OFFICE OF ENVIRONMENTAL HEALTH AND SAFETY

The Office of Environmental Health and Safety (EHS) is a department of Business and Finance at The Ohio State University. Created to serve all the University's employees, the division monitors and helps solve health and safety problems that may occur on or about the job. If such problems are found to exist, then professional staff members in EHS will make evaluations and recommendations to correct any harmful or dangerous conditions.

EHS also conducts seminars and workshops concerned with employee health education and offers consultation services. In addition, the division monitors federal, state, and local regulations for safety standards both on the job and in the work environment.

CHEMICAL MANAGEMENT PROGRAM

Specific responsibilities of the program are as follows:

1. Assuring that University hazardous waste policy follows federal, state, and local regulations.

2. Maintaining permits for the University's generator sites.

3. Establishing guidelines for the safe handling of chemicals and chemical waste.

4. The Chemical Management Program is responsible for overseeing the collection and subsequent management of chemical waste until its final treatment or disposal. Specific duties of the program include:

    a. Determination of disposal or treatment methodology for chemical waste materials.

    b. Preparation, submission, and maintenance of records, reports, and manifests as

required by government regulations.

c. Scheduling pickups, transportation, and packing of chemical wastes.

d. Obtaining contracts for disposal and transportation of chemical wastes.

e. Operation of the Chemical Recycling Program.

f. Management of training and informational programs pertaining to hazardous waste.

OVERVIEW OF THE CHEMICAL MANAGEMENT PROGRAM

Chemical waste generated through the University is disposed of through a special labeling, packing, and handling program. Identification of those materials which are regulated as hazardous waste, and determination of the appropriate disposal methodology is based on the potential hazards and the chemical and physical characteristics of the compound. An overview of the disposal steps of this program are illustrated on the following page in Figure 1.

The program is designed to achieve three main goals:

1. Protection of employee health and safety,
2. Reduction of hazardous chemical waste in the Laboratory, and
3. Compliance with federal, state, and local regulations.

The following types of waste are not handled by the program.

1. Nonhazardous solid waste
   - garbage, rubbish (normal trash disposal
   - paper, cardboard, aluminum, glass

In addition to chemical waste, the other type of waste handled through the program is Biohazardous infectious waste. The following section will give information on the Infectious Waste Program.

INFECTIOUS WASTE GENERATION AND TREATMENT

The Ohio State University, as required by Ohio Administrative Code Section 3745-27, has registered with the Ohio Environmental Protection Agency as a large quantity generator of infectious waste. Faculty and staff, who are generators of infectious waste, must comply with these regulations.

If you are a generator of infectious waste, the following pages contain information dealing with these regulations. You, the generator, are responsible for assuring compliance with infectious regulations including:

1. identification and segregation,
2. proper packaging,
3. proper treatment,
4. personnel training,
5. spill and containment plans, and
6. contingency plans.

To assist you, a decision tree has been developed. Proceed to the decision tree and the referenced section to determine which regulations apply to you. It is your responsibility to notify EHS of your activities and to comply with OEPA regulations.

NOTE: THE DECISION TREE IS NOT INCLUDED IN THIS VERSION. PLEASE REFER TO A HARD COPY OF THE GUIDEBOOK FOR THE DECISION TREE.

Should you choose to treat infectious waste, you must register with EHS at 292-1284 and your laboratory/facility will be audited quarterly by EHS and a representative of OEPA. Assistance is available from EHS to help develop and implement procedures consistent with the regulations.

REFERENCE #2
PACKAGING AND DISPOSAL OF
UNTREATED INFECTIOUS WASTE

As a generator that does not treat infectious waste, you are required by Ohio Administrative Code Section 3745-27-30 to:

Material Required:

1. Red bags or Biohazard bags, Biohazard shipping boxes, and Sharps containers.
2. All material in item #1 except Sharps containers are available at no charge from EHS. Sharps containers are available through the Medical Stores. Call 292-1284 for delivery of the bags and boxes.

Packaging:

1. Separate infectious from noninfectious waste at the point of generation.
2. Place infectious waste other than Sharps in securely closed Red bags or plastic bags labeled with the international Biohazard symbol. Place bags in a biohazard box and tape shut. Label the biohazard box with your room number and building.
3. Place all sharp infectious waste and all unused discarded hypodermic needles, syringes, and scalpel blades in a Sharps container (i.e., any rigid plastic, sealable container labeled sharps and displaying the international biohazard symbol). Bag, box and label as in item #2.

Disposal:

1. Call EHS at 292-1284 for pick-up of packaged infectious waste.
2. Generators of infectious waste may discharge untreated liquid or semi-liquid infectious wastes consisting of blood, blood products, body fluids, and excreta into the sanitary sewer

system (OAC 3745-27-30-C).

Spills:

1. All generators must record in a log all spills or accidents involving infectious waste in quantities greater than one cubic foot.
2. All generators must develop and implement a spill containment and clean up procedure. The procedure must be readily available to persons likely to handle infectious waste.
3. References #6 and #7 are provided to meet these requirements. Modifications of procedures should be forwarded to EHS for review and comments.

REFERENCE #3
TREATMENT BY INCINERATION

As a generator treating infectious waste onsite, you must comply with OAC 3745-27-32. Contact EHS at 292-1284 for further assistance.

REFERENCE #4
TREATMENT BY STEAM STERILIZATION

As a generator treating infectious waste onsite, you must comply with OAC 3745-27-32.

Operational Requirements:

1. Autoclave must operate at a minimum temperature of 121°C or 250°F at a minimum of 15 pounds per square inch pressure.
2. Autoclaves shall operate at specified temperature and pressure for one-half hour or longer, depending upon the load size.
3. Autoclave shall operate with a maximum registering thermometer, except for fast exhaust loads.
4. The temperature of the load must be recorded every two minutes.
5. The following must be available at the site:
    i. A copy of the OSU Infectious Waste Permit must be posted at the site,
    ii. The manufacturer's specifications and maintenance records must be available,
    iii. Infectious waste containment and clean-up procedures,
    iv. Contingency plan in the event the autoclave is out of service,
    v. Quality control procedures,
    vi. Standard operating procedures, and
    vii. Emergency telephone numbers and responders.
6. Each package of waste in a load shall have heat sensitive tape or equivalent to indicate temperature conditions.

Standard Operating Procedures:

1. The SOP's shall address the following items: time, temperature, pressure, type of infectious waste, type of container, closure of container,

loading pattern, maximum load quantity, and liquid content.

Quality Controls:

1. All autoclaves shall be:
   a. calibrated quarterly,
   b. tested with Bacillus Stearothermophilus each week the autoclave is utilized for treatment of infectious waste, and
   c. maintain a log containing: date, time cycle started, time cycle completed, operator, type of waste, temperature of maximum registering thermometer, and post-treatment reading of temperature sensitive tape.

2. Maintain a permanent record of temperature graphs.

Spill Containment: (as cited in Reference #6)

Disposal:

1. Treated infectious waste (except sharps) can be placed in the general refuse. All treated materials must be double bagged with the outside bag being opaque. No visible red bags or Biohazard bags are permitted.

REFERENCE #5
CHEMICAL TREATMENT

As a generator chemically treating infectious waste, you must comply with OAC 3745-27-32. The Ohio Environmental Protection Agency has only approved chemical treatment of infectious waste categorized as cultures. Therefore, the Director OEPA must approve chemical treatment of any other category of infectious waste or an alternate approved treatment method used.

Approved Chemical Treatment Solutions are:

1. Chlorine compounds, specifically hypochlorite and chlorinated isocyanurates, at a strength of 15% (v/v) and
2. Chemicals registered with the U.S.E.P.A. as virucidal, bactericidal, fungicidal, parasiticidal, or sporicidal.

Procedures:

1. All culture must remain submerged in chemical sterilant for a minimum of 10 minutes or as described by the manufacturer.
2. All treatment solutions shall be mixed immediately prior to use and discarded after use.
3. Excess chemical shall be decanted prior to disposal of treated cultures.

Disposal:

1. Treated liquid cultures can be put into the sanitary sewer system.
2. Treated cultures consisting of solids should be double-bagged and can be placed into the general refuse.

Spill and Containment Procedures: (See Reference #6)

Quality Control:

1. Maintain logs with the following information: type of waste, volume, treatment chemical, concentration, and contact time.

REFERENCE #6
SPILL CONTAINMENT AND CLEAN-UP PROCEDURES

According to OAC 3745-27-32, all treatment facilities shall keep a spill containment and clean-up kit within the vicinity of any storage area, loading/unloading areas, decontamination areas, and treatment areas where infectious wastes are managed. The location of the kits shall provide for rapid and efficient cleanup of spills anywhere within these areas.

Spill Kit Materials:

1. Absorbent,
2. One gallon approved chemical disinfectant (bleach),
3. Red bags or bags labeled with the Biohazard symbol,
4. Impermeable and disposable overalls (preferably tyvek total body coveralls),
5. Gloves (heavy neoprene or latex),
6. Goggles (can be reusable), and
7. Rigid plastic container for sharps.

** Spill Kits can be purchased from EOHS for a nominal fee. ***

Clean-up Procedures:

1. A copy of the clean-up procedures is provided later in this section.
2. The generator can prepare more specific or detailed clean-up procedures.

