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?

ADVISORY NO. 8.2: LABORATORY AUDITS
Appendix A CHECKLIST

GENERAL LAB INSPECTION CHECKLIST

Additional pages can be attached for site specific information. If you have questions or suggestions regarding the content of this survey, please contact Jan Utrecht, Environmental Health and Safety at 556-4968

Company/Principal Investigator: _____ Dept:_____

Building: _____ Room: _____

Lab Contact: _____

Work Phone: _____ Home Phone: _____

Completed by: _____

Date: _____

SAFETY PROGRAM ADMINISTRATION

1) Chemical Hygiene Plan

- Do all research labs have an up to date Chemical Hygiene Plan?
- Is a documented program evaluation performed at least annually? By whom?
- Are there any operations or activities which require prior approval before performing?
- Does each dept./center have a designated Chemical Hygiene Officer (CHO) or committee? Who?
- Is the CHO familiar with his/her duties?

2) Standard Operating Procedures (SOPs)

- Are there written SOPs covering the basic laboratory safety and hygiene practices?
- Is there an adequate procedure for identifying particularly hazardous substances used in the lab? Do they have their own written procedures?
- Is all work with radioactive materials authorized through the a predefined process approved by the Radiation Safety Committee/RSO
- Is all radiation producing equipment (x-ray machines, accelerators, etc.) identified and know by the RSO?
- Are all Class 3b and 4 lasers identified and know to the RSO or other responsible party?

3) Training of Laboratory Personnel

- Supervisor/PI has a specialized written training plan for his lab.
- Training is current for Chemical Hygiene Plan and Hazard Communication Standard.
- Training is complete for hazardous waste management.
- All laser workers have received training?
- All radiation workers have received training?
- Training is complete for bloodborne pathogens use.
- The training is documented.

HAZARDOUS MATERIALS

4) Labeling

- The laboratory doors are properly labeled with emergency notification, the hazards present (BL, lasers, radiation) and the NFPA 704M Diamond as well as any necessary precautions.
- The labels are not removed from incoming chemical containers.
- Containers of stock solutions properly identified (e.g., buffers labeled and marked only with the word "BUFFER").
- Small containers are labeled with the full chemical name, main hazard(s), and main precautionary information.
- Synthesized, unnamed chemicals labeled by their reactants and possible products (or by a useful generic description) and with their probable hazards.
- Containers of non-hazardous substances (e.g., water) labeled explicitly to avoid confusion.

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

5) Control

- Chemicals are not stored on laboratory benches in excessive quantities.
- Expired or out of use chemicals are disposed of as hazardous waste.
- Area for carcinogen use should be labeled.
- Secondary containment provided for liquid chemicals.
- No hazardous materials are stored next to or above sinks.
- Incompatible chemicals (including solids) segregated by compatible storage groups.
- All chemical containers closed, except when actively adding or removing materials from them (i.e., no funnels left in containers).
- Containers of peroxide-forming chemicals are dated upon receipt and disposed of when six-month shelf life is exceeded.
- Material Safety Data Sheets (MSDSs) and laboratory chemical inventory list are readily available.

Y	N	N/A	COMMENTS/DATE CORRECTED

6) Flammable/Combustible Liquids

- What is the quantity of class 1A liquids?
- If there are more than 10 gallons of flammable liquids, does the lab. have the necessary fire permits?
- How many flammable liquid storage cabinets are in the room and what is the capacity of each?
- Storage cabinets do not exceed maximum capacity.
- Flammable liquids (including flammable liquid wastes) are not stored outside of a storage cabinet in excess of 10 gallons.
- No flammable liquid storage cabinets are in the hallways.
- Flammables are not dispensed from gravity-fed or bottom-dispensing containers—use lid-mounted pumps (including <5% Ethanol solutions).
- Flammables are not stored in combustible containers.
- Ether and other highly-flammable liquids are used away from sources of heat and ignition (including Bunsen burners in hoods and gas water heaters).

Y	N	N/A	COMMENTS/DATE CORRECTED

7) Particularly Hazardous Substances

- Have all particularly hazardous substances been identified?
- Are areas or hoods where these substances are in use posted with a designated area sign?
- Have special procedures for these substances been identified?
- Are special procedures in practice?
- Are the users adequately trained?

