Laboratory Waste Minimization

Introduction

Hazardous waste minimization is the EPA's first choice method of pollution prevention. Waste minimization means a reduction in volume, toxicity and physical hazards of materials. As a generator of hazardous waste, the University of Toledo must be committed to reducing pollution. This can be accomplished by careful experiment design and laboratory management.

Waste minimization creates benefits. Smaller quantities of waste mean less compromise of the environment at disposal sites. Waste minimization leads to safer laboratory conditions and lessens employee exposure to hazardous chemicals. Waste minimization also promotes safer waste handling and transporting. It also reduces disposal costs which benefits the whole university community.

Waste minimization activities include:

- Treatment to reduce hazards.
- Substitutions of less hazardous materials.
- Procedural changes to minimize generation.
- Improved laboratory management practices.

Treatment to Reduce Hazards

The last step of an experiment should include treatment methods to reduce or eliminate the hazards of materials or byproducts.

- Chemically neutralize corrosives to a pH of 7.0. This must be done chemically and not by aqueous dilution. Aqueous dilution is not an acceptable method of neutralization as specified by EPA.
- Small quantities of inorganic acids (HCl, H2SO4, HNO3,) can be chemically neutralized and flushed down the drain. NEVER FLUSH CHROMIC ACID OR HYDROFLUORIC ACID -- EVEN IF NEUTRALIZED. Chromium must be treated as hazardous waste. HF can damage glass lines. Bases such as sodium, ammonium, and potassium hydroxide can also be chemically neutralized and flushed down the drain.
- Laboratory quantities of oxidizers can be treated. Small quantities of water-reactive or pyrophoric materials can be reacted off. Toxicity of some compounds can be reduced. Sodium cyanide can be treated to yield sodium cyanate and waste epoxy monomers can be polymerized to a safe solid state, for example. Other treatments include deactivating organometallic compounds and reclaiming metals.

Substitutions and Elimination

Minimize hazardous wastes by substituting less hazardous materials in experiments. This will also reinforce worker safety. The following are examples of substitutions:

- Use biodegradable detergents or other non-chromium cleaners for

glassware.
- Use biodegradable detergents such as Alconox in place of ethanol-base baths.
- Use non-mercury based preservatives
- Use red liquid (alcohol), metal, or digital thermometers.
- Substitute sodium hypochlorite for sodium dichromate
- Substitute alcohols for benzene
- Substitute cyclohexane for carbon tetrachloride.
- Substitute ethanol for formaldehyde in biological specimen preservation.
- Use water based paints instead of oil based paints.
- Eliminate the use of pigments containing heavy metals in art applications.
- In photography labs, eliminate silver from waste streams through recovery.
- In teaching labs, eliminate experiments using heavy metals. Replace with iron, cobalt, copper, etc.
- Substitute biodegradable liquid scintillation cocktails for xylene or toluene based cocktails.
- Try to substitute nonchlorinated solvents for chlorinated solvents.

Procedural Changes

Wastes can be minimized by implementing procedural changes such as:

- Use microscale or scaled down procedures in experiments.
- Distill spent solvents for reuse.
- Segregate halogenated waste from nonhalogenated wastes.
- Segregate organic liquids from inorganic wastes.
- Segregate very toxic wastes (potassium cyanide, acrolein, etc.) from less toxic wastes.
- Do not mix chemical waste with normal office trash or food waste.
- Avoid reagents or paints containing heavy metals.
- Purchase lecture bottles only from companies who will accept their return when empty.
- Reuse developers in photography labs.
- Recover metals for recycling or reuse by precipitation.

Management Practices

Good laboratory management can be instrumental in minimizing waste generation.

- Purchase only the quantity of material which you need.
- Pay attention to chemicals with restricted shelf life.
- Have one person from a research group order chemicals to avoid duplication of chemicals in a group.
- Share excess and unexpired chemicals with other groups.
- Keep containers labeled to avoid them later becoming unknowns. (This is a costly disposal.)
- When a researcher leaves a research group, ensure that no unwanted or unused or waste hazardous materials are left behind. Share usable materials and employ other methods to minimize waste of leftovers.