University of Delaware

CHEMICAL WASTE DISPOSAL TRAINING PROGRAM

This Training Program Will Cover:

- **What is a Chemical Waste.**
- **How to Manage Your Chemical Waste.**
- **How to Prepare Your Waste for Disposal.**
- **Inspecting Your Chemical Waste Accumulation Areas.**
- **Common Problems Found in Laboratories.**
- **Waste Minimization Techniques.**

Chemical Waste Management
What is a Chemical Waste?

- **Chemical waste is a broad term used by EHS that covers a variety of compounds. It includes hazardous wastes which are state and federally regulated substances.**

- **This chemical waste training program and the chemical waste management program at the University are based on this Federal law.**
  - The chemical waste training is to be completed annually.

Examples of Chemical Waste

- Unused and surplus reagent grade chemicals
- Intermediates and by-products generated from research & educational experiments
- Batteries
- Anything contaminated by chemicals
- Used oil of all types
- Spent solvents – including water based
- Mercury containing items
- Uncured resins (phenolic, epoxy, styrene, etc…)
- Dyes and glazes
- Degreasing solvents
- Computer/electronic equipment
- Toner cartridges
- Ethylene glycol
- Paints – both oil and latex
- Fluorescent light bulbs
- Light ballasts
- Preserved specimens
- Custodial and industrial cleaners
- Brake/transmission/power steering fluids
- Spent acids and bases
- The List Continues……..


SHARP
FO-45DR
DRUM CARTRIDGE/CARTOUCHE DE PHOTOCONDUCTEUR


BE SAFE!
ALWAYS SECURE
CYLINDERS
EMPTY


Preen
ORTHO
Rose & Floral Dust
Roundup


INDUSTRIAL ALCOHOL DIVISION
ALCOHOL, DEHYDRATED
ABSOLUTE - 200 PROOF


ARSENIC ACID


Please dispose chemicals

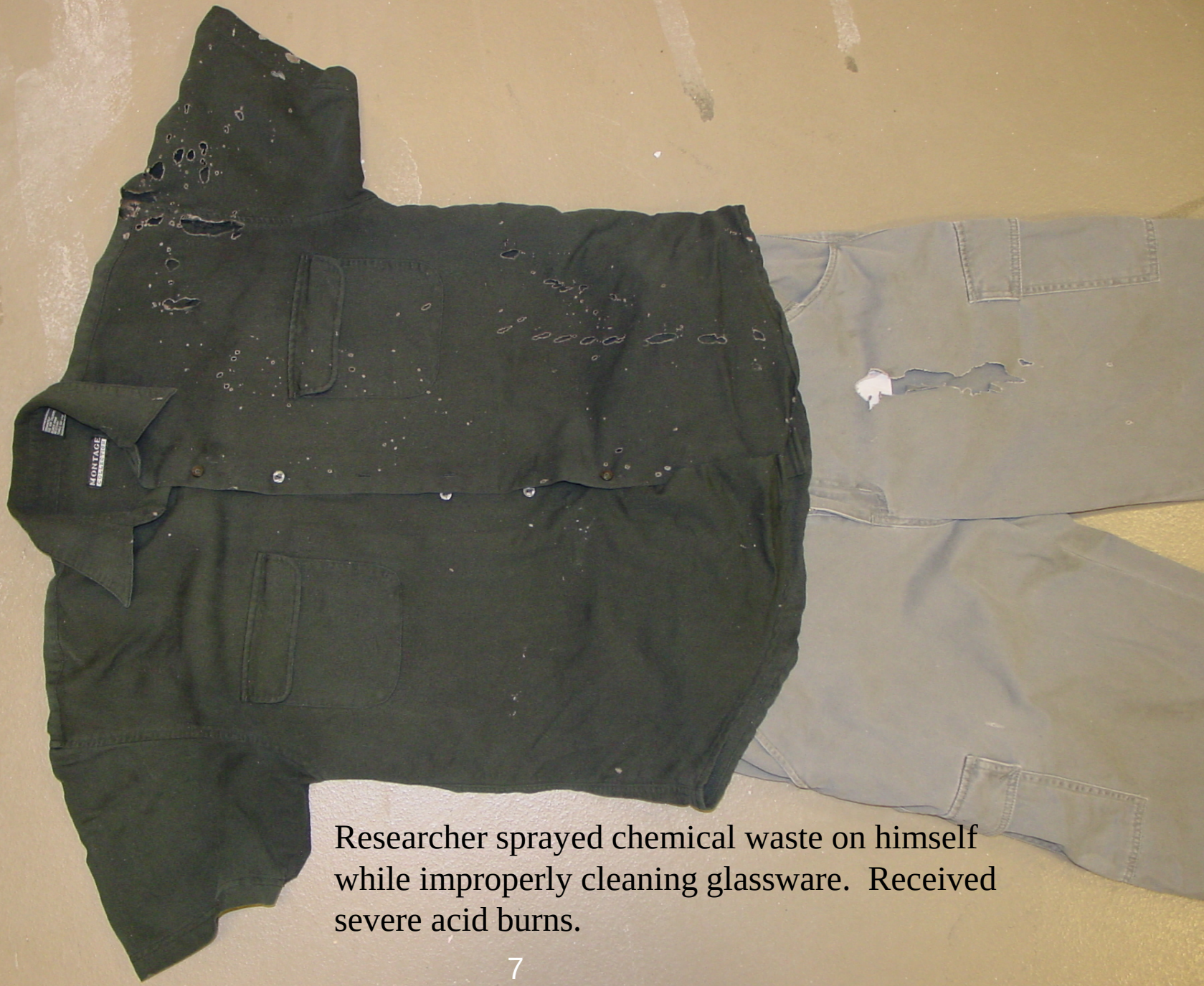

Fisherbrand


WHEATON
WHEATON

Why Do We Need to Manage Chemical Waste Properly?

- **It can adversely affect the health and safety of you, others, and the environment**

Improperly labeled waste reacted with contents and caused the drum to explode.



Researcher sprayed chemical waste on himself while improperly cleaning glassware. Received severe acid burns.

Why Do We Need to Manage Chemical Waste Properly?

- **Damage to Laboratory Space, Equipment and Research Projects**

Flammable liquids stored in this non-explosion-proof refrigerator caused it to explode.

Improper chemical waste management caused this explosion and fire.

Why Do We Need to Manage Chemical Waste Properly?

- **To Prevent Hazardous Compounds from Making Their Way into the Environment**

Trash truck load dumped on ground to remove chemical waste

Chemical waste found in a University solid waste dumpster

Why Do We Need to Manage Chemical Waste Properly?

- **There are Federal and State Regulations that require all generators of chemical waste to be trained on the proper management and disposal of their waste. These regulations have severe monetary and civil penalties associated with them.**

EPA fines

- 2006 – University of Florida $32,500
- 2006 – Yale University $28,000
- 2005 – University of Puerto Rico $1,000,000
- 2005 – Maine Comm. Coll. System $127,000
- 2005 – Clarkson University (NY) $45,000
- 2005 – Maine College of Art $107,000
- 2003 – Plymouth State U. (NH) $171,000
- 2002 – Delaware State University $12,000
- 2002 – Columbia University $797,000

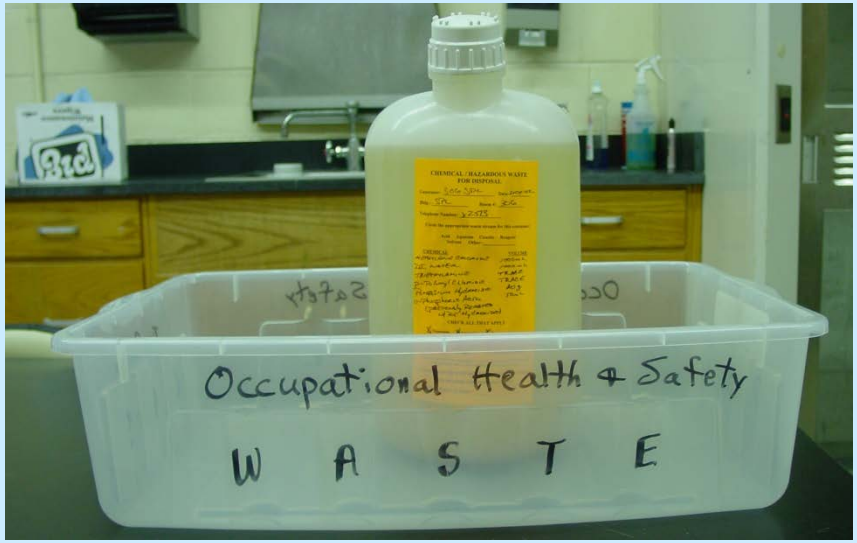
Chemical Waste Management

- The chemical waste management process starts when you design the experiment and review your (M)SDS or other information. You need to determine what you are going to generate. All of this information should be available in the (M)SDS, labels or product data sheets, or contact EHS for assistance.

