

## Disposal of Laboratory Waste, MSU Department of Chemistry

The Murray State University Office of Environmental Safety and Health has primary responsibility for hazardous waste pick-up and off-site disposal. They maintain a current Hazardous Waste Disposal Policy, which provides complete MSU policy on waste disposal. It is recommended reading, and is available by phoning the Office of Environmental Safety and Health (x3480) or by inquiring at the office of the Department of Chemistry Laboratory/Safety/Waste Coordinator (BL 452).

We are regulated primarily by Kentucky EPA on waste disposal matters. Waste from lab drains is sent to the City of Murray wastewater treatment system, and must meet additional requirements. Blackburn Science Building has been cited in the past by KY EPA for the following violations:

- improper labelling
- dirty containers
- tops off of hazardous waste bottles.

Failure to comply with waste disposal regulations may result in fines and/or criminal charges. Within the Department of Chemistry, responsibility for meeting these requirements is assigned to university employees, including faculty, staff, TA's, and student workers, under the authority of the Lab/Safety/Waste Coordinator and the Office of Environmental Safety and Health.

For any material you wish to discard, follow these two steps, as explained later.

- I. Classify the waste as hazardous or nonhazardous.
- II. Prepare the waste for disposal.

### I. Classify the Waste

A waste is considered to be hazardous if any chemical compound present in the waste is listed as a hazardous material. KY EPA maintains an extensive list of chemicals considered to be hazardous. Refer to the MSU Hazardous Waste Disposal Policy for this list. Non-listed waste is considered hazardous if it has at least one of the following characteristics.

- Ignitability - Waste has a flash point  $<60^{\circ}\text{C}$  ( $140^{\circ}\text{F}$ ). This will include all flammable materials and many combustible materials.
- Corrosivity - The waste is aqueous, with a pH  $<6$  or  $>12.5$ .
- Reactivity - The material is normally unstable. This includes materials which *may* react violently with water or form potentially explosive mixtures with water.

Toxicity - Contains at least one of the following materials, at even trace levels.

Arsenic	Hexachloroethane
Barium	Lead
Benzene	Lindane
Cadmium	Mercury
Carbon Tetrachloride	Methoxychlor
Chlordane	Methyl ethyl ketone
Chlorobenzene	Nitrobenzene
Chloroform	Pentachlorophenol
Chromium	Pyridine
Cresol (any isomer)	Selenium
2,4-D	Silver
1,4-Dichlorobenzene	Tetrachloroethylene
1,2-Dichloroethane	Toxaphene
1,1-Dichloroethylene	Trichloroethylene
2,4-Dinitrotoluene	2,4,5-Trichlorophenol
Endrin	2,4,6-Trichlorophenol
Heptachlor (and its epoxide)	2,4,5-TP (Silvex)
Hexachlorobenzene	Vinyl Chloride
Hexachlorobutadiene	

Appendix A provides guidance for miscellaneous waste types. If you are unable to classify the waste, contact the Office of Environmental Safety and Health or the Laboratory/Safety/Waste Coordinator.

## II. Prepare the Waste for Disposal

- A. If the waste is a non-hazardous solid, it may be placed in the laboratory's solid waste receptacle.
- B. If the waste is a non-hazardous liquid, it may be poured down the lab drain *if* the temperature of the waste <65°C (150°F), and it does not contain fats, waxes, greases, etc.
- C. If the waste is aqueous and is hazardous only because it has a pH outside the acceptable range (this may also include some water-reactive materials), it may be neutralized and poured down the lab drain (see neutralization procedure, Appendix B).
- D. If the waste is hazardous, and does not fit description C above, prepare the waste container for disposal as follows.

1. Confirm that the waste container is appropriate for the material contained. For instance, metal cans are inappropriate for corrosive wastes and plastic bottles are inappropriate for many solvents.
2. Wastes exhibiting similar hazardous properties may be combined, using the following guidelines.
  - a. Never combine incompatible materials.
  - b. Do not combine materials with different hazardous properties. For instance, do not combine flammable solvent waste with corrosive waste.
  - c. Segregate toxic wastes as much as possible. For instance, do not add mercury waste to a waste container used for chlorinated organic solvents.
3. Ascertain that there is adequate headspace in the container.
4. Make sure the outside of the container is clean and dry.
5. Label the container with the following information.
  - a. The words "HAZARDOUS WASTE".
  - b. A listing of the bottle contents, including concentrations for each component. Use chemical names, not formulas or symbols.
  - c. Note special hazards (i.e., "flammable"). Record the pH of aqueous solutions.
  - d. Provide the total volume or mass of waste in container.
  - e. Identify the waste source (i.e., "CHE 315, exp. 2)
6. Confirm that the top is securely fastened and is in good condition.
7. Waste that is ready for pick-up and off-site disposal should be placed in a designated area, preferably in a catch basin of some sort. Contact the Lab/Safety/Waste Coordinator when you have waste for disposal (this is not necessary for Freshman and Organic labs, unless an unusual situation exists). Waste is usually collected on Friday afternoons.

