



Hazardous Waste Manual

**How to Properly Dispose of Radioactive, Biological, and
Chemical Wastes Generated at Northern Arizona
University**

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Table of Contents

Introduction	3
Defining Biological, Radioactive, and Hazardous Waste	4
Classification of Hazardous Waste	5
Satellite Accumulation Area Requirements.....	6
Universal Waste (Batteries, Bulbs, etc.)	7
Non-Laboratory (Facilities) Generated Hazardous Wastes	7
Laboratory Generated Hazardous Wastes.....	7
Common Waste Types and Collection Requirements	8
Waste Pickup Requests.....	10
Combining Chemical Waste	10
DEA Scheduled Compounds.....	10
Unknown and/or Potentially Explosive/Toxic Chemicals.....	11
Appendix A.....	12
Appendix B.....	13
Appendix C.....	14
Appendix D.....	15

Introduction

Northern Arizona University initiated 5 Strategic Goals in 2019: Student Success and Access; Research and Discovery; Commitment to Native Americans; Engagement; and Stewardship. Safety is specifically included in NAU's Stewardship strategic goal. In support of this goal, as well as in support for academic success, research and others, NAU generates biological, hazardous, and radioactive wastes. NAU Environmental Health and Safety is responsible for the training, storage, disposal, and transport of these wastes in accordance with federal, state, and local regulations.

This document describes the origins, types, and procedures for waste disposal from the generator's perspective. The requirements outlined below *must* be followed to comply with state and federal regulations. A civil penalty under the Resource Conservation and Recovery Act (the EPA law regulating hazardous waste) is currently \$72,718 per day per violation. For this reason, requirements set forth in this document are a *must* or *shall*. Failure to adhere to these requirements may result in a fine and/or imprisonment to the University and/or parties involved.

The handling of any biological, radiological, or hazardous waste on NAU campus requires the user take training perspective to that area. Safe handling procedures and training can be found on the EHS website at nau.edu/ehs. These trainings include:

- NAU Chemical Hygiene Plan and Training
- NAU Radiation Safety Manual and Training
- NAU Biological Safety Manual and Biosafety Training
- NAU Hazard Communication Manual and Training

Defining Biological, Radioactive, and Hazardous Waste

Biological Waste

Biological waste is material generated in laboratories, clinical sites, or other medical waste that contains, or potentially contains, biohazardous agents or recombinant DNA material. Biological waste generated at NAU includes:

1. *Cultures and stocks*: Agents infectious to humans, animals, and plants, live and attenuated vaccines and anything used to contain, mix or transfer infectious agents. This includes but is not limited to petri dishes, pipettes, pipette tips, microtiter plates, disposable loops, etc.
2. *Medical waste*: generated in the diagnosis, treatment, or immunization of humans, either from clinical sites or research laboratories.
3. *Human blood, blood products and infectious body fluids*: This category includes blood that is not contained by a disposable item or is visibly dripping, serum, plasma, and other blood products or non-glass containers filled with such discarded fluids. It further includes any substance which contains potentially infectious material as defined by the OSHA Bloodborne Pathogens Standard including:
 1. human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and body fluids in situations where it is difficult to differentiate between body fluids,
 2. any unfixed tissue or organ (other than intact skin) from a human (living or dead) including cell or tissue cultures, and
 3. HIV or HBV-containing materials.
 4. Glass containers filled with such discarded fluids shall be considered sharps.
4. *Sharps*: needles, scalpel blades, hypodermic needles, syringes (with or without attached needles) and needles with attached tubing regardless of contact with infectious agents are medical waste. Other sharps include pasteur pipettes, disposable pipettes, razor blades, blood vials, test tubes, pipette tips, broken plastic culture dishes, glass culture dishes and other types of broken and unbroken glass waste (including microscope slides and cover slips) that may have been in contact with infectious material. Any item that can puncture or tear autoclave bags.
5. *Research animal waste* including all carcasses and body parts and contaminated bedding from animals that were intentionally exposed to infectious agents during research.

