

Center for Nano and Micro**Manufacturing Chemical Hygiene Plan****1.0 Introduction**

Cal/OSHA (Title 8 CCR Sec.5191) requires that all laboratories have a written Chemical Hygiene Plan as a fundamental chemical safety document for the laboratory. Chemical Hygiene Plans are required to include laboratory specific hazards and safety information. A hierarchy of administrative controls, engineering controls, and protective equipment form the basis of the chemical hygiene plan. The procedures within this manual are for your protection and describe the available potential dangers. Your lab membership is contingent on passing the CHP test that covers material found within this manual.

2.0 Responsible Persons

Associate Dean of Safety and Facilities: Case van
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Safety Officer: Rijuta Ravichandran
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3.0 Rooms Covered by this Chemical Hygiene Plan: 1249**4.0 General Safety Information**

The following safety procedures and rules must be read, understood, and practiced at all times. Users of all levels will be treated equally and are expected to carry out all operations with both the safety of the individual and other users as the primary consideration. Ignorance of the rules, lack of common sense, language difficulties, carelessness, and being short on time are not adequate excuses for unsafe behavior or poor etiquette.

Think about your actions and how they will affect other lab members, as well as yourself.

Use common sense and consideration when working. Be aware of your own and everyone's safety. If you see a lab member practicing unsafe procedures, do not hesitate to walk up and remind fellow lab members of proper procedures. Safety violations and hazards should be reported to the safety officer immediately. Safety is an ongoing effort. Laboratory procedures and rules continuously evolve based upon lab member input and changing laboratory conditions. If you have any questions, feel free to ask a staff member.

You are continuously being recorded while working in the facilities. Recorded violations may result in immediate suspensions for several days, weeks, or even permanently. These suspensions are at the sole discretion of CNM2 management with formal notification to the user and the principal investigator of the project. **As a general rule, anyone violating any safety rules or otherwise compromising his or her own personal safety or the safety of others will have their access to the laboratory restricted, suspended, or revoked.**

4.1 Emergencies

The Emergency Phone Numbers list (see next page) is posted by every lab telephone and at all lab entrances. The nature of an emergency will determine whether you will call 911 or call lab staff. Call 911 for any fire, severe injury, bomb threat or any other life-threatening situation. As soon as you are safely able to do so - follow up a 911

emergency phone calls with a call to staff. When placing calls to staff, call them in the order listed until you reach a live person.

