

**Arizona State University
Office of University Audits
Laboratory Safety Audit Report
April 30, 2018**

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Laboratory Safety Audit Report
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Summary:

The Laboratory Safety audit was included in the Arizona State University (ASU) FY2018 audit plan approved by the Arizona Board of Regents (ABOR) Audit Committee and ASU senior leadership. The audit focused on assessing compliance to the ASU Chemical Hygiene Plan. This area was last audited in FY2007. This audit is in support of ASU's mission to establish ASU as a leading global center for interdisciplinary research, discovery and development.

Background:

ASU is one of the fastest growing research enterprises in the United States with over \$546.5 million dollars of research expenditures in 2017. As a result, there are over two thousand labs at ASU, many of which are chemical labs supporting the learning, teaching and research environments. A lab is a facility or room where potentially hazardous chemicals, biological agents, or sources of energy are used and scientific experimentation, research or education occurs. Each lab has an assigned Principal Investigator (PI) who is responsible for the overall safety of the lab as well as ensuring ASU is compliant with the various regulatory mandates governing lab safety.

ASU's Environmental Health and Safety Department (EH&S) is responsible for guiding and monitoring compliance with Federal and State regulations and University policies concerning biosafety, radiation and chemical/physical safety. EH&S has developed and implemented policies and procedures to ensure the university complies with various regulatory mandates including those from the Occupational Safety and Health Administration (OSHA). OSHA 29 CFR 1910.1450 and 29 CRD 1910.132 requires ASU to have an established Chemical Hygiene Plan (CHP) to protect and guide employees and students from potential health hazards associated with handling, use, and storage of hazardous chemicals in laboratories. As part of the CHP, EH&S has implemented a Lab Registration program to facilitate a central repository of known labs, responsible individuals, and related chemical inventories. The lab registration program utilizes location data maintained by Facilities Management, which allows EH&S to track labs and chemicals by building and campus.

As part of their overall governance processes, EH&S provides ongoing training over lab safety and other safety areas. Training programs are available in person and online to ensure that appropriate individuals have access to safety training at all times. In addition, EH&S provides ongoing oversight through periodic lab inspections. The purpose of lab inspections is to determine individual compliance with local and federal regulations.

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Audit Objective: The objective of this engagement was to assess compliance with the Chemical Hygiene Plan including the following areas:

- Ensure labs are registered annually including providing updated chemical inventories
- Assessing overall compliance to the CHP
- Ensure employees complete the required training relevant for their type of lab
- Assess EH&S governance and oversight activities to drive compliance with the CHP
- Identify opportunities for improvement

Scope: The scope of the audit focused on compliance and oversight of the CHP for the time-period of October 2016 to October 2017. Initially, lab security was included in the scope of this review. Based on initial testing, pervasive issues were noted in both the ISAAC controlled access as well as the key management processes. As a result, the physical security part of the audit will be assessed as a separate project during FY 2018.

EH&S is currently in process of identifying a replacement for their internally developed EHSA application. EHSA does not provide adequate functionality or integration opportunities to effectively meet the increased needs of the safety program including appropriate chemical management. As a result of the known limitations and the planned replacement, EHSA general computer control testing was not considered in scope of this audit.

Methodology: Our audit consisted of tests of procedures necessary to provide a reasonable basis for expressing our opinion. Specifically, audit work consisted of interviews with the EH&S and principal investigators/lab managers, observation of work processes, review of documented policies and procedures and substantive tests including the following areas:

- Confirming the CHP meets the requirements of 29 CFR 1910.1450E
- Verifying the CHP is reviewed and updated as needed on an annual basis as required by OSHA
- Validating individuals that work in the labs have completed the required safety training on an annual basis for a sample of 34 labs
- Assessing EH&S Operations Committee oversight by reviewing meeting minutes for the audit period
- Assessing CHP compliance by performing lab inspections for a sample of 34 labs across the university. Inspection testing followed the defined EH&S inspection checklist, which assesses 52 attributes of the CHP

