This laboratory user guide and chemical hygiene plan has been prepared to introduce employees and students to the Environmental Engineering Laboratories in Ghausi Hall, and the policies and procedures governing their use. Please read through this manual in its entirety before using the facilities. Your comments and suggestions for improving working and safety conditions in the laboratories and for revising this manual are welcomed.

1. LABORATORY SAFETY

The nature of the courses taught and research conducted in these laboratories requires the use of many biologically and physicochemically toxic and hazardous materials. Of primary concern in these laboratories is that you and your fellow workers and students be able to conduct work under safe conditions. This objective can be achieved if you combine common sense with the knowledge you have gained from safety training programs and materials. It is requested that you specifically observe the following precautions and rules:

1.1 Safety Information

1.1.1 Safety Net Publications: UCD Environmental Health and Safety (EH&S) publishes safety information sheets called Safety Nets which cover a variety of general and laboratory safety topics. Copies of all pertinent Safety Net publications are kept on file in a binder located in the 2nd floor elevator lobby of Ghausi Hall. Review the table of contents of the Safety Net binder and read the Safety Net sheets which may be applicable to your specific activities. References are made throughout this document to specific Safety Net publications which provide additional information on specific topics. Safety Nets are available at: [http://safetyservices.ucdavis.edu/snfn/safetynets](http://safetyservices.ucdavis.edu/snfn/safetynets-1)

1.1.2 Material Safety Data Sheets: Know the hazard potential of each chemical and biologically active material you are using. Familiarize yourself with the Material Safety Data Sheets (MSDS) for the materials you are using. MSDS binders are located in yellow wire racks mounted to the inside of the hallway entrance door to each lab. They contain content specific to the chemicals in those labs. In addition, an MSDS binder is located in the elevator lobby at the north end of the hallway leading to the Environmental Labs on the second floor of Ghausi Hall. (see Safety Nets 34: Managing Chemical Waste Streams to Reduce Disposal Cost and 45: Glossary of MSDS Terms).
1.2 Personal Protection and First Aid

1.2.1 Wear eye protection (safety glasses or goggles) whenever you are working with materials that can injure your eyes, especially acids, bases, and oxidizers. It is recommended that you wear safety glasses at all times in the lab. All lab workers should receive eye glasses and splash goggles with their initial issue of Proper protective equipment (PPE). In addition, general use safety glasses are stored in a drawer to the right of the main sink in room 2105.

1.2.2 If you wear contact lenses, familiarize yourself with the special precautions listed in Safety Net 5: Eye and Face Safety Protection for Laboratory Workers.

1.2.3 Know the location of the emergency eye-wash stations, showers and first-aid kits. Lab eye-wash stations are located by the sinks in rooms 1014 A, 1114, 2104, 2105, 2109, 2110, and 2116. Hallway eyewash stations, as well as emergency showers, are recessed in the wall on the 1st and 2nd floors of the east-west hallways in Ghausi Hall. Read safety Net 66: Emergency Eyewash and Shower Testing and Use to familiarize yourself with the operation of the eye-wash stations and showers.

1.2.4 Wear hand protection when handling corrosive or hazardous materials. The use of nitrile rubber gloves is recommended when handling concentrated corrosive materials or organic solvents. Disposable PVC examining gloves offer minimal protection and are permeable to many organic substances. Check rubber gloves for holes and cracks before using. Do not touch surfaces with contaminated gloves (door knobs, equipment, bench tops, drawers, etc.) Rinse gloves well after use. Refer to Safety Net 50: Guidelines for the Selection of Chemical-Resistant Gloves for guidance on selection of chemical-resistant gloves. See Section 2.7.1-4 for location of rubber gloves, apron, lab coats and eye protection.

1.2.5 Open-toed shoes or sandals are not permitted in the laboratories. It is recommended that you store a pair of closed-toed shoes in the lab if you think you will be wearing sandals to campus.

1.2.6 Use of lab coats is recommended to protect your clothing. Protective aprons should be worn when handling highly corrosive materials. (See Section 2.7.3)
1.2.7 By March 31, 2014 all labs will have established PPE requirements based on lab hazard assessments. These requirements will apply to all individuals entering the lab for any reason.

