AUDIT & MANAGEMENT
AMAS
ADVISORY SERVICES

Audit Report

Laboratory Safety Program

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UC SANTA CRUZ

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I. EXECUTIVE SUMMARY

Audit and Management Advisory Services (AMAS) has completed a review of the Environmental Health & Safety (EH&S) Laboratory Research Safety Program with a focus on chemistry and biochemistry laboratories. This audit was included on the campus FY 2019-20 internal audit plan.

Based on the results of work performed within the scope of the audit, we found EH&S is overall, adequately monitoring whether principal investigators and laboratory personnel are completing laboratory safety training. However, there are opportunities to achieve better compliance with University of California policy and California Code of Regulations regarding training requirements.

We also determined that laboratory safety representatives are generally performing their duties in maintaining required lab-specific safety information and documentation. However, we found opportunities to improve self-inspections and procedures for updating the chemical inventory. Ultimately, the principal investigator is responsible for ensuring lab-specific information is documented accordingly.

The following observations requiring management corrective action is identified below:

A. Laboratory Safety Training Program

We found 1.5 percent of lab personnel as of July 2019 have not taken training by August 2019. While this percentage is low, there may be opportunities to achieve full compliance.

B. Laboratory Safety Representatives

We found opportunities to ensure more consistent performance of laboratory safety representative duties, particularly in the areas regarding self-inspections and procedures for maintaining the chemical inventory.

Agreement was reached with management on the recommended actions to address the risks identified in these areas. The observations and the related recommendations are described in greater detail in section III.

II. INTRODUCTION

Purpose

The purpose of the review was to evaluate laboratory safety practices in place and determine compliance with federal, state, and university guidelines with a focus on chemistry and biochemistry laboratories. This audit was included on the campus FY 2019-20 internal audit plan.

Background

Environmental Health and Safety (EH&S)

The Environmental Health and Safety (EH&S) unit's mission is to effectively manage health, safety, and environmental risks to the University of California, Santa Cruz (UCSC) community. The primary duties are to promote, facilitate, and provide expert consultation for EH&S programs in support of both academic and non-academic campus functions. The unit is responsible for monitoring compliance with environmental, health and safety programs intended to minimize or prevent occupational injuries and illnesses in the workplace and to protect the quality of the surrounding environment. EH&S advises the campus community of responsibilities with respect to health, safety and environmental issues; recommends appropriate corrective actions; and helps implement new health and safety programs. EH&S also acts as liaison between UCSC and various external agencies and regulatory bodies.

EH&S programs encompass a broad and complex range of disciplines, including areas such as laboratory and research safety, industrial hygiene, environmental management, radiation, hazardous materials, information technology, ergonomics, biosafety and emergency management. Programs relevant to this audit include:

- *Laboratory Research Safety Program*: This program's goal is to minimize the risk of injury or illness to laboratory personnel by ensuring that they have the training, information, support, and equipment needed to work safely in the laboratory.

- *Injury and Illness Prevention Program* (IIPP): The IIPP for each organizational group is the umbrella under which all employee health and safety programs are implemented, and all employees must be covered by an IIPP plan, but the level of organization at which the plan is administered can be variable. The campus has implemented a template-driven IIPP, which should be customized by each unit to ensure a safe and healthful work environment for its employees.

EH&S also conducts annual inspections of laboratories using or storing hazardous materials. Inspection summary reports are provided to principal investigators and laboratory safety representatives through the University of California (UC) developed online Inspect tool. Findings noted in the reports are assigned targets dates for correction. Findings not corrected timely are subject to follow up through the UCSC Compliance Assurance process.