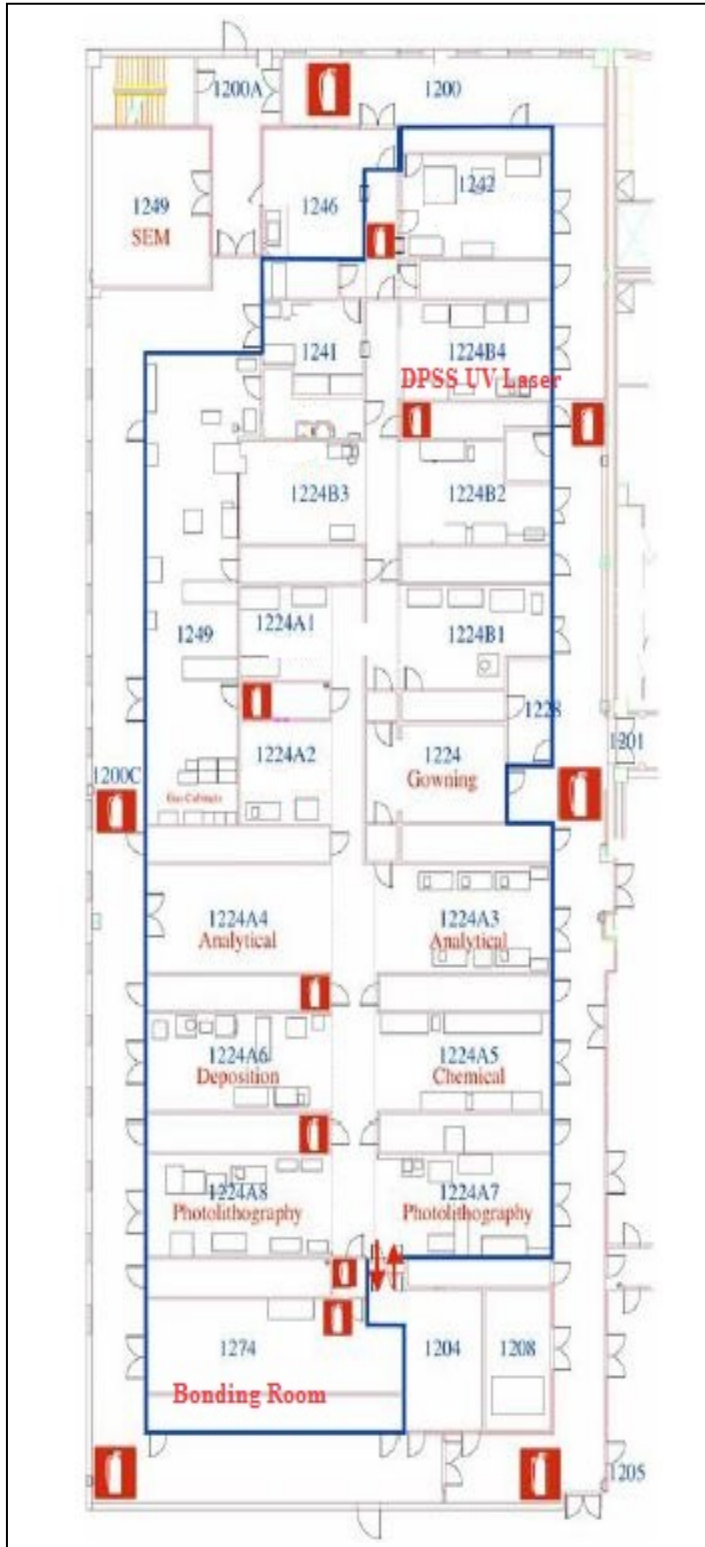
4.1.1 911 Emergency Response

Lab telephones are the best method to call 911. Using a lab phone provides emergency responders with the location of the emergency without the person calling for help having to provide it. Using a lab phone ensures that your call is immediately routed to the local emergency response station.

If you must use a cell phone to place an emergency call it is recommended that you dial UC Campus Police at 530-752-1234. This ensures that your call is routed to the local emergency response station.

Calls placed to 911 using a cell phone result in delay since they are directed to a statewide operator who must determine your location and then forward your call to the local emergency response station.

Follow all instruction of the emergency response operator.



4.1.2 Fire

In case of fire, use the red fire alarm pull boxes located at every lab exit. The campus Fire Department regularly checks fire extinguishers. In the event of a small fire in the lab, use the extinguishers if you are comfortable doing so and report it to the CNM2 staff immediately. If you are not comfortable using a fire extinguisher, follow the directions below.

For fires, pull the red fire alarm, call 911, and evacuate the building according to the directions in Appendix B. If you activate the fire alarm, also pull the Toxic Gas Shutoff if possible (Green). This shuts off all toxic gases. Remember if you pull red – pull green too. If your clothes catch fire, use the showers and do not panic. Make sure to memorize safety shower locations.

In Case of Fire, the fire extinguishers are located in all rooms. The campus Fire Department regularly checks fire extinguishers. You are not expected to fight fires. Use a fire extinguisher only if you are trained and feel safe. Your responsibilities are: **“Notify, Evaluate, and Evacuate”**. As soon as possible, activate the fire alarm, evacuate the building, and contact staff. Report any use of a fire extinguisher.

For fires, pull the red fire alarm, call 911, and evacuate the lab.

If your clothes catch fire, use the showers and do not panic. Make sure you know the location of all lab showers and eyewash stations.

Sprinkler System

CNM2 is protected by a water type sprinkler system. This system is designed to deliver >15-gallons / minute per sprinkler head. When water flows, an alarm is automatically sent to the fire station and firefighters will respond.

4.1.3 Medical Emergencies

CNM2 relies on several emergency medical resources to deal with injuries or life safety issues.

- Call 911 before you call staff when there is a serious injury or life threatening issue.
- Student Health & Wellness Center, located on La Rue between Hutchison Drive and Orchard Road, across the street from the Activities & Recreation Center (ARC).



