BOISE STATE UNIVERSITY

NEEDS ASSESSMENT

ADVANCED MATERIALS LABORATORY

FINAL REPORT

Mariola Diawara
Damien Miggins
Andrew Clark
Sam Wilson

OPWL 529
Needs Assessment
Fall 2023

Table of Contents

Boise State
Advanced Materials Lab

The Organization

- Lab specializes in researching material processing and behavior under extreme conditions
- Collaborates with several prominent organizations and receives support from a diverse range of sponsors
  - National Science Foundation
  - Department of Energy
  - Department of Defense
  - Idaho National Laboratory
- Five years in a row, the Advanced Materials Laboratory has been awarded the safest research laboratory at Boise State University
- Typically, 3-7 undergraduates and an equal number of graduate students are part of the team

Aim of Assessment

- Strength-based process to highlight successes
- Bolster the already present safety culture, while safeguarding the knowledge and skill transfer to students

Appreciative Inquiry

- Discovery: Identifying and appreciating the best of 'what is' working well
- Dream: Envisioning 'what might be', focusing on the potential and aspirations for improvement
- Design: Planning and prioritizing 'what could be' - designing the ideal state of changes to be implemented
- Destiny: Implementing 'what will be' - execute the design and sustain the changes

Process

Data Collection

- Extant Data
- Interviews

Data Analysis

- Data Interpretation
- Trend Identification

Root Causes

- Standardized Practices
- Workplace Culture

Intervention Selection

- Siko's I^2 Matrix
- Hale's Intervention Model
- Prioritization

Recommendations

Formalize Mentorship Program

Refine & further develop mentorship program with clear roles, matched pairings, safety trainings, and a feedback system for continuous enhancement

Build a Succession & Recruitment Plan

Conduct talent assessments, develop targeted recruitment strategies, that align with organizational dynamics

Perform Reciprocal Safety Audits

Partner for reciprocal safety audits, regularly exchange and analyze findings for continuous safety improvement

Lab Safety Performance Rubric

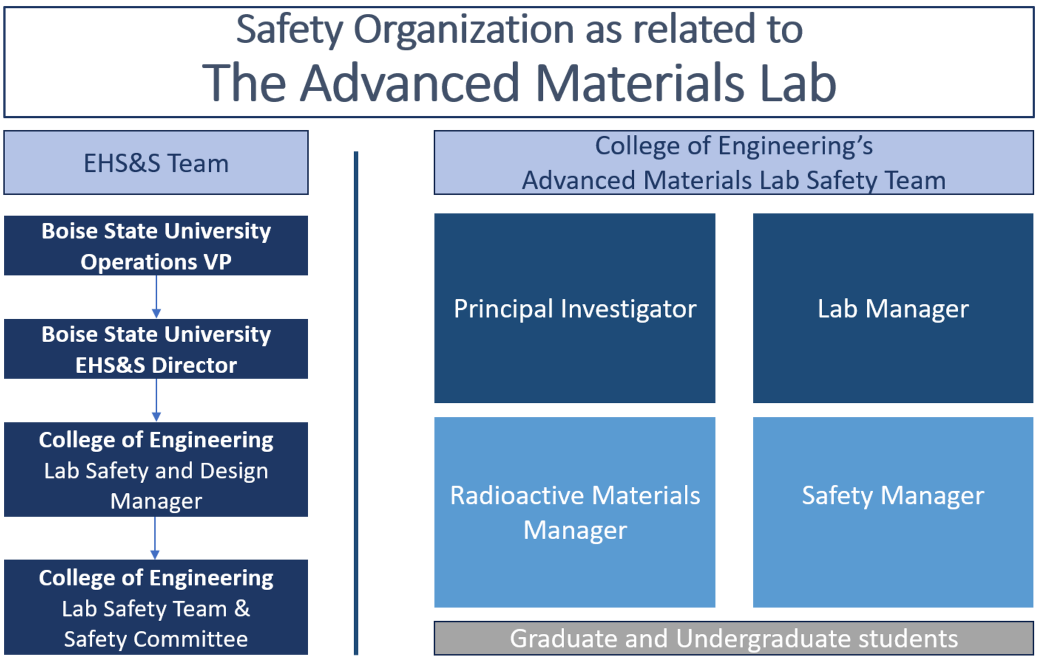
Utilize tool to assess safety practices in other laboratories and formulate evidence-based strategies for improvement

Organization

Boise State University (BSU), established in 1932 and situated in Boise, Idaho, is a public university renowned for its research-driven education. The university caters to approximately 26,000 students annually. Its College of Engineering (COEN) includes 450,000 square feet dedicated to classrooms, research labs, innovation studios, and collaboration spaces. The College of Engineering hosts a dedicated Safety Department, part of the BSU's Environmental Health, Safety and Sustainability organization, whose mission is to foster a robust safety culture. It is led by our client, the Lab Safety and Design Manager, whose responsibilities are spread across campus and specifically to all COEN lab and workspace safety elements (Table 1).

Consequently, the client and his safety team play a crucial role in educating the faculty, staff, and student community on emergency response protocols, health and safety policies, laboratory procedures and compliance through regular lab inspections, ensuring lab safety. Through its activities it underlines a shared responsibility for safety, continual improvement, and adherence to safety protocols in all aspects of the college's operation and in collaboration with the COEN research laboratories. One of those labs is the Advanced Materials Laboratory (AML).

Table 1 Safety Organization



The AML specializes in researching material processing and behavior under extreme conditions. A key focus area is nuclear technologies, including the development of materials and sensors for nuclear reactors, as part of the Advanced Sensors and Instrumentation Program. This lab collaborates with several prominent organizations and receives support from a diverse range of sponsors, including the National Science Foundation, Department of

Energy, Department of Defense, Idaho National Laboratory, Oak Ridge National Laboratory, Los Alamos National Laboratory, and more. Opportunities within this lab are available for both undergraduate and graduate students. Typically, 3-7 undergraduates and an equal number of graduate students are part of the team. Openings for new students vary annually, based on funding. The goal is aligned with national standards and that of the COEN; to build and maintain a strong safety culture where everyday habits from everyone involved reflect this commitment. The AML has allocated specific safety roles within the lab, to meet those goals (Table 2).

Table 2 Project Team

Needs Assessment Project Team Members	Role
Lab Safety and Design Manager	Client
Sam Wilson	Project Lead
Mariola Diawara	Main POC – Client Liaison
Andrew Clark	Editor, Feedback Manager
Damien Miggins	Design, Delivery
Main client team	**Responsibilities in the lab**
Principal Investigator	Oversees the lab, including compliance and ethics
Lab Manager	Runs many of the day-to-day lab operations
Radioactive Materials Manager	Handles all aspects of radioactive materials
Safety Manager	Manages lab safety, walkthroughs, compliance

Problem or Opportunity

The labs and studios at BSU embrace a commitment to safety by instilling a culture that values knowledge, expertise, and a proactive mindset. Instead of merely aiming to minimize incidents and near misses, the focus is on achieving an environment with thoughtful lab members who can respond to these occurrences accordingly. This ambitious goal underscores the collective responsibility of staff and students across engineering, science, and arts labs.

Through our interview process with the Materials Sciences Lab, we found that the lab culture is key in their exemplary lab hygiene and safety record. Namely, the emphasis of the lab puts on recognizing and enhancing the shared foundation of knowledge, expertise, and process-oriented mindset that exists across all lab spaces. The project, while specifically targeting the Materials Sciences Lab due to scope, seeks potential gains and shared opportunities that could benefit other labs within the university.

One constant factor that plays a major role in the labs at Boise State is the constant influx of new students and educators joining these labs, and many labs host individuals who have been there for a number of years. These existing members are not only guardians of safety but also mentors, guiding newcomers and passing on crucial information to ensure the sustained application of safety practices.

At the moment, the Lab Safety and Design Manager, along with other staff, imparts safety education to newcomers through live sessions, their recorded versions, an at-their-own-pace study of in-house learning resources, and crucially their mentorship program. However, the concern here is in lab hygiene and safety maintenance. Should there be a sudden change in staffing the labs, there is a real risk of backsliding or an overall loss in safety performance. A thorough review of the Material Sciences Lab members aims to record and spot patterns that could hint at chances to enhance training, mentorship, or infrastructure to bolster and sustain lab safety.

Initially the Project, on behalf of the Lab Safety Officer and the Safety Team at BSU aimed to:

a) Review instructional and non-instructional safety support.
b) Analyze safety incidents to identify potential instructional and non-instructional interventions.
c) Develop data-driven recommendations to enhance lab safety at Boise State University (BSU).

From our interviews early on, it became clear that the Advanced Materials Lab (AML) has been a consistently exemplary performer among BSU labs for the past 5 years with a stellar safety record, comprehensive training, and a strong safety culture. The question then was how to provide value to the AML, which started with a change from a deficit-based approach to a strengths-based approach also known as Appreciative Inquiry (AI). This shifted the focus of our analysis to AI's 4D model (Bentowski & Yamaga, 2006):

Discovery: Identifying and appreciating the best of ‘what is’ working well in the current organization.
Dream: Envisioning 'what might be', focusing on the potential and aspirations for improvement.
Design: Planning and prioritizing 'what could be' – designing the ideal state of changes to be implemented.
Destiny: (sometimes referred to as Delivery): Implementing 'what will be' – involving stakeholders to execute the design and sustain the changes.

In our comprehensive analysis of the Advanced Materials Lab at Boise State University, we adopted a strengths-based approach to understand and articulate the lab's current operational state. Our initial phase involved crafting key questions aimed at uncovering the lab's core competencies and practices that contribute to its success. Investigating the causes behind AML's effectiveness, our goal was to identify the specific aspects of its processes and culture that set it apart as an exemplary facility. The ultimate goal was not only to recognize these successful practices but to explore how they could be adapted and applied in other areas to replicate similar successes. Building on this foundation, we envisioned an ideal state for the lab, one that leverages its existing strengths while addressing areas with potential for growth and enhancement.

Current State

For our assessment of the current state of AML at BSU, we employed two primary models to guide our analysis: the Appreciative Inquiry (AI) 4-D Model and Chevalier's Updated Behavior Engineering Model (BEM). The AI model was instrumental in formulating key questions that helped us investigate the lab's current operational state and daily practices. This approach, grounded in appreciative inquiry, steered our focus towards identifying and understanding the lab's most effective practices.

To gain a systemic view of the lab, our questions were structured around the six dimensions defined in Chevalier's Updated BEM: Information, Resources, Incentives, Motivates, Capacity, and Knowledge/Skills (see Table 3). This framework allowed us to thoroughly examine both the internal dynamics of the lab and the external factors influencing its operations.

Table 3 Chevalier's Updated Behavior Engineering Model

Environment		
Information	Resources	Incentives
Roles and performance expectations are clearly defined; employees are given relevant and frequent feedback about adequacy of performance. Clear and relevant guides are used to describe the work process. The performance management system guides employee performance and development.	Materials, tools, and time needed to do the job are present. Processes and procedures are clearly defined and enhance individual performance if followed. Overall physical and psychological work environment contributes to improved performance; work conditions are safe, clean, organized, and conducive to performance.	Financial and nonfinancial incentives are present; measurement and reward systems reinforce positive performance. Jobs are enriched to allow for fulfillment of employee needs. Overall work environment is positive, where employees believe they have an opportunity to succeed; career development opportunities are present.
Individual		
Knowledge/ Skills	Capacity	Motives
Employees have the necessary knowledge, experience, skills to do the desired behaviors. Employees with the necessary knowledge, experience, and skills are properly placed to use and share what they know. Employees are cross-trained to understand each other's roles.	Employees have the capacity to learn and do what is needed to perform successfully. Employees are recruited and selected to match the realities of the work situation. Employees are free of emotional limitations that would interfere with their performance.	Motives of employees are aligned with the work and the work environment. Employees desire to perform the required jobs. Employees are recruited and selected to match the realities of the work situation.