1.3 Chemical Emergencies

In a chemical emergency do not hesitate to follow these procedures because a spill or contact seems too trivial. It is better to overreact!

1.3.1 For skin contact, flood the affected area with water immediately and continue flooding for at least 15 minutes. If a substantial portion of the body is involved, use a safety shower. If the chemical is toxic, or if its toxic properties are unknown, call Emergency Medical Services at (911) and Environmental Health and Safety (EH&S) at (2-1493) in that order.

1.3.2 For eye contact, flood eyes with water and continue flooding for at least 15 minutes. Remove contact lenses if possible, or move to corner of eye. Immediately call Emergency Medical Services (911) and EH&S (2-1493) in that order.

1.3.3 For inhalation or ingestion, follow directions on the product label or MSDS. Call Emergency Medical Services (911) and EH&S (2-1493) immediately. Refer to Safety Net 52: Emergency Medical Care for additional information on emergency medical care.

1.3.4 In case of spillage of any chemical:

1. If the volume of spill is greater than 500 ml (1 pint), or if any amount of extremely toxic substance is spilled, evacuate and seal the area. Call the Fire Department (911) and EH&S (2-1493) in that order. If you suspect or know the substance is flammable, extinguish or remove all ignition sources before sealing room. Post a note on the outside of any doors leading into the room warning others not to enter. If possible, have the MSDS for the spilled chemical ready to give to the responders.

2. If the volume of spill is less than 500 ml (1 pint) and the substance is not extremely toxic, check the container or MSDS for special instructions. If no instructions are immediately available, encircle and cover the spill with absorbent material until the liquid is absorbed. Do not flush with water. Neutralize strong acids with sodium
bicarbonate, sodium carbonate, or calcium hydroxide after absorbing. (Note: DO NOT absorb hydrofluoric acid - neutralize immediately). For more information see Safety Net 13: Guidelines for Chemical Spill Control

3. For formaldehyde and mercury spills see Safety Net 139: Guidelines for Handling Formaldehyde and Safety Net 16: Guidelines for Mercury Spill Control, respectively.

4. Solid spills are not usually emergencies. If the spilled material is toxic, use damped cloths or paper towels to transfer the material to plastic bags. Sweeping or brushing dry material may cause airborne dust.

5. All absorbed spill material must be transferred into double plastic bags, sealed and disposed of as a hazardous waste (see section 1.4.4). Notify lab manager, call, and hold for pickup by EH&S (2-1493).

1.4 Chemical Use and Storage

1.4.1 General

1.4.1.1 Liquid and surplus chemicals are stored in designated cabinets. Acids should be stored in one of the wood “Corrosives” cabinets under the work bench in room 2105 Ghausi Hall or near the fume hoods in room 2116 Ghausi Hall. Organic and inorganic acids must be segregated by storing in separate cabinets or, if stored in the same cabinet by using secondary containment. Strong bases can be stored in the blue “Corrosives” cabinet in room 2105 Ghausi Hall which is labeled for bases only. Solvents and other flammable liquids should be stored in the steel “Flammables” cabinets under the fume hoods or in the large yellow “Flammables” cabinets in rooms 1114 & 2116 Ghausi Hall.

1.4.1.2 When working with liquid reagent bottles, including solvents, acids, and bases, they must be kept in secondary containers, such as plastic dish pans.

1.4.1.3 When taking chemicals from reagent bottles, pour out slightly more than the amount of chemical needed into a clean beaker or weighing boat, then transfer chemical to the balance. NEVER POUR A CHEMICAL BACK INTO A REAGENT BOTTLE, AND ALWAYS USE A CLEAN SPOON OR SPATULA. Secure lids tightly and return reagent bottles to proper storage area.
1.4.1.4 Chemical solutions should be stored in reagent bottles that are properly sealed and labeled. A proper label is one made with water proof label tape and marking pen and marked with the first initial and last name of the owner, the exact contents, the date of preparation, and date of expiration date, if applicable.

