

Handling and Disposal of Chemicals

Audience:	University of Connecticut
Campus Covered:	All
EHS Contact:	Denis Shannon 6-3613
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The significant amount of chemical wastes generated at the University each month presents a serious and complex problem for the entire University community. Unless we understand that chemical waste is everyone's problem and responsibility, teaching and research efforts may be severely compromised. The key to solving this problem lies in recognizing this responsibility, understanding the management system, and **REDUCING THE VOLUME OF SURPLUS AND WASTE CHEMICALS**.

1) Your Responsibilities

When hazardous chemicals are mishandled or mismanaged, they have the potential to contaminate the environment and threaten human health. Whether your waste chemicals are generated in organic synthesis, analytical detection, or biomedical research, understanding your responsibility for those wastes (unwanted chemicals) is the most important first step in sound chemical waste management. See Part I, section D for the responsibilities of the laboratory worker and individual staff member.

2) The University of Connecticut Chemical Waste Management System

The success of the management system depends upon cooperation between you and the Department of Environmental Health and Safety. You are to use this manual to identify chemical waste and determine the appropriate route of disposal for that waste.

This manual outlines two routes of disposal for your surplus or waste chemicals: Disposal to the normal trash or sanitary sewer system, **ONLY IF YOU ARE SURE IT IS PERMISSIBLE**.

Department of Environmental Health and Safety pickup for recycling, incineration or landfilling in accordance with local, state and federal regulations, by a qualified treatment, storage, and disposal facility. When your surplus or waste chemicals are given to the Department of Environmental Health and Safety, we first check to see if the chemical is a waste. The principal investigator should check to see if this chemical can be reused. We then determine the degree of hazard and appropriate route of disposal.

Containers of hazardous chemical waste must:

- be labeled, "Hazardous Waste", with the respective hazard warning word, if it is ignitable, corrosive, reactive or toxic;

- have the contents itemized by % composition; use complete chemical names, not formulae, structures or abbreviations;
- have tightly fitting caps which are only removed to make additions;
- hold compatible chemicals;
- be stored by hazard category, and segregated from incompatible chemicals;
- be stored off the floor in a secure location.

Non hazardous waste may be disposed of in the sanitary sewer or with normal trash, if so advised by the Department of Environmental Health and Safety. Waste solvents and other hazardous wastes are disposed of through a commercial, licensed hazardous waste disposal company. These wastes will either be incinerated, or packaged in drums and sent to an EPA-approved hazardous waste landfill. Due to the nature and type of laboratory chemical wastes, this is a very costly procedure.

Throughout this process, the University is required to keep complete records that account for the disposal of hazardous wastes 'from the cradle to the grave', a concept which holds the generator of the waste liable for that waste, essentially forever.

3) Your Job in Waste Reduction

The act of Congress which makes it illegal to improperly manage hazardous wastes is entitled "The Resource Conservation and Recovery Act", or RCRA. The emphasis of this act is on waste reduction, hazardous waste identification and recycling. Of the disposal methods described above, hazardous waste landfilling is clearly the least desirable. Hazardous waste landfills are costly, use precious land resources and are to be used only as a method of last resort when other proper disposal methods are not available. The Department of Environmental Health and Safety embraced this philosophy and has designed its management system around waste reduction and recycling methods. This makes sense because the handling, transport, treatment and disposal of chemical waste is expensive. You can help reduce the amount of chemical waste.

Persons generating chemical waste as the result of experimentation must consider that waste is an integral part of the experiment. If a procedure exists whereby the initial chemical byproduct can be readily converted to a less hazardous form, or can be neutralized, this procedure must also be incorporated into the experimental method.

- A. **ORDER ONLY WHAT IS NEEDED.** The economy of purchasing larger sizes is offset by the University's disposal cost for your excess. These costs are generally more than the original price of the chemical. Be sure to check current stock before ordering chemicals. It may also be possible to borrow small amounts of chemicals from other laboratories. Take the time to check.
- B. **SUBSTITUTE** non-hazardous or less hazardous materials for hazardous ones whenever possible. There are commercially available non-hazardous substitutes for chromic acid cleaning solution. Alcohol based thermometers are less toxic than mercury ones and can be substituted satisfactorily in most cases. Investigate other possible substitutions through the literature or call the Department of Environmental Health and Safety for assistance.
- C. There are chemicals that can be safely disposed of in the normal trash (section C) or in the sanitary sewer system (section D).

