

GUIDE TO MANAGING LABORATORY CHEMICAL WASTE



**VANDERBILT
UNIVERSITY**

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IDENTIFYING HAZARDOUS WASTES IN YOUR LABORATORY

Lab occupants should treat all waste chemical solids, liquids, or containerized gases as hazardous wastes unless a specific chemical waste has been confirmed to be a non-hazardous waste. A laboratory chemical becomes a “waste” when you no longer intend to use it, regardless of whether it has been used or contaminated.

Please note that the terms “lab occupant” means any VU faculty, staff, postdoc, student or long-term non-VU person such as an intern or visitor using hazardous materials in the lab and “chemical” includes items containing chemicals such as sharps, ethidium bromide gels, paints, solvents, degreasers, glues, varnishes, and disinfectants in addition to stock chemicals and chemical solutions used in laboratory processes. Also, spilled chemicals and absorbent materials used to clean the spill should be disposed of as hazardous waste.

Hazardous wastes are defined by the [United States Environmental Protection Agency \(USEPA\)](#) as waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment. The [Resource Conservation and Recovery Act \(RCRA\)](#) gives EPA the authority to control hazardous waste. Hazardous wastes are required to be managed from “cradle to grave.” This includes the generation, transportation, treatment, storage and disposal of hazardous wastes.

The [Tennessee Department of Environment and Conservation](#) defines “hazardous waste” as a waste, or combination of wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible illness or incapacitating reversible illness or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

CHARACTERISTIC HAZARDOUS WASTES

Waste solids, liquids, or containerized gases that exhibit any of the following characteristics are defined as characteristic hazardous wastes: 1) Ignitability; 2) Corrosivity; 3) Reactivity; or 4) Toxicity.

LISTED HAZARDOUS WASTES

The USEPA has predetermined that certain wastes are hazardous, and these hazardous wastes have been incorporated into published lists.

- Acute Hazardous Wastes (P-Listed Wastes): Certain hazardous wastes are considered to be acutely toxic to human health and the environment and are defined as “acute hazardous wastes.”
- U-Listed Hazardous Wastes: U-listed hazardous wastes are pure and commercial grade formulations of specific unused chemicals that are considered wastes. Unused chemicals may be considered wastes because they are no longer needed, expired, spilled, or off specification.

- F-Listed Hazardous Wastes: F-listed hazardous wastes are non-specific source wastes that are generated by certain processes. Processes that generate F-listed hazardous wastes include solvents used in degreasing operations, wood preservation chemicals, and electroplating and other metal finishing processes. F-listed hazardous wastes are not likely to be found in a laboratory.
- K-Listed Hazardous Wastes: K-listed hazardous wastes are source-specific wastes that are generated by specific industries such as iron and steel production facilities. K-listed hazardous wastes are not likely to be found in a laboratory.

Listed hazardous waste can be found [here](#).

STORING HAZARDOUS WASTES IN YOUR LABORATORY

Hazardous Waste Storage Quick Facts:


- Store hazardous waste in **sealed**, compatible containers.
- Hazardous waste containers must be kept closed at all times except to add waste.
- Label hazardous waste containers with EHSS chemical waste tags as soon as waste accumulation begins.
- Store hazardous wastes within secondary containment.
- Segregate incompatible hazardous wastes.
- Never accumulate more than 55 gallons of hazardous waste or one quart of acute hazardous waste.

HAZARDOUS WASTE CONTAINERS

Hazardous chemical waste containers must be:

- made of materials that are compatible with the waste.
- in good condition and substantial enough to hold the waste (i.e. bags should not be used to hold liquid waste, etc).
- free of any leaks or residue on the outside of the container.
- not intended for biohazardous or radiological wastes unless the generated waste is a mixed waste.

Improperly packaged waste will be refused by EHSS. EHSS maintains a supply of acceptable liners and containers for packaging hazardous wastes to assist the labs with compliance that can be requested through [EHS Assist](#). EHSS has made available a quick reference sign for managing hazardous waste available online and included below.

**VANDERBILT
UNIVERSITY****Hazardous Chemical Waste
Accumulation Area**

Steps for Hazardous Waste Removal

- Containerize all waste in a sealed, compatible container.
- Label all waste containers with chemical waste tags provided by EHS as soon as waste accumulation begins.
- Request collection or order additional waste tags or carboys via EHS Assist or by scanning the QR code below.
 - ehsa.vanderbilt.edu


Hazardous Waste Storage

- Store all hazardous chemical wastes within secondary containment.
- Segregate incompatible wastes (e.g., acids from bases and organics from oxidizers).
- Keep waste containers closed when waste is not being added.
- Clean up spills when they happen or contact EHS for assistance.

