UNIVERSITY OF HOUSTON-CLEAR LAKE
ENVIRONMENTAL, HEALTH AND SAFETY DEPARTMENT

	Effective Date	**Number**
	Aug 8, 2022	L 09

Subject		
Glass Handling and Disposal – Intact or Broken		
Reference Standard Best Practice, see references at end	**Special Instructions** None	
Distribution Laboratory faculty and staff	**Reevaluation Date** 5 years	**No. Pages** 8

I. PURPOSE

To prevent and/or minimize glass injuries while handling laboratory glassware through:

1. Awareness of personal protective measures
2. Safe disposal of both broken and unbroken glassware, pipettes and vials, etc., to prevent injury to those handling waste containers; and
3. Online submission of the First Report of Injury (FROI) form for compliance reporting as well as follow-up evaluation for any corrective actions to prevent future incidents.

II. POLICY

Broken glass, intact glass (such as glass slides, coverslips, etc.), and empty glass chemical containers pose a laceration and/or contamination hazard to laboratory workers, custodial and other staff when placed in the regular trash can as it will break if not already broken, and can easily puncture through trash bags.

All glass being disposed of, whether intact or broken, must go in a glass disposal box, not in regular trash. Glass disposal boxes are sturdy containers labeled as “glass” (or equivalent wording) that are puncture proof and securely sealed to hold all glass pieces, whether intact or broken, prior to being handled and transported to a dumpster.

This applies to all research and teaching labs, shops, staff and students who handle glassware or come across broken glass. Broken glass and other sharp materials are physical hazards. Broken glass also has the potential to be a health hazard if it is contaminated with toxic chemicals, blood, or infectious substances which may enter the body through a cut or puncture.

III. PROCEDURES

A. Glass Disposal, General

An example of a proper glass disposal box is shown. When assembling the boxes use packing tape to secure the bottom of the box, with the accompanying liner bag inside. Never use red biohazardous waste bags as a liner.

Only clean glass may go in the glass box. No other trash or debris, no chemicals or chemical residue, and no liquids. See section III.B. for further details.

Do not put pipettes into glass boxes—pipettes have their own waste box or receptacle, which may be a smaller box for disposal, or autoclave bag for autoclave steam disinfection.

Do not overfill or completely fill the glass boxes. Glass must fit inside the box, below the lid so that the bag inside can be tied and the box tape sealed shut as required before trash pickup. If completely full, the weight of the glass box may be too heavy to handle.

- Never reach hands into the box to retrieve items or push down on glass to consolidate.
- Wear appropriate hand and eye protection when handling broken glassware. Use a broom and dustpan to collect broken pieces. Large pieces that cannot be swept up may be picked up by unbroken areas and carefully placed in the glass box, without putting hands into the box.
- Collection boxes are one-time use only. Do not empty the contents of box into the dumpster or reuse the container. The whole container shall be placed directly into a dumpster.
- Should special purchased, labeled glass disposal boxes not be available, suitable containers may be used meeting the requirements of labeling, puncture-proof, and closure. This may include a sturdy cardboard box with an inner trash bag, tied and taped shut equivalently, or a sealable plastic container such as a bucket with a sealed lid, both labeled “Glass” (or equivalent wording).

B. No Contaminated Glass

- Only clean glass may go in the glass box. No trash or other debris, no chemicals or chemical residue, and no liquids.
- Glass contaminated with biohazards, radioactive materials and/or chemicals must be disposed of separately and may not be included in the broken glass box. Put contaminated glass in the waste storage area and refer to the appropriate chemical,

biological, radiological manual, or waste SOP for those handling requirements. If the contaminated glass is broken, place it in another sealable container prior to moving it to the waste storage area. Contact EHS if assistance is needed.

