



LABORATORY CHEMICAL WASTE MANAGEMENT GUIDELINES



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EHR
Environmental Health & Radiation Safety
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1. Overview

EHRS is responsible for the development and implementation of proper management practices for all aspects of the handling, storage, and disposal of chemical wastes that are generated at the University of Pennsylvania. Our goal is to manage chemical wastes in a safe and environmentally sound manner that complies with all applicable federal, state and local regulations.

2. When is Hazardous Waste Regulated?

Hazardous waste is regulated from the moment it is generated inside the lab until it reaches its final destination for disposal or treatment at an offsite facility.

3. What is Hazardous Waste?

A hazardous waste is a solid, liquid, or gaseous material that displays either a “Hazardous Characteristic” or is specifically “listed” by name as a hazardous waste.

Characteristic wastes are not listed specifically by their chemical name but they are regulated as hazardous wastes because they exhibit one or more hazardous characteristics. These four characteristics are **Ignitability**, **Corrosivity**, **Reactivity**, and **Toxicity**.



The **Ignitability** characteristic applies to wastes that are:

- Liquids with a flash point less than 140° F
- Solids capable of spontaneous combustion under normal temperature and pressure
- Oxidizing materials
- Ignitable compressed gases
- Examples include ethanol, sodium nitrate, hydrogen gas, xylene and acetone

The **Corrosivity** characteristic applies to wastes that are:

- Aqueous solutions with a pH less than or equal to 2 or greater than or equal to 12.5
- This does not apply to solid or non-aqueous materials
- Examples include hydrochloric acid, nitric acid, and sodium hydroxide

The **Reactivity** characteristic applies to the following:

- Materials that react violently or generate toxic fumes when mixed with water
- Cyanide or sulfide bearing wastes which evolve toxic fumes when mixed with acids or bases
- Materials that are normally unstable or explosive
- Examples include sodium metal, reactive sulfides, potassium cyanide and picric acid

The **Toxicity** Characteristic applies to wastes that have the potential to contaminate groundwater if improperly disposed of. These materials are regulated as hazardous waste due to their potential to leach out specific toxic substances in a landfill. There are currently 40 contaminants on the list that include certain heavy metals, pesticides and organic compounds.

EPA HW No.	Contaminant	Level (mg/L)
D004	Arsenic	5.0
D005	Barium	100.0
D006	Cadmium	1.0
D007	Chromium	5.0
D008	Lead	5.0
D009	Mercury	0.2
D010	Selenium	1.0
D011	Silver	5.0
D012	Endrin	0.02
D013	Lindane	0.4
D014	Methoxychlor	10.0
D015	Toxaphene	0.5
D016	2,4-D	10.0
D017	2,4,5-TP Silvex	1.0
D018	Benzene	0.5
D019	Carbon tetrachloride	0.5
D020	Chlordane	0.03
D021	Chlorobenzene	100.0
D022	Chloroform	6.0
D023	o-Cresol	200.0

EPA HW No.	Contaminant	Level (mg/L)
D024	m-Cresol	200.0
D026	Cresol	200.0
D027	1,4-Dichlorobenzene	7.5
D028	1,2-Dichloroethane	0.5
D029	1,1-Dichloroethylene	0.7
D030	2,4-Dinitrotoluene	0.13
D031	Heptachlor	0.008
D025	p-Cresol	200.0
D032	Hexachlorobenzene	0.13
D033	Hexachlorobutadiene	0.5
D034	Hexachloroethane	3.0
D035	Methyl ethyl ketone	200.0
D036	Nitrobenzene	2.0
D037	Pentachlorophenol	100.0
D038	Pyridine	5.0
D039	Tetrachloroethylene	0.7
D040	Trichloroethylene	0.5
D041	2,4,5-Trichlorophenol	400.0
D042	2,4,6-Trichlorophenol	2.0
D043	Vinyl chloride	0.2

What is a **listed** Hazardous waste?

Unused or unopened chemicals will meet the definition of a **listed** hazardous waste if they appear on one of two lists. The **U-list** contains materials that are hazardous due to their toxicity. The **P-list** contains materials that are hazardous because they are acutely toxic. These lists only apply to unused materials that have one of the listed chemicals as the sole active ingredients. The list also applies to spill cleanups of these unused materials. The complete U and P lists are included in Appendix A and B of this manual.

