The Ohio State University

Chemical Management Guidebook

1st Edition, 1991

Last Revised, 2012

Office of Environmental Health & Safety

Division of Environmental Affairs

Chemical Management Program

TABLE OF CONTENTS

DIRECTORY

Important Phone Numbers

Fire & Ambulance	911
OSU Police Emergency	911 or 292-2525 cell
OSU Police Non-Emergency	292-2121
Office of Environmental Health & Safety	292-1284
Office of Environmental Health & Safety (emergency after 4:30pm)	911 (OSU Police)
Emergency Management & Fire Prevention	247-4276
University Security & Protective Services	292-7677
University Hospital Security	293-8500
Scientific Warehouse	292-4219
Reagent Laboratory	292-2557
Gas Cylinder Warehouse	292-2543
Chemistry Stores	292-3020

For recycling nonhazardous material, such as glass, paper, plastic, metal containers, pressurized aerosol containers, cardboard or pipet tips, contact Corey Hawkey at 292-1528 or email hawkey.13@osu.edu.

SECTION I – OVERVIEW

Office of Environmental Health & Safety

The Office of Environmental Health & Safety (EHS) is an office of Facilities Operations and Development at The Ohio State University. Created to serve all the university's employees, OEHS 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 conduct seminars and workshops concerned with employee health education and offers consultation services. In addition, EHS 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. Assure that university hazardous waste policy follows federal, state, and local regulations.
2. Maintain permits for the university's generator sites.
3. Establish guidelines for the safe handling of chemical and chemical waste.
4. The Chemical Waste 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

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.

The program is designed to achieve three main goals:

1. Protect employee health and safety.
2. Reduce hazardous chemical waste in the laboratory.
3. Compliance with federal, state and local regulations.

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

1. Nonhazardous solid waste, including: garbage, rubbish, paper, cardboard, aluminum and glass.
2. Low level radioactive waste, including:
    a. Radioactive solid lab trash.
    b. Radioactive aqueous based waste.
    c. Radioactive flammable solvent based waste.
    d. Liquid scintillation solutions.

For more information on low level radioactive waste, call radiation safety at 292-1284.

In addition to chemical waste, this document is meant to provide guidance for the safe handling of bio-hazardous or infectious waste. The following section will give information on the Infectious Waste Program.

SECTION II – INFECTIOUS WASTE

Infectious Waste Generation and Processing

The Ohio State University, as required by Ohio Administrative Code Section 3745-27, has registered with the Ohio Environmental Protection Agency (OEPA) 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 from humans or animals that are likely to contain infectious agents capable of transmitting disease, the following pages contain information dealing with these regulatory requirements. It should be noted that these wastes include sharps used in the treatment, transfer, or inoculation of human and animal infectious agents. As such, the generator is responsible for assuring compliance with infectious waste regulations including:

1. Identification
2. Segregation and Proper packaging
3. Storage / Disposal
4. Proper On-Site Treatment
5. Pre-Treatment
6. Personnel training
7. Spill and containment plans
8. Contingency plans
9. Spill reporting

In general, if you generate small quantities of infectious waste, you should consider packaging the material and contacting EHS for disposal. Should you choose to treat infectious waste (by means of incineration, chemical application, autoclave, ionizing or non-ionizing radiation) prior to packaging and disposal, you must notify EHS of your activities and comply with OEPA regulations. Before pretreatment, contact EHS at 292-1284 to register. Your laboratory/facility will be audited quarterly by EHS and a representative of the OEPA. Assistance is available from EHS to help develop and implement procedures consistent with the regulations.

Identification

In general, infectious wastes are materials from humans or animals that are likely to contain infectious agents that are capable of transmitting disease. It also includes sharps used in the treatment, transfer, or inoculation of human and animal agents. Other materials that may be considered infectious wastes would include:

- Cultures and stocks of infectious agents (human pathogens) and associated biological, without limitation, specimen cultures and stocks of infectious agents, wastes from production of biological and discarded live and attenuated vaccines.
- Laboratory wastes that were, or are likely to have been, in contact with infectious agents that may present a substantial threat to public health if improperly handled.
- Pathological wastes including, without limitation to, human and animal tissues, organs, and body parts, and body fluids and excreta that are contaminated with or are likely to be contaminated with infectious agents, removed or obtained during surgery or autopsy or for diagnostic evaluation.
- Waste materials from the rooms of humans, or the enclosures of animals that have been isolated because of diagnosed communicable diseases that are likely to transmit infectious agents. Such waste materials from the rooms of humans do not include any wastes of patients who have been placed on blood and body fluid precautions under the Universal Precaution System established by the Centers for Disease Control in the Public Health Service of the Department of Health and Human services, except to the extent specific wastes generated under the Universal Precaution System have been identified as infectious waste by other referenced rules.
- Human and animal blood specimens and blood products that are being disposed of, except that "blood product" does not include patient care waste such as bandages or disposable gowns that are lightly soiled to the extent that the generator of the wastes determines that they should be managed as infectious wastes. Bandages, gowns, or other waste materials generated in the diagnosis, treatment or immunization of humans or animals that, when held vertically, drip or exude blood or body fluids are said to be saturated and will be considered infectious waste.
- Contaminated carcasses, body parts, and bedding of animals that were intentionally exposed to infectious agents during research, production of biological, or testing of pharmaceuticals, and carcasses and bedding of animals otherwise infected that may present a substantial threat to public health if improperly handled.
- Sharp wastes used in the treatment of inoculation of human beings or animals or that have, or are likely to have, come in contact with infectious agents in medical, research, or industrial laboratories, including, without limitation, hypodermic needles and syringes, scalpel blades, and glass articles that have been broken. Such wastes are considered as "sharp infectious waste" or "sharps".
- Any other waste materials generated in the diagnosis, treatment, or immunization of humans or animals, in research pertaining thereto, or in the production or testing of biological that represent a substantial threat to public health when improperly managed.
- Any other waste materials the generator designates as infectious wastes.

