Environmental Health & Safety

Waste Guideline and Procedures Manual

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1.0 Hazardous Waste

1.1 Introduction

At The University of Iowa, hazardous chemical wastes are generated as a result of teaching, research, patient care service, and operational activities. The University's Environmental Health & Safety Office (EHS) is responsible for proper handling and ultimate disposal of chemical waste. EHS also provides technical assistance and training to individuals and departments who generate waste so they can comply with rules and regulations that direct waste generation activities. The EHS Waste Management Program provides waste management service and technical assistance.

The goals of the Hazardous Waste Management Program are to:

- Protect employee health and safety
- Protect the environment
- Reduce amount of hazardous waste generated
- Comply with hazardous waste regulations

The U.S. Environmental Protection Agency (EPA) regulates waste generation and management activities at the University. The Resource Conservation and Recovery Act (RCRA) provide authority for such regulation. RCRA provides for "cradle-to-grave" tracking and management of hazardous waste, i.e., from the generator to transporter to treatment, storage or disposal. Anyone or any facility that generates, treats, stores or disposes of hazardous waste must comply with RCRA. EPA regulations pertaining to hazardous waste are found in Title 40 of the Code of Federal Regulations, Parts 260-270. The U.S. Department of Transportation (DOT) regulates transportation of hazardous waste. DOT regulations pertaining to hazardous waste are found in Title 49 of the Code of Federal Regulations, Parts 171-173.

1.2 When is a Waste Hazardous?

Hazardous waste is a very specific term defined by EPA regulations. EPA groups hazardous waste into two categories:

- Characteristic waste (physical properties) and
- Listed waste (specifically identified by technical name).

EHS also collects other chemical waste not be defined by EPA as hazardous, that presents a hazard significant enough to warrant handling as a hazardous waste.

General Characteristic Waste (Ignitability, Corrosivity, Reactivity, Toxicity)

Waste exhibiting any of these characteristics is hazardous.

Ignitability (EPA code D001)

- Liquids that have a flash point less than 140° F (60° C.), e.g., xylene, acetonitrile, ethanol, toluene, paint thinner, methyl ethyl ketone.
- Solids capable of causing fire by friction, absorption of moisture, or spontaneous chemical change and when ignited burn vigorously and persistently to create a hazard, e.g., picric acid, sodium dithionite.
- Flammable compressed gases, e.g., hydrogen, ethylene, methane.
- Oxidizers: substances that yield oxygen readily to stimulate combustion, e.g., potassium permanganate, sodium chlorate, sodium nitrate.

Corrosivity (EPA code D002)

- Aqueous solutions with pH $\leq$ 2 or > 12.5.
- Liquids capable of corroding steel at a specified rate and temperature.

Reactivity (EPA code D003)

- Substances that react with water violently, or produce toxic gases or explosive mixtures with water, e.g., potassium, sodium, and sodium hydride.
- Substances that are normally unstable or explosive, e.g., phosphorous.
- Chemicals containing cyanide or sulfide that generate toxic gases when exposed to pH between 2 and 12.5, e.g., potassium cyanide, sodium sulfide.

Toxicity (EPA code D series D004 thru D043)

- Materials that contain certain heavy metals above regulated levels, e.g., silver, cadmium, mercury, arsenic. (Appendix I)
- Materials that contain certain organic constituents, mainly solvents and pesticides, above regulated levels, e.g., benzene, chloroform. (Appendix I)

Specifically Listed Waste

EPA specifically lists approximately 500 chemicals as hazardous waste.

- EPA P List (P coded), acutely toxic chemicals (Appendix II).
- EPA U List (U coded), toxic chemicals (Appendix III).
- EPA F List (F coded), wastes from non-specific sources (Appendix IV).
- EPA K list (K coded), wastes from specific sources (Appendix V).

Used Oil
Used oil is an EPA regulated material. Regulations direct that used oil should be recycled.

Universal Wastes
EPA also regulates a group of waste materials that are both hazardous to the environment and commonly found in industry as well as households. Because the materials are common, they are known as Universal Waste. Items identified as Universal Waste include:

- Mercury containing instruments such as thermometers, barometers, thermostats.
- Fluorescent lamps that contain mercury vapor.
- Batteries that contain hazardous materials such as NiCad, lithium and lead-acid batteries.

Refer to Section 2.0 below for more information on disposal of Universal Waste.

Other Chemical Waste
Many other chemicals present a hazard to human health or the environment, but they are not regulated by EPA under RCRA. Some items that are not hazardous to human health or the environment are simply prohibited from disposal at the local landfill. These include such things as:

- Ethidium bromide and ethidium bromide gels.
- Carcinogens, mutagens, teratogens.
- Pharmaceuticals.
- Pesticides and herbicides.
- Aerosol cans.
- Latex paints.

See Section 1.8 of this manual for more information on disposal of specific types of waste.

1.3 EHS Responsibilities

What Does EHS Do?
- Collects waste chemicals from the place where they are generated.
- Transports and handles waste.
- Stores, manages and disposes of waste.
- Meets regulatory requirements for record keeping.
- Complies with EPA and DOT regulations.

Waste Collected
EHS collects virtually all types of chemical waste, with a few exceptions.

Waste Not Collected

This list is not all-inclusive.

1. Empty containers - empties should be disposed of in general waste or recycled (Exception: EHS will collect empty aerosol containers, gas cylinders, and containers that previously held EPA P-listed chemicals.)
2. Fluorescent tubes, light bulbs - collected by maintenance staff and recycled by General Stores.
3. Asbestos.
4. Alkaline batteries.
5. General refuse and recyclable materials. (Exception: EHS will accept recyclable items that are also hazardous.)

Waste Transportation

Wastes are transported by EHS on a specially designed truck. Wastes are inventoried as they are collected and manifested for transportation to RCRA permitted facilities on the UI Research Campus for temporary storage.

Management and Record Keeping

Each waste item collected by EHS is assigned a serial number, tagged, and tracked using a database. This allows EHS to follow the course of waste through the storage, management, and disposal process. Hazardous waste is stored in barrels, cabinets, or shelves in a storage facility located on the UI Research Campus. Subsequently, a contractor is hired to pack and ship waste to a RCRA permitted commercial disposal site for treatment and disposal. EHS maintains all records required by the University's RCRA permit at the UI waste storage facilities.

1.4 Generator Responsibilities

Requirements

1. Collect waste in a suitable container that is in good condition.
2. Containers must be compatible with waste type.
3. Containers must remain closed except to add or remove waste.
4. Containers must be labeled with the words "Hazardous Waste" and its contents identified. Identify hazardous waste characteristics present in each waste container (i.e., ignitable, corrosive, reactive, toxic). Use labels provided by EHS to comply with these requirement.
5. Complete a Chemical Waste Pickup Request Form found on the EHS Web page to schedule waste removal. Filled containers should be removed within 90 days. If more than 55 gallons has accumulated, it must be removed within 3 days.

6. A representative of each waste generating area must receive training in hazardous waste management.
7. Do not mix incompatible chemicals.
8. Waste must be stored at or near the point of generation, in an area controlled by the generator.

Satellite Accumulation Areas (Waste Accumulation Areas)

EPA rules do not allow for a central accumulation area for collection and storage of waste prior to disposal. EPA views accumulation in a centrally located area as operation of a hazardous waste storage facility. Such an operation requires the generator to comply with the full weight of EPA regulations for a treatment and disposal facility. **Waste must accumulate where it is generated.**

Training

EHS identifies a waste coordinator for each waste generation area. The waste coordinator must receive training in hazardous waste management. Training is available through ICON.

Two courses address chemical waste disposal:

- Hazardous Waste Management for Labs – W07HAZ, and
- Hazardous Waste Management for Non-Labs – W32HAZ.

Training is required initially and annually.

Container Requirements

Hazardous waste must be collected in a container that is clean, in sound condition and appropriate for the waste type. Collection bottles must not be overfilled and must be capped with a tight fitting screw type cap. Bags must be tied off and boxes must be tightly sealed.

General Specifications

1. Container and cap/cap liner must be compatible with waste and in sound condition.
2. Cap must be screw type and fit tightly - corks and stoppers are unacceptable.
3. Proper headspace - 1.5 inches for flat top containers, 3 inches for tapered.
4. Outside of container must be clean and uncontaminated.
5. Container must be properly labeled. Use labels available from EHS.

Container Selection

Acceptable packaging for specific waste types:

1. Flammable liquids - glass bottles, steel cans, high-density plastic containers.
2. Concentrated acids and bases - 2.5-liter "acid" bottle.
   NOTE: One-gallon glass bottles are generally unacceptable for acids and bases because the high specific gravity of substances and the thinness of one-gallon glass containers increases the likelihood of container breakage. Metal containers and caps or cap liners made of cardboard are incompatible with corrosive materials.
3. Trace contaminated solid wastes (contaminated paper, gloves, etc.) - double bag using polyethylene bags. Bags should be sealed and placed in sturdy cardboard cartons and sealed with tape.
4. Aqueous solutions - glass bottles, plastic bottles, plastic cans. Plastic milk jugs or similar containers are unacceptable.
5. Broken mercury thermometers - broken thermometers without free flowing mercury may be packaged in the same manner as trace contaminated solid waste. Broken thermometers with mercury should be contained in a glass or plastic bottle with a tight cap.

1.5 Proper Liquid Waste Segregation Groups

If different chemical wastes are mixed together in a single container for disposal (commingled), then to the extent possible:

- Similar types of chemicals should be mixed together to make a common segregation group (see below).
- Only compatible chemicals may be mixed together within segregation groups.**Be sure commingled chemicals are compatible! Caution: mixing chemicals that are incompatible may result in splattering, heat generation, container pressurization, fire or explosion**. (See Appendix X for guidance).
- Keep aqueous-based waste separate from organic solvent-based waste.
- Keep paper, gloves, syringes and other solid items separate from liquids.
- Avoid mixing heavy metals, especially mercury, with solvents.

Commingle waste within the following general groups; **beware of incompatibilities:**

1. Halogenated, e.g., chloroform, methylene chloride.
2. Hydrocarbons, e.g., xylene, ether, hexane, acetone.
3. Nitrogenous, e.g., triethylamine, diisopropylamine.
4. Sulfurous, e.g., dimethylsulfoxide, dimethylsulfate.
5. Corrosive, e.g., sulfuric acid.
6. Aqueous solutions, e.g., diaminobenzidine, ethidium bromide, heavy metals.
7. Oils, e.g., pump oil.

1.6 Labeling Requirements

EHS supplies self-adhesive labels that must be applied to each container for pickup. You may also print your own labels from the EHS Web site. Commingled waste containers must be labeled as soon as waste is first added to the container. This will prevent accidental mixing of incompatible chemicals and satisfy EPA rules.

Why Label Waste?

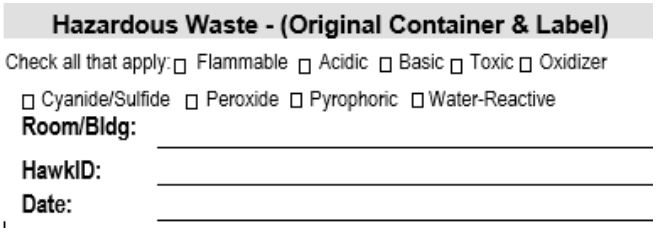
- Ensure safety.
- Prevent waste from becoming an unknown.
- Comply with EPA regulations.
- Contribute to the efficiency of material handling.
- EHS will not pick up waste that is not properly labeled.

Types of Labels

EHS supplies two types of labels for hazardous waste. Make sure the proper label for waste type is used.

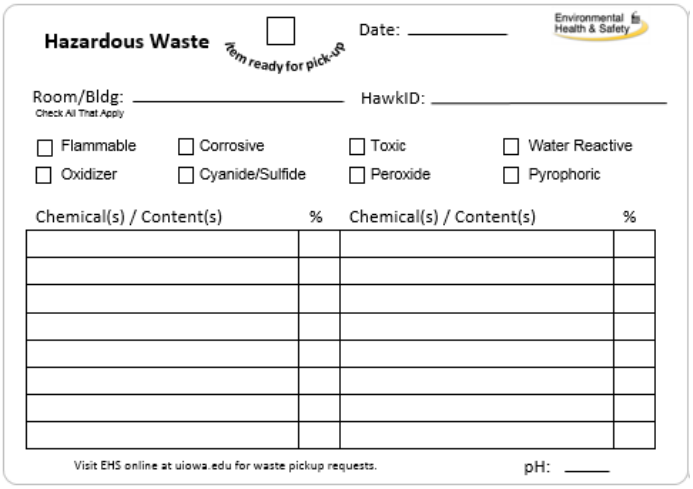
Small Hazardous Waste Label

Used on waste that is unused, in original containers, having the original manufacturer's label. Check boxes that identify hazards present. Ensure the hazardous waste label does not cover the original label. If a container is too small to allow this, place the label next to the container for disposal. EHS will apply the label to an inventory tag attached to each bottle by EHS.



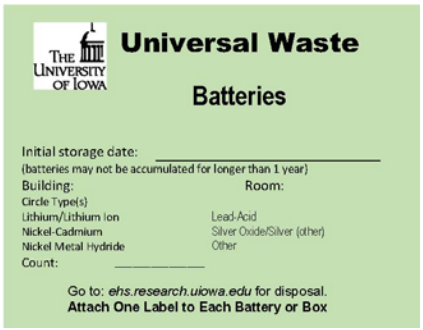
Large Hazardous Waste Label

Used on commingled wastes, wastes in original containers that are missing original labels, or wastes that are no longer in original containers. All components of the waste must be listed on the label and must total 100%. Check boxes that identify hazards present.



Universal Waste – Batteries Label

For use on batteries or boxes of batteries that are classified as Universal Waste. Place date on label immediately.

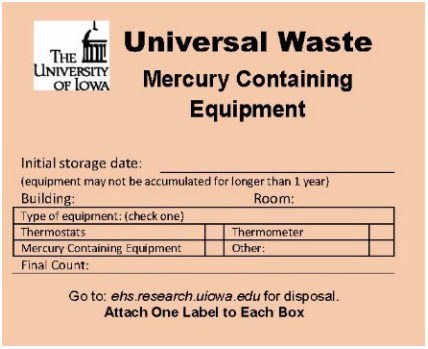


Universal Waste - Lamps Label

For use on boxes holding fluorescent lamps and other types of mercury containing waste lamps. Place date on label immediately.

Universal Waste - Mercury Containing Equipment Label

For use on containers holding thermometers, thermostats and other types of mercury containing equipment. Place date on label immediately.

