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OSU HAZARDOUS WASTE GENERATOR USER GUIDE

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Table of Contents

Introduction

This hazardous waste generators guideline has been designed to assist all Oregon State University (OSU) faculty, staff, and students in the safe management of hazardous wastes generated at OSU facilities. This guideline discusses the vital role you play in hazardous waste management.

Your Responsibilities

As a generator of waste, YOU have a legal responsibility to ensure the proper disposal of any hazardous waste you generate. There are various state and federal regulations that govern the disposal of chemical wastes. There are also criminal and civil penalties that can result from improper disposal of these wastes. In addition to potential citations, fines, and imprisonment, improper waste disposal can also result in national media attention and damage to your and the University's reputation.

YOU CAN BE PERSONALLY HELD LIABLE FOR "WILLFULLY AND KNOWINGLY" VIOLATING THESE REGULATIONS.

Dilution or evaporation is not allowed as a treatment method for hazardous waste.

You also have a responsibility to properly dispose of chemicals that can pose a present or potential hazard to human health or the environment. This includes accident and injury prevention to students, coworkers, and the campus community.

Disposal of Non-Hazardous Waste

Oregon State University does not advise the disposal of non-hazardous chemicals by trash or sanitary sewer. Chemicals not regulated today could be in the future, and the generator of chemical waste can still be held liable in the future if a particular chemical became regulated.

It is also important to keep in mind the stigma attached to the disposal of chemicals in the normal trash. This is especially true when chemicals are discovered in the trash by other members of the campus community who may not have the technical knowledge needed to identify and evaluate those chemicals. This type of situation can quickly escalate into unwarranted attention from the media and regulatory agencies. Please be aware of the concerns people have with regard to their health and safety when discovering strange and unknown chemicals in the trash.

In an effort to minimize any potential incidents, Environmental Health and Safety (EH&S) recommends disposing of all chemical wastes through the hazardous waste management program.

Keep in mind that improper disposal of hazardous wastes can result in fines, chemical reactions, the release of toxic or noxious gases and vapors, corrosion of the plumbing system, and can result in other environmental problems at the sewage treatment plant.

The Hazardous Waste Management Program

There is a wide variety of chemical waste generated at Oregon State University. Nearly all facets of the campus community generate some form of hazardous waste. Examples include:

- flammable, corrosive, reactive, and toxic laboratory waste
- waste solvents from vehicle maintenance, printing, and painting operations
- corrosive wastes from cleaning operations
- waste fixer and photographic chemicals from darkrooms
- paints, thinners, corrosives, and metal-containing wastes from art studios
- Universal waste (batteries, light bulbs, aerosols)
- other wastes from across campus

At OSU, Environmental Health and Safety (EH&S) has a team of hazardous waste specialists. EH&S provides:

- information on safe chemical handling, storage, use, and disposal
- hazardous waste collection and disposal
- laboratory and work area cleanouts
- spill response

Your involvement includes:

- recognizing your responsibilities as a chemical user according to the hazardous waste regulations
- understanding the hazardous waste management system
- implementing the procedures described in this guide
- making every technical and economically feasible effort to minimize the volume of surplus chemicals and the amount of hazardous waste that you generate.

Hazardous Waste Regulations

Hazardous waste is regulated by the U.S. Environmental Protection Agency (EPA) and the Oregon Department of Environmental Quality (DEQ) under the Resource Conservation and Recovery Act (RCRA). Oregon State University is regulated as a Large Quantity Generator (LQG) of hazardous wastes. This guide is intended to provide an overview of managing hazardous wastes on a university campus. The complete regulations and additional environmental compliance assistance information for colleges and universities can be found at the DEQ and EPA websites: EPA and DEQ

Managing Hazardous Waste

As a generator of hazardous waste, there are specific requirements that must be followed in order to properly handle, store, and dispose of hazardous wastes. These requirements include:

1. Making a determination as to whether the wastes you are generating are considered hazardous.
2. Following Satellite Accumulation Area requirements.
3. Following proper hazardous waste storage and disposal procedures.

What is a Hazardous Waste?

Hazardous waste can take on many forms. It can be a liquid, solid, or a contained gas and all of these have one thing in common: they are dangerous and have harmful effects on humans or the environment.

RCRA Definition of "Solid Waste" The definition of "solid waste" is extremely broad. A solid waste is a material that, in general practice, is any discarded (or sometimes discarded) material not specifically excluded by the hazardous waste regulations. A discarded material is any material (solid, liquid or contained gas) which is abandoned (disposed of, burned, or incinerated), recycled or considered inherently waste-like.

This definition is complicated, but basically, any material that is not a useable material and will be discarded may be defined as a solid waste from the hazardous waste regulations. The definition of solid waste can be found in 40 CFR 261.2. Because it is difficult to devise a definition that distinguishes between products like sludges and by-products, these materials when recycled will be evaluated individually to determine if the RCRA rules apply. Oregon uses the term "residue" to mean RCRA "solid waste" in its regulations, OAR 340-100-0010 (2)(ee).

RCRA Definition of "Hazardous Waste"

Waste that is regulated as hazardous because of its chemical properties is defined by EPA in two ways: (1) waste that has certain hazardous characteristics and (2) waste that is on certain lists of chemicals. The first category is based on the properties of materials that should be familiar to every laboratory worker. The second category is based on lists, established by EPA and certain states, of certain chemicals common to industry. These lists generally include materials that are widely used and recognized as hazardous. Chemicals are placed on these RCRA lists primarily on the basis of their toxicity.

The term "solid waste" can be somewhat misleading. The word "solid" does not refer to the physical state of the waste. Solid waste can be a solid, liquid, or a contained gas which may:

- Cause or significantly contribute to an increase in mortality or in serious illness; or
- Pose a substantial hazard to human health or the environment when improperly managed.

The definition of hazardous wastes can be found in 40 CFR 261.3, OAR 340-101-033 and 340-102-001. By definition, wastes are hazardous if they are 1) "listed" (specifically named) or 2) if they exhibit any of four hazardous waste characteristics (ignitability, corrosivity, reactivity, and toxicity). Mixtures of solid waste and a "listed" hazardous waste are also considered hazardous.

Hazardous Waste Determination

A hazardous waste determination is a procedure used to determine whether a solid waste is a hazardous waste. Any person who generates solid waste must determine if that waste is a hazardous waste. Generators are responsible for making hazardous waste determinations. Hazardous waste determinations must be updated every 12 months and whenever the process generating waste changes. Documentation of such determinations must be retained for 3 years after the waste is no longer generated.

How to Conduct a Hazardous Waste Determination with the Help of Hazardous Waste Professionals for Free.

OSU EH&S has made this very complicated regulatory requirement very simple. You, as the generator, must complete and submit a Hazardous Waste Process Determination Form.

Note: You must keep all hazardous waste determination documents, especially the information you relied on and the steps taken when making your determination.

Notes and General Instruction for Completing the Hazardous Waste Determination Form

Generation Location Building: Enter the Building where you are generating the waste.

Room Number: Enter the room number in the building where you are generating the waste.

Generator Name: a generator is any person, whose act or process produces hazardous waste. Please provide the name of the person who is generating the waste.

Process Name: the process name could be what you call the process, for example, disinfection of plastics, or the process of the work HCLP-Acetone.

Generation Process: describe how the waste is created.

Estimate the volume of waste generation: provide an estimate of the volume of waste you will be producing for the process. Example: 4 liters

Attachments: Attach all documents describing the waste you will be producing. Examples: SDS, SOP, methods of process, Lab test results of the contents of waste or provide your process knowledge. This may consist of information about the waste obtained from existing published waste analysis or studies generated by processes similar to those used in your operation. You may use any information you have about the waste including product labels, SDSs, etc. to help determine if the waste is listed or is characteristically hazardous.

If you do not have the necessary information to properly classify your waste, you will need to perform the necessary testing and provide the results. It will be YOUR responsibility to apply that information properly in the waste classification process.

Constituents of the Waste Table: List all constitutes of the waste, including water. The volume must equal 100%. For example:

Chemical	Volume %
Nitric Acid	5
Water	95

Physical State: Mark the box that represents the physical state of the waste, not the RCRA solid waste definition.

Characteristics: Check all the characteristic of the waste; this information may be found on the chemical(s) label or SDS.

Submit the form to the OSU EH&S Hazardous Waste Team and they will:

- Determine if your waste is hazardous or non-hazardous.
- Provide the appropriate pictogram
- Provide the EPA waste code
- Provide a completed hazardous waste label template that must be used for the waste generated for that process.

Failure to conduct a hazardous waste determination is a Class I violation. A civil penalty of up to $10,000 per day can be assessed for this violation and is one of the most common violations cited by inspectors.

When OSU EH&S Hazardous Waste Team emails you the determination, you must:

- Print out the determination form
- Sign the determination form
- Attach all the documents you provided for the determination, as this is now the final hazardous waste determination document.
- Place the final hazardous waste determination document in the chemical labeling station.
- Review annually or when the process changes
- Keep record until 3 years after the waste is no longer generated.

Note: An inspector may ask to see this form; it would be to your advantage to train staff and student what this form is and when to use it. The form takes the guesswork out of filling out a hazardous waste label and provides information on the hazards of the waste.

No generation of waste should begin unless you have completed a Hazardous Waste Determination.