1.4.1.5 Chemical solutions should not be stored in volumetric flasks.

1.4.1.6 Do not store chemicals on the lab floor. Return chemicals to designated storage areas.

1.4.1.7 Do not mouth-pipette chemical solutions.

1.4.1.8 Never place food or drinks, including coffee cups, on chemical storage shelves. Never store food for human consumption in a refrigerator with any samples or chemicals.

1.4.1.9 Refer to Safety Net 42 - Guidelines for Management of Laboratory Chemicals

1.4.2 Corrosive Chemicals - Acids, Bases, Oxidizers

1.4.2.1 Prepare acid and base solutions by adding concentrated acids or bases to water. Water added to strong acids or bases can result in explosions.

1.4.2.2 Always wear eye and hand protection and protective clothing when working with corrosive liquids.

1.4.2.3 When working with strong acid solutions or base on lab benches use protective covering such as Benchkote or Nalgene Clean Sheets. Clean up spills immediately.

1.4.2.4 Work with and store corrosive liquid solutions away from laboratory instruments.

1.4.2.5 When working with strong acids that emit vapors, (e.g. HCl, HClO4, HNO3) always work under the fume hood.

1.4.2.6 Store acid and base solutions separately. See storage notes in Section 1.4.1.1.

1.4.2.7 Store corrosives and strong oxidizers such as nitric acid chromic acid, peroxides separately from solvents, organics, and organic acids.
1.4.2.8 "Look before you handle". Bottles of corrosive liquids with crusts, powder deposits, crystallization around the cap, discolorations, etc. are indications of contamination. Handle such bottles with extreme caution and notify lab manager that these conditions exist.

1.4.2.9 Keep containers of corrosive liquids well sealed.

1.4.2.10 Do not use ground glass stoppers or auto dispensers with basic solutions. Use only rubber or teflon stoppers or teflon auto dispensers. Ground glass surfaces will be fused together when exposed to bases over long periods.

1.4.2.11 Store solutions of inorganic hydroxides in polyethylene containers.

1.4.2.12 Do not use metal plunger digital or transfer pipetters with hydrochloric or perchloric acid solutions. Acid fumes will corrode stainless steel plungers. Use only glass or teflon plunger pipettes.

1.4.3 Organic Chemicals - Flammables, Volatiles, Toxics

1.4.3.1 Store flammable liquids in labeled "flammable" storage cabinets. See Section 1.4.1.1 for specific locations.

1.4.3.2 If it is not possible to store flammable liquids in approved flammable storage cabinets, not more than 10 gallons of flammable liquids in original containers can be stored in any single laboratory. Note: Calculation of quantity is based on volume of container, not quantity of flammable liquid in container (if there is only 1 drop in a one-gallon jug, it is counted as a full gallon).

1.4.3.3 Refrigerate flammable liquids only in the "flammable materials" refrigerator (see Safety Net 31: Use of Refrigerators & Freezers in Laboratories). A flammable materials refrigerator is located in room 2105 Ghausi Hall. A flammable materials freezer is located in 2116 Ghausi Hall.

1.4.3.4 Always work under the fume hood with volatile organic chemicals.

1.4.3.5 Wear proper hand, eye and clothing protection when working with toxic substances. Certain volatile substances may require
the use of respirators. Read labels for protection requirements. Check with EH&S if you are uncertain.

1.4.4 Waste Chemicals

1.4.4.1 The following categories of waste chemicals are hazardous and should be stored for pickup by Environmental Health and Safety (EH&S):

- Flammable
- Explosive
- Toxic
- Corrosive pH< 4; pH>10
- Odorous materials
- Air or water reactive
- Solutions of heavy metals > 100 ppm
- Cyanides or sulfides > 1000 ppm
- Chlorinated solvent >1000 ppm
- Unknown chemicals or mixtures

Before generating any chemical waste, see the lab manager to verify proper labeling and storage procedures. Place liquid waste in either 5-gallon plastic carboys, if you are collecting large volumes, or 1-4 liter glass or plastic bottles, if you are collecting smaller volumes. If you reuse reagent bottles for waste storage, be sure to either deface the label by crossing out the chemical name and writing the word “EMPTY” using a felt-tip pen, such as a Sharpie, or remove original labels completely from containers. Label each bottle with a Hazardous Waste label obtained from the lab manager. Copies of the hazardous waste label are kept above the computer desk in room 2105 Ghausi Hall and are also available online (click here). Fill-out the label completely indicating exact contents. Do not mix unknown or incompatible chemicals. A designated storage cabinet for organic waste is in room 2105 Ghausi Hall. Acids and bases will need to be stored in secondary containers in bench cabinets.

