The Tool Box

Provided below is a variety of selected resources useful for implementation of the above recommendations. This list is not comprehensive, and the Task Force welcomes additions to the tool box, which may be submitted to https://www.surveymonkey.com/r/CNT9SM3. The most up-to-date tool box, may be accessed here (TBD).

Institution-Wide Dynamics and Resources

Recommendation #1 – The President/Chancellor renews commitment to improve the safety culture for all academic research, scholarship, and teaching.

1) To help presidents and chancellors effectively communicate the importance of safety, the Task Force has provided a timeline of recent notable university safety accidents and reactions:

a) 2009 UCLA-Researcher (Sheharbano (Sheri) Sangji) Dies After Lab Fire- C&EN
b) 2010 Texas Tech **–** University Lab Accident (Preston Brown) Under Investigation- C&EN
c) 2010 University of Florida – Student (Courtney Mason) has wrist severed in an equine farm accident - Gainesville Sun
d) 2011 Yale University – Yale student (Michele Dufault) killed as hair gets caught in lathe- NY Times
e) 2011 Chemical Safety Board- CSB Releases Investigation into 2010 Texas Tech Laboratory Accident- CSB TTU Case Study
f) 2011 UCLA- Charges brought in UCLA researcher's death- C&EN
g) 2012 American Chemical Society Report – Publishes guidance and recommendations to help strengthen safety culture - ACS Report
h) 2013 ACS Hazard Analysis Tools- At the request of the CSB the ACS develops and releases Identifying and Evaluating Hazards in Research Laboratories- ACS Hazard Analysis Tool
i) 2013 University Of California Reaches Agreement In Connection With Charges In Lab Researcher's Death - – The Los Angeles County District Attorney's Office dropped felony charges against the University of California Regents as part of an agreement involving labor code violations relating to the 2008 death of a chemistry staff research assistant. In the UC agreement, the Regents, the governing body of the University of California system, accepted responsibility for the laboratory conditions that led to researcher Sheharbano (Sheri) Sangji's death.- C&EN
j) 2013 UCLA Professor Harran criminal case – A Los Angeles County judge approved an agreement that could end a criminal case against University of California, Los Angeles, chemistry professor Patrick G. Harran. Harran was charged with four felony violations of the state labor code. The deal mandates that Harran complete multiple forms of community service and pay a $10,000 fine. The charges were not dismissed. Instead,

the case against Harran is effectively on hold while he completes the terms of the five-year agreement - C&EN

k) 2014 Stanford Report – Safety on Campus - Stanford Advancing the Culture of Safety

l) 2014 National Research Council – Promoting a Culture of Safety in Academic Chemical Research (2014) - National Academies Press: Safe Science

m) 2015 UCLA Legal Fees – The Harran case is approaching $4.5 Million - LA Times.

n) 2015 APLU/AAU Joint Task Force on Laboratory Safety - *Implementation of Safety Recommendations on Campus* - C&EN and *Under Pressure, Universities Take a Renewed Shot at Improving Lab Safety* - The Chronicle of Higher Education

o) USA Today - May 28, 2015 - Transparency is an important cornerstone in maintaining public trust in biological research, says the National Institutes of Health, which has issued guidance to laboratories that receive federal funding. While many research organizations answered USA TODAY's questions and provided basic records about their biosafety committees' work, dozens of others were not so forthcoming - USA Today

p) USA Today article on June 29, 2015 Senators, health experts demand action to address biolab accidents - USA Today

q) Sangji Family's presentation at ACS meeting asking that federal funding be dependent on a safe culture in the PI's lab. Articles in Science and Chemistryworld and CHEMJOBBER.

Recommendation #2 – The President/Chancellor designates a campus-lead and leadership team to begin the process. Consider appropriate committees to help implement a culture of safety, including a safety committee of faculty, Environmental Health and Safety (EH&S) officers, and other representatives that can provide formative feedback to researchers, educators, and staff.

1) The Stanford University Committee on Health and Safety (UCHS) is a faculty-led committee established in 1988 to advise the president on the safety policies and practices of the campus. In 2013, Stanford convened a task force in 2013 under the UCHS and the Office of the Vice Provost and Dean of Research to review and evaluate the laboratory safety culture at Stanford. The *Report of the Task Force for Advancing the Culture of Laboratory at Stanford University* is comprehensive with their findings, recommendations, and extensive appendices that include interviews with research personnel. It is available at Stanford University.
2) The University of Minnesota Safety Program includes faculty, graduate students, postdocs, and EH&S staff. The safety committee provides formative feedback on safety to labs. A short description was provided in the NRC's *Safe Science* report available at National Academies Press. Additional descriptions of the program available at Science AAAS and Journal of Chemical Education.

