a safety hazard during transportation or storage.

Scope

This procedure applies to organic solvent classified as Class 3 (Flammable Liquids) or Class 6.1 (Toxic Substances) by the current Canada Transportation of Dangerous Goods (TDG) Regulations. It specifies their handling by reuse through the Solvent Recovery Program or disposal through the Environmental Services Facility (ESF).

Background

Organic solvents may be classified as Class 3 (Flammable Liquids) or Class 6.1 (Toxic Substances) as defined by the current TDG regulations and the BC Hazardous Waste Regulation, 2009.

Metro Vancouver Sewer Use Bylaw No. 299, 2007 Consolidated prohibits the disposal of organic solvents in the sewer or landfill.

Procedure

A. Organic Solvents for Recovery

Solvents suitable for recovery can be recycled at the ESF for reuse.

ESF is able to redistill acetone and methanol solvents for reuse (only more than 50% concentrations are useful for recovery). UBC's solvent recovery program operates spinning band distillation units, which can provide labs with re-distilled solvents of technical grade (purity analysis is provided upon request). For more information on the Solvent Recovery Program call 604-822-1285.

1. Segregate and collect each solvent in its own UBC waste solvent containers, typically these are plastic red "Jerry" cans. **Segregate!** Do not mix two different solvents together. Use only containers that have been used for the same solvent stream.
2. Do not mix oil with solvents.
3. Do not pour sludge, grit, paper, or inorganic chemicals into the waste solvent.
4. Complete the required information and affix the generator bar code to the **Solvent - Recovery (Green)** tag (as shown below). Give a brief history of the solvent. Identify all contaminants.
5. Affix the tags to the appropriate containers.
6. Tighten all caps before shipping.
7. Place the containers in the building's designated area for pick-up by ESF

B. Halogenated and Non-Halogenated Organic Solvents

Halogenated solvents are organic solvents which contain halogen atoms: chlorine (Cl), fluorine (F), bromine (Br) or iodine (I). They are widely used because they are essentially non-flammable. Some common halogenated solvents include: chloroform, dichloromethane (methylene chloride), carbon tetrachloride, and chlorobenzene.

Non-halogenated solvents do not contain halogen atoms and include: alcohols (methanol, ethanol, isopropanol), acetone, xylenes, ethyl acetate, hexanes and toluene.

Halogenated and non-halogenated solvents are treated differently in terms of disposal. Non-halogenated solvents are used as fuel additives in cement kilns (essentially recycled). Halogenated solvents are incinerated at high temperatures and their cost of disposal is 2-3 times higher.

IMPORTANT NOTES:

- Segregation of halogenated and non-halogenated solvents is very important. Solvent mixtures are considered contaminated even at concentrations of halogenated solvents as low as 1000 ppm.
- ESF has replaced most of the non-halogenated solvent cans in an attempt to: (i) solve the ongoing problem of cross contamination of non- halogenated with halogenated solvent waste and (ii) support proper waste segregation and ultimately reduce disposal costs. While both types of cans are red, the new cans for non-halogenated solvents have green tie-wraps and blue labels attached to them. The old cans for halogenated solvents remained unchanged, i.e. red Jerry cans with no tie-wraps.

1. **Segregate** and collect only non-halogenated solvents in UBC non-halogenated waste solvent containers.
2. Do not mix halogenated and non-halogenated solvents together.
3. Do not mix oil with the waste solvents.
4. Do not pour acid, sludge, grit, glass, plastic, paper, or inorganic chemicals, into the waste solvents.
5. Complete the required information and affix the generator bar code to the **Flammable Liquid Disposal Tag (Blue)** (as shown below). Identify/classify all materials in the containers **including water content (%).**
6. Affix the tags to the appropriate containers.
7. Tighten all caps before shipping.
8. Place the containers in the building's designated are for pick-up by ESF.

Organic Solvents for Recovery Tag

SOLVENT—RECOVERY

The University of British Columbia, Environmental Services Facility

SR0811000001

Parcel Identification No:

SOLVENT—RECOVERY

SR0811000001

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓ quantify components >40%)

☐ Acetone	_____%	☐ Thinners	_____%
☐ Isopropyl Alcohol	_____%	☐ Methanol	_____%
☐ Varsol	_____%	☐ Water	_____%
☐ Xylenes	_____%	☐ Hexanes	_____%
☐ Benzene	_____%		

Other _____ _____%

Office use only:

Date Received: _____
mm/dd/yy

Volume:
- ☐ 5L
- ☐ 20L
- ☐ _____ L

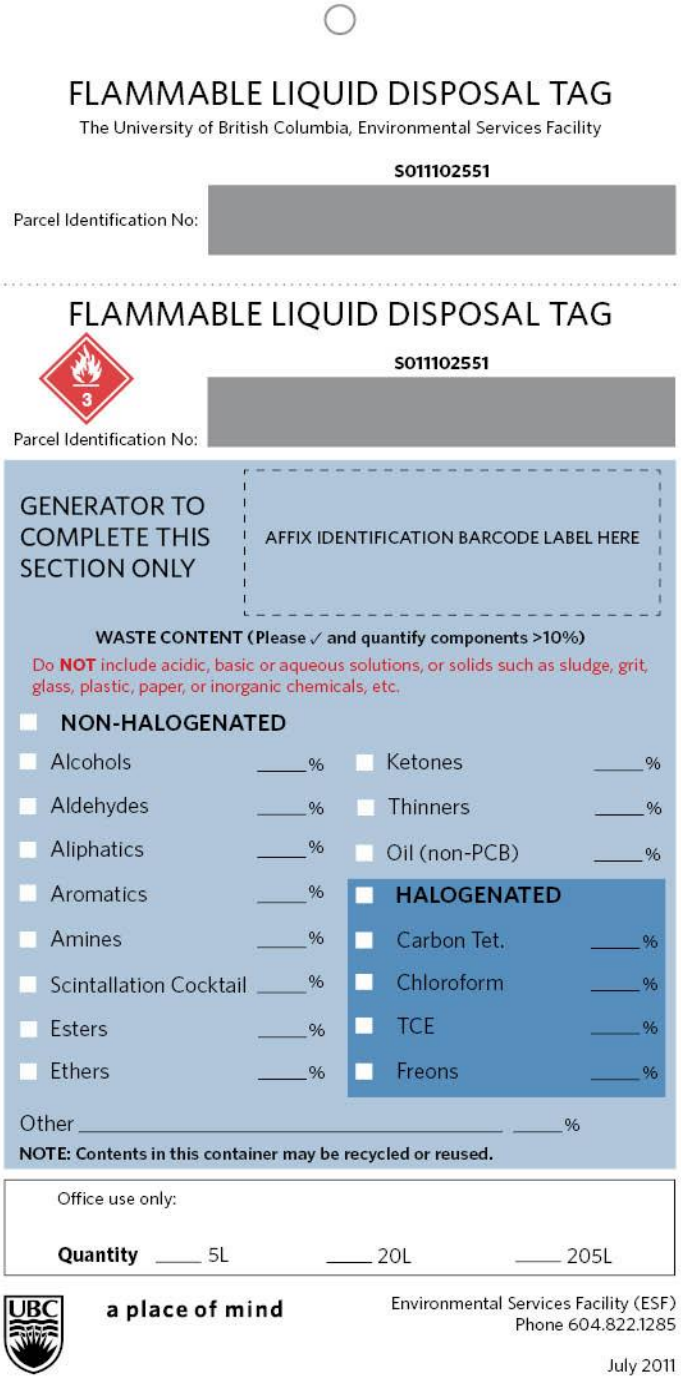
Storage Details:
- ESF, Rm 202, Shelf/Row _____
- Trailer
- Other _____

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

August 2011

Organic Solvents for Disposal Tags



FLAMMABLE LIQUID DISPOSAL TAG

The University of British Columbia, Environmental Services Facility

S011102551

Parcel Identification No:

FLAMMABLE LIQUID DISPOSAL TAG

S011102551

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓ and quantify components >10%)

Do **NOT** include acidic, basic or aqueous solutions, or solids such as sludge, grit, glass, plastic, paper, or inorganic chemicals, etc.

NON-HALOGENATED

- Alcohols ____%
- Aldehydes ____%
- Aliphatics ____%
- Aromatics ____%
- Amines ____%
- Scintallation Cocktail ____%
- Esters ____%
- Ethers ____%
- Ketones ____%
- Thinners ____%
- Oil (non-PCB) ____%

HALOGENATED

- Carbon Tet. ____%
- Chloroform ____%
- TCE ____%
- Freons ____%

Other _____ ____%

NOTE: Contents in this container may be recycled or reused.

Office use only:

Quantity ____ 5L ____ 20L ____ 205L

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

July 2011

Disposal of Photographic Waste

Purpose
This procedure ensures that photochemical wastes are segregated and stored properly so that silver can be recovered from the fixer.

