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1.0 PURPOSE OF THIS MANUAL

This manual has been designed to assist the students, staff and faculty of Indiana University Bloomington (IUB) in the safe and economical management of hazardous waste. The University Office of Environmental, Health, and Safety Management (UOEHSM) coordinates all facets of hazardous waste management in accordance with state and federal regulations, including the identification of hazardous wastes, hazardous waste storage and disposal, and hazardous waste minimization.

The university community plays a vital role in the management of hazardous wastes on the Bloomington campus. Proper waste management is dependent upon your day-to-day handling of these wastes in your lab or worksite. Please read the *Guide* carefully and feel free to call UOEHSM at 855-6311 if you have any questions.

This manual does not address radioactive waste disposal. For further information on this issue, please see the *Radiation Safety Manual,* also available from UOEHSM. For information on biologically contaminated wastes, see Appendix A of this guide.

2.0 INTRODUCTION TO THE UNIVERSITY OFFICE OF ENVIRONMENTAL, HEALTH, AND SAFETY MANAGEMENT

The role of the University Office of Environmental, Health, and Safety Management (UOEHSM) is to advise and consult in matters relating to the health, safety and the environment of Indiana University. UOEHSM maintains reference materials from local, state and federal agencies, particularly in regard to rules and regulations affecting campus operations, and will assist in technical interpretation of these materials.

UOEHSM staff function as advisors and consultants to deans, directors, heads of academic units, other staff members and students in all areas of environmental health, safety and radiological health. In addition, UOEHSM will conduct health and risk assessments or investigations when necessary or requested, will assist departmental safety committees in the development of departmental safety programs, and participate in health and safety training and education programs.

The UOEHSM Customer Service Team is responsible for a wide range of operations for IUB, including the following:

- hazardous waste management;
- spill response;
- community right-to-know program (SARA);
- water quality management;
- air quality management;
- underground storage tanks; and,
- safety issues.

2.1 Hazardous Waste Management

IUB generates a wide variety of hazardous wastes. An institution as large as IUB has a diverse set of operations ranging from academics to the maintenance of buildings. Nearly all facets of the university community generate some form of hazardous waste.

The following is a sample of the types of hazardous wastes generated at IUB.

- toxic, reactive, explosive and ignitable laboratory wastes;
- waste solvents from vehicle maintenance, printing and painting operations;
- corrosive wastes from cleaning operations;
- waste photographic fixer from darkrooms;
- other miscellaneous wastes from across campus.

2.2 Hazardous Waste Contacts

Dan Derheimer, Environmental Health & Safety Manager	5-3234 dderheim@indiana.edu
Rex Howard, Environmental Health & Safety Specialist	5-7907 rehoward@indiana.edu
Susan Howard, Environmental Health & Safety Specialist	6-2351 suhoward@indiana.edu
Dan Benn, Environmental Health & Safety Specialist	5-0857 dcbenn@indiana.edu
Chris Kohler, Laboratory Safety Specialist	5-5454 cekohler@indiana.edu

To request a waste pickup:

Visit our web page at www.ehs.indiana.edu and select the "Waste Disposal Request Form" under the Chemical Waste Management program area. If you have problems with the form, you can request assistance from one of the contacts above or call the main EHS line at 5-6311.

3.0 YOUR RESPONSIBILITIES

The success of the hazardous waste management program depends on the conscientious efforts of you and your coworkers. When hazardous materials are mismanaged, they have the potential to pollute the environment and threaten human health. Because you are handling hazardous waste on a day-to-day basis, it is essential that you follow this document's guidelines. You are expected to:

- package, label and store hazardous waste and unwanted chemical products according to the procedures listed in Sections 4.0 - 8.0 until UOEHSM can take possession of them for subsequent storage and off-campus disposal;
- identify and label all chemical wastes properly so unknowns are not generated;
- whenever you are in doubt, seek the advice of UOEHSM for procedures on how to handle and dispose of any chemical product; and,
- make every effort to reduce the amount of hazardous waste you generate.

4.0 MANAGING WASTE AND UNWANTED CHEMICALS

4.1 Our Management System

The success of our hazardous waste management program depends on your cooperation. You should use this management guide to identify hazardous wastes and determine their appropriate route of disposal.

There are three routes of disposal for waste chemicals:

- Management by UOEHSM – You may deliver chemicals to a UOEHSM Open House or request a pickup depending upon your location. An “Open House" allows you to bring your waste to us in Chemistry A027 during predetermined hours. See the current *Waste Collection Schedule* online for your location’s pickup or Open House times.

- Disposal of non-hazardous materials into the normal trash or sanitary sewer; and

- Chemical treatment, such as neutralization, followed by disposal into the sanitary sewer system. *Note: Any treatment method other than neutralization must be incorporated into an experimental procedure to be considered legal.*

When your surplus chemicals are given to UOEHSM, we first determine whether the chemical is indeed a waste, or whether it can be reused or recycled. If it is a waste, we determine the degree of hazard and the appropriate disposal route. Throughout this process, the university is required to keep records that account for hazardous wastes "from cradle to grave."

Most of your waste will likely need to be handled by UOEHSM. Waste that can go to the sanitary sewer or be placed in the normal trash is limited due to safety, environmental and legal considerations. If in doubt, it is prudent to have UOEHSM characterize your waste and determine how it should be managed.

4.2 Hazardous Waste Minimization

The Resource Conservation and Recovery Act (RCRA) outlines proper hazardous waste management, placing special emphasis on waste reduction and recycling. Through waste minimization, you can help reduce unnecessary expenditure of university funds (and ultimately your department's funds) on waste disposal and material procurement by following the guidelines below.