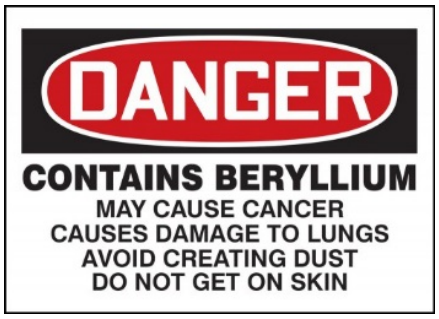


Used Oil

For use on all containers of used or waste oil, and used oil filters.

Danger Contains Beryllium Label

All waste containing beryllium or beryllium salts/oxides must have a Danger Contains Beryllium label attached, in addition to other required labels.



Labeling Procedures

1. Only labels provided by EHS are acceptable. Labels may be obtained free of charge by ordering them through the EHS Web site. You may also print your own labels using templates available on the EHS Web site.
2. Each container must have a label. The label must be attached to the container when it's initially used for waste. The date should be filled in when the container is full. The exception for this is the Universal Waste labels for which the date must be filled in immediately.
3. Labels should be filled out in pencil or may be printed by a computer printer if you are printing labels through the EHS Web site. Pencil is superior due to its resistance to solvent and acid splashes.
4. Labels must contain room number, building, HawkID, and date when required.
5. Containers of wastes that are commingled must list all components in the contents section, including water and all trace materials.
6. Abbreviations are not acceptable, write out the full name of chemical constituents.
7. Aqueous waste should have the pH of the solution recorded.
8. All used oils must also be labelled with the words, "used oil."
9. All waste containing beryllium must also be labeled with a Danger Contains Beryllium label.
10. Commingled waste containers must have all other labels removed, covered or defaced to avoid identity confusion.
11. If a container holds only the original contents, place the hazardous waste label so that the original label is not covered. If a container is too small to allow this, place the label next to the container for disposal. EHS will apply the label to an inventory tag attached to each bottle by EHS.
12. For labs that are generating large amounts of the same waste on a continuous basis, EHS may assign a waste code to save time when completing labels. Call EHS at (33)5-8501 for more information.

1.7 Pickup

EHS picks up all hazardous waste in the lab or area where it was generated. Waste must be packaged and labeled properly prior to arranging for pickup. Because EHS's transport vehicle has limited space, do not accumulate a large number of containers for pickup. Lab cleanouts involving more than 20 containers must be pre-arranged. EHS's waste pickup schedule is available on the EHS Web site. EHS visits each building weekly on the same day, although a few buildings are visited bi-weekly. A Chemical Waste Pickup Request Form must be received by 7:00 AM on the day of pickup, otherwise the request will be scheduled the following week.

Arranging for Pickup

To schedule waste collection, notify EHS by using the link on the EHS Web page to submit a Chemical Waste Pickup Request Form.

What if Your Waste is Not Removed?

If a pickup cannot be completed, EHS will leave a note explaining the reasons. Deficiencies must be corrected and another pickup scheduled.

Lab Cleanouts

Lab cleanouts are defined as a large quantity of unused chemicals that need to be disposed of at once.

The following guidelines apply to lab cleanouts:

- Special arrangements are required.
- Cleanouts are handled on a first come, first served basis.
- Several trips may be necessary to complete the cleanout.
- Notifying EHS as soon as possible will expedite your cleanout.

Unknowns

An unknown is a chemical of unknown identity in an unlabeled container. Federal regulations prohibit transportation, storage, or disposal of wastes of unknown identity. For this reason and for the safety of personnel, it is important that unknowns are not created. With proper management, the generation of unknowns is preventable.

Prevent generating unknowns by:

- Labeling all containers properly, even when creating reagent solutions for temporary use. Labeling will also prevent using the wrong material accidentally.
- Inspecting containers and labels periodically. Replace fading or deteriorating labels.

If you discover an unknown, these steps may help in identification.

- Ask area personnel about the container. Someone may remember its contents.
- Contact groups that previously used the area and see if they can recall the waste's identity.
- Simple tests such as pH may aid in identification.
- Check fresh reagents present; the waste was most likely derived from them. The field of possibilities can be greatly reduced.
- Review projects currently in progress.

If the identity of the unknown still cannot be determined, EHS provides an identification service. Following is a description of the process for unknown identification and disposal. Please note that this identification process is offered by EHS for the purpose of chemical disposal only, and there is a nominal fee charged to cover the cost.

1. Complete and submit the Request to Test Unknown Chemical form, which is located on the EHS Web site.
2. After receipt of the form a pickup will be scheduled by EHS and the item will be removed for testing.

1.8 Hazardous Waste Minimization

In an average year, The University of Iowa generates 25,000 – 30,000 containers holding approximately 250,000 lbs. of hazardous chemical waste. It is the goal of the University to reduce this amount. Waste minimization is a reduction in both toxicity and volume, thus contributing to increased safety of personnel and benefiting our environment. Waste reduction practices also help control increasing expenditures of hazardous waste disposal. Common techniques include:

Product Substitution

Use less hazardous or non-hazardous materials.

1. Substitute No-Chromix, Alconox, Terg-a-Zyme or other non-toxic detergents and enzymatic cleaners for chromic acid or potassium hydroxide/ethanol cleaning solutions.
2. Substitute non-hazardous biodegradable liquid scintillation cocktails for xylene and toluene-based cocktails.
3. Use soy-based inks instead of solvent-based inks in printing.
4. Use dry instead of wet printing processes.
5. Use non-halogenated solvents in degreasing operations.
6. Use non-mercury and non-sodium azide preservatives.
7. Use spirit, bi-metal, or digital thermometers.
8. Substitute ethanol for formaldehyde in specimen preservation.
9. Use water-based paints instead of oil-based paints.

Scale Down
Use microscale techniques to reduce or eliminate waste.

Waste Segregation
- Keep wastes segregated. Certain waste mixtures are more expensive to dispose of than others. For example, disposal of a gallon of xylene contaminated by mercury can cost hundreds of times more than that of xylene alone.
- Keep non-hazardous waste out of hazardous waste streams. This includes water in solvents, or paper and plastic in dry waste.

Waste Recovery
- Re-distilling solvents is a way to save the cost of purchasing new solvents. There are many lab-scale stills on the market.

Chemical Neutralization
- Neutralize dilute acids and bases in the lab.
- Deactivate carcinogens.

Good Management
- Maintain an inventory of chemicals in the area and discard any no longer in use. This will also prevent duplicate purchases.
- Label all materials. Unknown materials are expensive to analyze.
- Use waste generation as a criterion in the selection of new equipment.
- Purchase small quantities - The cost of disposing of excess can easily outweigh initial savings.
- Redistribution - Consult your colleagues; someone else may be able to use surplus.
- Train employees in waste management practices.

1.9 Activities That May Generate Hazardous Waste
Many activities at The University of Iowa are likely to generate specific types of waste that may or may not be hazardous. All waste must be evaluated and a determination made as to whether the waste is hazardous or not. The following is a list of various activities and the types of hazardous waste they are likely to generate.

Arts
Paints, solvents, thinners, inks, acids, glazes, pigments, silver, stains, preservatives, photochemicals, metal dust, and heavy metals.

Groundskeeping
Pesticides, herbicides, rodenticides, fertilizers, oil, oil filters, cleaners.

Hospital
Solvents, acids, bases, stains, heavy metals, pharmaceuticals, mercury, gases, carcinogens, batteries, various reagent chemicals.

Housekeeping
Drain cleaners, toilet bowl cleaners, caustics, aerosol cans, cleaning solvents, disinfectants.

Laboratories
Solvents, acids, bases, stains, heavy metals, pharmaceuticals, aerosol cans, mercury, gases, carcinogens, batteries, various reagent chemicals.

Maintenance
Oil, batteries (lead-acid, NiCad, mercury, lithium, etc.), thermostats/thermocouples (containing mercury), degreasers, muriatic acid, parts cleaning solvents, metal dust, water treatment chemicals, fluorescent bulbs, aerosol cans.

Operations and Maintenance
Solvents, paints, solvent and paint soaked rags/towels, paint booth filters, thinners, strippers, drain cleaners, toilet bowl cleaners, aerosol cans, disinfectants, oil, batteries (lead-acid, NiCad, mercury, lithium, etc.), thermostats/thermocouples (containing mercury), degreasers, parts cleaning solvents, water treatment chemicals, pesticides, herbicides, muriatic acid, caustics, rodenticides, grease, cleaners, fluorescent bulbs, PCB, metal dust.

Painting Operations
Solvent and paint soaked rags/towels, paints, stains, preservatives, paint booth filters, thinners/solvents, strippers, aerosol cans.

Printing
Solvents, inks, solvent and ink soaked rags/towels, oil

Vehicle Maintenance
Oil, oil filters, fuel filters, parts cleaning solvent, cleaners, caustics, gasoline, brake fluid, transmissions fluid, paint, batteries.

1.10 Managing Specific Wastes

Acids and Bases
Dilute solutions (10% or less) may be neutralized to pH 7 and sewered. Collect concentrated acids in 2.5 liter concentrated acid bottles for collection by EHS. One-gallon

bottles are unacceptable due to thinner glass that cannot support the high specific gravity of concentrated acids. Keep oxidizing acids separate from other acids.

Acrylamide Gels

EHS will collect acrylamide gels contaminated with toxic materials such as ethidium bromide or any EPA regulated material. Plain acrylamide gel may be disposed of in red tubs with biohazardous waste.

Aerosol Cans

Used or not, aerosol cans of paint, lubricants, insecticides, cleaners and other materials are considered hazardous waste. Apparently non-pressurized aerosol cans may still contain some material. EHS collects all aerosol cans for disposal.

Appliances

Appliances, also known as white goods, are disposed of through UI Surplus. Appliances may not be disposed of in the regular trash. In many cases they contain hazardous materials. Contact UI Surplus to make arrangements for removal.

Art Supplies

Many art supplies contain flammable, corrosive or toxic materials. Dispose of all solvents, solutions, paints, pigments and other unwanted art materials through EHS.

Asbestos

Asbestos containing material is disposed of by Facilities Management (FM) Environmental Services. If you have asbestos, contact the Work Control Center or FM Environmental Services.

Ballasts

EHS disposes of fluorescent light ballasts. Facilities Management (FM) personnel remove ballasts from light fixtures and accumulate them prior to collection by EHS.

Batteries

Batteries such as nickel-cadmium, mercury, silver, lithium, nickel-metal hydride, and lead-acid are hazardous. Examples of these are rechargeable batteries, computer batteries, phone batteries. EPA classifies such batteries as Universal Waste and EHS will collect them for recycling. At this time alkaline flashlight and radio batteries are not hazardous and should be disposed of in the regular trash as there is no avenue for recycling. For more details, refer to the section in this manual that deals with Universal Waste. Please note that EHS will not remove batteries that are inside pieces of equipment; the owner of the equipment must do this prior to pickup by EHS.

Biohazardous Waste

EHS manages infectious, medical, and biohazardous waste disposal. However, in most cases FM custodial staff transport red tubs of biohazardous waste to collection points, usually located in a dock area. For more details, refer to the section in this manual that deals with Biohazardous Waste. Hospital staff should follow UIHC procedures for biohazardous waste disposal.

Biohazard and Chemical Hazard Mixed

Infectious agents should be disinfected with biocide to remove the biohazard. If the biohazard cannot be removed, the container must be labeled as both biohazard and chemical waste and disposed of in the chemical waste stream.

Chemicals

Chemicals in storage past their expiration dates or useful life should be disposed of immediately. EHS accepts all chemicals, used or unused, for disposal.

Cleaning Supplies

Concentrated cleaning chemicals that are no longer useful must not be poured down drains. Contact EHS for disposal.

Computer Equipment and Parts

Computers and electronic equipment, also known as e-waste, is disposed of through UI Surplus. E-waste must not be disposed of in the regular trash because it contains toxic materials such as lead, mercury and silver. Contact UI Surplus to make arrangements for removal.

Controlled Substances

Disposal of controlled substances is the final action necessary to ensure proper management of controlled substances.

EHS has been approved by the DEA to dispose of controlled substances through the application of an approved procedure. Licensed researchers who want to dispose of controlled substances that are mixed with hazardous chemical waste must consult with EHS to ensure compliance with RCRA regulations.

Each licensed researcher is ultimately responsible to ensure controlled substances are properly disposed of and all necessary disposal forms are completed and submitted to the appropriate agency. To dispose of outdated, damaged, or otherwise unusable or unwanted controlled substances, contact EHS at (33)5-8501 (or Bill Murray at (33)5-4624).

The typical EHS procedure for disposal of expired/residual controlled substances (injectable solution) is summarized below:

- The laboratory notifies EHS that it has a controlled substance that needs disposal;
- An EHS representative will visit the lab prior to disposal;
- On the agreed upon date of disposal, EHS will bring a Controlled Substance Disposal Kit and provide directions on how to conduct the disposal;
- Disposal will be conducted by the Registrant or their duly appointed authorized employee and witnessed by an EHS employee;
- Disposal consists of blending an aqueous solution of the controlled substance within a container of kitty litter; and
- EHS will take possession of and dispose of the container of controlled substance/kitty litter blend.

Cytotoxic Drugs

EHS collects bulk cytotoxic and antineoplastic waste for disposal. Nursing and Pharmacy stations are routinely handled have special containers for this purpose. Hospital personnel should follow UIHC procedures for management.

Drug and Pharmaceuticals

Depending on form and type of drug waste, it may be collected by EHS, disposed of through our biohazardous waste vendor, or disposed of through a Reverse Distributor. Hospital personnel should follow UIHC procedures. See above for guidance on controlled substance disposal. Contact EHS for additional information.

Electronic Equipment

Electronic and computer equipment, also known as e-waste, is disposed of through UI Surplus. E-waste must not be disposed of in the regular trash because it contains toxic materials such as lead, mercury and silver. Contact UI Surplus to make arrangements for removal.

Electric Lamps

Sodium lamps, mercury vapor lamps, fluorescent tubes, and other similar items contain mercury vapor and are regulated by EPA as universal waste. They are collected by maintenance personnel as recyclable material. Recycling of Universal Waste – Lamps is managed by General Stores. For more details, refer to the section in this manual that deals with Universal Waste.

Empty Containers

An exception for this is that empty containers that previously held acutely toxic p-listed chemicals must be given to EHS for disposal.

Ethidium Bromide and Ethidium Bromide Gels

Gels and other solid, contaminated materials are collected by EHS for disposal. EHS distributes a container to be used for collection of ethidium bromide gels. Ethidium bromide may be removed from solutions using special filters available from Biochem Stores for that purpose. Filtered solutions may be disposed of down the drain. The filter and other contaminated dry material are collected by EHS for disposal. Solutions that have not been filtered are collected by EHS for disposal.