Adapted from Chevalier (2003)

Our primary method of data collection involved conducting semi-formal qualitative interviews, supported by an analysis of incident records. The interviews were designed to explore each of the six dimensions of the BEM, ensuring a comprehensive exploration of key aspects of the lab's environment. Additionally, we utilized existing data, primarily to confirm or disconfirm the findings revealed in the interviews.

Factors of the current state revealed from the interviews were categorized and aligned with the six dimensions of the BEM (Table 4). This categorization process enabled us to construct a systemic overview of AML's current state, providing a foundation for our subsequent analysis and recommendations. See Appendix A for the entire codebook with data sources.

Table 4 Condensed Codebook with Categories and Definitions

Code	Shorthand	Definition
Training	Info-Training	How well the training program prepares lab members to perform in a safe way.
Culture	Info-Culture	How well safe behavior is reinforced or undermined by senior lab members and managers.
Procedures	Info-Procedures	How well procedures support or hinder safe behavior.
Third party audits	Info-Audits	How well third party audits contribute to the information about, and sustainability of a safe environment.
Lab hygiene	Resources-Hygiene	How well the lab's environment is kept to a high degree of cleanliness and organization.
Tools	Resources-Tools	How well the lab provides necessary tools, or makes them available upon request; including SOPs and other necessary information.
Community	Incentives-Community	How well the lab community supports learning, interpersonal engagement, and a positive work environment.
Personal Development	Incentives-Development	How lab staff feel supported and empowered by coming from a high performing lab.
Inherent desire to be safe	Motives-Personal Safety	How much the lab staff are inherently motivated to perform their work in a safe way.
Hiring Policy	Capacity-Hiring	How well the hiring process determines how well lab staff are able to perform.

Staff Management	Capacity-Management	How much lab staff feel pressured to work while in a compromised state like sleep deprived or emotionally distracted.
Knowledge of unsafe behavior	Knowledge-Behavior	How much the lab staff know about unsafe practices and what to do to perform in a safe way.

Training:

At the AML, training is recognized as a dynamic and essential component of lab safety. The process is carefully structured to allow learners to progressively gain autonomy, especially critical when handling dangerous equipment. This gradual increase in responsibility not only ensures thorough learning but also fosters a sense of ownership among the learners. A standout feature of AML's training approach is the role of graduate students who “own” and are responsible for training others on specific lab equipment. This ownership translates into a culture of peer teaching, where knowledge and safety practices are shared and reinforced.

We have identified room for enhancement in the lab’s training program to meet the evolving needs of its staff. The lab members have expressed a need for resources that allow for quick and easy access to crucial safety information. This need is particularly evident when staff require refreshers on specific topics outside their routine operations. Staff have also identified a desire for a more varied annual safety seminar to increase critical engagement and challenge.

Culture:

The culture within AML is one of its strongest assets in maintaining a high safety standard. Open communication is deeply ingrained in the lab's ethos, creating an environment where discussing safety concerns is encouraged and free from fear or defensiveness. Senior staff members play a critical role in this culture by modeling ideal behavior, setting a standard for younger staff and students. This modeling goes beyond simply following procedures; it involves fostering a mindset where mistakes are learning opportunities. Regular safety-focused team meetings and the encouragement of proactive identification of potential unsafe practices further strengthen this culture. Importantly, lab members are encouraged to think critically, to question and understand the rationale behind their actions and SOPs, promoting a deeper level of safety awareness and preparedness.

Procedures:

AML has implemented regular safety walkthroughs as part of its regular operations. These walkthroughs involve different staff members each time, offering varied perspectives and ensuring widespread safety consciousness. Students are actively involved in creating and updating SOPs, a practice that not only keeps these procedures relevant but also promotes a sense of responsibility and ownership among the student body. When safety incidents occur, AML undertakes detailed reporting and analysis to understand the root causes and to implement corrective measures. Perhaps most importantly, lab management does not punish those involved in causing or reporting the accident. This comprehensive approach to incident handling contributes significantly to the lab's continuous improvement in safety practices.

Third-Party Audits:

Third-party audits play a significant role in the Advanced Materials Lab’s ability to maintain and enhance its safety standards. Currently, these audits are conducted by the COEN safety team, providing an essential external perspective on the lab's safety practices. The COEN team's audits are valuable, offering a degree of objectivity complements the lab's internal assessments.

However, our analysis suggests that there is room for further enhancement in this area. While the current Safety Madness event is appreciated, there are opportunities for it to be improved upon to make it a more rigorous learning opportunity.

Lab Hygiene:

Maintaining a clean and orderly lab environment is a key safety strategy at AML. Consistent labeling and storage practices are strictly adhered to, ensuring that the lab remains a safe working space. This focus on hygiene and organization aids in quickly identifying and addressing potential safety hazards.

Tools:

AML proactively ensures that all necessary tools and equipment are readily available and in proper working condition. Strict adherence to using the correct tools and equipment for each task is a fundamental rule, critical for safe lab operations. There is a staff member responsible for ensuring common items such as gloves are always kept in stock, while all lab staff are empowered to order unique or less commonly used items as needed.

Community:

The sense of community both within and outside the AML is a cornerstone of its safety culture. Regular social gatherings and activities strengthen the bonds among lab members, enhancing communication and team dynamics. This strong community spirit transcends into the lab’s daily operations, contributing to a cohesive and collaborative approach to safety.

Personal Development:

At the AML, personal and professional development opportunities are closely linked to the lab's culture of safety. Staff adherence to high safety standards is an integral part of their professional development. Stringent adherence to policies cultivates a strong sense of competence and confidence among the staff. Such attributes are highly valued, especially when staff members transition to other labs outside the university or step into the wider professional world.

The reputation of AML has for high-quality research and its commitment to maintaining exemplary safety standards significantly enhances the future career prospects of its staff. When staff members from AML move to new environments, their background from a lab known for its safety and excellence is often recognized and appreciated. It creates a profile of a well-trained, safety-conscious, and competent professional, which opens doors to diverse work and research opportunities.

Personal Motivation to be Safe:

A culture of vigilance and thoughtful action is deliberately nurtured at AML. Staff members are reminded that their personal safety is paramount, and complacency is considered a significant risk. This culture encourages staff to take responsibility for their safety, fostering an environment where safety is a personal, as well as collective, commitment.

Hiring Policy:

The hiring policy at AML is a critical component of its success. AML places a significant emphasis on cultural fit during the recruitment process, with a particular focus on safety-mindedness. This approach ensures that new hires not only align with but also contribute positively to the lab's safety culture.

Our data indicates that there can be a noticeable drop in safety performance during periods of transition, especially when key members leave. The time it takes for new members to fully reach the level of proficiency of their predecessors can create temporary gaps in the lab's safety practices.

Staff Management:

Management at AML is characterized by its adaptability and focus on individual success. The lab prioritizes safety and well-being over the pressure to complete tasks, creating a supportive work environment. This approach includes recognizing and responding to signs of fatigue or emotional distress, ensuring staff well-being is always a priority.

Knowledge of Unsafe Behavior:

AML leverages a hands-on learning approach. Central to this approach is the role of graduate students, who are entrusted with the responsibility of teaching others. This method serves multiple effects: it not only imparts practical knowledge about the lab equipment but also deepens the understanding of the teachers themselves. When graduate students teach their peers, they gain a better understanding of the inner workings of the equipment, reinforcing their own learning and enhancing their ability to identify and address unsafe practices.

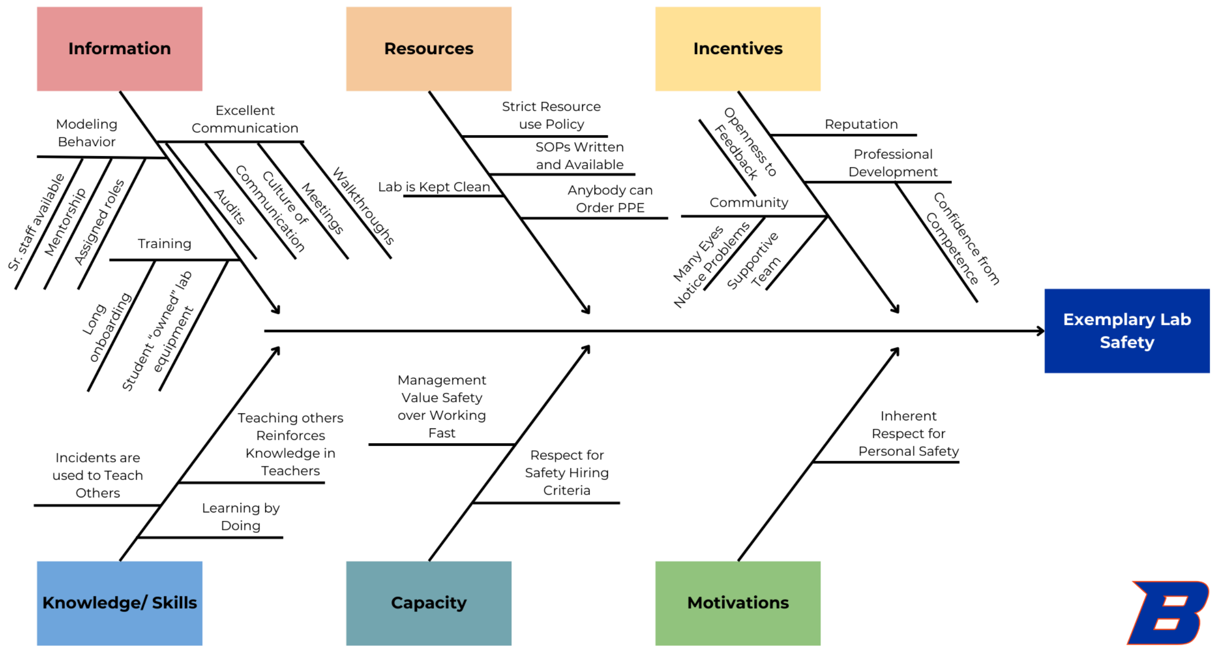
By actively engaging in the teaching and application of safety procedures, staff members develop a more nuanced understanding of safe and unsafe behaviors. This method goes beyond theoretical knowledge, allowing staff to experience first-hand the importance of each safety step and procedure.

Cause Analysis

In the cause analysis phase of our needs assessment at the AML, we focused on analyzing the data compiled in the codebook, with the aim of identifying common themes that interviewees highlighted as pivotal to the lab's success. This involved an examination of the responses and observations captured during the interviews, seeking patterns and recurring elements that were consistently mentioned as key contributors to the lab's operational excellence.

To facilitate a deeper understanding and visualization of these critical factors, we employed the use of a fishbone diagram (Figure 1). This tool allowed us to systematically organize and present the identified themes, illustrating how various practices and aspects of the lab interconnect and contribute to its overall success. By mapping these themes onto the fishbone diagram, we visually see relationships and hierarchies among different practices, as well as their relative impact on the lab's performance.

Figure 1 Fishbone Diagram



Adapted from Watkins (2012) Figure 3B.1 p.199

This approach enabled us to not only pinpoint the specific practices that are central to AML's success but also to understand the systemic interplay of factors that work together to create a high-functioning, safe, and productive lab environment.

Training:

AML's training program is progressive and comprehensive, involving a three-step approach that encompasses observational learning, hands-on experience under supervision, and eventual autonomous practice. This method ensures a deep understanding of safety protocols and cultivates critical thinking among trainees.

Peer-led teaching, particularly by graduate students who 'own' specific lab equipment, enhances the learning experience and reinforces safety practices, creating a culture of accountability and continuous learning.