- **Inventory your chemicals:** The most important step you can take toward waste minimization is to maintain a running inventory of chemicals present in your lab. An inventory will prevent you from ordering more of what you already have. It also helps you to store chemicals properly and can be an invaluable tool in emergency situations.

- **Order only what you need:** Don't buy a kilogram of material when you plan to use only a few grams. *The economy of larger sizes may be offset by the cost of disposing of your excess*. Before ordering chemicals, check your current stock; and it may be possible to borrow small amounts of chemicals from other labs. Please take the time to check.

- **Use recycled chemicals whenever possible:** We have an ongoing secondhand chemical program for usable but unwanted chemicals. All secondhand chemicals are in their original containers and many still have their factory seals. Before you call UOEHSM for disposal of your unwanted but usable chemicals, please check to see whether other labs in your building can use the material. You may contact UOEHSM for our secondhand chemical inventory before ordering, as well.

- **Substitute non-hazardous or less hazardous materials:** There are many non-hazardous substitutes for commonly used chemicals, such as chromic acid (see Appendix C of this guide). Other alternatives may be much less toxic. These substitutions can be done with satisfactory results in most cases.

- **Do not mix hazardous and non-hazardous waste:** Non-hazardous waste, when mixed with hazardous waste, will become hazardous itself. Do not mix small quantities of hazardous waste with non-hazardous waste because it will increase the volume of hazardous waste produced. Likewise, high concentration waste should not be mixed with low concentration waste.

5.0 WHAT IS HAZARDOUS WASTE?

This section will help you determine which of your chemical wastes are hazardous. For practical purposes, consider all waste hazardous unless it is listed in Appendix D. The United States Environmental Protection Agency (EPA) and the Indiana Department of Environmental Management (IDEM) consider a waste to be hazardous if it:

- is a listed hazardous waste, or
- exhibits certain hazardous characteristics (see Section 5.1 below).

In addition, UOEHSM considers numerous other toxic substances to be hazardous. This waste is considered "toxic" if:

- it has an oral LD_{50} for a rat of less than 500 mg/kg;
- the container that the chemical came in identifies it as a toxic or poisonous material; or,
- the chemical is a known or suspected carcinogen, mutagen or teratogen.

A chemical waste exhibiting any of these five criteria is hazardous and must be managed accordingly. (When in doubt, have UOEHSM determine if your waste is hazardous by bringing it to an Open House or by contacting us.) This section provides a detailed discussion of the definition of hazardous waste; Sections 6.0 and 7.0 detail the proper management procedures for chemical wastes.

5.1 Hazardous Waste Characteristics

EPA and IDEM regulate waste materials that meet one or more of the following physical characteristics as hazardous waste.

5.1.1 Ignitability

Ignitable wastes are capable of causing or intensifying a fire during routine handling. A waste is characteristic for ignitability if it has any one of the following properties:

- a liquid with a flash point less than 140^{o} F (60^{o} C);
- a solid, capable under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical changes, and when ignited, burns vigorously and persistently;
- an ignitable compressed gas; or,
- an oxidizer.

Examples include, but are not limited to, most organic solvents such as:

Acetone	Ethyl ether	Pentane
Benzene	Heptane	Petroleum Ether
Ethanol	Hexane	Toluene
Ethyl acetate	Methanol	Xylene

5.1.2 Corrosivity

Corrosive wastes include highly acidic or highly alkaline chemicals and those that are capable of corroding metal. A waste has the characteristic of corrosivity if it has one of the following properties:

- an aqueous waste with pH 2 or less, OR pH 12.5 or greater; or,
- a liquid that corrodes steel at a rate greater than 6.35mm (0.25 inches) per year.

If a waste exhibits ONLY the characteristic of corrosivity and is NOT a listed waste, it may be neutralized before disposal to the sanitary sewer (see Section 6.1.1). When in doubt, or if neutralization is not feasible, UOEHSM should manage the waste.

5.1.3 Reactivity

A waste has the characteristic of reactivity if it:

- is normally unstable and readily undergoes violent change without detonating;
- reacts violently with water;
- forms potentially explosive mixtures with water;
- mixes with water to generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment;
- 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;
- is capable of detonation or explosive reaction if subjected to a strong initiating source or heated under confinement;
- is readily capable of detonation or explosive; or,
- is a forbidden explosive or a Class A or Class B explosive.

5.1.4 Toxicity

Toxicity is determined by the “Toxicity Characteristic Leachate Procedure” (TCLP), a laboratory test that measures the concentration of the toxic material that could leach into ground water if improperly managed. The TCLP must be conducted on any waste that contains any of the specified TCLP contaminants. These contaminants include toxic metals such as lead and mercury, organics such as benzene and chloroform, and pesticides such as endrin (see Appendix E).

> *Note: UOEHSM assumes any chemical waste with any of the specified TCLP contaminants to be hazardous.*

6.0 MANAGEMENT OF SPECIFIC WASTE TYPES

The following are the techniques and requirements for the management of specific types of hazardous waste. Please adhere to these guidelines. If you have any questions, contact UOEHSM immediately.

6.1 Acids or Bases, Concentrated Solutions

This section explains the disposal of concentrated solutions of acids, such as hydrochloric, nitric and sulfuric acid, and bases such as ammonium hydroxide.

It is best to bring concentrated solutions of acids or bases to an Open House due to the work involved in neutralization. Use only disposable containers for waste with a pH less than 3 or greater than 12 because these containers will not be returned.

Any waste that exhibits ONLY the characteristic of corrosivity and is NOT a listed waste can be neutralized to within a pH range of 5 to 9 before disposal in the sanitary sewer. Flush waste with at least 20 parts water. When in doubt or if neutralization is not feasible, dispose of the waste through UOEHSM.

6.1.1 Neutralization procedures

Caution: vapors and heat are generated during neutralization.