Spill Log:

1. A copy of the spill log is also provided.
2. Spill logs must be maintained for five years.
3. All spills greater than one cubic foot must be reported to EHS immediately and to the Director of OEPA within 48 hours.

REFERENCE #7
CONTINGENCY PLAN

In accordance with OAC 3745-27-32 and 35, a contingency plan must be available at the treatment site.

In the event generators treating infectious waste cannot meet the storage requirements described below or are experiencing a malfunction in treatment processes the contingency plan shall be implemented.

Storage:

1. Store infectious waste in a manner that maintains the integrity of packing.
2. Maintain waste in a nonputrescent state, using refrigeration or freezing if necessary.
3. Lock outside storage to prevent unauthorized access.
4. Designate and label storage areas by posting Biohazard warning signs.
5. Store infectious waste in a manner that affords protection from animals.
6. No infectious waste may be stored more than 14 days.
7. No more than seven times the treatment facility's total maximum daily throughput capacity shall be stored for treatment.

CONTINGENCY PLAN

Emergency Coordinator: _____
Telephone: _____

Alternate Coordinator: Dr. Cecil Smith, EHS
Telephone: 292-1284

1. If you cannot comply with the storage requirements set forth, the following contingency plan shall be implemented:
   a. Notify your Emergency Coordinator.
   b. Call EHS and request red bags, biohazard boxes, and sharps containers as needed for packing infectious waste at your treatment location.
   c. Following packaging of infectious waste, EHS will arrange for offsite incineration.
2. Listing of emergency telephone numbers in addition to the Emergency Coordinator.
   i. Campus Police Dispatcher - 292-2525
   ii. EHS Chemical/Infectious Waste Management - 292-1284
   iii. EHS Main Office - 292-1284
   iv. OEPA Central District Office - 771-7505
   v. Emergency Number – 911
   vi. Columbus Health Department - 645-7676

CONTACTS: Dr. Cecil Smith, AVP
1314 Kinnear Road
Tel: 292-1284 292-2525

INFECTIOUS WASTE
SPILL CONTAINMENT AND CLEAN-UP PROCEDURE
THE OHIO STATE UNIVERSITY

In accordance with OAC 3745-27-30, the following containment and clean-up procedures are to be implemented in the event of an infectious waste spill.

Directions

1. Open the spill kit.

2. Put on the (1) Tyvek total body coveralls over normal work clothes, (2) the latex gloves and (3) the goggles.

3. If this is a liquid spill, contain by covering with absorbent pads.

4. Put up barrier tape at the spill site and limit access to authorized personnel.

5. Place contaminated absorbent and other contaminated solids into the red bags in the spill kit. Seal the bag with the enclosed ties and place in a second bag. Sharps (needles, blades, or broken glass) should be placed in the rigid container labeled sharps.

6. Cover contaminated surfaces with absorbent pads and soak with disinfectant (bleach) in the spill kit. Allow the bleach to stand on the contaminated surface for a minimum of ten (10) minutes.

7. Place the decontamination pads in a red bag. Use additional absorbent pads to soak up excess liquid, if necessary.

8. Remove the Tyvek coveralls and gloves and put them into the same red bag. Seal the bag with the enclosed ties and place into a second red bag. Seal the second bag. Put into a biohazard box.

9. Disinfect the goggles with the disposable alcohol pads in the spill kit. Put the goggles back into the spill kit.

NOTES

1. Complete the spill log and return address on the log sheet.

2. If you require assistance or have questions, contact the Office of Environmental Health and Safety at 292-1284 or the police dispatcher at 292-2525 after working hours.

INFECTIOUS WASTE SPILL REPORT

A spill report is required under OAC 3745-27-30(A)(10) for any spill that is greater than or equal to one cubic foot in volume. Complete this report and return to the address listed below.

Date and Time of Spill:

Date of Report:

Location of Spill:

Employee(s) Involved in Clean-up:

Waste Spilled:

Estimated Quantity:

Describe Clean-up Procedure:

Summary of Events Causing Spill (If Known):

Printed Name

Signature

Date

Mail Completed Report To:
Dr. Cecil Smith
Environmental Health and Safety
Room 210
1314 Kinnear Road, CAMPUS

DEFINITION OF HAZARDOUS WASTE
According to the Environmental Protection Agency (EPA), a chemical waste is considered to be hazardous if the waste exhibits any of the following characteristics.

Ignitability

A substance is considered to be ignitable if it exhibits any of the following properties:

1. It is a liquid, other than an aqueous solution containing less than 24% alcohol by volume and has a flash point less than 60°C (140°F), as determined by the Pensky-Martens Closed Cup Tester.

2. It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard.

3. It is a flammable compressed gas

4. It is an oxidizer such as chlorates, permanganates, inorganic peroxides, or nitrates that yield oxygen readily to stimulate the combustion of organic matter.

Corrosivity

A substance is considered to be corrosive if it exhibits any of the following properties:

1. It is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5, as determined by a pH meter using either an EPA or equivalent test method.

2. It is a liquid and corrodes steel (SAE 1020) at a rate greater than 6.35 mm/year at 55°C.

Reactivity

A substance is considered to be reactive if it exhibits any of the following properties:

1. It is normally unstable and readily undergoes violent change without detonating.

2. It reacts violently with water.

3. It forms potentially explosive mixtures with water.

4. When mixed with water, it generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment.

5. It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment.

6. It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

7. It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

8. It is a forbidden explosive as defined by 49 CFR 173.51, or a Class A explosive as defined by 49 CFR 173.53, or a Class B explosive as defined in 49 CFR 173.88.

Toxicity Characteristic Leaching Procedure (TCLP)

This characteristic identifies wastes from which certain toxic materials could be leached into groundwater supplies and is defined by a prescribed test procedure for water extraction of the waste. The extract is analyzed for concentrations of eight elements or ions; Arsenic, Barium, Cadmium, Chromium (VI), Lead, Mercury, Selenium, and Silver; and the thirty-one organic substances listed below.

Benzene
Carbon Tetrachloride
Chlordane
Chlorobenzene
Chloroform
o-Cresol
m-Cresol
p-Cresol
1,4-Dichlorobenzene
1,2-Dichloroethylene
1,1-Dichloroethylene
2,4-Dinitrotoluene
Endrin
Heptachlor
Hexachlorobenzene
Hexachloro-1,3-butadiene
Hexachloroethane
Lindane
Methoxychlor
Methyl ethyl ketone
Nitrobenzene
Pentachlorophenol
Pyridine
Tetrachloroethylene
Toxaphene
Trichloroethylene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
Vinyl chloride
2,4-D
2,4,5-TP Silvex

Identification of materials regulated as hazardous waste is complicated by discrepancies in definitional guidelines and terminology between the Environmental Protection Agency (EPA), the Department of Transportation (DOT) and state agencies. The process of classification of hazardous materials, therefore, must incorporate an understanding of the framework of EPA, DOT, and state regulations and definitions. If questions arise concerning whether a chemical is considered a hazardous waste, call the Chemical Management Program at 292-1284.

LABORATORY SAFETY GUIDELINES

Prior to Working with Chemicals:

1. Prior to an employee working with any chemical, the employee should read the Material Safety Data Sheet (MSDS) on the chemical. The MSDS lists the physical data of the chemical, fire and explosion data, any incompatibility the chemical may have with other chemicals, exposure limits, long and short term health effects, first aid information, personal protective equipment required when working with the chemical, and spill or leak response measures. Individual MSDS's can be requested by phone at no cost from EOHS. When ordering chemicals, and especially when ordering chemical preparations, request an MSDS from the manufacturer. Send a copy of the MSDS to the Office of Environmental Health and Safety, Room 210, 1314 Kinnear Road.

2. The employee should read the Chemical Management Guidebook before any work with chemicals is performed. This book will supply information concerning safety, chemical spill response, and disposal.

When Working with Chemicals:

1. Wear the proper personal protective equipment at all times. Consult your departmental safety officer, EHS, or the MSDS for the proper personal protective equipment.

2. Work in the fume hood whenever possible.

3. Label all flasks, beakers, and other containers. For short-term, temporary storage of a chemical in a beaker, use a wax pencil or tape label to mark the container. If collecting the chemical as waste, label the container with all the constituents that are placed in the container.

4. Use two hands when carrying a chemical bottle. If the bottle must be transported to another room, put it into the original cardboard box that it was shipped in or carry it in a specially manufactured plastic or rubber safety carrier.

5. Make sure that all gas cylinders are capped before moving them and that they are securely strapped into position before use. Cylinders can be ordered through Store 70 by using a 100-G form.

6. Do not use mercury thermometers in ovens. Purchase thermocouples or non-mercury thermometers for laboratory ovens. When a mercury thermometer breaks in an oven, the vaporizing mercury can reach dangerous levels because of the heat. Often the ovens cannot be cleaned after a mercury spill because the mercury condenses on the interior metal surfaces of the oven and revolatilizes whenever the oven is reheated. The cost of decontamination or disposal can be greater than the original cost of the oven.

7. Have a chemical spill kit nearby and know how to use it. You must also know the limitations of the kit. If there are any questions about a particular kit, contact the manufacturer or EHS.