It should be noted that nearly all of the categories of infectious waste depend upon the presence of infectious agents or the possibility of the presence of infectious agents. The

exceptions to this are **blood and blood products, cultures, and sharps,** which are independent of the presence of infectious agents.

Definitions

"Infectious agent" means a type of microorganism, helminth, or virus that causes, or significantly contributes to the cause of increased morbidity or mortality of human beings.

"Zoonotic agent" means a type of microorganism, helminth, or virus that causes disease in vertebrate animals and that is transmissible to human beings and causes or significantly contributes to the cause of increased morbidity or mortality of human beings.

Segregation and Packaging (untreated waste)

Infectious waste should be separated from non-infectious waste to reduce the quantity that ultimately will need to be disposed. Infectious waste other than "sharps" in securely closed biohazard or red plastic bags will need to be labeled with the international biohazard symbol. The bags should be placed in a biohazard box and the top taped shut. A label should be affixed to the biohazard box and identified as to the room and building.

All sharp infectious waste and all unused discarded hypodermic needles, syringes, and scalpel blades are to be discarded in a "sharps" container. Such a container can be any rigid or sealable container labeled as "sharps" and displaying the international symbol.

1. Assemble the infectious waste box provided by EHS and ensure that all markings are oriented correctly with the "Arrow" pointed upward.
2. Tape all seams with sturdy packaging tape. **Note:** Masking tape is not acceptable.
3. Line the infectious waste box with the red plastic infectious waste bag (provided by EHS) prior to the placement of infectious waste materials into the container.
4. Place only infectious materials or infectious contaminated materials in the infectious waste bags used to line infectious waste boxes.
5. Place liquid infectious waste in Department of Transportation (DOT) approved plastic containers or carboys prior to packaging for pickup. **Note:** Total liquid volume is not to exceed four (4) gallons.
6. Place liquid containing infectious waste containers in the bottom of the lined infectious waste boxes to facilitate pickup and storage. **Note:** Total liquid volume is not to exceed four (4) gallons.
7. Limit the total weight in the infectious waste box to 30 pounds.
8. Seal the bag prior to sealing the box.
9. Seal the box securely with packaging tape.
10. Include the building name, room number, and the name of the principle investigator or lab supervisor on the top of the box.

11. Arrange for pick-up of the packaged infectious waste or to request storage containers or packaging materials via the EHS website www.ehs.osu.edu, which is the preferred method.
12. Contact EHS for questions regarding infectious waste storage, packaging, or pick-up by calling 292-1284.

Storage

Infectious waste must be stored in a manner that maintains the integrity of the packing. The waste must be maintained in a non-putrescent state, using refrigeration or freezing if necessary. Outside storage areas must be locked to prevent unauthorized access. Storage areas must be designated, identified and labeled by posting biohazard warning signs. Infectious waste should be stored in a manner that affords protection from animals and unauthorized individuals. Infectious waste may not be stored more than 14 days. No more than seven times the treatment facility's total maximum daily throughput capacity shall be stored for treatment.

- Infectious waste boxes should be stored in designated infectious waste storage areas. Those storage areas that are not locked shall be visibly labeled with a sign stating "Warning: Infectious Waste" and/or displaying the international biohazard symbol at all points of access.
- Outside storage areas should be locked to prevent unauthorized access.

Disposal

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. 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. All other properly packaged infectious waste shall be picked up by EHS for incineration following a pickup request to EHS.

Proper On-Site Treatment

The Ohio Administrative Code (OAC) Section 3745-27-32 (Standards for the Operation of Infectious Waste Treatment Facilities) does allow a generator to treat infectious waste on-site by means of incineration, chemical application, and autoclaving (steam sterilization), as well as ionizing or non-ionizing radiation prior to disposal. Laboratories and other infectious waste generators must notify EHS, as well as register with the Ohio EPA if one of these on-site

treatment methods is utilized. The regulations require a generator maintain treatment records and be subject to quarterly auditing by EHS and the Ohio EPA. EHS is available to assist with the development and implementation of procedures that are consistent with the regulations. The following describes additional information regarding these treatment methods:

Incineration: As a generator treating infectious waste onsite, you must comply with OAC 3745-27-32. In the past, infectious waste (primarily animal carcasses and bedding) had been incinerated at Wiseman Hall, Biological Sciences or Goss Laboratory. These incinerators are no longer operational and are not permitted by the Ohio Environmental Protection Agency to burn infectious waste. **Note:** currently, all infectious waste is being incinerated commercially by a company that is licensed by the Ohio EPA and under contract with the university. Contact EHS at 292-1284 for further assistance.

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 degrees C or 250 degrees 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 following must be available at the site:
    a. A copy of the OSU Infectious Waste Permit must be posted at the site.
    b. The manufacturer's specifications and maintenance records must be available.
    c. Infectious waste containment and clean-up procedures.
    d. Contingency plan in the event the autoclave is out of service.
    e. Quality control procedures.
    f. Standard operating procedures.
    g. Emergency telephone numbers and responders.
5) 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: qualitative assurance tested monthly and tested with Bacillus stearothermophilus each week the autoclave is utilized for treatment of infectious waste. Also, a log must be maintained containing the 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:

See spill containment section.

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.

Chemical Application: As a generator chemically treating infectious waste, you must comply with OAC 3745-27-32.

The Ohio EPA has only approved chemical treatment of infectious waste categorized as "cultures". Therefore, chemical treatment of any other category of infectious waste must be approved by the Director of the Ohio EPA or an alternate approved treatment method used, which must comply with the following requirements:

Approved Chemical Treatment Solutions are:

1. Chlorine compounds, specifically hypochlorite at a strength of 15% (v/v). **Note:** the specific solutions stated in the rule are percent solutions of household bleach, not percent solutions of the active ingredient sodium hypochlorite. The hypochlorite concentration of household bleach ranges from 3 to 5.25%. To make one gallon of treatment solution with household bleach will require the mixing of 2.4 cups of bleach and 13.6 cups of water.
2. Chemicals registered with the U.S. EPA as virucidal, bactericidal, fungicidal, parasiticidal, or sporicidal.