Expired Date Chemicals

An expiration date is often listed on the container label. Frequently chemicals that are past their expiration date are no longer safe, or have degraded or reacted so that they are no longer useful. If you have chemicals that are in storage past their expiration dates, they should be disposed of immediately. Contact EHS to make arrangements for disposal.

Fluorescent Lamps

Fluorescent lamps and other similar bulbs contain mercury vapor and are regulated by EPA as Universal Waste. They are collected by maintenance personnel for recycling as lamps are changed. Recycling of Universal Waste – Lamps is managed by General Stores. Small lamps from scientific or audiovisual equipment may be accepted by EHS for recycling. For more details, refer to the section in this manual that deals with Universal Waste.

Formaldehyde

All unused formalin and formaldehyde reagents that require disposal must be disposed of through EHS. Spent or used formaldehyde solutions will also be collected by EHS.

Gas Cylinders

Non-returnable empty cylinders and bottles may be disposed of in general waste if the valve stem is removed. For gas cylinders with a Praxair label, contact Praxair at 1-800-283-8348. Lecture bottles and other non-Praxair cylinders must be disposed of through EHS.

Glass

Unbroken glass containers may be disposed of in the regular trash containers located throughout the buildings on campus.

Infectious Waste

EHS manages infectious, medical, and biohazardous waste disposal. However, in most cases FM custodial staff will transport red tubs of biohazardous waste to collection points, usually located in a dock area. For more details, refer to the section in this manual that deals with Biohazardous Waste. Hospital staff should follow UIHC procedures for biohazardous waste disposal.

Laboratory Equipment
Unwanted lab equipment must be free of contamination and then disposed of through UI Surplus.

Lead Shielding
Lead is a toxic hazardous waste. Lead pigs and lead shielding to be discarded must be collected by EHS for disposal.

Medical Waste
EHS manages infectious, medical, and biohazardous waste disposal. However, in most cases FM custodial staff will transport red tubs of biohazardous waste to collection points, usually located in a dock area. For more details, refer to the section in this manual that deals with Biohazardous Waste. Hospital staff should follow UIHC procedures for biohazardous waste disposal.

Mercury and Broken Mercury Thermometers
Free flowing mercury and thermometers with mercury must be packaged in a glass or plastic bottle with a screw top cap and disposed of in the chemical waste stream. Broken thermometers without free flowing mercury and mercury-contaminated debris should be double bagged in plastic bags and placed in a sturdy cardboard box sealed with tape.

Mercury-Containing Equipment
Many common items contain mercury. Some examples are thermometers, manometers, sphygmomanometers or blood pressure cuffs, thermocouples, certain instruments and gauges, and mercury switches. When discarding equipment, always check to see if it contains, or is contaminated by, mercury. Complete a Chemical Waste Pickup Request Form for disposal of all mercury-containing items. For more details, refer to the section in this manual that deals with Universal Waste.

Office Materials
Some common office materials may contain hazardous materials. Some examples are adhesives, paints, aerosols, and cleaning materials. Contact EHS for further information.

Oils
Oils are collected by EHS in glass, metal or high-density plastic bottles that are free of external contamination. Do not mix solvents or other wastes with oils. Depending upon the oil source, the generator may be responsible for having a PCB or heavy metal analysis performed prior to pickup. Oil filters should be punctured and hot drained prior to being disposed of in the regular trash. All used oil container must be marked with the words, "Used Oil."

Oil Contaminated Material

Any material that is used to clean up oil spills and has become contaminated with oil is picked up by EHS for disposal. Collect material in a bucket with lid or a drum. Small amounts of contaminated material may be double bagged and boxed. Seal the containers, label, and submit a Chemical Waste Collection Form for removal.

Oil Filters

Oil filters must be punctured and hot drained prior to disposal. To hot-drain a filter, remove the filter from the engine when the engine is hot. Then keep the filter above 60°F while it drains for 24 hours. Collect the oil that drains from the filter and manage it as used oil. Any oil filters that are not hot drained must be disposed of as hazardous waste. Iowa law prohibits disposal of oil filters in landfills, they must be recycled. Containers of used oil filters must be marked with the words, "Used Oil."

Paint Booth Filters

Paint booth filters contaminated with paint or solvents will be collected by EHS in steel cans or drums.

Paint, Paint Thinner & Paint-Related Material

Paint shops may collect paints and thinners in drums supplied by EHS. Drums must be labeled using EHS's large hazardous waste. Small amounts of thinner may be collected in five-gallon containers. Expired, used or unused paints and solvents must be collected by EHS for disposal.

Paint Rags

Rags contaminated with paint or solvents will be collected by EHS in steel cans, or they may be placed in a sealed bag in a box.

Peroxide Forming Chemicals

Chemicals that form peroxides (Appendix IX) should be dated when received and checked periodically with potassium iodide (KI) paper to detect peroxides. Many peroxide formers have expiration dates printed on the label. Dispose of any peroxide former as soon as it reaches its expiration date if not tested. If peroxides are detected the lab may be required to pay for expensive chemical stabilization prior to disposal. Contact EHS for more information.

Photographic Developing Chemicals

Photographic developing chemicals are collected by EHS for disposal. Many used photochemicals contain silver, a characteristic hazardous waste. EHS generally discourages use of benchtop recovery system, because of the uncertainty of the efficiency of silver

recovery. Without a complete testing program, it is not possible to ensure that silver is not being put down the drain.

Picric Acid

Picric acid is normally wet with greater than 10% water and is safe to handle in this condition. However, picric acid may become shock sensitive and explosive if dried or combined with metals.

- Never store in containers with metal caps.
- Check frequently to insure dampness. Add water if necessary.
- Tighten cap and seal with Parafilm to keep moisture in.
- Notify EHS if dry picric acid is found.
- Contact EHS for disposal of picric acid.

Propane Cylinders

EHS will dispose of all propane cylinders except those intended to be returned to manufacturers or suppliers.

Radioactive and Chemical Waste Mixed

Keep radioisotopes out of chemical waste whenever possible. For mixed waste, label as both chemical and radioactive and dispose of in the radioactive waste stream. Refer to the section of this manual on radioactive waste disposal for more information.

Sharps Contaminated with Chemicals

Always collect sharps in a sharps container, even if contaminated with chemicals. Remove the chemical hazard by evaporation or simple chemical treatment. If not possible, label the sharps container as both sharps and hazardous waste (see Appendix XI for proper management of sharps). Sharps contaminated with trace amounts of chemical may be disposed of as biohazardous waste. Contact EHS for more information.

Silica Gel

Used/spent silica gels often contain trace material that are toxic. Collect spent silica gel for disposal by EHS.

Stench Chemicals

Chemicals that emit a stench (e.g., thiols and sulfur containing compounds) should be disposed of in containers with tight fitting lids. Containers may be double sealed with Parafilm, tape, or overpacked in a slightly larger container, to further restrict odor.

Tollens Reagent
Tollens reagent, or ammoniacal silver nitrate, may form highly explosive fulminate over a short period of time. Avoid this problem by adding dilute nitric acid after use. Dispose of through EHS.

Toner Cartridges
Toner cartridges found in printers, fax machines, and copiers are recyclable. A used cartridge should be returned in the new cartridge box. Recycle used toner cartridges through General Stores.

Trace Contaminated Lab Waste
This includes gloves, gowns, bench paper, etc., that have been contaminated with carcinogens, mutagens, teratogens, heavy metals or other toxic chemicals. Materials from spill cleanups may be included in this category. Sharps, empty or full reagent bottles, and uncontaminated trash should not be packaged with trace contaminated waste. Trace contaminated debris should be double bagged, with each bag sealed, and placed in a sturdy cardboard box, that is sealed with tape and labeled as hazardous waste. Dispose of through EHS.

Unknowns
An unknown is defined as a chemical of unknown identity in an unlabeled container. Federal regulations specifically prohibit transportation, storage, or disposal of wastes of unknown identity. For this reason and for personnel safety, it is important to not create unknowns. Please refer to the section on unknowns in this manual for details. If the identity of the unknown cannot be determined, EHS provides an identification service.

1.11 Emergency Response

Satellite Accumulation Areas (SAA) are required to have a Contingency Plan that describes actions to be taken in response to fires, explosions of unplanned releases of hazardous waste or hazardous waste constituents to air, soil or surface water. EHS has prepared a Contingency Plan for use in SAAs. All staff working with hazardous waste should be familiar with the Contingency Plan and other emergency procedures.

Additional information on waste disposal is available on the EHS Web page.

2.0 Universal Waste

2.1 Introduction

Certain hazardous wastes are regulated by the EPA as universal waste. Universal waste may contain mercury, lead, cadmium, nickel and other hazardous materials. Some examples of universal waste are listed below. The list is not all inclusive. In the State of Iowa, alkaline batteries and incandescent lamps are not considered hazardous or universal waste, and may be thrown away in the regular trash. At this time there is no recycling alternative for alkaline batteries or incandescent bulbs.

2.2 Types of Universal Waste

Lamps	Batteries	Mercury Containing Equipment
Compact fluorescent	Car/Automotive	Barometers
Fluorescent	Hearing aid	Blood pressure cuffs
HID	Lead-acid	Mercury switches
High intensity discharge	Lithium ion	Sphygmomanometers
High pressure sodium	NiCad	Thermostats
Mercury vapor	Nickel-cadmium	Thermometers
Metal halide	Nickel metal hydride	
Neon	Rechargeable	
UV lamps	Small sealed lead-acid	

2.3 Lamps

Containers

- Call General Stores to obtain containers.
- General Stores delivers containers.
- Other containers may be used as long as they are structurally sound and rigid, and can be properly closed so that no lamps can fall out.

Labeling and Marking

- Generator of lamps removes or otherwise defaces all existing container labels attached to empty container.
- Generator of lamps attaches a new University of Iowa “Universal Waste-Lamps” label to the container.
- Mark on the label the date the first lamp is placed in the container.
- Mark on the label the name of the building where the lamps container is stored.
- Prior to disposal mark the label with the final lamp count.

- See section 1.4 of this manual for more information on labels. Contact General Stores or EHS to obtain labels. Labels are also available for printing from the EHS Web site.

Storage

- Lamps must be placed inside containers.
- All containers must be kept closed at all times, except when adding lamps. Use tape to hold box flaps shut to prevent breakage. New lamp boxes should also be taped shut.
- A tally sheet is used to account for the number of lamps in the container.

Disposal

- Containers of lamps must not be stored for longer than 11 months.
- Contact General Stores for pickup not more than 11 months after the date the first lamp is placed in the container, whether the container is full or not.
- General Stores will pick up containers of lamps for disposal.

Broken Lamps

- Clean up broken lamps immediately.
- Place broken lamp, and broken lamp parts into a lamp container.

Contractors

- A contractor maintaining a piece of equipment that uses a universal waste lamp may take the lamp with them for recycling. The University department contracting the work must ensure that the lamp is properly managed by the contractor.
- Contractors performing demolition and construction work are required to follow University of Iowa procedures for containers, labeling, storage and disposal.
- Contractors that remove lamps during building or equipment maintenance and do not intend to recycle the lamps are required to follow University of Iowa procedures for container labeling, storage and disposal.

2.4 Batteries

Containers

- Any structurally sound, rigid container is acceptable.
- Large batteries need not be placed into a container.

Labeling and Marking

- Generator of batteries attaches a University of Iowa "Universal Waste-Battery" label to either the container, or directly on large batteries.
- Mark on the label the date the first battery is placed in the container.
- Mark on the label the name of the building where the battery/battery container is stored.
- See section 1.4 of this manual for more information on labels. Contact EHS to obtain labels. Labels are also available for printing from the EHS Web site.

Storage

- Small batteries must be placed inside containers.
- Containers must be kept closed at all times, except when adding batteries to container.

Disposal

- Containers of batteries must not be stored for longer than 11 months.
- Contact EHS for pickup not more than 11 months after the date the first battery is placed in the container, whether the container is full or not.
- For individual batteries, contact EHS for pickup not more than 11 months after the battery is labeled and dated.
- EHS will pick up batteries/containers of batteries for disposal.

Broken/Leaking Batteries

- Clean up broken/leaking batteries immediately.
- Place into a separate container from non-broken/non-leaking batteries.
- Parts and residues of broken/leaking batteries become hazardous waste.
- Label containers with hazardous waste labels supplied by EHS. Labels are also available for printing from the EHS Web site.
- Contact EHS for disposal.

2.5 Mercury Containing Equipment

Containers

- Containers are selected based on the type and size of equipment and may vary.
- Small items of mercury containing equipment may be placed in a plastic bag, double bagged, and the bags tied closed.
- Bags must then be placed into a structurally sound, rigid container such as a cardboard box.
- Container must be capable of being closed so that no material can fall out.
- Contact EHS for assistance with selection of containers.

Labeling and Marking

- Generator of equipment attaches a University of Iowa "Universal Waste-Mercury Containing Equipment" label to the container.
- Mark on the label the date the first piece of equipment is placed in the container.
- Mark on the label the name of the building where the equipment container is stored.
- See section 1.4 of this manual for more information on labels. Contact EHS to obtain labels. Labels are also available for printing from the EHS Web site.

Storage

- Containers must be kept closed at all times, except when adding pieces of equipment to container.
- When appropriate use secondary containment to prevent spills.

Disposal

- Containers of equipment must not be stored for longer than 11 months.
- Contact EHS for pickup not more than 11 months after the date the first piece of equipment is placed in the container, whether the container is full or not.
- EHS will pick up mercury containing equipment for disposal.

Mercury Spills/Leaking Equipment

- Clean up mercury spills immediately.
- Contact EHS for questions on spill cleanup.
- Place mercury contaminated material into a separate container from non-broken/non-leaking equipment.
- Spill residues are also hazardous waste.
- Label containers with hazardous waste labels supplied by EHS.
- Contact EHS for disposal. Labels are also available for printing from the EHS Web site.

3.0 Radioactive Waste

3.1 Introduction

The University of Iowa generates radioactive wastes as a result of its teaching, research, and patient care activities. The University's Environmental Health & Safety (EHS) manages radioactive isotope use through its Radiation Protection Program, and radioactive waste disposal through its Radiation Waste Management Program. EHS provides technical assistance for generators to comply with regulations and policies.
Radioactive waste disposal is regulated by the Iowa Department of Public Health (IDPH), the Nuclear Regulatory Commission (NRC), and the Environmental Protection Agency (EPA).

EPA regulations apply to "mixed waste," i.e., waste that is both radioactive and hazardous chemical.

3.2 Radioactive Waste Defined

You are required to dispose of all waste that contains or is contaminated with radioactive material as radioactive waste. This means that if a hazardous chemical or biohazardous waste contains or is contaminated with radioactive material, it must be disposed of as radioactive waste.