8. Never throw chemicals in the trash. Call EHS if questions arise concerning the appropriate route of disposal for chemicals. You will be asked to properly containerize, label, and box the chemical and EHS will pick up the chemicals (at no cost to your lab or service area) after receiving a manifest from you. Note that in the event special research is required, collection of the waste may be delayed.

The following suggestions were adopted from Improving Safety in the Chemical Laboratory, edited by Jay Young (1987, John Wiley & Sons, Inc.). Ninety-five percent of all accidents in laboratories occur because the following rules were not followed:

Selection of Appropriate Protective Equipment

* Wear eye protection. Use goggles meeting ANSI standards, not just safety glasses.
* Wear or use face protection.
* Wear proper, chemical resistant gloves and boots if necessary.
* Wear proper protective clothing such as lab coats, coverall, etc. Do not wear loose sleeves, long ties, jewelry, open toe shoes, shorts, wristwatches with absorbent straps, contact lenses, etc.

* Safety shields must protect the sides and rear of an experiment as well as the individual in front of the experiment.
* Maintain emergency equipment and inspect it on a regular basis.

Communication

* Read all MSDS and labels.
* Properly label all chemical materials and wastes.
* Know what to do when the alarm bell sounds.
* Do not work alone in the laboratory or when the nearest person is too far away to hear a call for help.
* Know what to do when overexposure to a chemical or harmful agent occurs.
* Inform co-workers of hazardous work being conducted.
* Inform EOHS of any major chemical hazards in the laboratory.
* Perform and post results of safety audits.
* Label all hot surfaces.

Proper Ventilation

* Have fume hoods checked annually for proper performance and more often if problems are suspected. Excessive hood draft is just as bad as inadequate hood draft because turbulence will drive fumes into the lab space. Call EHS for information on fume hood inspections.
* Do not fill hoods with clutter and do not use them for long-term storage of chemicals. Segregate incompatible chemicals stored temporarily in hoods.
* Use perchloric acid only in special perchloric acid hoods.
* Test glove boxes for leaks.
* Test flexible ducts (elephant trunks) with smoke tubes.
* Call EHS to monitor lab air if problems are suspected.

Personal Hygiene

* Do not pipet by mouth.
* Do not use glassware in place of cups and plates for food.
* Do not apply cosmetics in the laboratory.
* Do not eat or drink beverages in the laboratory.
* Do not store food in laboratory refrigerators.
* Do not use the emergency eyewash as a drinking fountain.
* Wash hands thoroughly whenever you leave a laboratory.

Electrical Hazards

* Electrical wiring must comply with National Electric Code.
* Octopus arrays of plugged in wires are not allowed. Get permanent wiring installed.
* Removed equipment with frayed wiring from service until it is repaired.
* Do not allow wires to lie in puddles of water or other liquid chemicals.
* Keep electrical wires away from sources of heat, flame, or oxidizing agents that may be spilled.
* Do not use wire sockets or plugs that are corroded or become hot when used.
* When working close to water with electrical equipment, use ground fault circuit interruption protection for all circuits.
* When pouring flammable liquids, minimize electrical charge buildup with grounding straps and mats as required by NFPA 30, Flammable and Combustible Liquids Code. Bear in mind also that any transfer of flammable liquids from bulk storage must be carried out with proper grounding and bonding protection in place. If questions arise about requirements for the transfer and storage of flammable liquids, contact EHS.

Storage

* Do not keep ethers, such as diethyl ether, dioxane, or THF, and other peroxidizable materials past their expiration date because they form explosive and shock sensitive peroxides. Consult Appendix 1, Table A.4 for guidelines for determining the expiration date of peroxide-forming chemicals.
* Date and initial all new bottles of chemicals as they arrive in the lab. Dispose or recycle all chemicals no longer needed.
* Do not order more chemicals than needed for a project.
* Store flammable liquids in proper storage areas.
* Segregate incompatible chemicals and place in different storage locations. Do not store chemicals alphabetically.
* Flammable and combustible liquids that require refrigeration must be stored in a refrigerator approved for such use.
* Do not block aisle ways with equipment or chemicals.
* Do not store materials in front of safety showers, eyewashes, exit doors, fire extinguishers, and other safety equipment.
* Do not store chemical materials or wastes in hallways or public areas.

Emergency Procedures and Equipment

* Train employees on where to find fire extinguishers, eyewashes, safety showers, and telephones, and train these employees on how to use this equipment properly.
* Periodically test the above equipment. (Eyewashes should be tested weekly.)
* Stress to employees that the best immediate first aid for a chemical spill on skin or in the eyes is to flush for 15 minutes in running water.
* Develop emergency plans for what to do in case of fire, explosion, chemical spills, vandalism, accidents, storm damage, etc.
* Do not block or lock fire or exit doors.

Management Responsibilities

* Make sure all employees are trained prior to working with chemicals.
* Do not clutter areas where chemicals are stored and worked with.
* Use safety inspections and analysis of accidents as a constructive tool to prevent future accidents. Safety inspections may incorrectly be perceived to be vindictive.
* Perform a hazard analysis of new procedures and document and maintain records of these analyses. Develop hazardous chemical procurement, storage, use, and disposal plans based on these analyses.
* Guard against physical hazards as follows:
  - Use protective covers on moving belts and pulleys.
  - Never leave heat sources unattended.
  - Tape Dewar flasks.
  - Dispose of needles, pipets, and other sharp objects in sharps boxes.
  - Analyze and implement precautions for any hazards specific to your lab.

Personal Responsibility

* Never say Even though I know better, I'll do it - just this once!

While the tips above talk about labs, the same rules apply to shops, service areas, and any other facilities that may have chemicals in them.

It is the responsibility of faculty, principle investigators, and supervisors to establish and enforce safety guidelines, not just for laboratory personnel, but also for all people who may occasionally visit the laboratory or service area. If necessary protective equipment should be provided for visitors, plumbers, painters, sales people, janitors, and office staff. Furthermore, it is the responsibility of individual laboratory workers and staff employees to thereby follow the safety guidelines, which have been established for their laboratory, shop, or service area.

Hazardous Chemical Spill Cleanup Guidelines

The following guidelines are offered to help you decide if you should clean up a chemical spill.

Who Cleans Up the Spill?

You Clean Up the Spill

For chemical spills which do not involve injury, that do not represent a fire or life hazard, that are less than one gallon, and for which you have the proper training and proper personal protective equipment to do the cleanup, you clean up the spill. If there are any questions concerning a particular spill situation, contact EHS.

We Clean Up the Spill

For all other chemical spill situations, including those for which you have any questions or doubts about your ability to clean up the spill, call Environmental Health and Safety (EHS) at 292-1284. The situation will be evaluated and a proper response will follow. After hours, call 911. Report all injuries, fires, explosions, and potential life-threatening situations first to 911, then to EHS. If the chemical spill is too large for the University Spill Response Team to clean up, the Columbus Fire Department HazMat Team and/or private contractors will be called in to handle the cleanup procedures.

Planning For Chemical Spill Emergencies

1. Prepare a Telephone Emergency Sheet. The sheet should contain the following information and should be posted by each telephone.

    - Name and phone number of any on-site emergency personnel.
    - Emergency telephone number: 911
    - Environmental Health and Safety telephone number: 292-1284

- Location of the fire extinguishers.
- Location of the spill control equipment.
- Location of the fire alarm.

2. Train all employees in chemical spill procedures when they are first hired and periodically thereafter. Document training and have the employee and supervisor sign the documentation form to certify that the training was given. Keep the certification forms on file.

3. You can aid EHS by drawing a map of your lab or service area and clearly labeling where chemicals and waste chemicals are stored. Fire extinguishers, eyewashes, spill kits, exit routes, and any additional hazards should be clearly marked. Keep a copy of the map in the main office of your department and send a copy to EHS. If an emergency does occur, your main office or EHS could provide advance warning to emergency response personnel of hazards in the room. Update these maps whenever chemical management practices change in the room.

Hazardous Chemical Spill Cleanup Guidelines

Chemical spill or hazardous materials emergency situations should be handled as a fire emergency. Initial response in a fire situation can be summarized as RESCUE, CONFINE, REPORT, SECURE, and CLEANUP (FIGHT FIRE). These principles can also be applied to a hazardous materials spill situation.

RESCUE

Just as you are not to reenter a burning building, do not go back in to an area where a chemical spill has occurred. In many documented cases, rescuers not wearing proper protective equipment have been overcome by toxic or asphyxiating fumes trying to rescue other victims and died as a result. Do not make this mistake.

As you leave an area involved in a chemical spill,

assist people exiting the area.

* Evacuate personnel from the spill area.
* Direct personnel to the nearest fire exit. Do not use the elevators.
* Attend to victims.

First Aid

* Remove victim from spill area to fresh air (but do not endanger your own life by entering areas with toxic gases).
* Immediately remove contaminated clothing.
* Wash skin with water.
* Flush skin and/or eyes with water for at least 15 minutes.
  (You may not feel any immediate effect from a chemical spill, but it is important to wash quickly and thoroughly because many chemicals can cause severe tissue damage which is not apparent until hours later.)
* Get medical attention for victims.