Note: Due to the strict Ohio EPA regulations, there is no university department that currently uses steam sterilization of infectious waste.

Procedures:

1. All culture must remain submerged in a chemical sterilant for a minimum of 20 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 spill and containment section.

Quality Control:

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

Pre-Treatment

Infectious waste generators are allowed to "pre-treat" infectious waste by autoclaving or submerging cultures in sodium hypochlorite (bleach) solution prior to placing infectious waste in a biohazard (burn) box to be treated as infectious waste. "Pre-treated" waste is still considered infectious and must be packaged, stored, handled, transported, and treated in accordance with infectious waste regulations.

Since the university is not registered as a treatment facility, all infectious waste, including waste that has been pre-treated by autoclaving or bleaching must be properly processed. This would include the collection and packaging in biohazard boxes for off-site shipment to be incinerated by a registered incineration facility.

Personnel Training

Required training is determined by the type of agents used and tasks performed. This includes training required by regulatory agencies, institutional requirements, and in-house

laboratory requirements. Below is a partial list of online training programs offered by EHS. Contact EHS at 292-1284 for further information.

- **Autoclave Safety – New!**
- **Biological Safety Cabinets**
- **Biological Safety Training for BSL2**
- **Bloodborne Pathogens**
- **Bloodborne Pathogens Refresher Training**
- **Department of Athletics Bloodborne Pathogens Training**
- **Infectious Waste Disposal**
- **rDNA Training (Hosted by The Research Foundation)**

Spill and Containment Plans

The following pertains to infectious waste spills, containment and clean-up procedures. All infectious waste spills must be contained and cleaned up immediately.

I. A spill kit containing absorbent material, bleach, or another U.S.EPA registered tuberculocidal disinfectant, biohazard bags, gloves, eye protection, and a biohazard sharps container must be accessible in the laboratory.

II. To use bleach as a disinfectant, a 1:10 dilution (minimum 10% sodium hypochlorite solution) of household bleach should be prepared immediately prior to use, with a minimum of 30 minutes contact time with the waste. If another U.S.EPA registered tuberculocidal disinfectant is used, the manufacturer's recommendations for concentration and contact time should be followed.

Procedures:

Limit access to area to authorized personnel.

Open the spill kit

Put on appropriate PPE (i.e. gloves, eye protection, coveralls).

Contain liquid spills by covering with absorbent pads. Place contaminated absorbent pads and other contaminated solids into a biohazard bag. Seal the bag by tying in a knot and place into a second biohazard bag. Sharps (i.e. needles, blades or broken glassware) associated with the spill should be placed in a biohazard sharps container.

Clean the spill and cover contaminated surfaces with absorbent pads and soak with appropriate disinfectant (see II above). Allow the disinfectant to stand on the contaminated material for the minimum recommended contact time.

Place all materials used during the clean-up process in a biohazard bag. Seal the bag by tying in a knot and place into a second bag.

Place all biohazard bags into a biohazard burn box.

Disinfect all re-usable materials from the spill kit (i.e. goggles, dustpan, etc.) and put back into the kit. Replenish disposable items from the spill kit.

See the OSU Institutional Biosafety Manual for additional information on decontamination and spills. (http://ehs.osu.edu/manuals.aspx)

For assistance or questions, contact EHS at 292-1284 or the OSU Police dispatcher at 911 from a campus telephone, after work hours.

Contingency Plans

In accordance with OAC 3745-27-32 and 35, a contingency plan must be available at the pretreatment 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 non-putrescent 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: Mike St. Clair, 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) Follow packaging of infectious waste, EHS will arrange for offsite incineration.

2) Listing of emergency telephone numbers in addition to the emergency coordinator.
   a) Campus Police Dispatcher 292-2525
   b) EHS main office 292-1284
   c) Ohio EPA Central District Office (614) 771-7505
   d) Emergency number 911
   e) Columbus Health Department (614) 645-7676

For a separate copy of the contingency plan click here: Contingency Plan

Spill Reporting

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 Michael St.Clair, Office of Environmental Health & Safety, Room 210, 1314 Kinnear Rd., Columbus Campus.

Download Spill Report

Reference Material and Articles

Disinfectants and Expiration Date Information *(From the EHS Quarterly Newsletter-December 2011)*

Disinfectants are intended to destroy or irreversibly inactivate microorganisms (e.g. viruses, bacteria, and pathogenic fungi), but not necessarily spores and inanimate objects. Due to these beneficial properties, disinfectants are used for routine cleaning, treatment, as well as infectious waste spill containment and clean-up. It is important to note that disinfectants are known to have limited shelf life that reduces the potency of the active ingredients to destroy or limit the growth of microorganisms, especially infectious or pathogenic ones. Whereas some manufactured disinfectants may be stabilized to extend their usefulness, others are limited to a year or less once the protective seal or cap has been removed.

Bleach is the most popular disinfectant found in laboratories and is used quite often in the previously described ways. Clorox is one of those bleach brands that are generally found in research, clinical, and teaching laboratories. Clorox, like other manufacturers, usually will list an expiration date or some identification code that is unique to the day, year, and the manufacturing site. If there is no identification, the manufacturer should be contacted to learn how the shelf life

is to be determined or the product replaced. Once determined, the container should be dated and replaced prior to the expiration period.

The Clorox Company acknowledges that their bleach product has a one year shelf life beginning with the day of manufacture. The shelf life will rapidly decrease depending upon use, temperature, relative humidity, and sunlight. Clorox has provided their code system to assist in determining the shelf life of their product. An example of their code system (e.g. G18099) on a bleach bottle would be as follows: The first two characters (G1) identify the plant or location of the manufactured product. The third character (8) is the year the product was made or 2008. The fourth, fifth, and sixth characters stand for the day of the year the product was manufactured. For example, it would be the 99th day or April 8th.