Additionally, certain used or spent solvents can be regulated as a hazardous waste if they appear on the **F-list**. This list is included in Appendix C of this manual.

4. Hazardous chemical waste determination

Effective May 30, 2017, the hazardous waste determination must be performed in the lab when waste is first added to a container. This change was mandated by new EPA regulations and EHRS has issued revised yellow waste tags to comply with this new requirement. EHRS staff assumes responsibility for picking up all of the waste chemicals from your laboratory and for making the final hazardous waste determination.

5. Essential rules for managing hazardous chemical materials

1. When possible, seek ways that will minimize the quantity of waste generated inside the laboratory.
2. Only use appropriate containers for the storage of waste materials (Plastic is preferred).
3. Store chemical waste in a designated Satellite Accumulation Area.
4. Properly label all waste containers.
5. Keep waste containers **closed**.
6. **Contact** EHRS for pick-up.

5.1 Waste minimization

The University is required by Federal and State regulations to develop and implement a Waste Minimization Strategy. Ways to help achieve the goal of reducing the volume of chemical waste generated on campus include but are not limited to:

1. Practice the concept of *Source Reduction* by simply ordering the smallest quantity of chemical materials required for your research.
2. Keep an inventory of chemicals in your lab.
3. Share surplus chemical with other labs.
4. Purchase mercury-free instruments.
5. Substitute hazardous chemicals with non-hazardous chemicals whenever possible.
6. Reduce the scale of laboratory experiments to reduce the volume of waste being produced whenever possible.

5.2 Storing waste in the lab (Satellite Accumulation)

Each location on campus where hazardous waste is generated and stored is a Satellite Accumulation Area. There are specific requirements for managing chemical wastes within these areas. The orange sign shown below was updated to include our new 2017 chemical waste label. The new sign was issued fall 2017 and this replaces any earlier versions of the sign.

To begin, post this sign at all of the Satellite Accumulation Area's in your space. Hard copies can be requested [online](#) or you can download a [printable](#) PDF version.

Hazardous Waste Satellite Accumulation Area

LID


- Containers must be kept closed except when adding waste
- Use vented caps when needed

LABEL

- Labels must be fully completed when waste is first added to containers. Percentages can be added later

LEAKS & SPILLS

- Use secondary containment to prevent spills
- Segregate incompatible waste streams in separate secondary containment bins
- Containers must be in good condition. Leaking containers must be repackaged immediately

 **EHRS**
Environmental Health & Radiation Safety
University of Pennsylvania

Contact EHRS at 215-898-4453
www.ehrs.upenn.edu

Rev. 10.2017

Satellite Accumulation Area Requirements

A maximum of 55-gallons of hazardous waste may be stored within any Satellite Accumulation Area. In the case of acutely toxic chemical waste (P-list), a maximum of one quart of liquid or one kilogram of solid may be accumulated at a time. Some common P-list chemicals are sodium azide, osmium tetroxide, sodium cyanide. Once either limit is reached, EHRS must remove the material from your laboratory within 3 calendar days.

Storage limits

Hazardous waste containers may be stored in a Satellite Accumulation Area for up to 12 months from the day waste was first placed into the container as long as the accumulation limits of 55-gal or 1-quart for are not exceeded.

The location of the Satellite Accumulation Area must be at or near the point where the waste is generated. Waste must not be generated in one room and taken to another room for storage.

