UC MERCED AUDIT AND ADVISORY SERVICES

December 18, 2015

To: Michael Reese – Vice Chancellor for Business and Administrative Services

Subject: Audit of Laboratory and Field Safety Practices

Ref: Report No. M15A011

Internal Audit has completed an audit of UC Merced's Laboratory and Field Safety practices, which was part of the Fiscal Year 2014 – 2015 Audit Plan. The new leadership over this area has put together management corrective actions for the issues identified. We will follow up to verify that management corrective actions are completed.

We appreciate the help we received from the Environmental Health and Safety staff during this audit.

Todd Kucker
Internal Audit Director

Attachment

cc: SVP Vacca
Chancellor Leland
Provost and Executive Vice Chancellor Peterson
Associate Chancellor Putney
Vice Chancellor Traina
Dean Meza
Assistant Vice Chancellor Vasquez
Director Salazar
Director Ott
Risk Manager Castillo

UNIVERSITY OF CALIFORNIA, MERCED
AUDIT AND ADVISORY SERVICES

Laboratory and Field Safety
Report No. M15A011

December 18, 2015

Work Performed by:
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Management Summary

Internal Audit has completed an audit of laboratory and field safety practices. The purpose of the audit was to evaluate how UC Merced identifies and mitigates risks related to research conducted in laboratories and at locations away from campus.

The audit testing reviewed the effectiveness of Environmental Health and Safety's (EH&S) Research Laboratory Safety Program in identifying and mitigating unsafe laboratory practices. It also reviewed how EH&S and the Office of Research identify when research is being completed in the field and how the risks related to this research are managed.

Overall, from the audit, we concluded that procedures for promoting safe research practices in laboratories and at off-site locations need improvement. While new IT systems have been set up to improve laboratory safety, progress has been slow. Most of the issues identified during this audit, were not adequately corrected after the issues were identified during previous audits and advisory service projects.

To promote sustainable improvement in laboratory safety practices, periodic reporting to campus leadership and to the Ethics and Compliance Program should be established. As data in the new systems becomes more reliable and up-to-date, useful reporting will improve. Over time, the new systems should allow reporting of the percentage of annual laboratory inspections completed, percentage of students and employees completing mandatory laboratory safety training, and the number and aging of uncorrected issues from annual laboratory inspections.

We noted issues in the following areas, which are discussed further in the following report:

- Annual lab inspections and correcting identified issues
- Improving controls over chemical inventories
- Safely removing hazardous waste
- Improve monitoring of safety training
- Maintaining physical security over laboratories
- Identifying when research will be conducted at off-site locations

Objectives and Scope

Internal Audit has completed an audit of laboratory and field safety practices at UC Merced, which was part of the Fiscal Year 2014 – 2015 audit plan. The overall purpose of the audit was to evaluate how UC Merced identifies and mitigates risks related to research conducted in laboratories and at locations away from campus.

The audit objectives were to:

- Review the effectiveness of Environmental Health and Safety's (EH&S) Research Laboratory Safety Program in identifying and mitigating unsafe laboratory practices; and,
- Review how EH&S and the Office of Research identify when research is being completed in the field and how the risks related to this research are managed.

To fulfill these objectives, we reviewed EH&S's current Laboratory Inspection Program and processes related to chemical inventories and laboratory safety training. We also reviewed processes managed by departments other than EH&S which impact laboratory and field safety. These processes included physical access to labs which is managed by principal investigators and the locksmith department, and monitoring where researchers have traveled which is managed by Risk Services.

Background

Environmental Health and Safety (EH&S) is part of the Business and Administrative Services Division at UC Merced. The department is currently made up of six employees: the Director, a Chemical Hygiene Officer, a Biosafety Officer, a Campus Safety Officer, the Fire Marshal, and a contract part-time administrative coordinator, who basically runs the campus Ergonomics program. During August 2015, EH&S began reporting to the new Assistant Vice Chancellor of Campus Safety.

Laboratory Safety

EH&S provides guidance in managing the campus's Laboratory Safety Plan. The following is from the Laboratory Safety Plan's introduction:

"The Laboratory Safety Plan is intended to prevent injuries by helping laboratory personnel recognize, evaluate and control hazards in their laboratory. This is UC Merced's chemical hygiene plan and injury illness prevention plan for laboratories, and applies to all laboratories that use, store or handle potentially hazardous chemicals and all personnel who work in these facilities. Its effectiveness depends on the cooperation of faculty, staff, students, and the Office of Environmental Health and Safety (EH&S). It reflects Federal and State health and safety standards and published practices, standards, and guidelines of nationally recognized health and safety groups."

