



Laboratory Pollution Prevention

Introduction

UBC's Policy #6 (Environmental Protection Compliance), Policy #7 (Occupational and Research Health and Safety), and Policy #5 (Sustainable Development) 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



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

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.



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 MIT "Green" Alternatives Wizard (ehs.mit.edu/greenchem/) to replace hazardous chemicals and chemical processes with safer options
 - Use the EPA Green Chemistry guidelines (www.epa.gov/greenchemistry) for 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

- Donate surplus, uncontaminated chemicals to other labs in your building, 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:

- **Silver Recovery Program** – Photographic waste is recovered and reused by a silver refinery, and the corrosive liquid is neutralized before disposal.
- **Battery Recycling** – ESF recycles large automotive lead-acid batteries via Metalex Recycling. Household batteries are recycled directly via Call2Recycle, the charge-free provincial stewardship program.
- **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 waste is collected by ESF and sent to GFL Environmental to be recycled.