If waste storage bottles are full or you will no longer be generating the waste, coordinate waste pickup by EH&S through the lab manager. Place containers of organics that are ready for pickup in one of the secondary containment tubs inside the door of room 2105 Ghausi Hall.

1.4.4.2 Waste acid or base solutions may not be disposed of by neutralizing and flushing down the drain unless neutralization is a integral part of the protocol and the solutions are not contaminated with metals or organics.

1.4.4.3 Refer to Safety Net 43 - Identification and Segregation of Chemical Waste
1.4.5 Biological Wastes

1.4.5.1 Biological wastes which are non-medical (i.e. non-infectious) (e.g. coliform test tubes) require autoclaving in clear autoclave bags prior to disposal. Do not operate autoclave without receiving instructions from the lab manager or other qualified lab personnel. Do not use red biohazard bags for storage of non-medical wastes.

1.4.5.2 Medical/biohazardous (i.e. infectious) wastes require a Medical Waste Management Plan prior to generating any biohazardous waste. Consult the lab manager regarding requirements of a Medical Waste Management Plan.

1.4.5.3 Refer to Safety Net 3 - Guidelines for Disposal of Sharps, Biological & Medical Waste

1.4.6 Fume Hoods

1.4.6.1 Never remove sash from fume hood. Face-velocity of the air is reduced and the hood becomes ineffective.

1.4.6.2 Keep bench surfaces under hoods clear of chemicals and glassware. Do not store chemical solutions in hoods unless advised to do so by the lab manager.

1.4.6.3 Keep the sash closed unless working in the fume hood.

1.4.6.4 Refer to Safety Net 35 – How to Use a Chemical Fume Hood Safely

1.4.7 Gas Cylinders

1.4.7.1 Gas cylinders, whether in storage or in use and whether full or empty, are to be restrained in an upright position using a uni-strut rack or specially designed safety cart. Bench top clamp-on type holders are no longer allowed. When cylinders are not in use, cylinder caps must be in place.

1.4.7.2 Full or partially-full gas cylinders can be stored in the rack in the CEE cylinder cage behind Ghausi Hall. Notify the lab manager if this is desired. The key to the cylinder cage is kept hanging on a hook inside the door to 2109 Ghausi Hall.
1.4.7.3 Empty cylinders are to be labeled “Empty” or "Return" with labeling tape and returned to the CEE cylinder cage. The lab manager will then submit a pick up request to Central Stores/Receiving. Do not write on or otherwise deface the original manufacturer cylinder label.

1.4.7.4 Move cylinders with a cylinder hand truck with restraining chain. Remove regulators and replace valve cap before moving cylinders. The hand truck is kept in room 2109.

1.4.7.5 For newly delivered gas cylinders the packing slip, usually attached to one of the cylinder caps, needs to be turned into the main office. Order the minimum necessary quantities of gases to minimize demurrage fees.

1.4.7.6 For suspected leaks, use the electronic leak detector available in 2109 Ghausi Hall (see lab manager if unable to locate). Otherwise, use a 70% solution of isopropanol instead. Never attempt to "sniff" out a suspected leak.

1.4.7.7 Never use oil or grease on any hose or fitting carrying compressed gas. Explosion danger exists.

Never use a gas regulator marked "use no oil" to regulate any gas except those known to be water pumped. Explosion danger exists.

1.4.7.8 Never use a gas regulator that has been used to regulate oil pumped gas (e.g. compressed air) to regulate oxygen. Explosion danger exists.