## **Appendix A - Miscellaneous Wastes**

### **Empty reagent bottles**

If the chemical reagent is considered hazardous, the bottle should be rinsed into a hazardous waste collection container to remove all residue of the hazardous material. Then, rinse the reagent bottle three times with water. Remove the bottle label. The bottle may then be re-used or discarded in the laboratory waste receptacle (broken glass receptacle if it is a glass container.) Metal cans should be cleaned as specified above, and the bottom should be cut open using a can opener before discarding.

### **Old/expired chemical reagents**

Contact the Lab/Safety/Waste Coordinator.

### **Mercury waste**

Contact the Lab/Safety/Waste Coordinator.

### **Very hazardous materials (i.e., picric acid) and other special categories**

Contact the Lab/Safety/Waste Coordinator.

### **Biologically hazardous waste**

If the waste may be rendered non-infectious by autoclaving or adding bleach, the treated material may be discarded in a standard sealed waste container. For large quantities of such waste, or in any instance where treatment is not a viable option, the material must be sealed in a clearly designated biohazardous waste container for off-site disposal. Any waste with multiple hazards (i.e., hazards listed in section I in addition to biological hazards) must be clearly labeled with all hazard categories identified, and prepared for off-site disposal. Waste containers for biologically hazardous materials must be puncture resistant if sharp items are present in the waste.

## Appendix B - Neutralization Procedures

For neutralization procedures, the following safety precautions must be followed at all times.

1. Wear heavy neoprene gloves, chemical splash goggles, and a lab coat or lab apron.
2. Perform all steps in an operational fume hood.
3. Know where the nearest safety shower and eyewash are located. Be sure you can get to them readily.

The recommended equipment set-up: a large beaker with a large stir bar placed in an ice bath on a large magnetic stir plate in a fume hood. A ringstand for an addition funnel is helpful.

### Neutralization of Acids

1. Only those acidic mixtures for which acidity is the only hazard may be neutralized in-house.
2. Dilute concentrated acids before performing neutralization.
  - a. For water-reactive solutions (i.e., sulfuric acid, chlorosulfonic acid), add acid very slowly into cold water or a mixture of ice and water (for very reactive materials such as chlorosulfonic acid). Adjust rate of addition based on reaction observed. This addition may be performed using a separatory funnel or addition funnel. Provide additional cooling as necessary. Water volume should be at least three times the total acid volume. The beaker should be less than half full at completion of this step.
  - b. For other concentrated acids, add acid slowly to water. Provide cooling as necessary. Water volume should be at least three times the total acid volume. The beaker should be less than half full at completion of this step.
3. Slowly, with constant stirring, add 50% (w/w) sodium hydroxide solution or solid sodium bicarbonate (another base may be substituted by approval from Laboratory/Safety Waste Coordinator.) Use an ice bath if necessary to maintain temperature below 65°C. When neutralizing with sodium bicarbonate, use care to avoid foaming the mixture out of the container.
4. Periodically check the pH with a paper capable of distinguishing a change of one pH unit. When the pH of the mixture is between 6 and 8, addition of base is stopped and the mixture is allowed to stand for at least an hour to void excess CO<sub>2</sub> and to permit slower reactions of precipitated solids with residual acid.

5. After one hour, check pH. If the pH is between 6 and 8, the mixture is drainable. If the pH is less than 6, additional sodium bicarbonate is added to bring the pH up to between 6 and 8. The mixture is again allowed to stand for an hour before rechecking. This procedure is repeated until the pH remains at a pH between 6 and 8, after which it may be drained.

### **Neutralization of Alkaline Substances**

1. Only those alkaline mixtures for which the basicity is the only hazard may be neutralized in-house.
2. If the waste contains solid bases (sodium hydroxide pellets, etc.), first dissolve the solids in water and cool the mixture before proceeding. The beaker should be less than half full at completion of this step.
3. Slowly, with constant stirring, add 10% hydrochloric acid solution (another acid may be substituted by approval from Laboratory/Safety Waste Coordinator.) Use an ice bath if necessary to maintain temperature below 65°C. When neutralizing mixtures containing carbonates, use care to avoid foaming the mixture out of the container.
4. Periodically check the pH with a paper capable of distinguishing a change of one pH unit. When the pH of the mixture is between 6 and 8, addition of acid is stopped and the mixture is allowed to stand for at least an hour to void excess CO<sub>2</sub> and to permit slower reactions of precipitated solids with residual acid.
5. After one hour, check pH. If the pH is between 6 and 8, the mixture is drainable. If the pH is less than 6, additional sodium bicarbonate is added to bring the pH up to between 6 and 8. The mixture is again allowed to stand for an hour before rechecking. This procedure is repeated until the pH remains at a pH between 6 and 8, after which it may be drained.