Please contact EHS, if you have any questions regarding disinfectants and expiration date information.

SECTION III – DEFINITION OF HAZARDOUS WASTE

Definition of Hazardous Waste

According to the Environmental Protection Agency (EPA), a chemical waste is considered to be hazardous if any of the following characteristics are exhibited by the waste.

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 of 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 explosion 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 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, 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.

SECTION IV – LABORATORY SAFETY GUIDELINES

Laboratory Safety Guidelines

Prior to Working with Chemicals:

Prior to an employee working with any chemical, the employee should read the Material Safety Data Sheet (MSDS) of 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 obtained by logging onto the EHS website (www.ehs.osu.edu) and clicking on "ChemWatch MSDS Search". Request a MSDS from manufacturers when ordering chemicals and chemical preparations.

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:

- Wear the proper personal protective equipment. Consult your EHS research safety liaison or MSDS for specific information on personal protective equipment.
- Work with all hazardous chemicals in a properly functioning chemical fume hood.
- Label all flasks, beakers, and other containers. For short-term use, a wax pencil or tape label will work. If collecting the chemical as waste, label the container with all the constituents that are placed in the container.
- 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.
- Make sure that all gas cylinders are capped before moving them and that they are securely strapped into position before use.
- 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 re-volatilizes when the oven is reheated. The cost of decontamination or disposal can be greater than the original cost of the oven.
- 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 the kit, contact the manufacturer or EHS.

- 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. EHS will pick up the chemicals at no cost to your lab or service area after receiving an inventory listing. Note, 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 that meet ANSI standard Z87.
- Wear or use face protection.
- Wear compatible chemical resistant gloves, and boots if necessary.
- Wear appropriate body protection, such as lab coats, coveralls, aprons, 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. This includes flushing eyewashes.

Communication

- Read all material safety data sheets and labels.
- Properly label all chemical materials and wastes.
- Do not work alone in the laboratory.
- Know what to do when overexposure to a chemical or harmful agent occurs.
- Inform co-workers of hazardous work being conducted.
- Inform EHS of any major chemical hazards in the laboratory.
- Perform and post results of safety audits and inspections.
- Label all hot surfaces.

Proper Ventilation

- Have chemical fume hoods evaluated annually for proper performance or evaluated immediately if problems are suspected. Go to research safety on the EHS website (www.ehs.osu.edu) for further information.
- Do not fill chemical fume hoods with clutter and do not use them for long term storage of chemicals. Do not store incompatible chemicals together in the fume hood.
- Use perchloric acid only in special perchloric acid hoods (with wash-down systems).
- Test glove boxes for leaks.

- Test flexible ducts with smoke tubes.
- Contact the FOD service desk to schedule a chemical fume hood evaluation (2-6158).

Personal Hygiene

- Do not pipet by mouth.
- Do not apply cosmetics in the laboratory.
- Do not eat or drink beverages in the laboratory.
- Do not store food or drink in laboratory refrigerators or freezers.
- Wash hands thoroughly before leaving a laboratory.
- Ice from laboratory ice-machines is not for human consumption.

Electrical Hazards

- Electrical wiring must comply with National Electric Codes.
- Do not overload outlets or power strips.
- Extension cords are for temporary use only.
- Remove damaged equipment or frayed cords until repaired.
- Keep wires away from water or chemicals.
- Keep wires away from heat, flame or oxidizing agents that may have been spilled.
- Do not use outlets or plugs that are corroded or become hot when used.
- All outlets near water should have ground fault circuit interruption protection.
- When pouring flammable liquids, minimize electrical charge buildup with grounding straps and mats as required by NFPA 30 (Flammable and Combustible Liquids Code). <u>The transfer of flammable liquids from bulk storage must be carried out with proper grounding and bonding protection in place. If questions arise, contact EHS at 292-1284.</u>

Storage

- Do not keep ethers, such as diethyl ether, dioxane, or THF, and other peroxide forming materials past their expiration date. They can form explosive and shock sensitive peroxides. Consult Appendix 1 - table A.4 for guidelines determining the expiration date of peroxide forming chemicals.
- Date and initial all new bottles of chemicals as they arrive in the laboratory. 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 them 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 aisles 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 the fire extinguishers, eyewashes, safety showers, and telephones. Also, train employees on how to properly use this equipment.
- Periodically test the aforementioned equipment (eyewashes should be tested weekly).
- Stress the importance of flushing the skin and eyes for 15 minutes, should they spill or splash chemicals on themselves.
- Develop emergency plans for fires, explosions, chemicals spills, vandalism, accidents, storm damage etc.
- Do not block or lock fire doors or exits.

Management Responsibilities

- Make sure all employees are trained prior to working with chemicals.
- Do not clutter areas where chemicals are stored and used.
- Use safety inspections and analysis of accidents as a constructive tool to prevent future accidents.
- Perform a hazard analysis of new procedures; document and keep records of the hazard analysis. Develop hazardous chemical procurement, storage, use, and disposal plans based on these analyses.
- Guard against physical hazards as follows: use guarding to protect personnel from moving belts and pulleys, never leave heat sources unattended, tape Dewar flasks, dispose of needles, pipets and other sharp objects in sharps containers, analyze and implement precautions for any hazardous operations.

Personal Responsibility

The aforementioned tips also apply to chemical use in shops, service areas, and any other facilities that use chemicals.

It is the responsibility of faculty, principle investigators, and supervisors to establish and enforce safety guidelines for laboratory personnel, and all persons who may occasionally visit the laboratory or service area. If necessary, protective equipment should be provided for all visitors, including maintenance, janitorial and other service staff. Furthermore, it is the responsibility of individual laboratory workers and staff employees to follow the safety guidelines established for their laboratory, shop or service area.

SECTION V – CHEMICAL SPILL CLIANUP GUIDELINES

Hazardous Chemical Spill Cleanup Guidelines

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

Who Cleans Up The Spill?