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- Validating the accuracy and completeness of chemical inventories for the 34 labs included in the inspection testing by performing the following procedures:
 - Tracing a sample of 3-5 chemicals from the chemical inventory to ensure the chemical was in the lab
 - Tracing a sample of 3-5 chemicals from the lab to the chemical inventory
- Assessing EH&S governance by performing the following:
 - Verifying that new lab assessments are occurring timely by selecting 28 new labs and validating that EH&S performed the required assessment as defined within the CHP in addition to ensuring the responsible party form and chemical inventory were collected and updated in EHSA
 - Verifying that lab inspections are occurring every 18 months by selecting 34 labs and tracing to the last lab inspection report to ensure the inspection was performed timely and identified deficiencies were entered into EHSA for tracking
 - Confirming follow up lab inspections are performed within 30 days by selecting a sample 58 of labs with deficiencies noted in prior inspections and determining if follow up occurred in a timely manner
 - Reviewing the annual safety assessment performed by EH&S for 2015 and 2016 to ensure assessment was performed, metrics were accurate and appropriate follow up actions were completed
 - Comparing results of lab inspections performed by University Audit to the overall results reported by EH&S as part of their annual assessment to assess the accuracy of lab inspections

Conclusion: Overall, EH&S has developed a comprehensive CHP that meets OSHA requirements. Defined policies and procedures have been implemented to guide compliance with the CHP; however, improvement is needed to ensure PI's are complying with the defined requirements, especially in the areas of chemical inventories, chemical labeling, standard operating procedures and training. In addition, EH&S oversight over the CHP could be further enhanced.

EH&S has implemented an effective strategy to provide governance over the CHP. They provide ongoing training to faculty and staff, facilitate several committees focused on education and collaboration, and have a detailed website that provides an easy place for individuals to find relevant information related to lab safety. In addition, they have implemented a robust lab inspection program, which includes initial assessments when labs are started, ongoing periodic inspections and follow up inspections for labs with identified deficiencies. While they are generally meeting their goal of inspecting labs every 18 months, as ASU continues to grow, they will be unable to maintain this approach

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with existing staffing levels. In addition, they are not consistently performing the initial inspection as new labs register nor are they performing their follow up inspections on previously identified deficiencies within their defined timeline of 30 days. Testing indicated exception rates in these two areas of 61% and 55% respectively.

In addition, EH&S has implemented annual reporting regarding the university's overall performance as it relates to lab safety including compliance metrics. Improvement is required on the metrics to ensure transparency into exception rates related to lab inspections. Specifically, most labs contain multiple rooms, which are each considered a unique lab in the tracking system. When inspections are performed, deficiencies are noted overall for the lab once; however, when metrics are calculated each individual room is included in the calculation, which has resulted in exception rates being materially understated.

At the start of this audit, EH&S management reported that existing processes and systems utilized to centrally track chemicals located on the various campuses are not effective. Existing processes are manual with minimal integration with procurement systems resulting in inventories being incomplete, out of date or missing altogether. As a result, the university does not have an accurate view of where chemicals are stored nor the volume of chemicals, which may negatively affect incident response teams in the event of an accident. EH&S is currently designing a new process, including integration with the procurement systems, to address this issue.

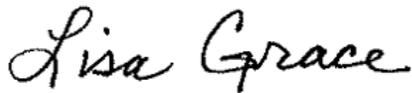
The control standards University Audit considered during this audit and the status of the related control environment are provided in the following table.

General Control Standard (The bulleted items are internal control objectives that apply to the general control standards, and will differ for each audit.)	Control Environment	Finding No.	Page No.
Reliability and Integrity of Financial and Operational Information			
<ul style="list-style-type: none"> • Reporting over lab safety is accurate and provides relevant information regarding the lab safety environment. 	Opportunity for Improvement	4	10
Effectiveness and Efficiency of Operations			
<ul style="list-style-type: none"> • Chemical Inventory tracking provides a complete and accurate view of chemical volumes and location. 	Opportunity for Improvement	1	7
<ul style="list-style-type: none"> • Principal Investigators comply with the requirements of the CHP. 	Opportunity for Improvement	2	8

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<ul style="list-style-type: none"> Required training is performed annually by individuals with access to labs. 	Opportunity for Improvement	2,6	8,13
<ul style="list-style-type: none"> EH&S provides appropriate oversight and governance over the CHP. 	Opportunity for Improvement	3,5	9,12
Safeguarding of Assets	Not Applicable	N/A	N/A
Compliance with Laws and Regulations			
<ul style="list-style-type: none"> Formal policies exist addressing the OSHA requirements related to the chemical use within Laboratories. 	Reasonable to Strong Controls in Place.	N/A	N/A

We appreciate the assistance of EH&S and individual laboratory representatives during the audit.



