

Baylor University's

Chemical and Biological Waste Guide

This document's purpose is to comply with the institution's Chemical and Biological Waste Program. Personnel that generate RCRA Hazardous Waste or Universal Waste must be trained yearly. Contact EHS if you need more information on receiving RCRA Hazardous Waste training.

The first step in determining how to handle items to discard is determining whether it is truly a waste or if it can be reused or repurposed. If the item is a waste, it must be classified as what type of waste it is.

This guide has been broken down into 8 topics:

1. Chemical Waste
2. Biological Waste
3. Radiological Waste
4. Mixed Waste
5. Broken Glass
6. Empty Containers
7. Mercury and mercury-containing items
8. Batteries

There is also an appendix section for chemical compatibility and choosing appropriate waste containers.

1. Chemical Waste – 2 types:

- a. RCRA Hazardous Waste
- b. Nonhazardous Waste

- a. RCRA Hazardous Waste – A waste material can be a hazardous waste in 2 ways. The first way is that the material exists on one of 4 lists of hazardous wastes (discussed below) and can be searched for using links found below and also in the pickup request system. If the waste is found on one of the 4 lists, there will be a specific waste code associated with that material. The second way for a material to be a hazardous waste is that the material has a characteristic that makes it a hazardous waste. There are four different characteristics (discussed below) to consider when evaluating whether a waste material could possibly be a hazardous waste. Any material that is deemed a hazardous waste must have at least one waste code assigned to it and multiple waste codes assigned to a material is common. Hazardous waste must be collected by EHS.

Without a RCRA waste code, a material is NOT a hazardous waste!

- i. Listed Wastes – The EPA has four RCRA waste lists. Two lists are for spent (used/consumed) materials and the other lists are for unused, expired, and/or out of specification materials. If a waste material is found on any of the EPA lists it will have a waste code assigned to it and will be a hazardous waste. The four lists are:
 1. F List – The “F” does not stand for flammable.
 - a. Is the material spent material?
 - i. Spent means that the material has been used for a purpose and is no longer useful due to contamination or some other factor rendering it not useful.
 - b. Is the material found in the [EPA Search?](#)

- i. Make note of the material's waste code identified on the EPA search, it will be required on the pickup request.
 - c. If Yes to both, the material is a hazardous waste
 - d. Commonly used F listed solvents would be solvents such as acetone, methanol, toluene, etc... used in chemical reactions or for cleaning processes
- 2. K List – Not used at Baylor University!
 - a. Meant for specific industries
 - b. Baylor is nonindustrial, so the K List will not apply to this institution
- 3. U List
 - a. Is the material UNUSED?
 - b. Is the material expired or degraded?
 - i. This includes spill cleanup debris of an unused/expired/degraded material found on the U List
 - c. Is the material a single chemical and found in the [EPA Search](#)?
 - i. If the material is a combination of chemicals, is the chemical found on the U List the “sole active ingredient”?
 - ii. Make note of the material's waste code identified on the EPA search, it will be required on the pickup request.
 - d. If yes to a through c, the material is a hazardous waste
 - e. If a material is found on the U List BUT has been used/consumed in some way, is no longer in its original container, or has been added to/with other materials, the U List waste code is no longer applicable!
 - f. Commonly examples of U listed wastes are unused solvents that have expired or are otherwise not useful
- 4. P List – The only difference between U List and P List wastes is that materials on the P List are considered acutely toxic.
 - a. Is the material UNUSED?

NOTE: Even the empty container that once held a P-Listed material is considered a hazardous waste and must be disposed of as hazardous waste.
 - b. Is the material expired or degraded?
 - i. This includes spill cleanup debris of an unused/expired/degraded material found on the P List
 - c. Is the material a single chemical and found in the [EPA Search](#)?
 - i. If the material is a combination of chemicals, is the chemical found on the P List the “sole active ingredient”?
 - ii. Make note of the material's waste code identified on the EPA search, it will be required on the pickup request.
 - d. If yes to a through c, the material is a hazardous waste
 - e. If a material is found on the P List BUT has been used/consumed in some way, is no longer in its original container, or has been added to/with other materials, the P List waste code is no longer applicable!
 - f. Cyanide salts, sodium azide, and epinephrine are good examples of P listed items. Remember that even when these items are fully consumed, the empty container itself is a P listed hazardous waste.