NEVER

- Never leave waste containers unlabeled.
- Never dispose of chemicals in sink or trash.
- Never use evaporation or dilution of chemicals as a disposal method.
- Never accumulate more than 55 gallons of hazardous waste.
- Never accumulate more than 1 quart of acute hazardous waste. (P- listed hazardous wastes in *Guide for Managing Lab Chemical Waste*).

Scan here to
initiate waste
pick up.



For more information
Please visit the VU EHS Website at
www.vanderbilt.edu/facilities/ehs/ or
email ehs@vanderbilt.edu.

**For large spills or emergencies, call
VUPS at 615-421-1911**

For information on broken glass, please see the broken glass boxes guidance available [here](#).

For more information on sharps, please see the [Chemical Sharps Disposal](#) guidance document.

LABELING HAZARDOUS WASTE CONTAINERS

Hazardous waste containers must be labeled with hazardous chemical waste tags as soon as the container is used to collect hazardous waste, regardless of whether the container is full. If a container is being used to collect hazardous waste intermittently, the tag should be filled out immediately upon use of the container and must be edited as more waste is added.

TDEC requires the following information on each tag:

- Exact contents of the container, including percentages and water content.
- All potential hazards and characteristics related to the contents.
- Name of the PI.
- Department.
- Building location and room number.
- Collection date (entered by EHSS personnel *ONLY*).

Note: Hazard characteristics for each chemical are available on the Safety Data Sheet or in the inventory listing available through EHS Assist.

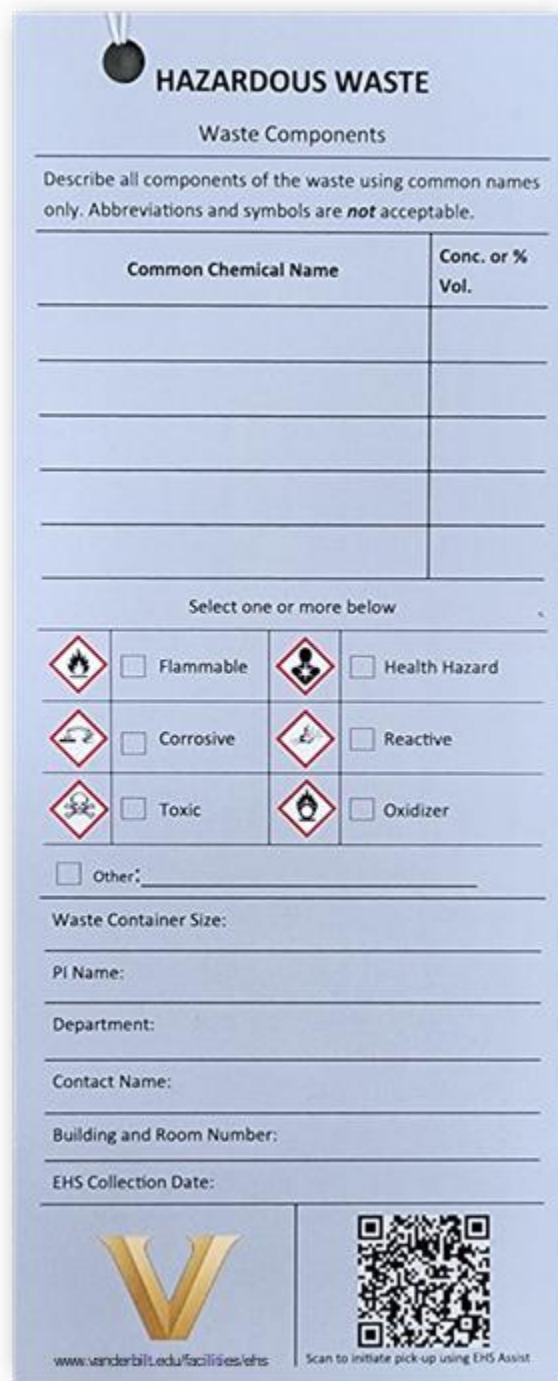
A separate tag must be attached to or accompany each individual hazardous waste container.

Old labels that do not accurately describe the contents of the waste

container (i.e., the original label for a toluene bottle now being use

to store waste xylene) must be defaced to the extent that the old name, characteristics, and pictograms are not legible, and the relevant information is clear.