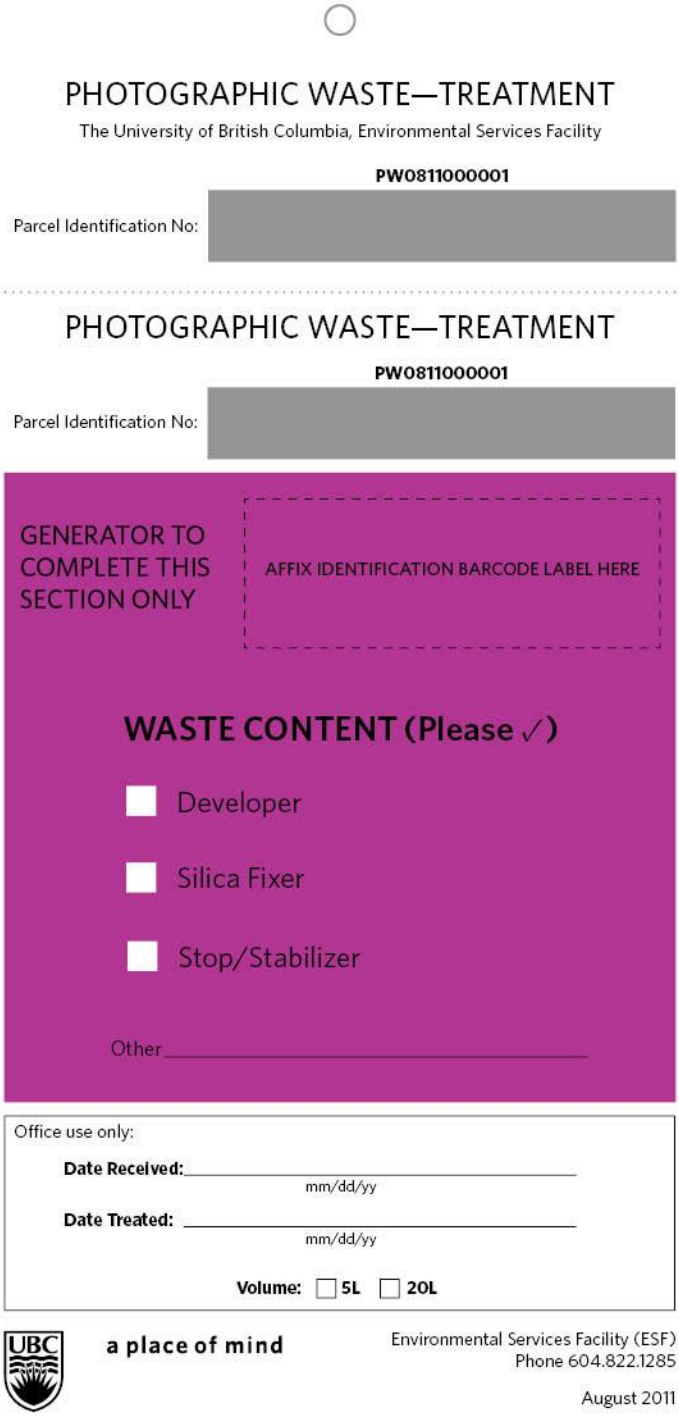
Scope
This disposal procedure applies to waste solutions of photochemical fixer, stabilizer, and developer.

Background
Disposal of photochemical waste without treatment in the sewer or landfill is prohibited by the Metro Vancouver Sewer Use Bylaw No. 299, 2007 Consolidated and the BC Hazardous Waste Regulation 2009.

Photochemical waste solutions are classed as "corrosive" and may contain levels of silver in excess of BC Hazardous Waste Regulations, 2009. In order to reduce photographic waste, generators are **highly encouraged to use digital photography** as much as possible.

Procedure
1. Collect photochemical wastes in a dedicated 5 or 20 liter **red** container which has only contained photochemicals, as provided by the Environmental Services Facility (ESF). To obtain these containers, call 604-822-1285 or 604-822-1281. Photochemicals contaminated with trace amounts of solvents will damage the photochemical recovery columns.
2. Separate containers must be used for **fixer**, **developer, stop** and **stabilizer**.
3. Do not mix solvents with photochemical waste.
4. When containers are full, complete the **Photographic Waste Tag (Purple)**, (as shown below), affix the generator bar code label, check the appropriate box on the tag and attach to the red containers.
5. Place containers in the building's designated waste area for pick-up by ESF.

Photographic Waste Disposal Tag



PHOTOGRAPHIC WASTE—TREATMENT

The University of British Columbia, Environmental Services Facility

PW0811000001

Parcel Identification No:

PHOTOGRAPHIC WASTE—TREATMENT

PW0811000001

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓)

- ☐ Developer
- ☐ Silica Fixer
- ☐ Stop/Stabilizer

Other _____

Office use only:

Date Received: _____ mm/dd/yy

Date Treated: _____ mm/dd/yy

Volume: ☐ 5L ☐ 20L

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

August 2011

Disposal of Ethidium Bromide Liquid Waste

Purpose
Ethidium bromide is considered a mutagen and must be neutralized and/or disposed of properly.

Scope
The following procedure describes the waste disposal and treatment of ethidium bromide solutions.

Background
Ethidium bromide (EtBr), (3,8 diamino-5-ethyl-6-phenylphenanthridinium bromide, CAS #1239-45-8), is commonly used as a nucleic acid stain. Ethidium bromide is considered a mutagen because it intercalates double stranded DNA. This could affect DNA biological processes, like DNA replication and transcription. Although ethidium bromide is strongly mutagenic, causing living cell mutations, there is no evidence at this time of human carcinogenicity or teratogenicity. However, EtBr can be toxic at high concentrations. Testing in humans and longer studies in any mammalian system would be required to fully understand the potential risk ethidium bromide poses to lab workers.

Consider substituting EtBr with less hazardous materials such as GelRed™ from Biotium (UV excitation at 300nm, emission at 595nm – so conventional UV transilluminators are sufficient) or SYBR® Safe DNA gel stain from Life Technologies/Invitrogen (requires filter for UV transilluminator, but has the advantage of using non-UV light for visualisation). Another non-toxic, non-mutagenic safe alternative to ethidium bromide is Amresco's EZ-Vision® fluorescent dye for visualization of DNA bands on a standard UV transilluminator.

Ethidium bromide is typically purchased in powder (an irritant to the upper respiratory tract, eyes and skin) or solution form and is soluble in water. Solid ethidium bromide waste (e.g., gels) typically contains 3 –5 ug/mL of ethidium bromide. At higher concentrations of EtBr the colour of the gel is dark pink or red. Items such as gloves, tubes and paper towels only contain traces of EtBr. Stock solutions of ethidium bromide contain higher concentrations of ethidium bromide than gels (approximately 10 mg/mL). Liquid ethidium bromide waste (e.g., buffers) typically contains less than 0.5 ug/mL of ethidium bromide.

The disposal of laboratory ethidium bromide remains a controversial subject. Ethidium bromide can be degraded chemically, or collected and incinerated. While it is not specifically regulated as a hazardous waste, the mutagenic properties may present health hazards and disposal concerns if it is not managed properly in the laboratory.

NOTE: Ethidium bromide is a chemical and should **NOT** be treated or labeled as a biohazard.

Procedure
A. Solid Waste Contaminated with Ethidium Bromide
For any solid waste contaminated with ethidium bromide (i.e., electrophoresis gels, gloves, test tubes, paper towels) follow the "Disposal of Non-Regulated Contaminated Solid Waste".

B. Contaminated Liquid Waste
Aqueous solutions containing ethidium bromide can be removed from solutions with activated charcoal or amberlite ion exchange resin or chemically deactivated. Some commonly used

methods are described below. **IMPORTANT NOTE**: Liquid waste contaminated with ethidium bromide **must not** be sent to the Environmental Services Facility (ESF). However, solutions containing heavy metals, organics, cyanides or sulfides should be disposed as hazardous waste.

1) Charcoal Filtration

Filtering the aqueous ethidium bromide waste solution, free of other contaminants, through a bed of activated charcoal is a relatively simple and effective method for removal of ethidium bromide. The filtrate may be poured down the sink drain. These methods should be used for ALL solutions of EtBr in organic solvents. There are a few simple options available for charcoal filtration:

a) Destaining "Tea" Bags

This method is the most convenient as it allows rapid concentration of ethidium bromide from large volumes of solutions into a small "tea" bag which can then be disposed of as "non-regulated contaminated solid waste".

One simple charcoal filtration method is the GreenBag™ which has the capacity to remove 10 mg EtBr/bag. The GreenBag™ kit [cat. # 2350-200] is available from MP Biologicals/Q-Biogene. There are other "tea" bags similar to the GreenBag™kits which remove ethidium bromide and other biological stains, including Coomassie Blue. Typically each bag will remove 99% of the dye from a 0.5 ug/mL EtBr solution. These bags are available from MO BIO [cat# 15007-25] or Amresco [cat# E732-25].

- Drop a destaining "tea" bag into the ethidium bromide solution.
- Allow to stand for the allotted time, usually overnight (stirring speeds the process).
- Pour filtrate down the drain.
- Follow the "Disposal of Non-Regulated Contaminated Solid Waste**"**. Place charcoal filter in a thick plastic bag and ensure no leaks. Place in a cardboard box and affix a **Non-Regulated Contaminated Solid Waste tag (Yellow)** (as shown below) and indicate waste type on tag. Store box in the building's designated chemical waste area for pick-up by ESF.

b) Powdered Activated Charcoal

Powdered activated charcoal can be used for buffers containing less than or equal to 0.5 ug/mL of ethidium bromide or for cleaning up accidental spills.

- Add 100 mg of powdered activated charcoal for each 100 mL of waste buffer solution.
- Store the solution for one hour at room temperature, shaking it intermittently. Filter the solution through a Whatman No. 1 filter and dispose of the filtrate down the drain.
- Follow the "Disposal of Non-Regulated Contaminated Solid Waste**"**. Place filter and activated charcoal in a thick plastic bag and ensure no leaks. Place in a cardboard box and affix a **Non-Regulated Contaminated Solid Waste tag (Yellow)** (as shown below) and indicate waste type on tag. Store box in the building's designated chemical waste area for pick-up by ESF.

NOTE: Used tea bags, cartridges and activated charcoal are still **highly contaminated** and will need to be further treated as contaminated solid waste. Refer to the "Disposal of Non-Regulated Contaminated Solid Waste**"** for steps on how to properly dispose of this type of waste.

