SECTION II:
UC/UCSB POLICIES, PROCEDURES AND RESOURCES

Sec. II is provided to the campus in an electronic version:
http://web.chem.ucsb.edu/~moretto/Sec.II.2014.pdf
*Per OSHA, this document needs to be reviewed and updated **annually** by EH&S. Therefore, we ask that this section NOT be printed out as a hard copy, as it becomes very difficult to locate hundreds of hard copies across the campus when the next update needs to occur.*

Introduction to Section II: UCSB/UC Policies, Procedures and Resources:

Section II addresses the campus policies, procedures and resources which are core/universal and apply to most labs. In order to free lab supervisors from independently having to address these issues in their Chemical Hygiene Plans (CHP), they are provided herein. In Section I the *laboratory-specific* issues/SOPs for a particular lab must be addressed.

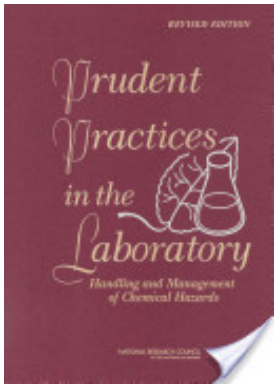
The information here is a formal part of the *UCSB Chemical Hygiene Plan*. Therefore, all lab personnel are responsible for being familiar with this information and following the prescriptions therein as they apply to their work. Almost all of the issues addressed herein are based on current regulations and codes, such as those of the California Occupational Safety and Health Administration (Cal-OSHA); Cal-EPA; CA Fire Code, etc.

Addressing Non-Chemical Hazards

The Lab Standard requires the addressing of **chemical** safety issues, but not other lab hazards. For example, biological and radiological hazards, electricity, high/low temperature and pressure, etc. Therefore, those issues are largely *not* addressed in this CHP, but instead are referenced:

- Via the links in the *Introduction* section, e.g., *Radiation Safety Program; Biological Safety Program.* These areas have their own requirements addressed therein.

- Via links in Section II to the free general reference book: ***Prudent Practices in the Laboratory***, from the National Research Council. This reference is widely recognized as the "bible" of laboratory safety and all researchers are strongly encouraged to bookmark its location, or buy a hardcopy for their areas. http://www.nap.edu/catalog.php?record_id=12654#toc



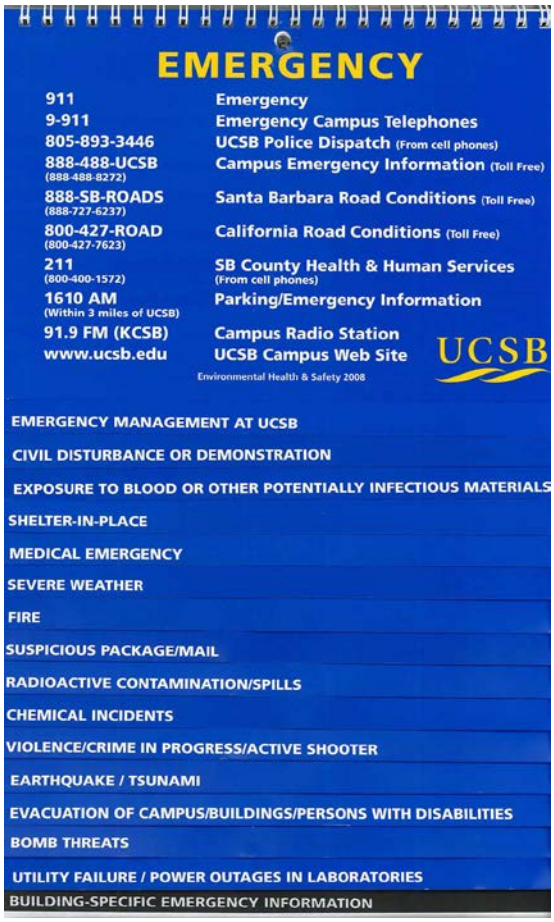
Researchers are however encouraged to include non-chemical hazards present in their laboratories in the lab-specific section I of their CHP. As an example, this could be accomplished via SOPs for equipment or protocols such as vacuum pump/line maintenance, or centrifuge use.

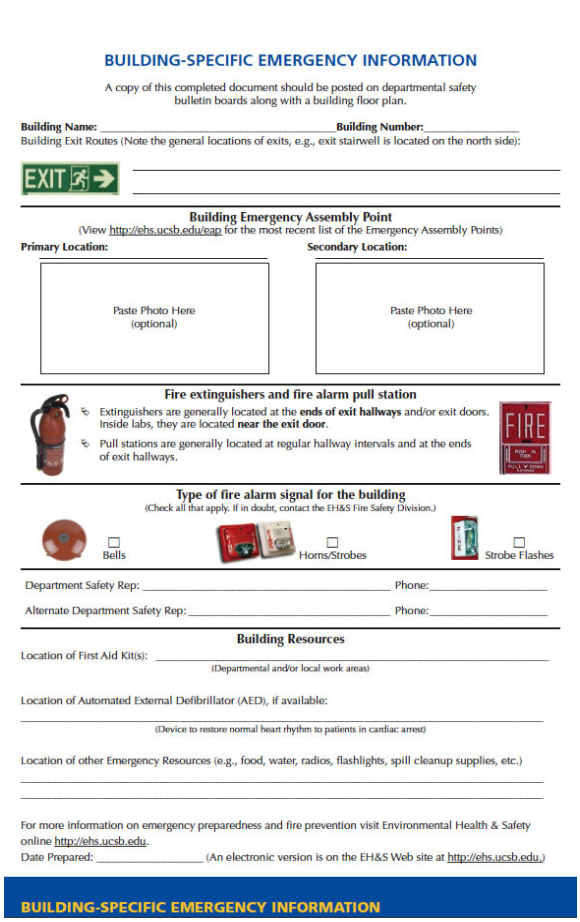
Emergency Response Procedures

The primary informational tool for response to campus incidents is the ***UCSB Emergency Information Flipchart*** pictured below. This document **should already be posted** in, or near, every laboratory, as well as in many offices. A Spanish version of the flipchart is available.