5.0 Electrical Safety

Before using a power strips in the CNM2, check with a CNM2 staff person. Many locations cannot handle the increase in electrical current load when a power strip is added. Power strips may not be used as extension cords, and extension cords may not be used with a power strip.

5.1 Electrical Shock

If you witness an electrical shock, DO NOT MAKE CONTACT WITH THE VICTIM WITHOUT MAKING SURE THEY ARE NO LONGER IN CONTACT WITH THE ELECTRICAL CURRENT. If the person still has contact, assume they are not grounded. If possible, shut off the current safely and quickly. Otherwise, use appropriate non- conductive material to help you break the current. Use extreme caution! Do not become another victim. Dial 911 Immediately and alert lab staff.

6.0 Facilities

For facility problems, such as a leak or a utility problem that does not represent a danger to the lab members but may result in damage to equipment, use the emergency phone list and call staff. **Do not call 911 for problems limited to facilities or equipment.**

For general building issues call Facilities trouble desk at 752-1655 or submit a work order online.

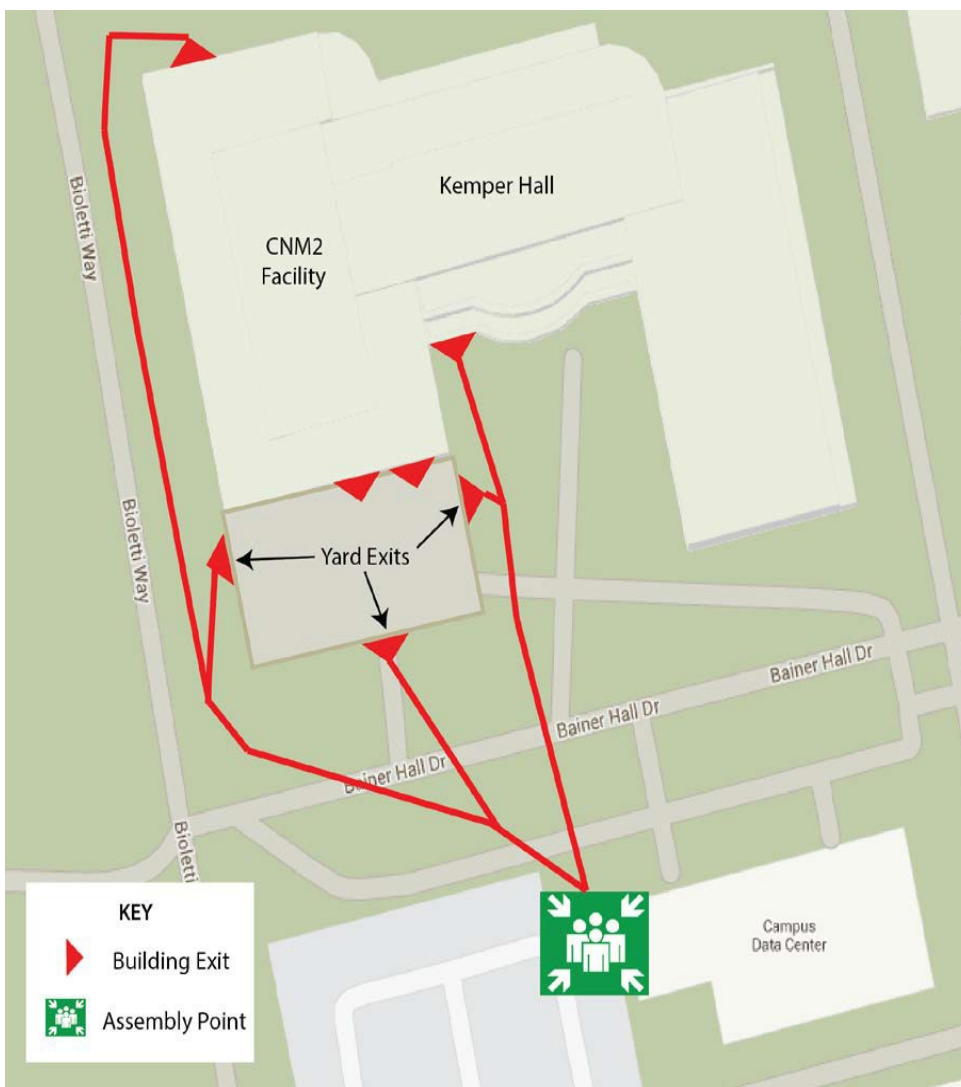
7.0 Flooding in the Lab

7.1 Search for the source of the leak and turn off supply valves. The sinks in the lab have three sources of water: DI supply, DI return, and ICW; all three supply valves should be turned off. Equipment may have multiple sources; try and find the shut-off valves located behind each sink or tool. If unable to determine source, or find shut off valve. Notify staff immediately!

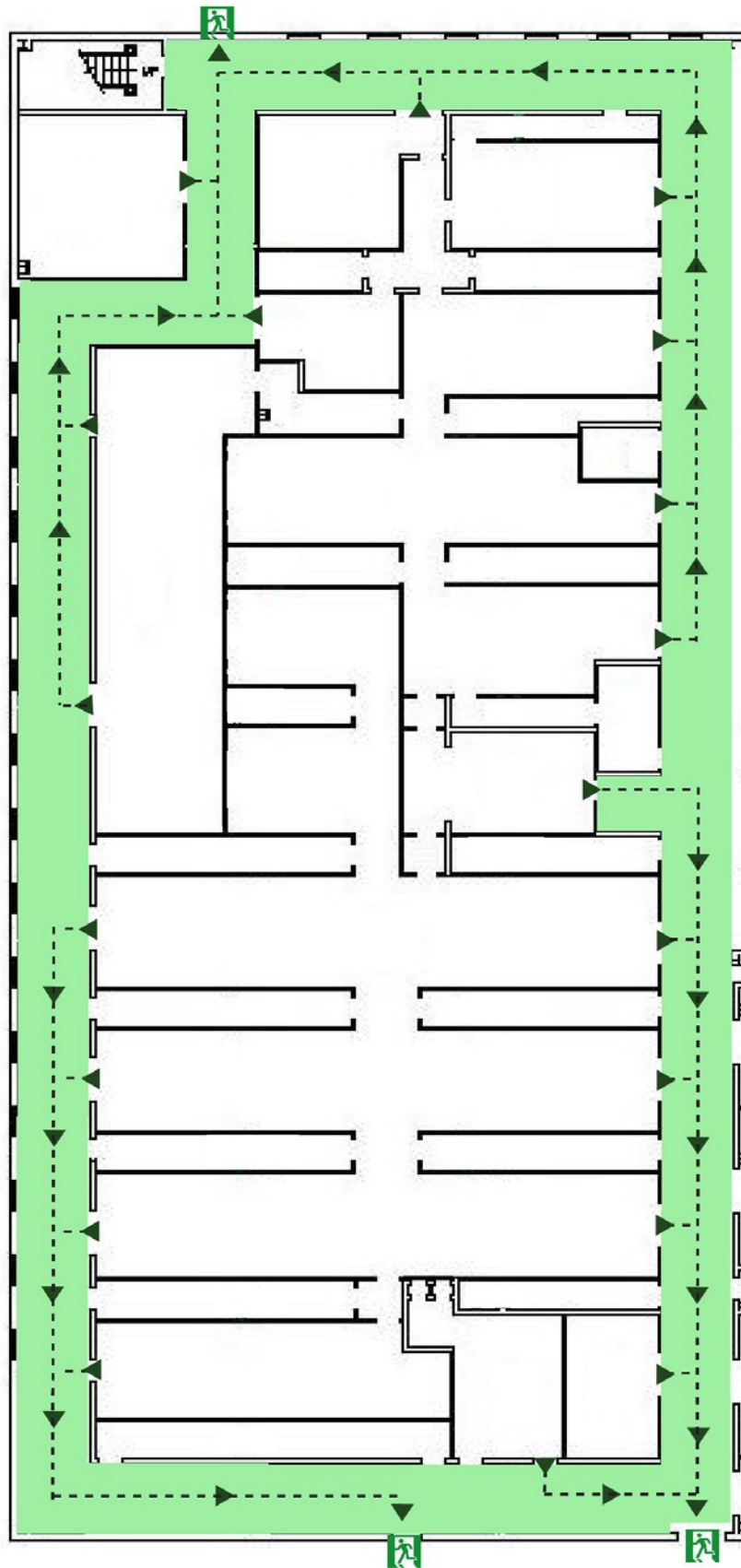
7.2. Notify a staff member who will help you clean it up. If the flooding happens after office hours, use the emergency phone list to contact the Facilities trouble desk at 752-1655 and report it as an emergency. If unsuccessful, contact CNM2 staff using emergency phone numbers listed.