Recommendation #3 – The campus-lead and leadership team conduct campus dialogues with stakeholders to develop a shared vision of safety that aligns with the institutional mission and to develop an action plan.

1) To help inform the campus-leadership team of best practices in advancing a culture of safety, the Task Force has compiled a list of resources:
   a) American Chemical Society Committee on Chemical Safety (2012). Creating Safety Cultures in Academic Institutions. American Chemical Society, Washington, DC, 2012: 34. Available at ACS.
   b) Battelle (2014). The Safe Conduct of Research. Available at Battelle.
   c) DOE Integrated Safety Management Guide (DOE 450.4-1c). Available at DOE Resources.
   d) Dupont USA Managing Operational Risk to Enhance Business Performance. Available at Dupont
   e) Hill, R. H., & Finster, D.C. (2013) Academic Leaders Create a Strong Safety Culture in Colleges and Universities. Journal of Chemical Health and Safety, 20(5), 27-34: Science Direct Journal of Chemical Health and Safety
   f) International Nuclear Safety Advisory Group. Available at Safety Series.
   g) National Research Council (US) Committee on Prudent Practices in the Laboratory. (2011). Prudent practices in the laboratory: Handling and management of chemical hazards: Updated Version. Available at National Academies Press.
   h) Occupational Safety & Health Administration – Creating a Safety Culture. Available at OSHA Creating a Safety Culture
   i) Safe Science: Promoting a Culture of Safety in Academic Chemical Research (2014). Committee on Establishing and Promoting a Culture of Safety in Academic Laboratory Research; Board on Chemical Sciences and Technology, Division on Earth and life Studies; and Board on Human-Systems Integration, Division of Behavioral and Social Sciences and Education (2014, 128 pp.; ISBN 978-0-309-30091-9). Available at National Academies Press Safe Science
   j) Schröder, I., Huang, D. Y. Q., Ellis, O., Gibson, J. H., & Wayne, N. L. (2015). Laboratory safety attitudes and practices: A comparison of academic, government, and industry researchers. Available at Journal of Chemical Health and Safety
   k) Stanford University (2014). Report of the Task Force for Advancing the Culture of Laboratory at Stanford University. Available at Stanford Advancing the Culture of Safety
   l) U.S. Chemical Safety and Hazard Investigation Board (2010). Texas Tech University Laboratory Explosion. Available at CSB TTU Case Study

2) Campus community discussions in departments, colleges, and the university are critical for strengthening a culture of safety. Consider hosting listening sessions that focus on creating a safe learning/work environment. Consider these **guiding principles** to help frame the discussion:

a) Scholarly excellence and responsible conduct of research includes safety as a critical component. *We do better science when we do safe science.*
b) Each institution should commit to a campus environment that ensures the health and safety of their entire community (faculty, students, staff, and visitors) and empowers the community to be responsible for the safety of others.
    i) Safety is everyone's responsibility.
    ii) A safe campus environment for workers is a right of employment. Available at OSHA Employer Responsibilities
    iii) A safe campus learning environment is a right of education.
    iv) Our university, like our "Family" needs us to ensure a safe environment.
c) Safety training and safety education is a critical component of research and education. It is important for instilling a culture of safety in the next generation of researchers and future faculty, and it is important for our student's career development and employability.
d) An improved safety culture is necessary to implement true risk reduction.

Recommendation #4 – The campus-lead and leadership team develop effective safety policies, procedures, and management system, and identifies the resources necessary for implementation. They establish a recognition and reward system and integrate these into tenure and promotion, hiring, and annual performance reviews.