How to Conduct a Hazardous Waste Determination on your Own

Each solid waste must be evaluated to determine if it is a hazardous waste. This process is called "Hazardous Waste Determination." This section will outline the steps that are required if you do the determination without the help of the OSU EH&S Hazardous Waste Team.

Requirements for conducting a hazardous waste determination can be found in OAR 340-102-0011. The generator is responsible to determine if the business's waste is considered hazardous under federal and State of Oregon regulations.

Hazardous wastes may be generated when:

- a material has been used and is spent, such as a spent solvent even if it is being recycled on-site; or
- a stored material has exceeded its shelf life, is no longer usable, and must be discarded.

For example, a shop will not generate the types of hazardous wastes commonly associated with an industrial process. But a shop may generate hazardous waste in the form of discarded paints and solvents or other materials which would be classified as hazardous waste. All generators of waste material are required by law to identify and evaluate their solid wastes. This is called a "hazardous waste determination."

Because a hazardous waste determination is the foundation on which proper hazardous waste management is built, failure to conduct a hazardous waste determination is a very serious violation. **Failure to conduct a hazardous waste determination is a Class I violation. A civil penalty of up to $10,000 per day can be assessed for this violation and is one of the most common violations cited by inspectors**.

The criteria used to determine if the waste is hazardous is found in OAR 340-102-0011 (which references 40 CFR 261) and OAR 340-101-0033, *Additional State-Only Hazardous Wastes*. These sections contain "listed characteristic" and "State-Only" hazardous wastes.

The federal regulations can be obtained online at https://www.ecfr.gov
Oregon rules can be obtained through DEQ website at
https://secure.sos.state.or.us/oard/displayChapterRules.action?selectedChapter=80

A COMPLETE HAZARDOUS WASTE DETERMINATION MUST FIRST ANSWER THE FOLLOWING QUESTIONS:

1. Is the material a solid waste?
2. Is the waste specifically excluded as a solid waste or hazardous waste?
3. Is the solid waste being generated a hazardous waste?
4. If the waste is hazardous, what is (are) the correct EPA hazardous waste code(s)?
5. Is the waste a State-only hazardous waste?
6. What are the waste codes of the waste?

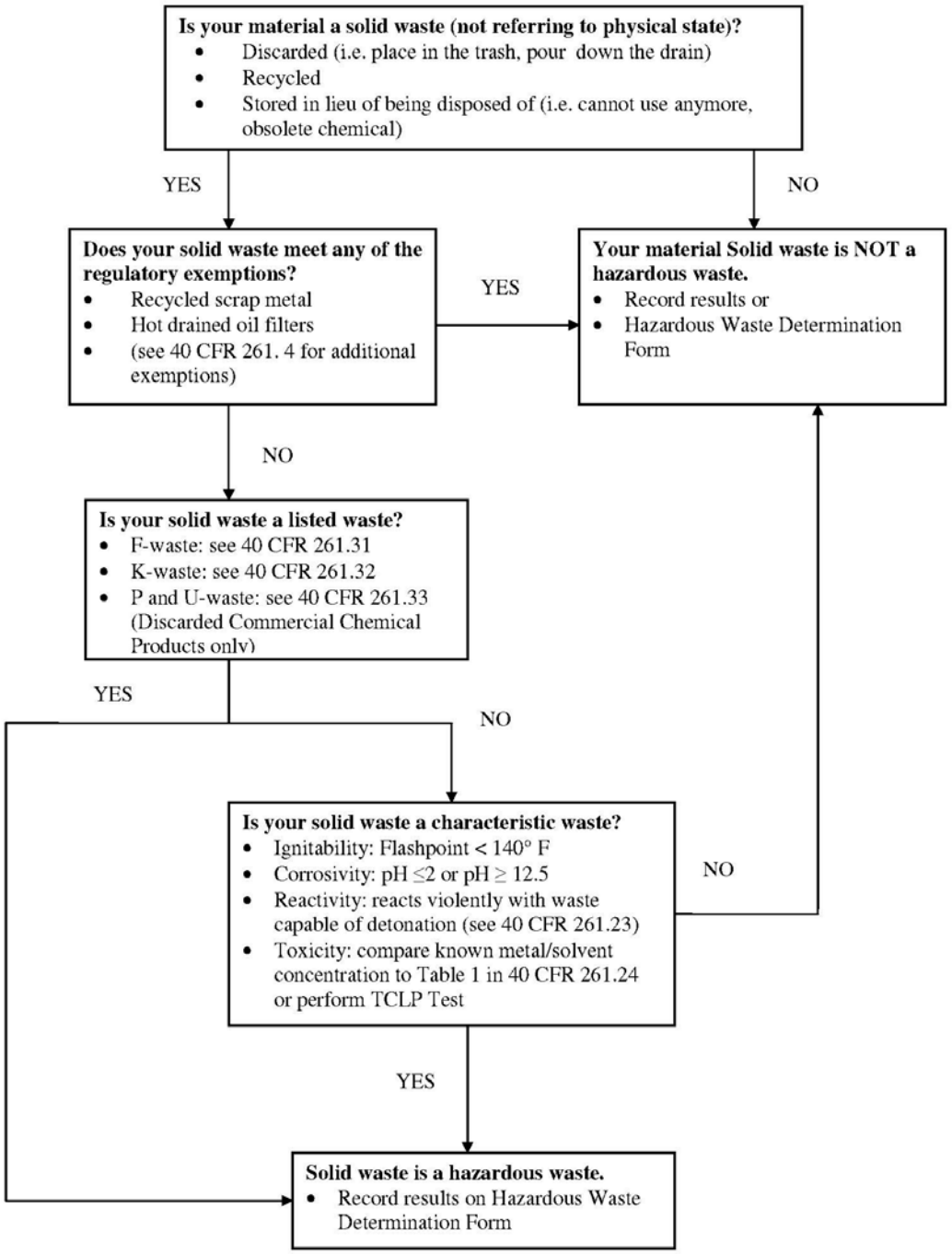
To answer these questions, a generator should:

Step 1: Determine If You Have A RCRA-defined Solid Waste.

The term "solid waste" can be somewhat misleading. The word "solid" does not refer to the physical state of the waste. Solid waste can be a solid, liquid, or a contained gas. Under the

Resource Conservation and Recovery Act (RCRA), a solid waste is any material that you will no longer be used for its originally intended purpose and will be discarded or a material that must be reclaimed, or processed, before reuse. For any material to be a hazardous waste, it must first be a solid waste.

FIGURE 1: HAZARDOUS WASTE DETERMINATION FLOW CHART



Step 2: Check for Excluded Wastes.
Determine if the waste is excluded specifically as an RCRA solid waste or hazardous waste. Refer to OAR 340101-0004 and 40 CFR 261.2, 261.3, 261.4, 261.6, 261.7, 261.8, and 261.9 for a specific listing of wastes that are excluded from regulation. Some examples of exclusions are:

- Used oil not mixed with hazardous waste that is sent for energy recovery or recycling.
- Lead acid batteries destined for off-site recycling.
- Residue in RCRA-defined empty containers.
- Materials recycled in an on-site closed-loop process.
- Materials reclaimed from some types of recycling processes
- Chlorofluorocarbons that are recycled.
- Wastes identified and managed as Universal Wastes, such as batteries, pesticides, mercury-containing lights, and mercury thermostats.

Step 3: Determine if the Waste is a Federal Listed Hazardous Waste.
A generator should compare both the waste generating process and the concentration of the hazardous constituent against these lists. These lists are found in 40 CFR 261.31261.333 and contain over 450 hazardous wastes in three different categories. EPA has 4 groups of "Listed Hazardous Waste".

F-listed hazardous wastes (40 CFR 261.31) are wastes from non-specific sources and include, but are not limited to spent halogenated solvents and wastewater treatment sludges from electroplating operations. Although there are 39 listings (F001- F039), the most common F-listed wastes generated on campus are F001, F002, F003, F004, and F005. These chemicals are primarily both halogenated and non-halogenated organic solvents.

Some common examples of F-listed hazardous wastes include:

a. A graduate student working in a science laboratory uses Acetone as a final rinse for cleaning glassware; the Acetone waste that results is considered an F003 listed hazardous waste. This Acetone rinse cannot be disposed of down the drain and must be managed as a hazardous waste.
b. A maintenance worker uses a 10% solution by volume (or greater) of Methylene chloride as a degreasing agent. The waste that results is considered an F001 listed hazardous waste and must be disposed of through the hazardous waste management program.
c. A person working in a Fine Arts department uses a trade name paint brush cleaner that contains 10% or more (by volume) of Toluene. The waste that results is considered an F005 listed hazardous waste and must be managed accordingly.

K-listed hazardous wastes (40 CFR 261.32) are wastes from specific manufacturing sources, including but not limited to, spent pickle liquor generated by the steel-making industry and baghouse waste from steel arc furnaces. OSU generators rarely have K-listed wastes.

P- and U-listed hazardous wastes (40 CFR 261.33) are unused "commercial chemical products", off-specification products, container residues and spill residues of such products.

The U and P codes are assigned to chemicals that are discarded commercial chemical products and container residues. The EPA and DEQ also regulate any residue or contaminated soil, water, or other debris resulting from the cleanup of a spill involving a U or P listed chemical as hazardous waste. It is also an EH&S policy that any mixture of chemicals that contain ANY concentration of U or P listed chemicals are considered to be hazardous waste and must be disposed of through the hazardous waste management program.

