



HNEI Lab Safety Walkthrough

Primer for the development and documentation of safe working practices in HNEI laboratories

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1. REVISION

This document contains information that are subject to change without notice. Use latest revision!

Revision	Changes	Contributor	Date
0.1	Pre Release	HNEI Safety Committee	May 25, 2016
0.2	1. In 'Hazard Identification' section replaced UCLA LHAT w/ UCSD LHAT template link as this is more comprehensive version 2. Added link to UCLA standard job safety analysis templates in 'OSHA/HIOSH Jobs hazard Section' as a reference/starting point	HNEI Safety Committee	June 3, 2016
0.3	1. Battery risk mitigation paper (Ashtiani 2008) added to Risk Mitigation section.	HNEI Safety Committee	June 6, 2016
0.4	1. Updated Appendix A with chemical inventory and training attendance confirmation, minor formatting changes. 2. Added reference to OSHA's laboratory standard to Section 5 in the Important Guidelines section	HNEI Safety Committee	June 30, 2016

2. FOREWORD

(Excerpted and edited from UH Departmental Health and Safety Guide, May 2015)

It is the policy of the University to provide for and maintain, through implementation of safety and health programs, conditions and practices that will provide safe and healthful campus environments. It is also the responsibility of each individual to comply with established health and safety regulations and procedures and to take every precaution necessary to prevent injury to themselves and to others. This policy is included in the University of Hawaii System-wide Administrative Procedures Manual, A9.750 University of Hawaii Health and Safety Program.

The [Departmental Health and Safety Guide](#) provides an overview of campus resources, regulatory requirements and recommended safe working practices which must be integrated into an effective departmental safety program. All HNEI lab staff must review this document as this defines the University of Hawaii administrative expectations of an effective safety program at the departmental level. As noted, this guide applies to the general work environments and not specific worksites such as laboratories, maintenance shops, animal care facilities and marine facilities. Each of these specific sites must have their own safety procedures or manuals applicable to the activities at that site, including but not limited to Chemical Hygiene Plan, respiratory protection, hazardous materials, etc.

3. PURPOSE

The purpose of this document, the HNEI Lab Safety Walkthrough, is to assist principal investigators, supervisors, employees, students and all other lab personnel to identify and comply with the available safety resources, required training, and documentation required for safe operation of HNEI on-campus and off-campus laboratories and facilities. This document will be updated regularly but is not-inclusive of all UH Policies. It is intended to guide laboratory PIs' through the University of Hawaii Environmental Health and Safety Office (EHSO) programs for the development and documentation of safe working practices and compliance with local, state, and federal regulations. As such, this document also identifies and uses resources beyond the EHSO website. These are intended as guides for all responsible parties. If a conflict exists, EHSO and University of Hawaii policies will apply.

[Section 4](#) provides the primary responsibilities of HNEI personnel for developing and maintaining HNEI's department level safety program. The remainder of the document, Sections 5-8, is in the form of a checklist intended to walk the reader through the wide collection of applicable regulations (e.g. EHSO, UH, HIOSH, OSHA) and useful resources to make our workplace a safer place. The checklist establishes a recommended workflow in the following order:

- [Section 5](#) Establish Lab Safety and Regulatory Compliance
 - Conduct a hazard analysis using the recommended methodology
 - Identify and implement the relevant training programs as a result of the hazard analysis
 - Identify, implement and display the personal protective equipment (PPE) requirements as a result of the hazard analysis
 - Identify and write the necessary Standard Operating Procedures (SOP) as a result of the hazard analyses
 - Conduct a review of your hazard analyses assisted by colleagues
- [Section 6](#) Maintain Lab Safety and Regulatory Compliance
 - Comply with EHSO general lab safety guidelines
 - Comply with outside agencies specific lab safety guidelines
 - Comply with chemical storage guidelines
 - Implement proper waste management program
 - Recognize change and review your hazard analyses and risk assessment accordingly
- [Section 7](#) Establish Emergency and Incident Reporting Procedures
 - Establish emergency procedures for the laboratory
 - Fill out and send near-miss/ accident/ injury report form
- [Section 8](#) Prepare for Departure from HNEI
 - Fill out and send chemical user closeout form
 - Fill out and send laboratory decommissioning form