1) Consider these policies for recognizing and rewarding effective safety practices:
    a. Make safety, conducting hazard analysis, completion of safety training, etc. a part of all faculty annual reviews.
    b. Require the inclusion of the candidate's safety record as a part of a supervisor's performance appraisal comments and letters supporting tenure or promotion.
2) Consider this recommendation on centralized funding from the *Report of the Task Force for Advancing the Culture of Laboratory at Stanford University*:
    Recommendation #6 Need for centralized funding support for comprehensive, campus-wide safety related mandates. Funding for safety equipment and requirements within the laboratory remain a continuing struggle for many laboratories. Everything is monetized, but laboratory operations need some core resources focused on safety support. For example, there is a need for core central funding for personal protective equipment (PPE), safety equipment and safety requirements applicable to all laboratories.
3) Resource guides for laboratory safety
    a. ACS has a page with Safety in the Classroom ACS links. Available at ACS.
    b. ACS Committee on Chemical Safety (2013). Identifying and Evaluating Hazards in Research Laboratories: Guidelines Developed by the Hazards Identification and Evaluation Task Force. American Chemical Society, Washington, DC. Available at ACS Hazard Analysis Tool
    c. Aldrich Technical Bulletins

d. Bretherick, L. (2013). *Bretherick's handbook of reactive chemical hazards*. Butterworth-Heinemann.
e. Chemical Laboratory Information Profiles (CLIPs) describes the hazards of a chemical to assist teachers and students in determining precautions for laboratory work. Clips can also be used to guide student discussions and create assignments.
f. Department of Health and Human Services has a site that links to many references. Many of the references are below too. Available at DHS.
g. Dow Lab Safety Academy provides many resources for enhancing safety practices.
h. Furr, A. K. (2000). *CRC handbook of laboratory safety*. CRC press. Available at CRC Press or Amazon.
i. Hill, R. H., & Finster, D. (2011). *Laboratory safety for chemistry students*. John Wiley & Sons.
j. National Research Council (US) Committee on Prudent Practices in the Laboratory. (2011). Prudent practices in the laboratory: Handling and management of chemical hazards: Updated Version. Free download at National Academies Press.
k. NFPA 45: Standard on Fire Protection for Laboratories Using Chemicals. Some institutions will need to follow other building codes such as the Uniform Building Code, but NFPA 45 is one of the documents that is referenced in the OSHA Lab Standard. Free Access at the NFPA website.
l. Northwestern University Research (2013). *Essential Information on Laboratory Safety.* Available at Northwestern University.
m. OSHA Lab Safety Guidance.
n. Safety in Academic Chemistry Laboratories: Volume 1, Accident Prevention for College and University Students. American Chemical society. Available also as a Spanish version and Arabic version.
o. Safety in Academic Chemistry Laboratories: Volume 2 (teacher's edition)
p. Safety for Introductory Chemistry Students Brochure.
q. Salerno, R. M., & Gaudioso, J. (Eds.). (2015). *Laboratory Biorisk Management: Biosafety and Biosecurity*. CRC Press. Available at Amazon.

Recommendation #5 -- The institution develops a risk assessment process for laboratory safety that is integral to all activities conducted in laboratory or field operations. There are appropriate resources to assist the faculty with risk assessment.

1) Actively engage campus Risk Management and Boards of Trustees/Regents to support campus safety initiatives to mitigate and manage risk due to research and academic safety issues. Available at Risk Management
   a) Ensure that research and academic safety is incorporated into all unit risk analyses and are reflected in the university's heat map of risk.

b) Upon identification of the risks associated with research and academic safety, risk management plans should call for regular review and changes in policies and procedures to reflect the associated risk.

Recommendation #6 – The campus-lead and leadership team clearly articulate the roles and responsibilities of all stakeholders.

1) Recommendations from the National Academies on roles and responsibilities of different stakeholders.
   a) National Research Council (2014). *Safe Science: Actions for Environmental Health and Safety Staff.* Washington, DC: The National Academies Press. Available at The National Academies Press
   b) National Research Council (2014). *Safe Science: Actions for University Senior Leaders*. Washington, DC: The National Academies Press. Available at The National Academies Press.
   c) National Research Council (2014). *Safe Science: Actions for Laboratory Researchers*. Washington, DC: The National Academies Press. Available at The National Academies Press
   d) National Research Council (2014). *Safe Science: Actions for Principal Investigators and Department Chairs*. Washington, DC: The National Academies Press. Available at The National Academies Press
   e) National Research Council (2014). *Safe Science: Actions for Deans and Vice Presidents for Research*. Washington, DC: The National Academies Press. Available at The National Academies Press
2) The *Report of the Task Force for Advancing the Culture of Laboratory at Stanford University* provides guidance on suggested roles and responsibilities. Available at Stanford University.
3) Presidential Leadership among other leaders must be engaged to create a true change in safety culture on campus. OSHA's Safety & Health Management System eTool provides guidance to management leadership. Available at OSHA Management Leadership
4) University examples of roles and responsibilities.
   a) University of Texas. Available at Responsibilities and Procedures
   b) University of California, Berkeley. Available at Responsibilities
   c) North Carolina State University. Available at Environmental Health and Safety Policies and Programs
   d) University of Utah. Available at Policy 3-300: Environmental Health and Safety Policy