Staff Modeling Ideal Behavior:

Senior lab staff and managers at AML set high standards of behavior, directly influencing the lab's safety culture. Their commitment to modeling ideal practices plays a crucial role in maintaining a high bar for safety and operational excellence.

The mentorship program at AML is integral to its success, with experienced lab members guiding newcomers. This mentorship fosters professional and personal growth while reinforcing adherence to safety protocols.

Leadership within AML is highly accessible, with managers exemplifying the ideals they expect from their staff. This approach fosters respect and trust, further strengthening the lab's culture.

Culture of Communication:

Regular staff walkthroughs in the lab and safety-focused meetings ensure that safety remains at the forefront of operations. These activities serve as constant reminders and checks for safety adherence.

AML's culture encourages open communication, where all opinions are valued, and everyone is empowered to ask questions and speak up about safety concerns. This openness contributes to a proactive approach to safety and a willingness to learn from different perspectives.

The lab welcomes external audits as opportunities for learning and staying vigilant against complacency. These audits provide fresh perspectives and help in identifying potential areas of improvement.

Reporting of all incidents, big or small, is a key policy at AML. Staff members are never punished for speaking up or causing accidents, fostering a culture where safety concerns and mistakes are openly discussed and addressed.

Ideal State of the Lab

In the process of defining the ideal state for the AML, we participated in a creative exercise with various stakeholders. Our goal was to conceptualize an “idealized” version of the lab, independent of limitations and constraints. This visioning exercise was grounded in a series of key questions designed to encourage stakeholders to think expansively about what a “blue sky” scenario for the lab might look like, free from resource constraints.

Once this unrestricted vision was established, we engaged stakeholders in a more grounded discussion to shape a realistic and achievable version of this ideal state. This step was crucial in aligning the aspirational aspects of the lab's future with the practicalities and constraints of available resources. Stakeholders were asked to consider what aspects of their “blue sky” vision could be feasibly implemented, taking into account realistic resource availability and other practical considerations.

The insights and aspirations gathered from these discussions were then integrated into our unified codebook (Appendix A). Each element of the envisioned ideal state was categorized according to the relevant dimension in Chevalier's updated BEM. This approach allowed us to systematically organize these ideals, ensuring that they were aligned with the different aspects of lab operations as defined by the BEM.

Through this process, we were able to construct a vision of AML that is both aspirational and grounded in reality. This vision serves as a guide for our intervention selection.

E-Learning Integration:

In the ideal state, AML has fully integrated e-learning 'nuggets' or micro-learning modules into its training ecosystem. These modules are readily available on all computer systems for quick reference, ensuring that staff and students have instant access to vital information the moment it is needed. This would include all training materials, as well as material data sheets, SOPs, operations manuals, emergency protocols, and any other information the lab staff identify as useful to their work. This approach not only facilitates immediate knowledge refreshment but also supports continuous learning, making it easier for lab members to stay updated with the latest safety protocols and procedures.

Dynamic Yearly Safety Seminars:

The lab's yearly safety seminar undergoes dynamic changes annually to retain the interest of recurring participants. The content is creatively redesigned each year to present familiar safety concepts in new, engaging ways. Furthermore, the knowledge checks following these seminars are varied year-to-year, posing greater challenges to experienced staff, thereby ensuring their continuous engagement.

Structured Onboarding and Training Processes:

AML's onboarding process is meticulously documented, with clear guidelines and best practices for each machine or tool in the lab. This documentation is regularly updated by the student 'owners' of the equipment, ensuring that the training material is always current and relevant. This comprehensive approach to onboarding and training not only streamlines the learning process for new members but also reinforces the ownership and responsibility of existing members.

Cultivating Lab Culture:

While the lab already possesses an excellent culture, in its ideal state, there is a concerted effort to reinforce this sense of community. This is achieved through the establishment of traditions, rituals, and bonding experiences that go beyond the confines of lab work. These communal activities strengthen team cohesion and foster a supportive, collaborative environment.

Enhanced Mentorship Program:

The mentorship program at AML is fully supported with structured processes, organization, and dedicated resources. Training for both mentors and mentees is formalized, and regular meetings are held to exchange best practices and share knowledge. Additionally, specific staff members are assigned to oversee the mentorship program, ensuring its effective implementation and success.

Robust Succession Planning:

A thorough succession planning program is in place to mitigate any performance dips during both expected and unexpected staff turnovers. This program might be integrated with the mentorship program or operate independently, but its aim is to prepare future lab leaders in advance, ensuring a seamless transition and continuity in lab operations.

Intensified Third-Party Audits:

In its ideal state, AML increases the frequency and thoroughness of third-party audits. These audits leverage the lab's external relationships to bring in independent perspectives, providing fresh insights into the lab’s safety practices. The COEN safety team’s audits are also intensified, incorporating simulated emergency scenarios to test the lab staff’s response capabilities and to provoke discussions about preparedness and procedural improvements.

University Support for Safety Initiatives:

The university steps up its support for COEN’s safety initiatives, providing increased resources and backing. This enhanced support includes funding for safety equipment, training programs, and staff. The university's commitment plays a crucial role in realizing the lab's ideal state, ensuring that COEN remains at the forefront of safety and research excellence.

Intervention Selection

The selection of interventions for the Advanced Materials Lab (AML) was the final step in our needs assessment process, aimed at bridging the gap between the lab's current state and its envisioned ideal state. This process involved a comparison of these two states to identify key areas for improvement, with a particular focus on leveraging the lab's strengths, as identified in the cause analysis, to inform our choices of interventions.

To systematically select and optimize lab safety interventions, we adopted Judy Hale's Intervention Selection Model from "The Performance Consultant's Fieldbook" (2006). This model provides a structured approach to categorizing interventions into distinct groups and families, thereby facilitating their identification and application. By aligning these categorized interventions with the lab's identified safety strengths, we ensured that our approach was both targeted and effective (Table 5). This method allowed us to choose interventions that not only addressed specific safety needs but also complemented the existing successful practices within the lab.

Table 5 Hale's Intervention Family

Hale's Intervention Family	Type of Intervention
Interventions that Standardize	Formalize the Mentorship Program - a pillar of safety training, pairs seasoned experts with new members to enhance learning and adherence to safety protocols. Key features include: · Developmental focus on growth for mentors and mentees. · Strategic selection for optimal compatibility and knowledge transfer. · Reinforcement of safety standards and lab practice quality. · Promotion of a continuous learning and safety-centric culture.
Interventions that Develop	Build a Succession and Recruitment Strategic Plan - a key initiative for organizational growth, focusing on future leadership and talent continuity. Its core elements include: · Identification and development of potential leaders for future roles. · A systematic approach to talent acquisition aligned with organizational goals. · Ensuring a consistent pipeline of skilled individuals for critical positions. · Fostering an environment that values long-term career progression and organizational stability.

	Create Lab Specific Training Modules - Integrated in SOPs and Processes - an essential strategy for enhancing lab safety and efficiency. Key aspects of this program include: · Initial phase focusing on learning through observation of SOPs and experienced personnel. · Transition to hands-on tasks with close supervision, emphasizing understanding of SOPs. · Final phase grants autonomy while maintaining supervisory oversight to reinforce safety protocols.
	Continue Team Building Activities and events - integral to fostering a culture of growth, recognition, and fulfillment in the lab. These activities: · Support a culture of empowerment, where team members actively contribute to safety. · Enhance teamwork and support, promoting collaboration and mutual support among employees. · Complement leadership efforts in instilling a comprehensive commitment to safety. · Contribute to the lab's evolving practice of integrating safety into its core culture, ensuring continuous improvement and engagement.
Interventions that Measure	Perform reciprocal safety audits with trusted external partners. Allows for Benchmarking - a critical strategy for enhancing safety standards and practices. Key features include: · Collaboration with external partners for comprehensive safety audits. · Opportunity for benchmarking against industry standards and best practices

Feasibility Analysis

We then utilized Siko's I-2 Intervention Matrix (2013) to assess the feasibility and prioritize the selected interventions. The matrix's design, focusing on the invasiveness (Table 6) and impact (Table 7) of each intervention, was instrumental in distilling the complex issue of lab safety into a manageable and quantifiable framework. The quadrant layout of the matrix enabled us to effectively prioritize interventions, ensuring that our choices were effective and balanced. The dual-axis framework of the matrix, evaluating both immediate impact and organizational invasiveness, was crucial in our decision-making process, helping us to identify solutions that were not only effective but achievable.

Invasiveness criteria definitions:

Scale: 1 = Least Invasive (Preferred) to 5 = Most Invasive.
Cost - the total financial resources needed for implementing and maintaining an intervention.
Ease of Implementation - the simplicity and feasibility of putting an intervention into practice.
Manpower Needed - the quantity and skill level of personnel required to execute an intervention.

Table 6 Interventions Ranked by Invasiveness

Interventions Ranked by Invasiveness				
Intervention	Cost	Ease of Implementation	Manpower Needed	Invasiveness Total
Build a Succession and Recruitment Strategic Plan	1	2	1	4
Formalize the Mentorship Program	2	2	3	7
Create Lab Specific Training Modules Aligned & Integrated in SOPs and Processes	5	3	5	13
Perform Reciprocal Safety Audits with Trusted External Partners to Benchmark Against Industry	2	3	3	8
Continue Team Building Activities and Events	2	1	1	4

Impact criteria definitions:

Scale: 1 = Lowest Impact to 5 = Highest Impact (preferred).

Effectiveness - defined as the degree to which an intervention influences lab safety performance.
Lab Morale - refers to the effect an intervention has on the overall mood, motivation, and job satisfaction of the laboratory staff.
Sustainability - the ability of an intervention to maintain its effectiveness and benefits over time without depleting resources.

Table 7 Interventions Ranked by Impact

Interventions Ranked by Impact				
Intervention	Effectiveness	Lab Morale	Sustainability	Impact Total
Build a Succession and Recruitment Strategic Plan	5	4	5	13
Formalize the Mentorship Program	4	5	5	14
Create Lab Specific Training Modules Aligned & Integrated in SOPs and Processes	3	3	3	9
Perform Reciprocal Safety Audits with Trusted External Partners to Benchmark Against Industry	3	4	3	10
Continue Team Building Activities and Events	2	4	3	9

Utilizing the I-2 matrix improved our approach to prioritizing interventions. This strategic tool allowed us to visually plot interventions and identify those within the desirable Quadrant 2, characterized by High Impact and Low Invasiveness (Table 8). According to Siko (2013), interventions in this quadrant, located in the lower-right of the matrix, are particularly favorable (Figure 2). They are capable of delivering substantial benefits with minimal resource strain, such as financial outlay, complex implementation hurdles, or excessive manpower demands. This quadrant's interventions are thus earmarked for prioritization, as they promise the greatest return on investment and ease of adoption, aligning with organizational goals of efficiency and high performance.