You are not required to neutralize any wastes yourself. You may always choose to dispose of these materials in disposable containers through UOEHSM. If you choose to neutralize and subsequently dispose of these materials yourself, please adhere to the handling guidelines in the *Laboratory Chemical Safety Plan*.

- ***Do not neutralize strongly oxidizing acids such as perchloric acid and chromic acid.***
- Perform all steps slowly.
- Keep containers cool while neutralizing.
- **Acid neutralization:** While stirring, add acids to large amounts of an ice-water and base (sodium carbonate, calcium hydroxide, or 8 M sodium hydroxide) solution.
- **Base neutralization:** First add the base to a large vessel containing water. Slowly add a 1 M solution of HCl.
- Neutralize concentrated acid and base solutions to within a pH range of 5 to 9, and then flush them into the sanitary sewer with at least 20 parts of water.
- **Allow the contents to react for at least twenty-four hours to obtain a legitimate pH and to dissipate the any heat associated with the neutralization reaction before offering the waste to UOEHSM for disposal. The container should not be hot and the contents should not be smoking.**

6.1.2 Chromic acid

Chromic acid is a powerful oxidizing agent. It is both toxic and corrosive and can explode on contact with organic materials. Users of chromic acid cleaning solutions have suffered burns to skin and clothing. Hexavalent chromium is also classified as a carcinogen.

Chromic acid cleaning solutions leave a residue of hexavalent chromium on the glass surface that is almost impossible to remove. This residue has been known to interfere with certain research procedures, since the material can leach into solution.

We urge you to consider the chromic acid alternatives listed in Appendix C of this guide.

6.2 Air and Water Reactives

Bring all air and water reactives, such as those listed below, to an Open House or call UOEHSM for pick-up. Package any liquids separately from solids and note any special hazard and/or handling precautions on the waste tag. Examples of these chemicals include:

Acetyl chloride
Bromine
Calcium metal
Lithium metal
Phosphorus (yellow)
Potassium metal
Sodium metal
Thionyl chloride
Trichlorosilane

6.3 Aqueous Solutions of Toxic Metals

All solutions containing toxic metals must be disposed of by UOEHSM. These include:

Aluminum	Chromium	Nickel
Arsenic	Copper	Selenium
Barium	Lead	Silver
Cadmium	Mercury*	Zinc

** For any solutions containing mercury, please indicate on the waste tag whether the mercury concentration is less than or greater than 260ppm.*

6.4 Aqueous Solutions of Toxic Organic Chemicals

Try to keep organic wastes separate from aqueous waste so that unnecessary aqueous organic waste streams are not generated.

6.5 Chemically Contaminated Items (CCIs)

Chemically contaminated items (CCIs) can only be put into the normal trash if they are nonreactive, nonignitable, noninfectious, nonradioactive, and the contaminant is not highly toxic. This category includes such disposable lab ware as gloves, bench top coverings, pipets, test tubes, aprons, etc.

If you feel that the normal trash is not an appropriate disposal route for your CCIs, package them in a 5-gallon plastic bag (obtained through the Chemistry or Biology stores), which can be placed conveniently inside a 5-gallon plastic bucket. Label the *Hazardous Chemical Waste Tag* as "Chemically Contaminated Items" or "CCIs" and list chemical contaminants. Call UOEHSM if you have any questions.

Radioactive or biologically contaminated CCIs must be handled separately. Refer to the *Radiation Safety Manual* or Appendix A of this guide, as appropriate.

Note: All PCB contaminated lab ware at ≥ 50 ppm must be packaged separately and given to UOEHSM for disposal.

6.6 Empty Containers

Bottles are considered “empty” when you have removed all contents possible by normal means (pouring, scooping, etc.). These may be placed in the normal trash. However, some buildings provide a glass dumpster for disposal. Consult building policies or your safety officer.

Note: The Chemistry department requires triple rinsing of empty reactives containers.

Punch a hole in 5-gallon metal containers or safety cans that are no longer needed, and place directly in the normal trash dumpster. This will prevent their reuse. A non-sparking pick is available in Chemistry A027.

6.7 Potentially Explosive Chemicals

Package each container of potentially explosive chemicals separately from other chemicals. Follow the packaging instructions in Section 7.0 and be sure to note on the *Hazardous Chemical Waste Tag* the waste's characteristics and any special handling precautions. If you do not feel comfortable handling the chemical, or are unsure of its shock sensitivity, call UOEHSM for assistance. Potentially explosive chemicals include:

Ammonium nitrate	Peroxide forming agents (See 6.10)
Diazo compounds	Dry picric acid
Hydrazine compounds	Nitrocellulose

6.8 Metallic Mercury

UOEHSM collects and recycles free-flowing metallic mercury. Package it in a tightly sealed and leak-free container. Place broken mercury thermometers in a one-gallon overpack (obtainable from UOEHSM) or a secured plastic bag and bring to an Open House.

Note: There are alternatives to mercury thermometers, and they should be used whenever possible. In addition, if you use mercury it is imperative that you have a mercury spill kit available.

6.9 Non-Hazardous Liquid Waste

Most liquid chemical waste will need to be handled by UOEHSM. However, you might have some non-hazardous waste (listed in Appendix B of this guide) that can be flushed to the sewer after 20X dilution with water. These non-toxic chemicals can be flushed to the sanitary sewer because they are:

- water soluble;
- degradable in the sanitary sewer system; ***and***
- non-hazardous.

Non-hazardous, water-soluble solid chemicals can also be dissolved in water and disposed in this manner. All chemicals poured into the sewer must be followed by at least 20 parts water.