5.3 Container management in SAA's

Waste containers stored in a Satellite Accumulation Area must be:

- In good condition
- Compatible with the waste being stored
- Kept closed at all times except when filling
- Labeled with a yellow chemical waste label
- Stored inside secondary containment bins (provided by EHRS for no charge)
- Waste must always remain in the lab
- Never store waste in PUBLIC AREAS (such as hallways)

5.4 Waste containers

- For most large quantities of compatible liquid waste, use the 5-gallon carboys provided by EHRS free of charge.
- One gallon and 1-liter containers are also available for smaller volumes of waste



19-Liter carboy



1-Gallon bottle



1-Liter bottle

5.4.1 Properly labeling waste containers

- All waste containers must have a yellow chemical waste label affixed when waste is first placed into the container

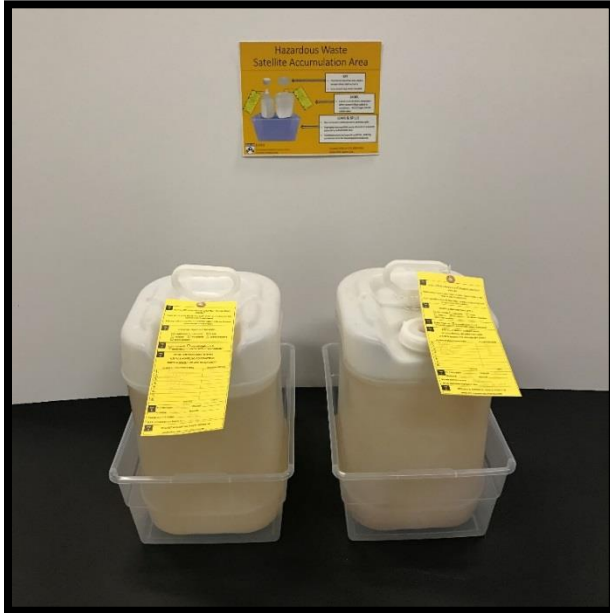
- All sections of the label must be completed when waste is first added to a container. Percentages and additional constituents can be added later
- Don't use chemical symbols, abbreviations, or codes for waste identification
- Use Pencil to complete the label since inks are easily washed off by solvent waste streams

Step 1 Is this a <input type="checkbox"/> Hazardous or <input type="checkbox"/> Non-Hazardous Waste? Refer to the EHRs Waste Determination Quick Guide on the reverse side for guidance EPA regulations require this determination to be performed when waste is first added!	<div style="border: 1px solid black; padding: 5px; width: fit-content;">Perform the hazardous waste determination</div>																				
Step 2 CHECK ALL HAZARDS THAT APPLY <input type="checkbox"/> Flammable <input type="checkbox"/> Corrosive <input type="checkbox"/> Toxic <input type="checkbox"/> Oxidizer <input type="checkbox"/> Pyrophoric <input type="checkbox"/> Water Reactive <input type="checkbox"/> Other (explain) _____	<div style="border: 1px solid black; padding: 5px; width: fit-content;">Check all hazards that apply</div>																				
Step 3 Is this material: <input type="checkbox"/> unused/virgin or is it <input type="checkbox"/> used/spent or reacted with other chemicals?	<div style="border: 1px solid black; padding: 5px; width: fit-content;">Select the condition</div>																				
Step 4 LIST ALL CHEMICAL CONSTITUENTS USE FULL NAMES, NO ABBREVIATIONS WRITE IN PENCIL! INK WASHES OFF EASILY <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 80%;">CHEMICAL [CONCENTRATION]</th> <th style="width: 20%;">% COMPOSITION</th> </tr> </thead> <tbody> <tr><td>1.</td><td></td></tr> <tr><td>2.</td><td></td></tr> <tr><td>3.</td><td></td></tr> <tr><td>4.</td><td></td></tr> <tr><td>5.</td><td></td></tr> <tr><td>6.</td><td></td></tr> <tr><td>7.</td><td></td></tr> <tr><td>8.</td><td></td></tr> <tr> <td style="text-align: right;">TOTAL</td> <td style="text-align: center;">100%</td> </tr> </tbody> </table>	CHEMICAL [CONCENTRATION]	% COMPOSITION	1.		2.		3.		4.		5.		6.		7.		8.		TOTAL	100%	<div style="border: 1px solid black; padding: 5px; width: fit-content;">List all chemical constituents</div>
CHEMICAL [CONCENTRATION]	% COMPOSITION																				
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2.																					
3.																					
4.																					
5.																					
6.																					
7.																					
8.																					
TOTAL	100%																				
Step 5 PI / Manager: _____ Phone#: _____ Building: _____ Room#: _____ Waste contact name: _____ DATE container started in lab: _____	<div style="border: 1px solid black; padding: 5px; width: fit-content;">Fill in contact info and container start date</div>																				
Step 6 REQUEST A CHEMICAL WASTE PICKUP at: www.ehrs.upenn.edu/chemwaste	<div style="border: 1px solid black; padding: 5px; width: fit-content;">Request a pickup when ready</div>																				