Chemical Waste Management

- **Selecting a Container**
  - **For Solvent and Non-Corrosive Aqueous Streams:**
    - Use a Low Density Polyethylene Container (LDPE).
      - **No Larger than 5 gallons**
  - **For (Concentrated) Corrosive Waste Streams:**
    - Use non-metallic Safety Cans with a self-venting lid
    - Explosion-proof and approved for all acids and bases
      - **No Larger than 2 ½ gallons**
  - They can be purchased directly from Fisher Scientific
    - Contact EHS for the links to purchase them

Approved Containers for Liquid Chemical Waste



LDPE Container for Solvents and Non-Corrosive Aqueous Waste Streams

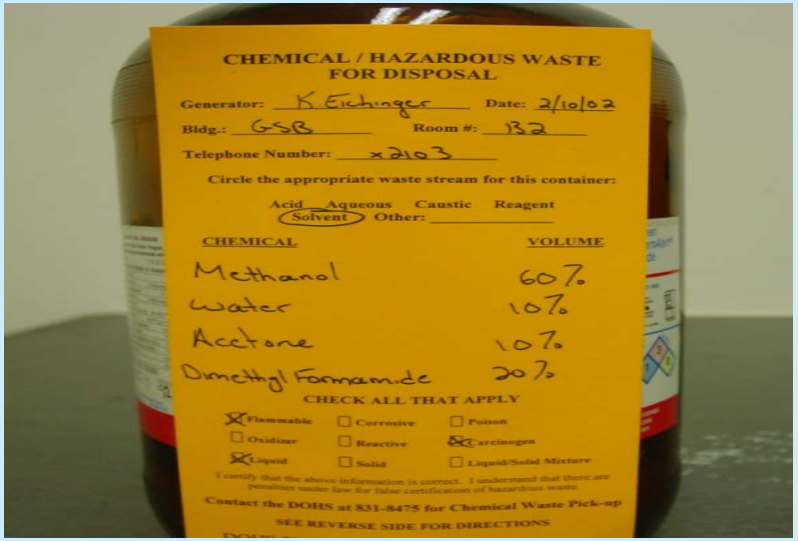
Justrite Safety Container for Corrosive Waste Streams

General Rules About Containers

- The container must be compatible with the waste streams that will be placed in it.
  - Do not use a metal container to store acids.
  - Do not use a glass container to store hydrofluoric acid.
  - Do not use glass or metal containers to store organic peroxides.
- **EHS only accepts liquid waste in the aforementioned plastic containers unless they are reagents in their original bottles!!!!**

Reused Chemical Bottles

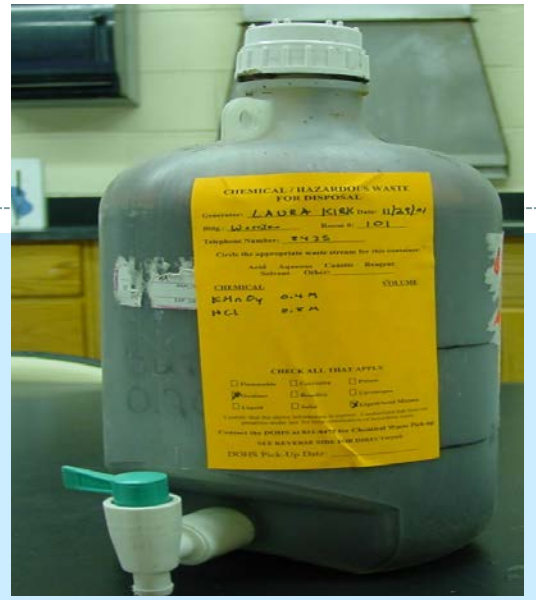
- EHS will **NOT** accept any liquid chemical waste in a reused chemical container.
  - Reagent bottles were made for the specific chemical they contain. They can degrade/become brittle when being used for storage of chemical waste.
- This excludes waste reagents in original containers.



General Rules About Containers

- The container must be able to be capped, sealed or closed.
- Containers must be in good physical condition
  - **Do not use containers that are old, dented, damaged, leaking or cracked.**
- Do not use containers that can be confused with consumer commodities.
  - Soda Bottles
  - Milk Jugs

Do not use containers that are dented, damaged, cracked or in bad condition to store chemical waste.

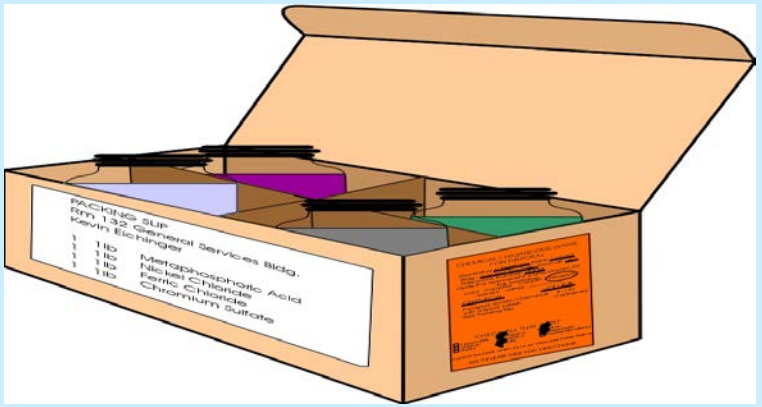


Ensuring That Your Container Gets Returned

- Since orange labels are removed and replaced after waste has been emptied, or they can fall off or be lost, it is important to make sure the container itself is properly labeled.
- Use a permanent marker to clearly mark the ***building name*** and ***room number*** on the container.
- Check container each time it is ready to be picked up to make sure that those markings are still visible and have not been washed away, and remark the container if necessary.

Special Considerations

- Lab Clean-Out of Reagent Chemicals
  - Package in sturdy cardboard boxes
  - Use sufficient package material to prevent container on container contact
  - Package by hazard class
    - http://www.udel.edu/ehs/research/chemical/chemical-storage.html
  - Place a chemical waste label and packing slip on the outside of the box.



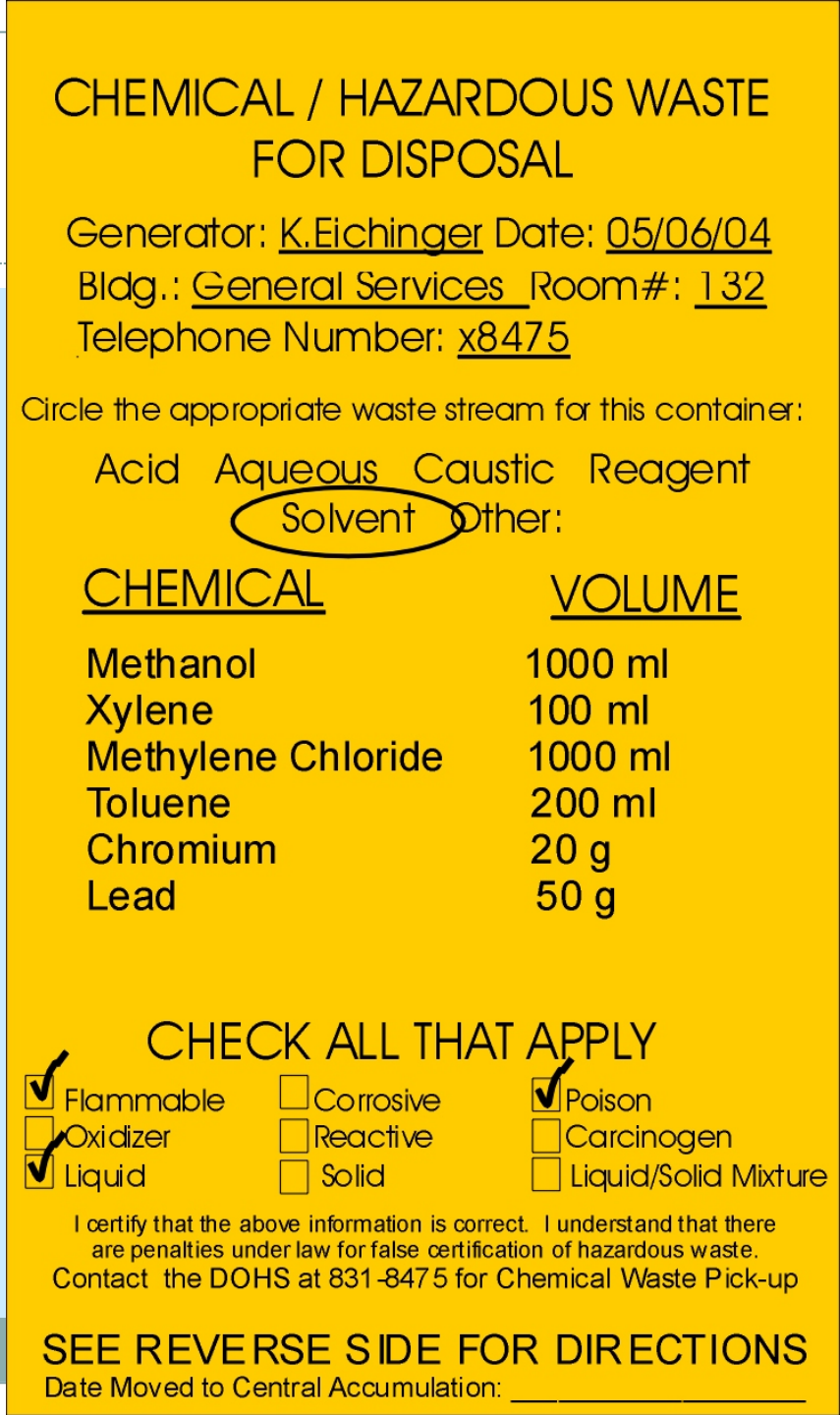
Special Considerations

- If you have a clean-out of **greater than 10 chemical compounds** please contact EHS (302-831-8475) and ask for the Chemical Waste Specialist.

- A date and time will be scheduled for the chemical waste team to come to the lab and remove all of the compounds that are destined for disposal.
  - We do not require a chemical list/inventory for clean-outs of greater than 10 chemical compounds.

Chemical Waste Management: Labeling

- **Labeling**
  - Available from EHS
  - Directions on the back side
  - Must be applied to all chemical waste containers ***as soon as waste is added***!!
- All chemical waste containers need to be labeled:
  - Lab trash, chemically contaminated sharps, and liquid chemical waste.