4. RESPONSIBILITIES

Director: Responsible for establishing and maintaining programs in their area which will provide a safe and healthy work and living environment. Specific activities include:

- Designate Departmental Safety Coordinator for HNEI
- Meet with new hires to discuss expectations of safety in the workplace

Departmental Safety Coordinator: Serves as liaison with EHSO and other service organizations to assist departmental personnel in developing and maintaining the safety program. Specific activities include:

- Collect and archive safety documents generated by HNEI laboratory personnel
- Send reminders to PI's and Supervisors for periodic updating of compliance documentation
- Update Director on status of individual lab documentation and record keeping

Principal Investigators/Supervisors (PI/SP): Responsible for compliance with UH safety policy as it relates to operations under their control. Specific areas of responsibility include employee safety training, identification and elimination of hazardous conditions and recordkeeping. Signed copies documenting completion of each action are to be submitted to Departmental Safety Coordinator in a timely manner. At a minimum this is to include documents listed in Appendix A. Specific responsibilities include:

- Conduct/coordinate quantitative Hazard Assessment of all laboratory activities according to [Section 5](#)
- Write Standard Operating Procedures (SOP) for identified hazards and train lab staff on it
- Bundle SOPs, Chemical Hygiene Plan (CHP), Chemical Inventory, and Safety Data Sheets (SDS) at the entrance of the laboratory
- Post Personal Protective Equipment (PPE) signage and provide necessary PPE with training for all personnel
- Schedule and perform Hazard Assessment Review of all of the above with at least 3 colleagues (non-students) from other teams or outside agencies
- Review and update every 6 months
- Make yourself available as a Hazard Assessment Reviewer for other laboratories at least twice a year
- Provide all existing personnel and new hires with copies of SOP, CHP, SDS bundles and this HNEI safety walkthrough checklist
- Complete EHSO's laboratory personnel safety checklist with all personnel every 6 months
- Address the safety concerns pointed out by lab staff and reviewers without delay
- Make sure near-miss/accident/injury forms are filled out and forward to EHSO and Departmental Safety Coordinator
- Forward EHSO lab inspection reports to HNEI Safety Coordinator within 48hrs of receipt
- Complete the laboratory decommissioning form at least 15 days prior to vacating laboratory spaces

Lab Staff (incl. PI and SP): Each individual is responsible for following procedures and guidelines provided by their supervisor/instructor as well as identifying hazardous conditions in the workplace. Staff must schedule and attend training sessions and understand all applicable safety requirements. Individuals will be asked to sign their copy of EHSO's laboratory personnel safety checklist to indicate that they have reviewed and understand all applicable safety requirements and procedures and must not do so until they are fully understood. Individuals are responsible for asking questions about unknown or hazardous situations, substances or procedures. Specific responsibilities include:

- Meet with the Director upon arrival to discuss expectations of safety in the workplace
- Schedule initial EHSO lab safety training course within 15 days of arrival
- Attend EHSO lab safety training prior to participating in any experimental work
- Identify and attend additional training as specified by the PI (e.g. SOPs).
- Follow oral and written procedures and guidelines provided by their supervisor/instructor
- Obey PPE requirements at all times.
- Bring up safety concerns that haven't been handled by your PI in a satisfactory fashion
- Update and maintain chemical and hazardous waste inventory
- Submit EHSO's accident, near miss, and incident reporting forms to the PI within 24 hrs
- Complete the chemical user closeout form 15 days prior to leaving the University.