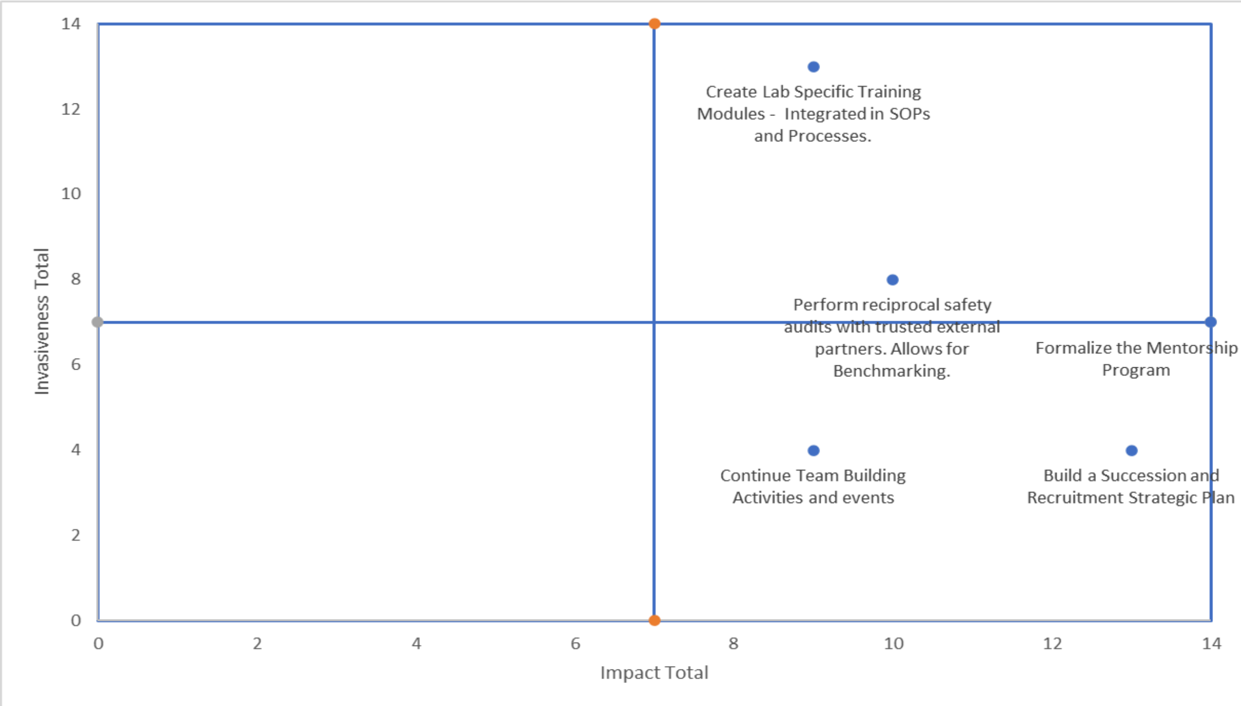
Based on our matrix, three interventions fall into the preferred Quadrant 2, while remaining interventions fall into Quadrant 1.

Table 8 Intervention Distribution

Quadrant 2	Quadrant 1

Formalize the Mentorship Program	Create Lab Specific Training Modules aligned and to be integrated in SOPs and processes.
Build a Succession and Recruitment Strategy	Perform reciprocal safety audits with trusted external partners to benchmark against industry.
Continue Team Building Activities and Events	

Figure 2



(Adapted from Siko, 2013)

Final Recommendation

Following our detailed analysis, we advise giving precedence to the interventions outlined below and have proposed subsequent actions for their implementation.

Formalize the Mentorship Program:

1. Develop a structured framework for the mentorship program, outlining roles, expectations, and goals for both mentors and mentees.
2. Implement a mentor-mentee matching system based on expertise and learning needs to ensure optimal knowledge transfer.
3. Schedule regular training sessions and workshops focusing on lab safety protocols and best practices.
4. Establish a feedback loop for continuous improvement of the program and adapt to changing safety requirements.

Build a Succession and Recruitment Strategic Plan:

1. Conduct talent assessments to identify current employees with leadership potential and align their development with future organizational needs.
2. Develop a recruitment strategy that focuses on acquiring skills essential for critical roles, ensuring alignment with the lab's long-term goals.
3. Integrate career progression plans into the HR policies to encourage long-term commitment and growth within the organization.
4. Monitor and adjust the plan periodically to respond to evolving organizational needs and external industry trends.

Perform Reciprocal Safety Audits with Trusted External Partners to Benchmark Against Industry Standards:

1. Establish partnerships with reputable external organizations to conduct reciprocal safety audits. This collaboration ensures an unbiased assessment and provides a broad perspective on safety practices.
2. Develop a comprehensive audit checklist that covers all aspects of lab safety, tailored to industry benchmarks and best practices.
3. Schedule regular audit exchanges with these partners, allowing for the continuous evaluation and comparison of safety protocols.
4. Implement a system to analyze audit findings, focusing on areas of improvement and adaptation of best practices identified during the audits.

Rationale for Implementation:

These interventions are chosen for their direct impact on enhancing safety standards, improving knowledge transfer, and fostering a culture of continuous learning and growth within the lab.
The focus on mentorship, strategic planning, and safety audits aligns with the lab's long-term objectives of maintaining high safety standards, ensuring a skilled workforce, and promoting a supportive and collaborative work environment.
Implementing these steps will require minimal disruption to existing workflows, as they build upon and enhance current practices.

Implementation Consideration:

- Ensure that the implementation of these interventions is phased and well-communicated to all stakeholders.
- Allocate necessary resources and support for each intervention to ensure its success.
- Continuously monitor and evaluate the effectiveness of these interventions, making adjustments as needed based on feedback and results
- Safeguard practices to prevent the erosion of successful behaviors and culture.

Additional Recommendation:

We believe that the AML could be a model for exceptional safety. The lessons learned from this needs analysis offer BSU the opportunity to establish a standardized blueprint for exemplary lab safety. Based on the policies and practices in AML, we have created a rubric which the COEN Safety Team could use to guide and measure other labs. This rubric, outlined in Appendix E, is designed to guide and evaluate the safety protocols of other labs systemically. It is structured in alignment with Chevalier's BEM ensuring that labs are assessed holistically. The subcategories in the rubric are based on our observations of the specific practices that make the AML exemplary. This tool can be adapted by the COEN Safety Team as a standard measure to assess and enhance safety practices across the university lab network.

This rubric as presented is not a finished product, but is meant to be the starting point for a more detailed tool for measuring and guiding safety performance in the labs at BSU.

Limitations

#	Limitation	Implications
1.	**Scope of Labs:** With 370 diverse labs, even though the focus is on the Advanced Materials Lab, findings might not be universally applicable across all labs. Each lab has unique challenges and safety nuances. This limitation can severely affect the scalability and applicability of recommendations across the institution.	**Resource Allocation:** Recommendations might require significant resources – financial, time, or personnel – to be allocated for safety improvements, training, or equipment upgrades. Implementing new safety measures can be resource-intensive, potentially straining the institution's budget and resources.
2.	**Data Completeness:** The quality and depth of data, especially from historical records, can vary across labs. There could be gaps in incident reporting or documentation inconsistencies, which can affect analysis accuracy. Inaccurate or incomplete data can lead to misinformed decisions.	**Safety Culture Transformation:** If significant gaps or issues are identified, it might necessitate a broader cultural shift in how safety is perceived and prioritized. Transforming an established culture is challenging and impacts everyone within the organization.
3.	**Stakeholder Feedback:** While stakeholders like PIs, lab safety managers, mentors, and lab members provide valuable insights, there's potential for bias, even unintentionally. Biased feedback can distort the true picture of safety culture and practices.	**Continuous Monitoring:** The project might reveal the need for more frequent safety audits, feedback loops, and continuous monitoring mechanisms to ensure that safety standards are consistently upheld.
	Budget restrictions: Although there is a designated budget allocated by the university for operational needs, the adequacy of this funding is a subject of ongoing consideration. As the university expands its programs, additional resources will be necessary to maintain high quality standards and meet baseline expectations.	**Operational Funding Model:** Due to its reliance on 'one-time funding requests' for essential operations like training, part-time student assistance, equipment procurement and calibration, the current funding model is restrictive. This affects staffing and resources, hindering the optimal functionality of the department. To implement any high impact interventions, a reassessment and adjustment of the budget is necessary to ensure that current and future needs of the program are met.

Ethical Due Diligence

Ethical Due Diligence: In our commitment to uphold the highest ethical standards throughout the Lab Safety Needs Assessment Project, we have delineated several key areas of focus. These areas embody a synthesis of industry best practices, proven methodologies, and fundamental ethical principles. They guide our approach to ensure transparency, respect for all participants, data integrity, and continuous improvement. By adhering to these principles, we aim to deliver an assessment that is both rigorous in its accuracy and unwavering in its ethical considerations.

1. **Transparency and Value-Driven Approach**:
    - We will ensure that all methodologies, intentions, and actions undertaken during the project are transparent and comprehensible. We are committed to always communicating the project's goals in alignment with the value they bring to all stakeholders.
2. **Informed Consent and Collaboration**:
    - We will always obtain informed consent before collecting data, especially from human participants, ensuring they fully understand the purpose and potential risks. We commit to working collaboratively with all stakeholders, actively involving them in pivotal decisions related to data collection and analysis.
3. **Data Integrity, Privacy, and Confidentiality**:
    - We will rigorously safeguard all data, employing strict confidentiality protocols. We commit to implementing robust measures to anonymize personal data and ensure its secure storage. Furthermore, we pledge to present data with utmost honesty, devoid of any misrepresentation or undue manipulation.
4. **Conflict Avoidance and Disclosure**:
    - We will proactively identify and transparently disclose any potential conflicts of interest, ensuring the findings and conclusions of the assessment remain unbiased and genuine.
5. **Continuous Improvement and Feedback**:
    - We will adopt a dynamic and iterative approach, welcoming feedback from stakeholders and using it to refine our methodologies or strategies. We are dedicated to the continuous improvement of our assessment's proficiency and relevancy.
6. **Uphold Validated and Best Practices**:
    - We will prioritize using proven and validated practices for all aspects of data collection and analysis. We are dedicated to ensuring every technique, tool, or protocol we employ aligns with the highest standards in lab safety research and performance technology.

References

Chevalier, R. (2003, May/June). Updating the behavior engineering model. Performance Improvement, 42(5), 8–13. https://doi.org/10.1002/pfi.4930420504

Research and Economic Development. (n.d.). About Boise State Research. Boise State University. Retrieved December 7, 2023, from https://www.boisestate.edu/research/

College of Engineering. (n.d.). Home. Boise State University. Retrieved December 7, 2023, from https://www.boisestate.edu/coen/

Advanced Materials Laboratory. (n.d.). Home. Boise State University. Retrieved December 7, 2023, from https://www.boisestate.edu/aml/

College of Engineering Safety website. Retrieved October 18, 2023, from https://www.boisestate.edu/coen-safety/

Cooperrider, D., & Whitney, D. (2005). A positive revolution in change: Appreciative inquiry. In The Change Handbook: The Definitive Resource on Today's Best Methods for Engaging Whole Systems (p. 87).

Bentkowski, E., & Yamaga, M. (2006). Exploring appreciative inquiry. Volume 4, Issue 2, Fall 2006, Volume 4(Issue 2). Retrieved from https://jstor.org/stable/community.31298168

Hale, J. A. (2006). *The performance consultant's fieldbook: Tools and techniques for improving organizations and people*. Pfeiffer.

Siko, J. P. (2013). Using the I² Intervention Matrix to Select the Best Course of Action. Performance Improvement, 52(10), 23–26. https://doi.org/10.1002/pfi.21378

Watkins, R., West-Meiers, M., & Visser, Y. L. (2012). *A guide to assessing needs: Essential tools for collecting information, making decisions, and achieving development results*. World Bank.

Appendices

Appendix A. Unified Qualitative Data Codebook

Appendix A.1 Chevalier’s Updated Behavior Engineering Model

<table>
<tr><td colspan="3">Environment</td></tr>
<tr><td>Information</td><td>Resources</td><td>Incentives</td></tr>
<tr><td>Roles and performance expectations are clearly defined; employees are given relevant and frequent feedback about adequacy of performance.

Clear and relevant guides are used to describe the work process. The performance management system guides employee performance and development.</td><td>Materials, tools, and time needed to do the job are present. Processes and procedures are clearly defined and enhance individual performance if followed.

Overall physical and psychological work environment contributes to improved performance; work conditions are safe, clean, organized, and conducive to performance.</td><td>Financial and nonfinancial incentives are present; measurement and reward systems reinforce positive performance. Jobs are enriched to allow for fulfillment of employee needs.