- D. It is important that small quantities of hazardous chemicals are not mixed with nonhazardous waste, as this may cause the entire waste to be listed as hazardous.

You can help! Before you call the Department of Environmental Health and Safety for pickup of an unwanted but useable chemical, please check to see if other laboratories in your department or building can use it. Waste solvents should not be evaporated in your laboratories. Segregate and collect solvents for pickup by EH & S (see Section G.) Other waste Volume Reduction Methods When planning experiments, consider the following questions in your planning:

Can any material be recovered for reuse? Can the product of one reaction be used as the starting material for the next experiment? Will the experiment generate any chemical that can be safely broken down by a laboratory procedure? (e.g. elementary neutralization.) Can any unusual disposal problems be anticipated? If so, inform the Department of Environmental Health and Safety beforehand. (e.g. mixed waste - Chemical/Radioactive, or Chemical/Biological.) Are chemicals being acquired only in needed quantities? Is there a possibility of replacing a hazardous reagent or solvent with one that is less hazardous and easier to dispose of?

4) Reduction of the Scale of Experiments

The use of microscale in the study of chemical and biochemical reactions can lead to significant savings in costs of chemicals, energy, apparatus, and space. It is now technically feasible to run many reactions with much smaller quantities of chemicals. Technical advances that have made this possible include:

Fast microprocessor-based, top-loading balances that are sensitive to 0.1 mg;

- a) Chromatographic techniques, such as high performance liquid, gas, size exclusion, and ion exchange, that can cleanly separate and purify milligram quantities of substances;
- b) c.) Sensitive spectrometers that can analyze milligram, and sometimes microgram, quantities of substances;
- c) d.) Microscale glassware, including pipettes, burettes, syringes, reactors, and stills for handling reagents and reagent products;
- d) e.) Flow and transfer systems based on small internal diameter metal and plastic tubing that make it possible to study flow type reactions, catalysts, and multi-step reactions on a very small scale, even under pressure. In addition to reduction of waste volumes, today's economies dictate investigation of these microtechniques for use in laboratory operations.

5) Control of Reagents That Can Deteriorate

INDEFINITE AND UNCONTROLLED ACCUMULATION OF EXCESS REAGENTS CREATE STORAGE PROBLEMS AND SAFETY HAZARDS. THESE PROBLEMS CAN BE ALLEVIATED, AND PURCHASE COSTS SAVED, BY INCORPORATING A CENTRALIZED CHEMICAL STORAGE SYSTEM, ACCESSIBLE TO ALL RESEARCHERS. THIS ELIMINATES HOARDING AND DUPLICITY OF HAZARDOUS CHEMICALS.

Reagents that react readily with oxygen or water are prone to deteriorate when stored for long periods of time after the original container has been opened. A laboratory labeling program for chemicals which deteriorate over time should be instituted to prevent accumulation of outdated chemicals which pose an increased risk to the laboratory and personnel.

6) Prevention of Orphan Reaction Mixtures

All reaction mixtures stored in laboratory glassware should be labeled with the chemical composition, the date they were formed, the name of the laboratory worker and faculty member responsible, and a notebook reference. This procedure can provide the information necessary to guide the disposal of the mixture if the responsible laboratory worker is not available.

IT IS SUGGESTED THAT DEPARTMENTS INITIATE A CHECKOUT PROCEDURE THAT REQUIRES DEPARTING LABORATORY WORKERS TO IDENTIFY ANY REACTION MIXTURES THAT THEY HAVE NOT DISPOSED OF AND TO PROVIDE THE INFORMATION NECESSARY FOR THEIR SAFE DISPOSAL.

Individual departments may be held responsible for the costs associated with the identification and removal of orphan reaction mixtures and unknown chemicals left behind by departing investigators or graduate students, and any extraordinary cleanup costs for removal of waste chemicals.