Recommendation #7 – The institution establishes a unified administrative reporting model that connects responsibility for developing and implementing academic safety policies under one administrative pillar in the institution, and that includes faculty, EH&S officers, and administrative leaders.

1) Following the laboratory explosion at Texas Tech University, the university modified its reporting structure so that EH&S reports to the vice president for research. Their pre and post organizational charts are included in the CSB case study on Texas Tech University.
2) From *Safe Science: Promoting a Culture of Safety in Academic Chemical Research (NRC, 2014):*

   Vice presidents for research and deans of schools and colleges should, in addition to deploying funds in ways that support safety, ensure that the lines of research undertaken by the institution are ones it has the capacity to perform safely. They can make certain that everyone involved in the research enterprise knows their role and responsibilities in supporting safety. They can develop reporting structures that support safety culture; an example would be for senior environmental health and safety (EHS) officials to report through the senior research management programs, typically at the vice president level or higher—a structure that may better integrate safety management into overall research management.

Recommendation #8 – The campus-lead, leadership team, and faculty embed safety communication in laboratories, classes, departments and in the wider campus.

1) Video tools/examples to raise awareness of the importance of safety
   a) One of the Best Safety Speeches Ever By Alcoa CEO. Available at EHS Safety News America
   b) Chemical Safety Board video *Experimenting with Danger*. Available at YouTube
   c) Laboratory Safety Memorial Wall – list of deaths due to laboratory accidents. Available at The Laboratory Safety Institute
   d) UMN Video on training Graduate Students. Available at YouTube
   e) Dow Lab Safety Academy. Available at Dow
   f) University of California San Diego- A Day in the Lab UCSD. Available at YouTube
   g) Lab Techniques & Safety: Crash Course Chemistry #21. Available at YouTube
   h) Kate's Story – A Safety Video. Available at YouTube
2) Daily safety communication resources
   a) Create campus specific safety videos to use at public meetings.
   b) Open every formal meeting on campus with a safety message.
   c) WCF Safety Meeting Resources. Available at WCF
   d) United States Department of Labor Safety and Health Topics. Available at OSHA Safety and Health Topics
   e) Centers for Disease Control and Prevention, Workplace Safety & Health Topics. Available at CDC
   f) University of California Riverside Fast Facts. Available at University of California, Riverside
3) Examples of marketing campaigns for safety

a) North Carolina State University won CSHEMA's institutional marketing campaign Award of Excellence for its "WolfAlert Emergency Communication Campaign". Available at WolfAlert
b) University of Nevada Reno's "Focus on Safety" campaign earned the 'Marketing Campaign Award of Distinction' at the CSHEMA national conference. Available at Focus on Safety

Recommendation #9 – The campus-lead, leadership team, and faculty work to create a trusting and safe culture. They encourage open dialogue and celebrate reporting and learning from near misses.

1) The *Report of the Task Force for Advancing the Culture of Laboratory at Stanford University* provides interview findings from ethnographic studies of their research personnel as well as findings from their culture of safety climate survey. These might provide context on the values, attitudes, and behaviors of research personnel that could help facilitate more open dialog. Available at Stanford University.
2) References for the importance of trusting environments:
   a) Lawler, E.E. High-Involvement Management. Jossey-Bass, San Francisco, CA, 1986 – ISBN-0-87589-686-3
   b) Conchie, S. M., P. J. Taylor, and I. J. Donald. Promoting safety voice with safety-specific transformational leadership: The mediating role of two dimensions of trust. *Journal of Occupational Health Psychology* 2012; 17(1): 105-115. Available at APA PsycNET

Recommendation #10 – The institution empowers undergraduate students, graduate students, post docs, and staff to voice safety questions and concerns to their faculty supervisors, offices of EH&S, and/or safety committee.

