ADVISORY NO. 8.2: LABORATORY AUDITS

PURPOSE AND PROCEDURE

The laboratory, with all of the hazardous substances and electrical equipment contained in it, can pose a potential safety hazard if not properly maintained and if safe laboratory procedures are not followed. The potential for injury not only exists for those working in the lab, but also to people working nearby as in the case of a release of a hazardous substance or a fire.

To minimize the University's efforts to minimize the potential hazards in laboratories, the Office of Environmental Health and Safety is required to audit all laboratories and provide feedback to stakeholders (e.g. principal investigator, lab manager, etc.) on potential hazards and to provide technical assistance in eliminating/minimizing risks. To get the most out of the audit program and reduce interruptions of research programs, EH&S developed three types of audits, i.e., Project Specific Audits, common or emerging laboratory issues and develop target priorities. Referral Audits are used to follow-up on regulatory compliance issues or unsafe or unhealthy conditions. Announced Audits focus on a particular issue such as use and functioning of laboratory fume hoods.

The audit results are sent via email to the Principal Investigator responsible for the laboratory, usually within a week of the laboratory audit. It is the responsibility of the Principal Investigator to correct the issues identified. Resolution of the audit issues is tracked and the Principal Investigator is contacted regarding resolution of outstanding issues and to provide technical assistance, if necessary. The department Business Administrator or other senior managers in the responsible department may be alerted, where appropriate, if audit issues require further resolution. For a general lab inspection checklist for the use of Principal Investigator or any other Laboratory member for internal audits or a general list of what EH&S evaluates during audits see Appendix A. Please note that the inspection checklist in Appendix A is only a generalization of the scope of the EH&S laboratory safety audit.

SCOPE

A standard form will be used for all laboratory audits. The items, which will be checked, will include the following:

Electrical

If there is a fume hood alarm or another type of environmental alarm, is it working properly and has it been tested? Is there clear access to the electrical panel in case of fire or other emergency? Is all electrical equipment properly grounded? Do any electric cords have frayed or damaged insulation? Are there an excessive number of extension cords in use?

Fire

Is a fire extinguisher present in the lab or is there one nearby? Is the extinguisher being inspected on a monthly basis? Are all aisles clear?

Housekeeping

Are the bench top work areas, and the lab as a whole, kept clean? Is there evidence of eating or drinking in the lab?

Chemical Storage

Are all chemicals segregated and stored according to chemical class (e.g. acids and bases segregated, flammables separated from oxidizers, reactives isolated, etc.)? Are flammables stored in flammable storage cabinets? Are there more than 10 gallons of flammables stored in the room outside of flammable storage cabinets? If there are ethers or other peroxide-formers stored in the lab for more than 3 months, have they been tested for the formation of peroxides? Are all bottles clearly labeled with their contents? Are all gas cylinders secured?

Waste

Is there a glass disposal receptacle present and labeled as such? If needles, razor blades or other sharp objects are used, is there a sharps container present for their disposal? Is all chemical waste properly collected and labeled? Is all infectious waste autoclaved before disposal or otherwise treated appropriately?

Ventilation

Are there any room vents which are blocked or obstructed in any way? Are there excessive amounts of bottles or equipment stored in the fume hoods? Are fume hoods properly installed and ducted to prevent cross contamination and exposure? Are the fume hoods working properly? During lab audits, all fume hoods in the room will be checked to see if they have an adequate face velocity.

Emergency

Is there an eyewash and shower in the lab or nearby? Does the lab have a spill kit adequate for a spill of any of the chemicals used there? Are emergency procedures for fire, chemical spills and other types of emergencies clearly posted in the lab near the door?

Miscellaneous

Is there any exposed friable asbestos in the room? Is the entrance to the room clearly labeled with applicable hazard warning signs such as the radiation hazard sign or the biohazard sign? Is there a laboratory file (or a central department file) containing Material Safety Data Sheets (MSDS) for all chemicals used?

For more information, download the **EH&S Laboratory and Workshop Safety Inspection Checklist** or review below in Appendix A.