Chemical spills over large body areas

* Remove contaminated clothing while under a shower.
* Flood affected body area with water for 15 minutes.
* Resume water wash if pain returns.
* Wash off chemicals with water; do not use neutralizing chemicals, creams, lotions, or salves.
* Make sure medical personnel understand exactly what chemical is involved.

CONFINE

* Close all doors.
* Isolate area.
* Establish exhaust ventilation if possible.
* Open windows if possible without exposing yourself to the fumes.

REPORT

Call 911:

* for spills that involve injury requiring medical treatment.
* for spills that involve fire or explosion hazards.
* for spills which are potentially life threatening.
* for all chemical spills after work hours (4:30 PM - 7:30 AM).

Call EHS at 292-1284:

* for chemical spill situations that do not require 911 assistance.
* for spills of one gallon or more of any chemical, or any quantity of a highly reactive or toxic material.
* for spills of an unknown chemical.
* for spills that you do not have proper training or proper personal protective equipment to do the cleanup.
* for spills for which you have any questions or doubts about your ability to clean up the spill.

When calling EHS the following information will be requested:

* Your name, telephone number, and location.
* Location of the incident.
* Time and type of incident.
* Name and quantity of the material involved.
* The extent of injuries, if any.
* The possible hazards to human health or the environment outside the facility.
* Other hazards that may be encountered in the area, such as large quantities of stored chemicals (particularly oxidizers, flammables, and air-born toxic or irritant materials), radioactive materials, biohazards, etc.

SECURE

Until emergency responders arrive on the scene, you, your staff, and your building emergency officers will have to block off entrances to the spill site and prevent people from entering the contaminated area.

* Lock doors leading to the chemical spill and post signs on the doors warning of the spill (if necessary).
* Post staff at commonly used entrances to the spill site, so they can warn people to use other routes.
* For any large outdoor chemical spill, keep people upwind and uphill from the site.

CLEANUP

Based on the chemical spill situations described in Who Cleans up the Spill section, decide who will do the cleanup. If you are going to do the cleanup, follow the procedures listed in the "What to do When You Clean Up a Spill" section.

What To Do When You Clean Up A Spill

If you have proper training, proper personal protective equipment, and the proper materials to absorb and clean up your chemical spill, and no one has been injured, the spill is contained, and the spill is not life threatening or a fire or explosion hazard, then follow the following procedures:

1. With the exception that you do not need to report the incident to 911 or EHS, perform all the procedures in the RESCUE, CONFINE, REPORT, and SECURE sections above.

2. When cleaning up the spill yourself, locate the spill kit.

3. Choose appropriate personal protective equipment.
    - Always wear protective gloves and goggles.
    - If there is a chance of body contact, wear an apron or coveralls.
    - If the spill is on the floor, wear protective boots or shoe covers.
    * If there are inhalation hazards, wear a respirator. If a respirator is used, the person wearing the respirator must meet all of the requirements set forth in 29 CFR 1910.134. (These include but are not limited to fit testing and medical exams.

4. Remove ignition sources.
    - Turn off hot plates, stirring motors, and flame sources.
    - Shut down all other equipment.
    - If unable to shut off sources of ignition, notify the emergency responders.

5. Confine or contain the spill.
    - Cover with an absorbent mixture.
    - Clean up minor spill with paper towels or a sponge if they will not react.
    - Sweep solid materials into a dustpan, and place in a sealed container.
    - If it is an acid/base spill, first add a neutralizing agent.

    Small amounts of inorganic acid/base:
    * Use a neutralizing agent and then absorbent material.

    Small amounts of other materials:
    * Absorb with non-reactive material (e.g. vermiculite, sand, towels, Floor-Dri).

    Large amounts of inorganic acid/base:
    * Neutralize and call for help.

    Large amounts of other materials:
    * Make a judgment call, dependent upon the amount, toxicity, and reactivity; you may handle it yourself or call for help.

6. Spills that require special handling:

    Acid chlorides:
    * Use Oil-Dri, Zorb-all, dry sand, etc.
    * Avoid water and sodium bicarbonate.

    Mercury:
    * Small spills (broken thermometer and smaller quantities of mercury), use an aspirator bulb or suction device. Then mop with mercury decontaminating powder solution (saturated HgX in water or other commercially available products).
    * For (1) larger spills than a broken thermometer, (2) any spill in an oven or

heated area, and (3) spills in small unventilated rooms, call EOHS and ask for mercury vapor monitoring.

Alkali metals:
* Smother in dry sand.
* Put in a hood.
* If possible, dispose of by slow addition of isopropanol.

White (Yellow) Phosphorus:
* Blanket with wet sand or wet absorbent.

7. Remove absorbent material with a broom and dustpan.
   * Place in a plastic bag or other appropriate container.
   * If the spilled chemical is a volatile solvent, transfer the plastic bag to a fume hood for storage until the material can be picked up.
   * If a material is a non-volatile, hazardous chemical, dispose of the material as a hazardous chemical waste.
   * If the spilled material is a non-volatile, non-hazardous chemical, contact EOHS to determine the appropriate disposal method.

8. Wet mop the spill area.

Comments

Questions arise as to what constitutes a large spill requiring EHS or other parties to cleanup or oversee the cleanup procedures and what are the limitations of commercially available spill cleanup kits.
A large chemical spill can be as small as a few milliliters if the material is a highly volatile, toxic, or reactive compound spilled in a confined space. Many times you will have to make a professional judgment as to the severity of the spill. When in doubt, you can always call EHS at 292-1284 for advice.

Chemical spill cleanup kits are a must in the laboratory and other service areas that use chemicals. The kits are very useful if you and your fellow

workers know how to use them properly. Chemical absorbents or neutralizers can be used quickly and effectively to contain a spill. Use these items if your personal safety is not in jeopardy. If in your judgment a respirator is necessary to clean up the spill, secure the room and call EHS to aid in the spill clean up.

Be aware of the fact that while you may be in a well ventilated room, the Lower Explosion Limit (LEL) of a chemical may be reached at the surface of the spill and you want to avoid any sparks or sources of ignition when doing the cleanup. The protective equipment in a spill kit will not protect you from a flash fire. Many times the best way to handle the spill of a highly volatile compound, such as diethyl ether or chloroform, is to open the windows and fume hoods, leave the room and close the doors, and let the room air out. In these cases, call EHS at 292-1284, so they can send someone to monitor the situation. If in your professional opinion, there is a strong risk of fire or explosion, call 911 and EOHS for fire department backup, pull the building alarm, and evacuate the building. In most cases of a chemical bottle breaking in a laboratory, you will not need to call the fire department.
Do not forget that any person who needs to wear a respirator must be fit tested, have a medical exam, and meet the requirements of 29 CFR 1910.134.

Waste Minimization

The Ohio State University is committed to the protection of human health and the environment. To meet these commitments, the University strongly encourages employees to utilize chemical waste minimization (waste reduction) techniques to reduce the volume and toxicity of chemical wastes produced at the University. An important benefit from waste minimization is that it will reduce the University's escalating chemical disposal costs which are currently estimated at $1.0 million annually and expected to rise with federal and state restrictions in the future.

The following are common waste minimization techniques:

1. Product Substitution
   Substitute non-hazardous or less toxic materials in your chemical processes and experiments. Some examples of this are:

   a. The substitution of citric acid based AmeriClear for xylene, benzene, and toluene containing reagents in histology laboratories.

   b. Substitution of non-hazardous proprietary liquid scintillation cocktails for standard xylene or toluene based cocktails in radioactive tracer studies.

   c. The use of water based inks instead of solvent based inks in printing operations.

   d. The use of peracetic acid rather than formaldehyde in cleaning hospital kidney dialysis machines (the peracetic acid reacts with the organic material in the dialysis waste stream to produce a non-hazardous waste)

   e. The use of non-halogenated solvents in parts washers or other solvent processes.

   f. Detergents and enzymatic cleaners can be

substituted for sulfuric acid/potassium dichromate (chromerge) cleaning solutions and ethanol/potassium hydroxide cleaning solutions.

2. Process Modification

To the extent that it does not affect vital research, teaching, or service laboratories and service areas (such as printing and graphics or heavy equipment shops) are requested to modify experimental or standard processes to decrease the quantity of hazardous chemicals used and generated. In labs, micro analysis techniques can greatly reduce the amount of waste generated. Examples of this are the use of micro rather than macro Kjeldahl apparatus in nitrogen determinations (Kjeldahl waste is considered hazardous waste due to the selenium and mercury compounds used as catalysts) and the use of micro chemical oxygen demand analyzers (which generate sulfuric acid - dichromate - silver waste). Maintenance shops can also utilize parts washer solvent recycling programs through vendors such as Safety-Kleen and Penzoil.

3. Segregation and Characterization

a. Do not mix wastes. Especially do not mix hazardous wastes with non-hazardous waste.
b. Accurately label the waste bottles as to their exact contents.

Segregation and characterization allows waste to be redistributed for reuse if someone else in the University system can use the chemicals; if the waste cannot be redistributed, it simplifies waste treatment and minimizes cost.

4. Chemical Redistribution

Unopened or unused portions of chemicals may be redistributed within the University free of charge. The manifest that you fill out to have waste picked up has a column labeled "RECY?". If this column is checked, the hazardous waste personnel will pull these chemicals out of the waste stream for redistribution to laboratories that can use them. If you wish to have your name added to the mailing list for free

chemicals from our redistribution program, please call EHS at 292-1284.