The plan is a comprehensive document that includes details related to areas such as: Fire Safety, Chemical Safety, Chemical Storage and Inventory Control, Personal Protective Equipment, Biosafety, and Radiation Safety.

An important part of the Laboratory Safety Plan is the annual inspections of laboratories. The following is a description of the annual inspection process from the Laboratory Safety Plan:

> "EH&S has a comprehensive chemical safety compliance program to assist laboratories and other facilities that use, handle or store hazardous chemicals to maintain a safe work environment. This program helps to ensure compliance with regulations and to fulfill UC's commitment to protecting the health and safety of the campus community.
>
> As part of this chemical safety program, EH&S conducts annual inspections of laboratories and other facilities with hazardous chemicals to ensure the laboratory is operating in a safe manner and to ensure compliance with all federal, state and university safety requirements. The primary goal of inspection is to identify both existing and potential accident-causing hazards, actions, faulty operations and procedures that can be corrected before an accident occurs. EH&S can order the cessation of any activity that is 'Immediately Dangerous to Life and Health' until that hazardous condition or activity is abated.
>
> The chemical safety inspection is comprehensive in nature and looks into all key aspects of working with hazardous chemicals. While inspections are a snapshot in time and cannot identify every accident-causing mistake, they do provide important information on the overall operation of a particular laboratory. They can also help to identify weaknesses that may require more systematic action across a broader spectrum of laboratories, and strengths that should be fostered in other laboratories…
>
> Critical deficiencies are those that have the potential to lead to serious injuries or be of critical importance in the event of an emergency. Critical deficiencies must be immediately corrected. Non-critical deficiencies must be corrected within 30 days. A copy of the most recent Laboratory Inspection Checklist and Inspection Report should be maintained as part of the records inside the Laboratory Safety Plan."

EH&S works closely with Principal Investigators and laboratory personnel to manage chemical inventories, lab safety training for employees and students, annual lab assessments, and hazardous waste disposal.

<u>UC EH&S Technologies</u>

During recent years, the UC Office of the President EH&S has implemented a suite of various applications to promote laboratory and research safety in an efficient manner. The following are some of the systems set up to improve processes and reporting related to laboratory and field safety.

Laboratory Hazard Assessment Tool (LHAT) – A UC wide assessment tool that helps Principal Investigators identify activities and hazards to ensure that lab personnel are properly protected in their work environment. LHAT provides an on-line solution that facilitates reviews of lab risks, identifies required personal protective equipment (PPE), and gives training in the use of PPE, as required for the EH&S PPE distribution program.

Safety Inspection Tool (SIT) - A web-based audit application that reduces the amount of time any given danger exists in a workspace. The system is used to manage inspection programs, which includes scheduling inspections, conducting inspections, and correcting inspections findings.

Chemical Inventory System (CIS) - A web-based inventory system which researchers use for maintaining and tracking the chemical inventory in their labs.

Waste Accumulation Storage Tracking electronically (WASTe) - A system that allows a user to efficiently create and print a disposal tag for hazardous waste and track chemical waste in the lab.

Risk Assessment Determinations in Chemical Academic Laboratory (RADICAL) - A risk management tool that allows a researcher to develop a Standard Operating Procedure (SOP) for chemicals and processes to provide researchers with pertinent information to conduct their research safely.

Learning Management System (LMS) – The UC's training management system which is used to sign up for training and keep track of trainings completed.

Field Safety/Travel Operations Planner (FSTOP) - A web-based tool used to create a customized field trip plan to address possible risks associated with a trip. The goal of the system is to increase personal safety and awareness of risks for the participant. FSTOP is built around five important questions everyone should consider before leaving on a trip:

1. What are you planning to go and do?
2. What are the hazards involved?
3. How do you plan to control the hazards?
4. How will you ensure these controls are implemented?
5. How will you provide feedback to make improvements to the plan?

Field Safety

Field research is defined as work activities conducted primarily for the purpose of research, undertaken by employees or students of UC Merced beyond the geographic boundaries of UC Merced property and the engineered (urban) environment and/or outside the United States. It also includes service and research activities undertaken, by agreement, on behalf of other agencies, including government and private organizations.

UC Merced researchers travel to many locations, including the Sierra Nevada Mountain Range, and to other countries, such as Belize, Ethiopia, and Nepal.

When researchers travel out of the state they are currently asked to register their trip and complete a Field Operational Planner. The Planner is intended to address possible risks specifically associated with field research, teaching and foreign operations. When a UC employee or student travels internationally, the iJet/Worldcue system is used to monitor the safety of the international locations in case the individuals need to be safely removed.