3.3 EHS Responsibilities

Containers

EHS supplies the following waste container types:

- Dry waste (>90 day half-life)
- Dry waste (<90 day half-life)
- Liquid bottles (1-1/2 gallon)
- LSC Vials
- Bags

Waste Collection

Radioactive waste is collected in the area where it is generated.

Waste Transportation

Radioactive waste is transported by EHS on a specially designed truck. A waste inventory is created as waste is collected and manifested for transportation to storage facilities on the UI Research Campus.

Waste Management and Record Keeping

Each waste item collected by EHS is assigned a serial number, tagged, and tracked in a database. This allows EHS to follow the course of each item through collection, storage, management, and disposal. Waste management methods depend on the waste type and length of the half-life of the radioisotope. Records required by IDPH and EPA are maintained by EHS.

3.4 Generator Responsibilities

General Requirements

The radioactivity in radioactive waste is licensed material, and as such, remains subject to all regulatory requirements. Observe the following guidelines:

- Keep volumes small; do not let radioactive waste accumulate.
- Place only radioactive waste in radioactive waste containers. Mixing non-radioactive and radioactive waste creates unnecessary hazards and significantly increases disposal cost.
- Label all radioactive waste containers.
- Do not leave radioactive waste in unattended areas. Secure all radioactive wastes from unauthorized removal.
- Radioactive waste containing biological, pathogenic, or infectious material must be treated to the maximum extent practicable to reduce potential hazards (disinfect with biocide).
- Keep a record of isotope and activity each time waste is placed in waste containers. This will facilitate completing the radioactive waste tag.
- Obtain training – training programs are available through the EHS Web site.

Containers

Collect radioactive waste in the proper containers. Obtain dry waste, LSC vial, and liquid waste containers from EHS. There is no charge for containers supplied by EHS. Sharps containers may be obtained from Biochem Stores and General Stores.

- Keep radioactive waste containers closed unless adding items or materials.
- Radioactive waste must be stored securely at all times to prevent unauthorized removal.

Tagging

Each time you place radioactive waste in its container, enter the radionuclide and activity (in uCi) on the radioactive waste tag provided by EHS. Keep the waste tag attached to the container at all times.

3.5 Segregating Radioactive Waste

Segregate radioactive waste by waste type and radioactive half-life. Segregation is the responsibility of the generator, and takes place in the work area where the waste is produced.

Segregate by Half-Life

Radioactive waste is separated into two categories based on half-life.

Short Half-Life = less than 90 days, e.g., I^{125}, P^{32}, P^{33}, S^{35}

Long Half-Life = greater than 90 days, e.g., C^{14}, Cl^{36}, Fe^{55}, H^{3}

Segregate by Waste Type

There are nine general types of radioactive waste generated at The University of Iowa:

- Aqueous liquid waste
- Animal carcasses
- Dry Waste
- Liquid scintillation vials
- Mixed waste
- Radioactive sharps
- Source vials
- Sealed sources
- Lead shielding

Aqueous and Mixed Waste

When organic solvents or other hazardous chemical wastes are contaminated with radioactive material it is known as mixed waste. Mixed waste must always be segregated from aqueous liquid waste.

- Secondary containment is required.
- Segregate by half-life and, if possible, by radionuclide.
- Keep waste containers closed at all times unless adding or removing waste.
- Do not mix solvents or other chemically hazardous liquid waste with water.
- Do not put solid material in liquid waste containers.
- Avoid overfilling radioactive waste containers – leave at least 3 inches of headspace.
- Do not mark liquid waste containers supplied by EHS. If labeling is necessary, use tape.
- Prior to pick up by EHS, tightly secure container cap, affix a radioactive label to the container, and place the radioactive waste tag under the bottle handle.

Animal Carcass Waste

Animal carcasses also include animal body parts, excreta, and bedding.

- Double-bag using strong polyethylene bags.
- Package in as small a volume as possible.
- Add coagulants or absorbents to reduce liquids.
- Bags should not be punctured and outer bag must be free from blood.
- Securely close and seal bags with tape. Complete the radioactive waste tag prior to pick up by EHS.
- Larger animals may need to be cut into smaller parts.

Dry Waste

Only paper, plastic, and unbroken glass should be placed in dry waste containers. Do not place liquids, lead, needles, razors, broken glass, or other sharps in dry waste containers.

- EHS supplies containers.
- Segregate by half-life. Orange label = <90 days half-life. Red label = >90 days half life.
- Do not overfill containers. Lid must fit snugly to the top of container.
- Deface/obliterate all radioactive symbols and wording on any items placed into a dry waste container.
- Do not put liquids, lead, or sharps into dry waste containers.
- Do not place items in black or colored bags prior to placing inside a dry waste container.

Prior to pickup by EHS, secure the liner and seal with tape. Complete the radioactive waste tag and affix it to the lid of the radioactive waste container.

Liquid Scintillation Vials Waste

Only LSC vials may be placed in liquid scintillation vial waste containers. Do not place source vials in liquid scintillation vial waste containers.

- Segregate C^{14} and H^{3}LSC vials in one container and place all other radionuclide LSC vials in another.
- Use biodegradable liquid scintillation cocktail, such as Econosafe or Ready Safe, whenever possible.
- Avoid overfilling liquid scintillation vial waste containers. Lid must fit snugly on the top of the container.

Prior to pick up by EHS, complete the radioactive waste tag and affix it to the lid of the waste container.

Radioactive Sharps Waste

Radioactive sharps must be placed only into sharps containers – not dry waste containers.

- Collect only in containers designed to hold sharps. These are available from Biochem Stores or General Stores.
- Affix a radioactive warning label to any sharps container used to dispose of radioactive waste.
- Do not overfill containers.
- Segregate radioactive sharps by half-life.

Prior to pickup by EHS, tape the lid securely to container, and complete the radioactive waste tag and affix to the sharps container.

Source Vials

- Vials containing liquid are not to be placed in radioactive waste containers. Attach a tag directly to the source vial and shield, prior to pickup by EHS.
- Empty vials must have the label and markings obliterated, and must be removed from lead shielding. Dispose of empty vials in the radioactive dry waste.

Sealed Sources

Do not dispose of licensed or generally licensed sealed sources in any EHS radioactive waste container. Sealed sources do not require further packaging if they are not leaking. If a sealed source is leaking, contact the Radiation Protection Section of EHS for assistance.

Lead Shielding

Do not place lead shielding in radioactive waste containers. To prepare shielding for pickup by EHS:

- Remove from outer plastic containers, if applicable.
- Perform a contamination survey.
- Complete and attach a radioactive waste tag.

Do not accumulate large quantities of lead in your lab.

3.6 Requirements for Waste Pickup

EHS will not remove radioactive waste until you have performed the following:

- Checked the outer surface of the waste container for contamination.
- Completed a radioactive waste tag for each container or sealed source.
- Sealed all containers appropriately.
- Completed an online radioactive waste pickup request.

Check for Contamination

- Perform a wipe test of the entire surface of the external container.
- Count the wipe in a scintillation counter or gamma counter.
- If the result is >22 dpm/cm2, decontaminate, re-wipe and count.
- If the result is <22 dpm/cm2 check the “yes” box found on the radioactive waste tag.

Completing a Radioactive Waste Tag

- EHS provides tags for identifying the contents of radioactive waste. You will need to know the identity of all radionuclides and their activity in order to complete the waste tag.
- Dry waste activities are estimated by the user and may be based on the general rule that about 10-20% of the activity used in an experiment ends up as solid waste.
- Liquid waste activities should be determined by counting a sample of the waste in a scintillation counter or gamma counter.

The waste tag must be completed in full and in pencil.

It is only necessary to complete the back of the radioactive waste tag if the waste is a liquid.

- Identify each chemical component and its percentage – this must equal 100%.
- Do not abbreviate chemical names.
- Indicate pH if waste is aqueous.
- If waste is a liquid scintillation cocktail – identify the brand name.

Radioactive Waste Pickup Request

The waste generator must request a waste pickup from EHS. Waste pickup requests are now taken online. Visit the EHS Web site to complete an online radioactive waste pickup request.

What if Your Waste is Not Removed?

If a pickup cannot be completed, EHS will leave a note explaining the reasons. Deficiencies must be corrected and another pickup scheduled.

3.7 Waste Minimization

- Avoid ordering and storing more radioactive material than is actually needed.
- Do not place items that are not radioactive or contaminated in radioactive waste containers.
- Replace xylene and toluene based liquid scintillation cocktail with ones that are biodegradable.

4.0 Biohazardous Waste

4.1 Introduction

The University of Iowa's Biohazardous Waste Management Plan has been prepared in accordance with DOT, EPA, OSHA and State of Iowa regulations. At The University of Iowa, most biohazardous waste is transported off-site for disposal in red polyethylene Rubbermaid containers.

4.2 Training

The objective of training is to familiarize staff and comply with federal and state regulations, and proper management practices for biohazardous waste required at the University of Iowa. Biohazardous waste generated by UI is transported for disposal by a licensed vendor on public roads. The U.S. Department of Transportation regulates transportation of hazardous materials on public roads. Biohazardous waste is a hazardous material, and therefore training is required for all laboratory staff, and other non-

laboratory staff that generate and/or handle biohazardous waste tubs. Training is required initially and every three years thereafter.

4.3 Biohazardous Waste Defined

Biohazardous waste typically includes waste containing pathogens with sufficient virulence and quantity so that exposure to the waste by a susceptible host could result in an infectious disease. The University of Iowa also includes other types of waste from medical areas, patient care, and research as described below.

4.4 Biohazardous Waste Types

1. Cultures, stocks of infectious agents and associated biologicals, including but not limited to:
    - Specimens from medical, pathology and research laboratories
    - Disposable culture dishes
    - Devices used to transfer, inoculate, and mix cultures
    - Wastes from the production of biologicals
    - Discarded live and attenuated vaccines

2. Human blood, blood products, and body fluids.

3. All sharps (contaminated and uncontaminated) such as:
    - Needles and syringes
    - Scalpels, razors and microtome blades
    - Pasteur pipettes
    - Slides and cover slips
    - Shards of contaminated broken glass

4. Animal carcasses, body parts, and bedding from animals exposed to pathogens in research.

5. Other laboratory waste including but not limited to:
    - Specimen containers
    - Disposable gloves, lab coats, masks and aprons
    - Disposable pipettes
    - All cell culture materials
    - All microorganisms constructed using recombinant DNA

6. All materials that have been steam sterilized.

Biohazardous waste contaminated with radioactive materials must be managed as radioactive waste through EHS. Refer to the section on radioactive waste. Biohazardous waste contaminated with chemicals that are EPA hazardous wastes must be disposed of as hazardous waste. Refer to the section on hazardous waste.

4.5 Handling Biohazardous Waste

Waste must be segregated at the point of origin by the generator. Culture plates and vials containing pathogenic organisms must be autoclaved prior to disposal, using autoclavable bags (orange or red). Place in a redbag-lined biohazard container after autoclaving. Do not use the biohazard box's red liner for autoclaving.

Prior to disposal waste must be placed directly into the redbag-lined Rubbermaid transport containers.

Contaminated sharps must be placed in a red sharps container or a Winfield Sharps-tainer.

Animal carcasses, body parts, and bedding from animals exposed to pathogens should be disposed of in accordance with the Office of Animal Resources (OAR) procedures. Call OAR for information at (33)5-7985.

Human tissues and body parts are disposed of in the Anatomy crematory. Call the Deeded Body Program of Anatomy Coordinator at (33)5-7762.

Human blood, blood products and body fluids greater than 500 ml must be solidified with a product such as Isolyzer and placed in a biohazard box (white with a red plastic liner). Amounts less than 500 ml may be disinfected with a bleach solution (1:10 final dilution) and sewered.

4.6 Uncontaminated Waste

- Uncontaminated sharps must be placed in a red sharps container or a Winfield Sharps-tainer.
- Uncontaminated plastics are discarded in the regular trash, or recycled where that option is available.
- Unbroken glass containers may be disposed of in the regular trash containers located throughout the buildings on campus.
- Broken glassware must be managed as sharps.

4.7 Preparing for Pickup

Properly packaged and labeled waste will be removed by Custodians. Place containers in the locally designated area for removal.

In order to comply with Dept. of Transportation shipping regulations the laboratory or staff that generates the biohazardous waste must prepare their waste for disposal as follows:

- All biohazardous waste, including white biohazard boxes and sharps containers, must be placed in a red plastic biowaste tub lined with red bag.
- To avoid puncturing the red bag tub liner, do not overfill tub.
- It is highly recommended that tubs be double-lined as single liners are prone to tears.
- Tie the red bag liner closed using a single "gooseneck" knot (do not use tape or zip ties).
- Attach a fully completed Biohazardous Waste Certification label sticker to the side of the biowaste tub.
- Custodians will not remove biowaste tubs unless a completed Biohazardous Waste Certification label is attached to the tub.

4.8 Frequently Asked Questions:

Where Do I Obtain Biohazard Waste Certification Labels?

- Select departmental offices.
- Biochem Stores.
- Locations on dock areas where red tubs are stored.
- Submit a Waste Label Request Form from the EHS Web page.

Where Do I Obtain Red Plastic Biowaste Tubs?

- Red plastic biowaste tubs are kept in the dock areas of BSB, MEB, BB, Pharmacy, DSB and Chemistry. Large red bags to line the tubs are also available at those locations and must be used for that purpose. For other locations, contact EHS.
- Laboratory staff are responsible for obtaining the above containers, as needed.

Where Do Filled Biowaste Tubs Go? Who Handles Them?

- Laboratory staff should place properly filled/tied/labeled biowaste tubs in the same location as in the past.
- Custodians will transfer the filled tubs displaying a completed Biohazardous Waste Certification label to an area for removal.

What Are the Container Labeling Requirements?

- Laboratory staff must place all biohazardous waste materials in red plastic biowaste tubs, i.e., red bag, biowaste box, sharps container.
- Laboratory staff must complete and attach the Biohazardous Waste Certification label to the side of the biowaste tub, near the handle.
- Custodians will place a bar code on the tubs to identify the building.

4.9 Labeling Instructions

- Complete the Biohazardous Waste Certification label (requires printed name, signature, room, building, and date).
- Remove one-half of the label-backing only.
- Stick the signed and dated label on the side of the tub next to a handle. Custodians will not remove containers without the completed Biohazardous Waste Certification label.

4.10 Ordering Sharps Containers

Containers are available from Biochem Stores, General Stores and Chemistry Stores.

Appendix I - (D Codes)

Maximum Concentrations of Contaminants for Toxicity Characteristic (TCLP)

If waste contains the following heavy metals and/or organic contaminants above the listed regulatory levels, it must be managed as a hazardous waste.