5.4.2 Why is labeling so important?

- EHRS staff members need this information to decide how to safely manage the material
- Environmental laws require the generator to label chemical waste materials
- Chemical constituents must be known to allow us to dispose of chemicals with minimal cost and impact to the environment

Below is an example of a properly set up Satellite Accumulation Area



EHRS staff members consolidate the contents of about 300 five gallon carboys each month. We cannot perform this task safely without knowing exactly what is in each container.



Many chemicals are poured together into drums. Other chemicals are packaged together based on compatibility.



5.5 Drain disposal

Hazardous chemicals **must never** be poured down the drain as a method of disposal. Contact [Jim Crumley](#) of EHRS if you have specific questions about drain disposal.

5.6 Responsibilities and Penalties

Managing hazardous waste is an important responsibility. Improperly managing containers of hazardous waste can have serious consequences that can lead to injuries or fires. There are also criminal and civil penalties that can result from violations. The maximum penalties for EPA waste violations are currently set at \$70,117 per violation, per day.

In addition to potential citations, fines, and imprisonment, improper waste disposal can also result in national media attention and damage to the University's reputation.

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

6. Waste Streams with special procedures

6.1 Unknown materials

Unknown waste materials must be managed and labeled as hazardous waste until testing is performed by EHRS staff. Containers of unknown materials must be labeled with a yellow chemical waste label.

Please write the word “unknown” on the label and provide any available information about what the material could potentially be and check the appropriate hazard boxes for any known or suspected hazards.

6.2 Peroxide forming chemicals

Hazard Definition

Peroxide-forming chemicals are a class of materials that have the ability to form shock-sensitive and explosive peroxide crystals. When triggered by friction or shock the peroxides will explode. Peroxide forming chemicals include solids, liquids and gases. These chemicals may also be flammable or reactive so other SOPs will likely apply to their use in the laboratory. The safety data sheet and label for peroxide-forming chemicals may or may not include the following hazard statement: 2.3 Hazards not otherwise classified (HNOC) or not covered by GHS: May form explosive peroxides.

Storage

Peroxides form after exposure to air. The rate of peroxide formation is dependent on the specific chemical, the amount of air exposure and whether the chemical contains an inhibitor to retard peroxide formation. Therefore, it is imperative that potential peroxide-forming chemicals be entered into the lab’s CIS-Pro chemical inventory and assigned an expiration date based the storage limitations for the chemical’s class (see class descriptions below). Peroxide-forming chemicals should be stored away from light and heat with tightly secured caps and labeled with dates of receipt and opening.

Classes of Peroxide-Forming Chemicals

Peroxide formers fall into three classes. Class A peroxide forming chemicals can form explosive levels of peroxides while sitting on the shelf. These chemicals should be tested before use or disposed of through the chemical waste system three months after opening or at the expiration date on the container if unopened. Contact EHRS if crystals are present or if the solvent is discolored.

Expire 3 months after opening:

Isopropyl ether	Sodium amide
Butadiene	Tetrafluoroethylene
Chlorobutadiene (chloroprene, liquid monomer)	Divinyl acetylene
Potassium amide	Vinylidene chloride
Potassium metal	

Class B peroxide formers are only a hazard if the peroxides are concentrated, which may happen upon evaporation or distillation of the solvent. These materials should be disposed of 1 year after opening or at the expiration date on the container if unopened.