Conclusion

Overall, from the audit, we concluded that procedures for promoting safe research practices in laboratories and at off-site locations need improvement. While new IT systems have been set up to improve laboratory safety, progress has been slow. Most of the issues identified during this audit, were not adequately corrected after the issues were identified during previous audits and advisory service projects.

To promote sustainable improvement in laboratory safety practices, periodic reporting to campus leadership and to the Ethics and Compliance Program should be established. As data in the new systems becomes more reliable and up-to date, useful reporting will improve. Over time, the new systems should allow reporting of the percentage of annual laboratory inspections completed, percentage of students and employees completing mandatory laboratory safety training, and the number and aging of uncorrected issues from annual laboratory inspections.

We noted issues in the following areas:

- Annual lab inspections and correcting identified issues
- Improving controls over chemical inventories
- Safely removing hazardous waste
- Improve monitoring of safety training
- Maintaining physical security over laboratories
- Identifying when research will be conducted at off-site locations

Observations and Management Corrective Actions

1. Annual lab inspections and correcting identified issues

During recent years, the Safety Inspection Tool (SIT) system was implemented by the UC Office of the President to improve documentation and processes related to the annual inspections on UC campuses. During the audit, we selected a sample of Principal Investigators and laboratories and determined whether annual laboratory inspections were completed by EH&S during 2014 and 2015. From reviewing the information in SIT and from reviewing documentation maintained by EH&S, we could not verify that all laboratories had been inspected on an annual basis.

We also reviewed the results of the completed inspections and noted that there was not sufficient follow up by EH&S to verify that identified issues were properly corrected in a timely manner.

As the volume of research continues to increase at UC Merced, it appears that the EH&S staff cannot keep up with annual inspections and follow up. The purpose of the annual inspections is to identify unsafe conditions which should be corrected to protect laboratory employees and students.

The difficulties of inspecting all campus laboratories and verifying that unsafe conditions are corrected were identified in an audit completed during 2010 (M11A002 – UCM Laboratory Safety). The 2010 audit identified that needed corrective actions outlined during the annual inspections had not been corrected. The report noted that "EH&S has limited staff and does not have a follow-up process for critical deficiencies. There is no formal escalation process to inform members of the campus hierarchy, up to the Vice Chancellor of Research." Per EH&S, a draft policy has been submitted to

During the 2010 audit, the management corrective action was to implement a notification process when labs contain critical safety deficiencies and continuing examples of non-compliance. Since the 2010 audit, a formal process to notify leadership has not been formally established.

We recommend that all labs be annually inspected by EH&S. The results of the inspections should be maintained in the SIT system as evidence that the inspection was completed. Efforts should be made to formally follow up on identified issues and verify that the issues were corrected. The status of uncorrected issues should be periodically reported to campus leadership so they are aware of lab safety risks.

To promote continuous improvement, we recommend periodic reporting of the percentage of annual laboratory inspections completed and reporting the status of uncorrected issues to campus leadership. EH&S will need the support of campus leadership to correct these issues and improve lab safety.

Management Corrective Action

The EH&S Director will periodically review the results of lab inspections in the Safety Inspection Tool (SIT) to verify that all laboratories are inspected annually.

SIT will be used to track identified deficiencies (Metric 1) and to document that critical deficiencies are immediately corrected and non-critical deficiencies are corrected within 30-days (Metric 2). The ability to develop this metric depends on EH&S being able to set up this functionality in the SIT program.

A formal escalation process will be established where EH&S will notify Deans and the Vice Chancellor for Research when deficiencies noted during annual inspections are not corrected as required by the Laboratory Safety Plan.

Metrics 1 and 2 above will be reported to the Ethics and Compliance Management Committee on an annual basis.

The development of this action plan will be completed as of July 1, 2016. The first report will be issued in January 2017 for the calendar year 2016 and then will be reported every January for the prior calendar year.

2. Improving control over chemical inventories

During recent years, the UC Office of the President implemented the Chemical Inventory System (CIS) so campuses can better track chemicals in laboratories. Prior to the system, it was common for Principal Investigators to maintain spreadsheets or utilize other informal techniques of tracking chemicals in their laboratories. On an annual basis, PI's were required to report the chemicals in their laboratories at a point in time during the year.

During discussions with EH&S employees, we noted that chemical inventories are not kept up to date in CIS. It appears that many PI's do not keep their chemical inventories up-to-date and/or have continued to utilize their spreadsheets and informal techniques rather than keep chemical inventories reported in CIS updated.