1) Example of empowering students to be involved in laboratory safety discussed at Science AAAS.
   a) A more in depth analysis of how the University of Minnesota empowered students can be found at McGarry, K. A., Hurley, K. R., Volp, K. A., Hill, I. M., Merritt, B. A., Peterson, K. L., ... & Tolman, W. B. (2013). Student Involvement in Improving the Culture of Safety in Academic Laboratories. *Journal of Chemical Education*, *90*(11), 1414-1417. Available at Journal of Chemical Education.
2) Dupont's Safety Training Observation Program (STOP) provides a path to workplace safety by making safe behavior and workplace conditions part of the work culture. Available at Dupont.
3) OSHA provides guidance on how employees can be involved in safety. Available at OSHA Employee Involvement.

Recommendation #11 – The institution works to strengthen collegial and collaborative relationships between faculty and the staff in the offices of EH&S.

Incorporate into the campus dialog an expectation of partnership and support between EH&S and faculty. Keep regular and open meetings between faculty and EH&S.

Recommendation #12 – The institution works to enhance effective working relationships with first responders.

Data, Hazard Identification, and Analysis

Recommendation #13 – The institution implements routine hazard analyses, including them as integral components of undergraduate and graduate education; thesis, dissertation, and funding proposals; and experimental design for all experiments.

1) OSHA's Safety & Health Management Systems eTool – Worksite Analysis. Available at OSHA Worksite Analysis
2) OSHA's Safety & Health Management Systems eTool – Hazard Control. Available at OSHA Hazard Control
3) General Standard Operating Procedures (SOP) guidelines and examples
   a) Center for Laboratory Safety Document Management. Available at UC Center for Laboratory Safety
   b) USU SOP Guidelines. Available at Office of Research and Graduate Studies USU
   c) USU SOP FAQs. Available at Office of Research and Graduate Studies USU
   d) USU Liquid Nitrogen handling guidelines. Available at Office of Research and Graduate Studies USU
4) Hazard assessment tools
   a) American Chemical Society Committee on Chemical Safety (2013). Identifying and Evaluating Hazards in Research Laboratories: Guidelines Developed by the Hazards Identification and Evaluation Task Force. American Chemical Society, Washington, DC. Available at ACS Hazard Analysis Tool
   b) UCLA's Laboratory Hazard Assessment Tool – The LHAT facilitates identification of hazards and identifies the Personal Protective Equipment (PPE) to be used during the specified work activities. Available at UCLA EH&S
   c) NIOSH Pocket Guide to Chemical Hazards. Available at CDC
5) For hazards in the field, the International Society for Agricultural Safety and Health (ISASH) has many resources.

Recommendation #14 – The institution implements a process to report incidents and near misses so that the campus community can learn from these incidents.

1) Examples of whistle blowing, accident reporting, and near miss reporting forms

a) Texas Tech Near Miss System "SCANS". Available at Texas Tech University
b) University of Wisconsin- Safety Yellow Cards. Available at University of Wisconsin
c) The Laboratory Safety Institute (2015). The Lab Safety Memorial Wall. Available at The Laboratory Safety Institute

2) Examples of lessons learned websites at universities
   a) UC Center for Laboratory Safety. Available at UC Center for Laboratory Safety
   b) Texas Tech Lessons Learned. Available at Texas Tech University
   c) University of California Berkeley. Available at EH&S University of California, Berkeley
   d) University of California, Irvine. Available at University of California, Irvine EH&S
3) Resources to help guide the development of a near miss reporting system
   a) OSHA's Safety & Health Management Systems eTool. Available at OSHA Safety and Health Topics
   b) Orr, M. F., Sloop, S., & Wu, J. (1999). Acute chemical incidents surveillance—Hazardous Substances Emergency Events Surveillance, nine states, 1999–2008. CDC. Available at CDC
   c) Strauch, B. (2015). Can we examine safety culture in accident investigations, or should we? Safety Science, 77, 102-111. Available at Science Direct
   d) U.S. Chemical Safety and Hazard Investigation Board (2010). Texas Tech University: Laboratory Explosion. Available at CSB TTU Case Study
   e) Do we recognize near misses. Available at Science Direct

Training and Learning

Recommendation #15 – The institution provides laboratory safety training for students, faculty, EH&S staff, and department heads.