> ***NOTE: If you intend to dispose of more than one liter of any of these materials, or if you are unsure whether or not you should dispose of a certain material, please contact UOEHSM prior to disposal.***

6.10 Non-Hazardous Solid Waste

Most waste chemicals will need to be handled by UOEHSM, but you might have some non-hazardous waste listed in Appendix B of this guide that can be disposed of in the normal trash. These are solid chemicals that have very low toxicity and no positive determination of carcinogenicity. Assume all other chemicals are hazardous waste.

If you plan to dispose of any one of these non-hazardous chemicals, please make sure that it is placed in a tightly sealed container.

> ***NOTE: If you are unsure whether or not you should dispose of a certain material in this manner, please contact UOEHSM. Only non-hazardous solid materials can be placed in the trash.***

6.11 Peroxide-Forming Agents

Peroxides are low power explosives and are very sensitive to shock and heat. A variety of organic compounds react with oxygen from the air to form unstable peroxides. Common examples include:

Aldehydes
Compounds with benzylic hydrogens
Compounds with allyl groups
Diethyl ether
Dioxane
Miscellaneous ethers
Isopropyl ether
Tetrahydrofuran
Vinyls

One of the following conditions must be met before peroxide formers may be accepted by UOEHSM for disposal. These are requirements enforced by our disposal contractor, as well as good laboratory safety practices.

- The material must be **less than twelve months old**. This information must be marked clearly on the Hazardous Chemical Waste Tag.

- If the material is **greater than twelve months old but less than two years old**,

check for peroxide formation by using peroxide paper stocked at Chemistry Stores. If peroxide formation is less than 100 ppm, add 1 tsp. of hydroquinone per pint of material to prevent the formation of additional peroxides. Mark this information on your waste tag (e.g., "<100 ppm, hydroquinone added") and bring it to an Open House. If peroxide formation is greater than 100 ppm, CALL UOEHSM for technical assistance.

- If the material is **greater than 2 years old but less than 5 years old**, it should be assessed for other factors such as: duration of exposure to sunlight, volume of container (i.e., "Is it full?"), security of the seal, exposure to changes in temperature, etc. If you do not know the answer to any of these questions, find someone who does. **Do not open the container to check for peroxide formation**, as the material could be shock-sensitive.

- If the container is **more than five years old**, do not move the container at all. Post a sign reading "DANGER: possible shock-sensitive chemical" and call UOEHSM for technical assistance.

6.11.1 Safety Tips for Peroxide Formers

Date new containers when opened and bring to an Open House within 3 months of this date for Category I compounds and within 12 months for category II and III compounds. Refer to Appendix F for these lists and the National Safety Council's recommendations for labeling of peroxidizable liquids.

- Exposure of any peroxide-forming agent to light or air increases the rate of peroxide formation. Store these agents in full, light-resistant containers.

- Refrigeration does not prevent peroxide formation.

- As is the case with all hazardous chemicals, order only those amounts that you need in order to decrease storage time.

- Be particularly cautious with materials of unknown age! Do not attempt to remove caps from containers that may cause shock or sparks. Call UOEHSM for advice or assistance when such containers are found.

- Never distill peroxide-forming solvents unless they are known to be free of peroxides. Peroxides concentrated in still residue can be a serious explosive hazard.

6.12 Sharps

Several categories of sharps are generated on campus, such as needles, razors, and sharp glassware. Although most are not considered hazardous waste, they do require special handling for safety reasons. **Regardless of contamination**, sharps should be placed in **puncture-resistant**, cardboard or plastic containers and labeled as "sharps."

- Chemically contaminated sharps (CCIs): Metal and glass sharps that are grossly contaminated with hazardous chemicals should be collected in puncture-proof containers, marked as "sharps" and "CCI," and sealed tightly (see Section 6.5 for additional requirements). CCI sharps should then be delivered to UOEHSM for disposal.

- Biohazardous sharps: Contaminated metal and glass sharps should be placed in red, biohazardous sharps containers, labeled as "sharps" and affixed with a biohazard waste tag. Consult the *Biohazardous Waste Disposal* policy (Appendix A of this guide) for further instructions.

- Radioactive sharps: Consult the *Radiation Safety Manual* for further instructions.

- Uncontaminated metal sharps: Containers should be labeled as "sharps" and "solid waste" and sealed tightly. They may then be disposed of through UOEHSM or in a biohazard collection drum.

- Uncontaminated glass sharps: At some buildings, these may be placed directly in glass dumpsters with no special labeling or container requirements. If no glass dumpster is available, package in a puncture proof container, label as "glass sharps" and "solid waste," seal tightly, and place in the normal trash.

  Note: Sharps containers are sold in chemistry stores, the biology stock room and lab supply catalogues. Red biohazard sharps containers are to be used ONLY for biohazardous waste because regulatory requirements prohibit disposal by the same means as chemically contaminated sharps.

Labeling and Handling of Sharps

Type	Package	Labeling	Disposal
Biohazardous metal and glass	puncture proof biohazard container (red)	"sharps" and use a biohazard waste tag	See Appendix A for instructions for disposal through UOEHSM or LAR
Radioactive	puncture proof container	See the *Radiation Safety Manual* for labeling procedures	UOEHSM Radiation Safety
Chemically contaminated		"sharps" and "CCIs"	UOEHSM
Uncontaminated metal sharps		"sharps" and "solid waste"	UOEHSM or a biohazardous waste container
Uncontaminated glass*		"glass sharps" and "solid waste"	normal trash

** No labeling or special container is required if disposed of directly in a glass dumpster.*

6.13 Silica Gel

Accumulate silica gel in 5-gallon plastic buckets (or 1 gallon plastic overpacks for small generators) that can be obtained at an Open House. Store all containers closed and label "Waste Silica Gel." Only gel should be accumulated in these containers – no plastic wrap or instruments.