The campus utilizes CIS to report the amounts of chemicals in laboratories to state (CalEPA and Cal-OSHA), local government agencies (Certified Unified Program Agencies – CUPA), and for fire standards. As the inventories are not up to date, the campus is not accurately reporting chemical levels. Also, if there is a fire in a laboratory, accurate chemical inventories are critical for emergency workers.

For some of the labs in the new Science and Engineering 2 Building, there are quantity limits for certain chemicals (Maximum Allowable Quantities – MAQ) as defined by the Fire Code, due to the building's B occupancy rating. If it appears that chemical levels are too high in CIS, EH&S will hold orders until PI's update the inventories of these chemicals. If chemical inventories in CIS are not accurate, this control is not effective to keeping chemical levels to certain thresholds.

While a system has been implemented to improve tracking of chemical inventories, the lack of adequate control over the campus chemical inventory was identified during the 2010 audit (M11A002 – UCM Laboratory Safety). After the audit, the management corrective action was to encourage PI's to complete and return their chemical inventory data sheets at least annually. With CIS, UC Merced can now maintain better control over chemicals with improved processes.

In order to keep the chemical inventories up to date, when chemicals are purchased, the purchased chemicals should be added to balances in CIS. When items are used up and removed, the chemicals should be removed from CIS. Periodically, PI's should take physical inventories of chemicals in their laboratories and adjust levels reported in CIS. CIS has a new feature which asks the PI to quarterly certify that their inventory is accurate, but there is no means to ensure that they comply with this requirement.

We recommend that steps be taken to verify that accurate chemical inventories have been set up for all laboratories in CIS as of a particular date. Then procedures should be implemented for keeping up to date with chemical inventories in laboratories.

Management Corrective Action

All Principal Investigators will be required to complete an annual certification for their laboratories regarding the accuracy of the chemicals included in the Chemical Inventory System (CIS). This report will be due to EH&S by September 15 of each year in order to give EH&S time to develop the required reports they submit to State regulatory agencies.

EH&S will begin putting together and annual report for the Ethics and Compliance Program Management Committee to show the percentage of laboratories where the Principal Investigators have certified. A list of Principal Investigators who have not certified will be reported. If the annual certification is not completed, escalation procedures outlined in the "Policy on the Assurance of Laboratory Safety Compliance" (currently being developed) will be followed to ensure compliance with this provision.

This action plan will be completed as of July 1, 2016.

3. Safely removing hazardous waste

Removing hazardous waste from laboratories requires adequate knowledge of chemicals. The responsibility for removing hazardous waste includes various risks, such as unknown and unlabeled chemicals. During discussions with EH&S employees, we noted that student employees are responsible for removing hazardous waste from laboratories, transporting the chemicals to a campus central storage facility, and segregating and storing the chemicals, prior to transportation to an off-campus disposal facility. As EH&S does not have sufficient resources to manage these responsibilities, they do their best to adequately train student employees in handling hazardous waste. Per EH&S, no other UC campus involves students in removing hazardous waste.

During a 2013 advisory service of EH&S (M13C001 – Limited Scope Review of Environmental Health and Safety), this risk was identified. During the review, Internal Audit recommended that a trained hazardous waste technician be hired to manage the campus hazardous waste program and perform the campus hazardous waste pickups. At that time, a management corrective action was to request the funding of a hazardous waste technician. The hazardous waste technician was never added to EH&S staff.

The UC Office of the President has implemented the Waste Accumulation Storage Tracking electronically (WASTe) system to improve the management of hazardous waste. Risks can result when hazardous waste is not properly labeled which means that it may not be disposed of timely or could result in an accident due to incompatible waste being added to a container.

We recommend that a full-time employee who is properly trained in handling and removing hazardous waste manage these responsibilities. While UC Merced has very capable students, it seems that UC Merced's judgement would be questioned for putting students at risk in this manner.

Management Corrective Action

A full-time hazardous waste technician has been funded. This action plan will be completed by March 31, 2016, or when recruitment for this new technician position is successfully completed.

4. Reliable processes to review for required training

The UC Laboratory Safety Training policy requires safety training for employees and students who work with hazardous materials, equipment, and processes in research and teaching. Based upon the work to be completed, PI's complete, or approve, a training needs assessment for each individual in their lab group. Before the individual is granted unescorted access to laboratories, they are required to complete the safety training. There are periodically refresher training requirements for the courses.

Currently, PI's are responsible for setting up students and employees in their labs in the Laboratory Hazard Assessment Tool (LHAT). This identifies who needs personal protective equipment, laboratory safety training, and physical access to the laboratories.