EH&S Laboratory & Workshop Safety

Inspection Checklist

For Discretionary Routine and Audit Prep Usage

Biological Hazard Storage Use and Waste Standards

- ☐ **1.** Ensure that protocols in accordance with bloodborne pathogens (BBP) standards are followed when handling BBP or other potentially infectious materials in the lab. Verify that all personnel are current on their training and have access to the laboratory Exposure Control Plan.
- ☐ **2.** Confirm that all equipment used for handling biohazardous or potentially infectious materials are cleaned and maintained in accordance to BBP standards. Safety canisters for centrifugation should be regularly inspected, well-maintained, and only opened inside a Biosafety Cabinet (BSC).
- ☐ **3.** Ensure that all Biosafety Cabinets (BSCs) are certified annually and after relocation. Always keep them clean and free of clutter.
- ☐ **4.** Check that facilities conducting biohazardous work display the appropriate Biosafety Level signage on doors and that all storage containers holding biohazardous or potentially infectious materials are labeled in accordance to EH&S advisory 10.2.
- ☐ **5.** Ensure that all biohazardous waste containers are maintained to preserve their integrity, including keeping lids sealed when not in use and ensuring they are leak-proof and in good condition. Additionally, verify that all containers are correctly labeled and disposed of when they reach 66% capacity, and avoid overfilling.
- ☐ **6.** Confirm that rated sharps containers in accordance to EH&S advisory 10.2 are readily available and easily accessible to lab occupants. All sharps should be disposed of immediately after use. Sharps containers must be disposed of prior to reaching their designated fill line and avoid overfilling.
- ☐ **7.** Verify that used pipettes and pipette tips that have contacted biohazardous materials are stored in a labeled rigid lined container then added to the biohazard waste container once full or put directly into the biohazard waste container. Pipettes and tips used with non-hazardous materials should be placed in a box with a clear bag liner and discarded as standard lab trash. Ensure all containers are appropriately sized to fully contain their contents without items extending beyond the container. Additionally, make sure no contaminated glassware or tip waste is disposed of in any general waste or broken glass containers.
- ☐ **8.** Maintain readily accessible autoclave operations manuals and quality assurance logs. Ensure all personnel using the autoclave are trained and authorized. For sterilization/disinfection applications, verify autoclave functionality at least quarterly using biological indicators and maintain corresponding records.
- ☐ **9.** Non-infectious liquid waste intended for sink disposal must be sterilized/disinfected before disposal. This can be achieved either chemically (using a 10% bleach solution by volume) or by autoclaving for

at least 60 minutes. Ensure all bleach solutions are prepared fresh and disposed of frequently to ensure proper disinfection. Infectious waste, regardless of sterilization method, must always be disposed of via the bio-waste stream.

☐ **10.** Verify that biohazard spill cleanup kits are available, and all personnel are trained in emergency biohazard spill procedures.

Chemical Storage and Use Standards

☐ **1.** Make sure all chemical containers are clearly labeled in accordance with the OSHA Hazard Communications standard (contents ID in English, any hazard info, and concentrations if applicable). Containers should also be maintained and inspected regularly to ensure good condition (no leaks, cracks, or other damage). Additionally make sure all chemical containers are fully sealed when in storage.

☐ **2.** Ensure all chemicals are stored in designated cabinets or shelving away from power supplies, heat sources, or direct sunlight and within safe reach. Explosion proof refrigerators should also be used when applicable and -80 freezers should be maintained in accordance to manufacturer specifications.

☐ **3.** Verify that chemical stock quantities do exceed the flammable load set by the NFPA Fire Codes, and old or unused chemicals are routinely checked and disposed of and chemical inventory is consistently kept up to date.

☐ **4.** Make sure that all lab members are up to date on training in how to respond to chemical spills and are aware of the location of the chemical spill kits. Any chemical spills or residues need to be responded to and cleaned up promptly.

☐ **5.** Verify that any incompatible chemicals are stored separately (acids, bases, organic acids, oxidizing acids) and separate chemicals of concern (highly hazardous, carcinogenic, mutagenic, teratogenic, etc.). Additionally confirm that all pyrophoric, shock sensitive, temperature sensitive, and water reactive chemicals are stored in accordance to Safety Data Sheet specifications.

☐ **6.** Ensure all Safety Data Sheets (SDS) are available and updated, and all lab members know of their location. Signage indicating the SDS location should also be posted. Additionally make sure all lab members are trained in and aware of any hazardous agents in the lab and are aware of any symptoms associated with them.

☐ **7.** If mercury is present in the lab, ensure a spill kit is available, and all personnel are trained to respond to a mercury spill. If possible, replace mercury containing equipment with non-mercury containing equipment.

☐ **8.** Ensure safety procedures, in accordance to SDS specifications, are in place when handling Hydrofluoric acid, Picric acid, Perchloric acid, and any peroxide-forming chemicals in the laboratory. Picric acid, Perchloric acid, and peroxide formers must be labeled with the date upon receipt and tested every three to six months, as well as before each use. Additionally, if Formaldehyde is used in the lab, respective spill kits must be available, and personnel training must be kept up to date.