Overall work environment is positive, where employees believe they have an opportunity to succeed; career development opportunities are present.</td></tr>
<tr><td colspan="3">Individual</td></tr>
<tr><td>Knowledge/ Skills</td><td>Capacity</td><td>Motives</td></tr>
<tr><td>Employees have the necessary knowledge, experience, skills to do the desired behaviors.

Employees with the necessary knowledge, experience, and skills are properly placed to use and share what they know. Employees are cross-trained to understand each other's roles.</td><td>Employees have the capacity to learn and do what is needed to perform successfully. Employees are recruited and selected to match the realities of the work situation.

Employees are free of emotional limitations that would interfere with their performance.</td><td>Motives of employees are aligned with the work and the work environment. Employees desire to perform the required jobs.

Employees are recruited and selected to match the realities of the work situation.</td></tr>
</table>

Adapted from Chevalier (2003)

Appendix A.2 Condensed Codebook with Categories and Definitions

Code	Shorthand	Definition
Training	Info-Training	How well the training program prepares lab members to perform in a safe way.
Culture	Info-Culture	How well safe behavior is reinforced or undermined by senior lab members and managers.
Procedures	Info-Procedures	How well procedures support or hinder safe behavior.
Third party audits	Info-Audits	How well third party audits (any walkthroughs done by parties outside the materials lab) contribute to the information about, and sustainability of a safe environment.
Lab hygiene	Resources-Hygiene	How well the lab's environment is kept to a high degree of cleanliness, organization, and safety.
Tools	Resources-Tools	How well the lab provides necessary tools, or makes them available upon request; including SOPs and other necessary information.
Community	Incentives-Community	How well the lab community supports learning, interpersonal engagement, and a positive work environment.
Personal Development	Incentives-Development	How lab staff feel supported and empowered by coming from a high performing lab.
Inherent desire to be safe	Motives-Personal Safety	How much the lab staff are inherently motivated to perform their work in a safe way.
Hiring Policy	Capacity-Hiring	How well the hiring process determines how well lab staff are able to perform.
Staff Management	Capacity-Management	How much lab staff feel pressured to work while in a compromised state like sleep deprived or emotionally distracted.
Knowledge of unsafe behavior	Knowledge-Behavior	How much the lab staff know about unsafe practices and what to do to perform in a safe way.

Appendix A.3 Condensed Codebook with Date Sources

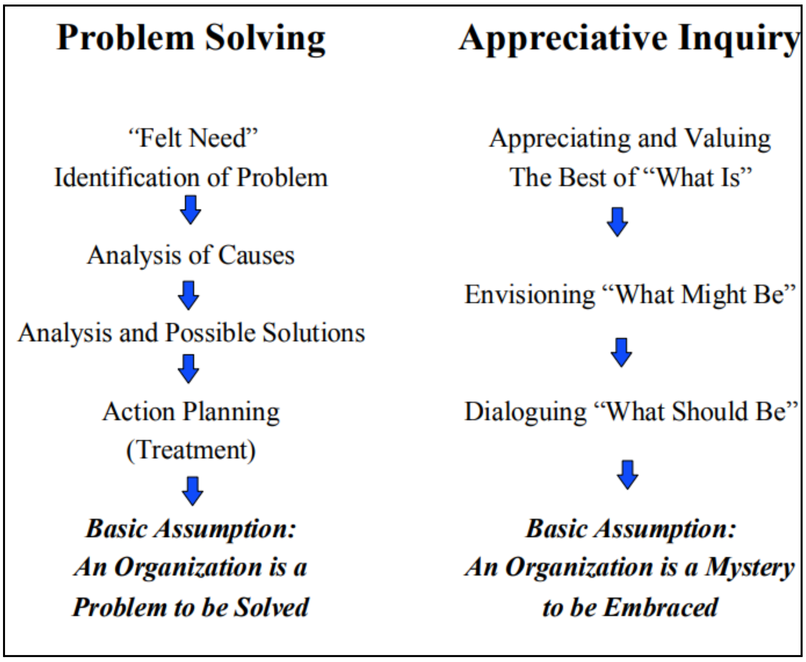
Condensed Codebook- With Data & Sources			
Shorthand	Source	Strength/ Neutral/ Opportunity	Training
Info-Training	E-2, E-6, E-5	Strength	Training is not a one-off process but takes multiple sessions where learners are gradually given more authority in the lab.
	E-4, E-6, E-5	Strength	Learning to use a dangerous machine should take more than one or two training sessions and needs the owner to slowly give you more autonomy.
	E-3, E-6	Strength	Having grad students own the lab equipment makes them better able to teach each other.
	E-3, E-2, E-5	Opportunity	Easily accessible micro learning or e-learning modules could be helpful.
	E-1	Opportunity	One way to measure training is when there is an incident, do the lab staff do what they're expected to do?
	E-2, E-5	Opportunity	Training is still insufficient.
	E-6	Strength	Comprehensive training provides a common baseline so we are all confident that everyone knows a certain minimum skillset
	E-6	Opportunity	The yearly safety refreshers should be adjusted each year so they're more challenging to experienced learners.
Shorthand	Source	Strength/ Neutral/ Opportunity	Culture
Info-Culture	E-3, E-2, E-6, E-4, E-5	Strength	There is no fear about discussing concerns, nor is there defensiveness amongst the staff when someone is asked a challenging question.
	E-4, E-2, E-1, E-5	Strength	Senior staff are expected to model ideal behavior for junior staff to learn from.
	E-1, E-2, E-6, E-4, E-5	Strength	Nobody gets punished or ridiculed for asking questions, making a mistake, or reporting incidents.
	E-1, E-2, E-3, E-6	Strength	All incidents, no matter how small and large, are reported.
	E-1	Strength	High performing labs are proactive about spotting unsafe practices, and the materials lab is very proactive.
	E-2, E-3, E-4, E-6, E-5	Strength	Having regular team meetings where safety is discussed is an important aspect of lab culture.
	E-6, E-2, E-4, E-5	Strength	There's always someone around who can help you, answer questions, or point out if you're doing something unsafe.
	E-2, E-6, E-5	Strength	Senior managers make themselves available to talk to and respond to questions. Everyone has their personal cell phone numbers.
	E-2, E-4, E-6	Strength	Lab members are constantly encouraged to think about why they are doing something beyond what the SOP says.
Shorthand	Source	Strength/ Neutral/ Opportunity	Procedures
Info-Procedures	E-3, E-2, E-6	Strength	The lab has weekly safety walkthroughs and participants rotate every few months. This helps people see the lab from a perspective of safety.
	E-3, E-2, E-6	Strength	Students write the SOPs and are responsible for updating them when they need to be changed.
	E-2, E-6	Strength	When there is an incident, the lab does a thorough incident report to understand what went wrong and what can be improved in the future.

	E-2, E-4, E-6, E-5	Strength	There are specific roles assigned to graduate and undergraduate students which disperses responsibility across the lab.
	E-2, E-4, E-6, E-5	Opportunity	A mentoring system is important for passing along highly specialized knowledge and skills.
	E-5	Opportunity	When senior lab staff leave and there is turnover, performance drops for a period of time.
	E-1, E-6, E-5	Strength	Keeping things standardized and consistent is really important for information and expectations.
Shorthand	Source	Strength/ Neutral/ Opportunity	Third Party Audits
Info-Audits	E-3, E-6	Opportunity	There should be more random safety audits.
	E-1	Strength	Doing the walkthroughs provides an opportunity to learn about what they could do better and stimulate conversation.
Shorthand	Source	Strength/ Neutral/ Opportunity	Lab Hygiene
Resources-Hygiene	E-4, E-6	Strength	labeling and storing everything consistently helps with safety
	E-6	Strength	When the lab is clean, it's easier to spot when something is out of place.
Shorthand	Source	Strength/ Neutral/ Opportunity	Tools
Resources-Tools	E-3, E-2	Strength	The lab is proactive about stocking everything one might needs to do their processes
	E-3	Strength	The materials lab would never tolerate someone using the wrong sized gloves or working without the correct tools
	E-4, E-2, E-6	Strength	You have to make necessary information easily accessible.
Shorthand	Source	Strength/ Neutral/ Opportunity	Community
Incentives-Community	E-4, E-1, E-2, E-6, E-5	Strength	Feeling comfortable talking to each other helps build camaraderie and assists in communication.
	E-2, E-5	Strength	The lab cultivates a culture of teamwork and camaraderie.
	E-4	Neutral	When people have a bad attitude, it discourages communicating and asking questions
	E-6, E-5	Strength	The lab staff take deliberate steps to build a community outside the lab.
Shorthand	Source	Strength/ Neutral/ Opportunity	Personal Development
Incentives-Development	E-3, E-5	Strength	Working in a university lab is a good opportunity to learn necessary skills for industry work
	E-4, E-1	Strength	Always following safety procedures and safe work practices makes you a better candidate and employee outside of the lab.
	E-1, E-4	Strength	Verbal praise is given freely.
	E-1	Neutral	Outside rewards can often be counterproductive by rewarding bad behavior or non-reporting of incidents
	E-6	Strength	Handling accidents or dangerous situations competently makes you feel empowered and confident.
Shorthand	Source	Strength/ Neutral/ Opportunity	Inherent desire to be Safe
Motives-Personal Safety	E-3, E-4, E-5	Strength	Staff are expected to keep a mindset of vigilance and thoughtful action.
	E-4, E-1, E-6	Strength	A lot of motivation to be safe comes from an internal desire to not get hurt.
	E-1	Neutral	Being complacent is worse than being untrained.

	E-1, E-2, E-5	Strength	Students are encouraged and reminded to take responsibility for their own safety.
Shorthand	Source	Strength/ Neutral/ Opportunity	Hiring Policy
Capacity-Hiring	E-2, E-6	Strength	When hiring people, it's important they are a good culture fit
	E-6, E-5	Strength	Safety starts with hiring people who share ideas about how to be safe
Shorthand	Source	Strength/ Neutral/ Opportunity	Staff Management
Capacity-Management	E-2	Strength	When people are not immediately a good fit, management tries to find a good place for them to succeed in.
	E-2	Strength	The lab prioritized safety concerns over pressure to finish work on time.
	E-6	Strength	When someone is looking tired or emotionally unavailable, the lab members encourage them to rest.
Shorthand	Source	Strength/ Neutral/ Opportunity	Knowledge of Unsafe Behavior
Knowledge-Behavior	E-3, E-4	Strength	Having grad students teach others makes them more knowledgeable about the inner workings of the equipment.
	E-3, E-1, E-2, E-5	Opportunity	Unfortunately, it sometimes takes an incident to make people respect safety procedures.
	E-3, E-5, E-6	Strength	Learning by doing is very effective.