2) Chemical Neutralization

Solutions containing ethidium bromide can be chemically deactivated, neutralized and poured down the drain. Chemical deactivation **MUST NOT** be used for organic solvent (flammable) solutions of EtBr. Deactivation **MUST** be confirmed using UV light to detect fluorescence.

Most ethidium bromide users are familiar with using household bleach as a simple and inexpensive method of deactivation (i.e. Armour method below). However, in 1987, Lunn and Sansone studied eight methods for destroying ethidium bromide. By using mutagenic assay techniques (e.g. the Ames test) they showed that as much as 5% of the activity of ethidium bromide (or a subsequent mutagen formed by the oxidation) survived treatment with sodium hypochlorite.

Studies showed the following protocol to be the best method for destroying mutagenic activity in ethidium bromide solutions (Lunn G. and Sansone E., *Analytical Biochemistry,* 162: 453-458, 1987).

a) Lunn and Sansone Method

Add sufficient water to reduce the concentration of ethidium bromide to 0.5mg/mL or less. For each 100 mL of ethidium bromide aqueous solution (0.5 mg/mL):

- Add 20 mL of freshly prepared 5% hypophosphorus acid (H_3PO_2) solution (dilute 10 mL of hypophosphorous acid commercially available as a 50% solution, into 90 mL of water).
- Add 12 mL of freshly prepared 0.5 M sodium nitrite ($NaNO_2$) solution (dissolve 3.45g of sodium nitrite in water to a final volume of 100 mL).
- Stir the mixture briefly and let stand for minimum 20 hours at room temperature.
- Using a UV light, check to ensure that all the EtBr has been removed (absence of reddish-orange fluorescence)
- Adjust pH to 5.5-10.5 using sodium bicarbonate ($NaHCO_3$) and pour down the drain with copious amounts of water.

b) Armour Method

Add sufficient water to reduce the concentration of ethidium bromide to 0.5mg/mL or less. For each 100 mL of ethidium bromide aqueous solution (0.5 mg/mL):

- Add 100mL of bleach (sodium hypochlorite, NaOCl).
- Stir the mixture for 4 hours at room temperature and let it sit for 2-3 days. (Alternatively, stir continuously for 20 hours using a magnetic stirring plate).
- Using a UV light, check to ensure that all the EtBr has been removed (absence of reddish-orange fluorescence)
- Adjust pH to 5.5-10.5 using sodium bicarbonate and pour down the drain with copious amounts of water. Alternatively, for large volumes of solution use 3% hydrogen peroxide (H_2O_2) or sodium thiosulphate ($Na_2S_2O_3$) to neutralize the bleach. **Remember** that bleach is corrosive with a pH = 11-13. **Do not** pour bleach solutions down the drain without neutralizing first!

IMPORTANT NOTES: In this updated version of the procedure, there is a change in the quantity of bleach and the time required to deactivate the ethidium bromide solution (Armour method). The previous amount of bleach was 440 mL to 100mL of EtBr and the time was 2 hours. This change was deemed necessary in order to minimize the amount of bleach used.

All the chemicals used for the chemical deactivation are toxic and/or corrosive and the methods described above are rather complicated and time consuming. Most universities in Canada and elsewhere are not endorsing the bleaching technique and in general are moving away from the chemical deactivation methods. The bleaching technique is currently being evaluated by RMS due to its possible residual mutagenicity, and will likely be banned **in the near future.** Therefore, **OXIDATION WITH BLEACH IS DISCOURAGED. Waste generators are STRONGLY encouraged to use the safer and less controversial charcoal filtration techniques described above.**

For further information, please contact the Advisor, Environmental Services at 604-822-9840.

Non-Regulated Contaminated Solid Waste

NON-REGULATED CONTAMINATED SOLID WASTE

The University of British Columbia, Environmental Services Facility

NR08110000001

Parcel Identification No:

NON-REGULATED CONTAMINATED SOLID WASTE

NR08110000001

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT

- ☐ Soild waste contaminated with Ethidium Bromide
- ☐ Silica Gel

Other _____

Office use only:

Date Received: _____
MM/DD/YY

Weight: _____ Kg

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

August 2011

Disposal of Non-Regulated Contaminated Solid Waste

Purpose

This procedure ensures that non-regulated solid wastes are diverted from landfill and disposed of properly.

Scope

This disposal procedure applies to non-regulated solid wastes such as contaminated silica gel and solid waste contaminated with ethidium bromide.

Background

Certain wastes, although not regulated as hazardous, are not permitted at the landfill. These wastes classified as non-regulated (NR) waste must be diverted from the solid waste stream and disposed of properly in a secured land fill. Silica gel may be contaminated with solvents, trace organic chemicals or heavy metals (e.g. moisture indicators). Ethidium bromide waste is generated from gels.

Procedure

1. Collect solid waste contaminated with ethidium bromide or silica gel in a thick plastic bag. Ensure there are no leaks. Double-bag waste in a thick clear garbage bag.
2. Each bag must not weigh more than 10 kg. Ensure that there is no liquid in the bag.
3. Package the bag in a heavy duty cardboard box. Tape box to seal.
4. Affix a **Non-Regulated Contaminated Solid Waste tag (Yellow).**
5. Indicate waste type on tag.
6. Attach generator barcode sticker on tag.
7. Store box in the building's designated chemical waste area.
8. Contact the Environmental Services Facility at 604-827-5389 if your building is not on the regular pick up schedule.

Non-Regulated Contaminated Solid Waste

NON-REGULATED CONTAMINATED SOLID WASTE

The University of British Columbia, Environmental Services Facility

NR08110000001

Parcel Identification No:

NON-REGULATED CONTAMINATED SOLID WASTE

NR08110000001

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT

- ☐ Soild waste contaminated with Ethidium Bromide
- ☐ Silica Gel

Other_____

Office use only:

Date Received: _____
MM/DD/YY

Weight: _____ Kg

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

August 2011

Disposal of Mercury Waste

Purpose

This procedure specifies the proper disposal of mercury waste in order to ensure the safety of workers and staff, and in compliance with the BC Environmental Management Act, 2003 and the BC Hazardous Waste Regulation, 2009.

Scope

This procedure applies to the disposal of mercury waste, which includes equipment and devices such as: thermometers, barometers, manometers, blood pressure monitors (broken or unbroken), microscope lamps, fluorescent lamps/light bulbs, thermostats, electric switches, or other.

Background

Waste mercury is regulated as Class 8 (Corrosive) and Class 6.1 (Toxic Substance), as defined by the current Transportation of Dangerous Goods Regulation.

The Metro Vancouver Sewer Use Bylaw No. 299, 2007 Consolidated and the BC Hazardous Waste Regulation, 2009 prohibit the discharge of waste mercury into sewers or landfills.

Procedure

Fluorescent lamps/light bulbs are recycled via Building Operations, while thermostats and electric switches are sent for disposal (contact the Service Centre at 604-822-2173 for more information). The most common lab devices that contain mercury are thermometers and manometers and they are disposed of via ESF.

A. Mercury Thermometers or Manometers (Unbroken or Waste)

If no mercury has spilled and the thermometers are intact, put into a glass or plastic bottle/container. Label the bottle "**Mercury Thermometers for Disposal**". Request approval for disposal from the Environmental Services Facility (ESF) via the online Chemical Waste Inventory System (CWIS).

B. Broken Mercury Thermometers or Manometers

1. Refer to the Spill Clean Up Procedures for details on how to clean up a mercury spill. Report the spill to a supervisor and to RMS using the Spill Reporting Form. If necessary, contact HAZMAT (911) for immediate assistance and Risk Management Services 604-822-9840 for further assistance.
2. Place all waste mercury in a sealed vial or jar and all the clean-up materials in a leak-proof container. Label the jar as **"Mercury Waste"** and list as "Mercury" under chemical name when entering the information in the Chemical Waste Inventory System, for ESF approval.
3. Contact ESF at 604-822-6306 for more directions concerning disposal.

NOTE: For any other mercury waste, place mercury in a sealed container, label as **"Mercury Waste"** and dispose using the online Chemical Waste Inventory System.

Disposal of Unknown Laboratory Chemicals

Purpose

This procedure specifies the method for the proper disposal of unidentified laboratory chemicals such that hazards are addressed and UBC is in compliance with all legislation.

Scope

This disposal procedure applies to hazardous laboratory chemicals in the solid or liquid form that cannot be identified and does not include gases or lecture bottles.

Background

The Environmental Services Facility (ESF) Operation Plan authorized by the BC Ministry of the Environment (MOE) does not allow ESF to handle unknown chemicals.

The disposal of unidentified chemicals is the responsibility of the generator. The expense of identifying the unknowns is borne by the generator. ESF will arrange for the disposal of unknowns on the generator's behalf by external contractor.

Disposal of unidentified hazardous chemicals in the sewer or landfill is prohibited by the Metro Vancouver Sewer Use Bylaw No. 299, 2007 Consolidated and by the BC Hazardous Waste Regulations, 2009.

Procedure

1. Put the containers of unknowns (any type of unidentified waste) in a cardboard box.
2. Write "**Unidentified chemicals - Do Not Touch**" on the box in clear lettering.
3. Store securely.
4. Contact ESF at 604-822-6306 to arrange for an approved external contractor to pick-up the waste.
5. ESF will contact the external contractor on the generator's behalf.
6. The **generator pays the contractor directly** for the cost of identification and disposal.

Disposal of Explosive Chemicals

Purpose
This procedure specifies the requirements for the disposal of Dangerous Goods (DG) Class 1 (Explosives), chemicals identified as explosive, or potentially explosive substances.