CHEMICAL / HAZARDOUS WASTE FOR DISPOSAL

Generator: K.Eichinger Date: 05/06/04
Bldg.: General Services Room#: 132
Telephone Number: x8475

Circle the appropriate waste stream for this container:

Acid Aqueous Caustic Reagent Solvent Other:

CHEMICAL	VOLUME
Methanol	1000 ml
Xylene	100 ml
Methylene Chloride	1000 ml
Toluene	200 ml
Chromium	20 g
Lead	50 g

CHECK ALL THAT APPLY

☑ Flammable	☐ Corrosive	☑ Poison
☐ Oxidizer	☐ Reactive	☐ Carcinogen
☑ Liquid	☐ Solid	☐ Liquid/Solid Mixture

I certify that the above information is correct. I understand that there are penalties under law for false certification of hazardous waste.
Contact the DOHS at 831-8475 for Chemical Waste Pick-up

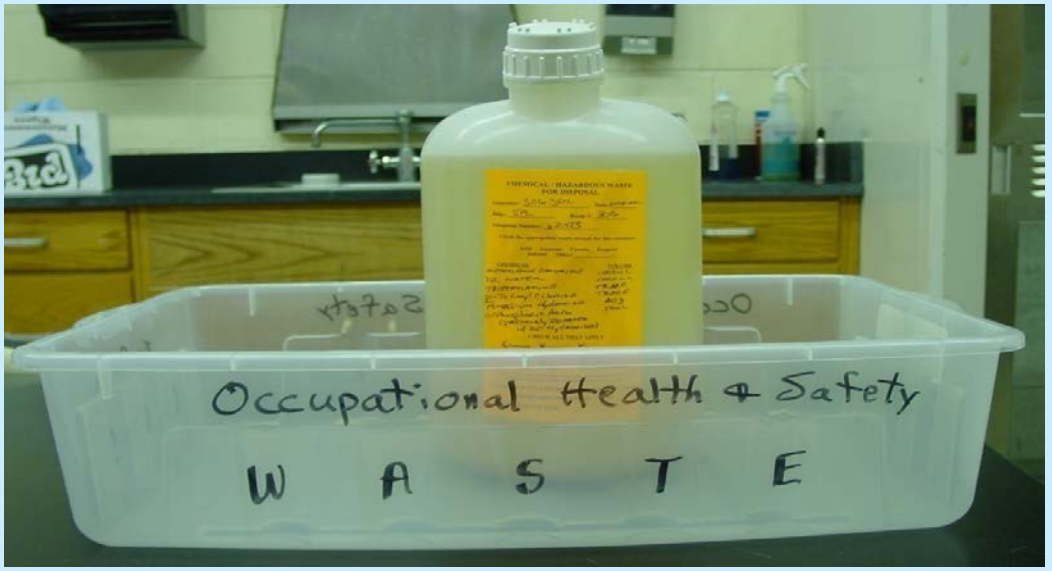
SEE REVERSE SIDE FOR DIRECTIONS
Date Moved to Central Accumulation: _____

Chemical Waste Management: Labeling

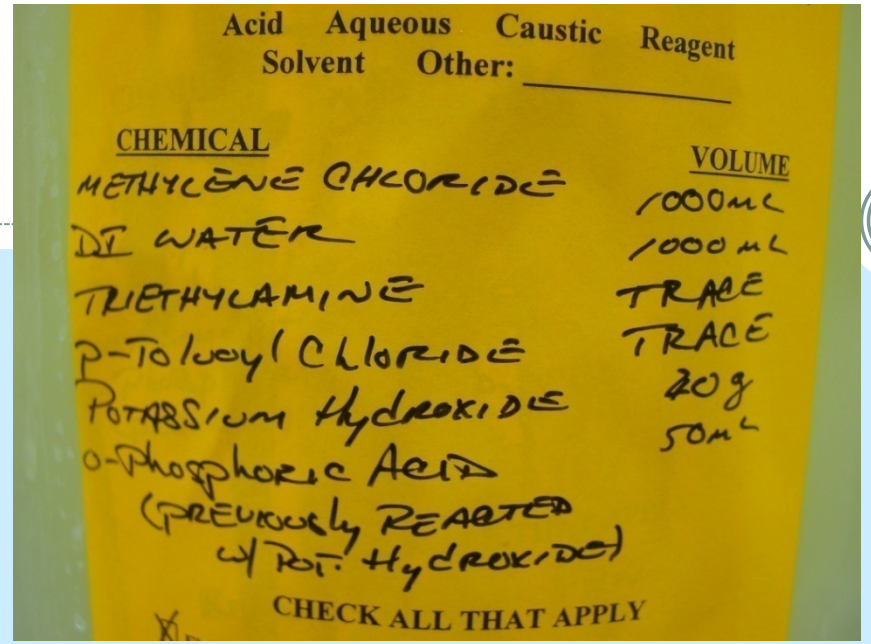
- List each waste constituent down to 1%; heavy metals must be listed down to the parts per million range. Label contents must add up to 100%.
- Use only common chemical names or IUPAC Nomenclature when listing the chemical constituents on the label.
- It is everyone's right to know what is contained in each waste container.
- The hazardous waste labels and their information are the primary source of information that is used to determine how to most accurately dispose of the material/waste.

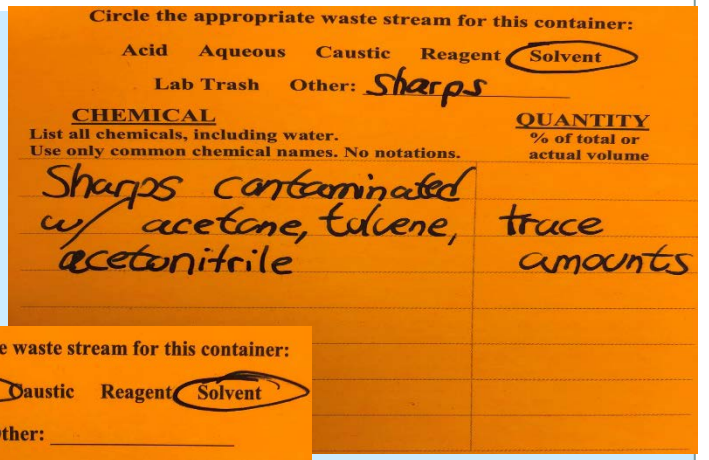
Do Not Use:

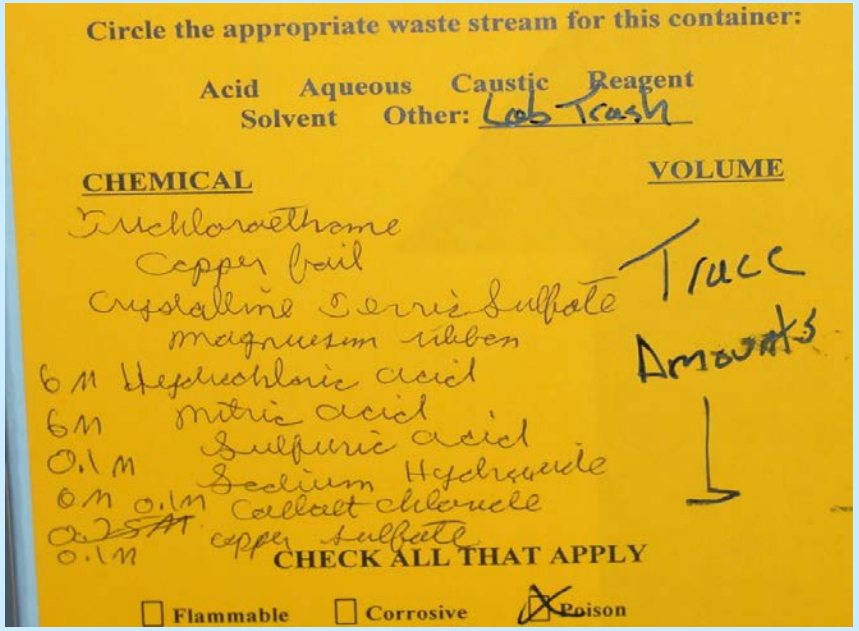
Abbreviations
Chemical Symbols
Trade names

