# Hazardous Waste Disposal Policy

Webster University, Biological Sciences
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## DEFINITION OF HAZARDOUS WASTE

A Hazardous Waste is any substance that: *exhibits certain characteristics* as defined by federal and Missouri rules and regulations, is *unusable* or unwanted in any way and *poses a potential hazard* to individuals, the environment or public health. To be considered hazardous waste, the material must possess at least one of the following qualities:

- Flammability
- Reactivity
- Toxicity
- Corrosivity

## EXAMPLES OF HAZARDOUS WASTE:

- Opened surplus chemicals
- Unwanted products and material generated during a laboratory experiment
- Expired or off-specification chemicals (in containers that have been opened)
- Empty chemical drums containers with a capacity over 10 gallons
- Non-returnable gas cylinders and lecture bottles or pressurized chemicals
- Residue of spill clean-up materials-contaminated rags and absorbents

- Carcinogens and cytotoxic (antineoplastic) agents
- Non-radioactive lead shielding, lead blocks and lead scrap
- Photographic film processing solutions
- Used solvents
- Thermometers and other items containing mercury
- Paint, paint thinners, brush cleaners, linseed oil,
- Heavy metal-containing waste or products (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver).

## SPECIAL WASTE TYPES:

The following categories of waste have additional disposal requirements and should NOT be mixed with regular hazardous waste. Contact the Chemical Safety Officer if you wish to dispose of any of these materials.

- Used oil --- motor, vacuum pump, lubricating
- Pesticides
- Batteries (any type)
- Prescription drugs and controlled substances,
- Solvent- or thinner-contaminated rags

## HAZARDOUS WASTE DISPOSAL OVERVIEW

1) Collect Hazardous Waste in sturdy leak-proof containers for disposal

- Do not use the sinks or surrounding areas for handling, storing, or disposing of hazardous chemicals.
- Do not dispose of hazardous chemicals via the sink or in the trash.
- Evaporation is NEVER an acceptable waste disposal or minimization method.
    - Only insignificant, residual amounts of water associated with rinsed glassware or rinsed containers may be removed by evaporation.

2) Place Hazardous Waste in the proper waste stream

- Most waste will fall into one of the following categories:
    - Halogenated solvents (e.g., dichloromethane)
    - Non-polar, immiscible solvents (e.g., hexane)
    - Polar, miscible solvents (e.g., methanol)
    - Corrosive (acidic)
    - Corrosive (basic)
    - Heavy metals (contains arsenic, barium, cadmium, chromium, lead, mercury, selenium or silver)
- The highest-hazard waste streams are heavy metals, then halogenated solvents.
    - Material containing heavy metals should always be placed in a separate waste container to prevent heavy metal contamination of other waste streams. (If a few mL of heavy metal waste are added to 5 L of solvent, we have to dispose of all 5 L as heavy metal waste.)
    - Separate halogenated from non-halogenated solvents. They have different

incineration requirements and must be handled differently by the waste hauler. (If a few mL of halogenated solvent are added to 5 L of ordinary non-halogenated solvent, the entire 5 L must be disposed of as halogenated material.)

- If a waste doesn't seem to fall into any of these categories, contact the Chemical Safety Officer for guidance.

3) Label waste containers

- All chemical waste containers must be properly labeled. Complete and attach a Hazardous Waste Label for any unlabeled waste containers.
- Always enter a start date (the date the first drop of material was placed in the container)
- On the waste label, identify constituents by chemical name.
  - No abbreviations, or chemical formulas!
- The label must contain the approximate amount or concentration of constituents.
  - *Entering amounts or concentrations can save the department significant money,* as waste haulers charge different fees for waste depending upon its composition.
  - If no concentrations or amounts are listed on the label, the waste hauler charges a higher fee to process the waste because they must assume that everything listed is present in large amounts.

4) Store waste containers properly.

- Caps must be tight. No open funnels or filling aids may be left in containers when waste is not actively being added.
- During waste collection, process waste containers (i.e., HPLC, photographic solutions) must have a cap with tight fitting hole for the fill tube.
- Never store flammables with oxidizers or acids with caustics.
- Labs must use bins for segregation and secondary containment.
- Flammable wastes are best stored in a fire rated flammables cabinet.