8.0 Evacuation Procedures

8.1.1 When the building fire alarm sounds you **MUST** evacuate the laboratory immediately through the safest route available. Advise those around you to evacuate the building. Secure your process (turn off the equipment in a safe manner), proceed to the nearest yellow exit door and leave the lab quickly but calmly. Do not worry about de-gowning.



Emergency exits are shown in the next page. Note, the main lab entrance to the gowning room is **not** an emergency exit. Unless absolutely necessary, do not evacuate the lab using the gowning room entrance door. Once you have exited the building, proceed to Emergency Assembly Area on the south side of Kemper near the loading dock. If YOU are the individual that activated the fire alarm, or if you have any information related to the emergency, remain at the emergency assembly area so you can provide information to emergency responders and laboratory staff. You may not re-enter Kemper Hall or the cleanroom until all evacuation alarms and lights have been reset and the Fire Department or staff have announced “all clear” and given permission to re-enter the building.



Be aware of your own and everyone else's safety. If you see a lab member practicing unsafe procedures, do not hesitate to walk up and remind him/her of proper methodology. Safety violations should be reported to staff immediately.

82 Laboratory Protocols

8.2.1 Protective Eyewear

You **MUST** wear safety glasses when cleaning samples, or using any chemicals. Only safety glasses approved by the American National Safety Institute (ANSI) and meeting the ANSI Z-87.1 standard are allowed. Safety glasses are not required while using the microscope. CNM2 maintains an inventory of approved safety glasses which lab members can use but must return before leaving the lab.

For those lab members who wear prescription glasses, prescription safety glasses **MUST** be obtained – or you must wear safety glasses or goggles over your prescription glasses.

Wearing contact lenses in a research laboratory environment is discouraged. While UC does not have a policy forbidding the wearing of contact lenses combination with safety glasses, it is not recommended. Contact lenses are prone to absorbing or trapping chemicals possibly prolonging or aggravating an accidental exposure. CNM2 does not recommend wearing contact lenses with safety glasses.

8.2.2 General Laboratory Practices

When in a lab, walk, don't run. Avoid backing up; always look where you are going. Don't rush. Wash your hands after working in any laboratory. Remember that the nitrile gloves must be worn at all times while working, which is intended to protect equipment and materials from the oils, salts, and particulates that are always on your skin. Avoid touching your face with your gloved hands. Check your gloves frequently; put on fresh gloves if they become torn or contaminated.

It is campus wide EH&S policy that gloves are not to be worn outside of laboratories. This is to ensure that any contaminants that might be on your gloves are not transferred outside the laboratory when touching door handles, elevator buttons, etc. Be sure to remove all gowning items including all gloves as you depart the laboratory. It is not acceptable to keep gloves on to "protect the cleanliness" of your samples as you transfer them to another laboratory. Use plastic bags or boxes to transfer your samples.

8.2.3 Food and Beverages

Food and beverages are **not** allowed in any part of CNM2, its satellite labs, or service chases.

8.2.4 Cell Phones

You may use cell phones in room 1249; remember to be courteous to other members and to keep conversations to a minimum. **After using a cell phone, change your nitrile gloves to avoid contamination from perspiration and skin oils on all cell phones.**

8.2.5 Head phones

Radios, music players and headphones are not allowed while operating equipment and are prohibited in CNM2.