Y	N	N/A	COMMENTS/DATE CORRECTED

8) Radioactive Materials

- All uses of radioactive material are authorized through the RSO?
- Stock materials of radioactive materials are secured against unauthorized removal? Refrigerator locked? Etc.
- Do personnel wear lab coats and radiation dosimeters when handling material?

- Are all labs using radioactive materials known to the and registered with the RSO?

CHEMICAL WASTE

9) Storage

- Have all chemical wastes been identified as non-hazardous or hazardous?
- Specific storage containers provided for (check applicable categories): q chemical waste q recyclable solvents q sharps q radioactive waste
- All hazardous chemical waste is arranged for picked up by _____, not drain disposed or evaporated.
- All hazardous chemical waste is secondarily contained.
- Solutions with heavy metals are disposed of as hazardous waste.
- The satellite hazardous waste accumulation storage area is clearly labeled.
- The 90-day hazardous waste accumulation is marked and has a hazardous waste sign.
- The hazardous waste training record is posted.
- Pickup is arranged before container becomes full.
- Waste containers are sturdy, routinely inspected for leaks, compatible with the waste, and kept closed using screw caps.
- Waste is segregated by compatible storage group.
- Waste storage rooms are on the same floor of the building and are under the control of the same lab supervisor/PI as the room where the wastes were generated.
- Are there any non-hazardous chemicals or compounds that are drain disposed? If so, what are they?

10) Labeling

- All hazardous chemical waste containers have waste tags with the waste's hazardous properties and full chemical names (or a list of full names and percentages when waste mixtures are involved).
- In the satellite accumulation areas the waste tags do not have the dates. There must be a date on the container when accumulation began
- In the 90-day areas the red tags have the date from when the container was full.
- Synthesized, unnamed chemical wastes are labeled by their reactants and possible products (or by useful generic description) and with their probable hazards.

RADIOACTIVE WASTE

11) Storage

- Are the radioactive waste streams segregated into appropriate containers?
- Are the inventory cards on the containers complete?
- Has pick-up of full containers been requested of RPO?
- Is there a decay in place policy in the lab? For what isotopes?

Y	N	N/A	COMMENTS/DATE CORRECTED
Y	N	N/A	COMMENTS/DATE CORRECTED
Y	N	N/A	COMMENTS/DATE CORRECTED

BIOHAZARDOUS WASTE

12) Storage

- Solid biohazardous waste is bagged in 3 mil polyethylene bags.
- Biohazardous liquid waste is either chemically treated with disinfectant as generated or treated right afterwards or autoclaved. Biohazardous liquid waste is not stored.
- All waste is properly tagged with tags from the Biosafety Office.

13) Labeling

- Tags filled out with the date, name of the waste generator, name of the waste processor, and treatment method.

14) Treatment

- Written notebook log kept for autoclaved waste.
- Log of autoclave validation runs includes date, time, duration of run, pressure, temperature, and number of ampoules included in waste treatment validation run.
- Copy of log readily available.
- Ampoule(s) analyzed/read by _____
- The results of the ampoules' test are then entered in the autoclave validation run notebook.
- Animal carcasses are properly bagged and labeled before placing them in freezers.
- Non-hazardous animal bedding is double bagged and disposed into building dumpster.
- Biohazardous animal bedding is bagged, autoclaved (when necessary), boxed (cardboard), and shipped to _____ for incinerator.
- **All** infected/contaminated sharps are placed in red plastic sharps containers.
- When the sharps container is ¾ full it must be autoclaved, sealed shut, and placed in cardboard box.
- Box is sealed and labeled with a "sharps' tag" filled out and placed on box for removal by custodians.
- All work surfaces are cleaned with a disinfectant solution that is active against the organisms in use.

PERSONAL HEALTH AND SAFETY

15) Food and Drink

- Food and drink should not be in the laboratory.
- Food and drink stored only in refrigerator or freezer dedicated/labeled for food.