A number of commonly used chemicals can be found on the U and P lists. Some examples include:

U-listed		P-listed
Acrylamide	Mercury	Osmium tetroxide
Chloroform	Methanol	Potassium cyanide
Ethyl acetate	Phenol	Sodium azide
Formic acid	Xylene	Sodium cyanide

Please note that if you spill a chemical found on the U or P lists, the resulting cleanup debris is considered a hazardous waste. For example, if you spill a 100ml bottle of Chloroform, the Kimwipes or paper towels used to clean up the spill are also considered hazardous waste and must be disposed of through the hazardous waste management program.

Step 4: Determine if the Waste is a Characteristic Hazardous Waste.
In addition to listed hazardous wastes, the EPA and ODEQ regulate any chemical wastes as hazardous waste if the waste exhibits any one or more of the following characteristics: ignitability, Corrosivity, Reactivity, and Toxicity. A waste may be a “characteristic hazardous waste” based on its physical or chemical properties. Waste can be evaluated as a possible characteristic hazardous waste using chemical/physical analysis or by using knowledge of the process generating the waste. Even if your waste is listed, under Oregon law you must determine if the waste is a characteristic hazardous waste as listed below:

IGNITABILITY
Ignitability (40 CFR 261.21). Ignitable wastes are those that are capable of causing or intensifying a fire during routine handling. Ignitable wastes carry the EPA waste code D001. A waste exhibits the characteristic of ignitability if it has ANY of the following properties:

- A liquid, other than an aqueous solution containing less than 24% alcohol by volume, and has a flashpoint less than 140° F (60° C);
- Is not a liquid and is capable under standard temperature and pressure of causing fire through friction,

Remember: WASTE CAN HAVE MANY CHARACTERISTICS

absorption of moisture, or spontaneous chemical changes, and when ignited burns so vigorously and persistently that it creates a hazard;
- Is an ignitable compressed gas - aerosols, propane cylinders
- Is an oxidizer

Examples include most organic solvents such as:

Acetone	Ethyl ether	Paint
Benzene	Heptane	Paint thinner
Ethanol	Hexane	Toluene
Ethyl acetate	Methanol	Xylene

CORROSIVITY
Corrosivity (40 CFR 261.22) - Corrosive wastes include highly acidic or highly alkaline chemicals. Corrosive wastes carry the EPA waste code D002. A waste exhibits the characteristic of corrosivity if it has ANY of the following properties:

- Is an aqueous waste that has a pH less than or equal to 2 OR a pH greater than or equal to 12.5;
- Is a liquid that corrodes steel at a rate greater than 6.35mm (0.25 inches) per year;
- It is OSU policy to classify corrosive solid chemicals as hazardous wastes if: when the solid chemical is added to water resulting in an aqueous solution with a pH less than or equal to 2;
- A pH greater than or equal to 12.5. Additionally, if the original chemical container identifies the contents as corrosive, then the chemical waste must be disposed of through the hazardous waste management program.

Examples of corrosive hazardous wastes include:

Hydrochloric acid (Muriatic acid)	Sodium hydroxide solution
Sulfuric acid	Sodium hydroxide pellets
Nitric acid	Ammonium hydroxide solution
Acetic acid	Potassium hydroxide flakes
Hydrofluoric Acid	Calcium hydroxide

REACTIVITY
Reactivity (40 CFR 261.23) - Reactive wastes include highly reactive and/or unstable chemicals. Reactive wastes carry the EPA waste code D003. A waste exhibits the characteristic of reactivity if it has ANY of the following properties:

- It is normally unstable and readily undergoes violent change without detonating
- It reacts violently with water
- It forms potentially explosive mixtures with water
- When mixed with water it generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment

- It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment
- Is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement
- It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure
- It is a forbidden explosive or a Class A or Class B explosive

Examples of reactive hazardous wastes include:

Ammonium sulfide	Picric acid (dry)
Benzoyl peroxide (dry)	Sodium cyanide
tert-Butyllithium in solvent	Sodium metal

TOXICITY

Toxicity Characteristic (40 CFR 261.24) – Toxicity is determined by a laboratory test which measures the concentration of the toxic material which would most likely leach into the groundwater if that waste is improperly managed. The test is known as the "Toxicity Characteristic Leachate Procedure," or TCLP. Toxic wastes carry the EPA waste codes D004-D043.

Any chemical waste that is identified as toxic in the SDS or on the container must be disposed of through the hazardous waste management program.

NOTE: Dilution is not allowed as a treatment method for hazardous waste.

Examples of toxic contaminants include:

Barium
Lead
Benzene
Mercury
Chloroform
Pyridine
Chromium
Silver

Note: In making your determination, be sure to include all applicable waste codes whether it is a listed hazardous waste, characteristic hazardous waste or a combination of both listed and characteristic hazardous waste, and state - only waste codes.

Step 5: Determine if the waste is a "State-Only" Hazardous Waste

If your waste is neither a federal listed nor a characteristic hazardous waste, it may still be a "State-Only" hazardous waste. State-only hazardous wastes are described in OAR 340-101-0033, *Additional Hazardous Wastes*.

Unless specified otherwise, "State-Only" hazardous wastes must be managed the same as RCRA regulated wastes. State-only hazardous wastes include, but are not limited to,

pesticide residues and mixtures of wastes containing constituents of P (3%) & U (10%) listed wastes (see lists in 40 CFR 261.31 and 261.32).

Step 6: Determine All Applicable Hazardous Waste Codes. Oregon hazardous waste rules require that generators determine all applicable waste codes associated with their waste. In making your determination, be sure to include all applicable waste codes whether it is a listed hazardous waste, characteristic hazardous waste, or a combination of both. For example, a correct hazardous waste determination for waste paint and paint thinner mix might be D001 (ignitable), F003 and F005 (for acetone and toluene thinners used to clean the spray gun) and D008 (for lead as a constituent of the paint). List any applicable state-only waste codes.

In addition to the criteria above, Environmental Health and Safety also considers chemical waste to be hazardous if it:

- has an oral Lethal Dose (LD50) for a rate of less than 500 mg/kg

OR

- if the original container identifies the chemical as toxic or poisonous

OR

- if the chemical is a known or suspected carcinogen, mutagen, or teratogen

Examples of this would be ethidium bromide.

To summarize, a chemical waste exhibiting any one of these criteria is to be considered as hazardous waste and must be managed accordingly through the hazardous waste system.

When in doubt, dispose of chemical waste through the hazardous waste management program.

Note: If you determine your waste is a hazardous waste under federal regulations it is not an Oregon "State only" hazardous waste.

<u>Knowledge of the Process and Waste Analysis</u>

In general, there are two methods for performing your own hazardous waste determination. The first, "knowledge of the process," makes use of available information to make the determination. The second, analysis, relies on testing of the waste to determine the concentration of hazardous constituents present. Knowledge of process, analytical data and/or a combination of these form the basis by which all hazardous waste determinations are completed.

Process knowledge may be information on the wastes obtained from existing published or documented waste analysis

But wait, there's more! It may be hazardous waste by local rules or OSU policy.

data or studies conducted on hazardous wastes generated by processes similar to that which generated your waste.

For example, you should use process knowledge when determining if your waste is a listed hazardous waste. Therefore, with many listed hazardous wastes, generator knowledge is appropriate because the physical/chemical makeup of the waste is generally well known and consistent from lab to lab.

Generator Knowledge of Process
If you use generator knowledge alone or in conjunction with sampling and analysis, you must maintain documentation of the information used to make the waste determination.

Documentation used to support generator knowledge may include, but is not limited to:

- Safety data sheets or similar documents,
- Supplier/manufacturer- or vendor-provided information,
- Product labels. Note: Waste streams may differ greatly from original products,
- A thorough process description, including data on all raw materials used in the process,
- The OSU EH&S website has a library of hazardous waste determinations you may print. Don't recreate the wheel if you don't have to
- Other forms of detailed documentation.

Documenting both the generator knowledge and any analytical data is essential. Information used to make the waste determination must be maintained for at least three years after the waste is generated.

Analyzing Your Wastes
You may not have enough information to make your waste determination using solely "knowledge of process" for all your waste streams. Sampling and

Remember: Whether you use "knowledge of process" or analysis to complete your hazardous waste determination, the determination must be done correctly. An incorrect hazardous waste determination is a Class 1 violation and subject to civil penalties of up to $10,000 per day.

Note: 40 CFR 268.7(a)(6) requires generators who determine their waste is land disposal restricted solely on knowledge of process must retain all supporting data used, in their files for a period of 3 years after the last shipment of the waste was sent for either on-site or off-site treatment. This includes waste analysis data, knowledge of process information and any other pertinent documentation.

Note: The use of existing or historical rec
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Note: An SDS should be viewed as a supporting document and not as the sole means of documenting a hazardous waste determination.

Knowledge of process in itself may not be adequate to perform a proper hazardous waste determination

analysis of the waste are often necessary to complete the determination. Your only alternative is to take a representative sample and have your waste analyzed.