5. Neutralization and Deactivation

Some laboratories generate a simple, pure chemical stream, such as dilute acid or base that can be rendered non-hazardous by simple neutralization. Other labs may generate a dilute aqueous stream that contains a metal which can be easily precipitated. In these cases, labs are encouraged to call EHS to determine if they can process these materials to render them non-hazardous.

6. Management

Audit chemical supplies and use inventory control:

a. Survey all the chemicals in your labs, shops, and storerooms and submit for disposal all of those chemicals that have not been used within the past year or two.

b. Purchase only the quantity of chemical required for specific projects.

c. If you have chemicals stored in a "shared" storeroom, take responsibility to recycle or submit for disposal those chemicals left by personnel or students no longer with the University.

d. When purchasing automated equipment, use the type and amount of hazardous waste generated by the machine as one of the purchasing criteria.

7. Training

Train your employees when they are first hired and on a regular basis thereafter in waste minimization concepts. Training should include:

a. The concepts described above.

b. Annual documentation of the training signed by both the employee and supervisor.

Chemical Redistribution

Many materials treated as chemical waste are actually surplus chemicals which are reusable. To assist waste reduction, the Chemical Redistribution Program accepts both opened and unopened containers of unwanted chemicals and redistributes them to other University laboratories. Recycled chemicals are provided free of charge to any interested University department, research, or teaching laboratory.

An effective redistribution program is dependent on a constant influx of materials. When submitting chemicals for disposal, keep in mind that chemicals which are potentially recyclable should be indicated by checking the column marked "RECY?" so that they may be pulled out of the waste stream and examined for possible redistribution. Inform the Chemical Redistribution Program of any usable, unwanted chemicals which have accumulated in the laboratory and, in particular, the scheduling of laboratory clean-outs. A member of the Chemical Management Program will in turn come out to the area where the prospective recyclable materials are stored, and package any recyclable materials for pickup.

Note that certain chemicals are particularly desirable for redistribution and include the following:

Solvents

Acetone
Dichloromethane (Methylene chloride)
Ethyl acetate
Formaldehyde
Glycerol
Hexanes
Isopropanol
Methanol
Petroleum ether
Toluene
Xylene

Acids

Acetic acid (glacial)
Hydrochloric acid

Sulfuric acid

Poisons/ORM-E

Indicators
Iodine (solid or solution) Metals (powder, dust, shot)
Sodium, calcium, silver, and potassium salts

Oxidizers

Bromine
Potassium chlorate
Potassium dichromate
Silver nitrate

Unopened Chemicals

The Chemical Redistribution Program accepts both opened and unopened chemicals on an individual basis. The Chemical Redistribution Program will recycle almost all unopened chemicals.

The Chemical Redistribution Program will provide a monthly listing of currently available materials. Available chemicals are listed with the compound name, company name, grade description, and total amount in kilograms or liters as illustrated below.

Compound Name	Company Name	Grade	Amount	Unopen
Crotonyl chloride	ALD	TECH	0.1L	X
Cupric acetate	SGM	ACS	0.45K	
Cupric bromide	TPI	ANALY	0.45K	
Cyclohexane	JTB	ACS	0.47L	X
Decolorizing carbon	MAL	PRACT	5K	

A copy of the Chemical Redistribution Program Request Form is on the next page. The form will be included with each months mailing. Individuals interested in ordering recycled chemicals should complete the form as follows:

1. Fill out the following information: name, phone number, date, department name, building name, and room number.

2. Indicate the desired chemicals and the following corresponding information:

grade description (see Table 1 for a list of grade descriptions and their definitions)

company name (see Table 2 for a list of company names and their abbreviations)

amount requested
if unopened

Chemical Redistribution requests are filled on a first come first serve basis by mail only (no phone calls will be accepted). Mail or fax your request to the address below. To be included in the mailing list or to address any questions concerning redistribution procedures, contact the Chemical Redistribution Program at the following address:

Chemical Redistribution Program
EHS
Room 210
1314 Kinnear Road
Columbus, OH 43212 (614) 292-1284
Fax - (614) 292-6404

Collecting, Packaging, Manifesting

This section provides general guidelines for collecting, labeling, segregating, manifesting, and packaging chemical waste. The entirety of waste disposal procedures begins with the generator (shop or laboratory personnel) who decides first if the material is unneeded and whether it should be disposed of. Materials, which are no longer of use, should not be considered waste until all other alternatives, such as recycling or recovery, have been considered. Once it is declared waste, the first step in guiding it into the correct channel for disposal is to identify the material and the degree of hazard it poses. Chemical waste can be classified as one or more of several types of waste, including those listed below. Note that certain wastes require special procedures, or procedures in addition to the standard disposal operations provided in this section, and are subsequently addressed in their respective sections.

	Section	
Page Batteries	Section VIII	73
Chemical Mixtures	Section VIII	66
Commercial Products	Section VIII	68
Compressed gas cylinders	Section IX	75
Laboratory cleanouts	Section IX	86
Labware	Section VIII	70
Peroxide forming chemicals	Section IX	81
Pyrophoric chemicals	Section IX	80
Shock sensitive chemicals	Section IX	78
Spent Solvent waste	Section VIII	72
Unknown chemicals	Section IX	83
Water reactive chemicals	Section IX	77

Collecting the Waste

In the process of collecting chemical waste, laboratory personnel should contain the waste in a safe and reasonable manner for its storage and subsequent disposal. Collection bottles used for laboratory waste must be kept capped, properly labeled, and stored in a safe location in the laboratory. Oil and solvent drums should not be stored with an open bung or funnel in them. Storage locations, such as flammable liquid or acid storage cabinets, should be determined based on the characteristics of the waste contents. For chemicals

listed in the Chemical Registry, the DDC (Drum Designator Code) describes the primary hazard and the chemical/physical characteristics of the substance. (For a listing of the DDC's and their definitions, refer to Appendix 3.) If containers larger than one gallon in size are desirable for collecting waste, obtain prior approval from the Chemical Management Program. Note that any waste containing mercury compounds must be kept in separate collection bottles. Also note that wastes mixed from different sources (i.e., reactions or processes) are capable of reacting dangerously.

Submit chemical waste for pickup in appropriate containers as follows:

1. Screw Cap Bottles

Stoppered or corked flasks and bottles are unacceptable. The contents of these containers should be transferred to a screw cap bottle. Keep in mind that both the bottle and the screw cap must be chemically resistant to the waste chemical contained. Bottles with broken or cracked screw caps are also unacceptable. Note that there are exceptions to using screw cap bottles and some of these are listed below. If there are problems in transferring the waste to the suggested container for disposal, contact the Chemical Management Program (292-1284).

2. Exceptions to screw cap bottles: overpack containers

The following containers may be overpacked into a larger screw top bottle or a plastic bucket with snap-on lid and surrounded with an absorbent material such as vermiculite:

a. flasks with frozen stoppers containing an unknown substance or an item, which forms explosive peroxides,

b. bottles containing unwanted hydrofluoric acid,

c. glass sealed ampoules with low boiling point or extremely toxic chemicals, or

d. chemical containers, which are specially packaged.

3. Plastic bags

Wastes such as contaminated glassware, or powdered chemicals which are not in a proper bottle, should be packaged in plastic bags sealed to prevent spillage or contamination and then overpacked as described in step two.

Labeling the Bottles

Bottles of waste must be labeled as they are generated in the laboratory. Every bottle must be labeled in one of two ways:

1. Original label

Unused or outdated chemicals that are in their original containers with labels identifying the contents may be submitted for waste pickup as is; if the label appears faded or illegible, affix a new label to the bottle.

2. Hazardous waste label

Collection bottles used for mixed or spent waste must use the hazardous waste label supplied by the Chemical Management Program. To obtain these labels, call EHS at 292-1284.

The following procedures should be carried out to ensure proper labeling and safe handling of collection bottles:

a. Attach the label to the bottle as soon as the bottle is started as a collection container. Record the starting date on the label.

b. As ingredients are added to the bottle, maintain a separate ledger recording the ingredients and amounts added. All solvents, including water in solutions and sludges, must be recorded.

c. Bottles in the process of being filled must be capped and stored in a safe location; storage location should be determined based on the ingredients listed and the characteristics of the contents.

d. Collection bottles must be submitted for disposal within 45 days of the label start date, regardless of whether or not the bottle is filled.

e. When submitting the bottle for disposal the following information must be recorded on both the label and the Chemical Disposal Request:

    1. approximate percentages of the ingredients,

    2. pH of aqueous solutions or pH of a 10% aqueous solution for organic mixtures and/or

    3. presence of any sludge or precipitant in the waste.

Segregating the Chemical for Transportation

For compliance with Department of Transportation regulations and safety considerations of University employees, chemicals submitted for disposal or redistribution must be segregated and packaged by chemical class. The first two digits of the DDC listed in the Chemical Registry identify these classes.

Chemical wastes should be segregated and packaged for disposal according to the following procedures:

1. Materials must be packed in sturdy cardboard boxes, each box including materials within one hazard class only. The first two digits of the DDC designate the hazard class.