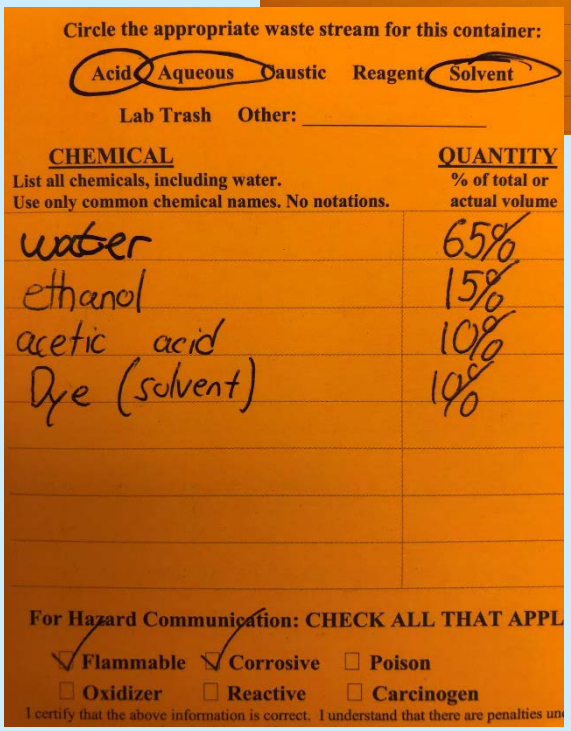


Examples of Good Labels

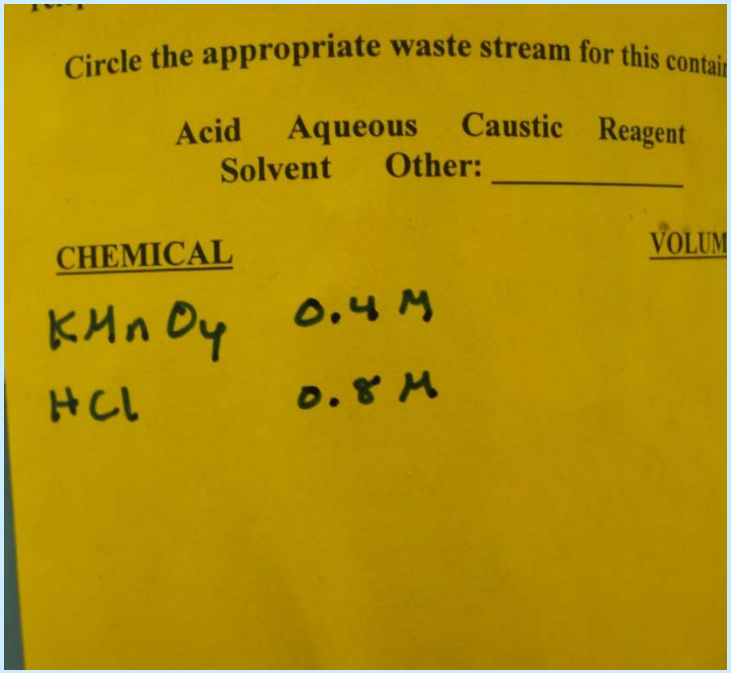




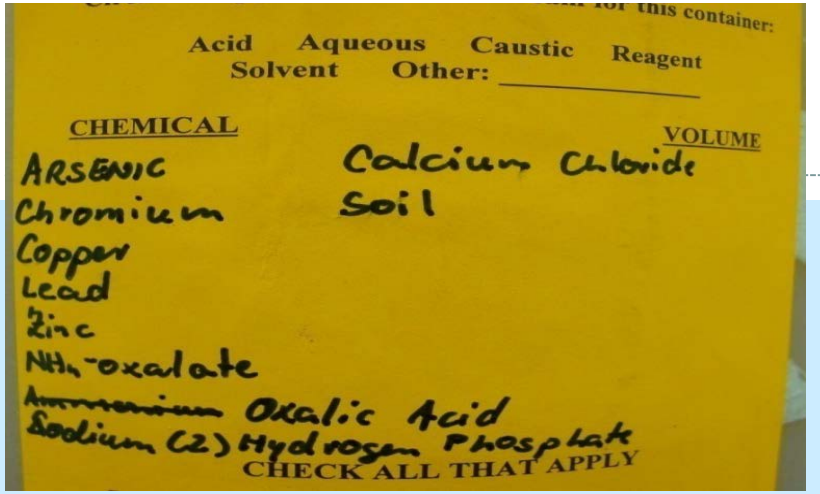




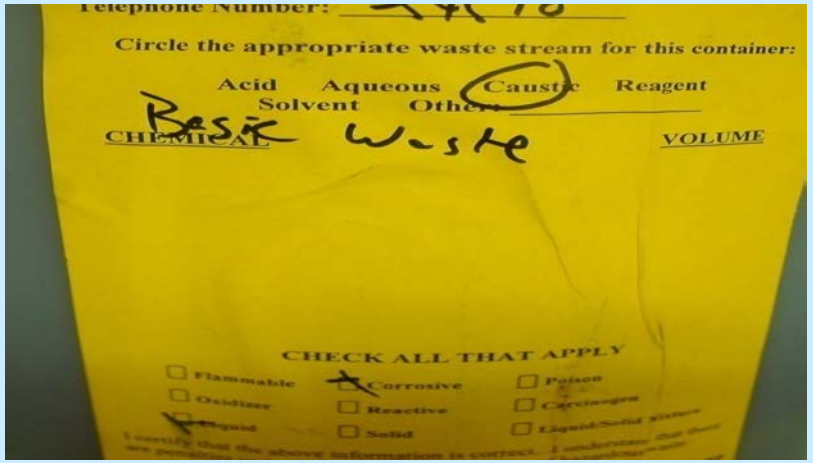
Bad Labels



Nomenclature should be common chemical name, volume should be percent of total or actual milliliters



No volumes or percentages



No volume, no chemical names

Chemical Waste Management: Adding Waste

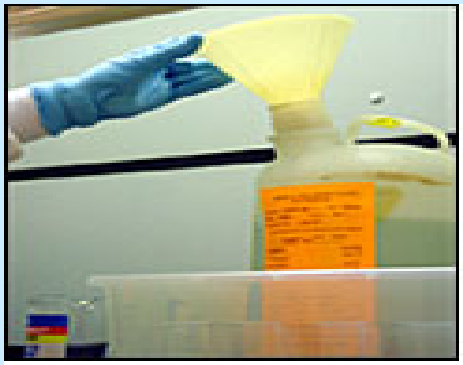
- **Adding Waste to a Container**
  - Waste can be added only after you choose the proper container and it is labeled.
  - Minimum PPE
    - Liquid Waste
      - Splash Goggles
      - Appropriate Gloves
      - Lab Coat and Proper Lab Attire
    - Solid Waste
      - Safety Glasses
      - Appropriate Gloves
      - Lab Coat and Proper Lab Attire

Chemical Waste Management: Adding Waste

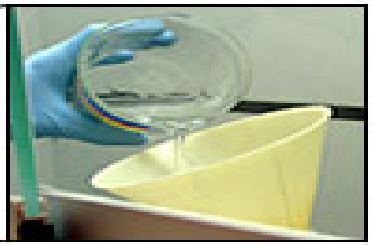
- Perform in a Fume Hood
- Use a funnel
- Watch for any unexpected reactions. Immediately contact EHS at x8475, or 911 after hours, if there is an unexpected reaction or incompatible materials are added together.

Chemical Waste Management: Adding Waste

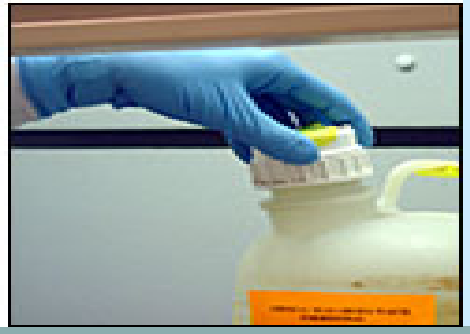
1. Check the orange chemical waste label to assure you are adding waste to the proper container. Remove the lid and insert a funnel.



2. Slowly add the liquid waste, check for unexpected reactions and minimize splashing.



3. When finished adding the waste, remove the funnel and seal the container. Store in the appropriate cabinet or area in 2° containment



Chemical Waste Management: Adding Waste

1. Check the orange chemical waste label to assure you are adding waste to the proper container.

2 Apply the first latch and open the container.

5. Close lid by removing the second latch and store in the appropriate cabinet or area in 2° containment

4. Add the waste, watching for any unexpected reactions.

3 Attach the second latch to lock the container lid open.

Chemical Waste Management: Storing Waste

- **Storing Your Waste**
  - **Waste containers must remain closed or sealed at all times** except when waste is being added or removed from the container.
  - Liquid waste containers must be stored in secondary containment systems according to Hazard Class.
  - Store chemical waste in an appropriate cabinet or area. Try not to store waste or other chemicals in a fume hood while processes or reactions are occurring.
  - Request a chemical waste pick up or move to a central accumulation area when a container is full.
  - **Fill containers to a maximum of 90% full**. Head space is needed for expansion or ease of dispensing.

Properly Stored, Sealed and Labeled

Notice container is only 90% full

Multiple, incompatible waste streams stored sealed and labeled in **separate** secondary containment bins

Compatibility for Storage of Hazardous Chemicals

- **Types of Chemicals:**
- Inorganic Acids:
  - Hydrochloric Acid, Phosphoric Acid, Sulfuric Acid, etc.
- Organic Acids:
  - Trifluoroacetic Acid, Acetic Acid, Formaldehyde, etc.
- Inorganic Bases:
  - Sodium Hydroxide, Potassium Hydroxide, etc.
- Organic Bases:
  - Amines (diethylamine, trimethylamine, etc.)
- Solvents:
  - Hexane, Acetone, Tetrahydrofuran, Xylene, etc.
- Oxidizers:
  - Sodium Dichromate, Silver Nitrate, Potassium Dichromate, Potassium Permanganate, etc.

Compatibility Table:

	Inorganic Acid	Organic Acid	Inorganic Base	Organic Base	Solvents	Oxidizers
Inorganic Acid	★	X	X	X	X	X
Organic Acid	X	★	X	X	★	X
Inorganic Base	X	X	★	X	X	X
Organic Base	X	X	X	★	★	X
Solvents	X	★	X	★	★	X
Oxidizer	X	X	X	X	X	★

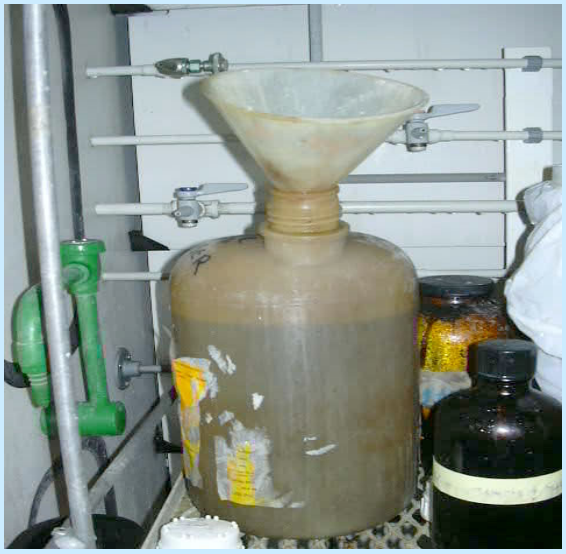
Key:
Incompatibles: **X**
Compatibles: ★

Chemical Waste Management : Inspecting Your Waste Accumulation Areas

- **Inspecting Your Waste Accumulation Areas**
  - Inspect your waste storage areas at least weekly
  - Things to check for:
    - Leaking containers
    - Unlabeled containers
    - Open containers
    - Incompatible containers stored next to each other
    - Liquid containers stored outside of secondary containers
    - Excessive accumulation of chemical waste
    - If any of these conditions exist, correct immediately

Improperly stored chemical waste. No secondary containment and open containers.
Waste and other chemicals stored while processes are occurring.
Also notice a very cluttered and unsafe fume hood

Improperly stored container: not labeled, open, in a sink



Improperly stored container: not labeled, open

Chemical Waste Management : Inspecting Your Waste Accumulation Areas

- At any time a lab space may not exceed more than 55 gallons of hazardous waste.
  - A lab space is considered any lab that has a door and a separate room number.
  - The 55 gallons is not based on the actual amount of waste that is in each container, but is based on the size of the waste containers.
  - Solid lab trash boxes and liquid waste are combined for the 55 gallon limit for waste in the lab space/room.

Chemical Waste Management : Inspecting Your Waste Accumulation Areas

- Example:
  - If the lab contained the following:
    - Seven LDPE jugs that were 2 gallons each (Total of 14 gallons of liquid)
    - Three lab trash boxes that are 13 gallons each (Total of 39 gallons of lab trash)
      - The lab contains a total of 53 gallons of waste. Lab is not in violation of State regulations.