You clean up the spill – if the spill does not involve injury, does not represent a fire or life hazard, is less than one gallon, and you have the proper training and personal protective equipment. If there are any questions concerning a particular spill, contact EHS.

EHS cleans up the spill – for all other chemical spill situations, including those where personnel have questions or doubts about their ability to clean up the spill. Call Environmental Health & Safety at 292-1284. After hours, call 911 from a university phone or 292-2525 from a cell phone. Report all injuries, fires, explosion, and potential life-threatening situations to 911 or 292-2525; then contact EHS. If the chemical spill is too large for EHS to handle, the Columbus Fire Department or a private contractor will be called by EHS.

Planning For Chemical Spill Emergencies

Emergency Telephone List

An emergency telephone call list should be posted by each laboratory telephone. It should include the following:

- Name and phone number of any on-site emergency personnel.
- Emergency telephone number 911 and 292-2525.
- The Office of Environmental Health & Safety telephone number 292-1284.
- The location of the fire extinguishers.
- The location of the spill control equipment.
- The location of the fire alarm.

Training

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. Keep the certification form on file.

Map

Draw a map of your lab or service area and clearly label 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 with your chemical hygiene plan. Update the map 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. 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 into 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 while trying to rescue other victims; many have died.

As you leave a chemical spill area, 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 the 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 which chemical is involved.

CONFINE

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

REPORT

Call 911 or 292-2525:

- For spills that involve injury requiring medical treatment.
- For spills that involve fire or explosion hazards.
- For spills that are potentially life threatening.
- For all chemical spills after work hours (4:30pm through 7:30am).

Call EHS at 292-1284:

- For chemical spill situations that do not require 911 assistance.
- For chemical spills of a gallon or more, or any quantity of highly reactive or toxic material.
- For spills of unknown chemicals.
- For spills where personnel are not properly trained or equipped.
- For spills where there are questions or doubts regarding the 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 spilled.
- 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 (oxidizers, flammables, and airborne 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 the "Who Cleans Up The Spill" section, decide who will do the cleanup.

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, you can then follow these procedures:

1) **Locate the chemical spill kit.**
2) **Select the appropriate personal protective equipment.**
   - ✓ Always were gloves compatible with the spilled chemical and chemical splash goggles.
   - ✓ For body protection, wear a lab coat. If more protection is indicated, consider wearing an apron or coveralls.
   - ✓ If foot protection is indicated, wear protective boots or shoe covers.
   - ✓ If respiratory hazards are minimal, an N-95 respirator or respirator with the appropriate cartridges may be worn if personnel have completed fit-testing with EHS. (If severe respiratory hazards exist, contact EHS for assistance).
3) **Remove ignition sources.**
   - ✓ Turn off hot plates, stirring motors, and flame sources.
   - ✓ Shut down all other equipment.
   - ✓ If personnel are unable to shut off sources of ignition, notify the emergency responders.
4) **Confine or contain the spill.**
   - ✓ Cover with an absorbent mixture.
   - ✓ Clean up minor spills with paper towels or a sponge if they will not react.
   - ✓ Sweep solid materials into a dust pan and place the material in a sealed container.
   - ✓ If it is an acid/base spill, first add a neutralizing agent.

- ✓ For small amounts of inorganic acids and bases, use a neutralizing agent such as “Spill X -A” for acids and “Spill X - B” for bases, and then use absorbent material.
- ✓ For small amounts of other materials, absorb with non-reactive material such as vermiculite, sand, towels, or “Floor-Dri”.
- ✓ For large amounts of inorganic acids or bases, call EHS for assistance (292-1284).
- ✓ For large amounts of other materials, make a judgment call, dependent upon the amount, toxicity, and reactivity. You may handle spills yourself or call EHS for assistance.

5) **Remove absorbent material with a broom and dust pan.**
   - ✓ Place material in a plastic bag or other appropriate container. If the spilled chemical is a volatile solvent, transfer the plastic bag to a chemical fume hood for storage until the material can be picked up. If the spilled chemical is a non-volatile, hazardous chemical, dispose of the material as a hazardous chemical waste. If the spilled chemical is a non-volatile, non-hazardous chemical, contact EHS to determine the appropriate disposal method.
6) **Wet mop the spill area.**
7) **Spills that require special handling.**
   - ✓ Acid Chlorides: use “Oil-Dri”, “Zorb-all”, dry sand, etc. Avoid water and sodium bicarbonate.
   - ✓ Mercury: for small spills (broken thermometer and smaller quantities) use an aspirator bulb or suction device. Then mob with a mercury decontaminating powder solution (saturated HgX in water or other commercially available products). For spills larger than a broken thermometer, spills in an oven or heated area, and spills in small unventilated rooms, contact EHS at 292-1284).
   - ✓ Alkali Metals: smother the material in dry sand and place it in a chemical fume hood, contact EHS at 292-1284 for disposal instructions.
   - ✓ White (Yellow) Phosphorus: blanket with wet sand or wet absorbent, place it in a chemical fume hood, contact EHS at 292-1284 for disposal instructions.

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 required in the laboratory and other service areas that use chemicals. The kits are very useful if personnel know how to use them. 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 cleanup.

Be aware that even in a well-ventilated room, the lower explosion limit (LEL) of a chemical may be reached at the surface of the spill. You will want to avoid any sparks or sources of ignition during the cleanup. The protective equipment in a spill kit will not protect you from a flash fire. At times, the best way to handle a spill of a highly volatile compound, such as diethyl ether or chloroform, is to open the windows, turn the chemical fume hoods on, leave the room, close the doors, and let the room air out. In these cases, call EHS at 292-1284 to monitor the situation. If in your professional opinion, there is a strong risk of fire or explosion, call 911 (292-2525 cell) and EHS 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.