- ii. Characteristic Waste – The EPA has 4 characteristic types that can lead to a material being a hazardous waste. They are ignitable, corrosive, reactive, and toxic. Note that the “toxic” characteristic is a list of 40 separate compounds. If a waste material has any of the four characteristics listed below, it will have a waste code assigned to it and will be a hazardous waste. Many of these characteristics can be found on the material’s safety data sheet (SDS).
 - 1. Ignitable
 - a. Is the material a liquid with a flash point less than 60 °C or 140 °F?
 - b. Is the material a liquid with greater than 24% alcohol by volume?
 - c. Is the material capable of causing fire through friction, absorption of moisture, or spontaneous chemical changes?
 - d. Is the material an ignitable compressed gas? It is an ignitable gas if:
 - i. A mixture of 13% or less (by volume) with regular air forms a flammable mixture, or
 - ii. The flammable range with air is wider than 12% regardless of what the lower flammability limit is.
 - e. Is the material an oxidizer?
 - i. A few examples would be materials containing chlorate, permanganate, inorganic peroxide, organic peroxide, or nitrate
 - f. If yes to any one of the possibilities (a through e), the material is a hazardous waste and will require the D001 waste code.
 - g. Common materials and products around campus that meet the definition of ignitable would be solvents like acetone, ethanol, toluene, mineral spirits.
 - 2. Corrosive
 - a. Is the pH less than or equal to 2 or greater than or equal to 12.5?
 - i. The material must contain at least 50% water to use a pH test
 - b. Is the material a liquid that if it came in contact with steel, would it cause excessive corrosion?
 - i. The actual requirement is causing greater than a ¼ inch of corrosion to steel in a year.
 - c. If yes to a or b, the material is a hazardous waste and will require the D002 waste code.
 - d. Common materials and products around campus that would meet the definition of corrosive would be:
 - i. Items containing acids like hydrochloric acid
 - 1. Pool acid, surface cleaner
 - ii. Items containing bases like sodium hydroxide
 - 1. Cleaning agents and clog removers
 - 3. Reactive – This is possibly the hardest characteristic to determine for any suspected material. Generator knowledge is critical for determining the reactive characteristic.
 - a. Is the material normally unstable and readily undergoes VIOLENT change without detonating?
 - b. Does the material react VIOLENTLY with water?
 - c. Does the material form EXPLOSIVE mixtures with water?
 - d. When exposed to water, does the material generate toxic gases, vapors, or fumes in a quantity to present a danger to human health or the environment?
 - e. Does the material contain cyanide or sulfide?

- f. Is the material capable of DETONATION if subjected to a strong initiating force or if heated under confinement?
 - g. Is the material readily capable of DETONATION or EXPLOSIVE decomposition or reaction at standard temperature and pressure?
 - h. If yes to any one of the possibilities (a – g), the material is a hazardous waste and will require the D003 waste code.
 - i. If you feel you have a material that meets the description of a reactive hazardous waste, please reach out to EHS to discuss your waste material.
4. Toxic
- a. Does the material contain ANY of the items found on the [EPA D List](#) even in very dilute concentrations?
 - i. Please check this list CAREFULLY. The reporting threshold concentrations for these items are in the parts per million (ppm) and parts per billion (ppb) levels!
 - b. If yes, the material is a hazardous waste.
 - c. The specific waste code that is required will depend on which chemical is contained in the waste.
 - d. Make note of the material's waste code identified on the EPA list, it will be required on the pickup request form.
 - e. Common materials and products around campus that would meet the definition of corrosive would be:
 - i. Certain solvents like benzene and chloroform
 - ii. Methyl ethyl ketone commonly found in paints
 - iii. Anything with these elements in it:
 - 1. Arsenic
 - 2. Barium
 - 3. Cadmium
 - 4. Chromium
 - 5. Lead
 - 6. Mercury
 - 7. Selenium
 - 8. Silver
 - iv. Certain herbicides and pesticides
- iii. Universal Waste – These are certain types of waste items that are hazardous wastes based on criteria listed above but have been allowed to promote environmentally friendly management of the items. The following waste items must be collected for disposal as regulated waste:
- 1. Lamps (Bulbs)
 - a. Fluorescent lamps
 - b. Compact Fluorescent Lamps (CFL)
 - c. High-intensity Discharge (HID)
 - i. Mercury vapor
 - ii. Metal halide
 - iii. Sodium
 - 2. Batteries
 - a. Lead-containing batteries
 - b. Lithium-type batteries