Lisa Grace, CPA, CIA, CISA
Executive Director

Audit Results, Recommendations, and Responses

1. Processes and systems utilized to centrally track chemicals located on the various campuses are not effective.

Condition: Chemical inventories are incomplete, out of date or missing altogether from the central tracking and reporting system.

Criteria: PI's are required to submit chemical inventories when a lab is opened as well as annual updates after that. The PI can input inventory information directly into the tracking system (EHSA) or they can provide to EH&S to input. They are also required to maintain a current inventory of chemicals in their lab at all times.

Cause: The existing process to track and report chemical inventories is manual with minimal integration with procurement systems. Information is generally maintained by manual input either by the PI or EH&S.

Effect: The University does not have an accurate view of where chemicals are stored nor the volume of chemicals, including chemicals of interest as defined by the Department of Homeland Security and other particularly hazardous chemicals, which may negatively affect incident response teams in the event of an incident.

Recommendation: EH&S management is currently designing a new process, including integration with the procurement systems to address this issue.

While this project progresses, management should assess the existing process to determine if efficiencies can be introduced that minimize the manual processes such as requiring the PI's to submit inventories electronically and limiting chemicals that are tracked to high-risk items. The focus of these efficiencies should be to improve the accuracy of higher risk areas knowing the new process/system is required to achieve the desired state of tracking and reporting.

Management Response:

EH&S agrees with the recommendation and is currently in the process of reviewing the annual lab registration process and chemical inventory submittals to determine if the process can be redesigned to improve efficiencies as recommended. However, EH&S will need to continue to employ manual processes to address regulatory compliance for chemicals of interest as defined by the Department of Homeland Security and for Particularly Hazardous Substances as defined by the Occupational Safety & Health Administration.

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EH&S is also exploring other options for environmental management systems through the ASU purchasing RFP process.

2. Compliance to the Chemical Hygiene Plan requires improvement.

Condition: PI's are primarily responsible for ensuring they comply with all local federal regulations in addition to ASU policies. Testing indicated compliance concerns in the following areas:

- 10 of 31 labs inspected (32%) that contained chemicals did not have complete or accurate chemical inventories.
- 7 of 15 labs inspected (47%) that were required to have specific standard operating procedures (SOP) related to particularly hazardous substances did not have them or did not have appropriate staff certify they were aware of the SOP as required by the CHP.
- 12 of 34 labs inspected (35%) had containers without proper labeling.
- Required training is not being completed on an annual basis.
 - 41 of 341 individuals tested (12%) were not current with fire safety training.
 - 69 of 341 individuals tested (20%) were not current with hazardous waste training.
 - 48 of 321 individuals tested (15%) were not current with lab safety training.

Other deficiencies were noted however, exception rates did not indicate pervasive issues.

Criteria: The CHP defines specific requirements that PI's must comply with related to lab safety. While EH&S owns the CHP and provides overall guidance and monitoring of the program, the PI's have direct accountability for ensuring they are in compliance.

Cause: Compliance to the CHP is the responsibility of the PI; however, this is managed by the various colleges and schools as well as through KED in a decentralized manner.

In addition, existing EH&S processes related to non-compliance are targeted at addressing specific exceptions rather than ensuring the process that resulted in the exception being addressed. Current practice during lab inspections is to note an exception and close it if the PI is able to resolve the item during the inspection (indicating it was resolved) wherever possible. This practice does not ensure that the underlying process issues are resolved to prevent the deficiency in the future.

Effect: Lack of compliance to the CHP puts faculty and staff at increased risk to lab incidents. Additionally, it puts the university at increased risk of being unable to demonstrate robust processes when reviewed by outside agencies such as OSHA resulting in potential monetary fines.

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Recommendation: Currently, EH&S provides a report summarizing the results of a lab inspection; however, these reports are only provided to the PI and other lab personnel. It is recommended that additional reporting be put into place for higher risk exceptions that is provided to Department Chairs and KED on a periodic basis to ensure there is appropriate visibility to non-compliant areas. Escalation procedures should be put in place to address instances where appropriate remediation is not performed or where issues are pervasive within a college or unit.

In addition, EH&S should review their current practice of closing items at the time of initial inspection to ensure process related issues are not handled in this manner.