SECTION VI – WASTE MINIMAZATION & CHEMICAL RECYCLING

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. An important benefit from waste minimization is that it will reduce the university's escalating chemical disposal costs which are currently estimated at $1 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. The 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 waste 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 Recycling

   Unopened or unused portions of chemicals may be redistributed within the university free of charge. If the list of your surplus chemicals qualifies for redistribution, please include a note to recycle. If there is a note to recycle, the hazardous waste personnel will pull these chemicals out of the waste stream for redistribution to laboratories that can use them.

5. Neutralization and Deactivation

   Some laboratories generate a simple, pure chemical stream, such as a 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 the 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 Recycling

Many materials treated as chemical waste are actually surplus chemicals which are reusable. To assist waste reduction, the Chemical Recycling 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 recycling program is dependent on a constant influx of materials. When submitting chemicals for disposal, keep in mind, chemicals which are potentially recyclable should be indicated or noted "Recycle" so that they may be pulled out of the waste stream and examined for possible redistribution. Inform the Chemical Recycling 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 Hazardous Waste 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 recycling 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, potassium salts.

Oxidizers: bromine, potassium chlorate, potassium dichromate, silver nitrate.

Unopened Chemicals: the Chemical Recycling Program accepts both opened and unopened chemicals on an individual basis. The Chemical Recycling Program will recycle almost all unopened chemicals.

The Chemical Recycling Program will provide a monthly listing of 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	Grade	Amount	Unopened
Crotonyl Chlordide	ALD	TECH	0.1 L	X
Cupric Acetate Monohydrate	SGM	ACS	0.45 K	
Cupric Bromide	TPI	ANALY	0.45 K	
Cyclohexane	JTB	ACS	0.47 L	X
Decolorizing Carbon	MAL	PRACT	5 K	

Individuals interested in ordering recycled chemicals should go to the EHS website (www.ehs.osu.edu) and click on the Chemical Redistribution tab for more information. For questions, contact EHS at 292-1284.

Table 1 – Grade Designation Abbreviations

Abbreviation	Description	Abbreviation	Description
---	No grade specified	INSQL	Instrument quality
XX.X%	Simple percentage	LABGR	Laboratory grade
XX% DC	XX% Dye content	N.F.	National formulary
.X N	.X Normal solution	NANO	Nanograde
99+ GL	99+% gold label	OR	Organic reagent
A-GRD	"A" Grade	PEST	Pesticide grade
ACS	Meets ACS Specifications	PRACT	Practical
ANALY	Analyzed (JTB)	PURE	Pure
ANALY	Analytical (Mal)	PURIF	Purified
BACT	Bacteriological grade	REAGT	Reagent grade
BRILL	Brilliant grade	REFRG	Refrigeration grade
CERT	Certified	RESTD	Reference standard
CHROM	Chromatographic grade	RGSTD	Reagent standard
CLIN	Clinical grade	SAACS	Scintanalyzed ACS
COMMR	Commercial grade	SCIGR	Science grade
C.P.	Chemically pure	SCINT	Scintillation grade
DESIC	Desicator grade	SEQUN	Sequenation grade
EM	Electron microscope grade	SPACS	Spectroanalyzed ACS
FCC	Food chemical codex quality	SPECT	Spectrophotometric
FINE	Fine	SPTGL	Spectrophotometric gold label
FOOD	Food grade	SPTAR	Spectroanalyzed analytical reagent
GLASS	Distilled in glass	SYNTH	Synthetic
GLDLB	Gold label	TECH	Technical grade
GR 1	Grade 1	TLC	TLC grade
GR 2	Grade 2	TP I	Type I
GR 3	Grade 3	TP III	Type III
HISTO	Histological grade	SIGMA	Sigma grade
HPLC	HPLC grade	USPGL	U.S.P. Gilt label
INSTR	Instrument grade	WS & IG	Washed and ignited

Table 2 – Company Designation Abbreviations

AIT	Alltech Associates, Inc.
ALD	Aldrich Chemical Company
ALL	Allied Chemical Company
ALN	Al-Don Chemical Company
ATL	Atlas Chemical Company
ANC	Anachemia Chemicals, LTD.
APC	American Potash & Chemical Corp.
B/A	Baker/Adams (Division of Allied Chemical)
B&J	Burdick & Jackson
BEK	Beckman
BRD	Bio-Rad
CCI	Columbus Chemical Industries
CLB	Calbiochem
CRN	Corning Glass Works
CSC	Central Scientific Company
CSL	Chemical Specialties Laboratory
DCC	Davison Chemical Company
DOW	Dow Chemical
EHS	E.H. Sargent & Company
EFI	Ernest F. Fullam Company
EM	EM Science
EMS	Electron Microscopy Science
EST	Eastman Kodak Company
FRY	Frey Scientific Company
FSH	Fisher Scientific
FLK	Fluka Chemical Company
GE	General Electric
GEL	Gelman Instrument Company
GFS	G. Fredrick Smith Chemical Company
HAR	Harleco Chemical Products
ICN	ICN Biomedicals
JTB	J.T. Baker
K&K	K&K Labs
KAR	Karlan Chemical Corporation
LRI	Ladd Research Industries, Inc.
MAL	Mallinckrodt
MAN	Mann Research Labs
MAS	Maserno Laboratories
MAR	Manufacturing & Research Chemists
MCB	Matheson, Coleman, & Bell
MMR	Magnus, Mabbe, & Reynard
MRK	Merck
NCC	National Carbon Company
NDG	National Diagnostics
P&B	Pfaltz & Bauer, Inc.
PHM	Pharmacia
PLY	Polysciences
PRS	Pierce
RBZ	Roboz Instrument Company
S/P	American Scientific Products
SCC	Stansi Scientific Company
SGM	Sigma Chemical Company
SPM	Spectrum Chemical Company
S/W	Sargent Welch
TPI	Ted Pella, Inc.

SECTION VII – COLLECTION, PACKAGING, & LISTING

Collecting, Packaging, Listing

This section provides general guidelines for collecting, labeling, segregating, listing, 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.