Laboratory Safety Manual (LSM)

EH&S provides an online *Laboratory Safety Manual* (LSM) with information regarding protection from health hazards associated with the laboratory environment in accordance with applicable California Occupational Safety and Health Administration (Cal-OSHA) regulations, including the *Chemical Hygiene Plan* (CHP) requirements specified in *California Code of Regulations, Title 8, Section 5191*. The LSM serves as a resource

for identifying and evaluating the nature of potential laboratory hazards, as well as determining appropriate hazard controls. The information in this manual applies to all laboratories that use, store or handle potentially hazardous materials and all personnel who work in these facilities. At UCSC, this information is documented in what is referred to as the "IIPP/CHP Binder" and is to include documents described in the following table:

Key Inserts and Forms for the Injury and Illness Prevention Program/ Chemical Hygiene Plan Binder (IIPP/CHP Binder)	
Document	**Description**
LSR Job Responsibilities	This document lists the IIPP/CHP responsibilities for the laboratory safety representatives (LSRs) and should be the first page in the IIPP/CHP binder.
Identification of Responsible Persons	This form lists persons with authority and responsibility for implementing the Injury and Illness Prevention Program and Chemical Hygiene Plan.
Laboratory Safety Training Checklist	This checklist can be customized to include specific laboratory operations. It can also be used to document IIPP/CHP and laboratory safety training for each new employee.
Self-Inspection Checklist	This checklist is used for quarterly self-inspections and can be customized to include specific laboratory operations. Self-inspections can be conducted either using this checklist or using the online Inspect tool.

Lab-specific information must be reviewed and approved by the principal investigator when new processes are added, existing processes change significantly, or at least annually. The principal investigator is responsible for documenting lab-specific safety information and other documentation information, including:

- Laboratory Safety Fundamentals training for all personnel working in the lab.
- Lab-Specific Training Checklist completion for all personnel working in the lab.
- Laboratory Hazard Assessment personal protective equipment assessment for each lab.
- Standard Operating Procedures (SOPs) for processes that use particularly hazardous substances, including "Operations Requiring Prior Approval".
- Laboratory Self-Inspection Checklist used by the laboratory group to conduct periodic inspections.

UC Safety Systems (UC Safety)

UC Safety is an integrated solution for laboratory management and safety developed by the University of California (UC). UC Safety provides a single system for handling laboratory safety, occupational health, and risk management. Application tools relevant to this audit include:

- Inspect: At UCSC, EH&S annual inspections and laboratory self-inspections are performed using Inspect. Summary reports of these inspections are available to principal investigators and laboratory safety representatives also through the online Inspect tool. The application is available in a native phone application as well as for tablet and desktop.

- Chemicals: This application facilitates the collection and storage of information related to chemical types and amounts within campus laboratories and facilities. Chemicals helps the UC meet reporting and compliance requirements. The application is available in a native phone application as well as for tablet and desktop.

The Laboratory Safety Representative (LSR)

The Laboratory Safety Representative (LSR) serves as the conduit for questions and safety information between the laboratory group/principal investigator and EH&S. The LSR should understand laboratory procedures and equipment in order to assist in the process of anticipating, recognizing, evaluating, and controlling laboratory hazards. Ultimate responsibility for laboratory safety rests with the principal investigator. Ongoing LSR duties include:

- Maintaining chemical inventory using the Chemicals tool.
- Coordinating with EH&S on annual safety inspections, correcting deficiencies, and maintaining records of corrections through the Inspect tool.
- Ensuring waste containers are properly labeled or tagged.
- Ensuring all laboratory members have access to personal protective equipment.

See the following table for details on additional LSR duties:

Laboratory Safety Representative (LSR) Duties	
Areas	**Description of Duties**
Communication	• Serve as the laboratory group's primary safety and compliance contact for the department, division, and EH&S. • Attend quarterly LSR meetings organized by EH&S. • Ensure the online UCSC EH&S *Laboratory Safety Manual* (LSM) is readily accessible via computer, and that all laboratory group members have reviewed relevant information in the LSM.
Standard Operating Procedures (SOPs)	• Work with EH&S to coordinate the development of written standard operating procedures for hazardous procedures, listed UC Regents Laboratory Safety Settlement Agreement chemicals (Exhibit I), and particularly hazardous materials. Ensure that SOPs are reviewed and signed by the principal investigator. • Ensure the availability of laboratory-specific SOPs. • Maintain documentation of SOP review and signature by laboratory personnel. • Promote yearly review of SOPs by those using the process and the principal investigator.
Personal Protective Equipment	• Ensure the availability and use of personal protective equipment. • Encourage/support laboratory personnel to use PPE. The principal investigator is ultimately responsible for PPE usage in the laboratory.
Training	• Maintain training documentation for laboratory personnel. Laboratory personnel are responsible for participating in training and providing documentation to the LSR. • Ensure that all laboratory personnel attend online "Laboratory Safety Fundamentals" and "Hazardous Waste Management" classes.