6.14 Solid Chemicals

Package tightly capped containers of hazardous solid chemicals, precipitates, semisolids, or gels according to the general instructions given in Section 7.0. Decant off free liquids and pack in separate containers. Assume all solids are hazardous unless they are listed in Appendix B of this guide or have been verified non-hazardous by UOEHSM.

6.15 Organic Solvents

Place your organic solvents in a safety can. (Very small generators can use other containers if a safety can is not practical.) Label your safety can or containers as contents are added so that you will be able to account for 100% of the chemical composition of the can. Do not depend on your memory when it is time to fill out your *Hazardous Chemical Waste Tag*! Waste must have a pH between 3 and 11 or it will be rejected.

Note: All safety cans should be labeled with the words "hazardous waste."

6.15.1 Substances which should NOT be put into safety cans

Safety cans are to be used for solvents, only. The following substances are inappropriate for solvent consolidation and should NOT be placed in your safety cans in any concentration:

- Acid and base solutions (If you have large volumes of solvents with low or high pH, you may use safety cans and neutralize the waste before offering to UOEHSM according to the neutralization procedures outlined in section 6.1.1 of this guide. Be aware, however, that if the pH of the waste is not greater than 3 or less than 11 at the time it is presented for disposal, it may be rejected. Also, be sure to allow 24 hours after neutralization before disposal to insure that the pH has stabilized and the heat of reaction has dissipated.)
- Aqueous solutions of toxic organic chemicals (If your procedures are such that water is mixed with solvents during the course of a reaction, it is okay to put in a safety can with other solvents. Just don't add primarily aqueous solutions to the solvents in the safety cans.)
- Metals (e.g., Sb, As, Ba, Cd, Cr, Pb, Hg, Ni, Se, Ag)
- Vacuum pump oil
- Sulfides or inorganic cyanides
- Strong oxidizers or reducers
- Water reactive substances
- Unknowns
- Stench compounds
- Any materials which react with organic solvents

6.16 Strong Oxidizers and Reducers

Bring all oxidizers and reducers, such as those listed below, to an Open House or call UOEHSM for pickup.

Strong oxidizers:	***Strong reducers:***
Chromic acid (fresh)	n-Butyl lithium
Metallic chlorates	Calcium hydride
Metallic nitrates	Metallic sulfides
Metallic perchlorates	Sodium hydride
Metallic permanganates	Stannous chloride
Perchloric acid	

6.17 Unknown Chemicals

You must make every effort to provide an accurate description of all chemicals that you give us. Unknown chemicals present serious legal and safety problems for the university. Without an accurate description, it is difficult to handle and dispose of the chemical safely. Disposal companies will not accept chemical waste without an analysis, and an analysis of one sample could cost $1000.

Often you can deduce the contents of an unknown container by locating the original generator, even if they are in another part of the country. If this is not successful, a fellow researcher may be familiar with the kinds of chemicals used in a particular research lab.

You can reduce the occurrence of unknown chemicals by being thorough in maintaining chemical container labels. Make periodic reviews of chemical stock and be sure to label all waste containers as they are filled.

6.17.1 Moving? CALL US!

We often receive unknown and unwanted chemicals when new personnel enter a laboratory. To alleviate this problem, it is your responsibility to sort through your chemical inventory, exchange what you can with other researchers, and bring the rest to an Open House. Give us a call if special pick-up arrangements are needed.

6.18 Vacuum Pump Oil

Uncontaminated vacuum pump oil can be recycled and should be brought to an Open House for consolidation and management as used oil.

7.0 HAZARDOUS WASTE PACKAGING AND LABELING

Good packaging increases safety in handling and transporting chemicals. Proper identification of the materials is also important. Because of hazardous waste regulations, we must know 100% of the composition of all waste materials. Please follow these rules when giving materials to UOEHSM.

NOTE: These directions are also summarized on the back of the Hazardous Chemical Waste Tags (Appendix G of this guide).

7.1 Container Storage

- Federal and state regulations require that all waste containers be closed while not in use. Storing an open waste container in a hood or anywhere in your work area is a violation.

- Label containers as "hazardous waste" and list contents of the container on the *Hazardous Chemical Waste Tag* during accumulation. Alternatively, a "hazardous waste" sticker with general contents listed may be used until the waste is delivered to UOEHSM for disposal.

- As a general rule, different wastes (solids vs. liquid, solvents vs. aqueous) should be accumulated in separate waste containers. This simplifies cataloging of waste constituents in a particular container, reduces the risk of reaction between incompatible wastes and avoids the costly disposal of complex mixtures. This guideline does not preclude the mixing of wastes that could obviously be mixed together, such as compatible solvent waste.

- Do not put liquid waste in plastic containers, as the containers tend to degrade and leak.

- Do not put acid waste in metal containers, as the containers will corrode and leak as well as evolve flammable hydrogen gas.

- Separate and protect ignitable waste from ignition sources.

- Sign the *Tag*, fill in an accumulation date when the container is "full" and bring it to the next Open House or call for pickup. *Note: "full" is 90% of container capacity, to allow for expansion.*

**** See the Satellite Accumulation Area posting in Appendix D of this guide for a quick reference of storage guidelines.***

7.2 General Waste Packaging Instructions

- Containers must be free of contamination on the outside, securely closed and capable of containing the waste inside. Container size should fit the amount of waste inside as nearly as possible to reduce disposal cost.

- Do not use biohazard bags for the storage of chemical wastes.

- Containers must be labeled with a *Hazardous Chemical Waste Tag* (Appendix G of this guide). Directions are printed on the backs of the tags. If you conduct an inventory and dispose of large quantities of unused chemicals, UOEHSM will waive the tagging requirement when the original label is intact. Call for details.

- Tags must state **each** chemical constituent present in the waste container and corresponding percentages. Toxic chemicals, other than mercury and PCBs, that constitute less than 1% may be listed as "trace." ***Please write legibly***.