Scope
This procedure applies to the disposal of chemicals that are considered explosive or potentially explosive.

Background
Explosive chemicals are classified according to the BC Environmental Management Act, 2003 and Hazardous Waste Regulation, 2009, as well as the current Transportation of Dangerous Goods (TDG) Regulations.

Disposal of explosive waste in the sewer or landfill is prohibited by the Metro Vancouver Sewer Use Bylaw No. 299, 2007 Consolidated.

Procedure
The Environmental Services Facility (ESF) **DOES NOT** accept explosives.

The procedure for the disposal of all types of explosives is as follows:

1. Put the containers of explosives in a cardboard box.
2. Write "**Explosives - Do Not Touch**" on the box in clear lettering.
3. Store securely.
4. Contact ESF at 604-822-6306 to arrange for an approved external contractor to pick-up the waste.
5. ESF will contact the external contractor on the generator's behalf and will let them know what the approximate cost of disposal is.
6. The **generator pays the contractor directly** for the cost of disposal.

IMPORTANT NOTE: Generators MUST test for peroxides before sending peroxide forming chemicals (e.g. ethers) for disposal. If the chemicals have not been recently tested (3, 6 or 12 months depending on the peroxide hazard), they are too hazardous (potentially explosive) and thus unsafe to handle. Refer to the current **Chemical Safety Manual** (Appendix G) for a list of Peroxidizable Compounds, classification and testing schedule. Also refer to the "**Handling and Removing Peroxides Procedure**" (see RMS "A-Z Forms and Publications") for additional information.

Disposal of Propane and Butane Gas Cylinders

Purpose

This procedure specifies the safe and proper disposal of non-rechargeable and non-returnable propane and butane gas cylinders.

Scope

This procedure applies only to the disposal of non-rechargeable and non-returnable propane and butane cylinders. This procedure does not apply to other gas cylinders and lecture bottles.

Background

Compressed gas cylinders are not accepted at local landfills. As a result many of the university's compressed gas cylinders designated for disposal (empty or full) remain in the buildings thereby creating fire or explosion hazards.

Gas cylinders should be disposed of or recycled in a safe manner. When purchasing propane or butane gas cylinders, generators must ensure that the cylinders are refillable or can be returned to the supplier.

Procedure

Propane/Butane cylinders

1. All propane and butane cylinders must first be approved for disposal by the Environmental Services Facility (ESF) via the online Chemical Waste Inventory System.
2. Ensure that the generator information is filled in completely.
3. Approved processed requests are sent to the generator via e-mail.
4. Package cylinders in strong cardboard boxes.
5. The weight of each box must not exceed 10 kg.
6. Once the box is full, tape the box closed.
7. Tape an envelope with the approved form on the box. Write the generator's name, department, and telephone number on the envelope. On top of each box write the gas cylinder hazard class code number.
8. Place the boxes in the building's designated area for pick-up by ESF.
9. Do not vent propane or butane cylinders through the fume hood.

NOTE: BBQ propane cans and tanks of any size cannot be disposed of via ESF. It is the responsibility of generators and their departments to return them to the suppliers from which they were purchased.

Disposal of Waste Oil

Purpose

This procedure specifies the requirements for the packaging and disposal of oil or material contaminated with oil, such that UBC is in compliance with all local and provincial legislation.

Scope

Waste oil is defined as a hazardous waste if it is a "refined petroleum product that has become unsuitable for its original purpose owing to the presence of impurities, or a loss of its original properties", according to the BC Hazardous Waste Regulations, 2009. This disposal procedure applies to the disposal of waste oil, or a non-hazardous material containing more than 3% by weight of oil.

Types of waste oil include the following:

- Automotive lubricating oil
- Cutting oil
- Fuel oil
- Gear oil
- Hydraulic oil
- Refined petroleum based oil
- Synthetic oil
- Emulsion
- Crude oil
- Vacuum-pump oil

IMPORTANT NOTE: Waste oils must not be contaminated with **water, solvents, toxic materials** or **polychlorinated biphenyls (PCB's).**

Background

Oil reuse and recycle operations must strictly adhere to the BC Hazardous Waste Regulations, 2009. Waste oil is not permitted in landfills and in sanitary or storm sewers in compliance with both the BC Hazardous Waste Regulations, 2009 and the Metro Vancouver Tipping Fee and Solid Waste Disposal Regulation Bylaw No. 263, 2012.

Procedure

The procedure for the collection and disposal of waste oil is as follows:

1. The oil can be collected in three ways:
   a) Supplier's original disposable plastic container if it is in good condition (i.e. not leaking);
   b) Designated 5 liter or 20 liter red plastic oil cans; or,
   c) 205 liter metal drums.
2. **Do not use red solvent cans for disposal of waste oil**. If you require empty oil containers, contact an Environmental Services Facility (ESF) Technician at 604-822-1281.
3. Complete the required information on the **Flammable Liquid Disposal Tag (Blue)** (as shown below) and affix the generator barcode sticker. Under "Other" write the type of oil in the container (as listed in the Scope of this procedure).
4. Make sure that all waste oil containers are properly tagged and identified, with lids tightly closed.
5. Place the containers in the building's designated area for pick-up by ESF.

IMPORTANT NOTE: For waste oil contaminated with a high amount of water that cannot be segregated contact ESF at 604-827-5389 for a special "Contaminated Waste Water" tag.

Flammable Liquid Disposal Tag

FLAMMABLE LIQUID DISPOSAL TAG

The University of British Columbia, Environmental Services Facility

S011102551

Parcel Identification No:

FLAMMABLE LIQUID DISPOSAL TAG

3

S011102551

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓ and quantify components >10%)

Do **NOT** include acidic, basic or aqueous solutions, or solids such as sludge, grit, glass, plastic, paper, or inorganic chemicals, etc.

NON-HALOGENATED

- Alcohols ____%
- Aldehydes ____%
- Aliphatics ____%
- Aromatics ____%
- Amines ____%
- Scintallation Cocktail ____%
- Esters ____%
- Ethers ____%
- Ketones ____%
- Thinners ____%
- Oil (non-PCB) ____%

HALOGENATED

- Carbon Tet. ____%
- Chloroform ____%
- TCE ____%
- Freons ____%

Other _____ ____%

NOTE: Contents in this container may be recycled or reused.

Office use only:

Quantity ____ 5L ____ 20L ____ 205L

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

July 2011

Disposal of Waste Paint

Purpose
This procedure specifies the methods for proper disposal of oil paint waste, latex based paint, and waste water generated from paint brush cleaning.

Scope
This procedure applies to the disposal and recycling of waste paint at UBC Point Grey Campus.

Background

Paint waste is a mixture of pigment and solvent. The solvent can be water or a variety of organic solvents, paint waste can be toxic. Users should be aware that Metro Vancouver Sewer Use Bylaw No. 299, 2007 Consolidated prohibits paint waste from being disposed of into the sewer. Paint waste is also considered a hazardous waste and is prohibited in Metro Vancouver landfills.

Procedure

A. Waste Solvent Contaminated with Paint

1. Follow the detailed "Disposal of Organic Solvent Waste Procedure"
2. Use the **Flammable Liquid Disposal tag (blue)** (as shown below) and check the "Non-Halogenated" box.
3. Contact the Environmental Services Facility (ESF) at 604-822-1281 for disposal.

B. Waste Water Contaminated With Paint

1. Collect waste water in 20 L plastic container (jerry-can) or 205 L drum.
2. Contact ESF (604-822-1281) to obtain a special **Contaminated Waste Water tag (aqua blue)**. Add the generator barcode sticker and check the waste component "Paint" on the tag.
3. Contact ESF at 604-822-1281 for disposal.

NOTE: If the paint contaminated aqueous waste is non-hazardous contact the Environmental Services Advisor (604-822-9840) to determine if it meets Metro Vancouver's Sanitary Sewer Use Bylaw requirements. Refer to the detailed "Disposal of Aqueous Waste Procedure".

C. Surplus Paint for Recycling

1. ESF will recycle surplus non-industrial paint containers and aerosol paint through Product Care.
2. Contact the ESF technician at 604-822-1281 to make arrangements for drop-off at the Environmental Services Facility.

Green Tips

- Buy only as much paint as you will need to use in a month.
- Water based paints are the safest option available.
- Latex paints are less toxic than oil based, and also do not need to be thinned and cleaned-off with solvents.