The last page (at right) should already be customized to include your *local* building information – such as the locations of the following: your building's Emergency Assembly Point, fire extinguishers and fire alarm pull stations, first-aid kits, Automated External Defibrillators, etc. If it is not customized contact your local Department Safety Rep. Please familiarize yourself with the layout and general content of the flipchart. It can also be viewed online at: **http://www.ehs.ucsb.edu/homepage/hprsc/203655_Emerg_Flipchart.pdf**

Power outages in labs are of particular concern – preparing for them and what to do during and afterwards. A fact sheet with some basic guidelines can be found at: http://www.ehs.ucsb.edu/units/labsfty/labrsc/factsheets/PowerFailures_FS32.pdf





Recommended Chemical Spill Cleanup Procedures

You should NOT clean up a spill if:

- You don't know what the spilled material is
- You lack the necessary protection or equipment to do the job safely
- The spill is too large to contain
- The spilled material is highly toxic
- You feel any symptoms of exposure

Instead contact: **x3194** EH&S (24 hr line – after-hours may have to wait up to 30 min for response to campus). OR, if immediately health-threatening call **911** (campus phone)

Spill Response Scheme:

Evaluate and Notify

- Assess the toxicity, flammability, or other properties of material (see label & MSDS)
- For flammables, remove or turn off ignition sources such as motors, pumps, fridges.
- Determine if there is an immediate health threat to you or your neighbors. If so, alert neighbors, isolate the area and call for help using the phone numbers above.
- If spill is minor, begin cleanup following steps below

Containment/Cleanup

- Don appropriate gloves, eye protection, lab coat, etc.
- Per SDS use absorbents* (e.g., "spill pillows" for solvents), or neutralizers appropriate for the material*, e.g. sodium bicarbonate for acids, citric for bases.
- Protect floor drains with absorbents or barriers around them
- Package and label waste. Include contaminated clothes, rags, equipment, etc.
- Store temporarily in a fume hood if material is volatile

Followup

- Send Hazardous Materials/ Waste Pickup Request form to EH&S
- Reorder and restock cleanup materials used
- Inform EH&S if there were any personnel exposures, or release to the environment

**Self-help spill cleanup equipment are available using graduate master keys in some buildings:* http://www.ehs.ucsb.edu/units/labsfty/labrsc/emergency/spillcloset.htm

Fire Extinguishers, First-Aid Kits and Emergency Showers/Eyewashes

Fire Extinguishers: Typically by the lab exit door and are the **ABC** variety (for flammable liquids/paper & wood/electrical, but *not* for flammable metals). EH&S conducts hands-on extinguisher training for most who attend the EH&S *Fundamentals of Laboratory Safety* class. See pg. II-3 for fire procedures. There is also an online extinguisher tutorial/video that individuals can complete. All campus individuals are strongly encouraged to complete this tutorial and view as refresher training when needed.

Online Fire Extinguisher Usage Tutorial:

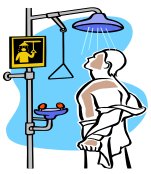
UC Learning Center

Need "UCSB Net ID" to login. Then search on "fire extinguisher"

First-Aid Kits: Individual laboratories should have their own 1st aid kit nearby in a location known to all. Supplies should be checked regularly. Departmental kits may not be accessible after-hours.

Emergency Showers and Eyewashes

- Know where your nearest unit is – they are typically within the lab, or in the corridor nearby. Units must be accessible always- no items should block access.
- In the case of chemical exposure to eyes or skin, flush the injury for a minimum of 15 minutes. Be sure to leave the eyes open under the water to flush them.
- Showers can also be used to extinguish a fire on an individual, or their clothing
- Consult the Safety Data Sheet (SDS) for material and show it to the doctor/nurse.
- Facilities periodically flushes emergency eyewash stations and showers. Lab personnel should also flush the eyewashes at least monthly as a precautionary measure. Call Facilities at x2661 if you have concerns regarding a specific unit.
- Eyewashes are plumbed with potable water - unlike the rest of the laboratory which is often on "industrial water"- and is considered safe to use on your body.
- Many eyewash/shower units are not equipped with a floor drain. This is because they are so infrequently used that they did not justify the cost of a drain when the building was constructed. Also, it is illegal to flush materials down the drain.



UC Policy on Laboratory Personal Protective Equipment (PPE)

In April 2014, UC instituted a new policy on the use of PPE in laboratories. The policy is intended to help protect lab workers from injury, meet Cal-OSHA requirements and bring more consistency to UC PPE practices. All members of the lab community have responsibilities under the policy - particularly lab supervisors/faculty and lab workers. Full policy is at: http://www.ehs.ucsb.edu/lc_links/Personal-Protective-Equipment.pdf

The most important aspects of the policy are when and where individuals must wear long pants, closed-toe shoes, safety eyewear and a lab coat. This is summarized on a poster which is mounted at the main door to all labs – see pg. 7. Other aspects:

- **Exemptions** from wearing PPE (policy requires written exemption from EH&S)
  - hazardous materials/processes-free areas
  - areas protected by adequate distance (some desk locations are problematic)
  - lab areas/desks protected by adequate physical shielding

- Supervisors shall perform a **written assessment** of the workplace to determine what PPE is needed – OSHA requirement. This is done via use the online *UC Laboratory Hazard Assessment Tool* ("LHAT"). See pg. II-8.

- Supervisor assures **workers are trained** on when PPE is needed and how to wear, adjust & maintain. Per pg. II-8, use the LHAT to receive the necessary documented training for basic lab coat and safety eyewear use.

- Laboratory coats shall not be **laundered** at private residences, or public laundry facilities. In May 2014, a free lab coat laundering program will begin – see pg. II-8.

- Safety eyewear must meet *American National Standards Institute* standards and be appropriate for the work. Typical prescription spectacles do **not** meet these standards (are not shatter-proof polycarbonate) unless specifically provided by an eye care professional. Safety goggles that readily fit over glasses are free – see pg. II-8.

- **Teaching courses** which include lab/shop/field work are required to indicate PPE requirements in the course syllabus. The PPE requirements for teaching labs are the same as for research per above, excluding use of the LHAT. The instructor of record for the course, or designee, is responsible for ensuring that students are familiar with and properly use PPE. The student is responsible for obtaining the PPE, excluding any PPE that might be provided by the sponsoring department.