Management Response:

EH&S agrees with the recommendation. While EH&S has provided annual summary reports to specific department Dean, Directors or Chairs as part of an annual review of safety and other EH&S metrics in recent years, more regular summary reports to department chairs will be developed. EH&S will work with KED and the University Lab Safety Committee (ULSC) to initiate this process and more clearly define procedures to be used if escalation of pervasive issues are identified in a particular College or unit. The current process of closing an inspection finding at the time of inspection is done only when an issue is addressed during the inspection and the lab inspector observes the corrective action. The EH&S inspection database still allows for tracking and trending these findings. We will however review this process with the ULSC and ask for their recommendation as to how to better address process related issues.

3. Follow up lab inspections are not completed timely nor is there adequate documentation to support what was assessed as part of the follow up activity.

Condition: EH&S is not completing follow up lab inspections timely. Their process is to complete follow up inspections approximately 30 days after the initial inspection to ensure that identified deficiencies have been remediated. Testing indicated that follow up inspections are not occurring timely. Specifically, 28 of 51 deficiencies included in our testing (55%) did not have a follow up review within 30 days. Testing indicated follow up is occurring on average within 95 days.

In addition, follow up activity is not documented other than to update the tracking system for the date the follow up inspection occurred. As a result, it cannot be assessed if the follow up activity is appropriate nor if all deficiencies were appropriately remediated.

Criteria: The CHP states that EH&S will conduct a follow up inspection about 30 days after the initial inspection with the exception of administrative paperwork type issues.

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Cause: Timely follow up is not performed due to resource constraints within EH&S. Due to the volume of labs, which continues to grow, there is not adequate staffing within EH&S to maintain the current lab inspection approach.

Effect: Untimely follow up may result in a high-risk area not being remediated in a timely manner increasing the overall risk to faculty, staff and the university.

Recommendation: EH&S should review their current process and determine if a risk based approach to follow up activities could be implemented. Specifically, their existing inventory of deficiencies should be assessed and a risk rating associated with each. The risk rating should define when the follow up activity should occur including when deficiencies can be reassessed at the next scheduled periodic inspection rather than through a follow up inspection. This approach will help ensure that limited resources are utilized for high-risk areas.

In addition, a minimum level of documentation should be established for follow up inspections to include the specific deficiencies tested as well as what the outcome of testing was.

Management Response:

EH&S agrees with the recommendation and will initiate a process to work with the EH&S Operations Committee to rank its inspection checklist items based on risk. For example, inspection findings for incompatible chemical storage would require a follow up within the specified time frame whereas a finding for maintaining training records may not. EH&S will work with the Operations Committee and the ULSC to develop new language to support this for the CHP. This will allow EH&S's current data management system to issue standard reports sent to principal investigators identifying the highest risk items clearly identifying that they are a priority and that a follow up inspection will be scheduled for those items. EH&S will revise its current procedures to specify which inspection items require specific documentation in the data management system based on risk. Current resources do not allow for entering complete documentation for all inspection items. Additionally, EH&S will explore alternate approaches to completing lab inspection follow up activities including documentation.

4. Annual reporting over lab safety requires improvement.

Condition: EH&S performs an annual self-assessment over lab safety. The purpose of the assessment is to evaluate regulatory compliance and identify continual improvement. As part of the assessment, compliance metrics are reported; however, exception rates are materially understated.

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In addition, compliance rates related to training are not included in the report. Instead, the number of individuals that have completed training compared to prior years is reported.

Criteria: Annual reporting should provide a clear view of non-compliant areas across the university to ensure that university leadership understands problem areas and can make informed decisions where additional focus is required.

Cause: When inspections are performed, deficiencies are noted overall for the lab once; however, when metrics are calculated each individual room is included in the calculation, which has resulted in exception rates being materially understated. For example, a lab inspection may cover 10 rooms under the same PI that are located together. If a deficiency is noted, it will be noted once however, in metric reporting the noted exception rate will reflect 10% for that specific PI.

The overall count of individuals that have completed training does not give adequate visibility to compliance exceptions.

Effect: The current metrics included in reporting do not provide an accurate representation of compliance rates.

Recommendation: Existing metric calculations should be revised to ensure that they accurately reflect exception rates in the environment. Either exceptions should be noted for each of the rooms located in a lab that are subject to the exception or the denominator for the metric should be adjusted to include only the main lab that exceptions are recorded against.

In addition, EH&S should enhance current reporting over training to include actual compliance rates at the lab level similar to the other metrics.