1.4.7.9 Never expose copper to acetylene gas. Acetylene gas and copper form copper acetylide (C$_2$C$_2$) - a powerful, erratic explosive.

1.4.7.10 When opening the main cylinder valve, turn the valve counterclockwise until it stops. Leaving the valve half open may invite leaks. When finished with the gas, close the main valve fully clockwise until it stops.

1.4.7.11 Never screw a gas regulator valve clockwise as far as it will go because the diaphragm can be punctured. Pressure regulating valves are closed when the handle is screwed counter-clockwise until it appears to be free. In general, leave the gas regulator valve set in its operating position at all times, even when the gas is not in use.
1.4.7.12 Some gas regulators, such as those for hydrogen, have reverse threading on their fittings. Be aware of those regulators. The threaded nut is notched around it’s circumference to indicate it is reverse threaded.

1.4.7.13 Refer to Safety Net 60 Compressed Gas Safety

2. LABORATORY MAINTENANCE

A messy laboratory is unsafe and indicative of poor laboratory practice and suspect experimental results. Maintenance of the labs is both a collective and an individual responsibility. To encourage each individual to maintain the lab, the following policies and procedures have been instituted:

2.1 Glassware

2.1.1 Each person is responsible for washing and rinsing their own glassware. Glassware should be rinsed with tap water followed by deionized (DI) water and placed in drying racks. Conserve DI water by rinsing with a swiftly flowing small stream from the outlet. The lab aid will return clean glassware to storage shelves. See Appendix A of this document for the clean glassware SOP.

2.1.2 If glassware requires acid washing follow the guidelines for acid washing listed in Appendix B and Safety Net 44: Alternatives to Chromic/Sulfuric Acid for Cleaning Laboratory Glassware.

2.1.3 The shared use glassware in the cabinets at the back of room 2105 Ghausi Hall have been cleaned to an exacting standard for use in trace organics analysis. If you use glassware from this cabinet you must clean it according to the protocol listed in Appendix A of this document, a copy of which is posted over the main sink in room 2105.

2.1.4 Glassware to be used on a continuing or repetitive basis may be reserved by labeling with last name and first initial using labeling tape and waterproof marker. Such dedicated glassware must be stored in a designated work or storage area, not in drying racks.

2.1.5 Dirty reusable glass pipettes should be rinsed with tap water and placed tip up in the pipette wash jar labelled "Dirty Pipettes" in
2105 Ghausi Hall. The lab aid will wash dirty pipettes as required.

2.1.6 A selection of clean, reusable glass pipettes are kept in the drawers to the right of the main sink in 2105 Ghausi Hall. Do not place dirty pipettes in these drawers.

2.1.7 Broken glassware and sharps should be discarded in the designated cardboard containers.

2.1.8 Refer to Safety Net 3: Guidelines for Disposal of Sharps, Biological & Medical Waste and Safety Net 12: Why Didn’t the Custodian Pick Up My Trash?

2.2 Benches and Counters

2.2.1 Keep bench tops clear of waste paper, dirty glassware, sample bottles, gloves, lab coats, stock chemicals, tools, etc. Return all items to proper storage immediately after use.

2.2.2 Sponge off any excess water on bench tops. Do not allow water to drip off bench tops to drawers and cabinets below.

2.2.3 Immediately clean up any minor spills of dry or liquid chemicals on bench tops. If the spilled material is hazardous, follow the procedures described in Section 1.3.4.

2.2.4 When working with corrosive chemicals on bench tops use a sheet of Benchkote or Nalgene clean sheets to protect the bench top. Dispose of used Benchkote sheets or wash off clean sheets for reuse.

2.3 Floors

2.3.1 Immediately clean up all spills, including water, and any broken glass. If spilled material is hazardous follow procedures in Section 1.3.4. A broom and dust pan are located in room 2105.

2.3.2 Do not store chemicals or instruments on floors.

2.3.3 Do not leave empty boxes or packaging materials on the floors. Throw such items in outside in the appropriate dumpster. If you wish to save boxes contact the lab manager for proper storage location.
2.4 Sinks and Drains

2.4.1 Do not flush any hazardous waste materials down the sink drains (See Section 1.4.4).

2.4.2 Do not pour any waste solids in the sinks that may clog drains.

2.5 Balances

2.5.1 Immediately clean up any spills in or around the balances. (See Section 1.3.4). Sponge or sweep off any residual chemical dust from around balances.