Waste Paint Logs

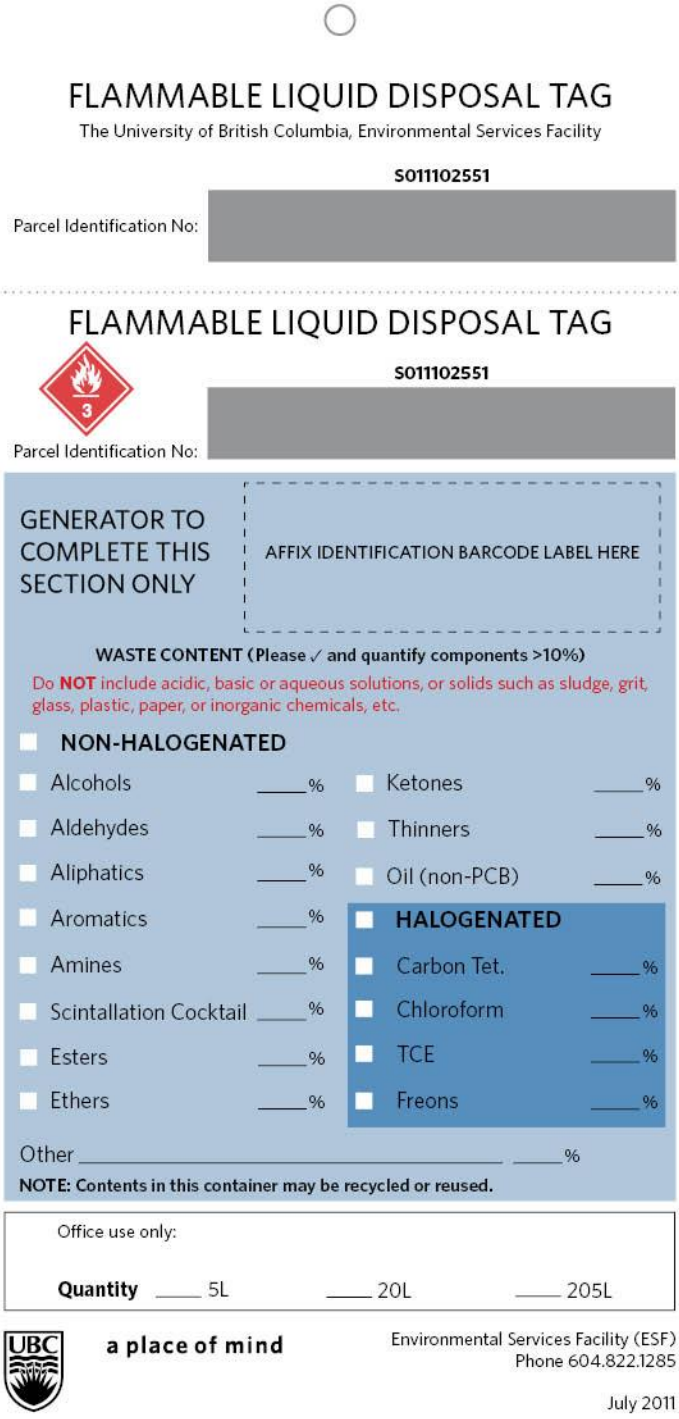
Name	Dept	Location	Volume (L)	Number of Containers
			0.25	
			1	
			4	
			20	

Name	Dept	Location	Volume (L)	Number of Containers
			0.25	
			1	
			4	
			20	

Name	Dept	Location	Volume (L)	Number of Containers
			0.25	
			1	
			4	
			20	

Name	Dept	Location	Volume (L)	Number of Containers
			0.25	
			1	
			4	
			20	

Flammable Liquid Disposal Tag



FLAMMABLE LIQUID DISPOSAL TAG

The University of British Columbia, Environmental Services Facility

S011102551

Parcel Identification No:

FLAMMABLE LIQUID DISPOSAL TAG

3

S011102551

Parcel Identification No:

GENERATOR TO COMPLETE THIS SECTION ONLY

AFFIX IDENTIFICATION BARCODE LABEL HERE

WASTE CONTENT (Please ✓ and quantify components >10%)

Do **NOT** include acidic, basic or aqueous solutions, or solids such as sludge, grit, glass, plastic, paper, or inorganic chemicals, etc.

☐ **NON-HALOGENATED**

☐ Alcohols	____%	☐ Ketones	____%
☐ Aldehydes	____%	☐ Thinners	____%
☐ Aliphatics	____%	☐ Oil (non-PCB)	____%
☐ Aromatics	____%	☐ **HALOGENATED**	
☐ Amines	____%	☐ Carbon Tet.	____%
☐ Scintallation Cocktail	____%	☐ Chloroform	____%
☐ Esters	____%	☐ TCE	____%
☐ Ethers	____%	☐ Freons	____%

Other _____ ____%

NOTE: Contents in this container may be recycled or reused.

Office use only:

Quantity ____ 5L ____ 20L ____ 205L

a place of mind

Environmental Services Facility (ESF)
Phone 604.822.1285

July 2011

Disposal of Waste Batteries

Purpose

This procedure specifies the procedure for the proper disposal of waste batteries such that UBC is in compliance with all legislations. Another objective is to promote waste minimization and embed sustainability into the culture and operations of our campus.

Scope

This disposal procedure applies to waste batteries in class 8 (corrosive) or class 6 (containing toxic heavy metals) as defined by the current Canada Transportation of Dangerous Goods (TDG) Regulations. Disposal of these items at UBC is facilitated by the Environmental Services Facility (ESF).

Waste batteries include the following:

a) Standard/Non-rechargeable Batteries:
- All sizes of regular consumer alkaline batteries (eg. AA and AAA)
- Watch batteries

b) Rechargeable Batteries:
- Nickel-Cadmium batteries (Ni-Cd)
- Lithium-Ion batteries (Li-ion)
- Nickel Metal Hydride (Ni-MH)
- Lead acid (automotive/power supply) batteries (Pb)

If you have any questions, contact the ESF Technicians at 604-827-5389.

Background

Waste batteries shall be disposed in accordance with the BC Environmental Management Act, 2003.

All batteries will be shipped for recycling by a designated contractor. Shipping and packing of all rechargeable batteries are required to comply with TDG shipping regulations in order to prevent short circuits and fires.

Procedure

A. Automotive Batter or UPS Batteries (Over 5 Pounds)

1. All battery disposal requests must clearly identify:
   a. Name
   b. Battery Type
   c. Quantity
   d. Location and Address Information
2. Ensure that ALL information is filled out completely.
3. E-mail the completed requests to ESF for approval: battery_recycling@riskmanagement.ubc.ca. Contact the ESF technician at 604-827-5389 if you have any questions.
4. UPS batteries: package inside a strong cardboard box and secure the box with tape prior to pick-up. Ensure each box weighs less than 10 kg.
5. Place batteries in the designated pick-up area for pick-up by ESF.
6. IMPORTANT NOTE: Ensure that all batteries are contained in plastic bags if they are wet or leaking.

B. Regular & Rechargeable Batteries (Below 5 Pounds)

The procedure for the disposal of all types of waste batteries except car and UPS batteries over 5 pounds is as follows:

1. Find a Call2Recycling Collection Box location
2. Before placing your batteries in the collection box, segregate them into the following two categories:
3. Non-Rechargeable Batteries (eg. alkaline batteries, AA, AAA, D, 9V, lantern batteries)
   - No extra packaging is required. Put these batteries directly into the battery recycling box.
4. Rechargeable Batteries (cell phone batteries, laptop batteries, electronic batteries, cordless hand-tool batteries) and Lithium Primary Batteries (button batteries, camera batteries)
   - Place each battery in its own plastic bag
5. Place inside the collection box
6. **Note**: If there is no Call2Recycle collection service in your area request a special White Battery Collection Box from ESF. To arrange for the delivery and pick-up of a white collection box contact the ESF Technician at battery_recycling@riskmanagement.ubc.ca or 604-827-5389.

Disposal of Laboratory Glass Waste

Purpose
This procedure specifies the method for proper disposal of glass waste to ensure the safety of disposal workers.

Scope
This procedure applies to disposal of glass that is uncontaminated or contaminated by biohazardous or biomedical agents, or hazardous chemicals.

Glass waste includes the following:
1. Glass bottles
2. Pipettes
3. Other glassware

Background
Disposal of contaminated glassware waste to landfills is prohibited by Metro Vancouver, and under the BC Hazardous Waste Regulation, 2009.

NOTE: At present, **laboratory glass cannot be recycled** but UBC is looking at recycling options. Lab glass is decontaminated according to this approved procedure, accumulated as a sub-solid waste stream in the lab and sent to the landfill for disposal.

Procedure
Only APPROVED containers may be used for these wastes. These containers must not to be used for any other purpose.

Approved glass waste containers: five gallon grey metal cans or white plastic pails. All containers must be clearly labeled as **"Glass Waste Only"**. Each container must be lined with a clear 6 mil plastic bag that encloses all the glass. Pails and bags are available through Building Operations Stores (604-822-5272).

- If **uncontaminated**, treat as regular glass waste.
- If the glass container was previously **contaminated** with the following hazardous materials:
  - Hazardous chemicals: safely empty container, decontaminate or neutralize as necessary, triple rinse, dry and dispose of as regular glass waste.
  - Risk Group 1 or Risk Group 2 biohazardous materials: decontaminate empty containers with bleach, by autoclaving, or by using other approved methods. For details refer to the "Treatment & Disposal of Biohazardous Waste Procedure". Then treat as regular glass waste.

In general, for the disposal of glass waste follow the steps below:
1. Decontaminate safely as required.
2. Clean completely of residues, including organic vapours and chemicals
   - leave bottles of organic solvents in a fume hood for at least one day
   - rinse other reagent bottles well with cold water
3. Remove all bottle caps.
4. Remove or deface all labels and hazard warnings.
5. Place in Glass Waste containers.
6. Once glass waste container is **3/4 full,** tie bag closed, ensuring that no glass objects

protrude past the top of the container.

7. Attach a label to the bag indicating your building, room, and telephone number.
8. Take container to the building's designated area for waste pick-up. If your area is not on the pick-up route for glass, call UBC Building Operations Service Centre (604-822-2173) to schedule a pick-up.
9. If there is a self-contained compactor available in your waste area (only available at certain building locations), you may empty the full plastic bags into it and take the metal cans back to the labs.

NOTE: NO sharps (e.g. needles, blades, syringes) and glass vials/jars containing chemicals or other hazardous materials can be disposed of in the glass waste containers.

Disposal of Polychlorinated Biphenyls

Purpose

This procedure specifies the requirements for the disposal of PCB-contaminated materials, to ensure that UBC is in compliance with all relevant legislation.