5. ESTABLISH LAB SAFETY AND REGULATORY COMPLIANCE

RESOURCES FOR PERFORMING HAZARDS ANALYSES	OSHA/HIOSH JOBS HAZARD	<ul style="list-style-type: none"> State and Federal Laws require employers to conduct Jobs Hazard Analysis as part of a workplace safety program so employers can analyze jobs and recognize hazards that must be communicated to the employees. OSHA Publication 3071: Job Hazard Analysis explains what a job hazard analysis is and offers guidelines to help you conduct a step-by-step analysis. EHSO a sample documentation template as well a sample format from HIOSH. For more complex tasks typical of a research environment, we recommend the ACS document below as guidance and we provide a recommended approach to conducting the hazard analysis for your lab. UCLA provides a template library of Job Hazard Analyses for standard/general workplace which can be used as a starting point. 	<input type="checkbox"/>
	HAZARDS IN RESEARCH LABORATORY	<ul style="list-style-type: none"> All employees must review the American Chemical Society's Guideline "Identifying and Evaluating Hazards in Research Laboratories". A recommended approach based on this guideline is provided below. Additional resources on more specific hazard analysis techniques may be found in the Guidelines for Hazard Evaluation Procedures (3rd Edition), AIChE Center for Chemical Process Safety, 2008 and in the OSHA/ Code of Federal Regulations 1910.110 Process Safety Management for Highly Hazardous Chemicals. 	<input type="checkbox"/>
IMPORTANT GUIDELINES AND POLICIES	OSHA LABORATORY STANDARD GUIDE	<ul style="list-style-type: none"> In 1990, OSHA issued the Occupational Exposure to Hazardous Chemicals in Laboratories standard (29 CFR 1910.1450). Commonly known as the "Laboratory Standard", it was developed to address workplaces where relatively small quantities of hazardous chemicals are used on a non-production basis. The laboratory standard consists of five major elements: 1. Hazard identification; 2. Chemical Hygiene Plan; 3. Information and training; 4. Exposure monitoring; and 5. Medical consultation and examinations. All employees must review the Laboratory Standard Guide (OSHA 3404-11R 2011). 	<input type="checkbox"/>
	PPE POLICY	<ul style="list-style-type: none"> Personal Protective Equipment (PPE) identification must be an outcome of a hazard assessment. Review the EHSO general guidelines on Personal Protective Equipment (PPE) Requirements. Review the OSHA Handout on PPE and employer/employee responsibilities. Review the Glove Selection Guide when choosing glove types. UCLA's PPE requirements document can also be consulted. Lab staff must add required glove types when entering new chemicals in the inventory. 	<input type="checkbox"/>
	STANDARD OPERATING PROCEDURES (SOP)	<ul style="list-style-type: none"> Standard Operating Procedures (SOP) requirements must be an outcome of a hazard assessment. SOPs are more comprehensive than step by step instructions. Lab staff must review the form fillable SOP template from EHSO to understand the required information in an SOP. Operations posing a special hazard (i.e heating phosphoric acid, working with pyrophorics and other reactive chemicals, carcinogens, using pressurized toxic/flammable/poison gases, conducting electrophoresis, distillations, extractions, etc.) must have completed SOPs and be kept in the CHP binder. A master list of SOPs must be maintained and added to training requirements. UCLA EHSO maintains a library of SOP templates for common chemicals and chemical groups. 	<input type="checkbox"/>