2. Concentrated sulfuric acid, perchloric acid, and nitric acid and water sensitive (WS), shock sensitive (SS), and cyanide (CN) compounds are exceptions and must be packaged in separate boxes.

3. Mixtures, new chemicals and commercial products not listed in the Chemical Registry, and unknown chemicals which have been tested for their chemical characteristics should be packaged separately or stored until instruction from the Chemical Management Program have been received.

Manifesting the Box of Chemical Wastes

The University manifest is a specialized packing slip designed to meet regulatory labeling requirements for transporting hazardous waste. Failure to properly complete the manifest may delay the collection of the waste. The manifest is composed of three parts: generator information, chemical information describing the contents of the box, and a signature assuming liability (see Example 1).

1. Generator Information

Fill out the following information: name, phone number, date, department number, building name, and room number.

2. Chemical Information

The chemical information supplied on the manifest must match the container label description for each item and should be completed in one of two ways, dependent on whether the chemical is listed in the Chemical Registry.

a. Chemicals listed in the Chemical Registry

The manifest should include the following information for chemicals listed in the Chemical Registry:

1. Drum Designator Code (DDC)
2. Compound name
3. If recyclable
4. Number of containers and the amount in each container in kilograms or liters. For each substance, itemize the number of containers and their respective amounts as in the following example:

# of containers/amount per container
2 X 4.00L
4 X 0.50K

5. Total amount - indicate the total amount in kilograms or liters

6. Drum number - this number is for the Chemical Management Program use only.

b. Chemicals not listed in the Chemical Registry

For unlisted chemicals, fill out the manifest and prepare for pickup as follows:

1. When submitting a large number of unlisted chemicals for pickup, send a list of the chemicals to the Chemical Management Program before packing.

2. Complete the chemical information on the manifest as above, leaving the DDC section blank.

3. If any of the following information is known, include this on the manifest:

   Product name
   Name and address of manufacturer
   Product or catalog order number
   Approximate age
   pH of aqueous solutions or pH of a 10% aqueous solution for organic mixtures

4. If a material safety data sheet is available, send it with the manifest top sheet to the Chemical Management Program.

5. Either package the items individually according to the procedures outlined below or call the Chemical Management Program (292-1284) for further information.

3. Generator Signature

It is the responsibility of each generator (shop or laboratory) to follow the guidelines given in this guidebook for evaluating, packaging, and labeling chemical wastes. By signing the manifest, the generator is stating that the procedures outlined in this book have been followed and the waste is ready for pickup.

Packaging the Chemicals for Transportation

After chemical waste bottles have been properly labeled, package the waste for transportation by carrying out the following procedures:

1. Completely enclose inner containers in sturdy cardboard boxes.
2. Tightly cap and stand all bottles upright.

3. Use appropriate cushioning or absorbent material to separate the inner containers; acceptable materials include vermiculite, cardboard dividers, or crumpled newspaper. Bottles should not be "gift wrapped" (individually wrapped in paper) and when the box is shaken, there should be no "clinking" sound from contact between glass bottles.

Caution: Perchloric acid, fuming nitric acid, and fuming sulfuric acid are strong oxidizers and are exceptions to the above procedures. They should be packaged separately in a plastic bucket with a lid and surrounded by kitty litter, floor dry, or sand. It is not necessary to box five gallon pails of waste chemicals, but attach the manifest directly to the pail.

In the case of highly volatile chemicals requiring refrigeration, do not package chemicals being submitted for waste collection. Complete the manifest

according to the normal procedures and note on the manifest (1) that the chemicals are refrigerated, and (2) the location of the refrigerator.

After manifesting the box and packaging the waste, submit the waste for disposal as follows:

1. Seal the box and attach the manifest to the top of the box. If there is the possibility of any confusion as to which is the topside, draw arrows on the sides of the box and mark it "this side up".

2. Annotate the manifest if special pickup arrangements are necessary.

3. Remove the top page of the manifest and send it to:

Campus mail

Chemical Management Program
EHS
Room 210
1314 Kinnear Road

Note: All manifests from the Department of Chemistry should be sent to the Department of Chemistry Safety Coordinator.

If more than one manifest is needed for a box, fill in page ___ of ___ in the lower left hand corner of the manifest. Staple these multiple manifest top sheets for one box together.

4. Do not keep boxes in the hallway while awaiting pickup.
Keep them in a safe area in the laboratory and try to segregate them by chemical characteristics (acids, caustic, flammable, etc.)

Once the Chemical Management Program receives the manifest, technical staff reviews it and members of the program pick up the waste. You will receive a call confirming a date for pickup (emergencies may cause a delay or rescheduling of the pickup date). Note that manifests sent by campus mail can take up to

three or four days before the Chemical Management Program receives them. If the program personnel have not contacted you or have not picked up your waste in three weeks, call the Chemical Management Program (292-1284).

Final Disposition of the Wastes

After the boxes of waste are picked up from your lab, they are sorted for disposal or recycling. Wastes consisting of liquid solvents or oils are poured into 55 gallon drums for chemical incineration in a chemical waste incinerator. The drums are then moved to the transfer facility on Kenny Road and are shipped off site by a licensed waste hauler within 10 days. The majority of the remaining waste is sorted and overpacked in their original containers into a "lab pack". A labpack is a steel, plastic, or fiber drum that contains intact bottles of waste surrounded by cushioning absorbent material. Absorbents or stabilizing materials selected for use in the lab packing depend on the characteristics of the waste and the disposal method required, and include materials such as vermiculite, shredded corn cobs, bentonite, floor dry (kitty litter), and cement. The specific type and size of the lab pack drum used is dependent on the waste characteristic and whether it is destined for incineration, treatment, or landfill. After lab packing has been completed, the information is sent to a licensed disposal site for final approval for shipment to the treatment or disposal facility.

General Waste Types and Guidelines

The variety of chemicals used at The Ohio State University prohibits the development of guidelines specific to each chemical. Therefore, an overview of guidelines for collecting, labeling, packaging, and manifesting chemical waste are presented and must be subsequently tailored to accommodate different types of hazardous chemical wastes. Certain common chemical wastes, including chemical mixtures, commercial products, labware, and batteries, which require individual procedures or procedures in addition to the guidelines outlined, are addressed in this section for easy reference. If questions arise concerning the appropriate disposal procedure, contact the Chemical Management Program (292-1284).

Chemical Mixtures

To submit chemical mixtures for disposal, carry out standard disposal procedures and note the following requirements:

Use the hazardous waste labels provided by the Chemical Management Program for mixtures consisting of aggregate or collected waste.

List the mixture ingredients and their approximate percentages on both the bottle label and manifest. (Include water as an ingredient of aqueous solutions.)

Enclose the mixture ingredients in brackets on the manifest

Write the pH of aqueous solutions, or the pH of a 10% solution for organic mixtures, on both the label and manifest.

Indicate the presence of any sludge, precipitant, or material, which is polymerizable on the bottle label and manifest.

A mixture consisting of ingredients, which have a DDC with the same first two digits, may be packaged with other items of that DDC number. Otherwise, contact the Chemical Management Program for further instructions or package the mixture alone.

If there are any questions concerning labeling and packaging of mixtures, contact the Chemical Management Program (292-1284).

Commercial (Trade Name) Products

Commercial products being submitted for disposal must be identified as to their chemical constituents and hazard category before they can be picked up. For this reason, the following steps should be carried out in addition to normal disposal procedures:

Include the following information on the manifest

a. Product name
b. Ingredient list from the bottle label
c. Description of the product's usage
d. Manufacturer/distributor name, address, city, and telephone number
e. Product catalog number or batch code
f. Approximate age
g. pH (if liquid)

If available, send a Material Safety Data Sheet (MSDS) with the manifest. If none of the above information is available, it may be necessary to treat the chemical as an unknown. To evaluate an unknown commercial product, follow the guidelines outlined in Appendix 2: Unknown Chemicals, and contact the Chemical Management Program if questions arise concerning preliminary analysis procedures.

Labware

Empty chemical containers may be packaged and disposed of or recycled as follows:

Empty chemical containers may be disposed of as follows:

a. Triple rinse the bottles with about 10% of the bottle volume of an appropriate solvent which is capable of removing the chemical, then triple rinse the bottle with water. (Note that this rinsate becomes hazardous waste.) If there is no further chemical residue in the bottle, it may be disposed of in the trash.
b. If chemical residue remains in the labware, contact EHS to determine the appropriate route of disposal; it may be necessary to dispose of the contaminated labware as hazardous waste. Alternatively, it is probably best that containers of this type be used to collect compatible waste. Keep in mind that these containers must be relabeled appropriately.

Spent Solvent waste

Spent solvents are a common chemical waste generated in the laboratory. The following procedures will aid in the disposal of spent solvents from laboratories.

Spent solvents should be safely stored in your work area in safety cans.

Solvents in safety cans are picked up the first working day of every week by the Chemical Management Program staff.

When your safety can is nearing the full mark, call the Chemical Management Program (292-1284) to arrange for a pickup. Calls received will be placed on the next week's pickup list.

The following information must be clearly marked on the tag attached to the safety can:

a. Building name and room number where the can is used.

b. Person that we can contact as the generator.

c. Compound name and quantity added each time. Chemical structures are not acceptable. Unmarked cans will not be picked up.

d. Initials of the person disposing of the solvent.