Waste sampling and analysis may be necessary when:

- You are not able to determine with available information the chemical makeup of your waste stream;
- EPA amends RCRA waste identification/classification rules

Sampling and analysis of the waste are often more accurate and defensible than other options such as using knowledge of the process. Procedures and equipment for obtaining and analyzing samples are described in EPA's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" SW-846, 3rd Edition.

DEQ recommends that you prepare a sampling and analysis plan before sample collection and testing. In "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" SW-846, 3rd Edition, chapters 1 and 9 are excellent sources of information on sampling and analysis.

Reducing the Cost of Testing Your Waste Stream.
You should use your knowledge of the process to limit laboratory testing. Ask the lab to perform only those tests needed to determine the waste type and the hazardous characteristics. Testing will not determine if the waste is listed; the process in which the waste is generated will determine if the waste is listed. The cost of analysis will depend upon the complexity of these tests. You can reduce your analytical costs by providing as much information as possible on the constituents of the waste.

The Mixture Rule
According to EPA and DEQ regulations, the Mixture Rule defines whether a mixture of nonhazardous and hazardous waste results in a hazardous waste. The Mixture Rule states:

1. If ANY amount of a nonhazardous waste is mixed with ANY amount of a listed hazardous waste, then the resulting mixture is considered to be a hazardous waste.

2. If ANY amount of a nonhazardous waste is mixed with ANY amount of characteristically hazardous waste, then the resulting mixture is not considered to be hazardous if the resulting mixture no longer exhibits any the hazardous characteristics.

For example:
If you have a container of waste Sodium chloride solution (nonhazardous) and a container of waste Phenol (listed hazardous waste) and mix both chemicals in a larger waste container, the resulting mixture is considered to be a hazardous waste and must be disposed of through the hazardous waste management program.

If you have a container of dilute Sodium Hydroxide solution with a pH=10 (nonhazardous) and a container of Hydrochloric acid solution with a pH=2 (characteristic hazardous waste - corrosive) and mix both chemicals in a larger waste container and the resulting

pH of that mixture is greater than 2 or less than 12, then the mixture no longer exhibits the hazardous characteristic of corrosivity and therefore is not considered a hazardous waste.

It is important to note that although the above mixture in example #2 may not be hazardous, the mixture must be disposed of through the hazardous waste program., due to the potential to have a negative impact to our environment, but more importantly is a potential safety and health risk to Facilities staff that may need to work on plumbing lines.

Note: Safety Data Sheets: SDSs can provide useful information regarding ignitability (flash point), corrosivity (pH), or reactivity of the material going into the process. However, they tend to be less useful when it comes to identifying the toxic characteristics of waste generated from that process. The SDS only lists ingredients that make up greater than 1% of the total constituents (0.1% if they are carcinogens). Ingredients that are less than 1% by mass can equal up to 10,000 parts per million (ppm). This means that a material used in a process may contain a toxic constituent that is not listed on the SDS, but which contributes to the generation of hazardous waste. Additionally, the process itself may chemically or physically change the properties of the materials such that the generated waste is hazardous.

Waste Container Management

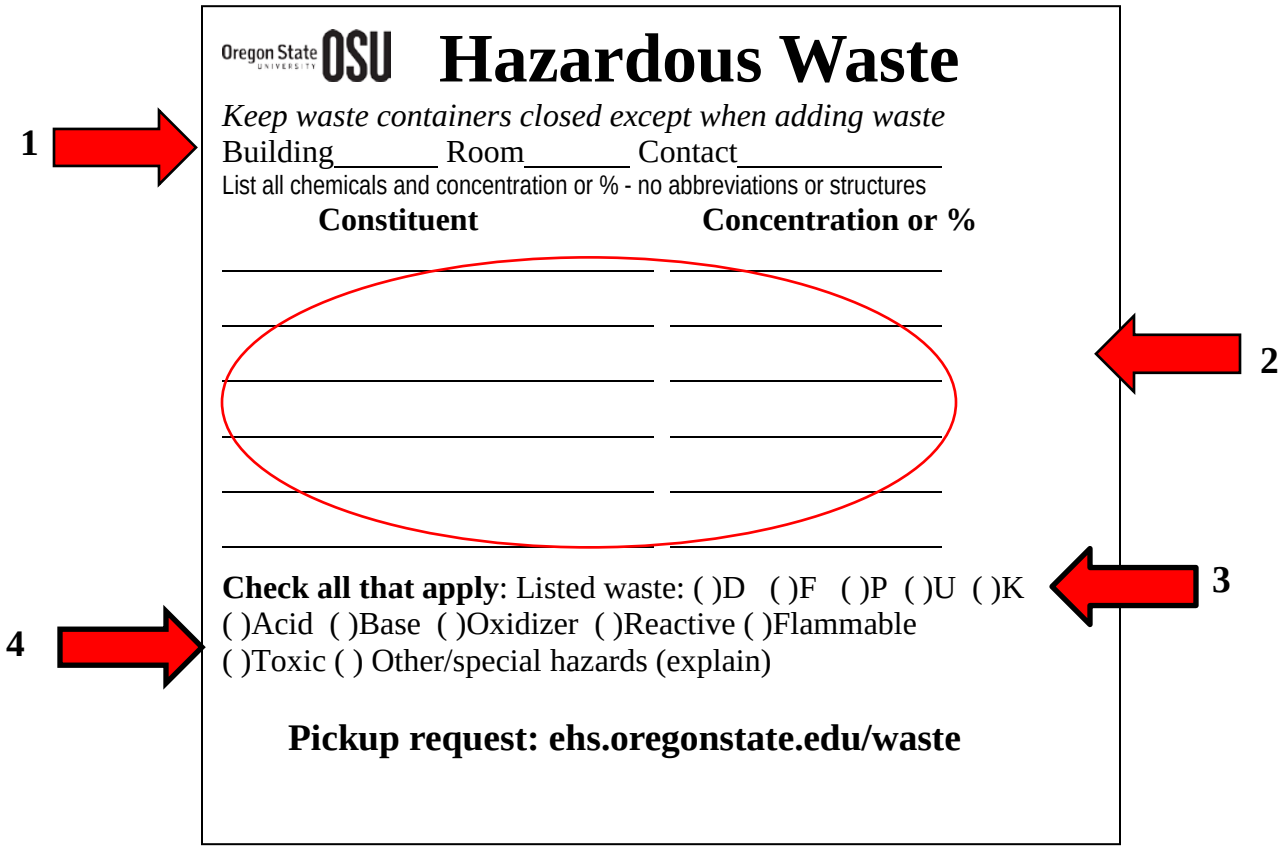
OSU EH&S provides waste containers at no cost. You may order them online using the waste pickup request form. Once EH&S receives the request they will deliver the containers to you. Follow these waste container management practices.

- Waste containers must have a Hazardous Waste label if it is "Hazardous Waste" that identifies the hazards of the contents of the containers in order to more clearly convey the risks associated with the unit contents.
- Non-hazardous waste containers must be marked “Non-hazardous Waste.
- Waste containers must be compatible with the waste, in good condition, handled carefully and replaced if leaking occurs.
- Liquid waste containers must have a screw type lid.
- Waste containers cannot be used to store hazardous wastes if the waste may cause the container to rupture, leak, corrode, or otherwise fail. Milk jugs, Nalgene bottles, canning jars are not approved waste containers.
- Containers must be compatible with the hazardous waste stored in them and must meet Department of Transportation (DOT) standards. Keep incompatible wastes away from each other. Put them in separate containers.
- Containers holding hazardous waste must be kept closed except when being filled or emptied.
- Wastes that are incompatible (such as ignitable and reactive) must be stored separately.
- In order to avoid fires, leaks, or other reactions, incompatible wastes must not be placed in the same container

When in doubt, dispose of chemical waste through the hazardous waste management program.

- Select appropriate containers after the waste has been characterized and you know if the wastes are compatible.
- When selecting a container, consider the amount of waste and type (characteristic) of waste. Choose the most appropriate size for the amount of waste generated.
- When selecting the container, you must make sure that waste won't react with the ***container*** itself. For example, hydrofluoric acid waste will react with glass – a glass container may fail and waste may be released. Use a plastic, or plastic-lined glass container to safely store hydrofluoric acid waste. To prevent container failure, carefully match the right container to the waste.
- If a container has been used to store waste or other materials, you are required to make sure that the waste/material previously held in the container is compatible with the waste you are going to put in the container.
- Use a funnel to prevent spills, and do not use the same funnel for all wastes.
- All liquid Waste Containers must be stored in a Secondary Container labeled "Secondary Containment for Hazardous Waste." Please note: These specially labeled trays are for storage of hazardous waste containers only. Do not use them for general purpose storage.
- It is acceptable to reuse empty bottles to accumulate hazardous waste. However, it is ESSENTIAL that the bottle is *completely empty and the old label removed or defaced* before the waste is added.
- **Do not overfill** waste containers. Leave a sizable amount of head space in the container to allow for expansion and safe transportation — 10% headspace is a good rule of thumb.
- **Do not mix solids with liquid waste.**
- **Waste Liquid-filled small containers** such as vials and Eppendorf tubes:
    - Double-bag containers in clear plastic bags to allow visual inspection by EH&S Hazardous Waste Team.
    - Containers bagged together must contain liquids or liquid mixtures with the same chemical constituents.
    - Seal each bag individually.
    - Accurately list the bag's contents and chemical constituents on the hazardous waste tag.