Laboratory Safety Representative (LSR) Duties	
Areas	**Description of Duties**
	• Review and sign the "UCSC Laboratory-Specific Safety Training Checklist" with all new laboratory personnel. • Record group meeting safety discussions. • Notify EH&S if additional safety-related training is needed for the laboratory group. EH&S is available to attend group meetings for either updates or laboratory group-specific training or refresher classes.
Laboratory Hazard and Exposure Controls	• Ensure all engineering controls are working properly prior to use. Promptly report problems to the principal investigator, department, Physical Plant Services, and EH&S as appropriate. • Inspect fire extinguishers on a monthly basis and record date (for those laboratories that have a fire extinguisher mounted on the wall). This may be delegated to other laboratory personnel. • Ensure those leaving the laboratory have disposed of their chemicals and gone through the check-out procedures. This is ultimately the principal investigator's responsibility. • Track and coordinate hazardous waste collection, labeling, storage and disposal.
Inspections	• Coordinate with EH&S on annual safety inspections, correct any deficiencies, and maintain records of corrections through the Inspect tool. • Coordinate quarterly laboratory self-inspections, then document and track corrections and report issues that require assistance to the principal investigator, department, Physical Plant Services, and/or or EH&S. Encourage the participation of other laboratory personnel in performing the self-inspections. • Work with laboratory personnel to minimize clutter.

Scope

Our scope is limited to laboratory safety with a focus on chemistry and biochemistry laboratories. Substantive audit procedures were performed as of July 2019 through September 2019. We conducted this review by means of the following:

- Reviewed UC and UC Santa Cruz policies, best practices, and other guidance relevant to laboratory safety.
- Reviewed campus management and EH&S announcements, online information, and other communication that convey the importance of laboratory safety, clarify roles and responsibilities for conducting safe work practices, and call attention to compliance with health and safety policies.
- Reviewed documents supporting EH&S laboratory safety training program activities and reports.
- Reviewed audit or advisory reports conducted at UC campuses related to laboratory safety.
- Interviewed personnel from EH&S, principal investigators, and laboratory safety representatives to gain an understanding of overall processes and procedures for management of laboratory safety.
- Performed and documented a risk assessment based on the results of our preliminary work, such as interviews, review of documentation, and other observations.

- Detailed testing that included selecting 10 laboratories to ensure personnel were trained prior to their start date. Data selected for testing was limited to laboratory worker roster provided by EH&S as of July 2019 and training records from the UC Learning Center as of August 2019.
- Detailed testing that included selecting nine laboratories to determine whether each laboratory included appropriate lab-specific information according to UC and UCSC policies. We also conducted interviews to identify general processes on how the chemical inventory is maintained; no further work was performed in this area.

For additional details, please see Appendix A. Summary of Work Performed and Results.

III. OBSERVATIONS REQUIRING MANAGEMENT CORRECTIVE ACTION

A.	Laboratory Safety Training Program

We found 1.5 percent of lab personnel as of July 2019 have not taken training by August 2019. While this percentage is low, there may be opportunities to achieve full compliance.

Risk Statement/Effect

Lack of timely training may result in incidents in the laboratory that could have been prevented. This is also in noncompliance with:

- *University of California Policy – Laboratory Safety Training* issued June 12, 2013.
- California Code of Regulations, Title 8, Section 5191 – *Occupational Exposure to Hazardous Chemicals in Laboratories.*

Agreement

A.1	EH&S and relevant campus units should continue working together to ensure that laboratory personnel undergo required training programs in the laboratory workplace prior to their start date. This could include working with the research divisions to limit unescorted access to the laboratory prior to training completion.	**Implementation Date** March 31, 2020 **Responsible Manager** Director, Environmental Health and Safety

A. Laboratory Safety Training Program – Detailed Discussion

Based on our work, we determined that EH&S is overall, adequately monitoring whether principal investigators and laboratory personnel are completing laboratory safety training. However, we found opportunities exist to continuously improve compliance with training requirements.