RECOMMENDED HAZARDS ANALYSIS APPROACH ¹		
SCOPE OF WORK	<ul style="list-style-type: none"> • ACTION: Define the scope of work of the hazard analyses and risk assessment analysis and enumerate the items. • REQUIREMENT: All room(s), equipment, materials/chemicals, personnel, contract(s) and task(s) must be covered under at least one scope. • OUTCOME: One or more scope(s) defined. 	<input type="checkbox"/>
HAZARD IDENTIFICATION	<ul style="list-style-type: none"> • ACTION: Conduct a systematic review of potential hazards associated with the items in the scope. Enumerate all physical, health and environmental hazards². • REQUIREMENT: Start with ACS's Table D-1, ACS's Control Banding (Section 8) and UCSD Laboratory Hazard Assessment Tool (LHAT) and UCLA JSA library. Also see Section 4 of NRC's Prudent Practices in the Laboratory, NIOSH Pocket Guide to Chemical Hazards, and the SDS of the materials/chemicals. For the complex tasks/processes not covered by the aforementioned resources, you may define an appropriate evaluation method based on ACS's What-if (Section 10), Job Hazard Analysis (EHSO/HIOSH Requirement) (Section 9) or SOP (Section 12) approaches. • OUTCOME: List of all identified hazards associated with all items in scope. 	<input type="checkbox"/>
RISK EVALUATION	<ul style="list-style-type: none"> • ACTION: Assign a <u>severity</u> for each hazard identified as a result of the previous section. Do not underestimate the severity; consider the worst case. Assign a <u>probability of occurrence</u> for each hazard. Try to obtain objective data, but if it is not available, use a conservative number. • REQUIREMENT: Use a quantitative approach to risk evaluation. Establish a risk rating (grading system) using ACS's "Severity of Consequences with Weighted Scaling" (Appendix B). The use of a different grading system must be justified and approved. • OUTCOME: Product of both is the <u>risk rating</u> for each hazard. 	<input type="checkbox"/>
RISK MITIGATION	<ul style="list-style-type: none"> • ACTION: Devise and implement mitigation schemes to reduce identified risks. Multiple mitigations may be necessary for each risk. Compute a final risk rating based on the initial risk rating and the quantitative effectiveness of the mitigation schemes. • REQUIREMENT: Each mitigation scheme must be assigned a risk reduction factor based on the effect on <u>severity</u> of the consequence and/or the <u>probability of the occurrence</u>. • OUTCOME: Risk assessment document in the form of a spreadsheet of all identified risks and the mitigation schemes put in place (with quantitative analysis as introduced in 2008 Ashtiani's paper). Engineering controls implemented, required PPE identified, provided and notice in place, SOPs printed and made available in the lab 	<input type="checkbox"/>
REVIEW PROCESS	<ul style="list-style-type: none"> • ACTION: Schedule a small committee of HNEI colleagues (3 or more) to tour the facility and review the risk assessment and SOPs with you. An outside expert may be hired for audit. • OUTCOME: If committee identifies gaps in the risk assessment, PI must take recommendations into consideration and revise his risk assessment accordingly and schedule an additional tour once new mitigation schemes are implemented. Committee must notify Departmental Safety Coordinator immediately if PI fails to address recommendations. 	<input type="checkbox"/>

¹ Based on ACS document "Identifying and Evaluating Hazards in Research Laboratories"