Management Response:

EH&S has used a data management system referred to as EH Assistant that is used at a number of other universities for about ten years. The metrics have been generated using the same system and considers the improvement in the downward trends to be an accurate reflection of improvement in ASU's performance in laboratory safety over this time period. Previous trend analysis has led EH&S to implement new safety programs to enhance existing training to increase safety awareness.

However, EH&S agrees with the recommendation to enhance its metrics related to laboratory safety and is already in the process of reviewing all EH&S metrics reported to ASU's management. The current metrics reported annually are automatically generated from the EH&S data management system and will require modification from the vendor

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to meet the objectives of the recommendation. EH&S will request this modification and if it cannot be provided by the vendor, EH&S will generate metrics manually and work with the EH&S Operations Committee and the ULSC to ensure metrics are providing an accurate assessment of compliance with the CHP requirements.

Currently, the EH&S data management system cannot identify all employees in specific units who may require lab safety training. EH&S will work with the ULSC to review this method of reporting and request input for improvement including consideration of providing specific names of individuals identified during inspections that were not trained. For this reason EH&S has been providing unit leadership with annual reports that list all employees currently trained in laboratory safety and hazardous waste management with a recommendation to determine if any other employees in their unit require this training.

5. New lab assessments are not being performed consistently.

Condition: EH&S does not consistently complete new lab assessments. Specifically, 17 of 28 new laboratories (61%) did not have a new lab assessment completed as directed by the CHP.

Criteria: EH&S performs new lab assessments as a way to offer guidance and assistance on lab registration, chemical inventory, and training requirements and to ensure that all hazardous material regulations are addressed and satisfied.

Cause: New lab assessments are not performed consistently due to resource constraints within EH&S. Due to the volume of labs, which continues to grow, there is not adequate staffing within EH&S to support the current approach of performing an inspection for each new lab that starts.

Effect: Without the initial assessment, high risk issues may go undetected for up to 18 months increasing the safety risk to faculty and staff as well as overall for the university.

Recommendation: EH&S should implement a risk based approach on performing new lab assessments. Specifically, utilizing the lab registration form, EH&S should identify the specific triggers that indicate potential higher risk areas and focus their limited resources on those labs. Lower risk labs should be required to perform a self-assessment utilizing EH&S checklists to ensure they are compliant.

Management Response:

EH&S agrees with the recommendation and will utilize the current laboratory risk categories in the Chemical Hygiene Plan to prioritize only Risk Level 2 and 3 laboratories for startup inspections. As most new laboratories fall into these categories EH&S will work with senior leadership and its committees to determine if additional resources can

be made available to address this finding. If additional resources are not available, EH&S considers start up inspections very important and would prioritize them over routine inspections resulting in a longer cycle time between inspections for existing labs.

6. Facilities Management has not implemented formal tracking to ensure that third party janitorial staff are completing required safety training.

Condition: Many of the labs at ASU utilize Olympus for janitorial services. There are no processes in place to validate that Olympus staff receive required safety training prior to working in the lab.

Criteria: Contractually, Olympus is required to ensure that their employees receive various safety training at time of hire and annually thereafter. Specific training includes the Blood Borne Pathogens (annual 365), Asbestos Awareness (annual), and Hazardous Communications (initially and as needed afterwards) and Driving on the Mall (as needed).

Cause: Formal tracking and monitoring by Facilities Management has not been put in place to ensure Olympus staff complete the required training as stated in the contract.

Effect: Lack of training potentially puts Olympus staff at increased risk to lab incidents. Additionally, it puts the university at increased risk of being unable to demonstrate robust processes when reviewed by outside agencies such as OSHA resulting in potential monetary fines.

Recommendation: Facilities Management should work with Olympus to implement processes to ensure Olympus staff completes all required training. Processes should involve Olympus confirming annually that training has been completed.

EH&S should implement additional oversight in this area to ensure required training is completed.

Management Response:

Olympus was required to bring training current in response to this finding. They communicated this was complete as of April 30, 2018. In addition, Facilities Management will implement monitoring processes to ensure Olympus completes required training and provides certification on an annual basis. We also plan to update the existing training requirements to include specialized lab safety training that provides additional guidance for Olympus employees to explain how their job duties may vary when working in the lab environment.

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EH&S will also provide a disclosure of potential hazards in ASU laboratories and make a recommendation to Olympus' management that they ensure their OSHA Hazard Communication Training address these potential hazardous.

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