Chemical Waste Management: Requesting a Chemical Waste Pick-Up

- **Getting Your Waste Removed from Your Lab**
  - You can request a chemical waste pick-up via our Department's Web Page: www.udel.edu/ehs
    - Click on "Waste" tab
    - Click on "Request a pickup" under "Chemical"
    - Click on "Waste Pick-Up Form"
      - Be as detailed as possible on location of waste in the lab and how much is to be picked up.
  - Or Call x8475 and talk with an Administrative Assistant
  - ***EHS will only remove waste that is properly labeled and in a satisfactory container!!***

Chemical Waste Management: Chemical Waste Pick-Up

- **EHS routinely picks up waste every week on Tuesday.**
  - ***Holidays and emergency responses could alter the day/time of pick-ups.***
- **Why your waste was not picked up?**
  - **The door to the lab was locked.**
  - **A contact could not be reached utilizing the phone number that was provided on the chemical waste pick-up request**
  - **It was unclear which waste container to take due to multiple full waste containers.**
    - **We advise that the lab put a piece of tape/paper on the specific waste container that states “For EHS”.**

Special Cases - CAAs

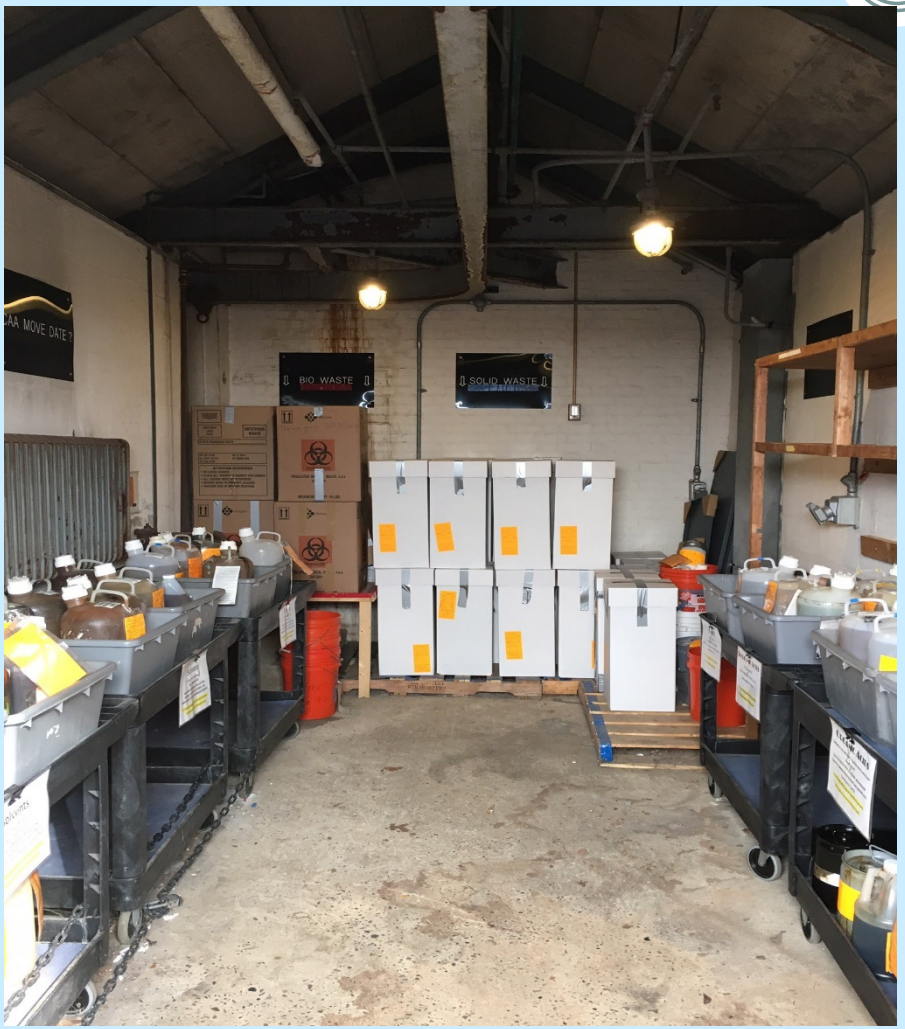
- Central Accumulation Area (CAA)
  - CAAs are established by the department
  - They are inspected weekly by EHS
    - Documentation of inspections are required by State and Federal regulators.
  - Researchers take their waste to the CAA
  - There are special set-up directions and criteria to use a CAA
  - The only two CAAs on campus are located at the:
    - **Brown Shed outside of Brown, Drake and LDL**
    - **ISEB Lab inside by the loading dock (Rm. 165D)**

CAAs: The Chemistry Department

- All chemical waste generated by the Brown, Drake and LDL Laboratories is to be transported down to the Brown Shed using a cart.
  - Do not move reactive or highly toxic compounds down to the shed. EHS will come to your laboratory and remove these compounds.
  - The chemical waste will be removed from the shed on a weekly basis depending on volume by EHS.
  - Keys can be obtained from the following location:
    - Fisher Scientific Chemical Stock Room
      - 063 Brown Lab
      - 302-831-2545

CAA: The Brown Shed

CAA: The Brown Shed



CAA: The Brown Shed Layout

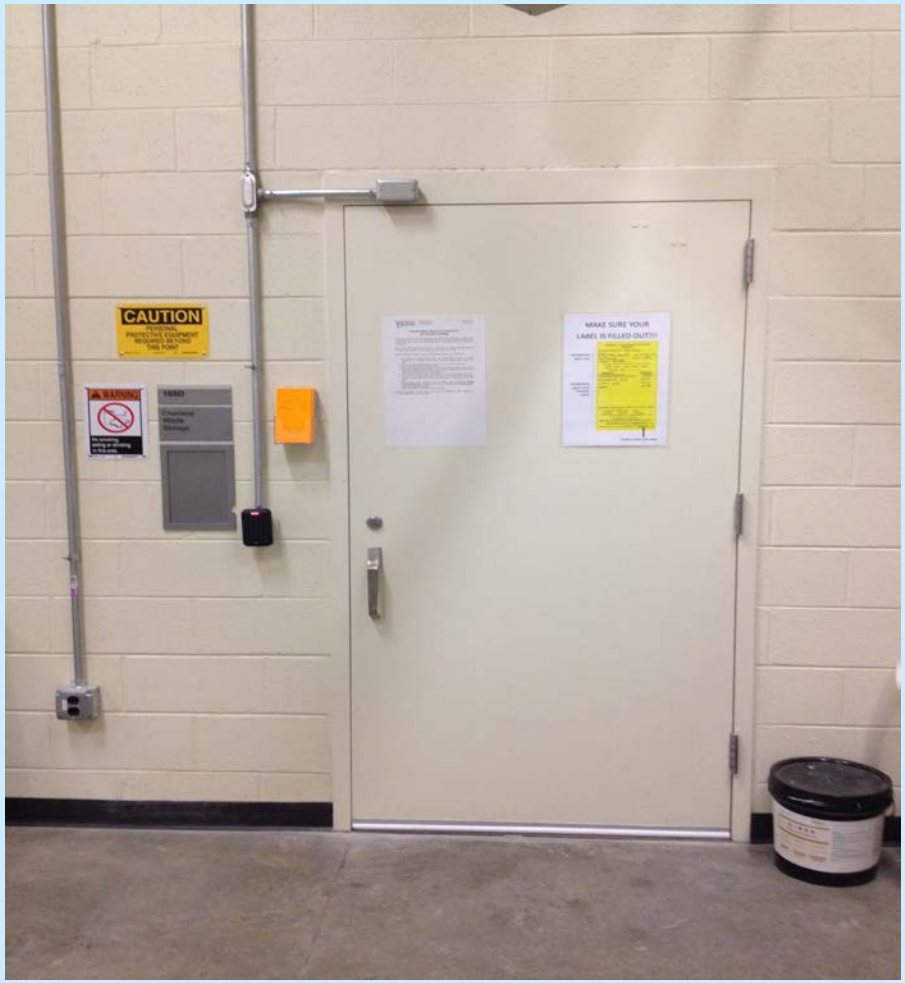
CAA: The Brown Shed

- Empty containers will be returned to the enclosed gray cabinets outside of the Brown Shed.
  - The keys for the Brown Shed will unlock the cabinets.

CAA: ISEB Lab

- All chemical waste generated in ISEB Lab is to be brought down to the chemical waste storage room by the loading dock (Room 165D).
  - Do not move reactive or highly toxic compounds down to the shed. EHS will come to your laboratory and remove these compounds.
  - The chemical waste will be removed from the shed on a weekly basis depending on volume by EHS.
  - Access is by key card only. Talk to your PI about gaining access or call EHS at x8475.
- The empty containers will be returned to the ISEB Lab CAA weekly.

CAA: ISEB Lab


CAUTION
MAKE SURE YOUR LABEL IS FILLED OUT!!!


CAUTION
PERSONAL PROTECTIVE EQUIPMENT REQUIRED BEYOND THIS POINT
WARNING
No smoking, eating or drinking in this area.
165D
Chemical Waste Storage

CAA: ISEB Lab


RETURNED WASTE CONTAINERS ONLY
NO CHEMICAL OR BIOLOGICAL WASTE
SOLVENTS
ORGANIC ACIDS
INORGANIC ACIDS
BASES
B USA


SOLID CHEMICAL WASTE DISPOSAL AREA
SOLID BIOLOGICAL WASTE DISPOSAL AREA

CAAs: General Procedures

1. All chemical waste procedures and policies must be followed.
2. All waste must be properly labeled, dated and in an approved container.
3. Use a sturdy cart and secondary containment bins to move the chemicals to the storeroom.
4. Once in the storeroom, place the waste container in the provided secondary containment according to hazard class.
5. The label must be filled out properly ***with the date that the waste was moved into the shed filled in at the bottom!!***

CAAs: General Procedures

Use a sturdy cart and secondary containment bins to move waste to the CAA. Wear appropriate PPE (lab coat, proper lab attire, gloves and safety glasses)