8.2.6 Visitors

Visitors are allowed by permission only. All visitors must be associated with the research missions of CNM2 and its lab membership. Friends and family members do not qualify as visitors. Please contact staff if you would like to bring a visitor into the lab. All visitors must remain with their host at all times. Visitors are never to operate equipment or handle chemicals. Visits are to be completed during staff hours (9am-5pm) only. In the event of evacuation, visitors are to be escorted out by their lab member hosts following all established evacuation protocols.

8.2.7 Personal Hygiene

Avoid touching your skin, eyes, or mouth while wearing gloves. The chemicals that are used in the lab are hazardous or may irritate skin. It is important to wash your hands after working in CNM2 – or any laboratory even if no known exposure has occurred. Remember, the nitrile gloves are meant to protect the cleanroom and equipment from skin oils and dirt. They do not serve adequate protection for chemical handling.

83 First Aid

Injuries, such as minor burns and cuts can be treated with the first aid kit located by each of the 5 Safety Stations within the lab or in the office. Injuries which require treatment by a health care professional must be documented by laboratory staff within 24 hours of medical treatment or on the Monday following a weekend. We want to know your injury has been properly treated and do everything possible to prevent another injury from occurring.

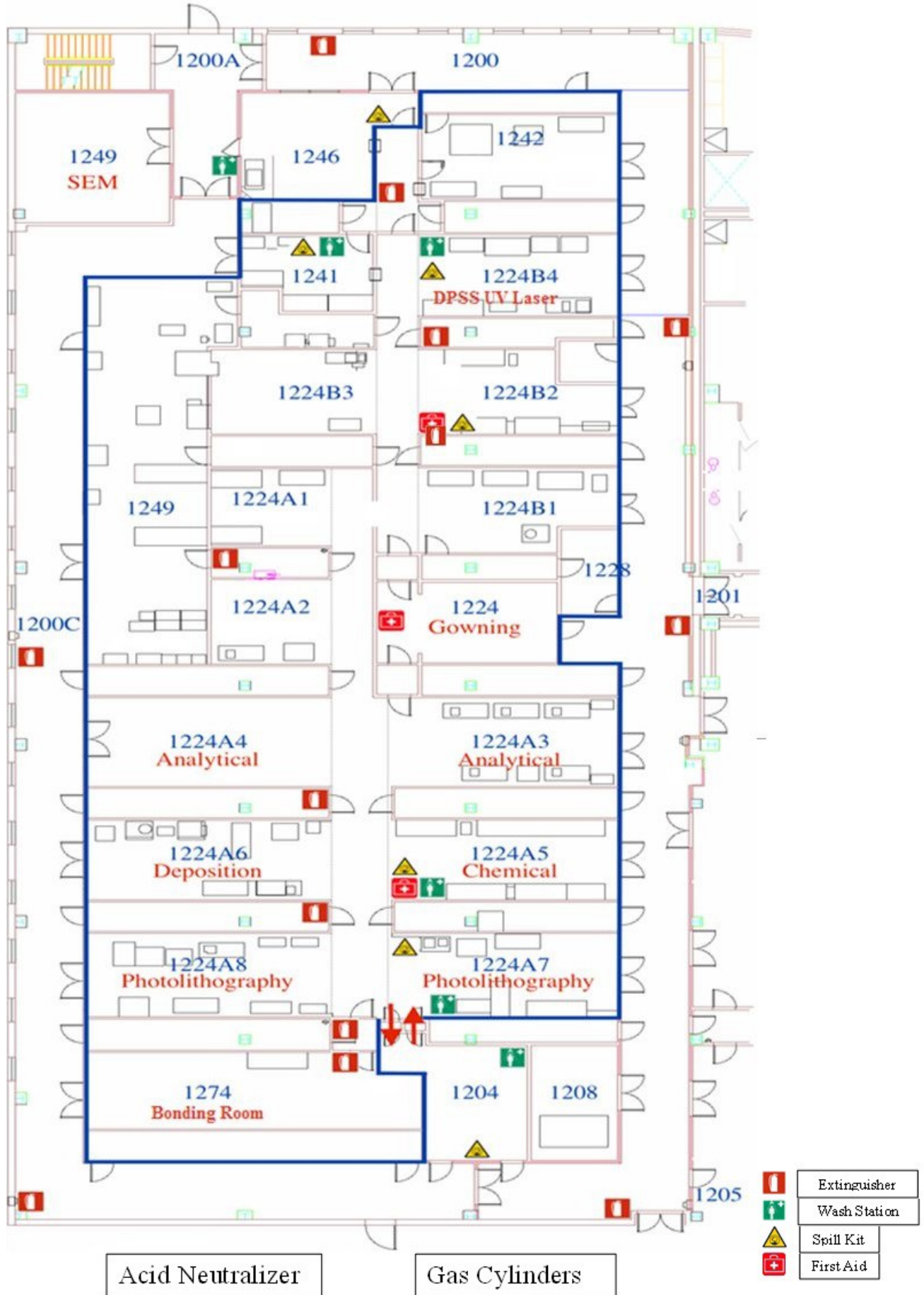
Lab members familiar with first aid should come to the aid of colleagues. California has a Good Samaritan law protecting people who give first aid from legal liability.