Required Elements of a Hazardous Waste Label



1. **Location and Contact information.** Fill in building and room number. Contact is the person generating the waste or someone who has knowledge about the waste in case additional information is needed.
2. **Constituents of waste.** List all chemicals or composition of waste List concentration or percentage which MUST equal 100%. It is important that ALL chemical names be written out and the approximate percentages of EACH constituent are listed. Chemicals in amounts of < 1 % can be written as “trace”. Also, include the percentage of water or solvent present. Final reaction products should be listed instead of chemical equations. Chemical structures, formulas, abbreviations, or acronyms are NOT acceptable. Chemical names MUST be written out. This information is found on the final hazardous waste determination document.
3. **Listed waste**, check all that apply. This information is found on the final hazardous waste determination document.
4. **C**heck all waste characteristics that apply. This information is found on the final hazardous waste determination document.

Keep in mind that the hazardous waste management program collects waste throughout the ENTIRE OSU campus. Your cooperation in completely and legibly completing Hazardous Waste labels is crucial.

Waste Disposal

(Lab clean outs, ordering containers, Universal waste pickups, donations for ChemReUse Program, ordering labels)

Generators are required to submit a request for pickup using an online form and are tracked within the system. For this reason, do not email, text or call EH&S personnel for a pickup of hazardous waste. The waste will be picked up within 1-7 days at your lab or work area.

EH&S provides gray tubs for waste pickups. Waste containers should be placed into the specially labeled gray tubs. These specially labeled gray tubs are for pickup of hazardous waste containers only. Do not use them for general purpose storage. Bigger containers such as small drums or more than 5 gallons do not need to be placed in the pickup tub. Please note on the form where to find the waste within the room.

- Please make sure all containers are labeled and ready to go before submitting a waste pickup request.
- Pickup day and time varies but takes place on weekdays between 6 am and 4 pm. University holidays will affect pickup schedule.
- EHS Hazardous Waste Team has keys to most campus locations; you do not need to be present or leave your lab unlocked unless you have an alarm system or specially keyed space. Be sure to note special room entry requirements on the hazardous waste pickup request form.

How to fill out a Waste Pickup Request Form

When filling out a Waste Pickup Request form, complete the following information:

1. Name, email, department and Onid username is auto-populated.

2. Phone number: provide a phone number in case we need to contact you.
3. Room number: provide the room number where the waste is located
4. Location in Room: provide the location of the waste in the room. Examples: in the fume hood, just inside the entry door, etc.
5. Building waste is located in: using the drop-down menu, choose which building the waste is located in.
6. Universal Waste: if your request includes universal waste check all that apply.
    a. Batteries: If you check batteries it will ask for volume and description and if you need a replacement container. Example: 12 large auto type; 5 gallons misc. small batteries; 5 lithium batteries.
    b. Light bulbs: If you check light bulbs it will ask for volume and description Example: one box of 4 ft. fluorescents; 1 box of u-tubes
    c. Aerosols: If you check aerosols it will ask for volume and description Example: 1 30 gal-drum of cooking spray cans; 1 trash can of paint cans.
    d. Other: If you check other, provide a description of the universal waste. An example would be used oil.
7. Hazardous Waste: if your request includes hazardous waste, check all that apply
    a. Chemical: If you check chemical it will ask for a description. Please provide the number of containers, the number of containers and a brief description of waste. Example: 5 each carboy of solvent waste, 3 each 500 ml various waste and 4 each 1 gal acid waste.
    b. Lab Clean out: If you check Lab cleanout it will ask for a description. Please provide a brief description which includes the type of lab, the number of chemicals and when it must be completed. Example: chemistry teaching lab, old and expired chemicals only, Sept 10, 2018; Organic chemistry, all chemicals, Sept 10, 2018.
    c. Chemical ReUse Donation: If you check the Chemical ReUse Donation you must provide the name of each chemical you are requesting to be approved for the Chemical ReUse Program.
8. Biological Waste If your request includes Biological waste check all that apply.
    a. Sharps container: If you check Sharps container it will ask for the volume of sharps. Provide the number of containers and the size of the container. Example: 1 ea. one quart, 2 ea. 5 quart
    b. Other: If you check other, provide a description of the biological waste.
9. To Order Empty/ Replacement containers or secondary containment: If you need any empty/replacement containers or secondary containment check yes. You can order containers without requesting a waste pickup.
    a. If you check yes, you will see the photos and a written description of each type. Enter the number of each type of container in the box provided.
10. Order Hazardous Waste Labels: Indicate whether or not you need hazardous waste labels.
11. Question or Comments: This portion of the form is used for notes, instruction, or questions.

Full waste containers should not be stored in labs for longer than 2 weeks.

Chemical ReUse Program

The Chemical ReUse Program can provide real cost savings for the University in two ways. First, utilizing chemicals from the Chemical ReUse Program decreases the amount of new chemicals purchased. Secondly, chemicals which are reused do not require disposal, avoiding the extremely high cost associated with that service.

Environmental Health & Safety (EH&S) manages a Chemical ReUse Program as part of the overall OSU Hazardous Material Services program. The objective is to collect chemicals from those who have no use for them and redistribute them to those who need them. These chemicals are available at no charge at ChemStores to faculty and staff and for University use only.

Criteria for Acceptable Chemicals

Only chemicals from OSU labs, clinics, and other support centers can be donated to the Chemical ReUse Program. Chemicals that are unopened are eligible. Chemicals that are selected for the redistribution program are carefully examined to determine if they meet the following criteria:

1. Chemical must be within its recommended shelf-life period.
2. Chemical must be in its original container and unopened.
3. The chemical container must be in good condition and all labels must be legible.
4. Chemical must maintain chemical integrity at ambient room temperature. Due to limited storage capability, chemicals which require refrigeration or freezer are not accepted into the Chemical ReUse Program at this time.
5. Each chemical will be reviewed prior to acceptance.
6. EH&S reserves the right to reject any chemical which they deem ineligible for the program.

Unacceptable Chemicals

The following items are not eligible for the Chemical ReUse Program:

1. Expired chemicals.
2. Laboratory prepared formulations.
3. Cylinders, lecture bottles, and dewars.
4. Radioactive materials.
5. DEA controlled substances.
6. Infectious substances and select agents.
7. Highly reactive chemicals.
8. Chemicals that require refrigeration or freezer.
9. Any chemical EH&S deems could pose a substantial health or safety risk (i.e. potential peroxide formers).

How to Donate Chemicals Suitable for the Chemical ReUse Program

1. Chemicals suitable for reuse can be donated to the program by using the Waste Pickup Request form. Check the box for Chemical ReUse Donations and list the chemical that is to be evaluated for the program. Please clearly mark the chemicals for reuse so EHS can easily differentiate them from normal chemical waste at your pickup location.

2. Deteriorating containers or containers in which evidence of a chemical change is apparent are not acceptable for reuse and will be disposed of. This includes leaking or damaged containers and visibly contaminated containers.

3. Only chemicals with original manufacturer's labels will be accepted for reuse.

4. Any expiration date stated on the container will be adhered to. In the case of no expiration date or a material which does not degrade regardless of the expiration date, EHS personnel will make the determination.

5. Materials not acceptable for reuse will be disposed of according to normal hazardous waste disposal procedures. EHS personnel will make the final determination on whether the material is acceptable for reuse or must be disposed of.

EHS Review and Approval (or Rejection)

After the online request has been submitted, EH&S anticipates seven business days for review, approval and pick up from the donor. IMPORTANT NOTE - Chemicals that are not approved for chemical exchange must be disposed of through the waste disposal program.

After approval of the donated chemical, EH&S will transfer the donated chemical from the Principal Investigator's (PI) Inventory to the Chemical ReUse Inventory (CHEM EXCHANGE) and deliver the donated chemical to ChemStores. ChemStores will enter the item in the ChemStores catalog and assign a unique identifier, indicating the chemicals are in the Chemical ReUse program. Then they are available at no cost to OSU personnel only for use at OSU only.

Satellite Accumulation Areas

Satellite Accumulation Area is the name given to the area where hazardous wastes are generated and stored before being moved to the campus 90-day central storage area. Satellite Accumulation Areas can be thought of as the individual rooms, work areas, art studios, and laboratories where hazardous waste is generated.

Hazardous waste can be accumulated in a Satellite Accumulation Area if the following requirements are met:

- A generator can accumulate up to 55 gallons of hazardous waste or one quart of acutely hazardous waste (P-listed) before the waste must be moved to the 90-day central storage area.
- Hazardous waste must be stored at or near the point of generation and under the control of the person who generated the waste.

NOTE: EH&S requires the Satellite Accumulation Area to be in the location of generation.

- Hazardous waste must be kept in the same room, lab, work area, or art studio that it is generated. Under the hazardous waste regulations, you cannot move a container of

hazardous waste from one location to another, including from one room to another room, down a hallway, to another building, etc.

- According to how the regulations are written, by moving hazardous waste from one room to another room or building, you are no longer storing waste under Satellite Accumulation Area rules, you are essentially creating another 90-day central storage area and must comply with all applicable storage requirements. To avoid this, keep hazardous waste stored at or near the point of generation.
- A general rule of thumb is to follow the "Frisbee Rule": You should be able to throw a Frisbee to your hazardous waste containers in your Satellite Accumulation Area. You can't throw a Frisbee through walls, from indoors to outdoors, around corners, down hallways, etc. and still reach your hazardous waste containers. Keep your hazardous waste containers in the same room in which the hazardous waste was generated.