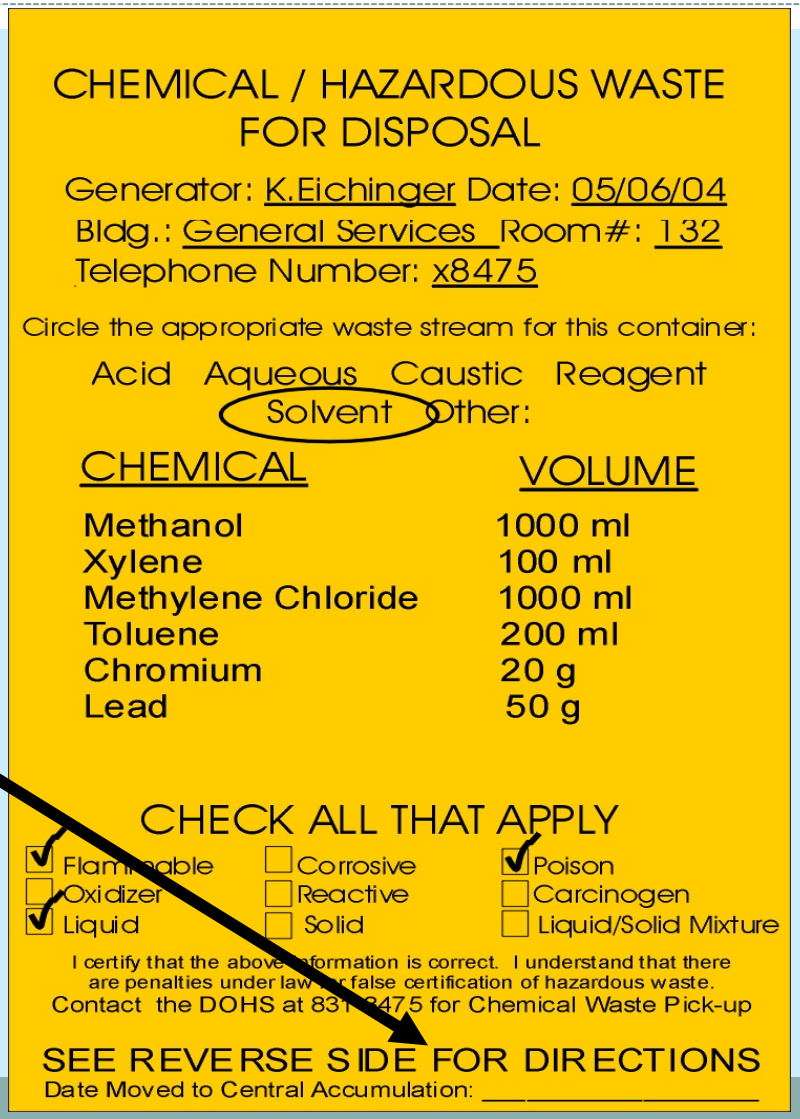
Place the waste in the secondary containment bins in the CAA, segregated per hazard class.

Note: All liquid waste containers must be placed into secondary containment.

CAAs: General Procedures

Date the label with the date that the waste container is moved to the Central Accumulation Area

Note: This is a State and Federal requirement. If it is not completed the University of Delaware could be subject to fines.



CHEMICAL / HAZARDOUS WASTE FOR DISPOSAL

Generator: K.Eichinger Date: 05/06/04
Bldg.: General Services Room#: 132
Telephone Number: x8475

Circle the appropriate waste stream for this container:

Acid Aqueous Caustic Reagent Solvent Other:

CHEMICAL	VOLUME
Methanol	1000 ml
Xylene	100 ml
Methylene Chloride	1000 ml
Toluene	200 ml
Chromium	20 g
Lead	50 g

CHECK ALL THAT APPLY

- ☑ Flammable
- ☐ Corrosive
- ☑ Poison
- ☐ Oxidizer
- ☐ Reactive
- ☐ Carcinogen
- ☑ Liquid
- ☐ Solid
- ☐ Liquid/Solid Mixture

I certify that the above information is correct. I understand that there are penalties under law for false certification of hazardous waste.
Contact the DOHS at 831-8475 for Chemical Waste Pick-up

SEE REVERSE SIDE FOR DIRECTIONS
Date Moved to Central Accumulation: _____

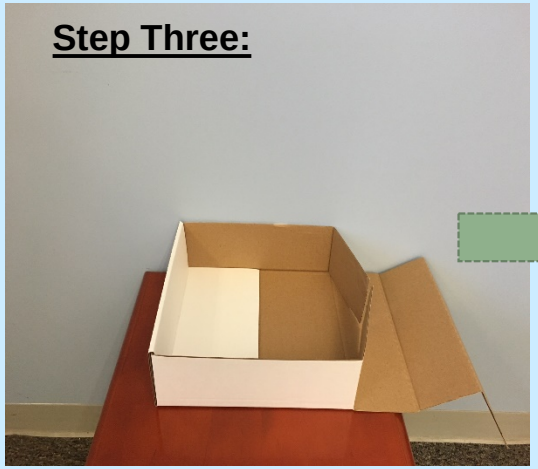
Solid Waste Management

Solid Waste Management: Building the Lid

Step One:

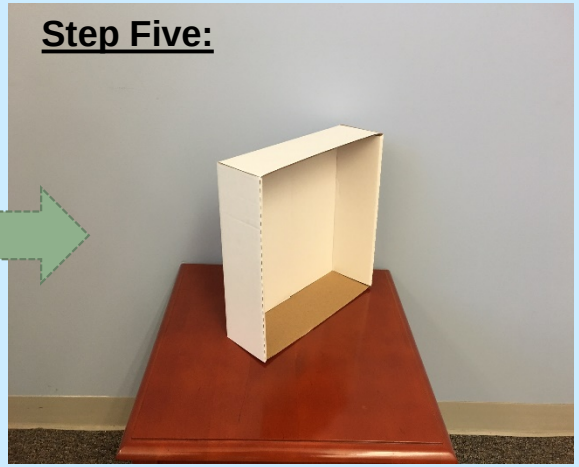
Step Two:

Step Three:



Step Four:

Step Five:



Solid Waste Management: Building the Box

Appropriate tape:
- Duct tape
- Packing tape

Inappropriate tape:
- Lab tape
- Scotch Tape

Step One: Fold in the one side.

Step Two: Fold in the two triangles.

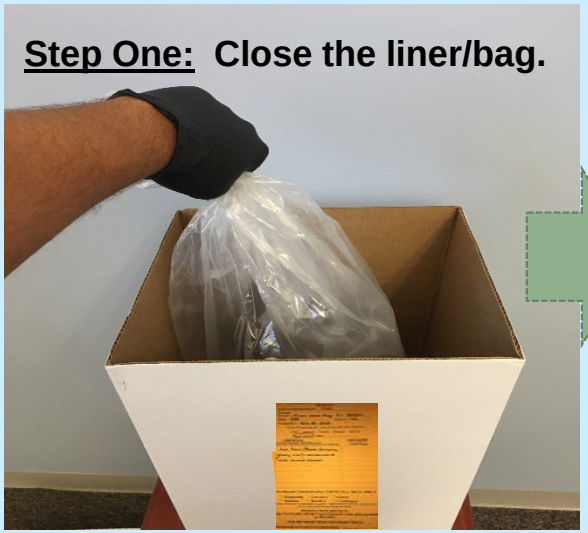
Step Three: Push the final side down and into the box.

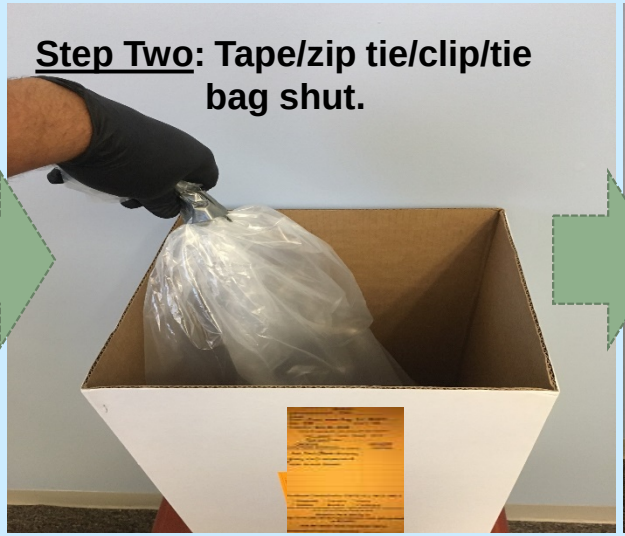
Step Four: Tape the bottom of the box.

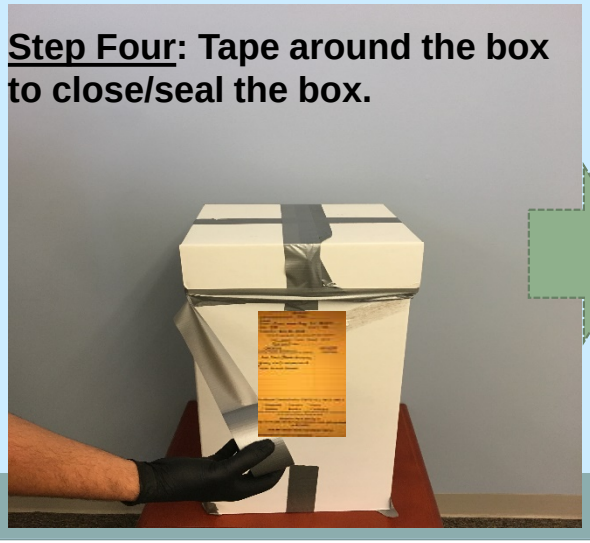
Step Five: Fold out handles to make room for liner

Step Six: Place liner in the box and label with orange hazardous waste label

Solid Waste Management: Preparing your lab trash box for pick-up

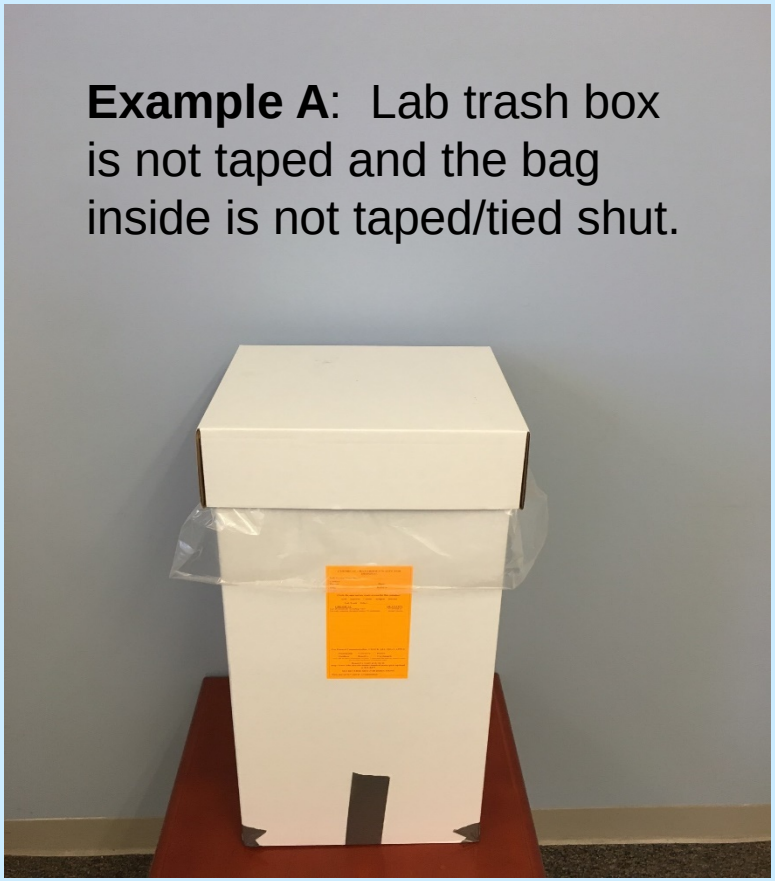






Improper Closure of Lab Trash Boxes when preparing them for pick-up

Example A: Lab trash box is not taped and the bag inside is not taped/tied shut.