Topic	Section
Batteries	VIII
Chemical Mixtures	VIII
Commercial Products	VIII
Compressed Gas Cylinders	IX
Laboratory Cleanouts	IX
Lab Ware	VIII
Peroxide Forming Chemicals	IX
Pyrophoric Chemicals	IX
Shock Sensitive Chemicals	IX
Spent Solvent Waste	VIII
Unknown Chemicals	IX
Water Reactive Chemicals	IX

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 content. 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 pick up in appropriate containers as follow:

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. Both the bottle and the screw cap must be chemically resistant to the waste chemical. Bottles with broken or cracked screw caps are 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 suggested containers for disposal, contact the Chemical Management Program (292-1284).
2. Over-pack Container – Exceptions to Screw Cap Bottles: The following containers may be over-packed into a larger screw cap 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.
   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 over-packed as described in step 2.

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, order them online at www.ehs.osu.edu.

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 sludge, 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: approximate percentages of the ingredients, pH of aqueous solutions or pH of a 10% aqueous solution for organic mixtures and/or the presence of any sludge or precipitant in the waste.

Segregating the Chemical for Transportation

For compliance with Department of Transportation regulations and safety consideration of university employees, chemicals submitted for disposal or redistribution must be segregated and packaged by chemical class. Chemical waste should be segregated and packaged for disposal according to the following procedures:

1. Materials must be packaged in sturdy cardboard boxes, each box containing materials from one hazard class only.
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, 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.

Generator Information

The following information should be included with the chemicals: contact name, phone number, date, department number, building name, and room number.

Chemical List

The chemical list should be prepared as follows:

1. For a large number of chemicals, send a list to the Chemical Management Program before packing.
2. If any of the following information is known, include this on the chemical list: product name, address of the manufacturer, product or catalog order number, approximate age of the chemical, pH of aqueous solutions or pH of a 10% aqueous solution for organic mixtures.
3. If a material safety data sheet is available, send it with the list to the Chemical Management Program.

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

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 list, 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 individually wrapped in paper and when the box is shaken, there should be no "clinking" sound from contact of 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 list directly to the pail.

   In case of highly volatile chemicals requiring refrigeration, do not package chemicals being submitted for waste collection. Complete the list according to the normal procedures and note on the list (1) that the chemicals are refrigerated, and (2) the location of the refrigerator.

After listing the contents of the box and packaging the waste, submit the waste for disposal as follow:

1. Seal the box and attach the list to the top of the box. If there is the possibility of any confusion as to which is the top side, draw arrows on the sides of the box and mark it "this side up". If more than one list is needed for a box, fill in "page__ of __" in the lower left hand corner of the list. Staple these multiple list top sheets, for one box, together.
2. Go to www.ehs.osu.edu to submit for pickup. Add comments if special pickup arrangements are necessary.

3. 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, caustics, flammables, etc.).

Once the Chemical Management Program receives the list, it is reviewed by technical staff and the waste is picked up by members of the program. You will receive a call confirming a date for pickup (emergencies may cause a delay or rescheduling of the pickup date).

Final Disposition of the Wastes

After the boxes of waste are picked up from your lab, they are transported to our Kinnear Road site. Here the items in the boxes 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 over-packed in their original containers into a “lab pack”. A lab pack is a steel, plastic, or fiber drum that contains intact bottles of waste surrounded by cushioning absorbent materials. 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 cops, 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.

SECTION VIII – WASTE REQUIRING SPECIAL PROCEDURES

Introduction

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 listing 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, lab ware, 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 at 292-1284.

Chemical Mixtures

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

1. Use the hazardous waste labels provided by the Chemical Management Program for mixtures consisting of aggregate or collected waste.
2. List the mixture ingredients and their approximate percentages on both the bottle label and list. (Include water as an ingredient of aqueous solutions) Enclose the mixture ingredients in brackets on the list.
3. Write the pH of aqueous solutions, or the pH of a 10% solution for organic mixtures, on both the label and list.
4. Indicate the presence of any sludge, precipitant, or material which is polymerizable on the bottle label and list.

If there are any questions concerning labeling and packaging of mixtures, contact the Chemical Management Program at 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:

1. Include the following information on the list
    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).

2. If available, send a Material Safety Data Sheet (MSDS) with the list.
3. 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.

Lab Ware

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

1. Triple rinse the bottles (with about 10% of the bottle volume) using a solvent capable of removing the chemical, then triple rinse the bottle with water. Note: this rinsate becomes hazardous waste. If there is no further chemical residue in the bottle, it may be disposed of in the trash.
2. If chemical residue remains in the lab ware, contact EHS to determine the appropriate route of disposal. It may be necessary to dispose of the contaminated lab ware 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.

1. Spent solvents should be safely stored in your work area in safety cans.
2. Solvents in safety cans are picked up the first working day of every week by the Chemical Management Program staff.
3. When your safety can is nearing the full mark, submit your pickup request by going to www.ehs.osu.edu and clicking on “Hazardous Waste Requests”. Requests will be placed on the next week’s pickup list.
4. 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 safety cans will not be picked up.
    d) Initials of the person disposing of the solvent.

Laboratories generating chemical wastes have the responsibility for identifying compound's 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.

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 the laboratory 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 flashlight, 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 geometrics of 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 Recycling Program and the Chemical Management Program. Call for information concerning collection of these items (292-1284).

SECTION IX – APPENDICES

Appendix 1: Wastes Requiring Special Procedures

Compressed Gas Containers

Due to regulations prohibiting landfilling of gas cylinders, disposal of these items present 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 cylinders are known. The Chemical Management Program has two possible options: a disposal company may vent the cylinder into a chemical waste incinerator or into the flow of another chemical treatment process, or a disposal company may 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 which 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 they were purchased. **Arrangement 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. If it is not possible to return the cylinders as specified above, submit the cylinders for waste pickup by the Chemical Management Program by 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 on 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 disposal list.