Posted at main doorway to each campus lab

U.C. PERSONAL PROTECTIVE EQUIPMENT POLICY

THE BASICS:

Minimum PPE for Entering a Laboratory Area: **Long Pants and Closed Toed Shoes**

PPE While Manipulating Hazardous Materials/Processes: **Appropriate Lab Coat and Safety Eyewear**

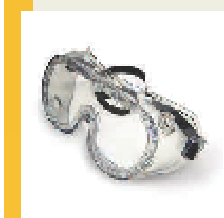
PPE While Adjacent to the Manipulation of Hazardous Materials/Processes: **Same PPE as Those Doing the Work**

ADDITIONAL PPE AS DETERMINED BY LHAT AND SOP'S:

Face Shield

Consider use when handling:

- Hazardous liquids with a splash hazard
- Pyrophoric, water reactive or potentially explosive chemicals
- Cryogenic liquids
- High pressure or vacuum systems



Splash Goggles

Use when handling:

- Hazardous liquids when >4L or with a splash hazard
- Corrosives when >4L
- Cyrogenic or scalding liquids when >4L

Gloves

Use appropriate gloves when handling:

- Hazardous, toxic or corrosive chemicals, engineered nanomaterials, unsealed radioactive materials
- Cryogenic liquids or dry ice
- Biohazards (double glove for BSL-2 or greater)

Chemical Resistant Apron

Use when handling:

- Minor spill clean-up
- Corrosives >4L

Consider when handling:

- Hazardous liquids w/splash hazard
- Acutely toxic chemicals
- High pressure or vacuum systems

See full PPE policy, LHAT, and your lab SOP's for more details. Additional requirements may apply as determined by the campus biosafety, radiation and animal care committees

Obtaining Free Laboratory Personal Protective Equipment (PPE) Via the UC Laboratory Hazard Assessment Tool ("LHAT")

Per Cal-OSHA, the employer must provide and document the following for each worker:

- An assessment of the PPE needed to do their work
- The needed PPE at no charge to the worker
- Training on the proper use and maintenance of the PPE
- A method to clean and sanitize the PPE

To facilitate these tasks, UC provides the following to those working in research labs:

- The online Laboratory Hazard Assessment Tool ("LHAT") for supervisor use, which identifies the PPE needs for their lab workers. The LHAT can only be accessed via an individual's UCSB NetID and password. https://ehs.ucop.edu/lhat/
- For lab workers, the LHAT provides a summary of the lab's PPE needs and provides/documents training on basic lab coat and eyewear use and maintenance
- Free laboratory coats (3 types for different hazards), safety eyewear and communal face shields and lab aprons – see below. Use & Limitations of UC-provided PPE.
- Free lab coat laundering services – see below

Obtaining Free PPE

After the lab supervisor completes the LHAT process, their workers login to the LHAT to review the assessment results, watch a short training video, take a quiz and print out a "PPE voucher". With the voucher they may pick-up two free lab coats and eyewear at the Graduate Storeroom in the Dept. of Chemistry & Biochemistry (Bldg. 557, room 1432). Short-time lab workers may receive a "loaner" coat they return to the University.

Lab Coat Laundry Service

There are **eleven sites** on campus for workers to drop off their dirty lab coats for laundering and pick-up when clean. Each coat will be marked with the coat's unique identifier number and the individual's name. Your cleaned coat will be returned to the one site that you designate.

Respiratory Protection

Typically, respiratory protection is not needed in a laboratory to eliminate exposures. Under most circumstances, safe work practices and engineering controls (e.g., fume hoods) adequately protect workers. Under certain circumstances, however, respiratory protection may be needed as determined by EH&S. These can include:

- Chemical spill outside the fume hood, or spill of biohazard outside a biosafety cabinet
- An unusual operation that can't be conducted in fume hood or biosafety cabinet
- Weighing powders outside a glove box or other protective enclosure. Disposable filtering face-piece respirators are generally recommended for nuisance dusts.
- When monitoring shows that exposures exist that cannot be otherwise controlled
- As required by a specific laboratory protocol or as defined by applicable regulations

Affected individuals must enroll in the *UCSB Respiratory Protection Program* which is designed to fully meet Cal-OSHA requirements (CCR, Title 8, 5144). Because there are numerous types of respirators available, and each has specific limitations and applications, respirator selection and use requires pre-approval by EH&S. For either required or voluntary use of *any* respirator, the worker must contact EH&S (x-8787, or x-3743, or Jesse.Bickley@ehs.ucsb.edu) After an evaluation of the work situation, if a respirator is deemed necessary, EH&S will provide the required medical evaluation (questionnaire), training and quantitative fit-testing.

Selecting the Proper Gloves

The correct gloves protect the hands against chemicals; the wrong gloves enhance chemical contact. The type of glove used should be chosen to be compatible with the particular chemicals being used. **There is no universal glove that protects you from all chemicals. To choose the correct glove, go to a Glove Reference Chart.** (links below).

Disposable gloves provide minimal protection and should be used with this in mind. If using concentrated solvents, corrosives or toxics, more heavy-duty gloves should be worn. These provide more protection, but have the drawback of being more cumbersome. Note also that about 15% of the population is allergic to latex http://www.cdc.gov/niosh/docs/97-135/ to some degree.

Check gloves before use for signs of wear or penetration. Disposable gloves can be inflated by mouth to check for pinholes. When removing gloves, be careful to avoid touching the outside of the gloves with your bare hands. Always remove gloves before leaving the lab.

All gloves are permeable, only the permeation rate varies, depending on the chemical, the glove material and thickness, temperature, concentration gradient, etc. However, once a material begins to permeate the glove, it will continue until an equilibrium is reached. You must, therefore, decide when it is appropriate to discard contaminated gloves.

Glove Reference Charts (No guarantees are made regarding the accuracy of these charts. Recommend cross-checking at least two sites.)

http://www.coleparmer.co.uk/catalog/manual_pdfs/MicroflexChemChart.pdf (Microflex)

http://www.bestglove.com/site/chemrest/default.aspx (Best Co.)

http://www.anselledmont.com/download/Ansell_7thEditionChemicalResistanceGuide.pdf (Ansell Edmont)

http://www.mapa-pro.com/hand-protection-selection-guide.html (MAPA Profesional)

Exposure Limits For Laboratory Chemicals & Carcinogens

Under OSHA, there are ~500 chemicals that have airborne chemical concentration limits. Legally, you can not be exposed above those limits. These values are known as **Permissible Exposure Limits (PEL)**. A smaller table of **PEL values** for ~50 common lab chemicals is also available. Given their volatility, they should always be used in a properly functioning fume hood, or glove box, or in completely-sealed systems. EH&S does quantitative exposure monitoring of lab operations if above PEL exposures are suspected.