For chemicals being disposed of in their original container, the original labeling is adequate if the labeling is legible and accurate.









HAZARDOUS WASTE

Waste Components

Describe all components of the waste using common names only. Abbreviations and symbols are **not** acceptable.

Common Chemical Name	Conc. or % Vol.

Select one or more below

	<input type="checkbox"/> Flammable		<input type="checkbox"/> Health Hazard
	<input type="checkbox"/> Corrosive		<input type="checkbox"/> Reactive
	<input type="checkbox"/> Toxic		<input type="checkbox"/> Oxidizer
<input type="checkbox"/> Other: _____			

Waste Container Size: _____


PI Name: _____


Department: _____

Contact Name: _____

Building and Room Number: _____

EHS Collection Date: _____

 www.vanderbilt.edu/facilities/ehs

 Scan to initiate pick-up using EHS Assist

SEALING HAZARDOUS WASTE CONTAINERS

[USEPA](#) and TDEC consider a container closed when all openings or lids are properly and securely affixed to the container, *except* when wastes are being added or removed.

- Containers should be sealed with a screw-type lid or other appropriate device to prevent leakage or spillage. Plastic wrap, aluminum foil, and other make-shift lids are unacceptable.
- Funnel systems must have the capability to be closed, even during a spill event.
 - EHSS maintains a supply of compliant funnels which seal the container upon closing and extra lids to assist labs with compliance. Supply requests can be submitted through [EHS Assist](#).
- Containers used to collect waste from a continuous process (i.e., drainage from a process collected with tubing inserted into a bottle) must be sealed using rubber stoppers with tubing inserts or other appropriate means to prevent evaporation of volatile waste or spillage into the laboratory area.

MIXING HAZARDOUS WASTES

- Hazardous wastes should be kept separate whenever possible.
- Mixing a hazardous waste with a non-hazardous waste increases the volume and cost of hazardous waste for disposal.
- Mixing hazardous wastes with other hazardous wastes can also increase disposal costs due to differences in disposal options for certain hazardous wastes.
 - Halogenated solvents such as methylene chloride and chloroform are costlier to dispose of than nonhalogenated solvents such as hexane and xylene; therefore, halogenated solvent wastes should be kept separate from non-halogenated solvent wastes.

HAZARDOUS WASTE CONTAINER STORAGE

A container holding hazardous waste must **ALWAYS** be closed during storage, except when it is necessary to add or remove waste and must be stored with secondary containment so that spills cannot reach sink, hood, or floor drains. Laboratories that store hazardous waste are required to:

- Designate a specific portion of your laboratory as a hazardous waste storage area.
 - Laboratories with multiple rooms may designate one hazardous waste accumulation area for all rooms only if hazardous waste will not have to be transported in or across a public hallway or through any area that is not controlled by the lab.
- Segregate incompatible hazardous wastes to prevent reaction.
 - Segregation methods include storing in separate cabinets, storing in separate hoods, or storing in separate secondary containment containers such as 5-gallon buckets or tubs.
 - Please refer to your laboratory's Chemical Hygiene Plan or the EHS website for [EHS guidelines](#) on segregating chemicals by hazard class.

HAZARDOUS WASTE STORAGE LIMITS

Laboratories should minimize the storage of hazardous wastes as much as possible and CANNOT store more than 55 gallons of hazardous waste or one quart of acute hazardous waste (P-listed hazardous wastes) at one time. Waste collection should be scheduled at a frequency that prevents exceeding these limits. If an excess occurs, immediately submit a collection request form to EHSS by using the waste collection function of [EHS Assist](#).

Hazardous waste must be stored:

- in a manner to minimize the risk of a spill.
- with secondary containment to contain any accidental leakage or spills.
- segregated by compatibility.

Based on the laboratory's rate of generation of hazardous waste, storage capacity, and quantity limits described above, a determination regarding the amount of hazardous waste that will be accumulated in storage needs to be made prior to having it collected by EHSS.

DISPOSING OF HAZARDOUS WASTE

Hazardous Waste Collection Quick Facts:

- Utilize the Hazardous Waste Collection Program to dispose of all your hazardous waste, FREE of charge.
- Submit the waste collection request in [EHS Assist](#) as soon as your hazardous waste is ready for pickup.
- Submit a request for additional waste supplies (containers, tags, funnels, etc.) through [EHS Assist](#).
- Never evaporate chemicals as a disposal method.
- Triple rinse empty containers that held acute hazardous waste prior to disposal as regular trash.
- Deface chemical or hazardous waste labels from empty chemical containers and remove cap prior to disposal as regular trash.
- Ensure that lab occupants are trained on proper waste handling and disposal procedures.