OTHER REMINDERS

- Always wear eye/face protection, lab coat and gloves when working with hazardous chemicals.
- Consult Safety Data Sheets (SDS) for more information on hazardous chemicals you may work with at Webster University

## WASTE MINIMIZATION

The Environmental Protection Agency's (EPA's) policy for hazardous waste management places the highest priority on waste minimization.

Waste minimization is any action that:

- Decreases the amount of hazardous waste generated, or
- Reduces the inherent toxicity of the waste.

The costs associated with the proper disposal of chemical wastes and the safe storage of chemicals in the research laboratory are inextricably linked. Researchers are encouraged to limit

the amount of chemicals purchased. It is easier to order additional chemicals than to dispose of unwanted or unused surplus chemicals. REMEMBER: The disposal cost can exceed ten times the cost of the chemical.

In some cases, there are no acceptable waste disposal options.

Rethink how you purchase, handle and store laboratory chemicals to control the increasing costs of proper chemical waste disposal and the inherent hazards of storing and working with hazardous chemicals.

Waste minimization benefits you, the university and the environment by:

- Significantly lowering costs;
- Reducing potential health hazards;
- Reducing potential long-term liabilities for disposal;
- Promoting environmental ethics; and
- Preventing pollution.

It is the responsibility of every investigator who generates waste to incorporate the principles of waste minimization into experimental design.

## SOURCE REDUCTION AND WASTE MINIMIZATION TIPS

- Substitute less hazardous chemicals whenever possible.
- When planning experiments or demonstrations, examine all wastes generated and ask how they could be minimize.
- Reduce the scale of processes so that less waste is generated.
- Evaporation under the hood (or on the bench) is NEVER an acceptable waste minimization method
- Minimize the volume of prepared solutions containing mercury and heavy metals.
- Clearly mark the contents of all chemical containers to prevent the generation of unknowns.
- Actively manage the inventory of all hazardous materials used in your laboratory or work location.
- Ask others in your department if they could use your unwanted chemicals.
- Neutralize, quench or destroy hazardous by-products as the last step in experiments.
- Separate halogenated from non-halogenated solvents.
- Separate aqueous and solvent wastes if possible.

## STORAGE OF HAZARDOUS CHEMICALS IN TEACHING AND RESEARCH LABORATORIES

In the laboratory, hazardous chemicals can be divided into four general categories -corrosives, flammables, reactives and toxics. In most cases, it is the immediate or obvious hazard that determines which category a particular chemical is classified.

GENERAL PRINCIPLES FOR MANAGING LABORATORY CHEMICALS

- Less is better. Purchase small amounts that you will use up within a year. Whereas the per-unit cost may be greater—significant savings are realized in reduced disposal costs and safer storage.
- Buy pre-made molar and normal solutions, thereby reducing the likelihood of waste.
- Obtain access to a SDS for each chemical, and consult the SDS before using a chemical.
- Read labels. Handling and storage information is on the manufacturer's label.
- Purchase chemicals in plastic containers to minimize potential breakage. If this is not possible, purchase shatter-resistant plastic coated bottles.
- Manage first-in, first-out! Indicate the date received and the date opened. Pay particular attention to expiration dates.
- Dispose of open, partially used or expired chemicals.
- Peroxide-forming compounds require frequent testing or disposal.
- Keep all chemical containers off floors, carts and electrical equipment.
- Physically segregate your chemicals according to compatibility.
- Label the secondary storage containers or areas in which particularly hazardous chemicals may be used.
- Store hazardous chemicals below eye level. This simple task greatly reduces the likelihood of something falling from above and breaking.
- Cabinets with doors are safer locations than open shelves for hazardous chemicals.
- Safely transport any hazardous chemical. Place in secondary containment such as a bottle carrier.
- Avoid placing any chemical container in direct sunlight, underneath a sink or near heat sources.
- Place volatile or flammable chemicals only in specially designed refrigerators.
- Be especially careful with reactive chemicals. Obtain and read the SDS for each reactive chemical that you may have or may work near.
- Label all containers in the laboratory with the following information (this includes any stock or working solutions):
  - Name of chemical or stock solution
  - Date started
  - Your initials
  - Hazard warning (i.e., flammable, toxic, corrosive, reactive)
- Store chemical by hazard class. Do not store merely by alphabetical order.
- Use and manage your chemical fume hood, wisely. Too many chemical containers or equipment block the air slots and compromise the containment performance.
- Follow all waste disposal guidelines