Out of 206 samples, we found three laboratory workers still had not completed training a month after the position start date. While this rate is low (1.5 percent), training completion prior to the worker's start date is still a requirement:

- *University of California Policy – Lab Safety Training* states, "Before any worker is granted unescorted access to laboratory/technical areas, they shall successfully complete a "Fundamentals of Laboratory Safety" training as offered/managed by their local EH&S department. Campuses may offer this training via instructor-led, web-based, or both."
- California Code of Regulations, Title 8, Section 5191 – *Occupational Exposure to Hazardous Chemicals in Laboratories* states, "The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area. Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training shall be determined by the employer."

Although not all personnel working in laboratories have undergone laboratory safety training, we understand the enforcement of required safety training for all laboratory personnel is an ongoing process. As stated earlier, EH&S offers information resources, training, and education opportunities in laboratory safety.

B.	Laboratory Safety Representatives	
We found opportunities to ensure more consistent performance of laboratory safety representative (LSR) duties, particularly in the areas regarding self-inspections and procedures for maintaining the chemical inventory.		
Risk Statement/Effect		
The most immediate, observable risk is the lack of continuous self-inspections, which are generally performed by the LSR. Furthermore, the lack of formalized procedures to maintain the chemical inventory may result in the lack of efficiency or improper tracking of hazardous chemicals.		
Agreement		
B.1	EH&S and relevant campus units should continue working together to ensure that laboratory safety representatives can adequately perform assigned duties, in consideration of their voluntary role and expected high turnover. For example, this could be ensured through enforcement of the responsibilities checklist. EH&S should also work with the science division deans to ensure that principal investigators are aware of these requirements, designate appropriate personnel to manage lab safety functions, and oversee lab safety compliance.	**Implementation Date** March 31, 2020 **Responsible Manager** Director, Environmental Health and Safety

B. Laboratory Safety Representatives – Detailed Discussion

We determined that laboratory safety representatives are generally performing their duties in maintaining required documentation in the IIPP/CHP & SOP binders. However, we found opportunities to improve self-inspections and processes for updating the chemical inventory.

Self-Inspection

Although EH&S performs an annual laboratory safety inspection, quarterly laboratory safety self-inspections are required and help ensure laboratory safety is maintained throughout the year. From our testing, we found:

- Two laboratories did not have documentation to support the performance of self-inspections. In both cases, we obtained documentation that EH&S performed their annual inspections of these laboratories, the results of which also found the lack of self-inspections. At the time of the audit, these laboratories both had newly appointed LSRs.
- One laboratory performed quarterly self-inspections but adequate documentation could not be located. The EH&S Lab Safety Specialist confirmed quarterly self-inspections were performed and documented as a hard copy. However, this laboratory insisted self-inspections were performed online, but a record of this could not be located in the Inspect tool within our scope period of FY 2019. We recognize this misunderstanding may be due to the prior LSR being unavailable during our audit.

Chemical Inventory

Based on interviews, we found that processes are in place to ensure the chemical inventory is up to date, but this is not consistently followed. The results of our work identified one laboratory reusing the same barcodes for reordered chemicals. As a best practice, consistent procedures should be enforced to ensure the appropriate tracking and updating of inventory.

Laboratory Safety Representatives Job Responsibilities

We found four out of nine laboratories did not include this document. In one case, we were also informed of a newly appointed LSR that had not been able to attend any of the quarterly meetings given by EH&S due to personal matters. We suggest encouraging laboratories to value this document as a potential approach to help with onboarding new LSRs.

Other Observations

- For two of our selected samples, the principal investigator requested to be the point of contact instead of the LSR. Through these interviews, we generally observed that the ability for graduate students to perform their LSR duties could be heavily dependent on support by the principal investigator.
- We were also informed that one principal investigator performs many of the LSR duties, including the self-inspections, to ensure it is performed correctly and as a response to the high turnover.