- i. Lithium-ion
 - ii. Lithium-polymer (LiPo)
 - iii. Lithium sulfur
 - c. Nickel metal hydride (Ni-MH)
 - d. Nickel cadmium (Ni-Cd)
 - e. **Alkaline batteries ARE NOT a hazardous/universal waste**
 - i. Alkaline batteries can be discarded in regular landfill waste bins
 3. Mercury-containing devices
 - a. Thermometers
 - b. Old style thermostats and switches
 - c. Barometers using mercury
 4. Pesticides: recalled or waste
 5. Aerosol cans
 6. Paint and paint-related wastes (PPRW) – Texas specific
 - a. Old paint, solvent contaminated with paint, paint contaminated material (rags, cloths, PPE, etc...), paint cleanup residue and debris
- b. Nonhazardous Waste – Wastes that are not hazardous waste under RCRA law but still pose a hazard. All nonhazardous waste must be collected by EHS. Determining whether an item is a “Nonhazardous” or can be disposed of as municipal waste or down the drain requires the generator to evaluate an item’s safety data sheet (SDS). Below are things to consider when determining whether a material is a nonhazardous waste or not. If your waste material contains multiple constituents, make determinations on each individual item contained within the waste. Any waste that has been determined to be disposable as municipal waste or down the drain must first be cleared by EHS.
- i. TCEQ Class 1 – The Texas Commission on Environmental Quality (TCEQ) has set a broader set of conditions for an item’s hazard characteristics to be considered a regulated waste item. Below are the conditions to be considered in order to be a regulated waste in the state of Texas.
 1. Contains at least 1 of the following: click [here](#) for list [make searchable by CAS and/or name, excel file saved]
 2. Ignitable
 - a. Flash point less than 65.6 °C or 150 °F
 - b. A solid or semi-solid material that is capable of catching fire under normal storage conditions and then burns vigorously and persistently enough to be a hazard TCEQ gives example list [here](#) [excel file saved]
 3. Corrosive
 - a. Solid or semisolid that when mixed with an equal amount of distilled water generates a solution with pH less than or equal to 2 or greater than or equal to 12.5
 4. Contains recoverable cyanides
 - ii. Regulatory Information portion of Safety Data Sheets (section 15) – There are many things to consider from this section so please be patient with evaluating this section. If you answer “Yes” to any of these questions, this waste will be a regulated waste.
 1. Is the material listed as a hazardous material under CERCLA (40 CFR 302)?
 2. Does the material have a reportable quantity (RQ)?
 3. Is the material listed as a marine pollutant?

- iii. DOT – Please refer to section 14 of a material's SDS for this information
 - 1. If a waste material contains any chemicals that are regulated by DOT, then it must be collected by EHS for appropriate waste disposal
 - iv. SARA – Please refer to section 15 of a material's SDS for this information
 - 1. If a waste material contains any chemical listed under SARA 311, 312, or 313, then it must be collected by EHS for appropriate waste disposal
 - a. SARA 311 and 312 are under Emergency Planning and Community Right-to-Know Act (EPCRA) and are known as the Hazardous Chemical Inventory Reporting Requirements
 - b. SARA 313 is under EPCRA and is known as the Toxic Chemical Release Inventory
 - v. CERCLA – Please refer to section 15 of a material's SDS for this information
 - 1. If a waste material contains any chemical listed under Comprehensive Environmental Response Compensation and Liability Act (CERCLA), then it must be collected by EHS for appropriate waste disposal
 - vi. Ethidium bromide
 - 1. All items containing ethidium bromide must be picked up by EHS for disposal. This includes:
 - a. Gels
 - b. Solutions
 - c. Contaminated items such as gloves, pipette tips, paper towels, etc...
2. Biological Waste
- a. All types of waste listed below must be autoclaved or chemically treated in accordance with the risk group characterization of the infectious material being used prior to disposal.
 - i. Any human-derived biological or substance known or suspected of being infectious to humans, plants, or animals before treatment that may cause harm to the general public if released into the environment. Additionally, this also includes any material contaminated with infectious substances and all items containing or contaminated with human blood or fluids.
 - ii. Non-infectious and includes material such as animal tissue, fluids, cell cultures and Petri dishes
 - b. Solid biological waste
 - i. Sharps must be stored in designated, puncture resistant sharps containers with a closeable top or lid. Once $\frac{3}{4}$ full, submit a pickup request form and EHS will pick up.
 - ii. Animal Carcass Disposal- Notify EHS at least 10 business days in advance in order to arrange collection and disposal by vendor.
 - 1. Collect and store frozen carcasses in biohazard bags until date of pickup. NOTE: Baylor's vendor will not accept any chemicals or inorganic material, such as gloves, bandages, or plastic (syringes, bags), etc, to be incinerated with the carcass(s).
 - 2. Dispose of all PPE and research items separately and handle according to your laboratory waste disposal procedure.
3. Radioactive Waste
- a. Short-lived isotopes (half-life less than 90 days)
 - i. Liquid waste – store in lab for 10 half-lives, then waste is no longer radioactive
 - ii. Solid waste – deposit in plexiglass container, hold for 10 half-lives, then waste is no longer radioactive