- Chemically contaminated glass must be picked up as hazardous (chemical) waste by our contracted chemical waste treatment and disposal vendor. Ensure glass or outer container is labeled with the chemical residues, and/or a waste profile is completed with EHS indicating contents.
  - *Be careful to verify dried chemical residue is not distilled peroxide forming chemicals or picric acid, both of which can be extremely explosive.* Refer to the Peroxide Forming Chemicals Storage Chart list on the EHS Lab Safety webpage.
    - *Peroxide formers are referred to as Potentially Explosive Chemicals (PEC's).*
    - These solvents have recommended storage time limits to prevent buildup of explosive concentrations.
    - Peroxides are less volatile than solvent and tend to concentrate in solution or in the container threads.
    - Experiments have determined that a percentage of 0.008% (80 PPM) or greater is enough to initiate explosive decomposition. Peroxides are sensitive to heat, friction, and shock, and some peroxides may explode without being concentrated. (i.e. Isopropyl Ether).
    - If past the storage timeline, or crystals are observed, **do not open** or move the container. Contact EHS immediately for high haz pickup.
  - Lab Waste Handling Chart - Overview of Waste Types
- Biologically contaminated glass must be properly chemically disinfected or autoclaved (steam disinfection) prior to disposal. Glass needing to be autoclaved may be autoclave bagged and/or placed in an autoclavable tray for secondary containment should the autoclave bag be punctured.

C. No Controlled Glassware

- Many laboratory glassware types must be destroyed prior to disposal, and may not be given to unauthorized recipients. These are referred to as controlled (substance) glassware, and are regulated by the Texas Department of Public Safety.
- Examples include distilling and condensing components, round bottom flasks, three necked flasks, Erlenmeyer flasks, separatory and filter funnels, and vacuum dryers. See L10 Controlled Glassware and Precursor Chemicals in the Chemical Safety or Waste sections of the EHS Lab Safety webpage for more information.

D. Glass Handling

- Injuries to the hands can occur when handling glassware in the lab, such as cuts, or puncture wounds, flying glass, chemical exposure, or fire.

- Exercise caution when handling and transporting glassware. Use a tray when carrying multiple glassware short distances, and a cart and/or tray with sides when transporting multiple glassware.
- Follow instructions and guidelines when assembling special glass apparatus (distillation columns, vacuum setups, etc.) and equipment that may contain glass (dishwashers, autoclaves, etc.).
- Inserting glass tubing into a rubber stopper is not recommended. When inserting plastic or rubber tubing onto glass tubing, use silicone grease, and a cork borer if necessary. Protect your hands with additional gloves, paper towels, or cotton gloves.
- Don't handle broken glass with bare hands. Use forceps, tongs, scoops, and broom with dustpan to collect broken pieces. Wear cut-resistant gloves if available. Large pieces that cannot be swept up may be picked up by unbroken areas and carefully placed in the glass box, without putting hands into the box.
- Never hand broken or sharp items such as glassware (or needles) to another person. Place them down on a counter and allow the other person to pick up.
- Be familiar with the location of safety equipment and exits in the lab, including sinks, eyewashes, safety showers, first aid kits, and phone.
- The most likely person to be injured by glassware is the user. However, anyone near imploding glassware may be hurt, which is another reason everyone must wear their personal protective equipment (PPE). By implementing safety controls while handling glass, and wearing PPE, the potential risks can be reduced.
- Special glassware are prone to breakage from hairline cracks in addition to dropping the item. Wear slip-resistant or cut-resistant gloves when handling glass to prevent cuts, abrasions, and skin puncture.
- Do not remove any items from a sharps or glass container.

E. Glassware Washing Tips

- Protective eyewear such as a face shield, safety goggles or safety glasses with side shields should be worn to protect against splatter from cleaning agents or from flying glass shards.
- Carefully handle glassware, as the soap and water will make the glassware slippery. Gloves with textured/slip-resistant palms or cut-resistant inner gloves are recommended.
- Wear thick water-resistant rubber or neoprene gloves to protect hands against chemicals such as acids, alkalis, solvents, and detergents used during glassware cleaning operations.
- Using protective plastic/rubber mat in and around the sink can prevent glass breakage
- Rest round bottom glassware in a cork or rubber ring in the sink

- Wear gloves, cut resistant if possible.
- Wash one piece at a time.
- Do not rush. Leave enough time to safely clean glassware.