Expire 1 year after opening:

Acetal	2-Cyclohexen-1-ol
Acetaldehyde	Cyclopentene

Benzyl alcohol	Decahydronaphthalene (decalin)
2-Butanol	Diacetylene (butadiyne)
Dioxanes	Dicyclopentadiene
Chlorofluoroethylene	Diethylene glycol dimethyl-ether (diglyme)
Cumene (isopropylbenzene)	Methyl-isobutyl ketone
Cyclohexene	4-Methyl-2-pentanol
Diethyl ether	2-Pentanol
Ethylene glycol ether acetates (cellosolves)	4-Penten-1-ol
Furan	1-Phenylethanol
4-Heptanol	2-Phenylethanol
2-Hexanol	Tetrahydrofuran
Methyl Acetylene	Tetrahydronaphthalene
3-Methyl-1-butanol	Other Secondary Alcohols
Vinyl Ethers	
Methyl-isobutyl ketone	

Class C peroxide formers may auto-polymerize as a result of peroxide formation. These materials should be disposed of 1 year after opening or at the expiration date on the container if unopened.

Expire 1 year after opening

Butadiene	Vinyldiene Chloride
Chlorobutadiene	Vinyl Acetylene
Chloroprene	Vinyl Chloride
Vinyl Acetate	Vinyl Pyridine
Chlorotrifluoroethylene	
Styrene	
Tetrafluoroethylene	

Approvals

Prior approval by EHRS is required for the purchase of inhibitor-free peroxide-forming solvents and peroxide-forming gases.

Testing for Peroxide

Use [XploSens PS detection strips](#) to check for peroxides. While there are no safe peroxide levels contact EHRS if solvent test shows peroxides >50ppm. Test all un-inhibited peroxide-forming chemicals before each use. Inhibited peroxide-forming chemicals that are beyond their expiration date must be tested for peroxides. Contact EHRS immediately and do not disturb containers if they appear to have peroxide crystals around the cap or solid crystals inside the bottle.

Drying solvents

Check peroxide-forming solvents for the presence of peroxides prior to drying. Commercially available Grubb's-type drying systems are the safest method to use. If distillation is used to dry peroxide-forming solvents, add sodium metal to the distillation pot to reduce peroxide formation and add benzophenone

as an indicator for the presence of sodium metal. The resultant blue color confirms that sodium is still present. Add more sodium metal to the pot when the blue color disappears. (See the Water-Sensitive Chemicals SOP and your lab's Hazard Control Plans for more information about the safe handling of sodium metal) Both Grubb's-Type Solvent Drying Systems and drying stills may remove the inhibitors (BHA & BHT), therefore the dried, uninhibited solvent must never be stored in the lab. Use immediately after dispensing from the still or drying column.

References

<http://www.sigmaaldrich.com/chemistry/solvents/learning-center/peroxide-formation.html#sthash.Rhw4RSHu.dpuf>

Peroxides and peroxide-forming compounds Chemical Health and Safety, 09/2001, Volume 8, Issue 5, p. 12 (available from Penn Library)

Ethyl ether and other peroxide-forming ethers, Chemical Health and Safety, Volume 10, Issue 1, January–February 2003, Pages 42 (available from Penn Library)

6.3 Waste oil

Waste oil should be collected in a proper waste container for collection by EHRS staff. These oils are commonly found in vacuum pumps and other types of laboratory equipment. If the oils are contaminated with metal or other specific chemicals then please include this information on the chemical waste label.

6.4 Gas producing waste streams

Several common laboratory chemical mixtures tend to produce gas and must be stored carefully to prevent pressurizing or exploding containers.

Aqua regia is a mixture of concentrated Nitric Acid (HNO_3) & Hydrochloric Acid (HCl)

Piranha solution is a mixture of Sulfuric Acid (H_2SO_4) & Hydrogen Peroxide (H_2O_2).

All gas producing wastes must be stored in poly containers that have special vented caps. These containers with vented caps are available from EHRS and can be ordered online from our [website](#). Glass containers must never be used for any gas producing waste streams due to the risk of explosion from over pressurization.



Cap with vented opening



These waste streams should also be stored in a special reactive waste bucket. The buckets are available from EHRIS at no charge and the instructions for using them are included on the bucket. The bucket serves as secondary containment for the vented 1-gallon bottle and should never be used as a primary container.