EPA Code	Contaminant	Regulatory Level (mg/L)
D004	Arsenic	05.0
D005	Barium	100.0
D018	Benzene	0.5
D006	Cadmium	1.0
D019	Carbon tetrachloride	0.5
D020	Chlordane	0.03
D021	Chlorobenzene	100.0
D022	Chloroform	6.0
D007	Chromium	5.0
D023	m-Cresol	200.0
D024	o-Cresol	200.0
D025	p-Cresol	200.0
D026	Cresol	200.0
D016	2, 4-D	010.0
D027	1, 4-Dichlorobenzene	7.5
D028	1, 2-Dichloroethane	0.5
D029	1, 1-Dichloroethylene	0.7
D030	2, 4-Dinitrotoluene	0.13
D012	Endrine	0.02
D031	Heptachlor & its epoxide	0.008
D032	Hexachlorobenzene	0.13
D033	Hexachlorobutadiene	0.5
D034	Hexachloroethane	3.0
D008	Lead	5.0
D013	Lindane	0.4
D009	Mercury	0.2
D014	Methoxychlor	10.0
D035	Methyl ethyl ketone	200.0
D036	Nitrobenzene	2.0
D037	Pentachlorophenol	100.0
D038	Pyridine	5.0
D010	Selenium	1.0
D011	Silver	5.0

D039	Tetrachloroethylene	0.7
D015	Toxaphene	0.5
D036	Nitrobenzene	2.0
D040	Trichloroethylene	0.5
D041	2, 4, 5-Trichlorophenol	400.0
D042	2, 4, 6-Trichlorophenol	2.0
D017	2, 4, 5-TP (Silvex)	1.0
D043	Vinyl Chloride	0.2

Appendix II - (P Codes)

Acutely Toxic Hazardous Wastes P-List (Acutely Toxics)					
P023	**107-20-0**	**Acetaldehyde, chloro-**	**P024**	**106-47-8**	**p-Chloroaniline**
P002	591-08-2	Acetamide, N-(aminothioxomethyl)-	**P026**	5344-82-1	1-(o-Chlorophenyl) thiourea
P057	640-19-7	Acetamide, 2-fluoro-	**P027**	542-76-7	3-Chloropropionitrile
P058	62-74-8	Acetic acid, fluoro-, sodium salt	**P029**	544-92-3	Copper cyanide
P002	591-08-2	1-Acetyl-2-thiourea	**P029**	544-92-3	Copper cyanide Cu(CN)
P003	107-02-8	Acrolein	**P030**		Cyanides (soluble cyanide salts), not otherwise specified
P070	116-06-3	Aldicarb	**P031**	460-19-5	Cyanogen
P004	309-00-2	Aldrin	**P033**	506-77-4	Cyanogen chloride
P005	107-18-6	Allyl alcohol	**P033**	506-77-4	Cyanogen chloride (CN)Cl
P006	20859-73-8	Aluminum phosphide (R,T)	**P034**	131-89-5	2-Cyclohexyl-4, 6-dinitrophenol
P007	2763-96-4	5-(Aminomethyl)-3-isoxazolol	**P016**	542-88-1	Dichloromethyl ether
P008	504-24-5	4-Aminopyridine	**P036**	696-28-6	Dichlorophenylarsine
P009	131-74-8	Ammonium pierate (R)	**P048**	51-28-5	2, 4-Dinitrophenol
P119	7803-55-6	Ammonium vandate	**P020**	88-85-7	Dinoseb
P099	506-61-6	Argentate (1-), bis(cyano-C)-, potassium	**P085**	152-16-9	Diphosphoramide, octamethyl-
P010	7778-39-4	Arsenic acid H3As04	**P111**	107-49-3	Diphosphoric acid, tetraethyl ester
P012	1327-53-3	Arsenic trioxide	**P039**	298-04-4	Disulfoton
P038	692-42-2	Arsine, diethyl-	**P049**	541-53-7	Dithiobiuret
P036	696-28-6	Arsonous dichloride, phenyl-	**P050**	115-29-7	Endosulfan
P054	151-56-4	Aziridine	**P088**	145-73-3	Endothall
P067	75-55-8	Aziridine, 2-methyl-	**P051**	72-20-8	Endrin
P013	542-62-1	Barium cyanide	**P051**	72-20-8	Endrin, & metabolites
P024	106-47-8	Benzenamine, 4-chloro-	**P042**	51-43-4	Epinephrine
P028	100-44-7	Benzene, (chloromethyl)-	**P031**	460-19-5	Ethanedinitrile
P042	51-43-4	1, 2-Benzenediol, 4-[1-hydroxy-2-(methylamino) ethyl]-, (R)	**P066**	16752-77-5	Ethanimidothioic acid, N-[[(methylamino) carbonyl] oxyl]-methyl ester
P046	122-09-8	Benzeneethanamine, alpha, alpha-dimethyl-	**P101**	107-12-0	Ethyl cyanide
P014	108-98-5	Benzenethiol	**P054**	151-56-4	Ethyleneimine
P001	81-81-2	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)-, & salts, when present at concentrations greater than 0.3%	**P097**	52-85-7	Famphur
P028	100-44-7	Benzyl chloride	**P056**	7782-41-4	Fluorine
P015	7440-41-7	Beryllium	**P057**	640-19-7	Fluoroacetamide
P017	598-31-2	Bromoacetone	**P058**	62-74-8	Fluoroacetic acid, sodium salt

P018	357-57-3	Brucine	**P065**	628-86-4	Fulminic acid, mercury (2+) salt (R,T)
P045	39196-18-4	2-Butanone, 3, 3-dimethyl-1-(methylthio)-, O-[methyliamino) carbonyl] oxime	**P059**	76-44-8	Heptachlor
P021	592-01-8	Calcium cyanide	**P062**	757-58-4	Hexaethyl tetraphosphate
P021	592-01-8	Calcium cyanide Ca(CN)2	**P116**	79-19-6	Hydrazinecarbothioamide
P022	75-15-0	Carbon disulfide	**P068**	60-34-4	Hydrazine, methyl-
P095	75-44-5	Carbon dichloride	**P063**	74-90-8	Hydrocyanic acid
P023	107-20-0	Chloroacetaldehyde	**P063**	74-90-8	Hydrogen cyanide
			P096	7803-51-2	Hydrogen phosphide
P060	465-73-6	Isodrin	**P110**	78-00-2	Plumbane, tetraethyl-
P007	2763-96-4	3(2H)-Isoxazolone, 5-(aminomethyl)-	**P067**	75-55-8	1, 2-Propylenimine
P092	62-38-4	Mercury, (acetato-O) phenyl-	**P102**	107-19-7	2-Propyn-1-o1
P065	628-86-4	Mercury fulminate (R,T)	**P008**	504-24-5	4-Pyridinamine
P082	62-75-9	Methanamine, N-methyl-N-nitroso-	**P075**	54-11-5	Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-, & salts
P064	624-83-9	Methane, isocyanato-	**P114**	12039-52-0	Selenious acid, dithallium (1+) salt
P068	60-34-4	Methyl hydrazine	**P103**	630-10-4	Selenourea
P064	624-83-9	Methyl isocyanate	**P104**	506-64-9	Silver cyanide
P069	75-86-5	2-Methyllactonitrile	**P104**	506-64-9	Silver cyanide Ag (CN)
P071	298-00-0	Methyl parathion	**P105**	26628-22-8	Sodium azide
P072	86-88-4	alpha-Naphthylthriourea	**P106**	143-33-9	Sodium cyanide
P073	13463-39-3	Nickel carbonyl	**P106**	143-33-9	Sodium cyanide Na (CN)
P073	13463-39-3	Nickel carbonyl Ni(C0)4, (T-4)-	**P107**	1314-96-1	Strontium sulfide SrS
P074	557-19-7	Nickel cyanide	**P108**	57-24-9	Strychnidin-10-one, & salts
P074	557-19-7	Nickel cynaide Ni(CN)2	**P018**	357-57-3	Strychnidin-10-one, 2, 3-dimethoxy-
P075	54-11-5	Nicotine, & salts	**P108**	57-24-9	Strychnine, & salts
P076	10102-43-9	Nitric oxide	**P115**	7446-18-6	Sulfuric acid, dithallium (1+) salt
P077	100-01-6	p-Nitroaniline	**P109**	3689-24-5	Tetraethyldithiopyrophosphate
P078	10102-44-0	Nitrogen dioxide	**P110**	78-00-2	Tetraethyl lead
P076	10102-43-9	Nitrogen oxide NO	**P111**	107-49-3	Tetraethyl pyrophosphate
P078	10102-44-0	Nitrogen oxide NO2	**P112**	509-14-8	Tetranitromethane (R)
P081	55-63-0	Nitroglycerine (R)	**P062**	757-58-4	Tetraphosphoric acid, hexaethyl ester
P082	62-75-9	N-Nitrosodimethylamine	**P113**	1314-32-5	Thallic oxide
P084	4549-40-0	N-Nitrosomethylvinylamine	**P113**	1314-32-5	Thallium oxide T1203
P085	152-16-9	Octamethylpyrophosphoramide	**P114**	12039-52-0	Thallium (I) selenite
P087	20816-12-0	Osmium oxide Os04, (T-4)-	**P115**	7446-18-6	Thallium (I) sulfate
P087	20816-12-0	Osmium tetroxide	**P109**	3689-24-5	Thiodiphosphoric acid, tetraethyl ester

P088	145-73-3	7-Oxabicyclo[2.2.1] heptane-2, 3-dicarboxylic acid	**P045**	39196-18-4	Thiofanox
P089	56-38-2	Parathion	**P049**	541-53-7	Thioimidodicarbonic diamide [(H2N)C(S)]2NH
P034	131-89-5	Phenol, 2-cyclohexyl-4, 6-dinitro-	**P014**	108-98-5	Thiophenol
P020	88-85-7	Phenol, 2-(1-methylpropyl)-4, 6-dinitro-	**P116**	79-19-6	Thiosemicarbazide
P009	131-74-8	Phenol, 2, 4, 6-trinitro-, ammonium salt (R)	**P026**	5344-82-1	Thiourea, (2-chlorophenyl)-
P092	62-38-4	Phenyimercury acetate	**P123**	8001-35-2	Toxaphene
P093	103-85-5	Phenylthiourea	**P118**	75-70-7	Trichloromethanethiol
P094	298-02-2	Phorate	**P119**	7803-55-6	Vanadic acid, ammonium salt
P095	75-44-5	Phosgene	**P120**	1314-62-1	Vanadium oxide V205
P096	7803-51-2	Phosphine	**P120**	1314-62-1	Vanadium pentoxide
P041	311-45-5	Phosphoric acid, diethyl 4-nitrophenyl ester	**P084**	4549-40-0	Vinylamine, N-methyl-N-nitroso-
P039	298-04-4	Phosphorodithioic acid, O, O-diethyl S-[2-(ethylthio) ethyl] ester	**P001**	81-81-2	Warfarin, & salts, when present at concentrations greater than 0.3%
P094	298-02-2	Phosphorodithioic acid, O, O-diethyl S-[(ethylthio) methyl] ester	**P121**	557-21-1	Zinc cyanide
P044	60-51-5	Phosphorodithioic acid, O, O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester	**P121**	557-21-1	Zinc cyanide Zn(CN)2
P043	55-91-4	Phosphorofluoridic acid, bis (1-methylethyl) ester			
P089	56-38-2	Phosphorothioic acid, O, O-diethyl O-(4-nitrophenyl) ester			
P040	297-97-2	Phosphorothioic acid, O, O-diethyl O-pyrazinyl ester			
P097	52-85-7	Phosphorothioic acid, O-[4-(dimethylamino) sulfonyl] phenyl]O, O-dimethyl ester			
P071	298-00-0	Phosphorothioic acid, O, O, -dimethyl O-(4-nitrophenyl) ester			

Appendix III - (U Codes)

Toxic Hazardous Wastes U-List (Toxics)			
Code	**Description**	**Code**	**Description**
U001	Acetaldehyde (I)	**U033**	Carbon oxyfluoride (R,T)
U001	Ethanol (I)	**U033**	Carbonic difluoride
U002	2-Propanone (I)	**U034**	Acetaldehyde, trichloro-
U002	Acetone (I)	**U034**	Chloral
U003	Acetonitrile (I,T)	**U035**	Benzenebutanoic acid, 4-[bis(2-chloroethyl)amino]-
U004	Acetophenone	**U035**	Chlorambucil
U004	Ethanone, 1-phenyl-	**U036**	4,7-Methano-1H-indene,1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-
U005	2-Acetylaminofluorene	**U036**	Chlordane, alpha & gamma isomers
U005	Acetamide, N-9H-fluoren-2-yl	**U037**	Benzene, chloro-
U006	Acetyl chloride (C,R,T)	**U037**	Chlorobenzene
U007	2-Propenamide	**U038**	Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl-alpha-hydroxy-, ethyl ester
U007	Acrylamide	**U038**	Chlorobenzilate
U008	2-Propenoic acid (I)	**U039**	p-Chloro-m-cresol
U008	Acrylic acid (I)	**U039**	Phenol, 4-chloro-3-methyl
U009	2-Propenenitrile	**U041**	Epichlorohydrin
U009	Acrylonitrile	**U041**	Oxirane, (chloromethyl)-
U010	Azirino [2',3':3,4]pyrrolo[1,2-a]indole-4,7-dione,6-amino-8-[[(aminocarbonyl)oxy]methyl]-1,1a,2,8,8a,8b-hexahydro-8a-methoxy-5-methyl-,[1aS-(1aalpha,8beta,8aalpha,8balpha)]-	**U042**	Ethene, (2-chloroethoxy)-
U010	Mitomycin C	**U043**	Ethene, chloro-
U011	1H-1,2,4-Triazol-3-amine	**U043**	Vinyl chloride
U011	Amitrole	**U044**	Chloroform
U012	Aniline (I,T)	**U044**	Methane, trichloro-
U012	Benzenamine (I,T)	**U045**	Methane, chloro- (I,T)
U014	Auramine	**U045**	Methyl chloride (I,T)
U014	Benzenamine, 4,4'-carbonimidoylbis[N,N-dimethyl-	**U046**	Chloromethyl methyl ether
U015	Azaserine	**U046**	Methane, chloromethoxy-
U015	L-Serine, diazoacetate (ester)	**U047**	beta-Chloronaphthalene
U016	Benz[c]acridine	**U047**	Naphthalene, 2-chloro-