2.5.2 Return all chemical bottles to your own storage area after weighing out chemicals.

2.5.3 Wash spatulas before returning them to storage drawer. Discard any waste materials (weighing boats, papers, etc.)

2.5.4 Turn balances off and/or remove any weights after use.

2.5.5 Keep bags of weighing boats closed to prevent contamination.

2.6 Refrigerators

2.6.1 All containers must be labeled properly (see 1.4.1.4).

2.6.2 Immediately clean up any spills in a refrigerator (See Section 1.3.4).

2.6.3 Discard expired solutions or samples as soon as possible.

2.7 Protective Equipment

2.7.1 For heavy protection use the black butyl rubber gloves from the drawers below the Milli-Q machine in 2105 Ghausi Hall. Rinse and dry gloves after use, using drying pins near the wash sinks. Return dry gloves to storage bins. If you regularly use rubber gloves, check out a new pair and mark them with your name with waterproof marker. Store your gloves in your personal drawer or desk.
2.7.2 Black rubber aprons are available in a drawer below the Milli-Q machine in 2105 Ghausi Hall.

2.7.3 Lab coats are available from the racks inside the doors of 2101 & 2104 Ghausi Hall. It is recommended that long-term users of the lab purchase their own lab coat.

2.7.4 Safety glasses and chemical splash goggles are available in a marked drawer below the Milli-Q machine in 2105 Ghausi Hall. It is recommended that long-term users of the lab purchase their own safety glasses. A full-face shield is hanging on the wall next to the autoclave in 2105 Ghuasi Hall. The face shield should be worn along with oven gloves and a lab coat when removing hot liquids from the autoclave.

3. LABORATORY EQUIPMENT

3.1 All major and most minor equipment items have been assigned a Civil Engineering property number. The storage locations of all such equipment items are indicated in the laboratory directory.

3.2 Equipment that will be used away from its normal storage or use location must be signed out on the equipment sign out sheet in room 2105.

3.3 Operating and instruction manuals are located near each piece of equipment, usually in a drawer.

3.4 Do not operate equipment or instruments if you are not familiar with their operation. Read instruction manuals carefully or consult lab manager before using unfamiliar equipment.

3.5 Routine maintenance of equipment is the responsibility of the user. Perform maintenance at required intervals to maintain proper operation.

3.6 If you experience operating problems and are unable to repair the equipment following manual instructions, notify the lab manager.

3.7 When using macro or micro pipettors care must be taken to maintain the integrity of the pistol seal. Never allow liquid to enter the shaft where it can come into contact with the piston or seal. Whenever liquid is present in the tip, the instrument should be held vertically. Never invert the instrument or lay it on its side with liquid in the tip. Do not use pipettors with chrome plated plunger to pipette vaporous acids (HCl, HClO₄). If metal plunger
pipettors are inadvertently used with acids, they should be dismantled and cleaned immediately after use.

4. **TOOLS**

A selection of commonly used tools is maintained in the tool box in 2116 Ghausi Hall. It is very important that each user observe the following procedures:

4.1 Tools kept out overnight must be signed out in the tool sign out binder next to the tool box. Return all tools immediately after use. Tools will not be allowed to be taken out of Ghausi Hall, unless special permission is granted by the lab manager.

4.2 You are financially responsible for tools signed out under your name.

5. **LAB ACCESS**

Doors to all lab rooms must be kept closed at all times so that the ventilation system can work properly. **Do not** prop open doors, except on a short-term basis, such as for transporting large items. Lock doors and shut off lights after normal working hours or when leaving a vacant lab. Do not give access to unauthorized users or persons you do not know. An electronic key system has been installed in Ghausi Hall CEE labs. Access is provided by the CEE Systems Administrator, Dan Djalili (530) 754-6421 after initial lab orientation and safety training has been provided by the CEE Lab Manager, Henry Calanchini (530) 754-6411.
APPENDIX A
GUIDELINES FOR STAFF THAT WEAR CONTACT LENSES

1. If at all possible, don't use contact lenses in any area where they can be exposed to chemical fumes (solvents, formaldehyde, ammonia, etc.) or where they may pose a special hazard if something is splashed in the eye.