16) Hygiene

- Employees wash areas of exposed skin before leaving laboratory.
- Hands must be washed after removing gloves and before leaving laboratory.
- Hands must be kept away from face while working in the laboratory areas. No cosmetic applications, taking pills, touching eyes, nose, and mouth.

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

HEALTH AND SAFETY EQUIPMENT

17) Safety Showers and Eye Washes

- Approved safety showers and eyewashes provided within the work area for immediate use (within 10'-75' of exposure depending on chemicals ANSI).
- All eye washes and showers have unobstructed access.
- Units inspected periodically for proper functioning (tag?): Eyewashes weekly and safety showers monthly.
- There is a sign indicating emergency safety showers and eyewashes.

18) Personal Protective Equipment (PPE)

- Has the correct PPE been selected based on a hazard analysis or standard operating procedure?
- PPE required for lab work: □ Hearing protection □ Face shields □ Lab coats □ Aprons □ No open-toed footwear □ Gloves □ PPE for radiological work □ Safety glasses/goggles with side shields
- All necessary equipment is available and properly used.

19) Laboratory Fume Hoods

- Storage within the hood is minimized.
- Equipment is elevated off the floor of the hood.
- All work is done at least 6 inches inside the hood.
- Front sash is lowered below chin when hood is in use.
- Certified/checked for adequate exhaust within the last year (label on hood?).
- Hood has continuous flow monitor.
- The bottom ventilation slot is open at least 2 inches.
- Hazardous materials are protected from entering the drains.

20) Biological Safety Cabinets (e.g., Laminar Flow Hoods)

- Certified within last year (check sticker on front or side).
- Proper type for work being conducted (Contact EH&S).
- The equipment is properly labeled for the hazards present (radiation, UV light, among others).
- The exhaust air is ducted _____ .

21) Compressed Gas Cylinder Safety

- Cylinders stored in well protected, well-vented, and dry locations away from highly combustible materials.
- Storage space will not be damaged by passing or falling objects or subject to tampering by unauthorized persons.
- Cylinders secured to a rigid structural component of the building with chains at 2/3 of each cylinder's height.
- Protective caps in place while cylinders are not in use.
- Proper regulators are being used.

22) Air Pollution Control Equipment

- Is there any air pollution control equipment (vapor recovery systems, cyclones, scrubbers, baghouses, electrostatic precipitators) in the lab?
- If so, are they maintained and maintenance records kept?

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

- Are there any sources of air emissions other than chemical use in the fume hoods?

23) Housekeeping and Miscellaneous Laboratory Safety

- Bench tops clean and organized and environs maintained to eliminate harmful exposures or unsafe conditions.
- Areas under sinks, window ledges, walls, and floors kept orderly.
- Vacuum lines equipped with traps designed specifically to accumulate/filter the hazardous materials being evacuated.
- All moving machinery (e.g., vacuum pumps) belts adequately protected by a rigid belt-guard or housing.
- Sharps properly disposed of.
- The condition of the broken glass box is adequate and placed out of harm's way.

24) Electrical Safety

- High voltage equipment (> 600V) labeled, grounded, and insulated.
- No equipment has frayed electrical cords.
- Extension cords are 3 pronged only and not used as permanent wiring.
- Extension cords and power strips are not chained together.
- Multiple adapters used only if they are equipped with circuit breakers.
- Apparati are grounded via 3-prong plugs.
- Plug covers are not loose.
- Hot plates and heaters are out of harm's way.

25) Basic Safety

- Chemical shelves have lips or other restraints.
- Cabinets and bookshelves are secured to walls.
- Overhead storage is minimized and restrained from falling.
- Heavy equipment (computers, HPLCs) are braced.

26) Respiratory Protection

- Use of respiratory protection conforms to 1998 OSHA guidelines. (see 29CFR1910.134)
- SCBAs inspected monthly.
- The users of respirators are fit-tested.
- Voluntary use respirators are in use?
- If air purifiying negative pressure respirators are used, has a change-out schedule been developed?
- The cartridge is changed appropriately.

27) Exposure Monitoring

- Has air sampling been performed where overexposure may occur?
- Are the air sampling data readily available?
- Is sampling repeated periodically when the action level is exceeded?
- Is medical consultation available to those routinely exposed in excess of the action level or permissible exposure limit or to those exposed during a spill or event?