- b. Long-lived isotopes (half-life greater than 90 days)
 - i. Contact the Radiation Safety Officer (RSO) for instructions
- 4. Mixed Waste
 - a. Biological / Chemical
 - i. Liquid and Solid Waste- When both chemical and biological waste types exist, the biological agent(s) should be treated first. Once the biological agents have been deactivated by either autoclave or chemical disinfection.
 - ii. Once biological agent is not viable, waste is now considered Chemical Waste.
 - iii. Determine what category of chemical waste you have and proceed with the appropriate waste disposal protocol.
 - b. Biological / Radiological
 - i. Biological and radiological wastes are considered radiological waste. Please see appropriate radiation disposal protocol.
 - ii. Not recommended with long-lived isotopes
 - c. Chemical / Radiological
 - i. Contact EHS before generating this type of waste so that proper arrangements for storage and disposal can be made prior to its generation.
- 5. Broken Glass Waste
 - a. **REMEMBER, empty containers that once held P Listed materials are themselves a hazardous waste and cannot be discarded in a broken glassware container!**
 - b. All broken glassware (that did not previously contain a P Listed material) can be disposed of in a broken glassware container
 - c. As long as the glassware placed in the box is clean and not containing any material, the box can be disposed of by custodial staff
 - i. Seal the inner plastic bag using tape
 - ii. Close the inner flap on the lid
 - iii. Seal the lid securely to the box using tape
- 6. Empty Chemical Containers
 - a. Ensure the item held in the container is NOT on the EPA P-List
 - i. **If the material that was once in the container is on the P-List, the container itself is a hazardous waste and must be treated as such**
 - b. If the container held a liquid, ensure the inside of the container is dry
 - c. If the container held a solid, make sure almost all of the material has been removed
 - i. EPA requires less than 3% by weight or 1 inch of residue (whichever is less) for any contained chemical, we want to be well under that limit
 - ii. DOT requires that the container does not pose a hazard
 - d. ALL markings that denote what the container once held must be defaced (DOT regulations use the terms: removed, obliterated, or securely covered)
 - e. Label the container as "EMPTY"
 - f. Dispose of the container uncapped
 - g. Do NOT dispose of any container in such a way that it could possibly expose other individuals or the environment to whatever was in the container
 - h. Plastic, metal and fiberboard containers only can be placed in trash cans.

- i. Empty glass containers must be placed in a rigid box that is marked as "broken glass". These boxes may be placed with (not in) the regular trash for collection by custodial staff. Be sure to tape the box securely shut.
 - j. For aerosol cans, the container must be completely empty and at atmospheric pressure (easily crushable by hand)
 - k. If disposing of 5 gallon solvent containers, they must be disposed of in a DUMPSTER, **not the BSB trash compactor**
7. Mercury
- a. The University minimizes the amount of mercury-containing items (reagents, instruments, etc...) on campus due to the complexity and expense associated with disposing of these types of items once they are determined to be a waste.
 - b. Mercury waste can be a regulated waste in many ways:
 - i. Hazardous waste
 - 1. Listed waste – see section 1.a.i.
 - a. Please note that P-Listed mercury reagents also make the container itself a hazardous waste!
 - 2. Characteristic waste – see section 1.a.ii.
 - ii. Universal waste – see section 1.a.iii.3
8. Batteries – see section 1.iii.2 (Universal Waste – Batteries) for battery disposal instructions

Appendix I: Chemical Compatibility and Container Information

- a. Chemical Compatibility
 - i. See the EHS website for a chemical compatibility chart to ensure chemicals are stored appropriately
- b. Container Information
 - ii. All containers used to store liquid waste must not be more than 75% full to leave ample headspace for vapor
 - iii. Choose the appropriate containers for the chemical(s)
 - 1. Appropriate
 - a. High density polyethylene container to store solvents
 - b. Glass bottle to contain water waste
 - 2. Not appropriate
 - a. A chemical solution stored in a recommissioned drinking bottle
 - b. Hydrofluoric acid solution stored in a glass bottle
 - c. Corrosive liquids stored in a metal container
 - iv. Please contact EHS with any waste questions you may have