F. Injuries from Broken Glass

- Resist the urge to catch falling glassware. Reflexes add to the risk of getting hurt.
- If injured, step away from the glassware, then evaluate your condition.
- Alert others in the lab, including Principle Investigator (Researcher) and/or Faculty so they can avoid the broken glass. All injuries and near misses must be reported to these individuals and per the instructions below.
- Allow the wound to bleed a little, which is the body's natural method of flushing out contaminants.
- Apply first aid (wash gently with water and soap, and apply antibacterial ointment, bandage)
- Seek medical attention if needed. **Immediate medical attention is required if the incident involves potential exposure to infectious materials, as well as chemical exposures to highly toxic chemicals, strong acids or bases, and/or chemicals that cause pulmonary edema (fluid buildup) in the lungs within 24-72 hours (hydrogen sulfide, nitric acid, chlorine or ammonia gas, etc.).**
  - UHCL Health Services (281-283-2626) is located in SSCB 1.1301
  - Dial Police at x.2222 (281-283-2222) if assistance is needed. They will notify EMS / Fire Department, indicate your location, and escort them to you. Police also has after hours contact information for lab faculty and EHS.
- Clean up damaged glass using broom and dustpan, and discard into glass box. If contaminated, but not damaged, glassware may be cleaned and soaked in an approved disinfectant for the allotted amount of time (10-15 minutes).
- **Complete a First Report of Injury and submit within 24hrs** to EHS@uhcl.edu, and HumanResources@uhcl.edu also if an employee. Incident reports may be found on the EHS website at https://www.uhcl.edu/about/administrative-offices/environmental-health-safety/forms. There are separate forms for students and employees.

G. Glassware Risks

The University of Iowa has a table of glassware risks as well as safe handling information for Schlenk line apparatus, Vacuum glass, Autoclaving glassware, and Glass thermometers, which is inserted below.

Type of Glassware Injury	Safety Control Recommendations to Reduce Risk	Example Activities	Potential Risk
Injury from imploding or flying glass. (Vacuum apparatus)	• Tape vacuum flasks and vacuum desiccators with electrical tape. • Keep cryogenic vacuum flasks wrapped with Nylon or other polymer based plastic mesh (view example). • Wrap glass desiccators with friction or electrical tape in a grid pattern, leaving the contents visible; this will guard against flying glass in case of implosion. • Wear a face shield, safety goggles, appropriate gloves, and lab coat. • Educate researchers in vacuum techniques. *Consider other factors that could possibly reduce risks, such as: Use low intensity vacuum devices, use smaller flasks, assure vacuum is released at the vacuum pump before removing vacuum flask/glassware, make sure glassware under vacuum is not located where it could be bumped or struck.*	Working with vacuum apparatus.	HIGH
Cuts when forcing glass tubing or pipettes onto rubber stoppers	• Use glycerin as a lubricant. • Wear cut-resistant gloves and safety glasses with side shields.	Working with glass tubes or Pasteur pipettes.	Moderate Plus
Cuts caused by breaking inlet/outlet stems from reflux condensers or desiccator stems	• Dip the end of Tygon tubing into a solvent such as acetone and gently insert onto glass stems. • Wear cut-resistant gloves, safety glasses with side shields, and lab coat.	Assembling/disassembling condensers, or holding the stem to open or close desiccators.	Moderate
Chemical or other hazardous material exposure caused by sharps injuries from contaminated glassware	• Develop and implement hazardous chemical or hazardous material-specific SOPs. • Work within a fume hood or appropriate engineering control. • Wear gloves, safety glasses with side shields, and lab coat. • Wear a face shield and safety goggles as appropriate for the specific experiment.	Working with or transferring toxic chemicals in reaction flasks, separatory funnels, etc.	Moderate

Broken or breaking glass during laboratory work/process (Injury from slipping glass)	• Check the glassware to ensure it is free of cracks, flaws or scratches. • Wear slip-resistant and/or cut-resistant gloves, safety glasses with side shields, and lab coat when washing glassware. • Wear safety glasses with side shield for transporting glassware outside the lab. • Wear a face shield and safety goggles as appropriate for the specific experiment.	Washing lab glassware, transporting to or from drying ovens, autoclaves, etc.	Low
Breaking glass ampules	Use ampoule breakers or triangular file to score the glass as appropriate. Wear a face shield, safety goggles, appropriate gloves, and lab coat.	Working with pharmaceutical and analytical standards or other sealed chemical ampoules.	Low
Inserting the inlet of an auto-pipetting device onto a glass pipette	Check for defective pipettes with cracked or chipped ends. Wear a face shield, safety goggles, appropriate gloves, and lab coat.	Dispensing liquid reagents in labs.	Low
Cutting glass tubes	• Purchase commercially available aspirator flasks with prefabricated stopped/Pyrex glass tubing assemblies. • Use a triangular file or diamond pencil for scoring/scratching a glass tube or visit your local glass shop for assistance • Wear a face shield, safety goggles, appropriate gloves, and lab coat.	Preparing aspirator/vacuum flasks filtration equipment	Low