² See Global Harmonization System classification or other where applicable

TRAINING PROGRAMS			
TRAINING PROGRAMS	EHSO LAB SAFETY TRAINING	<ul style="list-style-type: none"> • Lab staff must complete the initial lab safety and refresher training as appropriate. 	<input type="checkbox"/>
		<ul style="list-style-type: none"> • The PI or lab manager must complete the Lab Personnel Safety Checklist prior to initiating work and at each refresher training. 	<input type="checkbox"/>
		<ul style="list-style-type: none"> • Lab staff must review the latest version of the UH Manoa Chemical Hygiene Plan (CHP) and ensure a copy is available in the laboratory. 	<input type="checkbox"/>
	HAZARDOUS MATERIALS	<ul style="list-style-type: none"> • Lab staff must review the UH Hazardous Materials Management Program (HMMP) 	<input type="checkbox"/>
		<ul style="list-style-type: none"> • Lab staff must review the UH Hazard Communication Program (HAZCOM). 	<input type="checkbox"/>
		<ul style="list-style-type: none"> • Federal and State regulations as well as the UH HMMP require that all generators of hazardous waste receive mandatory initial training. • Annual refresher training must be completed, available online for on-campus and off-campus labs. 	<input type="checkbox"/>
	RESPIRATORY PROTECTION PROGRAM	<ul style="list-style-type: none"> • Respirators are to be used only when engineering controls (e.g. enclosure or confinement of the operation, ventilation or substitution of less toxic materials) are not feasible, while engineering controls are being installed or repaired or in emergencies. • When respirators are to be used, all requirements of the Respiratory Protection Program shall be met. A fact sheet is also available for a synopsis. • OSHA also provides guidance on information for using respirators when not mandated by any regulation. • Prior to any respiratory use, the Medical Clearance and Respirator Selection Worksheet must be completed as well as a hazard analysis indicating the need for a respirator. 	<input type="checkbox"/>
	ADDITIONAL EHSO TRAINING	<ul style="list-style-type: none"> • Be familiar with the Hearing Conservation Program, Asbestos Management Program, the UH Bloodborne Pathogen Exposure Control Plan for Non-Researchers, and OSHA/EHSO information on Mold in the workplace. 	<input type="checkbox"/>
		<ul style="list-style-type: none"> • EHSO provides additional training beyond lab safety and waste generation. Contact EHSO for additional classes as part of the Workplace Safety Training (Asbestos Awareness, Hazard Communication, Hearing Conservation, and Respiratory Protection, Back Injury and Prevention). • The UH Bloodborne Pathogen Exposure Control refresher training is online through Laulima. Other in-class refresher training must be arranged with EHSO. 	<input type="checkbox"/>
	BIO-SAFETY	<ul style="list-style-type: none"> • The University of Hawaii System has a comprehensive biosafety program throughout the UH campus network, managed by the Office of Research Compliance (ORC). Refer to the ORC for managing all biosafety requirements. • Must be familiar with the BSP2 form and checklist for authorization of importation of biologicals. PIs involved in research with biological agents must consult with the ORC for all biosafety requirements. 	<input type="checkbox"/>
RADIATION AND LASERS	<ul style="list-style-type: none"> • Review the UH Radiation Safety Manual, if applicable. • EHSO provides Radiation Safety Training. • Review the EHSO webpage in addition to all necessary forms for approving work with radioactive materials. • Review the UH Laser Safety Manual, if applicable. 	<input type="checkbox"/>	
DIVING SAFETY	<ul style="list-style-type: none"> • The University of Hawaii has a comprehensive Diver Safety Program, provided through EHSO. Refer to the webpage for further information. 	<input type="checkbox"/>	
FIRE SAFETY	<ul style="list-style-type: none"> • The University of Hawaii has a comprehensive Fire Safety Program, provided through EHSO. Refer to the webpage for further information. Additional training (Fire Safety and Fire Extinguisher Training) can be provided by EHSO. 	<input type="checkbox"/>	

6. MAINTAIN LAB SAFETY AND REGULATORY COMPLIANCE

MAINTAIN A SAFE WORKPLACE	SELF INSPECTION	<ul style="list-style-type: none"> Each lab must complete the on-campus or off-campus lab safety inspection checklist. Repeat inspections must occur quarterly. Each lab must identify, compile, and complete applicable general workplace checklists from HIOSH. 	<input type="checkbox"/>
	CHEMICAL STORAGE AND INVENTORY	<ul style="list-style-type: none"> Have chemical storage areas in order (in proper cabinets/shelves and not stored on the floor). All items, including compressed gas cylinders, must be clearly labeled, segregated by hazard class, and inventoried. Chemical inventories must be up to date and readily available. All lab personnel must be familiar with the chemicals in the lab. Review EHSO guidance for the Global Harmonization System for proper chemical labeling and hazard communication. Manufacturer-issued safety data sheets (SDS) for all chemicals present in lab must be made available by the entrance either in hard copy or via openly accessible online hosting (display URL by entrance). Review chemical inventories for peroxide forming chemicals, and ensure that they are tested and labeled per program requirements. Review specific security, storage, and/or safe use requirements for flammables, hazardous materials and pathogens, nitric acid, liquid nitrogen, moving chemicals, hydrofluoric acid, nano-materials, working when pregnant and associated carcinogen and reproductive toxicants, and hurricane preparedness. 	<input type="checkbox"/>
	HAZMAT SHIPMENT AND PROCUREMENT	<ul style="list-style-type: none"> Prior to ordering any new chemicals, the Procurement Authorization List of Hazardous Materials must be reviewed. Any materials identified on the list require completion of the Procurement Authorization of Hazardous Materials form and also the Agreement for the Use of Hazardous Materials form. Prior to any shipment, requirements for shipping hazardous goods must be reviewed 	<input type="checkbox"/>
	GENERAL WASTE	<ul style="list-style-type: none"> Lab staff must review the UH Waste Disposal Guidelines. Lab staff must review waste disposal procedures available in the specific waste categories. Lab staff must review UH Manoa's free quarterly recycling program for university-owned eWaste equipment. 	<input type="checkbox"/>
	HAZARDOUS MATERIALS WASTE	<ul style="list-style-type: none"> Hazardous waste must be properly labeled and stored (i.e, full constituent names, and relative percentages of mixtures, secondary containment provided, identified by and segregated by hazard class, and the word "waste" must be on every container). Review the waste inventory and ensure all P-coded chemicals are handled properly. Review the EHSO Resource Conservation and Recovery Act (RCRA) Audit planning guide and complete the attached container checklist if storing Hazardous waste. On-campus labs must review the Hazardous Materials and Waste Turn In Instructions and complete the turn in form prior to requesting waste pickup. Only certified waste generators can request pickup. Lab staff must review the UH Hazardous Materials Management Program (HMMP) 	<input type="checkbox"/>
	MANAGEMENT OF CHANGE	<ul style="list-style-type: none"> Review and update your risk assessment when change is introduced in the form of but not limited to: <ul style="list-style-type: none"> Change of personnel (new hire, member leaves), New equipment, new material/chemical (e.g. PO submitted), new contract or task, Near misses, incident At least every 6 months. Additional trigger events in ACS's Section 6.1. When major changes to a project or research scope occur it is recommended to schedule a small committee of HNEI colleagues to tour the facility and review the risk assessment and SOPs with you. An outside expert may be hired for audit. 	<input type="checkbox"/>