STORAGE OF FLAMMABLE LIQUIDS

- Limit the amount of flammable liquids in use to the smallest practical volume.
- Work with flammable liquids inside a chemical fume hood. Return all flammable liquids to an approved flammable storage cabinet. The doors to flammable storage cabinets must close securely. Self-closing doors are best.
- The maximum quantity of flammable and combustible liquids that can be stored openly or within an approved flammable storage cabinet is defined for each campus.

- The purchase of 5-gallon containers of flammable liquids is strongly discouraged. All transfers of flammable liquids from containers of five gallons or more must be performed inside a fume hood. These containers also must be stored in a flammable storage cabinet.
- Segregate flammables from oxidizers and oxidizing acids.
- Most refrigerators/freezers purchased by the labs are designed for non-hazardous materials. Refrigerators and freezers suitable for flammable material storage are specially labeled “Explosion safe” of “Explosion proof.”

STORAGE OF GAS CYLINDERS

- In general, only keep cylinders in your lab that are in current use or waiting for immediate use.
- Large toxic gas cylinders must be in an approved gas cylinder cabinet.
- All cylinders not attached to a regulator must have a valve protection cap in place.
- For vertical storage, cylinders must be secured (at a minimum) in their upper third by a tight fitting chain or belt secured to the wall or non-movable casework. This applies to all cylinders.
- One cylinder per chain or web belt.
- Horizontal storage of cylinders is only allowed in racks designed for the purpose. Cylinders must be chained to the rack.
- Cylinders must not be kept in corridors, hallways, stairways or cold rooms (or any other area with limited ventilation).

HANDLING CRYOGENIC FLUIDS

- Cryogenic liquids, such as liquid nitrogen, must be handled only in containers designed for that purpose.
- Full face protection (face shield) including safety glasses and goggles as well as insulated gloves, lab coat, covered shoes must be worn when handling cryogenic liquids.
- When transferring liquid from one container to another, the receiving container must be cooled gradually.

## Appendix A - DISPOSAL PROCEDURES FOR SPECIFIC WASTE STREAMS

Webster University laboratories utilize and generate a wide variety of hazardous substances. Appendix A contains information on how to handle some of the more common waste streams generated by the University. Refer to the following list for specific information:

ACIDS AND BASES

- Collect concentrated acids and bases in original containers whenever possible. This includes nitric, hydrofluoric, sulfuric, glacial acetic, hydrochloric, sodium hydroxide, ammonium hydroxide.
    - Hydrofluoric acid etches glass and must be collected in plastic containers.
    - The Chemical Safety Officer MUST be informed if you find Hydrofluoric acid in your lab. It requires special precautions to handle safely.
- Dilute acid and base solutions may be disposed of down a lab sink with copious amounts of water provided they are treated as follows:

  - Slowly stir acid into a large amount of an ice-water-to dilute to about 5% acid.
  - Prepare a base solution of one of the following: sodium carbonate (soda ash), calcium hydroxide (slaked lime), or sodium hydroxide. The base concentration should be 5 to 10 % for nitric and perchloric acids. (A one molar solution is about 4% (4 grams per 100 ml)).
  - Slowly stir diluted acid into the base solution until the pH is at least 5 but not greater than 10.
  - Slowly pour the neutralized solution down the drain with large amounts of water.
- No solvent or metal contaminated material is permitted for drain disposal.

AEROSOL CANS
If completely empty, aerosol cans may be disposed of as non-hazardous waste.

BATTERIES
Batteries are considered Universal Waste and are disposed of by the Facilities Department. There are many types of batteries on campus: lead-acid (automotive), mercury, lithium containing, ordinary household and rechargeable. Dispose of all battery types through an appropriately labeled container and call Facilities to pick up the container when full.