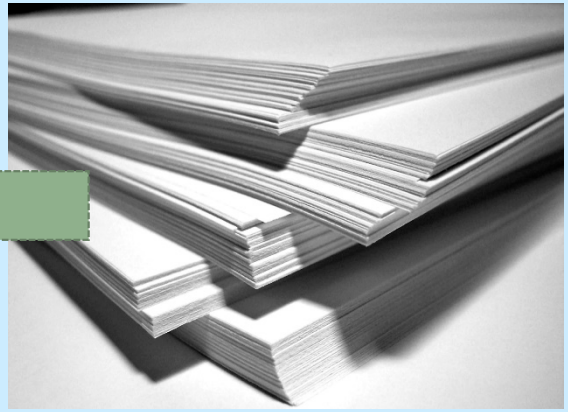
Example B: The bag inside is not taped/tied shut.

Note: There is the potential for a box to break open and the contents to spill if the interior bags and/or the boxes are not taped shut properly.

Solid Waste Management: What is considered lab trash?

What is considered municipal trash?

From Hand Washing Only.



Empty Lab Trash Boxes Are Available At:

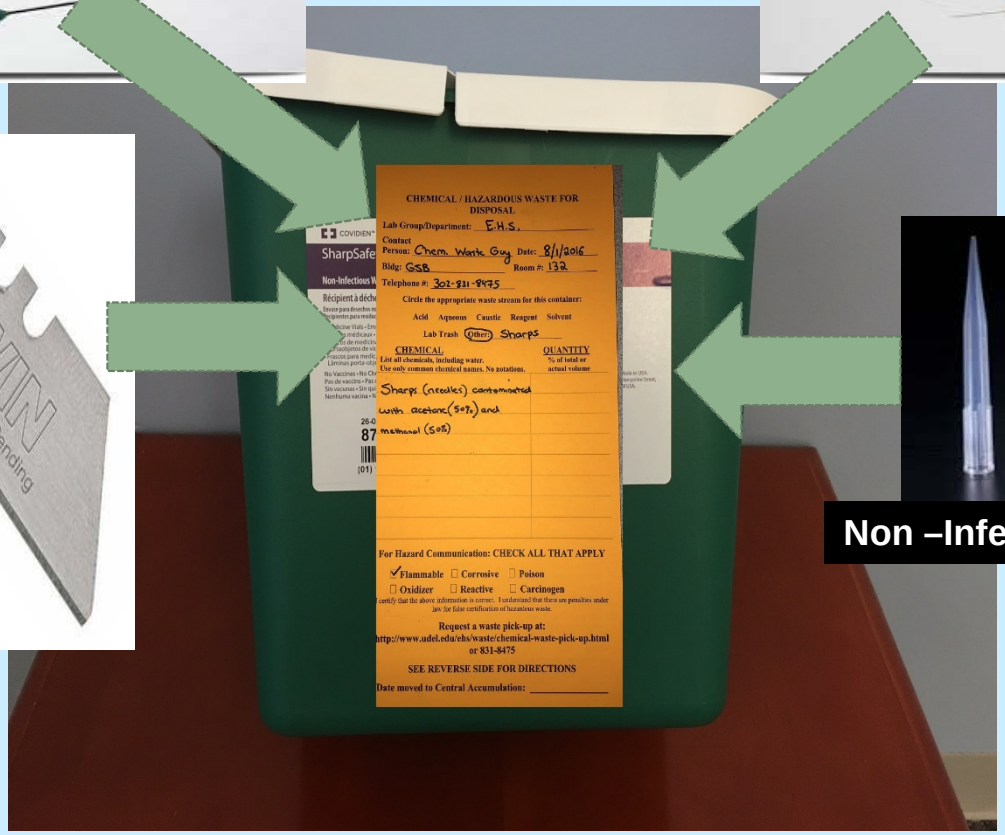
Fisher Stock Room – Brown
Fisher Stock Room – McKinly
Colburn Loading Dock
ISE Waste Room 165 D
Worrilow Room 308 (with bio haz boxes)
DBI (at the loading dock)

NOTE: The lab trash boxes come with the liners. There are six boxes (with liners) in a case.

Sharps Disposal

- Syringes and even syringes without a needle attached must go into a sharps container
- Contaminated micropipettes, pipette tips, and Pasteur pipettes must be discarded in a puncture-resistant container or a sharps container for disposal
- Note:
  - **Green sharps containers are for chemically contaminated sharps**
  - **Red sharps containers are for biologically contaminated sharps**

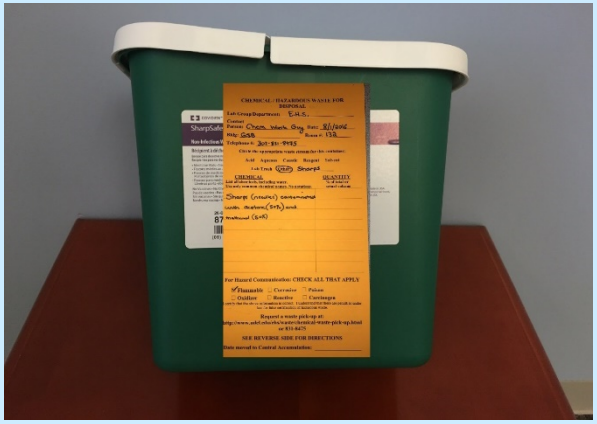
Sharps Disposal
What is considered a sharp?



Non –Infectious (no biologicals)

Chemically Contaminated Sharps Disposal

- Chemically Contaminated Sharps
  - Always use a green sharps container
  - Apply waste label to the outside of container
  - Close lid when not actively adding waste



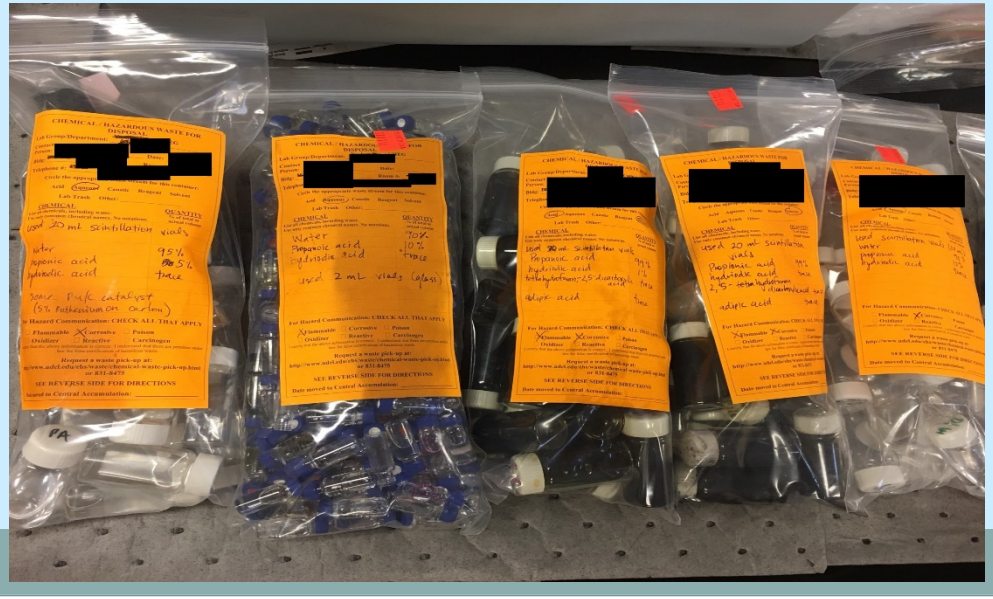
Ensuring your Sharps Container are Closed

Use a piece of tape to ensure that your sharps container remains closed when not in use.

Special Considerations – Small Vials containing hazardous liquid chemicals

Sample Vials – Sealed **15ml or less**

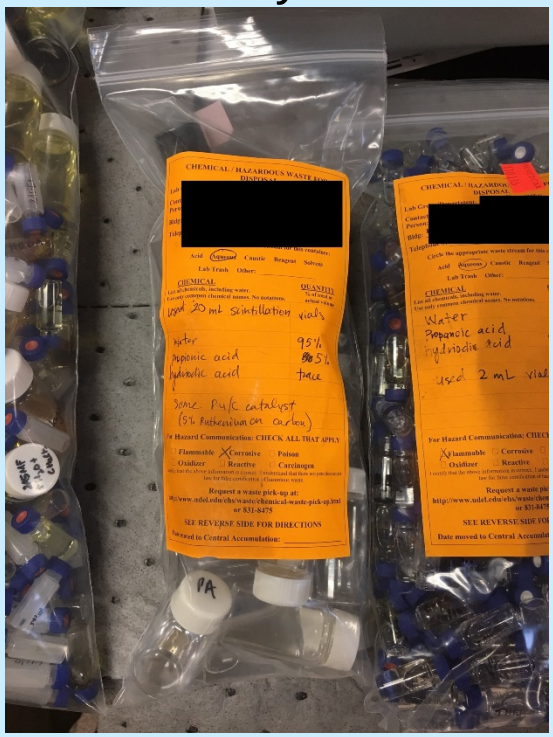
- Compatible small sealed vials containing hazardous chemical liquids can be collected in a baggie or bag for disposal.
- The baggie or bag should be labeled with an orange waste label and stored inside of a secondary containment.