2. If contacts are worn, be sure your supervisor and co-workers are aware that you use them.

3. Be aware of the special problems that contact lenses can pose:
   a) They can absorb chemical fumes.
   b) They can allow long and intimate contact of toxic chemicals with the eye.
   c) They can "trap" chemicals in the space between the contact lens and the eye.
   d) Lenses can be difficult to get out in an emergency due to muscle spasms of the eye.
   e) Flushing with large amounts of water may not successfully remove eye contaminants if contact lenses are still in.

4. If you work in an area where chemicals are used, always wash hands thoroughly with soap and water, and rinse hands well before handling contact lenses. This applies even if gloves were worn.

5. Never leave contact lenses or store them in any room where chemicals are present.

6. The Laboratory has an obligation under Cal/OSHA to inform all employees of the potential hazards associated with their workplace. The use of contact lenses in the chemical laboratory poses a special problem that employers should be aware of.

7. Section 3382, Title 8, CAC (Cal/OSHA) states:

"The wearing of contact lenses is prohibited in working environments having harmful exposure to materials or light flashes, except when special precautionary procedures, which are medically approved, have been established for the protection of the exposed employee."

This means that a medical doctor, such as the Campus Occupational Health Physician must approve the type of eye protection (goggles) worn by employees who wear contact lenses in chemical laboratories.
8. Refer to Safety Net 5 - *Eye and Face Safety Protection for Laboratory Workers*

Revised 3/13/2014
HJC
APPENDIX A
STANDARD OPERATING PROCEDURE (SOP) Clean Glassware

GENERAL WASHING and BAKING PROCEDURE USED
TO CLEAN GLASSWARE

Prepared by Brooke Heiney on 08/07/2006

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1.0 SCOPE AND APPLICATION

EQL SOP Clean Glassware describes the general procedure used for washing dirty glassware.

2.0 APPARATUS AND MATERIALS

2.1 Sink with drain
2.2 Industrial water
2.3 Deionized water
2.4 Milli-Q water
2.5 Liquid Nox
2.6 Appropriately sized scrub brush

3.0 PROCEDURE

3.1 Rinse dirty glassware 5 times with warm industrial water.
3.2 Place a proportionate amount of liquid-nox and industrial water into the glassware and scrub all surfaces with a scrub brush.
3.3 Rinse glassware 5 more times with warm industrial water.
3.4 Rinse glassware 5 times with deionized water.
3.5 Rinse glassware 5 times with Milli-Q water.
3.6 Wrap all openings found on the glassware with aluminum foil. Place the less lustrous side of the foil next to the surface of the glassware allowing the more lustrous side of the foil to be seen on the outside of the glassware.
3.7 Check the clean glassware baking oven, located in 2105 Ghausi Hall, for any glassware that has already been baked. If the oven is not empty, turn the power off by flipping the green power switch and slightly open the door. This will allow the glassware to begin cooling. If cooling happens too rapidly, the glassware may crack. To prevent cracking, increase the opening in the door about every 20 minutes. Wait for the glassware to be cool enough to unload by hand. When the glassware is at the desirable temperature, unload the oven by moving the glassware to the designated cooling area.
3.8 Load the oven with the clean glassware.
3.9 Turn the oven on by flipping the green power switch. Press and hold the SEL button, located to the left of the power switch, until the display screen changes.
3.10 Press the SEL button six times until the display screen shows 4.0. This indicates that the oven will bake the glassware for 4 hours.

3.11 Press the SEL button two more times until the display screen shows 450. This indicates that the oven will achieve a baking temperature of 450 degrees Celsius.

3.12 The power switch must be turned off and back on again after checking the oven settings. The oven will automatically follow the previously set instructions.