Scope

This procedure is only applicable to Polychlorinated Biphenyls (PCB) material handled by the UBC Electrical Shop. Other users of PCBs have to contact the Environmental Services Facility (ESF) for disposal procedures. Solid or liquid PCBs to be disposed of include in this procedure include:

- Electrical ballasts (including fluorescent light ballasts)
- Transformers with contaminated oil
- Contaminated oil in barrels
- Capacitors
- Electrical cables
- Spill clean-up material

UBC Building Operations will be charged by ESF for the disposal of PCB waste.

Background

Disposal of PCB contaminated material in the sewer or landfill is prohibited by Metro Vancouver Tipping Fee and Solid Waste Disposal Regulation Bylaw No. 263, 2012.

PCB waste is considered a special waste under the BC Environmental Management Act, 2003.

Procedure

A. Ballasts Disposal

1. After electrical ballasts have been removed by UBC Electricians, they must be brought to the electrical shop and sorted into PCB-containing and non-PCB-containing ballasts using the protocol set in the Technical Guidelines (Section 16502).
2. Non-PCB containing ballasts should be placed in a container marked "Non-PCB Ballasts" and disposed of through UBC Waste Management. Ballasts containing PCB's must be packaged in 20-litre (5-gallon) metal cans designated and labeled as containing PCB waste.
3. Place full cans into the metal cage at the dock area of UBC Electrical Shop. Keep cage locked at all times.
4. When the cage is nearly full, contact ESF at 604-822-6306 or 604-822-1285.
5. Environmental Services Facility will make arrangements for a contractor to pick-up PCB-containing ballasts.

NOTE: All fluorescent light ballasts are collected by Building Operations and disposed of via ESF.

B. Other PCB contaminated waste

Oil contaminated with >2ppm of PCB is considered hazardous waste (per BC Hazardous Waste Regulation) and is disposed of via approved contractors.

Contact 604-822-6306 or 604-822-1285 to arrange for disposal of this waste and other PCB contaminated waste.

Disposal of Laboratory Equipment (NEW)

Purpose

Laboratory equipment can potentially be contaminated with biological material, chemicals or radioisotopes. The equipment must be cleaned and/or decontaminated to protect workers moving or servicing the equipment, the environment, or the public purchasing/reusing surplus equipment.

Scope

Some laboratory equipment can contain materials which present hazards to personnel and/or the environment. Examples include thermometers which contain mercury or fluorescent light ballasts which may contain PCBs. If hazards cannot be removed and equipment sufficiently decontaminated, these units may have to be disposed of as chemical waste.

This procedure applies to the disposal of of equipment which must be decontaminated to assure the removal of hazardous materials prior to disposal, moving or servicing, which includes, but is not limited to:

- Biological safety cabinets (BSC)
- Centrifuges
- Cryostats
- Fume hoods
- Freezers
- Incubators
- Lasers
- Light ballasts
- Liquid scintillation counters
- Manometers
- Ovens
- Refrigerators
- Sinks
- Thermometers
- Tanks
- Walk in refrigeration/freezer units
- X-ray equipment

Procedure

General Guidelines:

- **The exact decontamination procedure will be dependent upon equipment use.**
- Each facility/laboratory is responsible for ensuring the equipment is decontaminated before disposal, moving or service.
- Lab personnel must also inform non-laboratory staff of the potential hazard present.
- Contact the people listed in Appendix 1 for specific questions.
- The **UBC Laboratory Clearance Form** (Appendix 2) must be attached to the decontaminated equipment or lab door, as appropriate.
- Decontamination of equipment can also be performed by external contractor and this can be arranged by RMS. The cost is the responsibility of the lab users/waste generators. Contact the Environmental Services Advisor for more information (604-822-9840).
- Follow the specific guidelines below to prepare equipment for disposal, moving or servicing.
- Also refer to the "**Exit Protocol/Lab Decommissioning Procedure for UBC Research Spaces**" in Appendix D.

A. Equipment Used to Process or Store Chemicals

- Safely remove, drain or discharge chemicals from the equipment.
- If equipment (e.g. manometers) contains mercury contact the Environmental Advisor (604-822-9840) for more information. Safe removal by external contractor can be arranged.
- Collect the material for reuse or chemical waste pick-up by ESF. Refer to the "Disposal of Chemical Waste Procedure" and/or the "Disposal of Mercury Waste Procedure" for more information.
- If applicable, use an inert gas or non-reactive liquid (e.g. water) to purge, rinse, or flush out residue chemical(s). In certain cases suitable solvents or other appropriate regents must be used for decontamination.
- Refer to the "Disposal of Aqueous Waste Procedure" regarding the appropriate disposal of aqueous rinsates. Decontamination solutions containing alcohol or other solvents require disposal per "Disposal of Organic Solvent Waste Procedure."
- Fume hoods must be cleared of all hazardous material and storage containers and the interiors thoroughly washed with warm soapy water.
- Incubators, refrigerators, ovens, and other storage equipment with non-permeable surfaces can be decontaminated by scrubbing with warm soapy water.
- Refrigerants from refrigeration units must be removed by Building Operations. For questions, contact the Service Centre (604-822-2173).
- Lab personnel may contact RMS if equipment cannot be safely and appropriately decontaminated and there is a need for an external contractor.

B. Equipment Used to Process or Store Biological Material

- Safely remove biological material from the equipment.
- Choose the most appropriate decontamination method. Some pieces of equipment must be treated with gas formaldehyde (BSCs), Vapourized Hydrogen Peroxide (animal unit equipment), or other types of liquid decontaminants. Note that bleach will often destroy a piece of equipment, so if it is going out for repairs it is not the best method.
- If bleaching is appropriate, decontaminate (sanitize) with 10% (1:10) fresh bleach solution. After 10-15 minutes contact time, rinse metal surfaces with water as bleach is corrosive. Neutralize bleach solutions (pH=5.5-10.5) before drain disposal.
- Clean the equipment with warm, soapy water, rinse and scrub as necessary. Note that this method only works for equipment has sealed surfaces, not for electronics, etc.
- Refer to the current "Biological Safety Manual" for proper decontamination materials and techniques for various surfaces and equipment including biosafety cabinets. Contact the Biosafety Advisor (604-822-9527) if you have questions.
- Refer to the "Disposal of Aqueous Waste Procedure" for proper neutralization of corrosive solutions. Contact the Environmental Advisor (604-822-9840) if you have questions.
- Lab personnel may contact RMS if equipment cannot be safely and appropriately decontaminated and there is a need for an external contractor.

C. Equipment Used to Process or Store Radioisotopes

- Wipe tests are required to determine whether or not radioactive contamination is present. Survey meters common to research laboratories are not adequate as they are not sensitive enough to meet regulatory requirements. The procedure for performing wipe tests and decontamination methods are outlined in the Radiation Safety and Methodology Reference Manual.

- If radioactive contamination is detected the equipment must be cleaned with small amounts of warm water and detergent or suitable solvent to avoid splashes. Commercial radiation solutions containing chelating agents may be helpful (e.g. COUNT-OFF™ surface cleaner).
- Repeat the wipe tests to ensure contamination has been removed to less than 100 counts per minute **above background** per 100 cm^2.
- If contamination persists or if you have any questions contact the Chemical & Radiation Safety Advisor (604-822-7052).
- Lab personnel may contact RMS if equipment cannot be safely and appropriately decontaminated and there is a need for an external contractor.

Appendix 1 – List of contacts for specific questions regarding equipment disposal and decontamination

Type of Equipment	Contact
Equipment containing mercury (thermometers, manometers, blood pressure monitors), gas cylinders, pressurized containers and vessels	Environmental Services Advisor 604-822-9840
Fume hoods, equipment containing capacitors, transformers containing PCBs, fluorescent light ballasts	Environmental Services Advisor 604-822-9840
Biosafety cabinets, centrifuges and any equipment contaminated with biological materials	Biosafety Advisor 604-822-9527
Equipment containing radiation surfaces (e.g. liquid scintillation counters, gamma counters, gas cromatographs, x-ray equipment, lasers, or equipment producing UV radiation)	Chemical & Radiation Safety Advisor 604-822-7052
Equipment containing asbestos (e.g. fume hood liners, ovens, older counter tops)	Asbestos Program Coordinator 604-822-8772
Units that can potentially be confined spaces (e.g. large tanks, walk-in refrigeration/freezer units, warm rooms)	Manager Occupational Health & Safety 604-822-1885

Appendix 2: UBC Laboratory & Equipment Clearance Form

Building:	Responsible (Lab) Supervisor:
Room Number:	Contact Number(s):
Department:	

Laboratory & Equipment Clearance must be obtained prior to scheduled work being carried out by Bldg Ops workers.

Possible Hazards (NOTE: The responsible supervisor must indicate if these hazards have been in use in the lab ***and MUST ensure the hazards have been controlled or removed as necessary***):

☐ Chemicals (including mercury)	☐ Lasers
☐ Biohazards (Risk Group 1-3 including toxins)	☐ Magnetic Fields
☐ Radiation	☐ Other (please specify)

Prior to starting work, Building Operations Personnel and Responsible (Lab) Supervisor must establish:
Scope of work to be performed & define the work area and/or equipment to be moved/removed.

Responsible (Laboratory) Supervisor must confirm the following:

Yes	No	N/A	
☐	☐	☐	Is it ensured energized equipment or experiments in process will not affect worker safety?
☐	☐	☐	Is it ensured the shutdowns of fume hoods or services will not affect the safety or operations of others?
☐	☐	☐	Is it ensured that **work surfaces** in this lab are clean and free of any hazards and residual contamination (chemicals, biohazards, etc)?
☐	☐	☐	Is it ensured that **equipment to be moved/removed** is clean and free of any hazards and residual contamination (chemicals, biohazards, radiation etc.)?
☐	☐	☐	Is it ensured that "Caution Radioactive Materials" warning labels are posted on work surfaces or equipment? (Responsible lab supervisor shall provide written authorization from the Radiation Safety Office that the equipment is free of radiation hazards.)
☐	☐	☐	Is it ensured that no laboratory work, that could expose worker to hazards during the course of his work, shall be conducted in the vicinity of the defined work area or equipment?