84 Safety Stations

There are 5 Safety Shower / Eyewash stations in the cleanroom and one in room 1246. Five of these shower locations have been designated as Safety Stations and are equipped with additional safety equipment. In addition to the safety shower and eyewash, each Safety Station is also equipped with the following:

- Spill Containment Kit
- First Aid Kit
- pH test strips
- HF burn paste

The locations of these stations are clearly marked with a Safety Station sign. The location of all 5 Safety Showers are shown on the layout map. Please memorize the locations of these stations so you know where to find the closest one to your working area.





SafetyNet #13 - Guidelines for Chemical Spill

Control General Steps To Follow

1. When 1 pint or more of a hazardous material or any amount of an extremely toxic substance is spilled or when in doubt, call the UC Davis Fire Department at 9-1-1. Evacuate the room, close the door, and wait for emergency personnel.
2. If the substance spilled is flammable, turn off all ignition sources before securing the room.
3. In case of chemical contact with skin or eyes, flood the affected area immediately with water; continue for at least 15 minutes. Seek medical assistance at Occupational Health Services located at the Cowell building or the Student Health and Wellness Center for skin irritation, contact with an extremely toxic substance, any eye injury, or any adverse reactions.
4. All contaminated clothing must be removed immediately. Clothes must be laundered before reuse or disposed of as hazardous waste.
5. When incidental to one's duties, small spills (1 pint or less) may be cleaned up by laboratory personnel. It is good laboratory practice to keep spill absorbents on hand. A good, general purpose spill absorbent is available from the Storehouse (Fisher Scientific, Cat. No.: NC9571649, DRIZORB Absorbent). Spill cleanup kits for solvents, acids, bases (caustics), mercury, hydrofluoric acid, and others are commercially available from sources such as J.T. Baker and Lab Safety Supply.
 - A. Most strong acids may be absorbed and neutralized with aqueous solutions of sodium bicarbonate, calcium hydroxide (slaked lime), or sodium carbonate (soda ash). (Note: DO NOT attempt to absorb hydrofluoric acid (HF). Skip this step and neutralize immediately only if you are familiar with proper neutralization procedures for HF; otherwise, return to step one.)
 - B. Caustic solutions and flammable liquids may be absorbed with an inert absorbent.
 - C. DO NOT attempt to blot cryogenic liquid spills with unprotected hands. Evacuate the space and allow the liquid to evaporate. If the cryogenic fluid evaporates to a flammable, toxic or asphyxiating gas, follow procedures (1) and (2) for large spills.
 - D. Formaldehyde spills may be absorbed with an inert absorbent.
 - E. For mercury spills, see [SafetyNet #16](#), "Guidelines for Mercury Spill Control", for more information.
 - F. Solid spills are not usually emergencies. If the material spilled is toxic, use dampened cloths or paper towels to transfer it to plastic bags. Brushing dry material may cause dust to become airborne.
6. All absorbed spill material must be collected in double plastic bags or plastic containers with secure lids and disposed of as hazardous waste. See [SafetyNet #8](#), "Guidelines for Disposal of Chemical Waste" for more information. If the absorbent is used for a flammable or volatile compound, it must be stored in a well-ventilated area away from sources of ignition while awaiting pickup. A fume hood is a good temporary storage area.