- ☐ **9.** If Nanomaterials are used in the lab, ensure all safety protocols and procedures in accordance to Hazard Communication specifications are in place for all use and disposal.
- ☐ **10.** Ensure all flammable liquids are stored in rated flammable cabinets. Flammable cabinets should always be closed and not have combustibles (paper, cardboard, wood) stored in or around them. Flammables should also be stored away from any oxidizers or ignition sources.
- ☐ **11.** Flammable liquids that require cold storage should be stored in refrigerators designed for flammable or explosion proof storage and never in a cold room.
- ☐ **12.** Verify that flammable and combustible materials are kept within the allowable limits for the laboratory space. Flammable liquids exceeding one gallon must be stored in approved safety canisters to ensure compliance and reduce fire risks.
- ☐ **13.** If non-ionizing radiation is used in the lab, make sure all personnel are trained in the safe handling and hazards of non-ionizing radiation emitting equipment. Additionally, all doors and equipment should be clearly labeled indicating presence of non-ionizing radiation.

Chemical Waste Standards

- ☐ **1.** Confirm all chemical waste is stored in accordance with EH&S advisory 7.3 and containers are well-maintained and clearly labeled (with chemical names and concentrations as well as hazards and dates) and make sure to deface any previous labels that are on the container. Waste containers should be kept closed when not in use. Once chemical waste receptacles are full, schedule for them to be picked up within three days.
- ☐ **2.** Ensure that Satellite Accumulation Areas (SAA's) are clearly labeled and only contain chemical waste that is consolidated and stored in additional secondary containments. SAAs should also be kept clean and free of any spill residues.
- ☐ **3.** Verify that incompatible wastes are segregated, and acutely hazardous wastes do not exceed 1qt in the SAA. Once waste receptacles are full contact EH&S for pickup within three days.
- ☐ **4.** Make sure that waste collection containers that are collecting waste via instrumentation are equipped with filling/venting caps or caps with holes drilled into them to secure the tubing and prevent spillage.
- ☐ **5.** Verify that pipettes and pipette tips that are used with hazardous chemicals are disposed of as in a rigid box with a bag liner, that is labeled as hazardous waste then disposed of through chemical waste channels. Pipettes and tips used with non-hazardous materials should be placed in a box with a clear bag liner and discarded as standard lab trash. Ensure all containers are appropriately sized to fully contain their contents without items extending beyond the container.
- ☐ **6.** Check that no improper disposal of hazardous waste is occurring i.e. sink disposal of non-designated chemicals or chemical disposal in general waste. This includes any contaminated glass or plastic ware.
- ☐ **7.** If any shipping of dangerous goods (hazardous chemicals or biologics) is occurring, ensure that the relevant personnel are up to date on DOT/IATA training.

General Laboratory / Workshop Safety

- ☐ **1.** Make sure that the Chemical Hygiene Plan (CHP) and Standard Operating Procedures (SOP) are available, updated, approved, and include the Chemical Hygiene Officer (CHO) information. The CHO and all personnel should be trained in the details of the CHP.
- ☐ **2.** Confirm that all entry doors into labs and workshops have the proper posted safety signage in compliance with EH&S universal signage program and spaces remain secure to prevent unauthorized entry.
- ☐ **3.** Verify that all personnel have received the required trainings pertaining to their work (i.e. OSHA Hazard Communication, EPA Hazardous Waste, OSHA Bloodborne Pathogens, Compressed gases, and any other advanced laboratory training pertaining to their work). Additionally make sure that all personnel are consistently up to date with the required refreshers of these trainings.
- ☐ **4.** Ensure centrifuges are guarded and interlocked, manuals and logbooks are kept and available, and all mechanical components are routinely inspected to guarantee good working condition. Additionally, make sure all personnel are trained in the usage, safety, and upkeep of centrifuges.
- ☐ **5.** Confirm that autoclaves are regularly inspected and logged, and all personnel are trained in the use of autoclaves.
- ☐ **6.** When Gel Electrophoresis (GE) work is occurring in the lab make sure the work is conducted in a functioning fume hood and all switches, cords, and connecting leads are in good condition. Additionally make sure all users are trained in GE work.
- ☐ **7.** Verify that all lab equipment is in good working condition and routinely checked for any needed maintenance.
- ☐ **8.** Ensure Bunsen Burners are in good condition and avoid usage around flammable or combustible materials.
- ☐ **9.** Guarantee food, drink, cosmetics, or medications are not used, consumed, or stored in the lab. If food, drink, cosmetics, or medications are needed for research be sure to label them with ‘For Research Purposes Only’. This includes baking soda, water originally intended for human consumption, Nair, and cooking oils.
- ☐ **10.** Ensure proper use of laboratory fume hoods by keeping the sash at or below the posted height or breathing zone during work and closing it when not in use. Maintain clean work surfaces and minimize clutter and storage within the fume hood. Additionally, using power strips inside the fume hood is not permissible.
- ☐ **11.** Check that the components of the fume hood such as the exhaust fans and alarm systems are functioning properly. If issues occur, contact Facilities Management or EH&S.
- ☐ **12.** All hazardous materials should be used in a functional fume hood appropriate for the specific hazard.
- ☐ **13.** Ensure that all eyewash stations and safety showers remain unobstructed, accessible, and marked with clear signage. Check that eyewash solution bottles are not expired and confirm that all personnel are fully trained in their use.