The undersigned responsible (lab) supervisor hereby verifies that the defined **work area and/or equipment** is free of biohazards, chemical or radiation contamination and that all other hazards are appropriately controlled.

Name	Position
Date	Signature

Building Operations workers will communicate completion of work to responsible supervisor

Please post signed copy on Lab Door or Equipment to be moved

7. Appendices

A. UBC Hazardous Waste Disposal Procedures Poster

a place of mind

UBC Hazardous Waste Management Procedures
Environmental Services Facility (ESF), Risk Management Services

ESF Weekly Pick-up Schedule
Please have wastes ready before 9:30 a.m.

Monday	Tuesday	Wednesday	Thursday	Friday

- Take all hazardous wastes to **centralized storage location** in your building.
- Please ensure wastes are **properly packaged** and **tagged** and do not exceed **10 kg**
- To ensure worker safety, ESF will **NOT** pickup waste that is not properly packaged, tagged or weighed

Chemical Waste Disposal
Valeriy Kichenko
604.822.6306 or 778-879.2863
valeriy.kichenko@ubc.ca

Biological Waste Disposal
Wegland Sit
604.827.5389 or 778-879.2866
wegland.sit@ubc.ca

Pickup and Delivery
Satish Maharaj
604.822.1281 or 604.240.4732
satish.maharaj@ubc.ca

Solvent, Photographic Waste Disposal & General Inquiry
Bang Dang
604.822.1285 or 604.323.4420
bang.dang@ubc.ca

Also visit:
www.riskmanagement.ubc.ca/environment

Produced by: Risk Management Services
Revised: January 2014

Biological Waste Disposal

Autoclaved Risk Group 1
- Autoclave in **clear**, **unlabeled** autoclave bags
- Double bag with clear bags and ensure no leaks
- Affix biological waste disposal tag (red)
- Indicate Risk Group 1 on tag
- Attach generator barcode sticker on tag

Autoclaved Risk Group 2
- Autoclave in **clear**, **unlabeled** (*) autoclave bags
- Double bag with clear bags and ensure no leaks
- Affix biological waste disposal tag (red)
- Indicate Risk Group 2 on tag
- Attach generator barcode sticker on tag

(*) **Note**: Orange biohazard bags are only used by containment level 3 facilities, non-UBC waste generators and off-campus labs.

Sharps Waste
- Collect in **red** or **yellow, autoclavable** sharps containers and ensure lid is securely closed/locked. Do not overfill.
- Autoclave
- Affix biological waste disposal tag (red) with generator barcode

Human Anatomical/ Human Blood & Fluids
- Double bag in **red** bags; ensure no leaks
- Affix biological waste disposal tag (red) with generator barcode
- Store in freezer for pickup

Pathological Waste
- Package in a **black** 6 mil polypropylene **bags**
- Double bag to ensure no leaks; do not exceed **10 kg**
- Affix biological waste disposal tag (red)
- Attach generator barcode **sticker** on tag
- Store in freezer for pick-up

Chemical Waste Disposal

Surplus Chemicals and Experimental Byproducts
- Check if chemical is included on the "**non-hazardous**" list: http://www.riskmanagement.ubc.ca/environment/hazardous-waste-management/waste-disposal-guide/chemicals
- Access Chemical Inventory System online http://www.riskmanagement.ubc.ca/environment/hazardous-waste-management/chemical-waste-disposal
- Input generator and chemical information
- Wait to obtain approval for disposal from ESF
- **Segregate** chemicals by hazard class
- Package chemicals with absorbent material in a **heavy duty cardboard box** (ensure package is less than 10kg)
- Tape the box closed
- Affix the approval form to the box (in an envelope)
- Print **generator contact info.** on the envelope
- Print **hazard class** and **authorization number** on box

Solvent/Oil Waste
- Collect in red jerry cans. **Segregate** halogenated & non-halogenated
- Ensure cap is tight and there are no leaks
- Affix flammable liquid tag (blue)
- Indicate **halogenated**, **non-halogenated** or **oil waste**
- Attach generator barcode sticker on tag

Non-Regulated Contaminated Solid Waste
- Double bag waste in thick clear garbage bags
- Ensure no liquid; do not exceed **10 kg**
- Package in a **heavy duty cardboard box**
- Affix non-regulated contaminated solid waste tag (yellow)
- Indicate waste type on tag
- Attach generator barcode sticker on tag

Photographic Waste
- Segregate fixer and developer
- Collect in **20 L** red jerry cans
- Affix photochemical tag (purple)
- Indicate waste type on tag
- Attach generator barcode sticker on tag

Note: ESF will not pick-up the following types of materials: 1) radioactive 2) potentially explosive 3) compressed gases 4) unknowns 5) controlled substances

B. Hazardous Waste Area Inspection Checklist

Year _____

Inspection Month / Item	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
All waste segregated according to hazard class												
All chemical containers:												
• In good condition												
• Labeled or tagged												
• Hazard class on boxes												
• Waste type on tag												
• Authorization #'s on boxes												
• Generator contact info												
• Weight restrictions followed												
Spill Response:												
• Area free of spills												
• Spill kits available												
• Spill response procedure & information available												
• Secondary containment available												
• Drain protection available												
• Fire extinguisher available												
Total volumes stored:												
• Total volume of flammable liquids below 500L												
• Total volume of corrosives below 100L												
• Total volume of toxics below 100L												
Date inspected												
Inspector's initials												

Inspect area at least once per month; enter Yes (Y), No (N) or not applicable (N/A) for each line item.

If item requires corrective action indicate date and type on a separate form.

NOTE: Some checklist items are mostly applicable to on-campus areas and while others apply more to off-campus (hospital) sites.

C. ESF Price List (2014)

Waste Stream Name [TDG Classification]	Unit of Measurement	Price ($)
Absorbing Materials	Kg	4.52
Anatomical Animal	Kg	3.60
Autoclaved Plastics	Kg	3.50
Batteries - Alkaline	Kg	5.00
Batteries - Sealed Lead Acid	Kg	1.00
Biomedical	Kg	18.00
Corrosive Liquid (acidic or basic) Waste containing metals	205 L drum	481.25
Corrosive Liquid (acidic or basic) Waste containing metals	L	1.93
Corrosive Liquid Waste containing cyanide	205 L drum	892.50
Corrosive Liquid Waste containing cyanide	20 L pail	315.00
Corrosive Liquid Waste containing cyanide	L	4.55
Corrosive Liquids or solids N.O.S. [TDG Class 8]	205 L drum (lab pack)	542.50
Corrosive Liquids or solids N.O.S. [TDG Class 8]	20 L pail (lab pack)	166.25
Corrosive Liquids or solids N.O.S. [TDG Class 8]	Kg or L	5.00
Corrosive/toxic liquids or solids	205 L drum (lab pack)	542.50
Corrosive/toxic liquids or solids	20 L pail	166.25
Corrosive/toxic liquids or solids	Kg or L	6.00
Dangerous When Wet [TDG Class 4.3]	20 L pail (lab pack)	315.00
Dangerous When Wet [TDG Class 4.3]	Kg or L	26.25
Environmental hazard liquid or solid [TDG Class 9]	20 L pail	166.25
Environmental hazard liquid or solid [TDG Class 9]	Kg or L	1.14
Flammable liquids [TDG Class 3]	205 L drum (lab pack)	420.00
Flammable liquids [TDG Class 3]	20 L pail (lab pack)	131.25
Flammable liquids [TDG Class 3]	Kg or L	3.54
Flammable Solid [TDG Class 4.1]	20 L pail (lab pack)	210.00
Flammable Solid [TDG Class 4.1]	Kg	9.10
Formalin solution	L	110.25
Lead debris	Kg	1.14
Mercury contaminated waste, debris	Kg	43.75
Mercury waste	Kg	43.75
Non- Regulated contaminated solid waste	20 L pail	43.75
Non- Regulated contaminated solid waste	Tub skid	437.50
Non- Regulated contaminated solid waste	205 L drum	586.25
Non-Regulated contaminated solid waste	350 Kg pallet	437.50
Oil sludge	205 L drum	166.25
Oil sludge	20 L pail	49.00
Organic Peroxide [TDG Class 5.2]	20 L pail (lab pack)	315.00

Organic Peroxide [TDG Class 5.2]	Kg or L	26.25
Oxidizer [TDG Class 5.1]	20 L pail	262.50
Oxidizer [TDG Class 5.1]	Kg or L	21.00
Paint waste [class 3]	205 L drum	262.50
Paint waste [class 3]	20 L pail	87.50
Paint waste [class 3]	L	0.61
Paint waste [class 8]	205 L drum	262.50
Paint waste [class 8]	20 L pail	87.50
Paint waste [class 8]	L	0.61
Sharps	Kg	4.05
Solvent /thinner	205 L drum	133.00
Solvent /thinner	20 L pail	52.50
Solvent /varsol	205 L drum	133.00
Solvent /varsol	20 L pail	52.50
Spontaneously Combustible [TDG Class 4.2]	20 L pail	315.00
Spontaneously Combustible [TDG Class 4.2]	Kg or L	26.25
Toxic [TDG Class 6.1]	205 L drum (lab pack)	542.50
Toxic [TDG Class 6.1]	20 L pail	166.25
Toxic [TDG Class 6.1]	Kg or L	3.50
Vermiculite	Bag (113 L)	52.50
Waste PCB containing oil or equipment [TDG Class 9 (9.1,9.2)]	205 L drum (lab pack)	Call for Quote
OTHER CHARGES		
20 L Plastic Red Can	each	35.00
205 L closed top drum (for liquids)- metal	each	80.00
205 L open top drum- metal	each	80.00
20L plastic pail with Lid	each	28.00
5 L Plastic Red Can	each	28.00
Chemists	Per hour	85.00
Laborer	Per hour	65.00
Manifest	1	25.00
Truck	Per hour	50.00
Minimum charge per consolidated monthly invoice	each	150.00
Minimum charge for any waste stream unless price is higher or otherwise noted	each	85.00

D. Exit Protocol/Lab Decommissioning Procedure for UBC Research Spaces

Purpose
To provide a framework for Administrative Heads of Units to develop a site-specific exit plan for research faculty and staff under their supervision that are leaving the University of British Columbia.