Laboratories generating chemical wastes have the responsibility for identifying compounds names and quantities. Inadequately labeled safety cans will not be accepted.

At no time should any mercury, mercury contaminated solvents, or any other heavy metals (lead, selenium, cadmium, chromium, arsenic, silver, and barium) be added to the safety can. Additionally, at no time shall unbuffered mineral acids or bases (pH < 5 or pH > 9), sulfides, or cyanides be added to these cans. These wastes shall be collected separately and submitted for disposal on a manifest form.

Safety can deficiencies will be indicated on a red tag attached to the safety can. Each lab is responsible for correcting any deficiencies. Leaking safety containers will not be returned and you will be responsible for buying a new one.

Batteries

Common household batteries have recently been recognized as a major source of mercury and other toxic metal pollution via air emissions from solid waste incinerators and leaching from solid waste landfills. As a result there has been a push to regulate batteries as hazardous waste to ensure proper disposal.

There are several types of batteries that will need to be source separated into categories for collection and disposal:

General Purpose: Alkaline and carbon-zinc batteries used in flashlights, beepers, radios, etc. These batteries are commonly available in AAA, AA, C, D, and 9-volt sizes and shapes.

Button Batteries: Silver oxide or mercury oxide batteries used in cameras, calculators, hearing aids, instrumentation, etc. Mercury oxide batteries may sometimes be in the general purpose formats. Lithium batteries are also button or cylindrical type batteries but due to their chemistry must be managed separately.

Specialty Batteries: Nickel-cadmium (Ni-Cad) and lithium batteries despite often having the geometries of the button or general purpose batteries must be managed separately due to their different disposal mechanisms. Ni-Cad batteries come in various sizes and shapes but are usually denoted as being rechargeable.

Lead-Acid Batteries: Lead-acid batteries are also considered hazardous waste unless managed for recycling. These are typically the familiar wet cell car battery but may also be a gel cell in various sizes and shapes.

Battery collection at the University will be coordinated by the Redistribution Program and the Chemical Management Program (292-1284). Call for information concerning collection of these items.

Appendix 1: Wastes Requiring Special Procedures

Compressed Gas Containers

Due to regulations prohibiting landfilling of gas cylinders, disposal of these items presents a special problem for the Chemical Management Program. Disposal companies which accept gas cylinders generally require certification that the cylinders are equipped with working valves and the contents of the cylinder are known. The Chemical Management Program has two possible options; a disposal company may 1) vent the cylinder into a chemical waste incinerator or into the flow of another chemical treatment process or 2) detonate the cylinder. Cylinder detonation is chosen as a last resort since it does not assure complete destruction of the contents nor control the release of the contents to the environment. In addition, detonation is extremely expensive, especially for cylinders whose contents are unknown. It in fact costs more than two thousand dollars to detonate one cylinder. Alternatively, it is much more preferable to return compressed gas cylinders to the manufacturer or distributor.

Compressed Gas Cylinders

Compressed gas cylinders that are lecture bottle size should be disposed of according to the following procedures:

1. Return the empty cylinder to the manufacturer or distributor through which it was purchased. Arrangements should be made at the time of purchase for return of the cylinders. If the manufacturer does not accept the cylinders for disposal, they should be purchased through another supplier.

2. In the event it is not possible to return the cylinders as specified above, submit the cylinders for waste pickup by the Chemical Management Program following normal disposal procedures.

Disposable butane and propane containers

Empty disposable butane and propane containers should be submitted in accordance with normal disposal procedures. These items will be punctured and landfilled.

Aerosol cans

Dispose of aerosol cans according to the Following procedures:

1. For unwanted aerosol cans, except those which originally contained pesticides, "P" or "U" list chemicals, or freons, spray the can near zero contents before disposing in the trash. Some aerosol cans, such as paint, can be emptied by spraying the remaining contents in a piece of cardboard and then disposing of both items in the trash.

2. Submit empty aerosol cans which originally contained pesticides, "P" or "U" list chemicals, or freons and any unwanted aerosol cans that are not empty for waste pickup by the Chemical Management Program. Note that in packaging, the aerosol cans should be stood upright in the box and capped to prevent the accidental release of contents. If the ingredients of the can are known, list them on the manifest.

Water Reactive Chemicals

Certain chemicals react with water to evolve heat and flammable or toxic gases and should be stored and handled so that they do not come in contact with liquid water or water vapor. Table A.1 lists some common laboratory materials that are water reactive. Water reactive compounds, "WS" (DDC), such as those listed below require special handling; contact the Chemical Management Program (292-1284) for disposal instructions.

Table A.1: Water Reactive Chemicals

Alkali metals
Alkali metal amides
Alkali metal hydrides
Anhydrous metal halides, such as AlCl3, TiCl4, ZrCl4, SnCl4 Calcium carbide
Grignard reagents
Halides of nonmetals, such as BCl3, BF3, PCl3, PCl5, SiCl4, S2Cl2 Inorganic acid halides, such as POCl3, SOCl2, SO2Cl2
Metal alkyls, such as lithium and aluminum alkyls
Organic acid halides and anhydrides of low molecular weight
Phosphorus pentoxide

Shock Sensitive Compounds

Table A.2 lists some common classes of laboratory chemicals, which have potential for producing a violent explosion when, subjected to shock or friction. Some chemicals identified as shock sensitive, "SS" (DDC), require water to be added to the chemical before transportation. For disposal instructions, contact the Chemical Management Program (292-1284).

Table A.2: Shock Sensitive Compounds

Acetylenic compounds, especially polyacetylenes, haloacetylenes, and heavy metal salts of acetylenes (copper, silver, and mercury salts are particularly sensitive)
Acyl nitrates
Alkyl nitrates, particularly polyol nitrates such as nitrocellulose and nitroglycerine
Alkyl and acyl nitrates
Alkyl perchlorates
Aminemetal oxosalts: metal compounds with coordinated ammonia, hydrazine, or similar nitrogenous donors and ionic perchlorate, nitrate, permanganate, or other oxidizing group
Azides, including metal, nonmetal, and organic azides
Chlorite salts of metals, such as AgClO2 and Hg(ClO2)2

Diazo compounds such as CH_2N_2
Diazonium salts, when dry
Fulminates such as mercury fulminate ($Hg(CNO)_2$)
Hydrogen peroxide becomes increasingly treacherous as the concentration rises above 30%, forming explosive mixtures with organic materials and decomposing violently in the presence of traces of transition metals
N-Halogen compounds such as difluoroamino compounds and halogen azides
N-Nitro compounds such as N-nitromethylamine, nitrourea, nitroguanidine, and nitric amide
Oxo salts of nitrogenous bases: perchlorates, dichromates, nitrates, iodates, chlorites, chlorates, and permanganates of ammonia, amines, hydroxylamine, guanidine, etc.
Perchlorate salts. Most metal, nonmetal, and amine perchlorates can be detonated and may undergo violent reaction in contact with combustible materials
Peroxides and hydroperoxides, organic
Peroxides (solids) that crystallize from or are left from evaporation of peroxidizable solvents
Picrates, especially salts of transition and heavy metals, such as Ni, Pb, Hg, Cu, and Zn
Polynitroalkyl compounds such as tetranitromethane and dinitroacetonitrile
Polynitroaromatic compounds such as polynitro hydrocarbons, phenols, and amines (dinitrotoluene, TNT, picric acid)

Pyrophoric Chemicals

Listed below are several classes of readily oxidized chemicals which can ignite spontaneously in air. Pyrophoric chemicals (DDC hazard class designations 08 and 09), such as the following, should be stored in tightly closed containers under an inert atmosphere and any handling of them should be carried out under an inert atmosphere or liquid as well. Due to their highly reactive characteristics, contact the Chemical Management Program (292-1284) for special instructions concerning their disposal.

Table A.3: Pyrophoric Chemicals

Grignard reagents, RMgX
Metal alkyls and aryls, such as RLi, RNa, R3Al, and R2Zn
Metal carbonyls, such as Ni(CO)4, Fe(CO)5, Co2(CO)8
Alkali metals such as Na, K
Metal powders, such as Al, Co, Fe, Mg, Mn, Pd, Pt, Ti, Sn, Zn, Zr
Metal hydrides, such as NaH, LiAlH4
Nonmetal hydrides, such as B2H6 and other boranes, PH3, AsH3 Nonmetal alkyls, such as R3B, R3P, R3As
Phosphorus (white)

Peroxide Forming Chemicals

Organic peroxides are a class of compounds with unusual stability problems and as such are one of the most hazardous classes of chemicals normally handled in the laboratory. Many common laboratory chemicals can form peroxides on exposure to air so that a single opening of the container to remove some of the contents can allow formation of peroxides to take place. Some compounds form peroxides that are violently explosive in concentrated solution or as solids and therefore should never be evaporated to dryness. Others are polymerizable unsaturated compounds and can initiate a runaway, explosive polymerization reaction. Due to the unstable nature of these compounds, it is necessary to contact the Chemical Management Program when discarding peroxide forming chemicals to determine the appropriate procedures.

Note that all peroxidizable compounds should be stored away from heat and light. They should be protected from physical damage and ignition sources. A warning label should be affixed to all peroxidizable compounds as illustrated below to indicate the date of receipt and the date the container was first opened.