U017	Benzal chloride	**U048**	o-Chlorophenol
U021	Benzidine	**U048**	Phenol, 2-chloro-
U022	Benzo[a]pyrene	**U049**	4-Chloro-o-toluidine, hydrochloride
U023	Benzene, (trichloromethyl)-	**U049**	Benzenamine, 4-chloro-2-methyl-, hydrochloride
U023	Benzotrichloride (C,R,T)	**U050**	Chrysene
U024	Dichloromethoxy ethane	**U051**	Creosote
U024	Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro-	**U052**	Cresol (Cresylic acid)
U025	Dichloroethyl ether	**U052**	Phenol, methyl-
U025	Ethane, 1,1'-oxybis[2-chloro-	**U053**	2-Butenal
U026	Chlornaphazin	**U053**	Crotonaldehyde
U026	Naphthalenamine, N,N'-bis(2-chloroethyl)-	**U055**	Benzene, (1-methylethyl)-(I)
U027	Dichloroisopropyl ether	**U055**	Cumene (I)
U027	Propane, 2,2'-oxybis[2-chloro-	**U056**	Benzene, hexahydro- (I)
U028	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester	**U056**	Cyclohexane (I)
U028	Diethylhexyl phthalate	**U057**	Cyclohexanone (I)
U029	Methane, bromo-	**U058**	2H-1,3,2-Oxazaphosphorin-2-amine,N,N-bis(2-chloroethyl)tetrahydro-,2-oxide
U029	Methyl bromide	**U058**	Cyclophosphamide
U030	4-Bromophenyl phenyl ether	**U059**	5,12-Naphthacenedione, 8-acetyl-10-[(3-amino-2,3,6-trideoxy)-alpha-L-lyxo-hexopyranosyl)oxy]-7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-,(8S-cis)-
U030	Benzene, 1-bromo-4-phenoxy-	**U059**	Daunomycin
U031	1-Butanol (I)	**U060**	Benzene, 1,1'-(2,2-dichloroethylidene)bis[4-chloro-
U031	n-Butyl alcohol (I)	**U060**	DDD
U032	Calcium chromate	**U061**	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-chloro-
U032	Chromic acid H2CrO4, calcium salt	**U061**	DDT
Code	**Description**	**Code**	**Description**
U062	Carbamothioic acid, bis(1-methlyethyl)-, S-(2,3-dichloro-2-propenyl) ester	**U093**	Benzenamine, N,N-dimethyl-4-(phenylazo)-
U062	Diallate	**U093**	p-Dimethylaminoazobenzene
U063	Dibenz[a,h]anthracene	**U094**	7,12-Dimethylbenz[a]anthracene
U064	Benzo[rst]pentaphene	**U094**	Benz[a]anthracene, 7,12-dimethyl-
U064	Dibenzo[a,i]pyrene	**U095**	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-
U066	1,2-Dibromo-3-chloropropane	**U095**	3,3'-Dimethylbenzidine
U066	Propane, 1,2-dibromo-3-chloro	**U096**	alpha, alpha-Dimethylbenzylhydroperoxide (R)
U067	Ethane, 1,2-dibromo-	**U096**	Hydroperoxide, 1-methyl-1-phenylethyl (R)

U067	Ethylene dibromide	**U097**	Carbamic chloride, dimethyl-
U068	Methane, dibromo-	**U097**	Dimethylcarbamoyl chloride
U068	Methylene bromide	**U098**	1,1-Dimethylhydrazine
U069	1,2-Benzenedicarboxylic acid, dibutyl ester	**U098**	Hydrazine, 1,1-dimethyl
U069	Dibutyl phthalate	**U099**	1,2-Dimethylhydrazine
U070	Benzene, 1,2-dichloro-	**U099**	Hydrazine, 1,1-dimethyl-
U070	o-Dichlorobenzene	**U101**	2,4-Dimethylphenol
U071	Benzene, 1,3-dichloro-	**U101**	Phenol, 2,4-dimethyl-
U071	m-Dichlorobenzene	**U102**	1,2-Benzenedicarboxylic acid, dimethyl ester
U072	Benzene, 1,4-dichloro-	**U102**	Dimethyl phthalate
U072	p-Dichlorobenzene	**U103**	Dimethyl sulfate
U073	[1,1'-Biphenyl]-4,4'-diamine,3,3'-dichloro-	**U103**	Sulfuric acid, dimethyl ester
U073	3,3'-Dichlorobenzidine	**U105**	2,4-Dinitrotoluene
U074	1,4-Dichloro-2-butene (I,T)	**U105**	Benzene, 1- methyl-2,4-dinitro-
U074	2-Butene, 1,4-dichloro- (I,T)	**U106**	2,6-Dinitrotoluene
U075	Dichlorodifluoromethane	**U106**	Benzene, 2-methyl-1,3-dinitro-
U075	Methane, dichlorodifluoro-	**U107**	1,2-Benzenedicarboxylic acid, dioctyl ester
U076	Ethane, 1,1-dichloro-	**U107**	Di-n-octyl phthalate
U076	Ethylidene dichloride	**U108**	1,4-Diethyleneoxide
U077	Ethane, 1,2- dichloro-	**U108**	1,4-Dioxane
U077	Ethylene dichloride	**U109**	1,2-Diphenylhydrazine
U078	1,1-Dichloroethylene	**U109**	Hydrazine, 1,2-diphenyl-
U078	Ethene, 1,1-dichloro-	**U110**	1-Propanimine, N-propyl-(I)
U079	1,2-Dichloroethylene	**U110**	Dipropylamine (I)
U079	Ethene, 1,2-dichloro-, (E)-	**U111**	1-Propanamine, N-nitroso-N-propyl-
U080	Methane, dichloro-	**U111**	Di-n-propylnitrosamine
U080	Methylene chloride	**U112**	Acetic acid ethyl ester (I)
U081	2,4-Dichlorophenol	**U112**	Ethyl acetate (I)
U081	Phenol, 2,4-dichloro-	**U113**	2-Propenoic acid, ethyl ester (I)
U082	2,6-Dichlorophenol	**U113**	Ethyl acrylate (I)
U082	Phenol, 2,6-dichloro-	**U114**	Carbamodithioic acid, 1,2-ethanediy[bis-, salts & esters
U083	Propane,1 2-dichloro	**U114**	Ethylenebisdithiocarbamic acid, salts & esters
U083	Propylene dichloride	**U115**	Ethylene oxide (I,T)
U084	1,3-Dichloropropene	**U115**	Oxirane (I,T)
U084	1-Propene, 1,3-ichloro-	**U116**	2-Imidazolidnethione
U085	1,2:3,4-Diepoxybutane (I,T)	**U116**	Ethylenethiourea
U085	2,2'-Bioxirane	**U117**	Ethane, 1,1'-oxybis-(I)
U086	Hydrazine, 1,2-diethyl-	**U117**	Ethyl ether (I)
U086	N,N'-Diethylhydrazine	**U118**	2-Propenoic acid, 2-methyl-, ethyl ester
U087	O,O-Diethyl S-methyl dithiophosphate	**U118**	Ethyl methacrylate

U087	Phosphorodithioic acid, O,O-diethyl S-methyl ester	**U119**	Methanesulfonic acid, ethyl ester
U088	1,2-Bezenedicarboxylic acid, diethyl ester	**U119**	Ethyl methanesulfonate
U088	Diethyl phthalate	**U120**	Fluoranthene
U089	Diethylstilbesterol	**U121**	Methane, trichlorofluoro-
U089	Phenol, 4,4'-(1,2-diethyl-1,2-ethenediyl)bis, (E)-	**U121**	Trichloromonofluoromethane
U090	1,3-Benzodioxole, 5-proply-	**U122**	Formaldehyde
U090	Dihydrosafrole	**U123**	Formic acid (C,T)
U091	[1,1'-Biphenyl]-4,4'-diamine,3,3'-dimethoxy	**U124**	Furan (I)
U091	3,3'-Dimethoxybenzidine	**U124**	Furfuran (I)
U092	Dimethylamine (I)	**U125**	2-Furancarboxaldehyde (I)
U092	Methanamine, N-methyl- (I)		
Code	**Description**	**Code**	**Description**
U125	Fufural (I)	**U156**	Methyl chlorocarbonate (I,T)
U126	Glycidylaldehyde	**U157**	3-Methylchloanthrene
U126	Oxiranecarboxyaldehyde	**U157**	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-
U127	Benzene, hexachloro-	**U158**	4,4'-Methylenebis(2-chloroaniline)
U127	Hexachlorobenzene	**U158**	Benzeneamine, 4,4'-methylenebis[2-chloro-
U128	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	**U159**	2-Butanone (I,T)
U128	Hexachlorobutadiene	**U159**	Methyl ethyl ketone (MEK) (I,T)
U129	Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1alpha,2alpha,3beta,4alpha,5alpha,6beta)-	**U160**	2-Butanone, peroxide (R,T)
U129	Lindane	**U160**	Methyl ethyl ketone peroxide (R,T)
U130	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-	**U161**	4-Methyl-2-pentanone (I)
U130	Hexachlorocyclopentadiene	**U161**	Methyl isobutyl ketone (I)
U131	Ethane, hexachloro-	**U161**	Pentanol, 4-methyl-
U131	Hexachloroethane	**U162**	2-Propenoic acid, 2-methyl-, methyl ester (I,T)
U132	Hexachlorophene	**U162**	Methyl methacrylate (I,T)
U132	Phenol, 2,2'-methylenebis[3,4,6-trichloro-	**U163**	Guanidine, N-methyl-N'-nitro-N-nitroso
U133	Hydrazine (R,T)	**U163**	MNNG
U134	Hydrofluoric acid (C,T)	**U164**	4(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-
U134	Hydrogen fluoride (C,T)	**U164**	Methylthiouracil
U135	Hydrogen sulfide	**U165**	Naphthalene
U135	Hydrogen sulfide H2S	**U166**	1,4-Naphthalenedione
U136	Arsenic acid, dimethyl-	**U166**	1,4-Naphthoquinone
U136	Cacodylic acid	**U167**	1-Naphthalenamine
U137	Indeno[1,2,3-cd]pyrene	**U167**	alpha-Naphthylamine
U138	Methane, iodo-	**U168**	2-Naphthalenamine
U138	Methyl iodide	**U168**	beta-Naphthylamine

U140	1-Propanol, 2-methyl- (I,T)	**U169**	Benzene, nitro-
U140	Isobutyl alcohol (I,T)	**U169**	Nitrobenzene (I,T)
U141	1,3-Benzodioxole, 5-(1-propenyl)-	**U170**	p-Nitrophenol
U141	Isosafrole	**U170**	Phenol, 4-nitro-
U142	1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2-one, 1,1a,3,3a,4,5,5,5a,5b,6-decachlorooctahydro-	**U171**	2-Nitropropane (I,T)
U142	Ketone	**U171**	Propane, 2-nitro- (I,T)
U143	2-Butenoic acid, 2-methyl-, 7-[[2,3-dihydroxy-2-(1-methoxyethyl)-3-methyl-1-oxobutoxy]methyl]-2,3,5,7a-tetrahydro-1H-pyrrolizin-1-yl-ester, [1S-[1alpha(Z), 7(2S*,3R*),7aalpha]]-	**U172**	1-Butanamine, N-butyl-N-nitroso-
U143	Lasiocarpine	**U172**	N-Nitrosodi-n-butylamine
U144	Acetic acid, lead(2+) salt	**U173**	Ethanol, 2,2'-(nitrosoimino)bis-
U144	Lead acetate	**U173**	N-Nitrosodiethanolamine
U145	Lead phospheate	**U174**	Ethanamine, N-ethyl-N-nitroso-
U145	Phosphoric acid, lead(2+) salt (2:3)	**U174**	N-Nitrosodiethylamine
U146	Lead subacetate	**U176**	N-Nitroso-N-ethylurea
U146	Lead, bis(acetato-O)tetrahydroxytri-	**U176**	Urea, N-ethyl-N-nitroso-
U147	2,5-Furnandione	**U177**	N-Nitroso-N-methylurea
U147	Maleic anhydride	**U177**	Urea, N-methyl-N-nitroso-
U148	3,6-Pyridazinedione, 1,2-dihydro-	**U178**	Carbamic acid, methylnitroso-, ethyl ester
U148	Maleic hydrazide	**U178**	N-Nitroso-N-methylurethane
U149	Malononitrile	**U179**	N-Nitropiperidine
U149	Propanedinitrile	**U179**	Piperidine, 1-nitroso-
U150	L-Phenylalanine, 4-[bis(2-chloroethyl)amino]-	**U180**	N-Nitrosopyrrolidine
U150	Melaphalan	**U180**	Pyrrolidine, 1-nitroso-
U151	Mercury	**U181**	5-Nitro-o-toluidine
U152	2-Propenenitrile, 2-methyl- (I,T)	**U181**	Benzenamine, 2-methyl-5-nitro
U152	Methacrylonitrile, (I,T)	**U182**	1,3,5-Trioxane, 2,4,-trimethyl-
U153	Methanethiol (I,T)	**U182**	Paraldehyde
U153	Thiomethanol (I,T)	**U183**	Benzene, pentachloro-
U154	Methanol (I)	**U183**	Pentachlorobezene
U154	Methyl alcohol (I)	**U184**	Ethane, pentachloro-
U155	1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)-	**U184**	Pentachloroethane
U155	Methapyrilene	**U185**	Benzene, pentachloronitro-
U156	Carbonochloridic acid, methyl ester (I,T)	**U185**	Pentachloronitrobenzene (PCNB)
U186	1,3-Pentadiene (I)	**U217**	Nitric acid, thallium(1+) salt
U186	1-Methylbutadiene (I)	**U217**	Thallium(I) nitrate
U187	Acetamide, N-(4-ethoxyphenyl)-	**U218**	Ethanethioamide
U187	Phenacetin	**U218**	Thioacetamide
U188	Phenol	**U219**	Thiourea