Carcinogens: Of the 500 materials, carcinogens are of particular note and are further/highly regulated under separate OSHA safety standards. They are separated into two classes - *Regulated Carcinogens and Select Carcinogens:*

Regulated Carcinogens fall into a higher hazard class and have extensive additional OSHA requirements associated with them. There are 30 in this category, but the common ones found in the lab are **formaldehyde, methylene chloride and benzene**. It is important to effectively apply safety controls as the regulatory requirements for laboratories that exceed threshold values for these chemicals are very extensive.

Select Carcinogens are materials which have met criteria established by the *National Toxicology Program (NTP)* or the *International Agency for Research on Cancer (IARC)* regarding the risk of cancer. There are hundreds of materials in this category. But, it is important to recognize that some substances involved in research are new compounds and have not been subjected to testing for carcinogenicity. The following are "select carcinogens" per Cal-OSHA and under their Lab Safety Standard must be addressed in a lab's CHP – see Sec. I on SOP development.

- Regulated Carcinogens (see above)
- *Annual Report on Carcinogens* published by the NTP, including all of the substances listed as "known to be carcinogens" and some listed as "reasonably anticipated to be carcinogens"
- IARC list: all of Group 1 "carcinogen to humans" materials; and some in Group 2A or 2B.

Controlling Chemical Exposures
The safe use of all OSHA-regulated materials should be addressed in the lab-specific *Chemical Hygiene Plan* (SOPs) – see Sec. I. EH&S does periodic reviews of carcinogen usage practices and exposure monitoring to determine if exposure levels might exceed OSHA limits. Typically, if these materials are used in a fume hood and proper PPE is utilized, there is little reason to believe exposure levels are a concern. If exposure limits are exceeded, additional steps must be taken to eliminate the exposure.

Both categories of carcinogens above are also OSHA-required to be only stored/used in a **"designated area"**. At UCSB, the entire laboratory where these are stored/used is the default designated area, unless the supervisor designates a sub-area of the laboratory in an SOP.

Safety Data Sheets (formerly known as MSDS)

What is a Safety Data Sheet? SDS –formerly known as Material Safety Data Sheets - are a summary of the health hazards of a chemical material and associated recommended safe work practices. SDS are required by OSHA under the *Lab Safety Standard* and *Hazard Communication Standard* to be made readily available by chemical vendors to the purchasers of their chemicals. The use and relevance of SDS are covered in the mandatory EH&S *Fundamentals of Laboratory Safety* class. If you work in a lab, then OSHA says you should:

- be aware of what an SDS is and their relevance to your health and safety
- be aware of how to access SDS for your work area
- maintain SDSs that are received with incoming chemical shipments and ensure that they are readily accessible to lab employees during each work shift when they are in their work area(s). Electronic access per below is acceptable with a printer**.**

(M)SDS Sources

UC SDS Database

Laboratory Chemical Safety Summaries (not MSDS, but quality info aimed at labs)

Fisher Scientific MSDS

Vermont Safety Information Resources, Inc. (SIRI)

Sigma-Aldrich MSDS

MSDS Provider (Manufacturer-direct access)

Matheson's Gases

Chemical Labelling

Under the Cal-OSHA Hazard Communication Standard (CCR, Title 8, 5194) all chemical containers must be properly labeled – unless a material is temporarily put into a new container for immediate use and is not going to be stored after that immediate use. Labeling requirements for all hazardous substances are summarized as follows:

General requirements

- All containers of hazardous materials must be labeled with the identity of the hazardous substance
- The label must contain all applicable hazard warning statements, e.g. flammable, carcinogen, corrosive

For commercial materials in the original vendor's container

- Manufacturer's product labels must remain on all containers, and must not be defaced

For materials repackaged in the laboratory

- Labels must be legible, in English, and provide the info above under general requirements
- This includes secondary containers (such as spray bottles and acid/base baths) and must be labeled as above
- New synthesized compounds, or commercial products that are repackaged, must be labeled with the appropriate hazard warnings based on the knowledge of the chemical and physical properties of that substance.

In 2012 Cal-OSHA adopted use of the **Globally Harmonized System (GHS)** of chemical classification and labeling which supersedes earlier systems. By Dec. 2013 employees using chemicals need to be trained on the new system. On the next page is a summary of the terms used in the system: *Hazard Statements, Hazard Classes, Signal Words and Pictograms, etc.* Campus chemical users should familiarize themselves with the basic aspects of this system and they will eventually see these terms used on all containers they receive from chemical vendors.

Pictograms and Hazard Codes Used in the Globally Harmonized Chemical Labeling System

Pictograms and Hazard Codes Used in the Globally-harmonized Chemical Labeling System

All chemical containers provided by vendors will eventually use the following labeling system. Per Cal-OSHA employees need to be familiar with the labeling system and its relevance to the hazards of hazardous materials.

Description	Pictogram	Hazard class and hazard category:
Exploding Bomb **GHS01**		Unstable explosives Explosives of Divisions 1.1, 1.2, 1.3, 1.4 Self reactive substances and mixtures, Types A,B Organic peroxides, Types A,B
Flame **GHS02**		Flammable gases, category 1 Flammable aerosols, categories 1,2 Flammable liquids, categories 1,2,3 Flammable solids, categories 1,2 Self-reactive substances and mixtures, Types B,C,D,E,F Pyrophoric liquids, and solids, category 1 Self-heating substances and mixtures, categories 1,2 Substances and mixtures, which in contact with water, emit flammable gases, categories 1,2,3 Organic peroxides, Types B,C,D,E,F
Flame Over Circle **GHS03**		Oxidizing gases, category 1 Oxidizing liquids, categories 1,2,3
Gas Cylinder **GHS04**		Gases under pressure: - Compressed gases - Liquefied gases - Refrigerated liquefied gases - Dissolved gases
Corrosion **GHS05**		Corrosive to metals, category 1 Skin corrosion, categories 1A,1B,1C Serious eye damage, category 1
Skull and Crossbones **GHS06**		Acute toxicity (oral, dermal, inhalation), categories 1,2,3
Exclamation Mark **GHS07**		Acute toxicity (oral, dermal, inhalation), category 4 Skin and eye irritation, category 2 Skin sensitisation, category 1 Specific Target Organ Toxicity – Single exposure, category 3
Health Hazard **GHS08**		Respiratory sensitization, category 1 Germ cell mutagenicity, categories 1A,1B,2 Carcinogenicity, categories 1A,1B,2 Reproductive toxicity, categories 1A,1B,2 Specific Target Organ Toxicity – Single exposure, categories 1,2 Specific Target Organ Toxicity – Repeated exposure, categories 1,2 Aspiration Hazard, category 1
Environment **GHS09**		Hazardous to the aquatic environment - Acute hazard, category1 - Chronic hazard, categories 1,2

Criteria For Implementing Engineering Controls

The next few pages deal primarily with "engineering controls", i.e. fume hoods, gas cabinets, glove boxes, etc. Engineering controls are considered the "first line of defense" in protecting workers. In contrast, personal protective equipment is generally considered the final defense. The Lab Standard requires that the general criteria for implementing control measures be described. PPE criteria are determined via the LHAT described above. The appropriate engineering control is often obvious, but the general criteria are noted here for the common ones. The criteria should be followed unless equivalent protection can be realized. Specific engineering controls can/should also be described in a lab's SOPs.