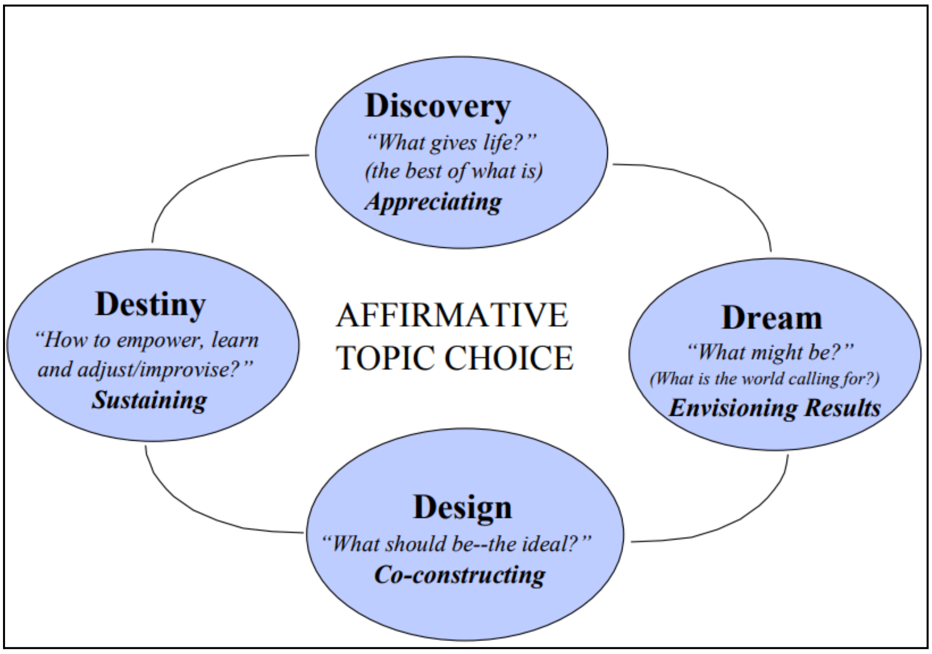
Appendix B. Models, Frameworks, Tools, and Instruments

Appendix B.1 Appreciative Inquiry compared to Problem Solving



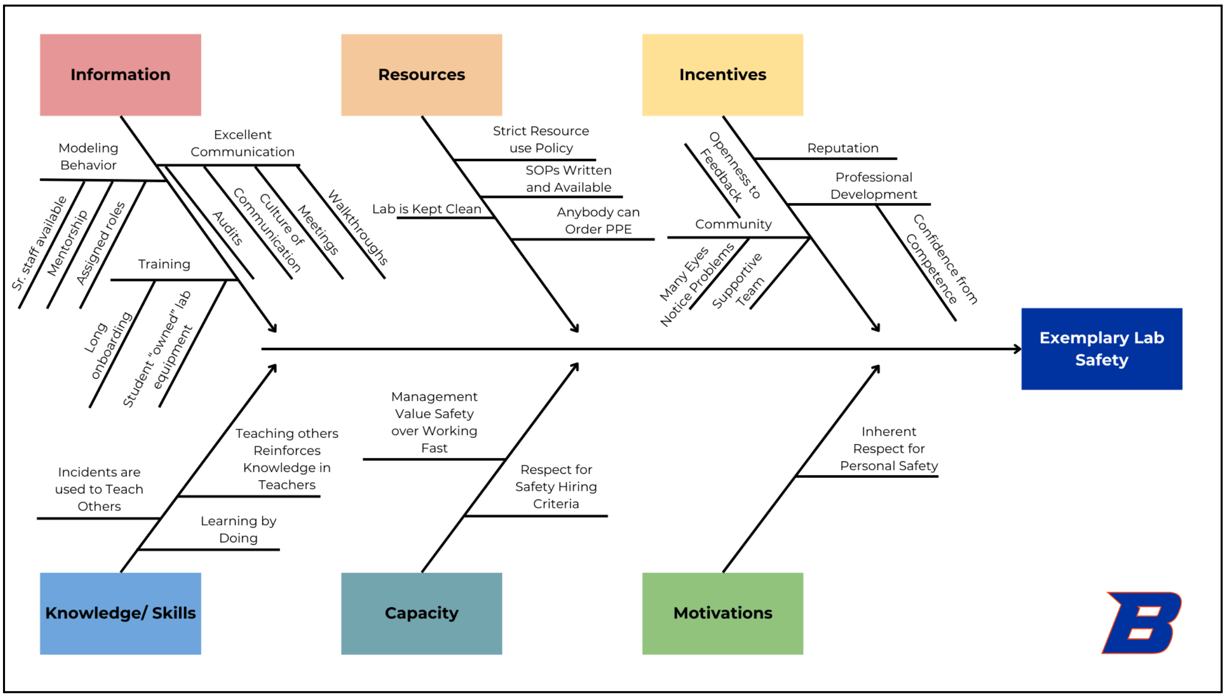
Reproduced from Cooperrider & Whitney (2005).

Appendix B.2 Appreciative Inquiry 4-D Cycle



Reproduced from Cooperrider & Whitney (2005).

Appendix B.3 Fishbone Diagram



Adapted from Watkins (2012)

Appendix B.4 Siko's I-2 Intervention Selection Matrix, Interventions Based on Invasiveness (blank)

TABLE	INTERVENTIONS RANKING BASED ON INVASIVENESS			
Intervention	Criteria 1	Criteria 2	Criteria 3	**Invasiveness Total**
Intervention 1				
Intervention 2				
Intervention 3				
Intervention 4				
Intervention 5				

Invasiveness criteria definitions:

- Scale: 1 = Least Invasive (Preferred) to 5 = Most Invasive.
- Cost - the total financial resources needed for implementing and maintaining an intervention.
- Ease of Implementation - the simplicity and feasibility of putting an intervention into practice.

- Manpower Needed - the quantity and skill level of personnel required to execute an intervention.

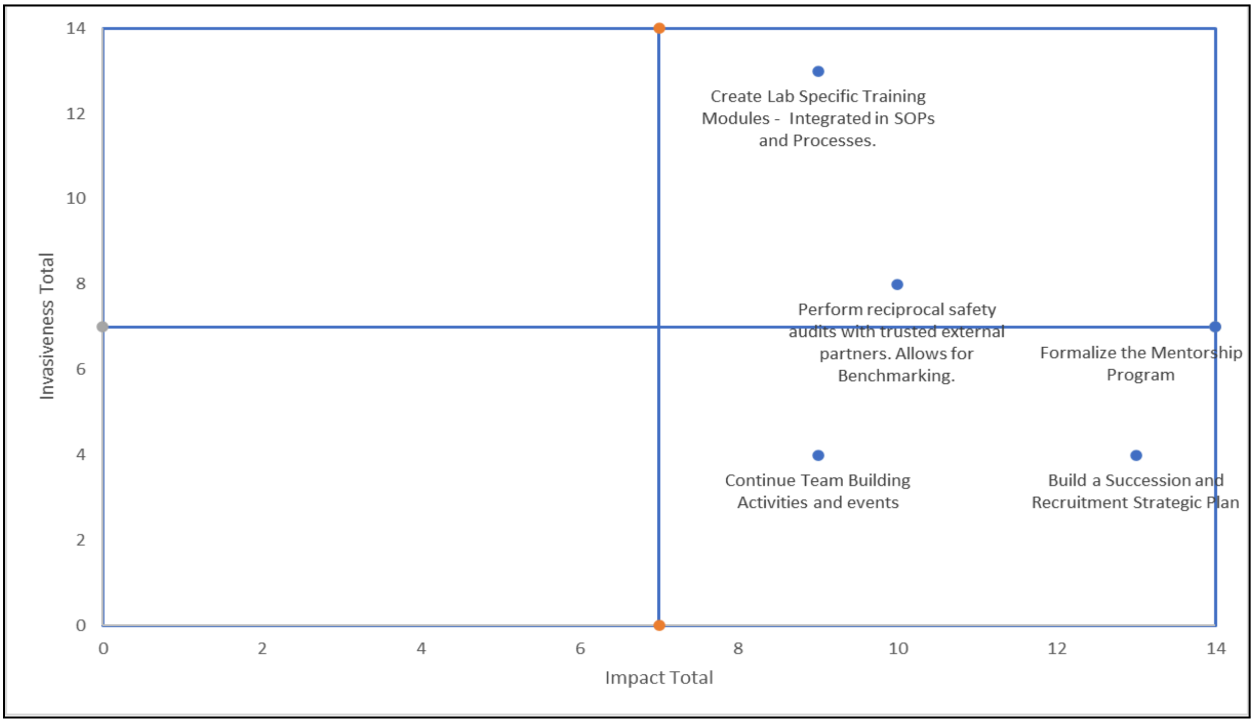
Appendix B.5 Siko's I-2 Intervention Selection Matrix, Interventions Based on Impact (blank)

TABLE	INTERVENTIONS RANKING BASED ON IMPACT			
Intervention	Criteria 1	Criteria 2	Criteria 3	**Impact Total**
Intervention 1				
Intervention 2				
Intervention 3				
Intervention 4				
Intervention 5				

Impact criteria definitions:

- Scale: 1 = Lowest Impact to 5 = Highest Impact (preferred).
- Effectiveness - defined as the degree to which an intervention influences lab safety performance.
- Lab Morale - refers to the effect an intervention has on the overall mood, motivation, and job satisfaction of the laboratory staff.
- Sustainability - the ability of an intervention to maintain its effectiveness and benefits over time without depleting resources
or causing adverse effects.

Appendix B.6 Siko's I-2 Intervention Selection Quadrants



Appendix C. Ethical Treatment

Appendix C.1 Informed Consent form

BOISE STATE UNIVERSITY

INFORMED CONSENT FORM FOR INTERVIEWS IN RESEARCH STUDY

Title of the Needs Assessment project:

Understanding and Improving Compliance and Safety Practices in the Material Sciences Lab

Practitioner's Information:

	Group Member	Email	Telephone (optional)
1.	Sam Wilson	samwilson417@u.boisestate.edu	+66616873268
2.	Andrew Clark	andrewclark428@u.boisestate.edu	+16143152893
3.	Damien Miggins	damienmiggins@u.boisestate.edu	+12673340496
4.	Mariola Diawara	marioladiawara@u.boisestate.edu	+31638100103 / +31648005289

Purpose of the Needs Assessment:

Our research aims to understand and analyze the current lab hygiene and safety procedures of the Materials Sciences lab, one of the 370 labs across the university. By analyzing the various processes, procedures, as well as other internal and external factors, we wish to offer the client and stakeholders from the lab itself additional insight, which can be used at their discretion in order to enhance the ongoing training and development of lab participants with respect to safety, with the goal of improving overall safety of lab participants. Our shared goal of mitigating the risks for all lab users ideally will build upon existing processes and procedures to help maintain a healthy lab culture, improve compliance, and make actionable recommendations to the lab.

Participant's Role:

If you agree to participate, you will be interviewed about your experiences, understandings, and practices related to the Material Lab's safety and compliance training and existing practices. Interviews will last about 60 minutes. You may also be asked to participate in an anonymous survey to help us aggregate and quantify our findings. We are interested in insights from individuals with various levels of experience and training to build a robust understanding of the functions and happenings in the lab.

Risks and Benefits:

Risks: As a participant you may feel uncomfortable discussing non-compliance or near-miss incidents or reporting on issues you believe could be improved, knowing your peers and/or supervisors could feel differently.

Benefits: Participants will contribute to improving the safety culture and compliance practices in the lab(s), potentially reducing the risk of future accidents and incidents, not only for themselves but for future lab users as well.

Confidentiality:

Your responses will be confidential, and data will be reported in aggregate without identification of individual participants. Only the research team will have access to the raw data.

Voluntary Participation and Withdrawal:

Participation in this study is entirely voluntary. You may withdraw at any point without penalty.

Consent Statement:

I have read and understood the information above. By signing, I voluntarily agree to participate in this Needs Assessment project.

Name: ___________________________

Signature: _______________________

Date: ___________________________

Questions or Concerns:

For any questions or concerns about the study, please contact Mariola Diawara at marioladiawara@u.boisestate.edu, as your primary contact. However, do feel free to reach out to any of the other project members and our Faculty Lead for this course, Dr. Don Winiecki at dwiniecki@boisestate.edu.

Instructions for Participants:

Please review the informed consent form carefully. If you agree to participate, sign and date the form. Understand that your consent must be given prior to being interviewed by our team. Your participation is important in enhancing safety and compliance practices in our labs, and we appreciate your contribution to this important endeavor.