Radioactive Waste

Radioactive waste may be either low-level or high-level waste. No high-level wastes exist on campus. Low-level waste includes all radioactive isotopes (including those that occur naturally) and/or discarded materials that are generated from procedures involving Bureau of Radiation Control licensing.

Hazardous Waste

The Resource Conservation and Recovery Act defines hazardous waste. A used or unused chemical or combination of chemicals could be classified as a hazardous waste by meeting one or more criteria, covered in detail below.

Mixed Waste

Staff, faculty, or students may create a waste that has a mixture of the above hazards. Examples include but are not limited to: ICPMS waste with both an EPA regulated (RCRA) heavy metal and radioactive isotope (e.g. silver and uranium); animal remains previously exposed to arsenic; and many others. Mixed waste disposal is expensive and challenging; prior to generating such wastes, contact EHS for guidance.

Classification of Hazardous Waste

A hazardous waste may be defined as a “Listed Waste” and/or could meet the definition of a “Characteristic Waste”. Characteristic wastes meet one or more criteria below:

Hazardous waste Characteristics:

- Ignitability:
 - A liquid with a flash point <140 degrees Fahrenheit
 - A solid that burns vigorously and/or persistently, either on its own or through absorption of moisture, or that undergoes spontaneous chemical change resulting in combustion
 - An oxidizer
 - An ignitable compressed gas
- Corrosivity
 - An aqueous solution with a pH ≤ 2 or ≥ 12.5
 - A liquid capable of corroding steel greater than a quarter inch/year at 130 degrees Fahrenheit
- Reactive
 - Materials that are unstable or undergo violent chemical change without detonation
 - Materials that react violently with water, form potentially explosive mixtures with water, or release dangerous or lethal gases when exposed to a pH between 2 and 12.5 that contain cyanide or sulfide
 - A DOT explosive, or material that is capable of detonation
- Toxicity
 - Any solid or liquid waste that contains constituents equal to or greater than the amounts specified in Appendix A

Listed wastes on campus include discarded chemical products (DCPs) and wastes from non-specific sources. Non-specific source wastes are identified in Appendix B. The list of DCPs is too long to include in this document, but can be found at 40 CFR 261.33 or by following this link: [EPA Listed Wastes](#). Commonly found listed wastes are included in Appendix C.

***Important note:** certain chemicals do not meet the EPA’s definition of a hazardous waste but are regulated by another entity. A common example is a reagent with a pH of 3; while the EPA doesn’t regard this as a corrosive RCRA waste, the City of Flagstaff does not allow drain disposal of any chemical that has a pH outside the range of 6.5-9. Contact EHS for clarification on the drain or trash disposal of such items.

Satellite Accumulation Area Requirements

NAU EHS supplies containers for biological, hazardous, and radioactive waste collection. EHS prefers that laboratory personnel on campus re-use empty receptacles that previously contained reagents or products for small volume (less than 5 gallon) collection, as long as the container is in good condition, compatible with the contents, and is capable of being closed such that when it is on its side does not leak. Available container sizes and types for each waste are described below:

Container Type	Chemical	Radioactive	Biological
4L Glass or Poly Bottle	X	X	
5-gal bucket or carboy (poly)	X	X	
15-gal drum open or closed head (poly)	X	X	
30-gal drum open or closed head (poly)	X		X
55-gal drum open or closed head (poly)	X		

Liquid wastes shall only be collected in waste receptacles with a screw on lid or fastening top. **Do not** collect liquids in standard, construction style 5-gallon pails- EHS will refuse pickup, require users to transfer the waste, and/or bill departments for disposal.

Labeling and Management

All chemical hazardous waste receptacles at Satellite Accumulation Areas (SAAs) are required to have the following information conspicuously displayed:

1. Contents
2. Hazards of the contents (flammable, toxic, etc.)
3. The words “Hazardous Waste”

4. If the waste is a combination of chemicals, a log of the constituents shall be attached.
 - a. Only bulk agreements where waste is a result of ongoing procedures with identical substances and proportions may be collected without a log.