FUME HOODS, WET BENCHES, GAS CABINETS & OTHER EXHAUST VENTILATION

- When using volatile substances that present a significant inhalation hazard
- When necessary to keep exposure levels below OSHA Permissible Exposure Limits
- When using toxic gases, particularly when required by the CA Fire Code
- When indicated in Standard Operating Procedures, or as indicated in Safety Data Sheets

BIOSAFETY CABINETS

- With laboratory operations involving biohazardous material as directed by National Institutes of Health (NIH) and Centers for Disease Control (CDC) guidelines and the OSHA Bloodborne Pathogens Standard
- When stipulated by the Biohazard Use Authorization issued by the Biosafety Committee
- When indicated in Standard Operating Procedures

GLOVE BOXES

- When indicated in Standard Operating Procedures

APPROVED HAZARDOUS MATERIALS STORAGE CABINETS AND SAFETY CANS

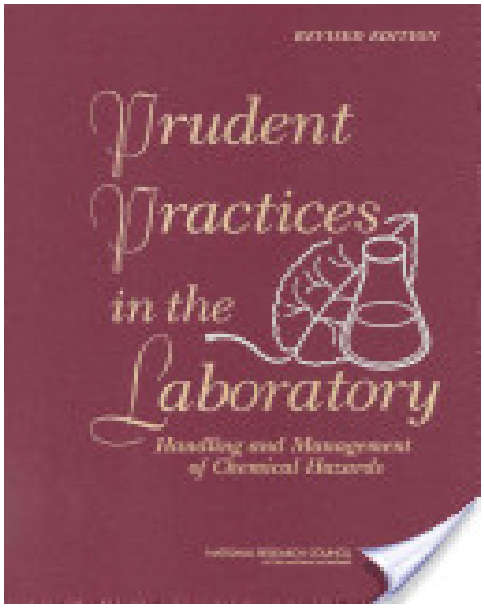
- Whenever possible, but particularly when CA fire code volume limits are exceeded
- When indicated in Standard Operating Procedures

FLAMMABLE STORAGE REFRIGERATORS (APPROVED-TYPE)

- When refrigerated storage of flammable materials is needed

General Procedures For Working With Hazardous Chemicals and Operations

Within UCSB laboratories exists a great diversity of research and associated hazards. To address this diversity and simultaneously reduce the length of this document, we have provided links below to selected sections of ***Prudent Practices in the Laboratory*** by the National Resource Council (2011). This free text is widely considered to be the definitive publication on general laboratory safety. The sections selected here are those dealing with the *generic* management of hazardous materials/operations. In contrast, the other sections of this *Chemical Hygiene Plan* tend to be related more to issues that are UC or UCSB specific, or Cal-OSHA driven.



Fume Hood Usage Guide: Standard Hoods

(Standard hoods do not have the "VAV control box" shown on the next page)

Per Cal-OSHA regulations, users of hoods must be trained on use of their fume hood. Attendance at one of the live or on-line lab safety orientations described below on the "UC Policy on Laboratory Safety Training" page satisfies that requirement. The information on this page should also be read by all hood users and is posted on campus hoods for easy reference.

Always work with the sash at, or below, the level of the red arrow sticker (picture on next pg.) and close it when not attended. To adequately protect you, your hood should be producing a face velocity of about 100 ft/min. EH&S tests your hood and posts the red arrow stickers at the **proper sash level to:**

- satisfy the required air flow and protect you against airborne chemicals
- protect you better from incidents within the hood
- *All hoods on campus are equipped with an air flow monitor and/or alarm to warn you if the air velocity is too low – see examples pictured below. **If the alarm engages, lower the sash slightly until the alarm stops.** Do **NOT** disengage or over-ride the alarm. If your alarm sounds consistently this could indicate a real problem – call EH&S.
- Always work at least 6 inches inside the hood to maximize capture efficiency.
- Store only a minimum of equipment and chemicals in your hood because:
- Excess materials will block the air flow into the intake slots at the back of the hood. Permanent equipment should be raised on a jack to allow the air to flow smoothly.
- Most fires and explosions occur in the hood. Minimizing chemical volumes will reduce the chances of a small accident escalating into a large one.
- Keep the lab windows closed. Drafts from open windows and doors can significantly affect your hood's performance (100 ft/min is only a few miles/hr of air).

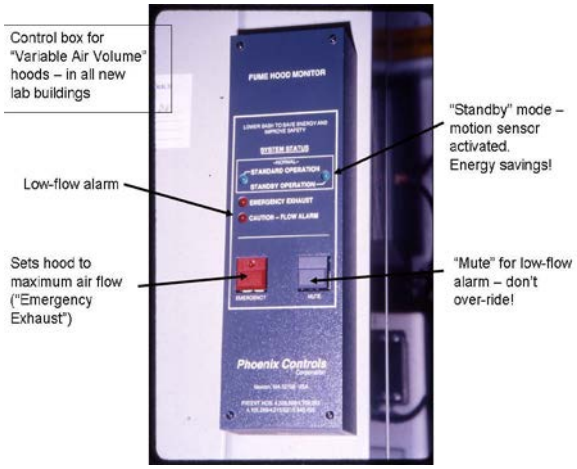
**"Magnihelic gauge" – note normal gauge position. Significant deviation may indicate condition of low air flow.*

**Visible/audible alarm Sounds during low-flow*

Fume Hood Usage Guide: Variable Air Volume Hoods ("Phoenix" system)

Per Cal-OSHA regulations, users of hoods must be trained on use of their fume hood. Attendance at one of the live or on-line lab safety orientations described below on the "UC Policy on Laboratory Safety Training" page satisfies that requirement. The information on this page should also be read by all hood users and is posted on campus hoods for easy reference.