NOTE: Satellite Accumulation Area rules DO NOT apply to chemicals that are still in use and therefore not considered hazardous waste. Satellite Accumulation Area rules apply only to hazardous waste containers.

- Hazardous waste must be properly labeled. ALL containers of hazardous waste MUST have a "Hazardous Waste" label listing all constituents in the waste container.
- ALL containers of hazardous waste MUST be kept closed except when adding or removing waste.
- Hazardous waste must be stored in containers that are compatible with the waste being stored and be free of cracks and leaks. If a container is leaking or in poor condition, call EH&S at 541-737-2273.
- Hazardous waste must be disposed of properly; do not dispose of hazardous waste down sink drains, in the normal trash, or by evaporation in fume hoods as this constitutes illegal disposal.
- Do not store hazardous waste containers in or around sinks, including cup sinks in hoods.
- Liquid hazardous waste containers must be stored in plastic secondary containment trays labeled "hazardous waste secondary containment". You can obtain one of these specially labeled trays by requesting them in the notes and comment section of the online waste pickup form.
- Do not mix solid waste with liquid waste.
- Do not mix Mercury or mercury-containing materials with any other waste.
- Do not mix Dioxin or dioxin-containing materials with any other waste.
- Do not mix Peroxide forming chemicals with any other waste.
- Do not mix Oxidizing agents with organic compounds, flammable, and combustible materials.
- Do not mix Oxidizing agents with reducing agents (e.g. zinc, alkaline metals).
- Do not mix Aqueous wastes with organic solvents.
- Do not mix Acids with Organic, flammable and combustible materials. Basic (caustics) and reactive metals such as sodium, magnesium, and potassium. Chemicals which can generate toxic gases upon contact such as sodium cyanide, iron sulfide, azides, and phosphides
- Chemical waste must NOT be poured down the sink for disposal. Remember: Dilution is NOT the Solution.

- Keep waste containers capped/covered when not actively being used.
- Keep all glass waste containers in secondary containment. Do not store on the floor.
- Contact EH&S for proper waste management and disposal or requesting supplies. http://my.ehs.oregonstate.edu/qualtrics/haz-waste-pickup.
- Always wear appropriate personal protective equipment when handling hazardous waste.
- DO NOT fill liquid containers completely. Leave enough head space to allow for expansion.
- DO NOT use structural formulas or abbreviations on the hazardous waste labels or disposal record

Management Procedures for Specific Chemical Waste Sites

The following guidelines are for the management of specific types of hazardous waste. It is important that you adhere to these guidelines. If you routinely generate a large quantity of a particular a chemical or waste stream, contact the hazardous waste safety officer at 541-737-2273 and special disposal arrangements can be made to accommodate your waste.

Silica Gel

Silica gel contaminated with solvents, heavy metals, or other toxic chemicals should be accumulated in leak-proof containers such as plastic wide mouth containers or a five-gallon bucket. Contact EH&S waste management personnel at 541-737-2273 for these supplies. When labeling Silica gel waste, be sure to list all of the contaminants, including solvents, and the approximate percentages on the Hazardous Waste Label.

Non regulated but treated as hazardous waste

In some cases, it is not prudent to dispose of nonhazardous waste into the dumpster. For example, ethidium bromide (mutagen) or phenol (poison) contaminated solid debris is best disposed of by incineration.

Pipette Tips

Follow instructions based on the type of contamination:

Used but not contaminated with hazardous material or chemical
Select an acceptable container:

- The pipettes' original box with a clear plastic bag placed inside.
- Any other rigid, puncture-proof container
- Label the container "Trash."

Dispose of the container.
If you used the original box, tie the liner bag and tape the box closed.
If you stored the pipettes in a storage container, close and seal the container.
Place the sealed box or container into a regular laboratory trash can.

Chemical contamination pipette tips
Select an acceptable storage container: Options for pipettes contaminated with hazardous materials include:

- The original pipette box with a plastic bag placed inside
- A sharps storage container
- Recycled rigid plastic roller bottles
- A zip closure type plastic bag

Label the storage container:

- Label with a hazardous waste label after you place the first contaminated pipette into the plastic bag or another container.

Dispose of contaminated pipettes:
If you stored the pipettes inside a plastic bag in their original box, tightly tie the bag closed.

Contaminated with mixed hazardous material
For pipettes contaminated with multiple categories of hazardous materials (biological, radioactive, or chemical), contact the EH&S for specific disposal instructions.

Empty Chemical Containers

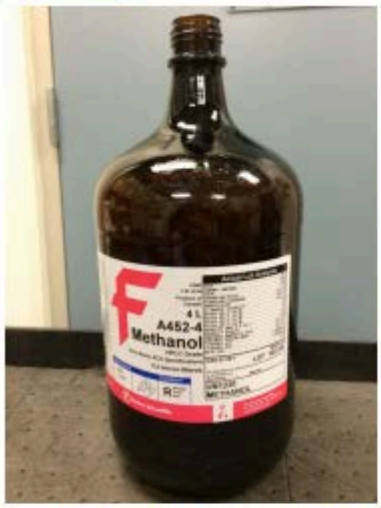
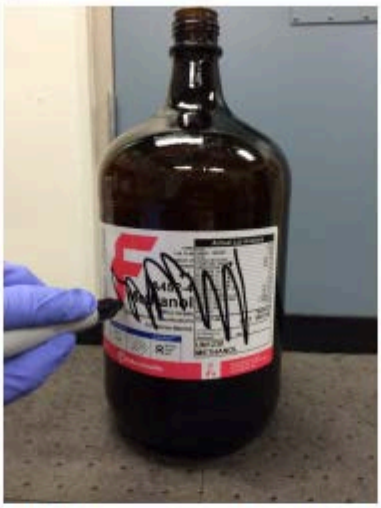
For a container to be disposed of and not be treated as a hazardous waste, it must be considered “RCRA empty.” For waste containers that used to hold an acute hazardous waste, this requires triple rinsing of the container with a solvent that can remove the hazardous waste (and collecting the solvent and managing it as a hazardous waste).

For non-acute hazardous wastes, the definition of RCRA empty would include:

- All waste has been removed that can be removed by pouring, pumping, or by means of suction; and
- No more than 1 inch (in.), equivalent to 2.5 centimeters, of residue remains on the bottom of the container or inner liner (commonly referred to as the "one-inch rule"); or
- No more than 3 percent by weight of total capacity of the container remains in the container or inner liner if the container is less than or equal to 119 gallons (gal) in size; or
- No more than 0.3 percent by weight of the total capacity of the container remains in the container or inner liner if the container is greater than 119 gal in size.

You must deface the label. The container may now be reused as a waste container or disposed of into the dumpster.

How to Deface an Empty Container

		
1. Remove the cap and triple rinse the empty container.	2. Take a pen or a sharpie and scribble over the label.	3. Ensure that there is adequate coverage and dispose of bottle in appropriate recycling container (plastic, glass, or amber).

Broken Glass Boxes

Broken glass and other sharp items shall be disposed of in rigid, puncture-resistant containers to protect persons collecting the waste materials (ChemStores has a broken glassware box for purchase). These containers must be properly labeled. They should never be filled to the point where any material is protruding, or so that the weight of the carton would present a lifting hazard. Check to ensure that the container is intact and sound before attempting to lift. Securely tape the container before depositing in the dumpster. Ensure that only clean (not contaminated) glass is deposited to these containers.

No Needles.
No contaminated pipettes.
No contaminated glassware.
No radioactive materials (must be disposed of as Radioactive Waste).
No chemicals (must be disposed of Hazardous Waste).
No biological materials (must be disposed of as Biohazard Waste) BROKEN MERCURY THERMOMETERS MUST BE DISPOSED OF AS HAZARDOUS WASTE! Also, make sure that the box does not have a Biohazard symbol on it or is lined with a Biohazard bag.

Concentrated Solutions of Acids and Bases

Concentrated solutions of acids and bases must be disposed of through the hazardous waste management program. EH&S recommends that laboratories using highly concentrated corrosive solutions have written policies and procedures in addition to providing documented training to students and staff.

Neutralization of acids

Best practice is to place a Hazardous Waste request with EH&S when disposing of any acid. However, certain acids may be neutralized and poured into the sanitary sewer, but only when the neutralized mixture is non-toxic and meets the city of Corvallis discharge limits (pH of 6-9.5). During the neutralization of acid, the lab worker should don full PPE and work in a fume hood if possible.

In order to reduce injury or accidental chemical reactions. The following is a list of acids and bases that shall not be neutralized and disposed of by sanitary sewer:

- Perchloric acid at any concentration
- Nitric acid, at concentrations above 70% or red fuming nitric acid.
- Sulfuric acid, fuming (Oleum or disulfuric acid)
- Hydrofluoric acid at any concentration.
- Acids with heavy metals in solution.
- Aqua Regia
- Acids that contain dyes or surfactants
- Any organic acids that are still toxic after neutralization (most organic acids - one exception is acetic acid with a concentration of less than 80%(i.e. do not neutralize glacial acetic acid

Chromic acid

Chromic acid is a powerful oxidizing agent that is both toxic and corrosive and can explode on contact with organic materials. Chromium (VI) is also classified as a carcinogen. Accidents involving Chromic acid cleaning solutions can result in burns to skin and clothing.