HAZARDOUS WASTE COLLECTION PROGRAM

EHSS has implemented a Hazardous Waste Collection Program to collect hazardous waste directly from your laboratory.

- You must utilize the Hazardous Waste Collection Program to dispose of all hazardous waste generated by your laboratory.
- There is NO CHARGE for using the Hazardous Waste Collection Program.
- Hazardous wastes must NOT be transported to the EHSS waste storage facilities by anyone other than EHSS staff members.

LABORATORY DISPOSAL OF WASTES

All hazardous wastes must be disposed of through the EHSS Hazardous Waste Collection Program and CANNOT be:

- discharged to the sewer via sink drains, hood drains, or other mechanisms.
- disposed of by evaporation – this includes evaporation in fume hoods or biosafety cabinets. Remember, hazardous waste containers must be kept closed at all times except to add or remove waste.

SUBMITTING A WASTE COLLECTION REQUEST

An electronic Chemical Waste Collection Request should be submitted through EHS Assist to have your hazardous waste collected by EHSS.

- Chemical hazardous wastes are collected Monday through Friday (except on observed holidays) and typically take less than three workdays.
- If an emergency waste collection is required, please contact EHSS directly by emailing chemicalsafety@vanderbilt.edu

DISPOSAL OF HAZARDOUS WASTE CONTAINERS

Acute Hazardous Waste Containers

An empty container that has held an acute hazardous waste must be disposed of by following the EHSS waste removal process via EHS Assist. For questions regarding “acute hazardous waste” identification, please refer to the Identifying Hazardous Wastes in Your Laboratory section above.

Other Hazardous Waste Containers

A container that has held any hazardous waste, other than an acute hazardous waste, can be disposed of as regular trash once the following conditions have been met:

- All waste has been poured out and the bottle is dry.
- The container has been defaced of any chemical or hazardous waste labels.
- The container’s cap has been removed.

RESEARCHER EDUCATION

Hazardous Waste Education Quick Facts:

- General hazardous waste education for Vanderbilt researchers can be self-assigned [here](#), in Oracle Learn.
- Researchers should have lab-specific safety training in addition to the general training.
- Non-Vanderbilt persons that occupy a Vanderbilt lab and use hazardous chemicals must complete [general training for non-Vanderbilt individuals](#).

The Chemical Safety and Hazardous Waste Program provides a wide range of safety training options to help ensure your safety and health when using hazardous chemicals and generating hazardous waste. These training courses are offered to meet numerous regulations and/or as a resource to encourage health and safety for all University community members.

- Researchers should be trained on the proper handling, storage, labeling, and disposal of hazardous wastes generated by your laboratory.
- General training is available through an Oracle Learn module entitled “Chemical and Physical Safety for Research Labs”.
- Researchers in each lab should also have lab-specific training on:
 - The specific waste generated by your lab,
 - procedures for responding to spills or leaks,
 - procedures for responding to exposures,
 - and waste minimization practices.
- Lab-specific safety training should be administered at a frequency sufficient to ensure competency in the proper management practices.
- The same education module, “Chemical and Physical Safety for Research Labs”, is available for non-Vanderbilt individuals that occupy a Vanderbilt lab and use hazardous chemicals and generate hazardous waste.

MINIMIZING WASTE IN YOUR LABORATORY

Waste Minimization Quick Facts:

- Order only the quantity of chemicals you need.
- Utilize inventory management and control to prevent the buildup of waste chemicals.
- Substitute non-hazardous or less hazardous chemicals and/or modify your process to use smaller quantities of hazardous chemicals whenever possible.
- Utilize good housekeeping practices to minimize the risk of a spill.

PRODUCT SUBSTITUTION

Laboratories should attempt to substitute non-hazardous or less toxic materials into their processes and experiments whenever possible.

INVENTORY MANAGEMENT AND CONTROL

Laboratories should periodically evaluate their chemical inventory and dispose of unwanted/obsolete chemicals. Purchase only the quantity of chemicals required for specific projects.

PROCESS MODIFICATION

To the extent that it does not affect vital research or teaching, laboratories should modify experiments to decrease the quantity of hazardous chemicals used and generated. Microanalysis or computational techniques can greatly reduce the amount of hazardous waste generated.