PEROXIDIZABLE COMPOUND

Received Opened

Date _____ _____
Discard or test within 6 months
after opening

Table A.4 provides specific examples of common chemicals that present serious hazards due to peroxide formation. Time limits from the date of the first opening of the original container are given as guidelines for testing or discarding of these compounds.

Table A.4: Common Peroxide Forming Chemicals

List A: Severe Peroxide Hazard on Storage with Exposure to Air

Discard within 3 months

Diisopropyl ether (isopropyl ether)
Divinylacetylene (DVA)
Potassium amide
Potassium metal
Sodium amide (sodamide)
Vinylidene chloride (1,1-di-chloroethylene)

List B: Peroxide Hazard on Concentration

Do not distill or evaporate without first testing for the presence of peroxides.

Discard or test for peroxides after 6 months

Acetaldehyde diethyl acetal (acetal)
Cumene (isopropyl benzene)
Cyclohexene
Cyclopentene
Decalin (decahydronaphthalene)

Diacetylene (butadiene)
Dicyclopentadiene
Diethyl ether (ether)
Diethylene glycol dimethyl ether (diglyme)
Dioxane
Ethylene glycol dimethyl ether (glyme)
Ethylene glycol ether acetates
Ethylene glycol monoethers (cellosolves)
Furan
Methylacetylene
Methylcyclopentane
Methyl isobutyl ketone
Tetrahydrofuran (THF)
Tetralin (tetrahydro-naphthalene)
Vinyl ethers

List C: Hazard of Rapid Polymerization Initiated by Internally Formed Peroxides

Normal Liquids
Discard or test for peroxides after 6 months

Chloroprene (2-chloro-1,3-butadiene)
Styrene
Vinyl acetate
Vinylpyridine

Normal Gases
Discard after 12 months

Butadiene
Tetrafluoroethylene (TFE)
Vinylacetylene (MVA)
Vinyl chloride

Appendix 2: Unknown Chemicals

Before disposing of laboratory waste, its hazard class must be identified so that it can be disposed of safely and in accordance with regulatory standards. For this reason, do not allow containers of unknown chemicals to accumulate. Avoid generating materials of unknown composition by properly labeling bottles and boxes with the contents, its associated hazards, and the date the waste chemical was first added to the container. Inspect the condition of the containers and their labels weekly, documenting the inspections. If a label appears faded or illegible, affix a new label to the bottle.

In the event you are unsure of the exact contents of a chemical mixture or you have an unlabeled compound, you must conduct a preliminary analysis of the unknown compound by examining the item and completing the Unknown Analysis Checklist on the following page. Photocopy the form and complete it, recording your observations and any known history of the material as requested.

CAUTION: Wear appropriate personal protective equipment and work in a hood when opening containers of unknown chemicals. Bear in mind the hazards involved in handling potential pyrophoric and peroxide forming chemicals. Several classes of chemicals can form explosive peroxides on long exposure to air. Unless it is known that the compound does not contain an explosive sub stance, do not use heroic efforts to open the bottle to examine the contents; it may be necessary to dispose of the bottle as a potentially explosive chemical. If you have questions concerning potential explosives, contact EHS at (292-1284).

Retain one copy of the completed form and submit a second copy to the Chemical Management Program at the following address:

Chemical Management Program
EHS
Room 210
1314 Kinnear Road

Once the program receives the Unknown Analysis Checklist, technical staff will review it and follow-up analysis will be performed by EHS personnel before waste pickup. If chemical waste personnel have not contacted you nor had your waste evaluated within three weeks, contact the Chemical Management Program (292-1284).

NOTE: A COPY OF THE UNKNOWN ANALYSIS FORM IS NOT INCLUDED IN THIS VERSION OF THE GUIDEBOOK. PLEASE REFER TO THE HARD COPY OF THE GUIDEBOOK OR CONTACT EHS FOR AN UNKNOWN ANALYSIS FORM.

Appendix 3: Drum Designator Code

The Drum Designator Code (DDC) is an internal system developed for classifying chemicals. The DDC classifies hazardous substances through the use of a two-part designation code. The first two digits of the DDC relate to the Department of Transportation (DOT) code and designate the chemical's primary hazard. The second part of the DDC consists of two letters, which further describe the chemical/physical characteristics of the substance and define the type of disposal or treatment methodology required.

The complexity of chemical waste management, generated by increasing regulatory restrictions, has led to development of the DDC. Defined below are the various designations of this coding system.

Drum Designator Codes

Hazard Class Codes

01	Corrosive bases
02	Corrosive acids
03	ORM-A (Otherwise Regulated material-A)
05	ORM-E (Otherwise Regulated material-E)
06	Combustible materials
07	Flammable gases
08	Flammable liquids
09	Flammable solids
11	Non-flammable gas
12	Organic peroxides
14	Explosives
16	Oxidizers
18	Poisons

Disposal Type Codes

BS	Bulkable solvent
CG	Compressed gases
CL	Chlorinated organic liquid
CN	Cyanide
CS	Chlorinated organic solid
DX	Dioxin containing
EX	Explosive
FB	Fuel blending
HM	Heavy metal
HP	Pesticide
LI	Liquid inorganic
LO	Liquid organic
NA	Nitric acid
NH	Non-hazardous
PA	Poison A
PB	Poison B
PI	Poisonous inorganic
PO	Pourable oil
PX	PCB contaminated
RX	Radioactive material
SC	Sulfuric/chromerge
SI	Solid inorganic
SO	Solid organic
SS	Shock sensitive
TW	Trade waste incinerator
WS	Water sensitive

NOTE: THE DRUM DESIGNATOR CODES ARE CONTAINED IN THE HARD COPY OF THE CHEMICAL MANAGEMENT GUIDEBOOK.

Appendix 4: Laboratory Cleanouts

Responsibility for proper management and disposal of hazardous waste falls to the occupants and administrative units assigned to the generator area. Intradepartmental and interdepartmental space reassignment often results in major hazardous material cleanouts. In these cases, the guidelines outlined in this guidebook must be followed. In addition to the usual guidelines listed, the Chemical Management Program must be notified in writing at least 30 days in advance of the cleanout in order to make disposal arrangements. Failure to make timely notification (30 days) of the cleanout will result in surcharges to the administrative unit for the cleanout.

If you are assigned a new space that contains hazardous waste left by the previous occupants, notification to the Chemical Management Program must be made in writing within 30 days of the space reassignment or the new occupant will assume all responsibility associated with the items left in the laboratory. If notification is made in these cases, the administrative unit that controlled the space before reassignment will incur surcharges associated with the removal of the hazardous waste.

Appendix 5: Chemical Waste Registry

This registry is a compilation of chemicals processed by the Chemical Management Program. Chemical materials are listed in alphabetical order, with the following corresponding designations to assist safe handling and proper manifesting of chemical waste:

1. Chemical Abstracts Service (CAS) Number
   The CAS number is a systematic number assigned to the chemical compound. Include this number on the hazardous waste manifest.

2. Environmental Protection Agency (EPA) Number
   The EPA number is intended to designate the primary hazard of a chemical according to the following guidelines:

D001	Ignitable - flammable liquids and oxidants
D002	Corrosives
D003	Reactive - water and shock sensitive compounds
D004-D043	Toxic materials - heavy metal poisons and specific pesticides
Pxxx	Acutely hazardous wastes
Uxxx	Toxic hazardous wastes

3. Drum Designator Code (DDC)

   The DDC is an internal system developed for classifying hazardous substances through the use of a two-part designation code. See Appendix 3 for a listing of DDC codes and their definitions. Include this designation on the hazardous waste manifest.

4. United Nations/North America (UN/NA) I.D. Number

   Four digit number used internationally (UN) or in

the United States and Canada (NA) to identify a hazardous material.

5. Flash point (FP)/pH

Flash points are recorded in degrees Fahrenheit according to the closed cup method. The pH values listed refer to the pH of an aqueous solution of 1% weight of the compound.

6. Liters (L), Kilograms (K), or Gas (G)

Indicates the physical state of the compound at room temperature.

7. Reportable Quantity (RQ)

This is the minimum amount of a DOT or EPA regulated compound that if discharged into the environment, must be reported to the National Response Center.

8. Comments

This column is reserved for any additional information that may aid safe handling of the material and includes the following abbreviations:

BP	Boiling Point
CAR	Carcinogenic
CL	Chlorinated Liquid
COM	Combustible
COR	Corrosive
CS	Chlorinated Solid
CSA	Cancer Suspect Agent
DRUG	Drug
EXP	Explosive
F	Flash Point
IRR	Irritant
LAC	Lachrymator
MP	Melting Point
MUT	Mutagen
OX	Oxidizer
P	pH
PIH	Poison Inhalation Hazard
PLY	Polymerizes
PRX	Peroxide Former

PYR	Pyrophoric
SKC	Skin Corrosive
SOL	Solid at Room Temperature
SS	Shock Sensitive
STENCH	Stench
TER	Teratogen
TOX	Toxic

NOTE: THE CHEMICAL WASTE REGISTRY IS CONTAINED IN THE HARD COPY OF THE CHEMICAL MANAGEMENT GUIDEBOOK.