Appendix C.2 Semi-structured interview protocol

Your name: [NAME]

Background

The University's labs, spanning engineering, science, and arts, prioritize safety and aim to minimize incidents and near-misses. This project targets the Materials Sciences Lab but seeks insights beneficial to all labs. With a mix of long-term members and newcomers, experienced members are pivotal in upholding safety and mentoring new entrants. Training, incident reporting and record-keeping, and mentoring all operate through different offices and individuals, and the following interviews are designed to help the Needs Assessment team better understand the current safety situation in the Materials Lab, and determine if there is a problem to be solved or an opportunity to disseminate an exemplary lab's best practices to the rest of the university's network of laboratories..

<u>Main topic:</u> *Understanding needs and opportunities regarding safety at the BSU Adv. Materials Lab*

<u>Key Concepts:</u>

1. What is the current state of the Materials lab?
2. What is an ideal state of the materials lab given perfect conditions and unlimited resources?
3. What would a more realistic and achievable vision of that ideal state look like?

<u>Design:</u> qualitative research study

<u>Data collection method:</u> Interview

<u>Analytic technique:</u> Thematic analysis across several interviews (if possible)

<u>Final deliverable:</u> Code book and Executive summary

Opening Script

Hey [NAME], thanks for meeting with us today. I'm [NAME], we're here for a follow-up chat about how things are going in the Advanced Materials Lab at BSU. We have had to pivot from our original plan of discovering problems with the lab to finding out what makes it so successful in terms of safety. Your take on this is valuable, and your insights will help us figure out what steps to take next. We encourage you to share all your thoughts, even if you already mentioned them in the previous interview, because in a way we are starting over from scratch and we would really like to get all your thoughts on why this lab is so stellar.

The interview will probably take about 30 to 60 minutes. The basic format is as follows:

This is your opportunity to explain why this lab is doing so well and help us envision an ideal state for the lab for us to potentially shoot for. And then we would like to come up with some more achievable and realistic goals that we could envision for the lab.

Our goal is finding out what exactly the Materials Lab is doing so well so maybe we can help turn those successes into processes and procedures that will outlast the individual staff members. Potentially other labs could (if they choose to) take some of the lessons we learn in this project and modify them and apply them to their own labs.

Just like last time, we will record this zoom call and the interview will be transcribed. Any names you give us will be either removed for our final report, or replaced with a pseudonym.

With your permission we would like to begin.

Interview Questions

1. **information**
    a. **Current State:**
        i. Could you share some of the most effective ways that safety expectations have been communicated to the team?
            1. What aspects of these approaches made them work so well?
        ii. When you think about how everyone on the team has come to understand their roles regarding lab safety, what actions or methods led to that comprehensive understanding?
        iii. When reflecting on the times when lab personnel received really effective and timely feedback on their safety performance, what processes or practices made this possible?
    b. **In a perfect world, how would communication work?**
        i. **What might a realistic version of that look like?**

2. **Resources**
    a. **Current state:**
        i. What safety materials and processes do you feel have been essential to your success here?
        ii. How has having the right tools at your disposal made a difference in maintaining a safe environment?
        iii. In what ways has the lab's environment supported your best safety practices?
        iv. Can you tell me about a time when lab resources particularly stood out in helping you maintain high safety standards?
    b. **In a perfect world, what kinds of resources would you have regarding safety?**
        i. **What would a realistic version of that look like?**

3. **Incentives**
    a. **Current State:**
        i. What kinds of recognition for safety efforts have really resonated with the team here?
        ii. Are there any incentives that really motivate the team around safety?
    b. **In a perfect world, what kinds of incentives could the lab or university offer regarding safety?**
        i. **What's a realistic version of that look like?**

4. **Motives**
    a. **Current State:**
        i. What are the key factors that create a strong commitment to safety standards amongst the staff in the lab?
        ii. Are there any shout-outs, awards, or pat-on-the-back moments for safety that you found particularly meaningful?
        iii. In what ways has the lab's approach to safety made you feel more capable and confident in your role?
    b. **In a perfect world, how would every lab member be motivated (internally) to make the lab a safer environment?**
        i. **What's a more realistic version of that?**
5. **Capacity**
    a. **Current State**
        i. How do you validate that people understand lab safety and are "ready to go" and work in the lab.
        ii. Can you walk me through the steps or processes you employ to ensure that personnel are effectively applying their skills and capabilities towards maintaining lab safety?
    b. **In a perfect world, what capacity would each lab member have (regarding safety)?**
        i. **What's a more realistic version of that look like?**

6. **Knowledge and Skills**
    a. **Current State**
        i. What about the safety training that sticks with you the most or has been the most useful?
        ii. How is training knowledge reinforced?
    b. **How could we improve knowledge and skills in a perfect world?**
        i. **What is a more realistic version of that look like?**

7. Other topics (just a reminder)
    a. Mentorship
    b. Grad students owning machines
    c. After an accident, [NAME] ID'd that the students in this lab did everything by the book
    d. How do debriefings (post-accident) work?
    e. How do new processes/ knowledge/ information get disseminated?
    f. STOP WORK
    g. Instruments that make it impossible to have critical failures
    h. How is it that all the students know [NAME]'s pop quizzes answers
    i. Why is there so much positive communication between the Mat Lab and the Safety Team

Closing Script

Thanks so much for taking the time today. Your perspective has been incredibly helpful in understanding the lab's safety practices and how things work at the Advanced Materials Lab.

If anything else comes to mind or you have more to say, don't hesitate to reach out. We value your input greatly. As for what's next, I'll get our conversation down on paper and start analyzing what we've discussed. Rest assured, I'll share the findings in a way that keeps everyone's identity safe, just like we agreed.

Thanks again for the valuable conversation. I hope you have a really good day ahead!

Appendix C.3 Contact Script

Dear [INSERT NAME],

We received your contact information from [INSERT NAME INSTRUCTOR] regarding the [INSERT NAME PROJECT] Assessment project we are working on with [INSERT CLIENT NAME] and yourselves. [INSERT NAME INSTRUCTOR], as our faculty lead for this course of the OPWL program, has given us your names to start off the work with initially. We want to thank you for making yourselves available.

Who are we?

We are students in the OPWL program and are currently taking the Needs Assessment class with [INSERT NAME INSTRUCTOR]. [INSERT NAME INSTRUCTOR], as he prefers to be called, has been so kind to source this project on our behalf, which allows us to work with you to assess the needs regarding lab safety in your area. The project team members you will be working with for this [INSERT NAME PROJECT] Needs Assessment project are:

- [INSERT NAME STUDENT 1]
- [INSERT NAME STUDENT 2]
- [INSERT NAME STUDENT 3]
- [INSERT NAME STUDENT 4]

I, [INSERT NAME], will be your primary point of contact representing our group. Please, feel free to reach out to me as needed for any questions, suggestions, and/or feedback.

First steps: Kick-Off meeting

We would like to invite you to a kick-off meeting and talk you through the initial steps. For this, we'd like to know your availability for the upcoming week. Please fill out your availability via [INSERT LINK] (the tool is called 'When2Meet', so we can find a mutually beneficial time for all of us to get together. I've already included my availability for reference only (please don't feel obliged to make it fit, since our team can be flexible).
We look forward to the dialogue and working with you soon.

Sincerely,
[INSERT NAME]

Appendix D. Needs Assessment Planning Table

Presented Problem or Opportunity

Key Questions	Frameworks	Data Sources	Data Collection Methods	Analysis	Dates
• What are the most effective safety practices currently in place at the AML? • How do these practices contribute to the lab's exemplary safety record? • What moments of excellence can staff recall where safety practices clearly prevented an incident or minimized potential harm? • In what ways do the lab's culture and structure support these successful safety practices? • What do staff and students feel are the strongest aspects of the lab's safety training and awareness?	Starter kit of Questions (D. Robinson et al., 2015) Appreciative Inquiry 4-D Model	**Client** **Graduate and undergraduate students who use the lab** **Lab safety team**	**records of accidents, safety records** **video walkthrough of the lab** **Lab Safety Team Interviews**	Initial findings underscore the lab's excellent safety record, deeply anchored in its culture, practices, and approach to learning. A key highlight is the absence of shame and punishment, replaced by a culture of learning from mistakes, where all views are valued and respected. This constructive environment is conducive to open dialogue and continuous improvement. The handling of a recent accident showcases the high level of training and competence among lab members. The incident, described as being managed "perfectly," reveals that the training and experience of the lab staff have effectively prepared them for emergency situations. This successful management of the incident aligns with the lab consistently winning the “safest lab” award and further demonstrates a well-established, effective informal system of safety practices.	Start: 09/14/23 Finish: 10/29/23

• Can you share examples of safety initiatives that have been particularly well-received or effective? • What are the lab's best stories of collaboration, problem-solving, or innovation in safety?				The use of incident logs, coupled with a strong emphasis on cleanliness, order, and respectful treatment of all lab members, contributes to this culture of preparedness and proactive safety.	

Organizational Analysis

Key Questions	Frameworks	Data Sources	Data Collection Methods	Analysis	Dates
• How have the resources allocated to laboratory safety contributed to the lab's success? • What are key examples where changes or improvements in lab safety procedures were successfully implemented? What factors contributed to these successes?	Appreciative Inquiry 4-D Model Chevalier's Updated BEM	**Client** **Graduate and Undergraduate Students** **Lab Safety Team**	**Interviews** **Incident records**	Training: Multiple session training and gradual authority increase. In-depth training for dangerous equipment. Grad students owning equipment enhances peer teaching. Microlearning and e-learning as potential enhancements. Incident response as a measure of training effectiveness. Need for more challenging refreshers for experienced staff. Culture:	Start: 09/28/23 Finish: 11/12/23

- How does the lab's organizational structure, such as hierarchies, teams, or committees, support its safety culture? Are there specific structures that have been particularly effective? - How does the lab effectively communicate new safety information and knowledge to members? - How do the lab’s hiring practices contribute to its safety culture? What are some examples of how new hires have been successfully recruited and integrated into the lab's safety culture? - What formal procedures and processes are in place that contribute to lab safety?				Open communication and absence of fear in discussing concerns. Senior staff modeling ideal behavior. Encouragement for reporting incidents and mistakes. Regular team meetings focusing on safety. Proactive approach to identifying unsafe practices. Encouragement for critical thinking beyond SOPs. Procedures: Regular safety walkthroughs with rotating participants. Student involvement in writing and updating SOPs. Comprehensive incident reporting and analysis. Role assignment to disperse responsibility. Importance of mentoring for knowledge transfer. Standardization and consistency in processes. Third Party Audits: Need for more frequent and random safety audits. Walkthroughs as learning and improvement opportunities. Lab Hygiene:	

● How is safety data officially recorded, evaluated, and monitored in the lab? ● How do formal procedures and informal practices complement each other in maintaining lab safety? Are there instances where informal practices have filled gaps in formal procedures? ● How frequently are the lab's safety procedures and SOPs reviewed and updated? What process is followed to ensure these updates reflect current best practices? ● What kinds of incentives have resonated with the team? ● What are the key factors that create a commitment to safety amongst the staff in the lab?				Consistent labeling and storage practices. Cleanliness aiding in safety management. Tools: Proactive stocking of necessary tools. Strict adherence to using correct tools and equipment. Community: Culture of camaraderie and comfortable communication. Team building and community outside the lab. Personal Development: Opportunities for learning industry-relevant skills. Encouragement of safety adherence for personal growth. Importance of competent handling of dangerous situations. Personal Motivation: Culture of vigilance and thoughtful action. Motivation rooted in personal safety concerns. Hiring Policy:	

● How does management validate that people are “ready to go” to work in the lab?				Emphasis on cultural fit in hiring. Prioritizing safety-minded individuals in recruitment. Staff Management: Adaptive management for individual success. Prioritizing safety over work completion pressure. Encouraging rest and managing fatigue. Knowledge of Unsafe Behavior: Learning from experience and incidents. Effectiveness of hands-on learning approach.	