The container must be closed at all times unless adding waste, compatible with the contents therein, at or near the point of generation, and separated by a physical barrier from other wastes (or reagents) that are incompatible. Satellite waste containers are subject to preparedness, prevention, and emergency procedure requirements. These are outlined in the EHS Hazardous Waste Contingency Plan, which can be found online at nau.edu/ehs.

The maximum amount of waste that may be accumulated at a satellite site is 55 gallons or 1 quart if the EPA designates the waste acutely hazardous. Once these limits are reached or the container is full, the date must be marked on the container and picked up by EHS within three calendar days for relocation to the Hazardous Waste Facility.

Universal Waste (Batteries, Bulbs, etc.)

Universal wastes include batteries, fluorescent bulbs, mercury containing equipment, and certain pesticides. The Universal Waste Program is managed by the General Maintenance Department. A drop off area is staged in the Facilities Building (#77) northernmost hallway. For questions concerning universal waste, please contact Gabriel Gurrola (Gabriel.Gurrola@nau.edu).

Non-Laboratory (Facilities) Generated Hazardous Wastes

Departments outside of laboratories (such as the trades, residence life support services, dining, etc.) generate both universal and hazardous wastes. An important note: these areas tend to be the most scrutinized by inspectors. Department Supervisors must ensure all chemicals are properly labeled, secured, stored, and are in useable condition (i.e. no expired products, dried up paint, etc.). In addition, supervisors are responsible for their department's SAAs and as such, shall ensure all SAA requirements are fulfilled on a daily basis.

Laboratory Generated Hazardous Wastes

Academic and Research laboratories make up approximately 80 percent of University Generated Hazardous Waste. Laboratory supervisors (including both Principal Investigators and Laboratory Managers) must ensure all chemicals are

properly labeled, secured, stored, and are in useable condition (i.e. no expired reagents, dusty containers, etc.). In addition, these personnel are responsible for their laboratory's SAAs and as such, shall ensure all SAA requirements are fulfilled on a daily basis.

Common Waste Types and Collection Requirements

Please note: the details in the list below is recommended and, in some cases, mandatory. EHS understands if work or laboratory processes require collection in such a way that these guidelines cannot be followed. However, they should be followed when possible regardless of convenience, cost, or preference.

Flammable and Non-Flammable Paints, Adhesives, Glues, etc.

Do not mix flammable and non-flammable paint. Carpet adhesives, glues, caulking, varnishes, and other facilities related chemicals shall not be disposed of in the trash unless the SDS of the material or EHS specifically states that it is ok to do so.

Formalin and Formaldehyde

Concentrated, dilute, and/or virgin formalin/formaldehyde solutions must be collected and disposed properly by EHS.

Ethidium Bromide Solutions and Gels

Concentrated, dilute, and virgin ethidium bromide solutions and gels must be collected and disposed properly by EHS. PAGE gels shall also be collected, unless EHS has approved trash disposal.

Ignitable liquids and Organic Solvents

Separate halogenated and non-halogenated solvents. Keep aqueous wastes separate from organic solvents. Do not combine acidic/basic wastes with solvents or create biphasic wastes when possible.

Acids, Bases, and Aqueous solutions

Keep acids, bases, or aqueous solutions with RCRA heavy metals separate from other wastes. Do not mix acids and bases. Do not collect, store, or transport corrosives in metal containers.

Mercury

Keep mercury solutions and salts separate from other heavy metals. Do not use/buy elemental mercury unless it is imperative to research. If possible, please replace

mercury thermometers and have them picked up by EHS ASAP by submitting an EHS Service request.

Contaminated Solids/Liquids

Keep contaminated solids (gloves, pipettes, vials, paper towels, etc.) separate from liquid wastes. Empty vials, test tubes, and other laboratory media with liquid **prior** to disposal.

Oxidizers

Keep oxidizers (both dilute solutions, wastes, and virgin product) separate from other wastes.