During the audit, we noted that employees and students listed for lab groups were not always accurate. There were instances when PI's had not updated information to show current information.

There is currently not an efficient and effective way to review that students and employees who have been granted access to laboratories have completed the required safety courses. During the audit, we attempted to review who had been granted campus card (CatCard) access to laboratories by reviewing access reports. As a very limited number of individuals have the ability to generate these reports from the CatCard system, it was difficult to obtain reports to complete the testing. Also, LHAT and the Learning Management System (LMS) do not currently interface with one another so it is a time-consuming process to review that individuals have completed the required training. As the current process to assign access to laboratories can result in delays, there is pressure to set up access to laboratories without reviewing whether the individuals have completed all required training.

Per UC policy, PI's are responsible for verifying that individuals in their laboratories complete required training. We recommend that EH&S collaborate with PI's to periodically review that the LHAT information for laboratories is accurate. To keep the list up-to-date, employees or students who no longer need access to the laboratories should be removed from the LHAT listing for the laboratory.

Management Corrective Action

As is presently done, EH&S will review the accuracy of employees and students listed in the Laboratory Hazard Assessment Tool (LHAT) during the annual laboratory inspections. Inaccurate LHAT information will be identified as a non-critical deficiency requiring correction

within 30 days. The status of non-critical deficiencies will be reported annually to the Ethics and Compliance Program Management Committee.

This action plan will be completed as of July 1, 2016.

5. Maintaining physical security of laboratories

Laboratories contain chemicals and other materials that can be dangerous for individuals who have not been properly trained regarding these items. Access controls have been set up to limit access to employees and students who have been completed training and granted access to the laboratory.

During the audit, we noted a laboratory door propped open. This bypasses all of the physical security measures in place to limit access to the laboratory. One sign on the propped open door read, “Caution – Designated area – Reproductive toxins, Acute toxins, or Select Carcinogens may be present”. Another sign read, “Fire Door – Do not prop open”.

This same issue was noted during a 2010 audit (M11A002 – UCM Laboratory Safety). The management action plan at that time was to work to set up a door alarm/notification solution and other security alerts. While warnings were posted to not prop open doors, alarms to notify when a door is propped open were never implemented.

Per EH&S, after the 2010 audit, a “Be Smart About Safety” proposal to fulfill the management action plan was submitted. The school Deans and faculty at the time were not in favor of the proposal so the corrective action for the audit issue was never completed.

We recommend that door alarms and notifications be set up to identify when a door has been propped open.

Management Corrective Action

The recommended door alarms are not supported by the school Deans and faculty. EH&S will begin tracking when they identify that laboratory doors have been propped open. In discussion with faculty, it is suggested that more statistics be collected on propped open doors to determine the frequency, location (repeat or random), and the reason for the doors being propped open. By identifying the root causes for propping doors open, EH&S will be better able to recommend safety improvements. EH&S will begin tracking this information immediately.

6. Identifying when research will be conducted at off-site locations

During the audit, we discussed current procedures for identifying when researchers travel to off-site locations to conduct research. We also reviewed the current procedures used by other UC campuses to identify when researchers travel off-site. UC Merced currently relies upon researchers to notify Risk Services or utilize the UC travel system, Connexxus, in order to

identify when researchers will be at other locations. There are most likely many instances where researchers travel to remote locations without notifying anyone at UC Merced. As a result, the campus would not be aware if a researcher needed assistance at an off-site location.

Identifying when research will be completed at off-site locations should be identified by the Office of Research and the Sponsored Projects Office during the pre-award review of an award. The Sponsored Projects Office and researcher should identify planned travel so the Office of Research, Risk Services, and the researchers can determine necessary steps to conduct the research in a safe manner.

We recommend that formal processes be set up by the Office of Research and Risk Services to adequately identify off-site research and to protect researchers.

Management Corrective Action

To improve processes for identifying when research will be conducted off-site will require the help of different departments at UC Merced.

EH&S will update the department webpages to provide a summary of things important to Principal Investigators. This summary will include important lab safety details. The webpage will also explain important field safety details, such as contacting Risk Services before conducting research off-site. This action plan will be completed by July 1, 2016.

The Sponsored Projects Office reviews and accepts new awards for UC Merced. The office will begin identifying when it appears that off-site research will be completed during awards and will notify Risk Services of pending field research. The procedures for identifying and communicating this information will be implemented by March 31, 2016.

Departmental Research Administrators work closely with Principal Investigators to provide support and review spending on awards. Research administrators will be trained to incorporate the notification of Risk Services in their grant management when faculty are planning travel for research purposes. This will become part of their ongoing training.