6.5 Compressed gas cylinders

- In general, compressed gas cylinders are the property of the vendor that delivers and replaces these units for the laboratory. Compressed gas cylinders must be returned to the vendor when they are empty or no longer needed
- Compressed gas cylinders must be properly secured to benches or walls with appropriate strapping at all times while being stored or in use. All compressed gas cylinders must be clearly labeled with the contents

6.6 Lecture bottles

- Lecture bottles (small compressed gases) are purchased through chemical supply vendors (such as Sigma Aldrich and Matheson). EHRIS recommends that researchers attempt to purchase lecture bottles from vendors who will accept partially full or empty containers when they are no longer needed in the lab. Airgas offers returnable lecture bottles in many common gases through their 'Saf-T-Cyl' program
- The disposal of lecture bottles is extremely expensive. If the vendor or supplier will not accept an unwanted lecture bottle, contact EHRIS to arrange for its disposal

Unwanted lecture bottles should be removed from the laboratory when they are no longer needed as they present a genuine concern for long-term storage and management.

Empty lecture bottles can also be disposed of through EHRIS. These bottles should be clearly labeled with the words 'empty'.



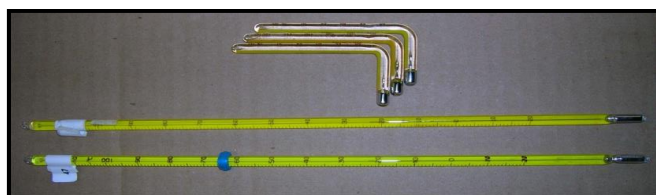
6.7 Aldrich Sure Paks

Aldrich Sure Paks are small metal containers that generally contain highly reactive liquid materials. Empty Sure Pak containers should be properly quenched and labeled accordingly. EHRS will take the empty quenched cylinders for recycling. Sure Paks that still contain product should not be quenched and EHRS will take them for disposal.



6.8 Mercury containing items

Mercury containing items such as thermometers, thermostat switches and manometers must be collected for proper disposal and not placed in the regular trash. Our office also offers a free mercury thermometer exchange program. Additional information and exchange requests can be found on our [website](#).



Thermometers



Switches

6.9 Mixed waste

A mixed waste is a material that is both a chemical hazardous waste and is also radioactive. These types of waste can be extremely expensive to dispose of. Always contact EHRS prior to generating these types of waste streams to discuss the disposal options and any charges that your lab may incur. Uranyl Nitrate is a commonly purchased reagent that is classified as a mixed waste since it is both radioactive and also an oxidizer. Another common example of mixed waste is any mixture of a long lived isotope with a flammable solvent or other material that meets the definition of a hazardous waste.

6.10 Empty containers

All empty chemical containers must be “triple rinsed” before disposal.*

*Empty containers that held acutely toxic hazardous wastes (P-list) must be managed as hazardous waste and given to EHRS for disposal. DO NOT TRIPLE RINSE these containers.

Empty containers of highly odoriferous materials like thiols or mercaptans must also be given to EHRS for disposal to avoid creating odor issues in the lab or hallways. Empty containers of odoriferous materials should be placed into a bag and stored inside a fume hood until EHRS collects them for disposal.

6.11 Disposal of chemically contaminated needles & syringes

Dispose of all chemically contaminated needles, syringes and razor blades as infectious waste by placing them inside a proper sharps container. These containers must be labeled with “Do Not Autoclave” Stickers. The labels are available from EHRS and must be placed on the outside of the containers. Additional information can be found on our [website](#).

Label sharps containers containing syringes contaminated with chemicals as “Chemical Contaminated Sharps –DO NOT AUTOCLAVE”.



6.12 DEA controlled substances disposal

General Information:

The purchase, use, storage and disposal of controlled substances are regulated by the United States Drug Enforcement Administration (DEA). Detailed information relating to controlled substances can be found online at the [DEA Diversion website](#).

Lists of controlled substances:

If you are unsure whether or not the substance(s) you have is regulated as a controlled substance refer to the online [lists](#) at the DEA website. There are five schedule lists of controlled substances which can be viewed by schedule or alphabetically.

Disposal procedures:

DEA regulations require registrants to use a licensed 'reverse distributor' for disposal. EHRS and the Office of Animal Welfare have contracted with a local reverse distributor and we host semi-annual disposal event where registrants can dispose of controlled drugs for no charge. Information for these events will be posted on the [EHRS website](#).