Y	N	N/A	COMMENTS/DATE CORRECTED
Y	N	N/A	COMMENTS/DATE CORRECTED
Y	N	N/A	COMMENTS/DATE CORRECTED
Y	N	N/A	COMMENTS/DATE CORRECTED
Y	N	N/A	COMMENTS/DATE CORRECTED

Laser Safety

- Does the lab use any Class 3b or 4 lasers?
- Are the lasers registered with Radiation Safety Officer of other responsible party?
- Are the Standard Operating Systems for each laser posted?
- Are appropriate warning signs and labels posted?
- Does the lab entrance have a warning light or lighted sign?
- Have all laser workers been trained by RPO?
- Have all laser workers had a baseline eye exam at University Health Services?
- Does the lab have appropriate laser eyewear and has this been verified by RPO?

28) Non-Ionizing Radiation (NIR) Sources

- Does the lab use any NIR sources (radar, heat sealers, strong magnets, radio frequency, plasma etcher/sputter, induction heaters, ion implanters)?
- Have these sources been registered with the RSO?
- Have proper warning signs been posted?

29) Emergency Planning and Procedures

- "In Case of Emergency" or "Emergency Instructions" visibly posted and current.
- Disaster and fire prevention plans available to lab occupants.
- Chemical spill kit/cleanup materials provided (if required by department plan).
- Training in spill clean-up procedures provided and documented (only if spill cleanup materials are provided).
- First Aid materials kept in adequate supply (in a sanitary and usable condition) and made readily available.

30) Fire Prevention

- Appropriate fire extinguisher mounted, unobstructed, available within 75 feet, in working order and inspected within the last year—check tag on extinguisher.
- Fire extinguisher sign is visible.
- Fire blankets labeled and unobstructed.
- 18 inch vertical clearance maintained from sprinkler heads (e.g., over shelves).
- Are lab doors kept closed?
- Storage of combustible material is minimized.

31) Exits and Width of Exits

- Exits and aisles are clear and free of obstructions in case of emergency.
- Exit signs readily visible.
- Width of exit aisles and pathways not less than 44 inches.
- No storage in exit corridors.

Y	N	N/A	COMMENTS/DATE CORRECTED
Y	N	N/A	COMMENTS/DATE CORRECTED
Y	N	N/A	COMMENTS/DATE CORRECTED
Y	N	N/A	COMMENTS/DATE CORRECTED

32) Specific Laboratory Procedures and Equipment

- Does the lab use Polymerase Chain Reaction (PCR)
- What chemicals are used for the DNA extraction?
- What type of gels are used in Gel Electrophoresis?
- Do you order dry bulk acrylamide?
- Where to you make the gels, e.g., benchtop, hood etc.?
- Is Ultraviolet light used in the procedures?
- Are PPE and shielding of UV source in place
- Are radioactive chemicals used?
- Do you perform scintillation counting? What chemicals are used in the scintillation vials?

Pipetting

- Are hand pipettes used?
- Are electric pipettes used?
- Have sharp edges (if any) on the pipettes been covered to prevent contact?
- Is pipetting performed more than 2 hours per day.

Dissection and micromanipulation

- Is dissection or micromanipulation using forceps performed? For how long, on average, each day
- Is a microtome used?
- Does the microtome require excessive force or unusual wrist angle to operate?

Centrifuges

- Are centrifuges used? If yes, have the rotors ever been replaced or repaired? Who performed the repair?
- Are ultra centrifuges used? If yes, are they located in a separate shielded room?
- Have the rotors on the ultra centrifuge ever been repaired, replaced or modified? By whom?
- Do the centrifuges have safety interlocks to prevent opening while spinning
- Are the centrifuges clean and apparently spill free? If there appears have been a spill, what was it and how often?
- Are the operating directions and limitations of the centrifuge readily available?

Tissue Culture

- Does tissue culture involving human cell lines occur in the lab?
- What biosafety level has the lab been designated?
- If tissue staining is performed, do any of the stains contain mercury?
- How are the waste staining solutions disposed of?

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED

Y	N	N/A	COMMENTS/DATE CORRECTED