Special Considerations – Small Vials containing hazardous liquid chemicals (continued)

Sample Vials – Sealed **15ml or less**

- Examples of acceptable bags:
  - 6 mil poly bags.
    - Note: If the bag does not seal then it should have secondary containment that has a lid.
  - Plastic freezer baggies
- Examples of acceptable secondary containment:
  - Bucket with lid.
  - Tray for baggies that have a sealed closure.



Special Considerations – Small Vials containing hazardous liquid chemicals (continued)

Examples of procedure using a 5 gallon bucket and bag to collect vials:

- Purchase clean 5 gallon polyethylene pail with lid
- Line the pail with a heavy duty plastic bag
- Place completed chemical waste label on the outside of the pail
- Place only compatible material in pail
- **When not actively adding waste, keep lid on the pail**
- When full, tightly seal bag with tape or bag closure tie. Place orange label on the bag.

Empty Chemical Containers

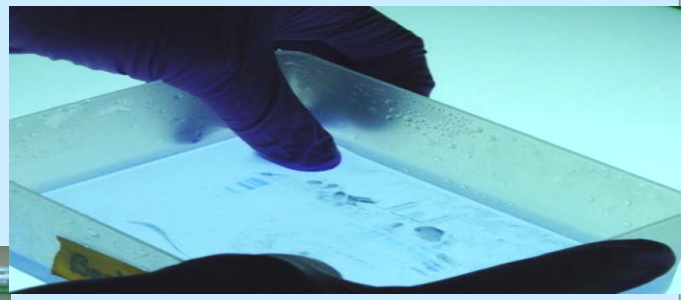
- Triple rinse with copious amounts of water. Collecting first rinse of water as hazardous waste in container.
- Deface the label completely or use sticker.
- Do **NOT** replace cap on container
- Place Empty/Triple Rinsed Container in glass only box, recycling container or directly into the dumpster.
- If it is acutely toxic or immiscible in water, treat containers as chemical waste and package separately for disposal by EHS.

Gel Waste Disposal

- Infectious Waste Gels:
  - Ethidium Bromide and Agarose Solid Gels
    - Collect in a bag, tightly seal, and place in infectious waste box
- Chemical Waste Gels:
  - Acrylamide Solid Gels
    - Collect in a bag, tightly seal, and manage as chemical waste.
  - Acrylamide and Ethidium Bromide Reagents
    - Place in a bag or box and manage as chemical waste
  - Liquid Ethidium Bromide and Acrylamide
    - Manage as non-corrosive aqueous chemical waste

Gel Waste (continued)

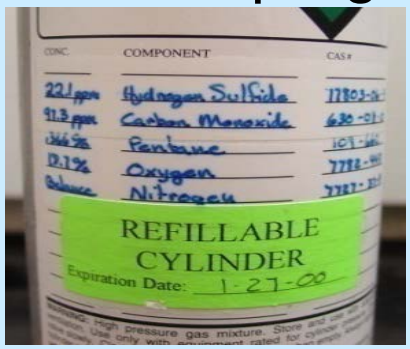
- **Waste Buffers**
  - Some buffers can be poured down the drain with copious amounts of water
    - Must be uncontaminated
    - If used as a running solution with ethidium bromide, run the solution through an ethidium bromide filter first. Place used filters in the infectious waste box
    - If used as a running solution with acrylamide gels, manage chemical waste.
  - Before pouring buffers down the drain contact EHS for approval



- **Staining and De-staining Solutions**
  - Must be managed as non-corrosive aqueous chemical waste.

Gas Cylinders

- The disposal of gas cylinders is extremely expensive.
- Unknown gas cylinders may cost in excess of $1,000 to identify and properly manage. Always check to make sure that all labels on gas cylinders are in good condition and legible.
- Try to use Aldrich Thin Walled Cylinders
- If Lecture bottles are absolutely necessary, use Matheson Tri-Gas or Messer Gas (MG Ind.). They have a lecture bottle return program.



Common Violations Found in Laboratories

- **Unknown / Unlabeled chemical waste**
  - Difficult to dispose of
  - Very expensive to dispose of
  - Poses unnecessary risks to personnel handling the unknown chemicals
  - Direct violation of hazardous waste regulations
  - You or your department may be charged for the disposal of unknown chemicals
- **Prevention**
  - Make sure all compounds and solutions are labeled with the full/proper chemical names
  - Conduct self laboratory inspections to ensure that containers are not cracked, labels are falling off, and/or the compounds are old/expired.

Common Violations Found in Laboratories

- **Mixing or Storage of Incompatible Chemicals**
  - Mixing of incompatible chemicals can cause:
    - Explosions
    - Fires
    - Generation of toxic aerosols
- **Prevention**
  - Having an accurate, up to date waste label on each container will greatly reduce the possibility of mixing incompatible materials
  - Use proper and approved chemical waste containers
  - Have more than one secondary containment bin in order to store incompatibles separate from one another.

Common Violations Found in Laboratories

- Improperly labeled waste containers.
- Laboratory personnel that are inadequately trained in proper management of chemical waste.
- Liquid containers stored outside of secondary containers. If containers leak the contents may migrate and commingle with incompatible chemicals.
- Waste containers stored in and/or near sink areas. If containers leak the contents would discharge down the drain.

Common Violations Found in Laboratories

- Chemical containers that are left uncapped / open (liquid waste container, lab trash boxes, chemically contaminated sharps containers)

Chemical Waste Minimization

- All generators of chemical waste are required by law to implement waste minimization techniques.
- Before disposing of a reagent grade chemical that is still usable and has ample shelf-life left determine if someone else has a need for the chemical.
- **Establish use parameters before ordering chemicals**. This will minimize waste by purchasing chemicals in the container size that permits maximum consumption.

Chemical Waste Minimization

- Substitute less hazardous chemicals whenever possible
  - Substitute mercury thermometers for other non-mercury
  - Substitute Benzene for less toxic Toluene
  - Substitute chlorinated solvents for water based solvents
- Store chemicals according to manufacturers' recommendations.
  - Refrigerating chemicals
  - Storing chemicals under an inert atmosphere
  - Storing chemicals in a desiccator
  - Keeping chemicals moist with water
  - Preserving chemicals with specific additives
  - Storing chemicals in a dark environment

Chemical Waste Minimization

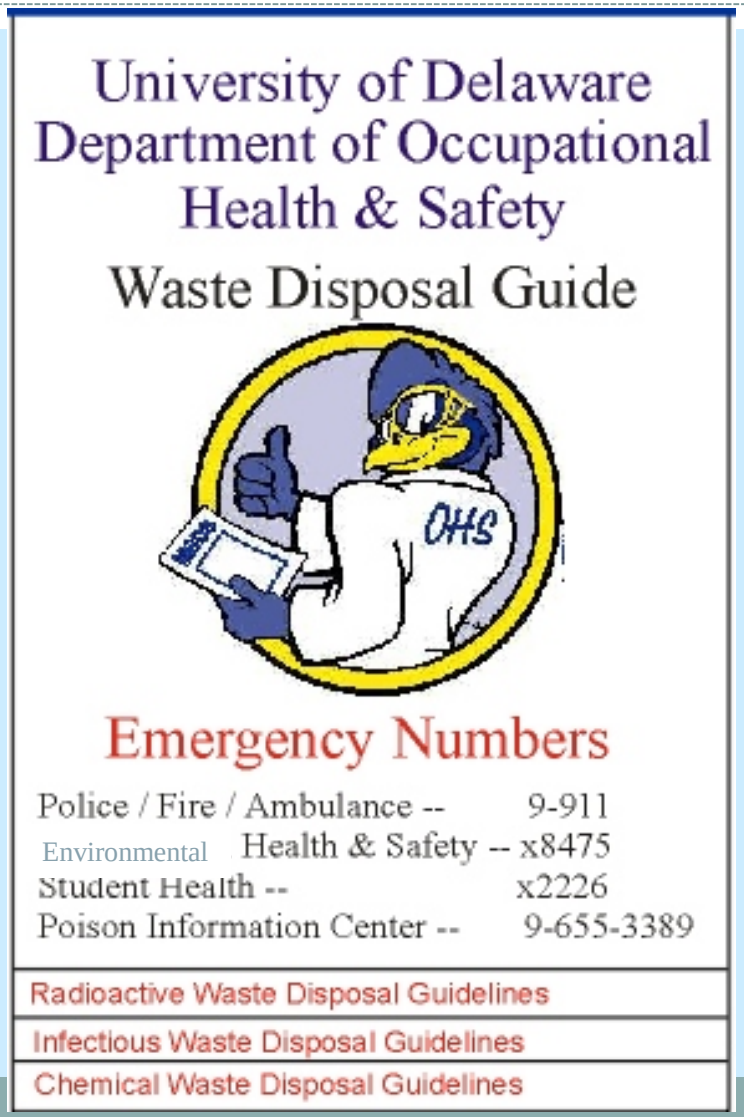
- When new chemicals are received, date and store them in a manner that allows the older chemicals to be used first.
  - This practice will develop a rotational system so that the older chemicals can be used before shelf life expires.
- Replace worn labels in a permanent, legible fashion. This will prevent an unknown chemical from being generated.
- Replace faulty or damaged caps and lids. This will safeguard against the effect of air and moisture contamination.

Chemical Waste Minimization

- Utilize calibrated dispensers if repeated dispensing is required.
- Reduce the scale of the experiment if protocol permits. Less chemicals used equates to less chemical waste generated.
- Utilize a gas cylinder vendor that will accept the gas cylinder back when you are through using it.

Waste Disposal Poster

- This poster provides helpful hints on how to manage the most common laboratory waste streams generated on campus
- The poster can be hung near the point of waste generation in the laboratory



Resources

- Chemical Waste Web Page
  - http://www.udel.edu/ehs/waste/waste-guidance.html
- EHS – x8475
  - Request:
    - Waste Pick-Up
    - Labels
    - Waste Posters
    - Sharps Containers
    - Chemical Spill Kits

Questions??

- **http://www.udel.edu/ehs/waste/waste-guidance.html**
- **Call (302)-831-8475**
- **Ask your Chemical Hygiene Officer or Safety Committee**