- Waste constituents must be spelled out completely — no abbreviations, formulas or structures.

- Additional tags may be used if necessary. Be sure to fill in information on the top two lines of the continuation tag, and sign and date both.

- A pH is required on the tag for aqueous solutions. Please allow time for reactions to end before reading pH. If bottles are to be returned, pH must be greater than 3 and less than 11.

- Affix tags to containers with a rubber band.

- *Hazardous Chemical Waste Tags* are available at Open Houses, from UOEHSM and from the Chemistry and Jordan Hall stockrooms.

7.3 Additional Waste Packaging Instructions for Solvents

- Waste solvents should be cleared from labs on a weekly basis. In no circumstance should solvents be allowed to accumulate for over two weeks.

- Safety cans are mandatory for ignitable solvents and advised for halogenated solvents. Safety can springs must be in good working order (i.e. able to spring closed and stay tightly sealed) or the can must be replaced. Glass bottles are discouraged, but will be accepted from very small generators.

- A safety can does not have to be full to bring it to an Open House or for collection by UOEHSM.

- Accumulate other waste streams (acids, metals, etc) in separate containers. Solvents should be free of all other wastes, including aqueous wastes and water not mixed during the same procedure.

8.0 CHEMICAL SPILL RESPONSE PROCEDURES

Accidents resulting in the release of chemicals will occur despite the best effort to work safely. It is essential that personnel have a spill response plan that includes appropriate procedures and materials to adequately contain and cleanup a spill. The following procedures should be used as a guide to help design an effective spill control plan for your work area. (Refer to the *Laboratory Chemical Safety Plan* for information on spill kit contents, and the *Chemical Spill Response Guide* for detailed information on spills.)

8.1 Major Spills

In the event of a spill which:

- involves the release of a type or quantity of chemical which poses an immediate risk to health;
- involves an uncontrolled fire or explosion; or,
- involves serious personal injury;

1. Evacuate as necessary and keep others from entering the affected area until assistance arrives.

2. Dial 9-911 for assistance and be prepared to provide details of the situation.

3. Stay onsite until assistance arrives.

8.2 Minor Spills

In the event of a spill involving the release of a type or quantity of chemical that does not pose an immediate risk to health, and does not have the potential to become an emergency within a short time period:

1. Notify other laboratory personnel of the accident.

2. Isolate the area. Close laboratory doors and evacuate the immediate area if necessary.

3. Remove all ignition sources and establish exhaust ventilation. Vent vapors to the outside of the building only (open windows and turn on fume hood).

4. Choose appropriate personal protective equipment (goggles, face shield, impervious gloves, lab coat, apron or coveralls, boots, respirator, etc.) *Note: All personnel must have medical approval and be fit tested before using a respirator. Contact UOEHSM for more information.*

5. Confine and contain the spill. Cover with appropriate absorbent material. Sweep solid material into a dustpan and place in a sealed plastic container. Decontaminate the area with soap and water after cleanup and place residue in a plastic bag or another sealed plastic container. Bring the containers to the next Open House or call UOEHSM for pickup.

For consultation or assistance, call UOEHSM during regular business hours or the IU Police Department all other times.

APPENDIX A: *Biohazardous Waste Disposal*

Biohazardous Waste Disposal

Guidelines for Indiana University Bloomington

The University Office of Environmental, Health, and Safety Management (UOEHSM) is responsible for ensuring the proper management and disposal of all biohazardous waste generated on the Bloomington campus. For the purpose of these guidelines, **biohazardous waste** is broadly defined as all biological waste (or biologically contaminated waste) that could have the potential to cause harm to humans, domestic or wild animals, or plants. Specific examples of biohazardous waste include cell cultures or animal tissues containing infectious agents or recombinant DNA; or human tissues, blood, or fluids.

The following guidelines must be observed by all generators of biohazardous waste. For additional information, clarification, or human waste pickup scheduling, call UOEHSM at 855-6311. Animal waste pickup may be arranged through Lab Animal Resources (LAR) at 855-2356.

Liquids

1. Decontaminate biohazardous liquids (such as bacterial cultures in liquid media or animal fluids known to contain pathogens) by treatment with an appropriate chemical disinfectant. For disposal of liquids containing human blood, contact the BioSafety Officer.

2. After decontamination, dispose of liquids down the drain to the sanitary sewer.

Disposable Solids

1. Place solid waste in clear autoclave bags (do not use red/orange biohazard bags), seal, and attach a "BIOHAZARD -- To Be Autoclaved" tag and a strip of autoclave tape.

2. After autoclaving, deface or remove all biohazard labels or tags and place bag in the non-hazardous solid waste stream, according to specific building requirements.

For any biohazardous solid waste which, for any reason, cannot be autoclaved or for autoclaved waste requiring additional precautionary disinfection (such as wastes containing BL2 level human pathogens):

3. Place the solid waste in a red/orange biohazard bag, complete and affix a "BIOHAZARD" waste tag, and complete an online pickup request to schedule a pickup. For certain departments, biohazardous waste will be picked up on a regular basis from a central location.

Animal Carcasses (tissues and associated non-sharps solid waste)

1. Place animal carcasses, tissues, and associated non-sharps solid waste in a red/orange biohazard bag. Double bag if necessary to ensure perforations do not occur.

2. Seal bag, complete and affix a "BIOHAZARD" waste tag, place the bag in a freezer, and call LAR to schedule pickup. For certain departments, animal waste will be picked up on a regular basis from a central location.

Sharps (metal sharps or contaminated glass sharps)

1. Place all metal sharps (such as razor blades and syringes) and any glass sharps with biohazardous contamination in a puncture-proof sharps container.