Compressed Gases

Compressed gas cylinders and lecture bottles shall be stored in an approved gas cabinet and used in an area rated for their use if required. Inert gases shall comply with all OSHA and EHS requirements. For compressed gas container disposal, please talk to your vendor about recycling prior to requesting an EHS pickup. If possible, use all the contents of the container such that it is in equilibrium with the atmosphere.

Perchloric acid and Perchlorates

Perchloric acid use **requires** a wash down hood. Keep perchloric acid and perchlorate wastes separate from all other wastes.

Cyanides and Pseudo-cyanides

Never collect any cyanide wastes (including pseudo-cyanides such as potassium hexacyanoferrate, guanidine thiocyanate, etc.) in a container larger than 1 liter. Do not combine cyanides with strong acids or oxidizers.

Toxic Wastes

Keep toxic wastes (those displayed in Appendix A) and acutely hazardous wastes (from [EPA Listed Wastes](#)) separate from other wastes whenever possible.

Explosive and Potentially Explosive Materials

Contact EHS immediately by phone if any expired peroxide forming (or contaminated) solvents, dry picric acid, Tetrazole, and/or other explosive or potentially explosive materials are found in the laboratory.

Waste Pickup Requests

Submit waste pickup requests **prior** to the point that containers will be overfull. Do not expect EHS to respond within a day; typical response time is 1-2 working days from the date of submittal. See Appendix D for an example of how to fill out a request.

1. Gather waste containers designated for disposal.
2. Place them in a common area such as a cabinet or lab bench (if possible)
3. Go to nau.edu/ehs and click on “service request”
4. Login using NAU credentials
5. Fill out pertinent information using drop downs (note: do not attempt to enter your employee ID in the blank field at the top)
6. In the comments section, detail the following information:
 - a. Location of waste
 - b. Type of waste
 - c. Number and size of containers
 - d. Whether a replacement container or containers are needed
 - e. Ideal time for retrieval, if applicable
7. If you wish to meet with EHS for pickup, please include one or two times a member of the team generating the waste is available in the ticket, along with their contact info unless the same person is submitting the request. EHS will then contact the individual to setup a pickup appointment.

Combining Chemical Waste

Contact EHS to combine wastes prior to doing so. The mixing of multiple chemical wastes may result in a dangerous chemical reaction. Generation of toxic gases, heat, possible overflow or rupturing of receptacles, fire, and explosions are all possible outcomes when mixing hazardous wastes. The EPA’s waste compatibility chart (found [here](#)) may assist in determining whether or not two wastes can be mixed safely. However, the chart is not to be used as the deciding factor in such scenarios.

DEA Scheduled Compounds

As required by law, only DEA Registrants can order, store, and distribute DEA Scheduled materials. To become a DEA registrant, contact the NAU Office of Regulatory Compliance.

Upon discovery of a DEA Scheduled Material (common research compounds are in the table below, a full list can be found [here](#)), NAU personnel shall contact NAU PD *immediately* for disposal. If NAU PD cannot retrieve the material within the hour, contact EHS using a service request.

Atropine	Benzphetamine
Barbital/bartcuric acid	Chloral Hydrate
Diethyl Propion	Diazepam
Ketamine	Laprozolam
Lorazepam	Nitrazepam

Unknown and/or Potentially Explosive/Toxic Chemicals

Chemical wastes or reagents that are unknown pose a particularly dangerous threat due to their unknown characteristics. NAU personnel shall not transport or handle any unknown chemical wastes without EHS approval. Upon discovery, submit a service request immediately with a best guess or guesses as to the identification of the unknown chemical(s). If the potential for an unknown appears to be immediately dangerous to life and health, contact NAU PD at 523-3000 or dial 911. Depending on the unknown's properties, EHS reserves the right to charge the individual, PI, department or departments responsible for disposal.