- Variable Air Volume (VAV) hoods — unlike a standard hood above — automatically adjust the face velocity to stay within recommended safe work levels (~ 100 ft./min). A VAV hood is easily distinguished by the gray control box on the hood – pictured below.
- **If the low-flow alarm engages, lower the sash until the alarm stops.** DO NOT over-ride the safety alarm by permanently engaging the "Mute" or "Emergency" button (e.g., with tape). If your hood is consistently alarming call EH&S (x-4899).
- Always work with the sash at or below the level of the **red arrow sticker** (below), because, if most bldg. sashes are raised, this will generate a hood alarm, and at your neighbor's hood, due to the limited capacity of your building's ventilation
- A lowered sash protects you against airborne chemicals and incidents better than at sash full open.
- The lower the sash, the greater the **energy conservation** – lower sash when not in use
- Store only the minimum of equipment and chemicals in your hood because:
    - Excess materials block air flow into the slots at back of the hood. Permanent equipment should be raised on a stand to allow the air flow into the lower slot.
    - Most lab fires/explosions occur in hoods. Minimizing chemical volumes will reduce the chances of a small accident escalating into a large one.
- Always work at least 6 inches inside the hood to maximize hood capture efficiency.



Refrigerators and Freezers in Labs

Certain refrigerator/freezer units are designed specfically for the storage of flammable materials, and to prevent potentially explosions. This is critical, since flammable vapors coupled with an ignition source could result in an explosion. In other words, a normal kitchen refrigerator is not safe for the storage of chemicals. Before purchasing a new unit, or using an existing one, consider if chemicals will be stored there. Note that many lab refrigerators will be around for decades and so one cannot guarantee that a normal unit will never be used for flammables storage. There are two types of refrigerator/freezer models, depending on the type of hazardous material the unit will store.

FLAMMABLE MATERIAL STORAGE REFRIGERATORS/FREEZERS:

These have no internal electrical components which could trigger an explosion. These must always be used for storage of volatile materials. Also known as "lab-safe" or "de-sparked" refrigerators.

EXPLOSION-PROOF REFRIGERATORS/FREEZERS:

For storage of volatile materials in areas with explosive atmospheres. Rarely necessary in lab environments.

All refrigerator/freezer purchases and modifications on campus **must be pre-approved** by EH&S at X8243. In addition, all approved units for storing flammable materials must be labeled with signage reading, "*Approved For Chemical Storage, No Food Storage"*. All refrigerator/freezer units not approved for storage of flammable materials must be signed as "Explosion Hazard", or equivalent. Contact EH&S for your free labels.

Examples of signage on campus lab refrigerators

UCI refrigerator which exploded when chemicals were stored in a unit which was not designed for flammables

UC Policy on Laboratory Safety Training

Documentation of occupationally-related safety training is a legal requirement under Cal-OSHA. In November 2013, the UC system adopted a new policy entitled: Laboratory Safety Training to satisfy OSHA and improve safety awareness. There are two primary requirements of the policy:

1. All "lab workers" complete a ***Fundamentals of Laboratory Safety*** orientation (live or online) in order to be given access to their lab(s) by their department. Most labs/departments have already been fulfilling this for years. Class descriptions and enrollment directions are given in the box below. Access to training records is noted below.

   The fundamentals trainings are generic and do not address the specific hazards/procedures for a particular lab, or individual. Lab supervisors/PIs are still responsible under the law for ensuring this has been provided. The fundamentals training covers the core issues common to most/all labs and addresses many specific regulatory requirements for documented training. Lab-specific training is addressed in the second major policy mandate.

2. The new requirement in the system-wide policy is for a **Training Needs Assessment (TNA)** to be performed for each lab worker. A copy of the UCSB TNA is shown on the next page. The form is automatically/electronically forwarded when the worker attends the *Fundamentals of Lab Safety* class above. The worker is instructed to work with their supervisor to complete the assessment of what safety training is needed based on their assigned work. Training can and should include lab-specific instruction done by/within the lab group and specialized EH&S provided training. The form also serves as a convenient place to *document* training**.**

Accessing the *Fundamentals of Laboratory Safety* Orientations (mandatory per UC policy)

- **Live Version:** 3-hour, instructor-led training is offered regularly - generally twice per quarter. Enroll via the UC Learning Center using UCSB NetID*. Search on "LS01". This training is **more in-depth** than the online version below and generally **includes hands-on fire extinguisher training.**

- **Online Version:** Available via the UC Learning Center using UCSB NetID*. Search on "LS60"

***note that undergraduate UCSB NetIDs do not work directly in the UC Learning Center, but follow the instructions therein for undergraduate enrollment procedures.*

EH&S Training Records

There is a Web interface which allows EH&S training records to be searched by worker name, supervisor name, or department from July 2000 to July 2012. EH&S training completed after July 2012 is documented in the **UC Learning Center** Individuals can access the Learning Center using their UCSB NetID and password to view their training history. Likewise, upon request, departments can have designated administrator(s) provided access to all the training records for individuals associated with their department.

LABORATORY WORKER SAFETY: TRAINING NEEDS ASSESSMENT and DOCUMENTATION

(completion and filing of this form for each supervisee is the responsibility of the laboratory supervisor)

Instructions: under CA law and UC policy, lab supervisors are responsible for ensuring that their workers have received **documented safety training**. Particularly, for: new employees; employees given new job assignments for which documented training has not previously been received; whenever new hazards are introduced, or recognized. Training can be formal or informal, and individual or group-based. This form serves ***two*** purposes relative to the above requirements:

1. A place to complete a **"Training Needs Assessment"** for each supervisee to first identify what training is appropriate for that individual. A formal assessment is required per the 2013 *UC policy: Laboratory Safety Training*
2. A place to **document the training** as it is completed.