7. ESTABLISH EMERGENCY AND INCIDENT REPORTING PROCEDURES

COMPROMISED SAFETY RESPONSE	UH POLICY	<ul style="list-style-type: none"> Review the UH Manoa Comprehensive Emergency Management Plan, provided by the UH Manoa Department of Public Safety. Review the UH Manoa Emergency Response Guide. All lab staff must review the protocol for Handling Outside Agency inspections. 	<input type="checkbox"/>
	ACCIDENT/INJURY REPORTING	<ul style="list-style-type: none"> State and Federal Laws require employers to maintain records of work-related injuries and near miss accidents. EHSO has provided forms for compliance. Review the Lab Safety Accident, Injury, and Near miss reporting webpage and the contents of the following forms: <ul style="list-style-type: none"> Accidental Injury and Illness Report (EHS Form 29) - must be filled out and forwarded to EHSO. Report of Work-Related Injury/Illness (UH Form 79) - must be filled out and submitted for processing to the departmental office. Near Miss Report - must be filled out after any near-miss incident and forwarded to EHSO. 	<input type="checkbox"/>

8. PREPARE FOR DEPARTURE FROM HNEI

EXIT	LABORATORY DECOMMISSIONING	<ul style="list-style-type: none"> All PIs must review UH Manoa's Laboratory Decommissioning Policy. Decommissioning checklists must be completed when (a) terminating affiliation with the University, (b) relocating to another laboratory space, (c) before a major laboratory renovation requiring relocation of hazardous materials, and (d) retirement from research activities. Chemical closeout forms must be completed prior to faculty/staff permanent departure and the conclusion of a research program. 	<input type="checkbox"/>
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9. APPENDIX A: ARCHIVED DOCUMENTS

Document	Format	Periodicity
Chemical Inventory	Spreadsheet	12 months
Up-to-date Hazard Analysis (Job Safety Analysis and/or Quantitative Risk Assessment)	Spreadsheet template	6 months
Up-to-date Standard Operating Procedures	EHSO template	6 months
Completed Laboratory Personnel Safety Checklist for all staff	EHSO template	6 months
Completed Laboratory Safety Self-Inspection Checklist	EHSO template	3 months
Accident, Near Miss, and Injury Reporting Forms	EHSO template	As received
EHSO/Outside Agency Laboratory Inspection Reports	As received	As received
Training Attendance Confirmations	As received	As received
Laboratory Decommissioning Forms	EHSO template	Vacating lab
Chemical User Closeout Forms	EHSO template	Leaving HNEI