If you are unable to wait for an event then a 'drug mail back' program is available as an alternative. The two companies listed below can provide this service and both companies are set up as approved University vendors. Contact either company and they will send you a drug "return kit" that includes all of the appropriate paperwork and packaging needed to ship the materials to them. Disposal pricing will vary depending on the quantity of materials that you have.

Stericycle Environmental Solutions
Gus Perna – Account Manager
gus.perna@stericycle.com
609-703-2394

Pharma Logistics
Aaron Feldman – Account Manager
847-837-1224
1050 E. High Street
Mundelein, IL 60060

Copies of all disposal documents must be kept on file by the DEA registrant.

Please contact Jim Crumley, EHRS Environmental Programs Manager at 215-746-5036 if you require additional information.

The Philadelphia Field Division contact information is listed below.

DEA Contact Information:

Philadelphia Field Division
William J. Green Federal Building
600 Arch Street, Room 10224
Philadelphia, PA 19106
(215) 238-5160 - Phone
(215) 238-5170 - Fax

Central DEA call center - 800-882-9539

6.13 Refrigerants in equipment

Many types of laboratory equipment contain refrigerants that must be removed from the equipment prior to disposal. Facilities and Real Estate Services can provide this service. Requests can be made through your building administrator or through the FRES Service and Maintenance [webpage](#). A budget code must be provided and the charge will vary depending on the size of the equipment. Once the Freon is removed it is sent for recycling and the piece of equipment will then be picked up by FRES and sent for recycling.

6.14 Battery recycling

Information about recycling batteries can be found on the [EHRS website](#).

6.15 Non-hazardous waste disposal

There are many chemical reagents and chemical products that do not meet the definition of a hazardous waste. These materials can also be collected by EHRS for proper disposal along with your other chemical waste streams.

7. Requesting a chemical waste pickup

Chemical waste pick-up requests can be made online using the [chemical waste pickup request form](#). Waste requests are generally completed within 5-7 business days. If you have any issues regarding a chemical waste request or have an unusual or large cleanout of chemicals please contact [Jim Crumley](#), EHRS Environmental Programs Manager, 215-746-5036.

8. Waste supplies

The following waste supplies are available from EHRS free of charge and can be requested [online](#).



Waste labels



1-Gallon



1-Liter



19-Liter



Secondary containment



SAA posters



Reactive buckets

9. Training requirements

The following training courses must be taken by all individuals working in a laboratory and generating chemical wastes.

- [Introduction to Laboratory Safety](#). Training consists of an instructor led training course and a periodic refresher course that is offered online through knowledge link.
- [Managing Laboratory Waste](#). This is an online training offered through Knowledge Link.

Additional training is required for anyone involved in preparing packages of dry ice or other dangerous goods for transport. Click [here](#) for additional information about shipping training.

10. Common Federal & State VIOLATIONS

Missing or incomplete labels and open containers are two of the most common violations found in research laboratories. Waste containers must be kept closed at all times except when waste is being added. All containers must be labeled with a properly completed chemical waste label.



Open Container with funnel



Poorly labeled container

11. What happens to all of your waste?

Most of the solvent waste generated at Penn is blended with similar materials and is used as a fuel for the kilns at cement manufacturing plants. We also send many other waste streams for recycling. These recycled waste streams include mercury and mercury containing equipment, rechargeable batteries, fluorescent light tubes & lead. Most other chemical reagents are sent for thermal incineration at an approved hazardous waste treatment facility.

12. Chemical spill procedures

The procedures for handling chemical spills can be found on the [EHRS website](#).

13. Frequently asked questions

The answers to many commonly asked questions about chemical waste disposal can be found on the [EHRS website](#).

14. Lab closeout procedures

If your laboratory is moving locations on campus or leaving the University the procedures for closing out your laboratory can be found on the [EHRS website](#).

15. Appendices

Appendix A – [U list for toxic materials](#)

Appendix B – [P list for acutely toxic materials](#)

Appendix C – [F-list for spent solvents \(External link\)](#)