For additional information, contact EH&S at 530-752-1493 or ehsdesk@ucdavis.edu.

When Staff Is Not Available:

- Lab members should prevent people from entering the area and contain the spill using a portable Spill Containment Kit located by each of the five Safety Stations. The kit is a five-gallon white pail which contains spill pillows, blankets, cleanroom gowns, gloves, a portable respirator and plastic hazardous disposal cleanup bags. The kit can be taken to the location of the spill. The material used in these pillows and blankets is selected for large moisture retention and its ability to neutralize acids.
- If the spill is significant or presents a serious hazard, call 9-1-1 and evacuate the lab. Make sure to inform others that are working in the lab to also evacuate. Pull the fire alarm
- Contact a staff member using the emergency contact list posted by every phone and by each entrance and exit. In all cases be sure and wash up following any spill event. File a written report on Mercury, under "Equipment" named "Safety": Marvell staff will complete spill cleanup.

General Procedures for Handling Unreactive Hazardous Materials

- Minimize quantities
- Clear your work area before starting.
- Protect bench tops using disposable covering (i.e. tek wipes)
- Change gloves each time you change work venue. For example, if the phone rings, take off your gloves before answering it. Do not re-use gloves, even if they look clean.
- Confine the material as you work. Clean up stray material before it can disperse: DO NOT WAIT until the job is done.

9 Sharps & Other Dangerous Objects**9.1 Broken Glassware**

Broken glassware should be disposed of in the buckets labeled "sharps" found in each of the bays and around the labs.

9.2 Wafers

Wafer pieces, wafers with thin films deposited, or wafers contaminated with photoresist are considered sharps and can be disposed of in the "sharps" buckets found around the lab.

9.3 Needles and Razor Blades

Needles and razor blades should be disposed of in the sharps disposal bins. Do not dispose of needles or razor blades in the trash cans!

10.0 Compressed Gases

10.1 Handling Gas Cylinders

Cylinders of both toxic and non-toxic compressed gases are used throughout the lab. Lab members may not install or disconnect these cylinders. Only trained staff may handle any compressed gas cylinders. There are several reasons for this policy. Some gases are toxic. Some gases in these cylinders are at high pressures, some as high as 3000 psi. Regulators are designed to handle specific gases and can explode if not properly chosen. Improper installation or purging will contaminate a full bottle of gas. Some of our etching gases cost thousands of dollars per cylinder and their loss or contamination is very costly.

Gas cylinders must be chained or strapped with two non-combustible restraints at all times.

10.2 Nitrogen Guns

Nitrogen guns and compressed gas can inflate the skin like a balloon, tearing it away from the tissue underneath. Be cautious and avoid cuts when spraying nitrogen or working around gas streams.

11.0 Flooding in the Lab

If water starts flooding the floor of the lab, follow these steps:

11.1 Search for the source of the leak and turn off supply valves. The sinks in the lab have three sources of water: DI supply, DI return, and ICW; all three supply valves should be turned off. Equipment may have multiple sources; try and find the shut-off valves located behind each sink or tool.

11.2 Notify a staff member who will help you clean it up. If the flooding happens after office hours, use the emergency phone list to contact a staff member.

11.3 Use the squeegees located in the freight elevator vestibule area to direct water to a floor drain. Use the wet vacuum located in the freight elevator vestibule area to vacuum up any remaining water from the floor.

11.4 Report the incident to staff on the emergency contact lists that are posted around the lab

12.0 Electrical Safety

All electrical power wiring where voltages exceed 24 Volts may only be done by qualified CNM2 staff. Report all electrical problems to staff. Learn the locations of the circuit breakers required by the equipment you use. Lab members must obey all DO NOT OPERATE and

LOCKOUT tags, and equipment locked messages. Do not attempt to operate any equipment with these designations. If someone is electrocuted in the lab, do not touch or grab them until the power has been shut off. Do not attempt to shut off power on the system; instead, use the circuit breakers located at the east end of every service chase.

The use of power strips in CNM2 is regulated. Many locations cannot handle the increase in electrical current load when a power strip is added. Power strips may not be used as extension cords.