CADMIUM and CHROMIUM
Wastes containing more than 1ppm are regulated, so the amount of Cadmium or Chromium added to any waste container *must* be noted.

CHEMICAL CARCINOGENS AND MUTAGENS
If original containers or associated contaminated disposable labware are to be discarded, use an appropriately labeled container. Triple rinse empty containers and collect all rinsate as hazardous waste.

CONTAMINATED GLASSWARE
Chemically contaminated glassware, pipette tips, needles, blades and sharps are collected in a puncture-proof broken-glass container.

CYANIDES
Cyanides, nitrites and sulfides are among the most toxic and rapidly acting substances found in a chemical lab. Symptoms of toxicity occur if these materials are swallowed, inhaled or absorbed through the skin. *Keep in locked and secure locations*. Always use secondary containers to help prevent breaks or spills. Use an appropriately labeled container for disposal.

DRAIN DISPOSAL
The range of substances that can be potentially hazardous is enormous. Almost any substance can be a hazardous waste if it is disposed of in large quantities or in high concentrations. Federal and state hazardous waste laws permit laboratories to dispose of small amounts of some chemicals in quantities that do not pose a hazard to human health or the environment. It is the policy of Webster University to prohibit the drain disposal of all potentially hazardous chemicals and take a more conservative approach when confronted with a less defined disposal situation.

- Suitable for Drain Disposal (See Appendix B)
- NOT Suitable for Drain Disposal
    1. Inherently toxic, malodorous or lachrymatory chemicals
    2. Solutions containing heavy metals
    3. Flammable liquids (flash point < 140◦F) of any type.
    4. Organic solvents—methanol, acetone, hexane, chloroform, etc
    5. Paint and paint thinner
    6. Poisons, carcinogens, teratogens or embryotoxins
    7. Toxic dyes and stains
    8. Sodium azide
    9. Strong acids and bases (either in pH extremes/concentration)
    10. Chromic/sulfuric acid cleaning solutions
    11. Photographic fixer
    12. Motor oil, gasoline, degreasing solutions, antifreeze or other automotive fluid
    13. Pesticides

ETHER
Ether is a highly flammable liquid and can form potentially explosive peroxides over time. Containers of ether must be dated when opened and tested periodically for the presence of peroxides. Ether must be collected using an appropriately labeled container. Ether cans have expiration dates on the label. Dispose before they expire.

ETHIDIUM BROMIDE (ETBR) & PROPIDIUM IODIDE
Ethidium bromide staining and running buffer solutions must be disposed using an appropriately labeled container. For the collection of acrylamide gels that contain ethidium bromide, dispose of in a five-gallon plastic pail.

Never use bleach to treat EtBr wastes. This actually increases toxicity.

NOTE: SYBR Safe® is sold as a safer alternative to Ethidium Bromide. It is less toxic and the stain and gels can be disposed as regular waste. SYBR Safe can be used in the same manner as solutions of EtBr. Tests indicate that it is just as, if not more sensitive than EtBr. It can also be read in the same manner with a standard UV or visible light trans-illuminator, or laser based scanner. SYBR Safe is provided ready to use as a concentrate, it can be cast directly in the gel or used as a post stain. It may also be used to stain RNA in gels. Recommended storage time is six months at room temperature.

FORMALIN/FORMALDEHYDE/GLUTARALDEHYDE/ PARAFORMALDEHYDE
Unwanted or unused formalin or formaldehyde must be disposed of in an appropriately labeled container.

NITRITES
Cyanides, nitrites and sulfides are among the most toxic and rapidly acting substances found in a chemical lab. Symptoms of toxicity occur if these materials are swallowed, inhaled or absorbed through the skin. Keep stored in locked and secure locations. Always use secondary containers to

help prevent breaks or spills. Use an appropriately labeled container for disposal.

OILS
Uncontaminated instrument and machine oils such as centrifuge, diffusion pump and vacuum pump oils must be collected in plastic containers and labeled appropriately. Oils found in X-Ray machines and other similar devices may contain PCB's (polychlorinated biphenyls), especially if the equipment is old. DO NOT MIX PCB CONTAMINATED OIL WITH OTHER OILS.