Laboratory Worker Name: _____ **Supervisor Name:** _____

1. On-Site Laboratory Safety Orientation ("day-one orientation", per UC policy)

A. Emergency Procedures

Topic Covered	Training Topic
❑	**UCSB Emergency Information Flipchart:** location/purpose – posted in every lab
❑	**Fire alarm pull station:** Location of and how to activate
❑	**Emergency eyewash/shower:** Location of and how to activate
❑	**First aid Kits:** Locations of and contents
❑	**Building Emergency Assembly Point and routes of exit –** see last pg. of Flipchart
❑	**UCSB Alert System (optional emergency texting system):** purpose and enrollment

B. Engineering Controls

❑ NA: ❑	**Chemical fume hoods:** Demo proper use and instruct on alarms/controls
❑ NA: ❑	**Biological safety cabinets**: Demo proper use and instruct on alarms/controls
❑ NA: ❑	**Chemical storage:** Locations of and segregation rules
❑ NA: ❑	**Other engineering controls:** glove boxes, gas cabinets, etc. – demo proper use Describe:

C. Administrative Controls

❑ NA: ❑	**Laboratory Safety Manual and Chemical Hygiene Plan**: location & contents. See also pg. 3: Chemical Hazards.
❑ NA: ❑	**(Material) Safety Data Sheets:** Demo electronic or hard copy access to repository

D. Personal Protective Equipment

❑ NA:❑	**Lab coat and Eye protection:** UC provided/fitted starting 2/14. Proper PPE will be determined and authorized via online *Laboratory Hazard Assessment Tool (LHAT*)
❑ NA: ❑	**Prescription safety glasses provided:** Via optometrist (over-the-glasses goggles are another option)
❑ NA: ❑	**Gloves:** Provided by lab. Location of, knowledge to select correct type and how to properly don/doff.
❑ NA: ❑	**Other PPE:** Lab provided. Describe:

E. Waste Disposal

❑ NA:❑	**Chemical/Biological/Radiological/Sharps Disposal:** Demo labeling/storage/pickup

F. Other

❑ NA: ❑	Describe:

Lab worker acknowledgement: I have been trained on, or provided with, all the above that are applicable to my work.
Lab worker signature: _____ **Date:**_____
Supervisor, or designated trainer signature: _____ **Date**:_____

2. Formal Training Classes Offered by EH&S

For those individuals doing the research noted below, the trainings noted are mandatory per regulation and/or campus policy. EH&S regularly offer these baseline trainings or refreshers. Where needed they should be augmented by training at the lab level. For example, training on the specifics of the lab's Biological Use Authorization, or Radiation Use Authorization. A place to document both lab-level and centralized training is provided here.

Training Courses	Training Needed (circle Y/N)	EH&S Training Date	EH&S Refresher Date	Lab level training date	Worker Initials	Trainer Initials
Radioactive Isotope User[1]:	Yes or No					
X-ray Equipment User[2]:	Yes or No		NA			
Biosafety Level II User[1]:	Yes or No		NA			
Bloodborne Pathogens User[1]:	Yes or No					
Aerosol Transmittable Disease User[1]:	Yes or No					
Autoclave User[1]:	Yes or No		NA			

Footnotes: 1. Enroll via UC Learning Center (learningcenter.ucsb.edu), 2. See EH&S Radiation Safety website

3. Safety Training by/at the Laboratory for "Hazardous Operations"

There is no definition of what constitutes a "hazardous operation", but common sense and what a reasonable person would expect should be employed in defining a local training program. Below are suggestions for hazards that are probably in this category. This is not a comprehensive list.

Noted below are training tools such as your OSHA-required Chemical Hygiene Plan, the *Prudent Practices in the Laboratory* book and numerous online trainings. Those resources can supplement **hands-on training/mentoring in the laboratory setting** which is necessary, both initially and as new hazards/operations are encountered. The tools noted below should be used as a reference during this mentoring to ensure that the details of the process or procedure are communicated completely and accurately. Such on-going training can most easily be documented via a brief note by the mentor in the trainee's lab notebook citing the subject, date/time and followed by the mentor's signature. For group-based training, can use a simple sign-in sheet with the topic, date and mentor noted.

Chemical Hazards

Chemical User: Yes____ No_____
Train on location and contents of the lab's *OSHA Chemical Hygiene Plan* and laboratory-specific section of Plan. Most importantly, the chemical **Standard Operating Procedures** for that lab.
Lab-specific CHP/SOP Training date:_____ Trainer initials: _____ Worker initials:_____

Supplemental online training* on chemical hazards are found as noted below under "Supplemental Training Resources".

Physical Hazards – suggested training topics for in-lab training, and/or training via online modules*

	User: Yes	User: No	Training Date	Trainer	Comments
• High Pressure vessels*	❑	❑	____	_____	_____
• Gas Cylinder Use*	❑	❑	____	_____	_____
• High voltage/basic electrical hazards*	❑	❑	____	_____	_____
• High Temperature equipment	❑	❑	____	_____	_____
• Glassware handling*	❑	❑	____	_____	_____
• Cryogenics*	❑	❑	____	_____	_____
• Centrifuge*	❑	❑	____	_____	_____
• Vacuum equipment*	❑	❑	____	_____	_____
• Mechanical integrity*	❑	❑	____	_____	_____
• Equipment w/ hazardous moving parts	❑	❑	____	_____	_____
• Ergonomics for Labs/Pipette Users*	❑	❑	____	_____	_____
• Lasers	❑	❑	____	_____	_____
• Other_____	❑	❑	____	_____	_____
• Other _____	❑	❑	____	_____	_____

Biological Hazards – suggested training topics for in-lab training, and/or training via online modules*

	User: Yes	User: No	Training Date	Trainer	Comments
Biosafety cabinet use*	❑	❑	____	_____	_____
Biological Hazards*	❑	❑	____	_____	_____
Other:_____	❑	❑	____	_____	_____
Other_____	❑	❑	____	_____	_____

Supplemental Training Resources

There are a number of *online training modules* to supplement in-lab training. Topics above marked with a * have an associated online training and are found at **click here.** EH&S makes no guarantees as to the accuracy, applicability and availability of these external trainings. Most online training completion is not automatically documented and must be done manually above, or elsewhere.
Another valuable *free* training resource is: **Prudent Practices in the Laboratory** by the National Research Council.

Laboratory Self-Inspection Checklist

EH&S inspects all labs on campus at least annually. However, it is strongly recommended that labs initiate periodic self-inspections (recommend minimum of twice-a-year).

Prior to the EH&S visits a Self-Inspection Checklist is generally distributed to aid laboratories in establishing their own audits. The list does not include every possible safety issue, but are general guidelines. Most items are based on applicable regulations or UC policy. Radiation and biohazard issues are not addressed in the checklist because they are highly specialized and these labs receive targeted EH&S visits.

Chemical Waste Disposal

REGULATIONS: Hazardous waste regulations are stringent and penalties for violations can be severe. Santa Barbara County inspects UCSB labs for compliance on a regular basis.