- ☐ **14.** Confirm that the laboratory is always in satisfactory sanitary condition with main corridors, bench tops, and floors free from excess clutter and all surfaces facilitate easy cleaning. Also make sure there is no evidence of vermin.
- ☐ **15.** Ensure any broken glass is promptly cleaned up and disposed of and once any glass disposal boxes are full, they are disposed of. Contact UC Housekeeping for any general waste disposal.
- ☐ **16.** Make sure soap and paper towels are available at all handwashing sinks and all personnel wash their hands at appropriate times.
- ☐ **17.** Verify that cold and/or warm rooms are free of long-term storage of cardboard, paper products, and/or Styrofoam. Storage rooms are to be kept in satisfactory sanitary condition.
- ☐ **18.** Ensure that all personnel are trained in handling hazardous or infectious agents and have received the necessary immunizations if needed. Verify that these hazards are documented in the CHP and that a medical surveillance program is established and maintained.

General Workplace Safety

- ☐ **1.** Maintain 36-inches of clear egress space in front of all electrical panels.
- ☐ **2.** Ensure all electrical cords are in good condition and extension cords are only used temporarily.
- ☐ **3.** Confirm all electrical equipment is sufficiently grounded.
- ☐ **4.** Ensure current evacuation plans are in place and primary and secondary evacuation monitors have attended evacuation monitor training.
- ☐ **5.** Make sure entry door signage is posted in accordance with EH&S universal signage program including updated emergency contact information. Site maps should also be posted.
- ☐ **6.** Ensure that ergonomic risk factors are minimized by utilizing ergonomically designed equipment and addressing any ergonomic stressors in the workspace.
- ☐ **7.** Verify that any trip, slip, and/or falling object hazards are not present and sufficient lighting is present.
- ☐ **8.** Ensure that fire extinguishers are available, appropriately classified for the space, inspected annually, and that all personnel are trained in their use.
- ☐ **9.** Ensure all main corridors are kept free of storage and obstructions and a clear 36-inch path of egress is maintained in all walking paths.
- ☐ **10.** Guarantee that no fire doors are being propped open and any line of sight through door windows is maintained, unless complete darkness is required for work.
- ☐ **11.** Ensure fire alarm pulls, strobe lights, and fire suppression systems are not obstructed.

Laser Safety

- ☐ **1.** Ensure a Laser Safety Program is in place and updated when class III lasers are in use and all personnel are up to date on training in the use of lasers.
- ☐ **2.** Verify that signage is posted on the outside of all entrances and indication lights are in place and used when laser is actively in use.
- ☐ **3.** Confirm that safety precautions in accordance with SOP's are available and in place such as window shrouds and protective eyewear.

Personal Protective Equipment Standards

- ☐ **1.** Guarantee disposable gloves are disposed of after a single use and reusage is avoided.
- ☐ **2.** Ensure that appropriate laboratory attire and PPE is worn and available in accordance with the hazards present in the space and all PPE is maintained and in good condition with no damage. Additionally confirm that all personnel are up to date with their task specific PPE training.
- ☐ **3.** Ensure that all individuals using respirators are medically cleared, fit-tested, and up to date on their training. Additionally, ensure respirators are regularly inspected and maintained in accordance to manufacturer specification.

Storage and Use of Compressed Gases Standards

- ☐ **1.** Ensure all compressed gas cylinders are labeled and secured properly – a single cylinder requires one sturdy mount with chain/strap on the upper 1/3 of the cylinder. Corralled cylinders (up to 5) require two sturdy mounts with chain/strap, one on the upper 1/3rd and one on the lower 2/3rd of the cylinder – and all cylinders are equipped with safety pressure relief valves or protective caps. Empty and full cylinders should also be stored separately. Compressed gas cylinders should also be stored in a well-ventilated area away from heavy traffic and spark producing materials.
- ☐ **2.** Check that all personnel are trained in accordance with OSHA standards in handling and transporting compressed gas cylinders.
- ☐ **3.** Confirm that flammable compressed gases are stored away from any ignition sources and/or oxidizers and always equipped with flashback arrestor.
- ☐ **4.** Verify that when gases that pose an asphyxiation and/or other inhalation hazard are present detection monitors are in use in the area (i.e. CO detector, oxygen sensor, or other gas detection alarm) and are fully operational.
- ☐ **5.** Make sure monthly inspections are conducted on gas cylinders to ensure no damage and/or excess rust has occurred.