2. Label the container "sharps," complete and affix a "BIOHAZARD" waste tag, and call to schedule pickup.

Contacts:

Questions on guidelines and human waste pickup	UOEHSM, 855-6311
Animal waste pickup	LAR, 855-2356

****Online waste pickup request form is located at:**
http://www.ehs.indiana.edu/waste/main.cfm

APPENDIX B: *Chemicals for the Normal Trash*

CHEMICALS FOR THE NORMAL TRASH

You can safely dispose of many solid chemicals in the normal trash if the containers are tightly capped and of good integrity. Examples are given on the following list. These chemicals were selected because they:

- have oral-rat LD_{50} toxicity values higher than 500 mg/kg, and
- have no positive determination for carcinogenicity according to the National Institute of Occupational Safety and Health (NIOSH) *1979 Registry of Toxic Effects of Chemical Substances.*

If you intend to dispose of more than five pounds of any one of these chemicals, Call UOEHSM for further evaluation.

-- A --

Acid, Ascorbic
Acid, Benzoic
Acid, Boric
Acid, Casamino
Acid, Citric
Acid, Lactic
Acid, Salicylic
Acid, Silicic
Acid, Stearic
Acid, Succinic
Acid, Tartaric
Agar
Albumen
Aluminum Oxide
Amino acids (alpha and naturally occurring salts)
Ammonium Bicarbonate
Ammonium Carbonate
Ammonium Chloride
Ammonium Citrate
Ammonium Lactate
Ammonium Phosphate
Ammonium Sulfate
Ammonium Sulfamate

-- B --

Base, Blood Agar
Beef Extract
Beeswax
Brom Phenol Blue
Broth Nutrient
Buffer Solution

-- C --

Calcium Borate
Calcium Carbonate
Calcium Chloride
Calcium Citrate
Calcium Lactate
Calcium Oxide
Calcium Phosphate
Calcium Sulfate
Cerelose (Glucose)
Chromatographic adsorbent
Crystal Violet
Cobalt Oxide

--D, E, F, G –

Dextrose
Drierite
Extract, Malt
Extract, Yeast
Ferrous Ammonium Sulfate
Galactose
Gelatin
Glucose
Graphite
Gum Arabic
Gum Guaiac

-- H, I, K, L --

Hematoxylin
Iron Oxide
Kaolin
Lactose
Lithium Carbonate
Lithium Sulfate
Litmus Mild

-- M --

Magnesium Borate
Magnesium Carbonate
Magnesium Chloride
Magnesium Citrate
Magnesium Lactate
Magnesium Oxide
Magnesium Phosphate
Magnesium Sulfate
Maltose
Manganese Acetate
Manganese Chloride
Manganese Sulfate
Methyl Red
Methyl Salicylate
Methylene Blue

-- P --

Paraffin
Pepsin
Peptone
Petroleum Jelly
Potassium Acetate
Potassium Bicarbonate
Potassium Bisulfate
Potassium Bitartrate
Potassium Bromide
Potassium Carbonate
Potassium Chloride
Potassium Citrate
Potassium Lactate
Potassium Iodide
Potassium Phosphate
Potassium Sodium Tartrate
Potassium Sulfate
Potassium Sulfite
Pumice

-- S --

SDS (Sodium Dodecyl Sulfate)
Sodium Acetate
Sodium Ammonium Phosphate
Sodium Benzoate
Sodium Bicarbonate
Sodium Bisulfate
Sodium Bisulfite
Sodium Borate
Sodium Bromide
Sodium Carbonate
Sodium Chloride
Sodium Citrate
Sodium Iodide
Sodium Lactate
Sodium Phosphate
Sodium Salicylate
Sodium Succinate
Sodium Sulfate
Sodium Sulfite
Sodium Tartrate
Sodium Thiosulfate
Sodium Tungstate
Starch
Strontium Carbonate
Strontium Phosphate
Strontium Sulfate
Sucrose
Sugars
Sugar Alcohols

-- T, U, W, Z --

Talcum Powder
Thymol
Tin Oxide
Trypticase
Urea
Zinc Oxide

APPENDIX C: *Chromic Acid Alternatives*

SUGGESTED ALTERNATIVES TO CHROMIC ACID CLEANING SOLUTIONS

Product	Manufacturer
No Chromix	Godax Laboratories
RBS 35 Concentrate	Pierce Chemical Co.
RBS Solid	Pierce Chemical Co.
S/P Laboratory Detergent Concentrate	American Scientific Products
S/P Contrad 70	American Scientific Products
Alconox	American Scientific Products Fisher Scientific Co.
Fisherbrand Sparkleen	Fisher Scientific Co.
FL-70 Concentrate	Fisher Scientific Co.
Liquinox Liquid Detergent	Fisher Scientific Co.
Isoclean	Lab Safety Supply
Count-Off	New England Nuclear Co.
Life Away Concentrated Decontaminant	Research Products International Corp.

APPENDIX D: *Satellite Accumulation Area Guidelines*

HAZARDOUS WASTE
SATELLITE ACCUMULATION AREA

1) Make sure all containers of hazardous waste are labeled with the words **"Hazardous Waste"** and other words that commonly identify the container contents.

2) Close all hazardous waste containers when not in immediate use.

3) Keep all hazardous waste containers in the same room where the waste was generated and under control of the operator/generator of the waste.

4) Separate all incompatible wastes. Example: acids from bases, oxidizers from organics.

5) Store all wastes in compatible containers.

6) Make sure that all waste containers are in good condition and working properly.

7) Follow good housekeeping practices. Keep a clean work area and clean up spills appropriately when they occur.

8) Keep flammables away from ignition sources.

9) Mark the date the waste container was filled on the container/drum/waste tag.