Environmental Analysis/Lay of the Land

Key Questions	Frameworks	Data Sources	Data Collection Methods	Analysis	Dates
● How do external safety standards and industry trends influence the lab's practices and procedures? ● How does the lab's safety culture and performance compare to other labs within the university and in	Appreciative Inquiry 4-D Model Chevalier’s Updated BEM	**Client** **Graduate and undergraduate students who use the lab** **Lab safety team**	**Lab Safety Team Interviews**	The lab's adherence to safety standards is primarily internally driven, complemented by adherence to mandates from governmental regulatory bodies. For instance, there are nation-wide templates for organizing material data sheets which the lab is required to follow. The lab’s culture is characterized by open communication, regular safety meetings, and a proactive approach	Start: 09/14/23 Finish: 11/12/23

similar institutions? ● What role do university policies and support structures play in shaping the lab's safety culture? ● What factors outside the lab create a sense of community amongst the staff? ● How have recent regulatory changes or industry guidelines impacted the lab’s safety protocols? ● How have technological advancements influenced the lab’s safety procedures and training methods? ● What are the expectations of stakeholders (such as funding agencies, university administration, students, and staff) regarding safety in the lab?				to identifying unsafe practices, which potentially sets it apart from others. Its recognition as the 'safest lab' suggests that it may have superior safety performance compared to its peers, however that can only be inferred because collecting data from other labs fell outside the scope of this analysis. Our data did not capture how AML’s collaborations with other labs impacted its safety procedures. Interviews mention the need to keep up with frequent regulatory changes, however we did not capture many specifics on changes that were made based on these regulations. COEN places a strong emphasis on lab safety because recognition of high quality work translates to funding and post-graduation work opportunities for students. The university more broadly does not provide sufficient resources to the COEN safety department. This limitation in funding and staffing hinders the department's ability to conduct frequent audits and update training materials.	

● How does collaboration with other labs and institutions contribute to the lab's ongoing safety improvements?				Lab staff frequently participate in social gatherings, fostering camaraderie and effective communication, which further reinforces their collective commitment to safety.	

Cause Analysis (what specific practices get us the current level of success?)

Key Questions	Frameworks	Data Sources	Data Collection Methods	Analysis	Dates
● What specific practices or behaviors have led to the lab's success in maintaining a strong safety culture? ● Why have these practices or behaviors been effective? What underlying principles or values do they represent? ● What conditions or resources have enabled these successful practices? How do leadership and team dynamics contribute?	Appreciative Inquiry 4-D Model Chevalier's Updated BEM Fishbone Diagram	**Client** **Graduate and undergraduate students who use the lab** **Lab safety team**	**Lab Safety Team Interviews**	The lab's success in safety is attributed to ongoing, progressive training, a culture of open communication, and peer-led teaching. Regular safety meetings and a proactive approach to safety are also key factors. Staff are selected and hired, in part, because they are a cultural fit with the lab's view of safety and have a healthy awareness of, and motivation to be, safe. These practices are effective because they create a sense of ownership and responsibility among staff, encourage openness and trust, and facilitate continuous learning and adaptation. These elements contribute to the ideal state by fostering an environment where safety is not just a set of rules, but are ingrained in	Start: 09/14/23 Finish: 11/12/23

● Can these successful practices be replicated or expanded to other areas within the lab or to other contexts? What would be needed to do so? ● What can be learned from these successful practices that can be applied to areas needing improvement? ● What are the barriers, if any, to leveraging these successful practices more broadly? How might these be overcome? ● How do external factors such as university policies, industry standards, and technological advancements contribute to or hinder these successful practices?				daily operations, and all members feel accountable and empowered to maintain high safety standards. Supportive leadership, the lab's community spirit, and a commitment to learning and improvement enable these practices. The lab's structure, which allows student involvement and responsibility, also plays a crucial role. These practices can be replicated in other areas by encouraging similar levels of open communication, structured and ongoing training, and community building. The lab's success shows the importance of a culture that values safety, learning, and community. Applying these values can improve areas that are currently underdeveloped. These practices align well with the lab's goals of promoting safety, efficiency, and a nurturing learning environment, preparing students for future professional roles. Barriers include limited resources from the university for safety initiatives and training resources, the mixed quality in mentorship, and	

				an under-developed succession strategy. Overcoming these requires additional support and a more formalized mentorship structure. University policies and external safety standards reinforce the lab's practices, though there's a gap in resource allocation. Industry advancements offer opportunities for updating training methods and motivating staff to new heights of professionalism as the already excellent reputation of the lab and COEN continue to improve.	

Ideal State Analysis (Gap Analysis)

Key Questions	Frameworks	Data Sources	Data Collection Methods	Analysis	Dates
● What does the ideal state of safety and operational efficiency look like for the Advanced Materials Lab? ● Which existing safety practices could be enhanced or expanded to move closer to the lab's ideal state? ● How can successful	Appreciative Inquiry 4-D Model Chevalier's Updated BEM	**Client** **Graduate and undergraduate students who use the lab** **Lab safety team**	**Lab Safety Team Interviews**	The lab is mostly doing everything right and has achieved the ideal state along many critical dimensions. However, some of these could still be improved. Ideally, e-learning "nuggets" or micro-learnings are available on all computer systems for quick reference or review. The yearly safety seminar is redesigned a little each year to keep things interesting for those who have seen the training previously.	Start: 09/14/23 Finish: 11/12/23

practices and elements of the lab's culture be replicated or extended to other areas where improvement is desired? ● What additional training or development opportunities would help staff contribute more effectively to achieving the ideal state? ● What additional resources or support would enable the lab to bridge the gap between its current state and the ideal state? ● How can the lab's sense of community and external collaborations be leveraged to support the achievement of the ideal state? ● What improvements in				The knowledge check following the yearly safety seminar is also changed from year-to-year to be more challenging for experienced lab staff. The AML onboarding process is well documented and any training processes or best practices for each machine or tool in the lab is also well documented and regularly updated by the student who "owns" the machine. The lab has an excellent culture, but in its ideal state, there is a conscious effort to support this sense of community with traditions, rituals, and other bonding experiences to support this community. In the lab's ideal state, the mentorship program is supported with processes, organization, and resources. There is training provided for mentors and mentees, meetings are organized to support best practices and share knowledge, and staff are assigned to oversee the organization and execution of the mentorship program. There is a robust succession planning program in place in order to avoid any drops in performance during expected and unexpected turnover. This could be organized in	

communication and knowledge sharing within the lab could help in reaching the ideal state? ● What benchmarks or external standards could the lab implement to help it achieve the ideal state?				conjunction with the mentorship program or as a separate program. Third party audits are increased in their regularity and vigor. In the lab's ideal state, the lab leverages its relationships with other labs, either in or outside the university, to get independent "fresh eyes" on the lab. Audits performed by the COEN safety team are also intensified and include simulated emergencies where lab staff have to respond to an incident to test their training and stimulate conversation about preparedness and processes. The university also supports these efforts with increased resources for safety initiatives.	

Intervention Selection

Key Questions	Frameworks	Data Sources	Data Collection Methods	Analysis	Dates
● What interventions can further develop and build upon the lab's existing strengths in safety training and culture? ● How can we enhance and	Hale's "Family of Interventions" Siko's I2 Matrix	**Client** **Graduate and undergraduate students who use the lab** **Lab safety team**	**Lab Safety Team Interviews**	Training: Create and integrate e-learning modules or micro-learnings for quick reference and review. This would enhance the accessibility of training materials and allow for ongoing learning.	Start: 11/01/23 Finish: 12/01/23

expand the effective practices identified, such as open communication, peer teaching, and proactive safety approaches? ● What interventions can address areas for growth while still aligning with the lab's successful practices and culture? ● Considering resource constraints, what cost-effective interventions can be implemented to improve safety training and audits? ● Which interventions will have a long-term, sustainable impact on the lab’s safety culture and operational efficiency? ● What metrics or indicators can be used to measure				Redesign the yearly safety seminar content annually to maintain engagement, especially for experienced staff. Change the accompanying knowledge checks to be more challenging and varied each year. Formalize and regularly update documentation for the onboarding process and best practices for each machine or tool, managed by the student "owners." This will ensure consistency and quality in training. Culture: Actively support and enhance the lab’s community spirit through organized traditions, rituals, and bonding experiences. This could involve both in-lab activities and social gatherings outside the lab. Mentorship: Develop a structured mentorship program with defined processes and resources. Provide training for mentors and mentees, organize regular best practice meetings, and assign staff to oversee the program. Succession Planning:	

the success and impact of the implemented interventions?				Establish a comprehensive succession planning program to manage both expected and unexpected staff turnover, potentially in conjunction with the mentorship program. Audits: Regularize and intensify third-party audits, including leveraging relationships with external labs for independent reviews. Incorporate simulated emergency scenarios to test response and preparedness to reveal training, preparedness, and stimulate conversation about safety. Documenting: Establish mechanisms for continuous feedback on safety practices and interventions, ensuring they are adaptable and responsive to the lab's evolving needs. University Support: Advocate for increased university support and resources dedicated to safety initiatives, including the COEN safety team's efforts in conducting more comprehensive audits and training updates.	

				Dissemination of Best Practices: Create documentation of best practices and successful strategies. Provide these to the other labs in the university as a template for them to learn from.	

Appendix E. Lab Safety Performance Rubric

Category	Description	5 -Exemplary	4 - Mature	3 - Developing	2 - Emerging	1 - Absent	Evidence	Comment/ recommendations
Information	How well safety roles are assigned with clear responsibilities defined.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Information	How well senior staff is readily available and approachable for general questions and for reporting near misses, incidents, and accidents.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Information	Graduate students “own” tools around the lab, and how well they train others on their assigned equipment.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Information	How well third party audits contribute to the information about, and sustainability of a safe environment.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Information	How well lab members know answers to challenging, safety related questions when asked by auditors.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Information	How well regularly team meetings discuss, document, and review safety expectations and lessons learned.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Information	How well a stop work procedure is implemented in the laboratory that can be invoked by anyone and must be adhered to by all.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Information	How well lab specific training prepares new staff on knowledge, skills, and attitude levels.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Information	How well lab safety walkthroughs are planned, executed, and participated in by all lab staff, with expectations and results clearly communicated and documented.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Information	How well a formal mentorship program is organized and executed, with clear roles, responsibilities, process steps, and expected goals and outcomes defined.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Resources	How well procedures support safe behavior, are clearly documented, and accessible.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be	Basic structure in place but needs	Needs significant improvement or not present		

				improved with minor changes	improvement			
Resources	How well the lab's environment is kept to a high degree of cleanliness and organization.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Resources	How well the lab provides necessary tools, or makes them available upon request; including SOPs and other necessary information.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Incentives	How well the lab community supports learning, interpersonal engagement, and a positive work environment.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Incentives	How well the lab staff feel supported and empowered in their larger career ambitions by coming from a high performing lab.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Motivations	How well safe behavior is modeled and reinforced by senior lab members, including managers.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Motivations	How well lab staff are inherently motivated to perform their work in a safe way.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Capacity	A succession plan is in place, and how well it impacts the hiring, documentation, and training cycle.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Capacity	How well managers support safe behavior in the lab, including respecting safety over timely performance, encouraging staff to go home if they are tired or emotionally unprepared for work, etc.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Knowledge/Skills	How well staff know about what are safe/unsafe practices and what to do to perform in a safe way.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Knowledge/Skills	Students "own" various tools and machines in the lab, and how well they know their machine and teach others to use them.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		
Knowledge/Skills	How well staff know the "why" of their actions beyond the procedures outlined in their SOPs.	Exemplary and should be a model for others	Strong performance and well implemented	Adequate and meets standards, could be improved with minor changes	Basic structure in place but needs improvement	Needs significant improvement or not present		