PEROXIDE FORMING COMPOUNDS
Certain chemicals (such as isopropyl ether, diethyl ether, dioxane, 2-butanol and tetrahydrofuran) can form organic peroxides if they are exposed to air, become more concentrated, or age. These compounds may violently explode when combined with certain other compounds (i.e., metals) or when exposed to heat, shock, friction, light, or static discharge.

Never move or open a container if crusty deposits formed on the material or its container, an oily, viscous layer appeared, or there are solids on the bottom**.**

- Clearly and explicitly label chemicals known to form peroxides.
- Always date the container when received and when opened.
- Limit the on-hand stock to a three (3) month supply or less.
- Air dry empty containers under the hood, flush with water, deface the label and put containers in the glass disposal container.
- Store away from heat and light.
- Protect from ignition sources, physical damage, contact with strong reducing agents or oxidizers, or other contamination.
- Ensure air-tight closures on containers, purge head space with nitrogen when possible.
- Keep a minimal working inventory.
- Never store in a freezer. Use explosion-proof or explosion-safe refrigerators, as needed.
- Never store in glass bottles with glass stoppers.
- Never attempt to clean containers that were used to store peroxide forming compounds by scraping or rubbing, especially if an oily deposit or crusty residue is present.
- Test for peroxide concentration before distilling or concentrating peroxide formers. Prevention of unwanted peroxides is paramount. Stabilization and disposal can cost up to $8,000 per container.

PESTICIDES
If old pesticides are found, please contact the head of Facilities.

PHARMACEUTICALS
The possession of controlled substances is only permitted with a valid DEA license. Keep Drug Enforcement Administration (DEA) regulated drugs under lock and key security until time of pick up.

PHENOL/CHLOROFORM
1. Collect liquid mixtures using labeled containers. Indicate percentages on the label.
2. Phenol/Chloroform-contaminated labware such as pipette tips and Eppendorf tubes with small

volumes of liquid must be collected using an appropriately labeled container.

It is not acceptable to throw this type of waste into general trash containers, autoclave in biohazard bags, or dispose of as biological waste. It must be disposed of as hazardous chemical waste.

REACTIVES

Chemicals that are considered reactive can react violently with air, water or other substances and also have the potential to explode. These chemicals include sodium azide, picric acid, sodium cyanide and perchloric acid.

- Segregate oxidizers from flammable and combustible materials, organic material and reducers;
- Pyrophoric chemicals ignite spontaneously on contact with air. Keep these chemicals in a glove box.
- Store breakable glass bottles inside a plastic bottle carrier.
- Shock-sensitive and/or explosive materials (benzoyl peroxide) can spontaneously release large amounts of energy when struck, shaken, dropped or agitated. Some chemicals become increasingly shock sensitive with age. Inspect these regularly for degradation and dispose of promptly. Consult the Safety Data Sheet (SDS) before working with reactives.
- Never contaminate reactive chemicals with heavy metals or incompatibles.

SODIUM AZIDE

Sodium azide is commonly used in low concentrations as a microbiocide to preserve samples. Avoid exposure to the pure material. Avoid weighing the solid by adding solvent to the material and diluting to working concentrations. Take care not to contaminate pure sodium azide with metals or foreign materials as this can lead to the formation of explosive metal azides. If used as a microbiocide, purchase sodium azide in solution. Azide solutions can also form explosive metal azides in drain pipes. Collect solutions and pure material for disposal in an appropriately labeled container. Best practice is to make azide waste solutions basic >pH 10 before moving them to the waste closet.

SOLVENTS

All solvents must be collected using an appropriately labeled container. Aqueous, halogenated and non-halogenated waste streams should be separated. Halogenated solvents include methylene chloride and chloroform. Non-halogenated solvents include methanol, acetone and xylene. List all chemical constituents on the waste label. This includes any metals. The pH also is very important to note on the waste label. No excess solids or debris is allowed. For laboratories using large volumes of certain solvents, it may be possible to distill or purify these solvents for reuse. Consult the Chemical Safety Officer if you wish to explore this possibility.