SEGREGATION AND CHARACTERIZATION

To the extent possible, do not mix wastes or waste streams. In particular, do not mix non-hazardous waste with hazardous waste. Segregation and characterization allow waste to be redistributed for reuse by another researcher. If the waste cannot be redistributed, segregation minimizes disposal costs.

NEUTRALIZATION AND RECLAMATION

Some laboratories generate a simple, pure chemical stream, such as a dilute acid or base that can be rendered nonhazardous by simple neutralization. Other laboratories may generate a dilute aqueous stream that contains a metal that can be easily precipitated, rendering the waste stream non-hazardous. Additionally, reclamation systems are available for some waste streams such as silver recovery systems for photograph fixer solutions. Strict laws apply to processes for neutralizing hazardous wastes. For these types of waste streams, labs are encouraged to contact EHSS to determine if they can process these materials to render them non-hazardous.

GOOD HOUSEKEEPING PRACTICES

Spilled chemicals and the materials used to clean up the spills must be disposed of as hazardous waste. Good housekeeping practices to minimize the likelihood of a spill can reduce the amount of hazardous waste generated.

HAZARDOUS WASTE SPILLS

Chemical spills must be cleaned up immediately. Spilled chemicals should be treated as hazardous waste. The materials used in the spill cleanup should also be treated as hazardous waste unless the materials can be decontaminated. Chemical spills that cannot be cleaned up by lab occupants should immediately be reported to VUPS at 615-421-1911 or via the VandySafe app after evacuating and isolating the spill area.

HIGHLY HAZARDOUS CHEMICAL WASTES

Highly Hazardous Chemical Waste Quick Facts:

- Highly hazardous chemical wastes must not be handled by researchers.
- Contact EHSS immediately if you encounter highly hazardous chemical wastes in your laboratory.
- Spilled chemicals and supplies used to clean spills must be disposed of as hazardous waste.
- Clean up spills when they happen or contact VUPS and EHSS for assistance.

Certain chemical wastes must be handled by special procedures due to their highly hazardous nature and risk of explosion during opening or routine handling. These chemicals include:

- ***Expired isopropyl and ethyl ethers (typically expire 6 months after the container is opened)***
- ***Dry picric acid***
- ***Dry 2,4- dinitrophenylhydrazine***

If you encounter these or other highly hazardous waste chemicals in your laboratory, leave them alone and notify EHSS immediately to arrange for disposal. Highly hazardous chemicals must NOT be handled by researchers.

Expired ether is one of the most common highly hazardous chemicals found in laboratories. Ether is extremely flammable and can form explosive peroxides after exposure to air and light. Since it is packaged in an air atmosphere, peroxides can form even in unopened containers.

When working with ether:

- Use the smallest container possible, away from heat, sunlight, and any source of ignition.
- It is very important to write the date received and the date opened on all ether containers.
- Opened containers should be disposed of through the EHSS Hazardous Waste Collection Program within 6 months.
- Unopened containers should be disposed of through the EHSS Hazardous Waste Collection Program within one year.
- Store in a storage cabinet or refrigerator/freezer certified for storing flammable materials.

Your laboratory/department will be charged for the disposal of highly hazardous chemicals since they are so costly, unplanned, and the result of not managing wastes properly in your lab. The charge will be the direct cost charged to EHSS by our disposal contractor. EHSS does not mark up the disposal charges for these chemicals.

LABORATORY SINK AND SEWER DISPOSAL OF CHEMICAL WASTES

In accordance with the University's commitment to protecting human health and the environment and the strict adherence to hazardous waste regulations, all hazardous chemical waste must be collected and properly disposed. The definition of hazardous waste includes the majority of laboratory chemicals used at Vanderbilt and thus require collection as hazardous waste. There are only a few chemicals that are permitted to be drain disposed.

The following non-hazardous substances are permitted to be drain disposed assuming they are not mixed or contaminated with hazardous materials. EHSS reserves the right to approve the discharge and/or drain disposal of all substances on a case-by-case basis.

Substances permitted for drain disposal.

- Aqueous solutions such as salts and buffer solutions within the 5.5 to 9.5 pH range.
- Chemicals that are water soluble and are non-hazardous.
- Naturally occurring Amino Acids and Salts
- Enzymes
- Sugars
- Proteins
- Acids and bases that have been neutralized and fall within the 5.5 to 9.5 pH range.

If you have any questions about hazardous waste or hazardous chemicals in the lab, please contact chemicalsafety@vanderbilt.edu.