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 which are water reactive. Water reactive compounds, "WS", 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 Hydrides	
Alkali Metal Amides	
Metal Alkyls	Lithium, Aluminum Alkyls Grignard Reagents, etc.
Halides of Nonmetals	BCl_3, BF_3, PCl_3, PCl_5, $SiCl_4$, S_2Cl_2
Inorganic Acid Halides	$POCl_3$, $SOCl_2$, SO_2Cl_2
Anhydrous Metal Halides	$AlCl_3$, $TiCl_4$, $ZrCl_4$, $SnCl_4$
Phosphorus Pentoxide	
Calcium Carbide	
Organic Acid Halide	
Anhydrides of low Molecular Weight	

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", 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	Poly-acetylenes, halo-acetylenes, heavy metal salts of acetylenes (copper, silver, mercury salts)
Acyl Nitrates	
Alkyl Nitrates	Polyol nitrates – nitrocellulose, nitroglycerine
Alkyl & Acyl Nitrates	
Alkyl Perchlorates	
Amminemetal Oxosalts	Metal compounds with coordinated ammonia, hydrazine, or similar nitrogenous donors and ionic perchlorate, nitrate, permanganate, or other oxidizing groups
Azides	Metal, nonmetal & organic azides
Chlorite Salts of Metals	$AgClO_2$, $Hg(ClO_2)_2$
Diazo Compounds	CH_2N_2
Diazonium Salts (when dry)	
Fulminates	Mercury fulminate ($Hg(CNO)_2$)
Hydrogen Peroxide	30% or greater
N-Halogen Compounds	Difluoroamino compounds and halogen azides
N-Nitro Compounds	N-nitromethylamine, nitrourea, nitroguanidine, nitric amide
Oxo Salts of Nitrogenous Bases	Perchlorates, dichromates, nitrates, iodates, chlorites, chlorates, permanganates of ammonia, amines, hydroxylamine, guanidine, etc.
Perchlorate Salts	Most metal, nonmetal, and amine perchlorates (when contact combustible materials)
Peroxides & Hydroperoxides	Organic
Peroxides (solid)	Crystalized from or left from evaporation of peroxidizable solvents
Picrates	Salts of transition & heavy metals i.e. Ni, Pb, Hg, Cu, & Zn
Polynitroalkyl Compounds	Tetranitromethane & dinitroacetonitrile
Polynitroaromatic compounds	Polynitro hydrocarbons, phenols, amines (dinitrotoluene, TNT, picric acid)

Pyrophoric Chemicals

Listed below are several classes of readily oxidized chemicals which can spontaneously ignite in air. Pyrophoric chemicals, 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. 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 & Aryls	RLi, RNa, R_3Al, R_2Zn
Metal Carbonyls	$Ni(CO)_4$, $Fe(CO)_5$, $Co_2(CO)_8$
Alkali Metals	Na, K
Metal Powders	Al, Co, Fe, Mg, Mn, Pd, Pt, Ti, Sn, Zn, Zr
Metal Hydrides	NaH, $LiAlH_4$
Nonmetal Hydrides	B_2H_6 & other boranes, PH_3, AsH_3
Nonmetal Alkyls	R_3B, R_3P, R_3As
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 commonly 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

Date Received _____

Date Opened _____

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)	Potassium Amide
Divinylacetylene (DVA)	Sodium Amide (sodamide)
Potassium Metal	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)	Ethylene Glycol Ether Acetates
Cumene (isopropyl benzene)	Ethylene Glycol Monoethers (cellosolves)
Cyclohexene	Furan
Decalin (decahydronaphthalene)	Methylacetylene
Diacetylene (butadiene)	Methylcyclopentane
Dicyclopentadiene	Methyl Isobutyl Ketone
Diethyl Ether (ether)	Tetrahydrofuran (THF)
Diethylene Glycol Dimethyl Ether (diglyme)	Tetralin (tetrahydronaphthalene)
Dioxane	Vinyl Ethers
Ethylene Glycol Dimethyl Ether (glyme)	

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)	Vinyl Acetate
Styrene	Vinyl Pyridine

(Normal Gases – discard after 12 months)

Butadiene	Vinylacetylene (MVA)
Tetrafluoroethylene (TFE)	Vinyl Chloride

Appendix 2: Unknown Chemicals

Before disposing of laboratory waste, its hazard class must be identified so that it can be disposed of safety 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 container 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 Form. Print the form and complete it, recording your observations, and any known history of the materials as requested.

CAUTION: Wear appropriate personal protective equipment and work in a chemical fume 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 substance, 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 FAX a second copy to the Chemical Management Program, 292-6404.

Once the program receives the unknown analysis checklist, it will be reviewed by technical staff and follow-up analysis will be performed by EHS personnel before waste pickup. If you have not been contacted by chemical waste personnel or had your waste evaluated within three weeks, contact the Chemical Management Program at, 292-1284.

Appendix 3: 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.

GLOSSARY OF TERMS

Department of Transportation (DOT) - The federal agency responsible for policies and procedures governing the transport of materials, including hazardous chemical wastes.

Environmental Protection Agency (EPA) - The federal agency responsible for enforcement of policies and procedures governing the generation, handling, and disposal of hazardous waste.

Flash Point (FP) - The minimum temperature at which a material gives off vapor within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the material.

Generator - A person or group which produces hazardous chemical waste.

Lethal Concentration$_{50}$ (LC_{50}) - A concentration, in air, that is lethal to 50% of a group of test animals.

Median Lethal Dose$_{50}$ (LD_{50}) - A dose ingested, injected, or applied to the skin that is lethal to 50% of a group of test animals.

Occupational Safety & Health Administration (OSHA) - The Federal or State agency responsible for the enforcement of safety and health regulations for industry and business.

Over Pack - An enclosure used to provide protection or convenience in handling of a package or to consolidate two or more packages.

Threshold Limit Value (TLV) - An exposure level under which most people can work consistently for 8 hours a day with no harmful effects.