10) Request a waste pickup by UOEHSM when your waste container(s) are full by completing an online request form: http://www.ehs.indiana.edu/waste/main.cfm

**Customers in the Chemistry Building should check the current waste collection schedule for open house collection dates.*

UOEHSM/DCB/11-2004

APPENDIX E: *Regulated Levels of Hazardous Waste Components*

Regulatory Levels for Toxic Contaminants in Waste*

Contaminant	Regulatory Level (mg/L)	EPA Hazardous Waste Number
Arsenic	5.0	D004
Barium	100.0	D005
Benzene	0.5	D018
Cadmium	1.0	D006
Carbon Tetrachloride	0.5	D019
Chlordane	0.03	D020
Chlorobenzene	100.0	D021
Chloroform	6.0	D022
Chromium	5.0	D007
o-Cresol	200.0	D023
m-Cresol	200.0	D024
p-Cresol	200.0	D025
Cresol	200.0	D026
2,4-D	10.0	D016
1,4-Dichlorobenzene	7.5	D027
1,2-Dichloroethane	0.5	D028
1,1-Dichloroethylene	0.7	D029
2,4-Dinitrotoluene	0.13	D030
Endrin	0.02	D012
Heptachlor (and its hydroxide)	0.008	D031
Hexachlorobenzene	0.13	D032
Hexachlorobutadiene	0.5	D033
Hexachloroethane	3.0	D034
Lead	5.0	D008
Lindane	0.4	D013
Mercury	0.2	D009
Methoxychlor	10.0	D014
Methyl Ethyl Ketone	200.0	D035
Nitrobenzene	2.0	D036
Pentachlorophenol	100.0	D037
Pyridine	5.0	D038
Selenium	1.0	D010
Silver	5.0	D011
Tetrachloroethylene	0.7	D039
Toxaphene	0.5	D015
Trichloroethylene	0.5	D040
2,4,5-Trichlorophenol	400.0	D041
2,4,6-Trichlorophenol	2.0	D042
2,4,5-TP (Silvex)	1.0	D017
Vinyl Chloride	0.2	D043

All waste with any amount of these compounds must be disposed by UOEHSM.

APPENDIX F: *Peroxidizable Compounds*

Peroxidizable Compounds

Many common laboratory chemicals can form peroxides during extended storage after exposure to light and air. Some compounds form peroxides that are violently explosive in concentrated solutions or in solids. Such compounds should never be evaporated to dryness. Others are polymerizable unsaturated compounds that form peroxides which can initiate a runaway, explosive polymerization reaction. The following is a list of typical compounds in each of these three categories. It is not an inclusive list. Be sure to consult individual chemical safety information to determine if a chemical not on this list has a peroxide formation hazard.

Category I: Peroxide hazard on storage

- Isopropyl ether
- Potassium metal
- Sodium amide (sodamide)
- Divinyl ether
- Potassium amide
- Vinylidene chloride

Category II: Peroxide hazard on concentration (either through distillation or evaporation)

- Dioxane
- Tetrahydrofuran
- Cumene
- Cyclopentene
- Dicyclopentadiene
- Furan
- Methyl cyclopentane
- Tetrahydronaphthalene
- Ethyl ether
- Acetal
- Cyclohexane
- Diacetylene
- Ethylene glycol dimethyl ether
- Methyl acetylene
- Methyl-i-butyl ketone
- Vinyl ethers

Category III: Hazards due to peroxide initiation of polymerization

- Butadiene
- Chlorotrifluoroethylene
- Tetrafluoroethylene
- Vinyl acetylene
- Vinyl pyridine
- Chlorobutadiene (chloroprene)
- Styrene
- Vinyl acetate
- Vinyl chloride

APPENDIX G: *Hazardous Chemical Waste Tag*

HAZARDOUS CHEMICAL WASTE TAG
(See reverse side for directions)

Code # 00/ 2456

Print Your Name:_____ Building and Room Number: _____ Phone Number:_____

Department and PI name:_____ Total amount in container:_____

Complete Chemical Composition: (List % or amount of all constituents including water/solvents)

1._____%
2._____%
3._____%
4._____%
5._____%
6._____%
7._____%
8._____%

Check if Applicable:
_____ Flammable?
_____ Corrosive? pH_____
_____ Oxidizer?
_____ Highly Toxic?
_____ Reactive/Explosive?

I certify that this information is true and I have done my best to reduce the volume and toxicity of this waste and have complied with the directions on the reverse side of this form.

Sign Name:_____

Date:_____

Note: Go to: www.ehs.indiana.edu/hazard.html to see a current **Waste Collection Schedule** containing our current chemical and radioactive waste collection dates and times. The **Hazardous Waste Management Guide,** containing guidelines for managing all non-radioactive waste is also located at this web page along with a **Waste Disposal Request Form** which is filled out by all locations needing a waste pick-up other than wastes brought to scheduled Open Houses in Chemistry A027.

1. Every container needs a waste tag unless you have multiple containers of the same exact waste packaged in one larger container. Attach the tag to the neck of its container with a rubber band.
2. While accumulating waste, list the contents in the waste container on the tag to keep a running total.
3. Abbreviations and structures are not permitted. Spell out each chemical. Record the approximate % of each chemical and list highly toxic chemicals at the exact level, no matter how small.
4. Accumulate different waste types in different containers. For example: aqueous waste from organic waste; liquids from solids; and incompatible wastes that might react with each other.
5. All waste must be stored in a securely closed screw top container capable of safely containing the waste inside.
6. Mark the container itself as a "Hazardous Waste" with the contents listed in case the tag falls off or is damaged. You can use a generic term for the contents such as, hazardous waste halogenated or non-halogenated solvents or hazardous waste paint thinner, etc.
7. Sign and date the tag when the container becomes full or is otherwise ready for disposal.