Chromic acid cleaning solutions leave a residue of Chromium (VI) on the glass surface, which is difficult to remove. This residue has been known to interfere with certain research procedures since the material can leach into solution. EH&S highly recommends that you consider using Chromic acid alternatives such as “No Chromix”, “Alconox”, or similar products which are available commercially.

Hydrofluoric acid

Hydrofluoric acid is a strong corrosive and highly toxic chemical that causes severe burns even from dilute solutions and can be fatal upon exposure to concentrated solutions. Benchtop use of Hydrofluoric acid is not permitted, it must only be used in a fume hood.

Because of Hydrofluoric acid’s ability to etch glass, the chemical and waste must be stored in plastic containers. EH&S recommends that PI’s of laboratories using HF+ have written policies, procedures, and training with documentation for all students and staff working with the chemical. PI’s are also required to provide all necessary PPE including Calcium gluconate for emergencies.

Any lab using Hydrofluoric acid should contact EH&S at 541-737-2273 to request an in-person HF awareness training. The amount of Hydrofluoric acid that is used and stored should be kept to an absolute minimum.

Organic Solvents

Do not dispose of organic solvents down the drain. Generators of organic solvents should keep non-halogenated waste solvents separated from halogenated waste solvents to the fullest extent possible. EH&S combines organic solvents into 55-gallon drums for fuels blending. It costs approximately three times as much to dispose of a drum of halogenated waste solvents versus a drum of non-halogenated waste solvents.

Blue Solvent jugs should only be used for the storage of organic waste solvents. Other wastes are inappropriate for fuels blending, can have a detrimental effect on the integrity of the metal 55-gallon drums used, and represent a serious health and safety issue to EH&S staff.

The following wastes must NOT be collected in Blue Solvent jugs:

- Any acid or base solutions (a pH between 4 and 11 is acceptable)
- Aqueous solutions of toxic organic chemicals
- Heavy metals (Lead, Mercury, Silver, Chromium, Barium, etc.)
- Vacuum pump oil
- Sulfides or inorganic cyanides
- Strong oxidizers or reducers
- Water reactive substances
- PCB waste
- Unknowns

Be sure to include approximate percentages of all waste solvents placed in safety cans. Do not rely on your memory to label solvents, keep a running list of solvents that you add to the waste container.

Mercury

Metallic mercury is collected and recycled. It should be packaged in a tightly sealed and leak-free container such as a bottle or vial with a screw top lid. Place broken mercury thermometers in a leak-proof container or a secured plastic bag. When collecting metallic mercury, DO NOT mix with other chemicals or waste if at all possible.

Do not use the past practice of adding sulfur, nitric acid, or water in an attempt to contain vapors. This only results in more hazardous waste being generated and rendering the metallic mercury as non-recyclable. However, the use of commercial ‘Hg Absorb’ powder found in mercury spill kits is acceptable.

Mercury is a highly toxic chemical and ALL mercury spills, including broken thermometers, must be cleaned up and the spilled debris must be disposed of through the hazardous waste management program. Commercial mercury spill kits are available through many safety supply companies. Never use a regular vacuum cleaner to clean up a mercury spill, this will only cause the mercury to vaporize and disperse into the air. Environmental Health & Safety has a special mercury vacuum designed for cleaning up

mercury spills and a mercury vapor analyzer to determine if all mercury has been cleaned up from a spill. Contact EH&S immediately at 541-737-2273 for assistance.

Fluorescent Tubes

Fluorescent tubes and other mercury-bearing lamps such as high-pressure sodium lamps, mercury vapor, and metal halide lamps must be disposed of properly. These items cannot be placed in the normal trash. Broken fluorescent tubes must be handled as hazardous waste. Every attempt should be made to keep these items intact and to prevent breakage.

If tubes are broken, place pieces into plastic bags immediately and contact EH&S at 541-737-2273

There is a program in place to manage fluorescent tubes and other mercury-bearing lamps. Contact EH&S at 541-737-2273 for more information. More information can be found on our website at http://my.ehs.oregonstate.edu/qualtrics/universal-waste-management-plan

Batteries

There is a program in place to recycle batteries (Alkaline, Ni-Cad, Lithium, Lead acid, Mercury, and button batteries). There are a number of battery collection containers around campus. If you would like to request a battery collection container for your building/work area or if a battery collection container is full, complete a hazardous waste pickup request. (http://my.ehs.oregonstate.edu/qualtrics/haz-waste-pickup)

Aerosol Cans and Cylinders

Aerosol cans and small propane cylinders can contain flammable, corrosive, and toxic chemicals and propellants. Aerosol cans and small propane cylinders are collected during regular hazardous waste pickups.

Large (2 or 4 foot) high-pressure gas cylinders can be removed by EH&S. Call 541-737-2273 for assistance.

Paint, Paint Thinner, Adhesives, and Print Shop Chemicals

Paint (oil-based), paint thinner, adhesives, and resins are flammable and are regulated as hazardous waste. These items cannot be poured down the drain or left out to evaporate. They must be disposed of through the hazardous waste management program.

Photographic Chemicals

Photographic chemicals can contain heavy metals such as Silver, Chromium, and Selenium that may be above regulatory levels and must be handled as hazardous waste. EH&S collects photographic chemicals through the regular hazardous waste pickup process. Special arrangements can be made to return collection containers to darkroom users. For more information on disposal of photographic chemicals, contact EH&S at 541-737-2273.

Reactive and Potentially Explosive Chemicals

Reactive chemicals such as strong oxidizers and reducers and air/water reactive chemicals must be disposed of through the hazardous waste management program. Because of their reactive nature, it is important to minimize the quantity of reactive chemicals in storage. If the integrity of the container appears to be compromised, dispose of the chemicals immediately. Never dispose of reactive chemicals, such as sodium metal, regardless of the quantity, down the drain or in the normal trash. Such practices can result in fires, toxic vapors, and gases being released, and injury to people. When disposing of these compounds, please note any special hazards on the Hazardous Waste label.

Some of these compounds can also become unstable and potentially explosive over time due to contamination with air, water, other material, or when the chemical dries out. If you come across any chemical that you suspect could be potentially explosive, do not attempt to move the container as some of these compounds are shock, heat, and friction sensitive. Be sure to let others in the lab or work area know the chemical exists and the potential explosion hazard. Contact EH&S at 541-737-2273 immediately for assistance.

Examples of potentially explosive chemicals include:

Benzoyl peroxide (dry)	Peroxide-forming compounds
Diazo compounds	Picric acid (dry)
2, 4-Dinitrophenyl hydrazine (dry)	Sodium amide
Nitrocellulose	Trinitro compounds

Peroxide Forming Chemicals

Many commonly used chemicals - organic solvents in particular - can form shock, heat, and friction sensitive peroxides upon exposure to oxygen through concentration, evaporation, and distillation. Due to the serious fire and explosion hazards, these chemicals can present, the following guidelines must be followed when using peroxide forming chemicals.

Class I: Unsaturated materials, especially those of low molecular weight, may polymerize violently and hazardously due to peroxide initiation.

Acrylic acid	Tetratluoroethylene
Acrylonitrile	Vinyl acetate
Butadiene	Vinyl acetylene
Chlorobutadiene (chloroprene)	Vinyl chloride
Methyl methacrylate	Vinyl pyridine
Styrene	Vinylidene chloride

Class II: The following chemicals are a peroxide hazard upon concentration (distillation/evaporation). A test for peroxide should be performed if the concentration is intended or suspected.

Acetal	Dioxane (p-dioxane)
Cumene	Ethylene glycol dimethyl ether (glyme)
Cyclohexene	Furan

Cyclooctene	Methyl acetylene
Cyclopentene	Methyl cyclopentane
Diacetylene	Methyl-i-butyl ketone
Dicyclopentadiene	Tetrahydroturan
Diethylene glycol dimethyl ether (diglyme)	Tetrahydronaphthalene
Diethyl ether	Vinyl ethers

Class Ill: Peroxides derived from the following compounds may explode without concentration.

Organic	Inorganic
Divinyl ether	Potassium metal
Divinyl acetylene	Potassium amide
Isopropyl ether	Sodium amide (sodamide)
Vinylidene Chloride	

Please note this list is not all-inclusive, there are numerous other chemicals that can form peroxides. Check Safety Data Sheets (SDS) or contact EH&S for more reference sources.

- All peroxide forming chemicals MUST be dated when received and dated when opened. Chemicals designated as Class III compounds should be disposed of within 3 months of opening and Class I and Class II compounds should be disposed of within 12 months of opening.
- All peroxidizable compounds should be stored away from heat and light. Sunlight is an especially good promoter of peroxidation.
- Refrigeration does not prevent peroxide formation.
- As is the case with all hazardous chemicals, and in particular with peroxide-forming chemicals, only order the amount of chemical that you need. Do not order excess chemicals that will not be used right away.
- Be sure to tightly close each container after use. Loose or leaky closures may allow for evaporation of the chemical which can result in peroxide formation.
- There are a number of inhibitors that can be used to help prevent peroxide formation. Examples include Hydroquinone, Alkyl phenols, and Aromatic Amines. Check with the chemical manufacturer to determine which inhibitor is the best to use.
- Never distill peroxide-forming solvents unless they are known to be free of peroxides. Peroxides concentrated in still residue can be a serious explosion hazard.
- There are peroxide test strips that can be used to test for peroxides. EH&S also has a number of references that list various methods for testing peroxides. While no definitive amount of peroxide concentration is given in the literature, a concentration of 50 ppm should be considered dangerous and a concentration > 100 ppm should be disposed of immediately.
- Compounds that are suspected of having very high peroxide levels because of age, unusual viscosity, discoloration, or crystal formation should be considered extremely dangerous. If you discover a container that meets this description, DO NOT attempt to open or move the container. Make other people working in your area aware of the potential explosion hazard and contact the EH&S immediately at 541-737-2273.