To ensure a proper lab decommissioning process, prior to renovation or transfer of lab occupancy.

Scope
This protocol is applicable to all departments with laboratories or operations where hazardous materials, or equipment that has come in contact with hazardous materials, are used.

Background
Federal and provincial regulations,[a] as well as UBC Policy 9 on Hazardous Materials Management has made it mandatory that principal investigators decommission their laboratories to ensure that the legal and ethical expectations associated with termination of their research are met.

When properly applied, an exit protocol ensures that:
- Unsafe conditions are eliminated;
- A proper clean-up is performed;
- Lab equipment is properly decontaminated and disposed of or recycled;
- Hazardous materials are properly disposed of or recycled/reused;
- Work surfaces are free of contamination;
- The health and safety of researchers is protected;
- University policies and Departmental procedures are followed; and
- Regulatory requirements are met.

[a] Workplace Hazardous Materials Information System (WHMIS); Provincial and Federal Health, Safety and Environmental regulations; the Canadian Nuclear Safety and Control Act (2000); Public Health Agency of Canada's Canadian Biosafety Standards and Guidelines.

Notification
It is recommended that faculty or staff member inform their Administrative Head of Unit of their intention to leave UBC three months in advance of the anticipated departure date. The Administrative Head of Unit shall then provide a copy of the Departmental Exit Protocol and inform the Department of Risk Management Services of the researcher's intent to leave the University. The date of this information transfer should be documented. It is then the responsibility of the Administrative Head of Unit to ensure that the faculty or staff member follows all the steps in the protocol to completion, including all requirements for documentation.

Checklist
A checklist will provide a simple method for the Administrative Head of Unit to confirm that the protocol has been completed. The faculty or staff member shall submit a completed exit protocol checklist to the Administrative Head of Unit prior to departure. The Administrative Head of Unit shall retain a copy and one shall also be provided to the faculty member.

Procedure

When the primary researcher or supervisor of a laboratory leaves or decommissions a laboratory, the following procedures shall be followed:

General:

1. A current inventory of all hazardous materials must be completed.
2. All unknowns must be identified and appropriately labeled.
3. All chemicals must be removed from the laboratory by transfer to another primary researcher/laboratory supervisor, or by disposal through the Environmental Services Facility (ESF).
4. All solid waste and glass waste containers must be emptied and properly disposed of.
5. All equipment not transferred to the future occupant of the space must be decontaminated and removed.
6. Fume-hoods, biosafety cabinets, glove boxes and lab benches must be decontaminated and cleaned.
7. Special arrangements must be made for the disposal of potentially explosive materials and lecture bottles of hazardous gases. For assistance contact the ESF (604-822-6306)
8. The Local Health and Safety Committee should inspect the laboratory and demonstrate approval of the process by signing the inventory form.
9. An approved inventory form should be sent to the Administrative Head of Unit or Director. It is the responsibility of the Administrative Head of Unit or Director to ensure that adequate procedures are followed for the decommissioning of laboratories.
10. In the case of building decommissioning, or when the area is to be renovated, or in swing spaces, the facility manager,[b] should participate in the lab inspection and approve lab decommissioning.

[b] Vancouver campus Facility Managers are represented by UBC Building Operations Facility Managers. For offsite locations Facility Managers are property management and/or land owner assigned designates. (e.g. Vancouver General Hospital Site- UBC occupants must obtain approval from VCHA Safety & Prevention Services).

Transfer of chemicals to another primary researcher or laboratory supervisor

All materials transferred must be labeled according to WHMIS requirements and the receiving party must obtain appropriate Material Safety Data Sheets. The transfer of radioactive materials to another licensee will require RMS consultation. Please contact the Chemical and Radiation Safety Advisor at 604-822-7052 for more information.

Disposal of Chemicals

The identity of all materials must be established before disposal. If there are unidentified materials (i.e. unknown substances), contact the Environmental Services Facility to arrange for materials to be classified for waste disposal purposes; there will be a cost associated with this process depending on required evaluation and TDG hazard class.

Make special arrangements for the disposal of potentially explosive materials or lecture bottles of hazardous gases by ESF approved contractor (contact ESF at 604-822-6306). Disposal costs are to be paid by the generator.

All chemicals must be disposed of via the online Chemical Waste Inventory System (CWIS). Detailed and complete information must be submitted. Following approval by ESF staff, the materials must be packaged according to the instructions provided and then arrangements are to be made with ESF at 604-822-6306 for waste pick-up.

Return compressed gas cylinders to suppliers.

Radioisotope Permit & Laboratory Decommissioning

Required from the Licensee:

1. Memo to Radiation Safety Office (RSO) stating intent to discontinue the radioisotope permit.
2. A complete set of wipe tests for each laboratory/room licensed for isotope use, regardless of radiation use, within the space. Please refer to your permit and associated amendments for the list of permitted rooms.
3. Record of proper disposal of all isotopes on hand. This can include a transfer of remaining isotope to another researcher that is licensed for that material or to the Radiation Safety Office.
4. Completion of a yearly isotope inventory (obtained from the RSO).
5. All isotope purchase, use, disposal and contamination control records must be transferred to the Radiation Safety Office.

Following the completion of the above steps, Radiation Safety Office staff will remove all signs and all records will be transferred to the RSO. Thereafter, a letter will be issued to the researcher, and the department head if requested, stating that the license is no longer active. Decommissioning of laboratory space is not complete until all steps have been verified by the Radiation Safety Office.

Biohazard Laboratory Decommissioning

1. Notify the Biosafety Office (604-822-9527) and the Office of Research Services that the biohazard protocols are to be concluded and by what date.
2. Record transfer of bio hazardous materials to the inventory of another researcher.
3. Destroy all biohazards not transferred to the inventory of another researcher. If using an autoclave, then documented proof of kill using biological indicators is required.
4. Decontaminate all working surfaces with appropriate decontaminate. If gas decontamination is necessary then documented proof of kill using biological indicators is required.
5. For any equipment that has been in contact with bio hazardous materials, a record of the decontamination methods, dates, and who performed the task must be kept on file with the department

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EXIT PROTOCOL CHECKLIST		Date:		
		Room #(s):		
Item #	**Have you:**	**Yes**	**No**	**N/A**
1	Created a complete inventory of all hazardous materials in the laboratory?			
2	Has Administrative Head of Unit received a copy of the inventory?			
3	Have all unknowns (chemicals, etc.) been identified and properly labeled?			
4	Have arrangements been made for the disposal of lecture bottles of hazardous gases and potentially explosive chemicals?			
5	Are MSDS sheets available for all known chemicals?			
6	Have all chemicals been disposed of via the online Chemical Waste Inventory System (CWIS)?			
7	Have the chemicals been transferred to a another researcher's inventory or to the Environmental Services Facility?			
8	Have compressed gas cylinders been returned to the suppliers?			
9	Has the Radiation Safety Office (RSO) been notified of your intent to decommission the radioisotope permit or lab areas?			
10	Has a complete set of wipe tests been performed in all licensed areas and submitted to the RSO?			
11	Have the radioisotopes been disposed of or transferred to another licensee?			
12	Has an annual inventory record been submitted to the RSO?			
13	Have all radiation inventory and contamination control records been submitted to the RSO?			
14	Has the Biosafety Office been notified of your intent to terminate work with Biohazards?			
15	Has bio hazardous material been disposed of and transferred to another researcher?			
16	Are all working surfaces decontaminated?			
17	Has the liquid nitrogen contract been terminated?			
18	Has specialized lab equipment been safely decontaminated/de-energized/recycled/disposed?			
19	Has the Safety Committee inspected the laboratory? [attach Exit Safety Inspection Report]			
20	If you will be transferring to a new laboratory or work area, has the RMS Occupational & Research Safety Associate been provided with updated information for the hazard information door signs, specifically hazard information and emergency contact information?			

When a researcher retires, closes an entire lab or moves to another building, the form must be signed below and forwarded to Risk Management Services for approval.

Principal Investigator:	Administrative Head of Unit:
Name:	Name:
Signature:	Signature:
Date:	Date:

Local Health and Safety Committee Chair:	Facility Manager:
Name:	Name:
Signature:	Signature:
Date:	Date:

When a PI leaves a lab, but the space will still be occupied by the same department, the incoming PI accepts the lab and the inventory in its current condition.

Outgoing Laboratory Supervisor:	Incoming Laboratory Supervisor:
Name:	Name:
Signature:	Signature:
Date:	Date:

END OF DOCUMENT

Distribution: Files available to all Risk Management Services employees with authority to access drive S:\Environment\Procedures

Initiator: Ligia Gheorghita, June 2014

Supervisor: Noga Levit, June 2014