Schlenk line Apparatus

- ***A mixture containing condensed liquid air/oxygen and organic compounds in a liquid nitrogen trap can potentially result in an explosion.***
- ***Contents of a liquid nitrogen trap should be promptly emptied after each experiment.***
- ***If the vacuum line valve is kept closed after the experiment, condensed liquid air in the liquid nitrogen trap will evaporate to a gas phase at ambient temperature and the trap will become a pressurized glass tube and can lead to a potential explosion.***
- ***The fume hood sash should be closed to the lowest possible height to prevent glass flying out of the fume hood in the event of an explosion/implosion.***

The Schlenk line is a specialized glass apparatus consisting of a vacuum pump, inert gas connection, liquid nitrogen cryotrap and paraffin oil gas bubbler and is typically used for manipulating air/moisture sensitive compounds. Researchers should be individually trained in Schlenk line manipulation under the direct supervision of the principal investigator or an experienced senior researcher.

High vacuum is often applied to remove the last traces of solvent from a sample. Implosion can occur due to the use of a high vacuum and flaws in glass apparatus. Therefore, researchers should check for cracks in glassware before starting work using a Schlenk line. They should also check for the presence of condensed liquid air (oxygen condensation) in the cryotrap before starting a Schlenk line work because this condition may lead to explosions. If needed, the vacuum trap valve should be opened to dissipate cryotrapped oxygen (light blue color).

Exposure to chemicals and glassware injuries while preparing or using the Schlenk line can be minimized by setting up Schlenk lines in a fume hood and proper planning, including performing a hazard evaluation prior to work.

Vacuum Glass Apparatus

Vacuum glassware with volumes of one or more liters should be wrapped with friction tape, electrical tape, or a plastic mesh cage to restrain fragments in the event of an implosion. This is appropriate for safe handling of vacuum storage bulbs, rotary evaporators, vacuum desiccators, etc. Round-bottomed thick-walled Pyrex or borosilicate glassware should be used for vacuum operations.

Distillation Apparatus

Peroxide forming chemical hazard note: do not distill peroxide forming chemicals (ethers, tetrahydrofuran, certain organic solvents) to dryness [*see list in Peroxide Forming Chemicals Storage Chart in Chemical Safety section of EHS Lab Safety webpage*]. Shock sensitive peroxides will crystallize out of the solution and will explode.

Autoclaves

All glassware should be inspected prior to autoclaving. Older glassware can be less stable and may break during the process. Wear insulated thermal gloves when removing glassware from autoclaves. If broken glass is discovered, the autoclave should be left to cool completely before cleaning broken glass debris. The OSHA fact sheet publication on Autoclaves and Sterilizers describes the DO's and DON'Ts while working with autoclaves and Sterilizers. Assure that employees using the autoclave have been informed how to use autoclaves safely.

Thermometers

- ***Whenever possible, replace glass thermometers with temperature probes, or use mercury-free alcohol-filled thermometers.***
- ***If a mercury thermometer or monometer must be used in specialized applications, it is highly recommended to coat these devices with PTFE resin.***

1. Do not use a thermometer as a stirring rod.
2. Make sure the measuring range of the thermometer is appropriate to minimize breakage from overheating the thermometer.

3. If thermometers are to be inserted into a rubber stopper, a tight fit can be accomplished using a PTFE tape as a sleeve. For distillation or reflux experiments with air/moisture sensitive reagents, thermometers with a 'ground-glass joint' are highly recommended.

IV. References:

- University of Pennsylvania, *Fact Sheet: Glassware Handling*. Retrieved 6/29/22 from https://ehrs.upenn.edu/health-safety/lab-safety/chemical-hygiene-plan/fact-sheets/fact-sheet-glassware-handling
- University of Nebraska Lincoln, *Glass Disposal – Intact or Broken* Safe Operating Procedure. Retrieved 6/29/22 from https://ehs.unl.edu/sop/s-glass_disposal.pdf
- University of Iowa, Glass and other Sharps Injury and Illness Prevention in Labs. Retrieved 6/29/22 from https://ehs.research.uiowa.edu/glass-and-other-sharps-injury-and-illness-prevention-labs

V. APPROVAL

Director of Environmental, Health & Safety

Date: 08/08/2022

VI. REVISION LOG

Revision Number	Approval Date	Description of Changes
0	11/12/2010	Laboratory Wastestream Chart created & posted
0	10/1/2018	Broken Glass Disposal Poster created & posted
1	08/08/2022	Policy Created