1) OSHA's Safety & Health Management Systems eTool provides guidance on Safety and Health Training- OSHA Safety and Health Training
2) Determining training needs
   a) Utah State University Training Matrix Survey is a survey which allows employees a different method to determine training needs. Survey is here: Office of Research and Graduate Studies USU and Training Matrix is here: Office of Research and Graduate Studies USU
   b) UCLA Lab Training Matrix outlines the minimum medical and training requirements for personnel (PIs, lab supervisors, graduate and undergraduate students and staff) working in a research setting. Available at UCLA EH&S
3) Online laboratory safety training resources
   a) Dow Lab Safety Training Modules. Available at Dow
   b) Cornell University Lab Safety Videos. Available at YouTube
   c) Lab Safety Videos List. Available at Lab Safety Videos
   d) Northwestern University Office of Research Safety Training. Available at Vimeo
4) Other safety training resources

a) The Safety Training Consortium is a higher education membership organization founded by research universities, for the purpose of developing safety training for the research community. *Excellence in Safety Education*. Available at Safety Training Consortium
b) Cornell University Lab Safety Certificate Program. Available at Cornell University

5) Approaches to emergency training
   a) Mock emergencies include: after hours, fake spills, fake blood, confusion, etc. to help students understand how crazy it can all get in an emergency. John Nauman, Director of Northern Arizona University Undergraduate Laboratory Program in Chemistry and Biochemistry
   b) Approaches to Emergency Training by Dawn Mason – Available at Google drive
   c) Some institutions have access restriction in which there is no laboratory access until training has been completed.

Recommendation #16 – The institution ensures undergraduate and graduate science & engineering curricula include an emphasis on safe practices.

1) Resources of interest
   a) Teaching of safety to students: "Laboratory Safety for Chemistry Students" by R. H. Hill and D. Finster, 2010, Wiley Publishing. ISBN: 978-0-470-34428-- Wiley
   b) Key Lessons for Preventing Incidents from Flammable Chemicals in Educational Demonstrations. Available at CSB
   c) Council on Research (CUR) listserv. A resource for undergraduate education directors – CUR Listserv
   d) CUR Quarterly for 2007 focuses on risk management related to undergraduates participating in research:[1]
      i) *How to get Started Using Chemicals and Radionuclides in an Undergraduate Research Laboratory. Available at* CUR
      ii) *Risk Management: Training Undergraduates in Research Ethics in Social and Behavioral Sciences. Available at* CUR
      iii) *Risk Management in International Undergraduate Field Classes: A Costa Rican Case Study. Available at* CUR
      iv) *The OUR-IRB Project: A Necessary Tool for Risk Management and Ethics Education. Available at* CUR

Continuous Improvement

Recommendation #17 – The institution conducts self-assessment and benchmarking using measures that can provide feedback on whether they are

[1] These references are made available freely by the Council on Undergraduate Research. For more information about the Council on Undergraduate Research, including additional articles pertaining to undergraduate research program operation, please see: http://www.cur.org.

moving to a safer culture.

1) Internal self-assessment can be done at the institutional level or at the sub-unit level (e.g. departments, colleges, institutes).
   a) Emory University Lab Safety Score Cards. Available at ABSA Conference
   b) USU Laboratory Audit Form. Available at Office of Research and Graduate Studies USU

2) External assessment
   a) The Campus Safety Health and Environmental Management (CSHEMA) Environmental Safety Tracking, Assessment, and Rating System (ESTARS) program is a comprehensive and extensive campus-wide guided self-assessment. Typically this is a yearlong process. Available at CSHEMA ESTARS.
   b) Peer assessment of culture and practices is another avenue for external assessment. Peers can be selected based on their academic and research profiles and maturation of their safety culture. This practice is common to the academy, especially around graduate program review. As an example, see The University of Texas System.
   c) Professional consulting organizations often provide services to industry and national laboratories.