Due to the extremely high cost of remote openings, special handling, and disposal of chemicals that are considered potentially explosive (> $1000 per container), users of peroxide forming chemicals must follow the guidelines listed above. If a particular container requires special handling or remote opening by an outside environmental company as a result of improper handling and storage by laboratory personnel and failure to follow the guidelines listed above, then all costs associated with the special handling will be charged back to the faculty member responsible for the laboratory.

Perchloric acid

Perchloric acid is a strong oxidizer and corrosive acid. Perchloric acid can also react with metal to form shock-sensitive metal perchlorates. This can occur when Perchloric acid is used in a regular (non-Perchloric acid) fume hood.

Because of this high hazard, the Perchloric acid must only be used in a special Perchloric acid fume hood, which has a wash down function.

Unknowns

Proper labeling of all chemical containers by lab members will prevent the creation of dangerous, expensive-to-dispose chemical wastes of unknown origin. Workers who generate large amounts of small sample-sized containers of waste must be equally careful to positively identify all chemical constituents in their samples so that they may be properly managed and disposed of.

Before leaving a lab, workers must ensure that all chemical wastes that they have been responsible for creating are positively identified and labeled.

Hazardous waste labels should be affixed to waste containers before any waste is added to the container; a running list of constituents can then be easily completed and tracked by all members of the lab. Each time a new constituent is added, the new addition must be added immediately to the label.

If lab workers come across old or abandoned chemicals of unknown origin or make-up, they are directed to label the container with a Hazardous Waste label and write “Awaiting Administrative Determination” and date the container. in the constituent section. Dispose of the unknown waste through EH&S as soon as possible to prevent inadvertent personnel exposure to the unknown chemical.

DO NOT GUESS AT THE IDENTITY OR “CREATE” A NAME FOR AN UNKNOWN! A wrongly identified waste, if released accidentally to the environment, if exploding during disposal, or if causing the fouling of an incinerator pollution control system, not only will harm life and property but could result in potential litigation. Likewise, the indiscriminate discarding of unknown chemical substances can have equally serious consequences.

Prevention and Management of Unknown Chemicals/Chemical Waste

Personnel must make every effort to provide an accurate description of all chemicals that they dispose of through the hazardous waste management program.

Many unknown chemicals are generated due to a lack of good housekeeping and good laboratory safety practices. ALL containers used to store chemicals must be properly labeled.

There are some easy ways to preventing the generation of unknown chemicals/materials:

1. Ensure that a label is present on all containers of chemicals including containers of wastes. This means all containers even beakers, test tubes, wash bottles, and other containers.
2. Use chemical names to identify the contents of containers. For hazardous wastes generated at OSU, this is a requirement. Do not use formulas, abbreviations or chemical structures on hazardous waste labels.
3. Containers in which the labels are degrading or falling off should be given a new label immediately.
4. Check laboratory notebooks for information related to vials or test tubes. Many researchers in labs keep detailed notes on what was placed in these containers.
5. Don't leave waste containers in the lab under the fume hood for extended periods of time. If a container isn't full but no more waste is anticipated in the near future, submit a waste pickup request to EH&S.
6. If chemical wastes cannot be identified, fill out a Hazardous Waste Label. Write the term "Unknown Waiting for " in the Constituents section of the label and add any information available concerning the waste. Laboratory personnel in possession of unknown wastes should make every effort, including contacting departed faculty or staff if necessary to determine a container's contents. Submit a waste pickup request to EH&S as soon as possible of unknowns.

ALL containers used to store chemicals must be labeled. Containers in which the labels are degrading or falling off should be given a new label. There are numerous reference materials with methods and procedures that can be used in identifying unknown chemicals. Every effort should be made to prevent the occurrence of unknown chemicals and to properly identify any unknowns that are discovered. Contact EH&S at 541-737-2273 for assistance.

Sink Disposal

Improper disposal of chemical waste can result in non-compliance with EPA, state and/or local hazardous waste regulations, University wastewater permit, have a negative impact to our environment, but more importantly is a potential safety and health risk to Facilities staff that may need to work on plumbing lines.

What Happens to the Hazardous Waste Generated on Campus

After a chemical waste has been generated, determined to be hazardous, and sent through the hazardous waste management program, there are 3 primary ways in which the waste is handled: bulk drums, lab pack drums and recycling/reclamation.

Bulk Drums

Bulking is to accomplish considerable cost savings by commingling (i.e., mixing) waste materials. This is the process where compatible wastes from various sources are combined prior to disposal. Commingling is particularly suitable for waste solvents because disposal of liquid in a 55-gallon drum is generally much less expensive than disposal of the same volume of liquid in small containers. Because mixing waste requires the transfer of waste between containers, it is imperative that the identity of all materials be known. Commingling requires the opening of containers and transferring their contents from the smaller laboratory containers to a larger drum.

Certain categories of liquid chemicals can be bulked and combined into drums. Examples include halogenated flammable solvents and non-halogenated solvents, bulked in separate drums. Bulking waste (as opposed to lab packing) can result in significant cost savings tor the University and ultimately your department. Bulking first involves segregating chemicals according to hazard class. Then a small amount of chemical from each container is mixed in a 1-gallon size container - to minimize any potential fire or explosions. If no reactions occur, then the rest of the chemical is poured into a 30- or 55-gallon drum. Accurately labeling chemicals helps to avoid potential reactions, fires, or explosions when chemicals are bulked.

Lab Pack Drums

Lab pack Laboratory waste typically leaves the generator's facility commingled in drums as compatible wastes or within a Lab Pack. Lab Packs are containers, often 55-gallon drums, in which small containers of waste are packed with an absorbent material. Lab Packs had been used as the principal method for disposing of laboratory waste within a landfill. However, recent landfill disposal restrictions severely limit landfill disposal of hazardous materials. Thus, the Lab Pack has become principally a shipping container. Typically, the Lab Pack is taken to a disposal facility, where it is either incinerated or unpacked and the contents redistributed for safe, efficient, and legal treatment and disposal.

Collecting containers of waste in a Lab Pack is usually much more expensive for ultimate disposal than is a commingling of compatible wastes, partly because a 55-gallon Lab Pack only holds about 16 gallons of waste.

Small containers of compatible waste materials are placed in a larger container, usually a 55-gallon drum, along with appropriate packing materials, as they are collected. When a drum is filled, it is sealed and ready for shipping. An inventory list of the contents of a Lab Pack is required for shipping and is usually requested by the TSDF.

Waste Contractor

OSU is considered a large quantity generator, that is, wastes stored at the campus EH&S Hazardous waste facility must be properly disposed of or shipped to a designated facility less than 90 days. To properly dispose of waste, bids are taken from waste contractors. Waste contractors are chosen based on cost, experience, reputation, waste management facility, and many other criteria. The waste contractors are carefully chosen and their EPA ID numbers are always verified since the waste is the responsibility of the waste generator

according to the “cradle-to-grave” rule. Once chosen, the hauler and designated facility are responsible for, but not limited to, the terms of the agreement in the waste contract.

Recycling/Reclamation

Chemicals such as vacuum pump or engine oil are sent for recycling/reclamation. Items containing mercury, such as thermometers and manometers are collected and the mercury is removed. It is important to minimize the amount of other material that is mixed in with these items. The addition of chemicals or other solid waste to these items can result in the material being unsuitable for reclamation and having to be disposed of as hazardous waste instead.

Drain/Trash Disposal

Oregon State University does not permit the disposal of chemical wastes by trash or sanitary sewer.

Ultimate Disposal

There are a variety of treatment/destruction methods that environmental companies use after they receive the waste generated by OSU. Some wastes (bulk flammable liquid drums) are used as a secondary fuel source at cement kilns. Wastes such as acids/bases and oxidizers/reducers can be treated at a facility to render the waste non-hazardous. Most waste will be sent to a hazardous waste incinerator.

References

OSU Hazardous Waste webpage: https://ehs.oregonstate.edu/waste
OSU Hazardous Waste Minimization Plan http://my.ehs.oregonstate.edu/qualtrics/haz-waste-minimization-plan
OSU Universal Waste Management Plan http://my.ehs.oregonstate.edu/qualtrics/universal-waste-management-plan
D listed (Characteristic) http://ehs.dev.acquia.cws.oregonstate.edu/files/pdf/DList.pdf
F listed (Waste from non-specific sources
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K listed (Waste from specific sources)
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Non-hazardous Waste list
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Safety Instruction Library http://ehs.dev.acquia.cws.oregonstate.edu/safety-instructions
Standard Operating Procedure (SOP) template Library https://ehs.oregonstate.edu/sop-template-library

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