U189	Phosphorus sulfide (R)	**U220**	Benzene, methyl-
U189	Sulfur phosphide (R)	**U220**	Toluene
U190	1,3-Isobenzofurandione	**U221**	Benzenediamine, ar-methyl-
U190	Phthalic anhydride	**U221**	Toluenediamine
U191	2-Picoline	**U222**	Benzenamine, 2-methyl-, hydrochloride
U191	Pyridine, 2-methyl-	**U222**	o-Toluidine hydrochloride
U192	Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynl)-	**U223**	Benzene, 1,3-diisocyanatomethyl- (R,T)
U192	Pronamide	**U223**	Toluene diisocyanate (R,T)
U193	1,2-Oxathiolane, 2,2-dioxide	**U225**	Bromoform
U193	1,3-Propane sultone	**U225**	Methane, tribromo-
U194	1-Propanamine (I,T)	**U226**	Ethane, 1,1,1-trichloro-
U194	n-Propylamine (I,T)	**U226**	Methyl chloroform
U196	Pyradine	**U227**	1,1,2-Trichloroethane
U197	2,5-Cyclohexadiene-1,4-dione	**U227**	Ethane, 1,1,2-trichloro-
U197	p-Benzoquinone	**U228**	Ethene, trichloro-
U200	Reserpine	**U228**	Trichloroethylene
U200	Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-trimethoxybenoyl)oxy]-,methyl ester, (3beta,16beta,17alpha,18beta,20alpha)-	**U234**	1,3,5-Trinitrobenzene (R,T)
U201	1,3-Benzenediol	**U234**	Benzene, 1,3,5-trinitro
U201	Resorcinol	**U235**	1-Propanol, 2,3-dibromo-, phosphate (3:1)
U202	1,2-Benzisothiazol-3(2H)-one, 1,1-dioxide, & salts	**U235**	Tris(2,3,-dibromopropyl) phosphate
U202	Saccharin, & salts	**U236**	2,7-Naphthalenedisulfonic acid,3,3'-[(3,3'-dimethyl[1,1'-biphenyl]-4,4'-diyl)bix(azo)bis[5-amino-4-hydroxy]-, tetrasodium salt
U203	1,3-Benzodioxole, 5-(2-propenyl)-	**U236**	Trypan blue
U203	Safrole	**U237**	2,4-(1H,3H)-Pyrimidinedione, 5-[bis(2-chloroethyl)amino]-
U204	Selenious acid	**U237**	Uracil mustard
U204	Selenium dioxide	**U238**	Carbamic acid, ethyl ester
U205	Selenium sulfide	**U238**	Ethyl carbamate (urethane)
U205	Selenium sulfide SeS2 (R,T)	**U239**	Benzene, dimethyl- (I,T)
U206	D-Glucose, 2-deoxy-2-[[(methylnitrosoamino)-carbonyl]amino]-	**U239**	Xylene (I)
U206	Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-,D-	**U240**	2,4-D, salts & esters
U206	Streptozotocin	**U240**	Acetic acid, (2,4-dichlorophenoxy)-, salts & esters
U207	1,2,4,5-Tetrachlorobenzene	**U243**	1-Propene, 1,1,2,3,3,3-hexachloro-
U207	Benzene, 1,2,4,5-tetrachloro-	**U243**	Hexachloropropene

U208	1,1,1,2-Tetrachloroethane	**U244**	Thioperoxydicarbonic diamide [(H2N)C(S)]2S2, tetramethyl-
U208	Ethane, 1,1,1,2-tetrachloro-	**U244**	Thiram
U209	1,1,2,2-Tetrachloroethane	**U246**	Cyanogen bromide (CN)Br
U209	Ethane, 1,1,2,2-tetrachloro-	**U247**	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-methoxy-
U210	Ethene, tetrachloro-	**U247**	Methoxychlor
U210	Tetrachloroethylene	**U248**	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenyl-butyl)-, & salts, when present at concentrations of 0.3% or less
U211	Carbon tetrachloride	**U249**	Zinc phosphide Zn3P2, when present at concentrations of 10% or less
U211	Methane, tetrachloro-	**U328**	Benzenamine, 2-methyl-
U213	Furan, tetrahydro- (I)	**U328**	o-Toluidine
U213	Tetrahydrofuran (I)	**U353**	Benzenamine, 4-methyl-
U214	Acetic acid, thallium(1+) salt	**U353**	p-Toluidine
U214	Thallium(I) acetate	**U359**	Ethanol, 2-ethoxy-
U215	Carbonic acid, dithallium(1+) salt	**U359**	Ethylene glycol monoethyl ether
U215	Thallium(I) carbonate		
U216	Thallium chloride Tlcl		
U216	Thallium(I) chloride		

Appendix IV - (F Codes)

Non-Specific Source Hazardous Wastes F-List (Spent Solvents)		
F001	The following spent halogenated solvents used in degreasing: Tetrachloroethylene, trichloroethylene, methylene chloride, 1, 1, 1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	(T)
F002	The following spent halogenated solvents: Tetrachloroethylene, methylene chloride, trichloroethylene, 1, 1, 1-trichloroethane, chlorobenzene, 1, 1, 2-trichloro-1, 2, 2-trifluoroethane, ortho-dichlorobenzene, trichlorofluoromethane, and 1, 1, 2-trichloroethane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those listed in F001, F004, or F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	
F003	The following spent non-halogenated solvents: Xylene,	(T)

	acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents; and all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, and, a total of ten percent or more (by volume) of one or more of those solvents listed in F001, F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	(I)*
F004	The following spent non-halogenated solvents: Cresois and cresylic acid, and Nitrobenzene; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	(T)
F005	The following spent non-halogenated solvents: Toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxy-ethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, or F004; and still bottoms from the recovery of	(I,T)

	these spent solvents and spent solvent mixtures.	
F006	Wastewater treatment sludges from electroplating operations except from the following processes: (1) Sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and 96) chemical etching and milling of aluminum.	(T)
F007	Spent cyanide plating bath solutions from electroplating operations	(R,T)
F008	Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process.	(R,T)
F009	Spent stripping and cleaning bath solution from electroplating operations where cyanides are used in the process.	(R,T)
F010	Quenching bath residues from oil baths from metal heat treating operations where cyanides are used in the process.	(R,T)
F011	Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations.	(R,T)
F012	Quenching wastewater treatment sludges from metal heat treating operations where cyanides are used in the process.	(T)
F019	Wastewater treatment sludges from the chemical conversion coating of aluminum except from zirconium phosphating in	(T)

	aluminum can wash-ing when such phosphating is an exclusive conversion coating process.	
F020	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- or tetrachlorophenol, or of intermediates used to produce their pesticide derivatives. (This listing does not include wastes from the production of hexachlorophene from highly purified 2, 4, 5-trichiorophenol.).	(H)
F021	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of pentachlorophenol, or of intermediates used to produce its derivatives.	(H)
F022	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzenes under alkaline conditions.	(H)
F023	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the production of materials on equipment previously used for the production or manufacturing use (as a reactant, chemical intermediate, or component in	(H)

	a formulating process) of tri- and tetrachlorophenois. (This listing does not include wastes from equipment used only for the production or use of Hexachlorophene from highly purified 2, 4, 5-trichlorophenol.).	
F024	Process wastes, including but not limited to, distillation residues, heavy ends, tars, and reactor clean-out wastes, from the production of certain chlorinated aliphatic hydrocarbons by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution. (This listing does not include wastewaters, wastewater treatment sludges, spent catalysts, and wastes listed in § 261.31 or § 261.32.).	(T)
F025	Condensed light ends, spent filters and filter aids, and spent desiccant wastes from the production of certain chlorinated aliphatic hydrocarbons, by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution.	(T)
F026	Wastes 9except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the manufacturing use (as a	(H)

	reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzene under alkaline conditions.	
F027	Discarded unused formulations containing tri-, tetra-, or pentachlorophenol or discarded unused formulations containing compounds derived from these chlorophenols. (This listing does not include formulations containing Hexachlorophene synthesized from prepurified 2, 4, 5-trichlorophenol as the sole component.).	(H)
F028	Residues resulting from the incineration of thermal treatment of soil contaminated with EPA Hazardous Waste Nos. F020, F021, F022, F023, F026, and F027.	(T)
F032[1]	Wastewaters, process residuals, preservative drippage, and spent formulations from wood preserving processes generated at plants that currently use or have previously used chlorophenolic formulations (except potentially cross-contaminated wastes that have had the F032 waste code deleted in accordance with § 261.35 of this chapter and where the generator does not resume or initiate use of chlorophenolic formulations). This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol. (NOTE: The listing of wastewaters that have not come into contact with process contaminants is stayed administratively. The listing for	(T)

	plants that have previously used chlorophenolic formulations is administratively stayed whenever these wastes are covered by the F034 or F035 listings. These stays will remain in effect until further administrative action is taken.).	
F034[1]	Wastewaters, process residuals, preservative drippage, and spent formulations from wood preserving process generated at plants that use creosote formulations. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol. (NOTE: The listing of wastewaters that have not come into contact with process contaminants is stayed administratively. The stay will remain in effect until further administrative action is taken.).	(T)
F035[1]	Wastewaters, process residuals, preservative drippage, and spent formulations from wood preserving process generated at plants that use inorganic preservatives containing arsenic or chromium. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol. (NOTE: The listing of wastewaters that have not come into contact with process contaminants is stayed administratively. The stay will remain in effect until further administrative action is taken.).	(T)
F037	Petroleum refinery primary oil/water/solids separation sludge - Any sludge generated	(T)

	from the gravitational separation of oil/water/solids during the storage or treatment of process wastewaters and oily cooling wastewaters from petroleum refineries. Such sludges include, but are not limited to, those generated in: oil/water/solids separators; tanks and impoundments; ditches and other conveyances; sumps; and stormwater units receiving dry weather fow. Sludge generated in stormwater units that do not receive dry weather flow, sludges generated from non-contact once-through cooling waters segregated for treatment from other process or oily cooling waters, sludges generated in aggressive biological treatment units as defined in § 261.31(b)(2) including sludges generated in one or more additional units after wastewaters have been treated in aggressive biological treatment units) and K051 wastes are not included in this listing.	
F038	Petroleum refinery secondary (emulsified) oil/water/solids separation sludge - Any sludge and/or float generated from the physical and/or chemical separation of oil/water/solids in process wastewaters and oily cooling wastewaters from petroleum refineries. Such wastes include, but are not limited to, all sludges and floats generated in: induced air flotation (IAF) units, tanks and impoundments, and all sludges generated in DAF units. Sludges generated in stormwater units that do not receive dry weather	(T)

	flow, sludges generated from non-contact once-through cooling waters segregated for treatment from other process or oily cooling waters, sludges and floats generated in aggressive biological treatment units as defined in § 261.31(b)(2) (including sludges and floats generated in one or more additional units) and F037, K048, and K051 wastes are not included in this listing.	
F039	Leachate (liquids that have percolated through land disposed wastes) resulting from the disposal of more than one restricted waste classified as hazardous under subpart D of this part. (Leachate resulting from the disposal of more than one restricted waste classified as hazardous under subpart D of this part. (Leachate resulting from the disposal of one or more of the following EPA Hazardous Wastes and no other Hazardous Wastes retains its EPA Hazardous Waste Number(s): F020, F021, F022, F026, F027, and/or F028.).	(T)

*(I,T) should be used to specify mixtures containing ignitable and toxic constituents.

Appendix V - (K Codes)

Specific Source Hazardous Wastes	
Code	**Description**
K001	Bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol.
K002	Wastewater treatment sludge from the production of chrome yellow and orange pigments.
K003	Wastewater treatment sludge from the production of molybdate orange pigments.
K004	Wastewater treatment sludge from the production of zinc yellow pigments
K005	Wastewater treatment sludge from the production of chrome green pigments.
K006	Wastewater treatment sludge from the production of chrome oxide green pigment (anhydrous and hydrated).
K007	Wastewater treatment sludge from the production of iron blue pigments.
K008	Oven residue from the production of chrome oxide green pigments.
K009	Distillation bottoms from the production of acetaldehyde from ethylene.
K010	Distillation side cuts from the production of acetaldehyde from ethylene.
K011	Bottom stream from the wastewater stripper in the production of acrylonitrile.
K013	Bottom streams from the actonitrile column in the production of acrylonitrile.
K014	Bottoms from the acetonitrile purification column in the production of acrylonitrile.
K015	Still bottoms from the distillation of benzyl chloride.
K016	Heavy ends or distillation residues from the production of carbon tetrachloride.
K017	Heavy ends (still bottoms) from the purification column in the production of epichlorohydrin.
K018	Heavy ends from the fractionation column in ethyl chloride production.
K019	Heavy ends from the distillation of ethylene dichloride in ethylene dichloride production.
K020	Heavy ends from the distillation of vinyl chloride in vinyl chloride monomer production.

K021	Aqueous spent antimony catalyst waste from fluoromethanes production.
K022	Distillation bottom tars from the production of phenol/acetate from cumene.
K023	Distillation light ends from the production of phthatlic anhydride from naphthalene.
K024	Distillation bottoms from the production of phthalic anhydride from naphthalene.
K025	Distillation bottoms from the production of nitrobenzene by the nitration of benzene.
K026	Stripping still tails from the production of methyl ethlyl pyridines.
K027	Centrifuge and distillation residues from toluene diisocyanate production.
K028	Spent catalyst from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane.
K029	Waste from the product steam stripper in the production of 1,1,1-trichloroethane.
K030	Column bottoms or heavy ends from the combined production of trichloroethylene and perchloroethylene.
K031	By-product salts generated in the production of MSMA and cacodylic acid.
K032	Wastewater treatment sludge from the production of chlordane.
K033	Wastewater and scrub water from the chlorination of cyclopentadiene in the production of chlordane.
K034	Filter solids from the filtration of hexachlorocyclopentadiene in the production of chlordane.
K035	Wastewater treatment sludges generated in the production of creosote.
K036	Still bottoms from toulene reclamation distillation in the production of disulfoton.
K037	Wastewater treatment sludges from the production of disulfoton.
K038	Wastewater from the washing and stripping of phorate production.
K039	Filter cake from the filtration of diethylphosphorodithioic acid in the produciton of phorate.
K040	Wastewater treatment sludge from the production of phorate.
K041	Wastewater treatment sludge from the production of toxaphene.

K042	Heavy ends or distillation residues from the distillation of tetrachlorobenzene in the production of 2,4,5-T.
K043	2,6-dichlorophenol waste from the production of 2,4-D.
K044	Wastewater treatment sludges from the manufacturing and processing of explosives.
K045	Spent carbon from the treatment of wastewater containing explosives.
K046	Wastewater treatment sludges from the manufacturing, formulation, and loading of lead-based initiating compounds.
K047	Pink/red water from TNT operations.
K048	Dissolved air flotation (DAF) float from the petroleum refining industry.
K049	Slop oil emulsion solids from the petroleum refining industry.
K050	Heat exchanger bundle cleaning sludge from the petroleum refining industry.
K051	API seperator sludge from the petroleum refining industry.
K052	Tank bottoms (leaded) from the petroleum refining industry.
K060	Ammonia still lime sludge from coking operations.
K061	Emission control dust/sludge from the primary production of steel in electric furnaces.
K062	Spent pickle liquor generated by steel finishing operations of facilities within the iron and steel industry (SIC Codes 331 and 332).
K064	Acid plant blowdown slurry/sludge resulting from the thickening of blowdown slurry from primary copper production.
K065	Surface impoundment solids contained in and dredged from surface impoundments at primary lead smelting facilities.
K066	Sludge from treatment of process wastewater and/or acid plant blowdown from primary zinc production.
K071	Brine purification muds from the mercury cell process in chlorine production, in which separately prepurified brine is not used.
K073	Chlorinated hydrocarbon waste from the purification step of the diaphragm cell process using graphite anodes in chlorine production.
K083	Distillation bottoms from aniline production.