3) Assessment resources
   a) Hill, R. H., & Finster, D. C. (2013). Academic leaders create strong safety cultures in colleges and universities. Journal of Chemical Health and Safety, 20(5), 27-34. Available at Science Direct
   b) Kotter, J. P. (1996). Leading change. Harvard Business Press. Available at Harvard Business Review
   c) Occupational Safety & Health Administration. Creating a Safety Culture. Available at OSHA Creating a Safety Culture
   d) Schröder, I., Huang, D. Y. Q., Ellis, O., Gibson, J. H., & Wayne, N. L. (2015). Laboratory safety attitudes and practices: A comparison of academic, government, and industry researchers. Journal of Chemical Health and Safety. Available at Science Direct
   e) Stanford University (2014). A Report of the Task Force for Advancing the Culture of Laboratory at Stanford University. Available at Stanford
   f) Strauch, B. (2015). Can we examine safety culture in accident investigations, or should we? Safety Science, 77, 102-111. Available at Science Direct

Recommendation #18 – The institution develops a continuous improvement system that provides feedback, reassessment, and on-going training and learning opportunities.

1) Self-assessment using CSHEMA's ESTARS program can be done on an on-going basis for continuous improvement and reassessment. Available at CSHEMA ESTARS.
2) The *Report of the Task Force for Advancing the Culture of Laboratory at Stanford University* provides the interview guide that was used for the ethnographic studies of Stanford's research personnel. The report also includes the culture of safety climate survey questions.

These might be useful as assessment tools for other campuses. Available at Stanford University.

Recommendation #19 – The institution develops a system of accountability including peer to peer accountability.

1) OSHA's Safety & Health Management Systems eTool – Safety and Health Program Audits and Reviews. Available at OSHA Safety and Health Program Audits and Reviews
2) UCLA's Laboratory Safety Compliance Procedure and Implementation Plan is a 3-tiered approach to dealing with PI's with repeat non-compliance findings on EH&S inspections. This procedure was developed by a faculty led Chemical and Physical Safety Committee.

Recommendation #20 – The institution promotes academic and industrial/government partnerships that allow academic researchers to learn from strong and well-developed safety cultures in industrial and government laboratories.

Reports/References of Interest

1. American Chemical Society Committee on Chemical Safety (2012). Creating Safety Cultures in Academic Institutions. American Chemical Society, Washington, DC, 2012: 34. Available at ACS.
2. Battelle (2014). The Safe Conduct of Research. Available at Battelle.
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5. Kotter, J. P. (1996). Leading change. Harvard Business Press. Available at Harvard Business Review
6. The Laboratory Safety Institute (2015). The Lab Safety Memorial Wall. Available at The Laboratory Safety Institute
7. National Research Council (US) Committee on Prudent Practices in the Laboratory. (2011). Prudent practices in the laboratory: Handling and management of chemical hazards: Updated Version. Available at National Academies Press
8. National Research Council (2014). *Safe Science: Promoting a Culture of Safety in Academic Chemical Research*. Washington, DC: The National Academies Press. Available at The National Academies Press
9. National Research Council (2014). *Safe Science: Actions for Environmental Health and Safety Staff.* Washington, DC: The National Academies Press. Available at The National Academies Press
10. National Research Council (2014). *Safe Science: Actions for University Senior Leaders*. Washington, DC: The National Academies Press. Available at The National Academies Press.
11. National Research Council (2014). *Safe Science: Actions for Laboratory Researchers*. Washington, DC: The National Academies Press. Available at The National Academies Press
12. National Research Council (2014). *Safe Science: Actions for Principal Investigators and Department Chairs*. Washington, DC: The National Academies Press. Available at The National Academies Press
13. National Research Council (2014). *Safe Science: Actions for Deans and Vice Presidents for Research*. Washington, DC: The National Academies Press. Available at The National Academies Press

14. Orr, M. F., Sloop, S., & Wu, J. (1999). Acute chemical incidents surveillance—Hazardous Substances Emergency Events Surveillance, nine states, 1999–2008. Available at CDC
15. OSHA's Safety and Health Management Systems eTool | Module 4: Creating Change - Safety and Health Program Management: Fact Sheets: Creating a Safety Culture. (1989). Retrieved October 23, 2015. Available at OSHA Creating a Safety Culture
16. Schröder, I., Huang, D. Y. Q., Ellis, O., Gibson, J. H., & Wayne, N. L. (2015). Laboratory safety attitudes and practices: A comparison of academic, government, and industry researchers. Journal of Chemical Health and Safety. Available at Science Direct
17. Stanford University (2014). A Report of the Task Force for Advancing the Culture of Laboratory at Stanford University. Available at Stanford
18. U.S. Chemical Safety and Hazard Investigation Board (2010). Texas Tech University: Laboratory Explosion. Available at CSB