Prevention of Unknown Wastes

NAU personnel shall prevent the production of unknown reagents and wastes. OSHA, GHS, and NAU Chemical Hygiene requirements set forth standards that prevent the creation of unknowns. In summary, practice the following:

- Label all containers, regardless of size and contents
- Use full names of chemicals, rather than abbreviations
- Utilize a "chemical key" or legend for abbreviations when needed
- Reallocate or waste the contents of "day-use" containers
- Re-label containers who have faulty or inadequate descriptions
- Attach logs to chemical wastes
- Inform fellow lab/department members what reagents/products your using
- Update your chemical inventory at least once/year
- Practice good housekeeping

Appendix A

Toxicity Characteristic Compounds and Levels

Compound	Concentration (mg/L)
Metals	-
Arsenic	5.0
Barium	100.0
Cadmium	1.0
Chromium	5.0
Lead	0.4
Mercury	0.2
Selenium	1.0
Silver	5.0
Pesticides	-
Chlordane	0.03
Endrin	0.02
Heptachlor	0.008
Lindane	0.4
Methoxychlor	10.0
Toxaphene	0.5
2,4-D	10.0
2,4,5 TP (Silvex)	1.0
Organics	-
Benzene	0.5
Carbon Tetrachloride	0.5
Chlorobenzene	100.0
Chloroform	6.0
Cresol (ortho, meta, and para)	200.0
1,4-Dichlorobenzene	7.5
1,2-Dichloroethane	0.5
1,1 Dichloroethylene	0.7
2,4-Dinitrotoluene	0.13
Hexachlorobenzene	0.13
Hexachlorobutadiene	0.5
Hexachloroethane	3.0
Methyl ethyl ketone	200.0
Nitrobenzene	2.0
Pentachlorophenol	100.0
Pyridine	5.0
Tetrachloroethylene	0.7
Trichloroethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
Vinyl chloride	0.2

Appendix B

Generic:		
F001	The following spent halogenated solvents used in degreasing: Tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures	(T)
F002	The following spent halogenated solvents: Tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, trichlorofluoromethane, and 1,1,2-trichloroethane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those listed in F001, F004, or F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures	(T)
F003	The following spent non-halogenated solvents: Xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents; and all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, and, a total of ten percent or more (by volume) of one or more of those solvents listed in F001, F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures	(I)*
F004	The following spent non-halogenated solvents: Cresols and cresylic acid, and nitrobenzene; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures	(T)
F005	The following spent non-halogenated solvents: Toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, or F004; and still bottoms from the recovery of these spent solvents and spent solvent mixtures	(I,T)

Appendix C

This table contains commonly found Commercial Chemical Products that are regulated for disposal in a different manner than those previously mentioned. Unless a specific procedure or process requires these compounds to be wasted with other reagents, please collect them separately for disposal.

Be advised, this is only 18 of 200 plus chemicals that are listed.

Aldrin	Cyanide Salts
Dieldrin	Epinephrine
Nickel Carbonyl	Osmium Tetroxide
Propargyl Alcohol	Sodium azide
Vanadium Pentoxide	Parathion
Hydrazine	p-Benzoquinone *
p-Nitrophenol *	Phenol *
Toluidine (ortho and para) *	Trypan Blue *
Benzo (a) pyrene*	Acrylamide *

*These chemicals may be combined with other wastes, as long as the concentration is provided in the service request or on the label.

Appendix D

EH&S SERVICE REQUEST

To request service complete the following fields and click the **SUBMIT** button.

Who is the Service Request For?


If submitting a request for another person, click **RESET**, enter the person's UID (abc12) OR Employee ID OR Name, and click its corresponding **FIND** to search.

UID*: [Reset](#)
Employee ID: [Reset](#)
Name*: [Reset](#)

How can We Contact You?

Email*:
Office Phone*:

Where is Work to be Done?

Bldg*: 
Room*:

Who is the Principal Investigator or Supervisor?

P.I. Name*:
Department*:

What is this Request About?

Category*: 
Sub-category*: 

What are the Details of this Work Request?

In order to better fulfill your waste needs, please be specific by including the location, type of waste, size of container, and whether replacement containers are needed. Thank you.

Comments/
Special Instructions
(500 Char. Limit)*

Complete request by clicking the **SUBMIT** button, or click **RESET** to clear all the fields.