K084	Wastewater treatment sludges generated during the production of veterinary pharmaceuticals from arsenic or oragano-arsenic compounds.
K085	Distillation or fractionation column bottoms from the production of chlorobenzenes.
K086	Solvent washes and sludges, caustic washes and sludges, or water washes and sludges from cleaning tubs and equipment use in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead.
K087	Decanter tank tar sludge from coking operations.
K088	Spent potliners from primary aluminum reduction.
K090	Emission control dust or sludge from ferrochromiumsilicon production.
K091	Emission control dust or sludge from ferrochromium production.
K093	Distillation light ends from the production of phthalic anhydride from ortho-xylene.
K094	Distillation bottoms from the production of phthalic anhydride from ortho-xylene.
K095	Distillation bottoms from the production of 1,1,1-trichloroethane.
K096	Heavy ends from the heavy ends column from the production of 1,1,1-trichloroethane.
K097	Vacuum stripper discharge from the chlordane chlorinator in the production of chlordane.
K098	Untreated process wastewater from the production of toxaphene.
K099	Untreated wastewater from the production of 2,4-D.
K100	Waste leaching solution from acid leaching of emisison control dust/sludge from secondary lead smelting.
K101	Distillation tar residues from the distillation of aniline-based compounds in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.
K102	Residue from the use of activated carbon for decolorization in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.
K103	Process residues from aniline extraction from the production of aniline.
K104	Combined wastewater streams generated from nitrobenzene/aniline production.

K105	Separated aqueous stream from the reactor product washing step in the production of cholorbenzenes.
K106	Wastewater treatment sludge from the mercury cell process in chlorine production.
K107	Column bottoms from product separation from the production of 1,1-dimethylhydrazine (UDMH) from carboxylic acid hydrazines.
K018	Condensed column overheads from product separion and condensed reactor vent gases from the production of 1,1-dimethylhydrazine (UDMH) from carboxylic acid hydrazides.
K109	Spent filter cartridges from product purification from the production of 1,1-dimethylhydrazine (UDMH) for carboxylic acid hydrazides.
K110	Condensed column overheads from intermediate separation from the production of 1,1-dimethylhydrazine (UDMH) from carboxylic acid hydrazides.
K111	Product washwaters from the production of dinitrotoluene via nitration of toluene.
K112	Reaction by-product water from the drying column in the production of toluenediamine via hydrogenation of dinitrotoluene.
K113	Condensed liquid light ends from purification of toluenediamine in production of toluenediamine via hydrogenation of dinitrotoluene.
K114	Vicinals from the purification of toluenediamine in production of toluenediamine via hydrogenation of dinitrotoluene.
K115	Heavy ends from purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.
K116	Organic condensate from the solvent recovery column in the production of toluene diisocynate via phosgenation of toluenediamine.
K117	Wastewater from the reactor vent gas scrubber in the production of ethylene dibromide via bromination of ethene.
K118	Spent absorbent solids from purification of ethylene dibromide in the production of ethylene dibromide via brominationof ethene.
K123	Process wastewater (including supernates, filtrates, and washwaters) from the production of ethylenebisdithiocarbamic acid and its salt.
K124	Reactor vent scrubber water from the production of ethylenebisdithiocarbamic acid and its salt.

K125	Filtration, evaporation, and centrifugation solids from the production of ethylenebisdithiocarbamic acid and its salts.
K126	Baghouse dust and floor sweepings in miling and packaging operations from production or formulation of ethylenebisdithiocarbamic acid and its salts.
K131	Wastewater from the reactor and spent sulfuric acid from the acid dryer from the production of methyl bromide.
K132	Spent absorbent and wastewater separator solids from the production of methyl bromide.
K136	Still bottoms from the purification of ethylene dibromide in the production of ethylene dibromide via bromination of ethene.

Appendix VI (Water Reactive Chemicals)

Some chemicals react with water and produce excessive heat, and flammable or toxic gases. Store under conditions that prevent contact with water. Some examples are listed below.

Acid anhydrides, e.g., acetic anhydride
Acid halides, inorganic, e.g., phosphoryl chloride, sulfuryl chloride
Acid halides, organic, e.g., acetyl chloride
Alkali metals
Alkali metal amides
Alkali metal hydrides
Anhydrous metal halides, e.g., aluminum trichloride
Calcium carbide
Grignard reagents
Metal alkyls
Non-metal halides, e.g., boron trifluoride, phosphorous trichloride
Phosphorous pentoxide
Sodium dithionite

Appendix VII (Pyrophoric Chemicals)

Some chemicals react with air and ignite spontaneously. Pyrophorics should be stored in a tight container in an inert atmosphere. Some common examples are listed below.

Activated zinc
Butyl lithium
Diethyl zinc
Phosphorous
Raney nickel
Trimethyl aluminum

Appendix VIII (Explosive/Shock Sensitive Chemicals)

Many common laboratory chemicals have the potential for producing a violent explosion when subjected to friction or shock (shock means being struck, vibrated, or agitated). Some examples of shock sensitive chemicals are listed below.

acetylides	fu
aluminum ophorite explosive	g
amatol	g
ammonal	h
ammonium nitrate	
ammonium perchlorate	m
ammonium picrate	m
ammonium salt lattice	n
butyl tetryl	n
calcium nitrate	n
copper acetylide	n
cyanuric triazide	n
cyclotrimethylenetrinitramine	n
dinitroethyleneurea	n
dinitroglycerine	n
dinitrophenol	n
dinitrophenolates	n
dinitrophenyl hydrazine	o
dinitrotoluene	o
dipicryl sulfone	o
dipicrylamine	p
erythritol tetranitrate	p
fulminate of mercury	p
fulminate of silver	p
fulminating gold	p
fulminating mercury	p

Appendix IX (Peroxide-Forming Chemicals)

Some chemicals react with oxygen to produce potentially unstable chemicals. These chemicals are classified as peroxide formers. Some examples are listed below.

Acrylic acid	4'Ethoxyacetophenone
Allyl ether	p-Ethoxybenzaldehyde
Allyl ethyl ether	o-Ethoxybenzoic acid
Allyl phenyl ether	2-(2-Ethoxyethoxy)ethanol
p-Anisaldehyde	2-(2-Ethoxyethoxy)ethyl acetate
m-Anisaldehyde	p-Ethoxyphenol
m-Anisyl alcohol	Ethylenebis(2-oxyethyl acetate)
Azoxydianisole	Ethyl ether
Benzoin methyl	p-Formylphenoxyaceticacid
ether	Furan
Benzyl ether	p-Hexyloxybenzaldehyde
1,2-Bis(2-chloroethoxy)ethane(pract)	(p-Hydroxyphenoxy)acetic acid
Bis(2-ethoxyethyl)adipate	Isoeugenol
Bis(2-ethoxy ethyl)ether	Isopentyl ether
Bis(2-ethoxy ethyl)sebacate	Isophorane
Bis(2-methoxyethoxy)ethane(pract)	Isoprene
Bis(2-methoxyethyl)ether	Isopropyl ether
Bis(pentyloxy)azoxybenzene	Ligroine
p-Bromoanisole	Methofuran
2-Bromoethyl ethyl ether	Methoxyacetic acid
2-Bromoethyl methyl ether	p-Methoxybenzylamine
2-Butoxyethanol	2-Methoxyethanol
2-(butoxyethoxy)ethyl acetate(pract)	2-(2-Methoxyethoxy)ethanol
t-Butyl ethyl ether	2-Methoxyethyl acetate
t-Butyl methyl ether	2-Methoxyethylamine
cyclooctene	1-Methoxynaphthalene
Decahydronaphthalene	4-Methoxy-2-nitroaniline
1,2-Dichloroethyl ethyl ether	m-Methoxyphenol
2,4-Dichlorophenoxyacetic acid	Methoxyphenylacetic acid
Diethoxymethane	o-Methoxyphenyl isocyanate
2,2-Diethoxypropane	3-Methoxypropionitrile
Diethyl ethoxymethylene malonate	o-Methoxypropionitrile
2,3-Dihydro2,5dimethoxyfuran(pract)	o-Nitrophenyl phenylether
Diisobutylene(pract)	2,5-Norbornadiene
2,5-Dimethoxyaniline(pract)	4,4'-Oxydiphenol
3,4-Dimethoxybenzaldehyde	p-Pentyloxyaniline
3,3'-Dimethoxy benzidine	p-Pentyloxybenzaldehyde
2,4-Dimethoxybenzoic acid	p-Pentyloxybenzoylchloride
4,4-Dimethoxy-2-butanone	Phenoxyacetic acid
1,2-Dimethoxyethane	Phenoxyacetyl chloride

Dimethoxymethane	m-(m-Phenoxyphenoxy)phenol
2,2-Dimethoxypropane	Propylether
2,5-Dimethoxytoluene	Styrene
p-Dioxane	Tetraethylene glycol
1,3-Dioxolane	Tetraethyleneglycolmonomethylether
1,2-Epoxy-3-isopropoxypropane	Trimethoxybenzaldehyde
	Trimethoxypropene
	Vinyl acetate

Appendix X (Examples of Potentially Incompatible Waste)

Reference: 40 CFR, Part 264, July 1, 1991.

Many hazardous wastes, when mixed with other waste or materials, can produce effects that are harmful to human health and the environment, such as: (1) heat or pressure, (2) fire or explosion, (3) violent reaction, (4) toxic dusts, mists, fumes, or gases, or (5) flammable fumes or gases.

Below are examples of potentially incompatible wastes, waste components, and materials, along with the harmful consequences that result from mixing materials in one group with materials in another group. The list is intended as a guide to indicate the need for special precautions when managing these potentially incompatible waste materials or components. This list is not intended to be exhaustive.

The generator must adequately analyze wastes to avoid creating uncontrolled substances or reactions of the type listed below, whether they are listed below or not.

It is possible for potentially incompatible wastes to be mixed in a way that precludes a reaction (e.g., adding acid to water rather than water to acid), or that neutralizes them (e.g., a strong acid mixed with a strong base), or that controls substances produced (e.g., by generating flammable gases in a closed tank equipped so that ignition cannot occur, and burning the gases in an incinerator). When in doubt, contact EHS for clarification.

In the lists on the next page, the mixing of a Group A material with a Group B material may have the consequence as noted.

Group 1-A	Group 1-B
Acetylene sludge Alkaline caustic liquids Alkaline cleaner Alkaline corrosive liquids Alkaline corrosive battery fluid Caustic wastewater Lime sludge and other corrosive alkalies Lime wastewater Lime and water Spent caustic	Acid sludge Acid and water Battery acid Chemical cleaners Electrolyte, acid Etching acid liquid or solvent Pickling

	liquor and other corrosive acids Spent acid Spent mixed acid Spent sulfuric acid *Potential consequences: Heat generation; violent reaction.*

Group 2-A	**Group 2-B**
Aluminum Beryllium Calcium Lithium Magnesium Potassium Sodium Zinc powder Other reactive metals and metal hydrides	Any waste in Group 1-A or 1-B *Potential consequences: Fire or explosion; generation of flammable hydrogen gas.*
Group 3-A	**Group 3-B**
Alcohols Water	Any

	concentrated waste in Groups 1-A or 1-B Calciu m Lithiu m Metal hydrid es Potass iu m SO 2Cl 2,, SO Cl2, PC l3, CH 3 SiCl 3 Ot her wat er rea ctiv e wa

	ste *Potential consequences: Fire, explosion, or heat generation; generation of flammable gases*
Group 4-A	**Group 4-B**
Alcohols Aldehydes Halogenated hydrocarbons Nitrated hydrocarbons Unsaturated hydrocarbons Other reactive organic compounds and solvents	Concentrated Group 1-A or 1-B waste

	s Gr ou p 2-A wa ste s *Pot enti al con seq uen ces: Fire , exp losi on or viol ent rea ctio n*
Group 5-A	**Gr ou p 5-B**
Spent cyanide and sulfide solutions	Gr ou p 1-B wa ste s *Pot enti al con seq uen ces: Ge ner atio*

	n of toxic hydrogen cyanide or hydrogen sulfide gas

Appendix XI (Sharps Management Chart)

The University of Iowa, Environmental Health & Safety

All Sharps must be segregated from other waste. Sharps include contaminated or uncontaminated broken glassware, needles, syringes, scalpel blades, microtome blades, Pasteur pipettes, and razor blades. Special containers must be used, such as the Winfield Sharps-tainers, in accordance with the type of contamination and needs of the area.

Management of Sharps Contaminated by a Single Hazard Group

Type of Contamination	Required Container	Required Labeling	Location	Removal by
Uncontaminated				
Glass and/or plastic ware (unbroken or broken)	None required. May use a rigid container.	None	Place with regular trash	Custodians
Other uncontaminated sharps	Winfield Sharps-tainer or other red sharps container. Handle as biohazardous waste. . Place in lined large red tub.	Biohazard symbol and the word biohazard	Designated area for bio-waste tubs.	Custodians
Biohazardous only				
Infectious agents/materials, blood, blood products and tissues, recombinant DNA	Winfield Sharps-tainer or other red sharps container. . Place in lined large red tub.	Biohazard symbol	Designated area for bio-waste tubs.	Custodians
Radioactive only				
<90 day half life	Winfield Sharps-tainer or other red sharps container	Radioactive <90 day half life	With other Rad Waste	EHS

>90 day half life	Winfield Sharps-tainer or other red sharps container	Radioactive >90 day half life	With other Rad Waste	EHS
Chemical Hazard only				
Chemical (EPA hazardous waste) sharps, except chemotherapy waste	Winfield Sharps-tainers	Hazardous Waste labels	With other Chemical Waste	EHS
Chemical (Non-EPA hazardous), except chemotherapy waste	Winfield Sharps-tainer or other red sharps container. Place in lined large red tub.	Biohazard symbol	Designated area for bio-waste tubs.	Custodians
Chemotherapy Waste	White bucket with lid	Hazardous Waste labels and lists	Observe UIHC policy	EHS

Management of Sharps that have Mixed Hazards

Types of Contamination	Management Methods
Radioactive and Biohazardous	Disinfect with biocide, e.g., bleach, to remove biohazard, then dispose of as radioactive sharps.
Chemical (EPA hazardous waste) and Biohazardous	Disinfect with biocide to remove biohazard, then dispose of as chemical sharps.
Chemical (Non-EPA hazardous) and biohazardous	Dispose of as biohazardous.
Chemical and Radioactive	Package separately in sharps container suitable for long-term storage. Label with radioactive waste label and include chemical waste information on back of label. Place package with radioactive waste for removal by EHS.
Chemical, Radioactive and Biohazardous	Disinfect with biocide. See options above for sharps with chemical and radioactive hazards.