STAINING SOLUTIONS

Staining solutions such as Wright's, eosin, iodine and methylene blue stains must be in an appropriately labeled container. You must list the solvent identity and concentration on the waste label (i.e., water, glacial acetic acid, 100% methanol).

SULFIDES
Cyanides, nitrites and sulfides are among the most toxic and rapidly acting substances found in a chemical lab. Symptoms of toxicity occur if these materials are swallowed, inhaled or absorbed through the skin. Store in locked and secure locations. Always use secondary containers to help prevent breaks or spills. Use an appropriately labeled container for disposal.

SCIENTIFIC EQUIPMENT- SURPLUS, REPAIR OR DISPOSAL
Any piece of scientific equipment must be carefully surveyed and decontaminated when it may have been in contact with potentially hazardous chemicals or biohazards.

## APPENDIX B - SANITARY SEWER OR ORDINARY REFUSE DISPOSAL

Only dilute solutions of non-toxic materials shall be disposed of in the sanitary sewer system. This includes most normal biological metabolites and nontoxic cellular constituents (proteins, nucleic acids, carbohydrates, soluble fats, and their precursors and catabolites, common sugars, amino acids, non-toxic common salts (NaCl, MgCl2, etc) and biological buffers with pH between 5-10. (Phosphate buffers, saline, Tris, etc.).

Note that acid or base solutions containing organic or inorganic impurities (e.g. base baths or acidic solutions used to clean glassware) must not be flushed down the drain even if neutralized. These solutions must be collected for hazardous waste disposal in an appropriately labeled container.

In general, only the non-hazardous laboratory chemicals in the following table may be placed into the ordinary refuse (garbage) for disposal. Non-hazardous materials in aqueous solution may be poured down the drain with the exception of >2% slurries of sand-, earth-, gypsum-, cement or other insoluble material. Materials that do not appear on these lists MUST be collected for disposal by the Chemical Safety Officer.

| | | | |
|---|---|---|---|
| Acids, pH>5 | Calcium oxide | L-cysteine | Sephadex |
| Actin | Calcium phosphate | L-glutamic acid | Silica Gel |
| Agar | Calcium sulfate | L-histidine | Sodium borate |
| Agarose | Citric acid | L-leucine | Sodium bicarbonate |
| Alcohol <24% | Collagen | Lactose monohydrate | Sodium carbonate |
| Alanine | Dextrin | Lysine hydrochloride | Sodium chloride |
| Albumin, bovine | EDTA (acid free) | Maltose | Sodium citrate |
| Alumina | EDTA disodium salt | Manganese chloride | Sodium phosphate |
| Aluminum oxide | Egg albumin | Manganese sulfate monohydrate | Sodium sulfate |
| Ammonium acetate | Ferric citrate | Mannitol | Sorbitol |
| Ammonium phosphate dibasic | Ferric oxide | Magnesium borate | Stannic oxide |
| Ammonium sulfate | Ferrous sulfate hexahydrate | Magnesium carbonate | Stannous oxide |
| Amylase | Fetal bovine serum | Magnesium chloride | Starch |
| Amylose | Folic acid | Magnesium oxide | Sugars |
| Antifoam E Emulsion | Fructose | Magnesium phosphate | Tetraethylammonium chloride monohydrate |
| Asparagine | Gelatin | Magnesium sulfate | Thiamine hydrochloride |
| Aspartic acid | Glucose | Niacin | Tin |
| Bases, pH <10 | Glutamic acid | Pectin | Titanium oxide |
| Boric Acid | Glycerol | Potassium borate | Tris base |
| Calcium acetate | Glycine | Potassium carbonate | Trypsin |
| Calcium borate | Glycogen | Potassium chloride | Yeast extract |
| Calcium carbonate | Inositol | Potassium phosphate | Zinc oxide |
| Calcium chloride | Iron | Potassium sulfate | |
| Calcium citrate | Iron oxide | Riboflavin | |

NOTE THAT LIQUID NITROGEN OR DRY ICE MUST NEVER BE PLACED IN THE SINKS, AS THEY CAN CRACK THE SINK AND CAUSE DAMAGE TO THE PLUMBING.