STORAGE

- Store chemical waste in a designated area. Label as, "**HAZARDOUS WASTE STORAGE AREA**"
- Store chemicals in containers compatible with, and durable enough for, the waste. Liquid waste must be in screw-top containers. Do not overfill - allow for expansion.

LABELING

- Identify waste by proper chemical name (no abbreviations or chemical structures). List chemical names of hazardous components in that mixture by percent weight.
- Deface existing labels when reusing containers.
- Label and date container(s) when the first drop of waste is added. Hazardous waste shall be given to EH&S for disposal within ***nine months*** of start date.
- Use ***UCSB HAZARDOUS WASTE*** label on all hazardous waste containers. All portions of the label must be completed. Labels available for free in all science storerooms –see below.

SEGREGATION: group waste into the following categories:

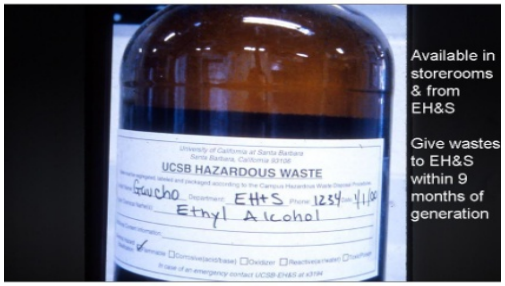
- halogenated organics (*dichloromethane, chloroform*)
- acids with pH 2 or less (*HCL, sulfuric acid*)
- alkali metals and other water reactives (*sodium,lithium)*
- strong oxidizers (*nitric acid, chlorates, permanganates*)
- unstable chemicals

-non-halogenated organics (acetone, methanol, xylene)
-alkaline solutions of pH 12.5 or greater (sodium hydroxide)
-heavy metal solutions and salts (mercury,silver, zinc)
-cyanides (potassium cyanide)

DISPOSAL

- Chemicals may not be disposed in regular trash, sink disposal, or allowed to evaporate.
- Complete a *UCSB Waste Pick-up Request Form*. Send by campus mail or fax(X8659). Also available on the *EH&S website* for electronic submission

- *EH&S cannot accept responsibility for improperly labeled, packaged, and/or segregated chemicals, and will not pick them up.*
- *Transferring waste into appropriate containers is the generators responsibility.*
- *Waste containers become the property of EH&S and will not be returned*



UCSB Hazardous Waste Label

Laboratory Sharps Disposal

Definitions:
"Sharps waste" means any device having acute rigid corners, edges, or protuberances capable of cutting or piercing, including, but not limited to, all of the following: hypodermic needles, syringes, razor blades and scalpel blades. Glass items contaminated with biohazards, such as pipettes, microscope slides and capillary tubes are also a "sharps waste."

Under no circumstances should "sharps waste" be disposed of in the normal trash. Sharps must be disposed of through Environmental Health & Safety (EH&S) or a certified medical waste management company.

Sharps Contaminated with Hazardous Chemical Waste

1. Place in a rigid, puncture-resistant container which, when sealed, is leak proof. Examples below.
2. Deface any biohazard symbols, if present.
3. Label the container with a hazardous waste label and include the chemical constituents.
4. Submit an online *Chemical Waste Collection Request* via the EH&S website. Please note on the request that the material is not biologically contaminated.

Sharps Contaminated with Radioactive Materials

1. Place in a rigid, puncture-resistant container which, when sealed, is leak proof. Examples below.
2. Deface any biohazard symbols, if present.
3. Label the container with a radioactive waste label and include the radioactive isotope.
4. Submit an online *Radioactive Waste Collection Request* via the EH&S website. Please note on the request that the material is not biologically contaminated.

Sharps Contaminated with Medical or Biohazardous Waste

1. Place in an approved biohazardous sharps container that is red, rigid, puncture-resistant and which, when sealed, is leak proof and cannot be opened without great difficulty -pictured below.
2. Autoclave your sharps container for a minimum of 30 minutes at 121°C and 15psi.
3. Label the sharps container with the words "autoclaved".
4. Submit an online *Chemical Waste Collection Request* via the EH&S website. Please note on the request that the material has been autoclaved. Or leave your autoclaved sharps container at Bio II 4106, LSB 2204, LSB 4218 or Chem 1201, where it will be picked up without a request.

OR

1. Place in an approved biohazardous sharps container that is red, rigid, puncture-resistant and which, when sealed, is leak proof and cannot be opened without great difficulty.
2. Contract with a certified medical waste management company to pick-up your medical or biohazardous sharps waste.

Unused or Non-Contaminated Hypodermic Needles

1. Place in an approved biohazardous sharps container that is rigid, puncture-resistant and which, when sealed, is leak proof and cannot be opened without great difficulty - examples below.
2. Deface any biohazard symbols, if present.
3. Submit an online *Chemical Waste Collection Request* via the EH&S website. Please note on the request that the material is not biologically contaminated.

Laboratory Glass Disposal

Definition: Laboratory glass is defined as equipment generally made of pyrex, borosilicate, and quartz glass used for scientific experiments. Examples of laboratory glass include, but are not limited to, the following: beakers, flasks, graduated cylinders, stirring rods, test tubes, microscope slides, glass pipettes, glass petri dishes, and glass vials. **Glass items contaminated with biohazards, such as pipettes, microscope slides, and capillary tubes are considered "sharps waste". Under no circumstances should "sharps waste" be disposed of in the normal trash. Sharps must be disposed through EH&S or a certified medical waste management company.**

Directions:

1. Prior to utilizing the cardboard lab glass box, duct tape the bottom to ensure the container is secure.
    - Labs can use a 32gal. red lidded cart to house cardboard lab glass box for ease of transport. (*loose lab glass cannot be placed in red lidded cart)*
2. Place appropriate unwanted lab glass in the cardboard lab glass box. Non-lab glass, such as beverage containers should be placed in recycling receptacles, and not disposed along with laboratory glass waste.
3. When full, use duct tape to secure the lid to the body of the box. Be sure that the lid is securely fastened to the body of the box so the contents remain inside.
4. Bring the cardboard lab glass box down to your building's red lidded carts and place inside. Then lock the cart.
    - If you are using the 32gal. cart to house the cardboard glass box, roll the cart down to the dumpster corral and leave for pick-up. Carts are serviced on Saturdays.

Lab Waste Management Program – Sharps Disposal Flowchart

Sharps Containers

Small → EH&S → Medical Waste Management Company → Landfill

Large → Medical Waste Management Company → Landfill

Cardboard Lab Glass Boxes

→

Carts serviced by MarBorg on Saturdays → Landfill