APPENDIX A. SUMMARY OF WORK PERFORMED AND RESULTS

Preliminary Analysis	
Work Performed	**Results**
Reviewed UC and UC Santa Cruz policies, best practices, and other relevant guidance.	1. We identified the most potentially relevant policies and guidance: • *University of California Policy – Laboratory Safety Training* issued June 12, 2013. • *University of California Policy – Personal Protective Equipment* issued June 12, 2013. • California Code of Regulations, Title 8, Section 5191 – *Occupational Exposure to Hazardous Chemicals in Laboratories*. • California Code of Regulations, Title 8, Section 3203 – *Injury and Illness Prevention Program*. • Occupational Safety and Health Administration – *Laboratory Safety Guidance* 2. We reviewed the following local guidance, policies, and procedures: • UCSC EH&S websites including: Lab Safety Training, Laboratory Specific Training, Laboratory Hazard Assessment Tool (LHAT), Personal Protective Equipment (PPE), Standard Operating Procedures, Chemical Inventory, Lab Safety Representatives, Chemistry Department LSR Information, etc. • UCSC Chemistry and Biochemistry website for Laboratory Safety.
Reviewed relevant audit or advisory reports conducted at UC campuses related to laboratory safety.	Identified common issues from other campuses.
Interviewed and communicated with personnel from EH&S, principal investigators, and laboratory safety representatives.	Developed a risk matrix and audit program to address the risk areas identified.

Fieldwork	
Work Performed	**Results**
To determine whether EH&S staff is adequately monitoring whether principal investigators (PIs) and other laboratory personnel are completing a laboratory safety training program based on the campus Laboratory Safety Manual, performed the following steps:	
Obtained EH&S laboratory worker roster as of July 2019 and performed analysis of 2250 lines of data.	Identified approximately 24 PIs and 311 laboratory workers within our scope.
From this data, judgmentally selected 10 PIs based on highest counts of workers per lab.	Identified 224 laboratory workers within our sample of 10 PIs. After removing duplicates, total count of unique laboratory workers was 206.
Obtained complete list of laboratory safety training records as of August 2019 from the University of California Learning Center (UC Learning Center), the UC systemwide principal learning management system.	When filtering data from the UC Learning Center, identified 4228 lines of data.
Filtered training records for training attendance from January 2016 through August 2019.	
For our sample, searched for training attendance data from the UC Learning Center within the past three years, based on the *University of California Policy – Laboratory Safety Training*.	Out of 206 laboratory workers, we identified 65 laboratory workers that needed to be manually reviewed for training dates, due to missing or inconsistent data.
Manually verified whether laboratory workers with no formula results have attended training.	After the manual review, identified a total of 16 laboratory workers with no matching training record. After further follow-up, we were informed that 13 are not laboratory workers. The remaining three were confirmed to not have completed training.
From a sample of nine labs, determined whether laboratory safety representatives (LSRs) were regularly updating the IIPP/CHP Binder & SOPs to include key documentation according to UC and UCSC policies and guidance:	
Laboratory Safety Representative Job Responsibilities: Requested a copy of the most recent document and generally reviewed for completeness.	Five out of nine laboratories included this sheet as part of their documentation.
Identification of Responsible Persons: Requested a copy of the most recent document and generally reviewed for completeness.	One laboratory had outdated information and was not completely filled out, however the LSR is new. The remaining eight laboratories had this documentation and was up to date.
Self-Inspection Checklist: Requested a copy of the most recent self-inspection documentation for FY 2018-19 and asked frequency this was performed. If documentation to support self-inspections could not be obtained, we reviewed EH&S inspections to	We found: • Two laboratories were not performing self-inspections. • One laboratory performs self-inspections but did not document this.

Fieldwork	
Work Performed	**Results**
identify whether self-inspections were observed to be performed.	• Six laboratories were regularly performing self-inspections.
SOPs: Requested a copy of SOPs and observed the binder in which the SOP is maintained for evidence that it is still being utilized (signatures, etc.)	For all nine samples, auditor observed the SOP binder was maintained.
To determine how often the chemical inventory is updated, in all interviews, inquired whether the most recent inventory was performed within the past three years and that appropriate procedures are being followed to add, remove, and track chemicals.	Based on interviews with the PIs and LSRs, we were informed: • Five laboratories have had a full inventory performed within the last three years. • Three laboratories that have not had an inventory performed to their knowledge, but procedures are in place to ensure appropriate tracking and updating of inventory. • One laboratory has not had an inventory performed to their knowledge, and proper procedures are not being followed to ensure appropriate tracking and updating of inventory.