3.13 Allow at least 5 hours to pass before opening the oven door again.
APPENDIX B

ACID WASHING

Many chemical analyses and some laboratory experiments require laboratory glassware to be scrupulously clean. Traces of foreign material will frequently invalidate hours of otherwise careful work. The best way to insure clean glassware is to wash it in acid. NOCHROMIX solution should be used in preference to chromic acid solutions because the spent solution is not classified as a hazardous waste and does not require special disposal procedures and there is no danger of toxic metal residual on the glassware. Nochromix is prepared by adding two packages of Nochromix granules to a standard 9 lb. bottle of concentrated (36N) sulfuric acid ($\text{H}_2\text{SO}_4$) and following mixing instructions on the package.

Chromic acid cleaning solutions should be used only if NOCHROMIX solution does not provide sufficient cleaning. Chromic acid cleansing solution is prepared by adding 1 bottle of Chromerge concentrate solution to a standard 9 lb bottle of 36N (concentrated) sulfuric acid. Follow mixing instructions on Chromerge bottle. Alternatively, make up a saturated solution of sodium dichromate; add 35 ml of the sodium dichromate solution in small increments to 1 liter of 36N sulfuric acid, mixing between additions. (Use 100 ml sodium dichromate solution per standard 9 lb. bottle of acid.) All containers of cleaning acid should be conspicuously marked. Use concentrated hydrochloric acid (under a hood) for cleansing solution when washing polyethylene laboratory equipment, because chromic acid solution oxidizes polyethylene. **ALL OF THESE ACIDS ARE DANGEROUS -- to you, to your clothes, and to others working in the laboratory. The best way to eliminate acid damage is to prevent the acid from contacting any but intended surfaces.**

Rubber gloves, aprons, and safety goggles **MUST** be worn. Also wear old clothes, and especially old shoes, when working with cleaning acid. Occasional spills will occur. Be prepared to follow clean up procedures. Know the location of eye washers and safety showers. Skin burns from acids can be very dangerous, so act promptly. Always wash with acid in or near a sink with copious quantities of running water to protect the plumbing. Some chemicals react violently with acid cleansing solution so pre-rinse dirty glassware with tap water before immersion in concentrated acid solution. Chemicals or sludge encrusted in graduated cylinders, test tubes, volumetric flasks, etc., should be removed with special brushes.

Carefully pour the acid cleaning solution into a beaker or other container. Clean any acid drips on the bottle and replace the cap. Pouring from the beaker, partially fill dirty glassware with the acid and rotate the piece until all surfaces have been fully covered with acid. If glassware is left to soak, a plastic or glass containment tray should be used beneath the soaking container. Pour the acid back into the beaker. Place the glassware (now coated with acid) into another dishpan or plastic bucket to drain. After draining for 20 minutes the glassware should be rinsed in at least 10 changes of tap water, chromic acid clings to glassware and will invalidate biological experiments if not completely removed. Follow tap water rinses with at least 3 rinses of distilled water. Note: squirting water in a swiftly flowing, thin film over the surfaces with a pressure hose for 10 seconds is equivalent to 10
rinsings. Air dry the glassware in a position so that dust cannot accumulate on inside surfaces, and put it away as soon as it is dry to prevent the accumulation of dust.

When finished with the cleaning acid, return it to the storage bottle through a large plastic funnel. Again, be sure the acid bottle is clean before putting it away. Carefully rinse and sponge-off bench tops to remove all acid residue. Thoroughly rinse sponge to remove acid residue. Gloves should be thoroughly cleaned and put on the drying clip before you leave the laboratory.

**NOCHROMIX** solution is spent when it turns orange or becomes discolored. A fresh package of crystals may be added to restore the oxidizing power. Severely discolored solutions or solutions containing sediment should be discarded by diluting in large volume of water and rinsing down the drain with large quantities of water. Chromic acid is spent when the solution turns from reddish-brown to dark green. Spent chromic acid solutions should be conspicuously marked "Waste Chromic Acid" and put into the waste acid storage cabinet.

Refer to Safety Net 44 - Alternatives to Chromic/Sulfuric Acid For Cleaning Laboratory Glassware.