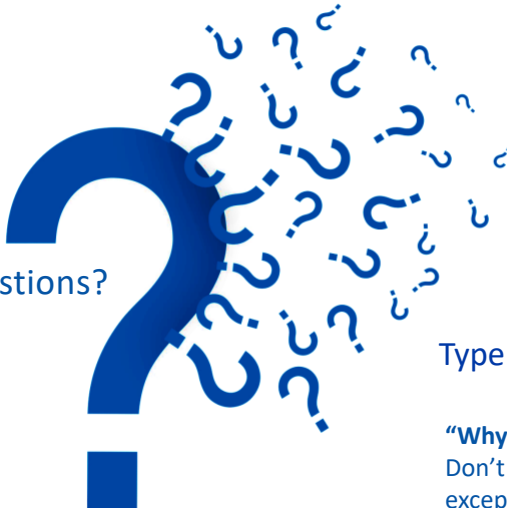
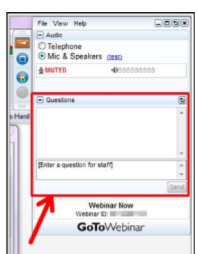


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“Hearing the perspective of the presenters was very helpful. I made a post-it note for myself to remind me to say “I care about you and because I care about you I am concerned that you are putting your eyesight at risk when you don't wear your goggles.”



<http://bit.ly/SafetyCultureVideo>

Fan of the Week

Ann Klotz, Chemical Hygiene Officer and Chemical Technician, Siena College, ACS member for 21 years!



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- Prepare for a changing employment landscape

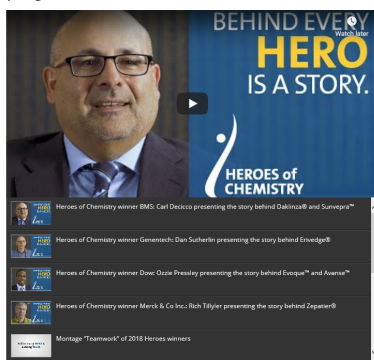
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#HeroesofChemistry ACS Heroes of Chemistry Award



Inspiring Hero Stories



[View All Past Recipients >>](#)

The ACS Heroes of Chemistry Award is the Annual award sponsored by the American Chemical Society that recognizes talented industrial chemical scientists whose work has led to the development of successful commercialized products ingrained with chemistry for the benefit of humankind.

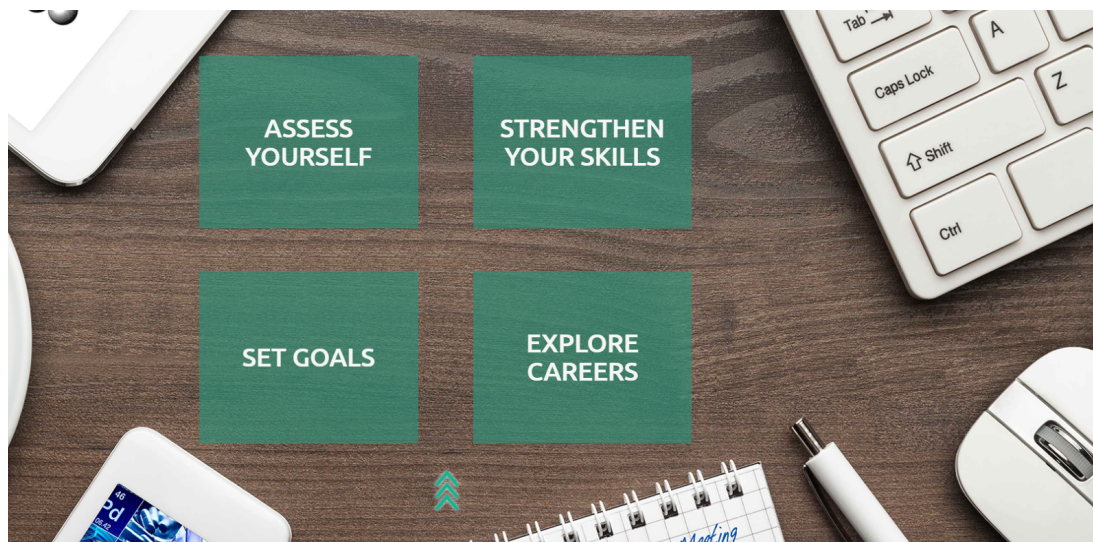
2018 Winners:



www.acs.org/heroes

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An individual development planning tool for you!



<https://chemidp.acs.org>

9

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Sammie Sigmann,
2019 Chair ACS
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ACS Chemical Health & Safety is an all-volunteer technical division of the American Chemical Society. The Division is home to chemists from industry and academia and safety professionals who are interested in the well-being of those who use chemicals (at work, in education, or at home) and the protection of the environment.


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Episode 20



Podcast: Lessons learned in lab safety


Four chemists share their stories of lab accidents with *Stereo Chemistry* to help the scientific community become safer

by Jillian Kemsley and Matt Davenport
JULY 24, 2019 | APPEARED IN VOLUME 97, ISSUE 30



<https://cen.acs.org/safety/Podcast-Lessons-learned-lab-safety/97/i30>


Episode 21



Podcast: Building a culture of safety

Stereo Chemistry examines how organizations are making safety a priority to prevent and prepare for accidents rather than react to them

by Jillian Kemsley, Matt Davenport
AUGUST 10, 2019



<https://cen.acs.org/safety/lab-safety/Podcast-Building-culture-safety/97/web/2019/08>

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LAB SAFETY
for
RESEARCHERS

Regulations

Lessons Learned

Responsibilities

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Lab Safety for Researchers: Responsibilities, Regulations, and Lessons Learned

Mary Beth Mulcahy
Principal Member of the Technical Staff, Global Chemical and Biological Security (GCBS) group, Sandia National Laboratories

Kali Miller
Development Editor in the Publications Division, American Chemical Society

Ralph Stuart
Chemical Hygiene Officer, Keene State College and Chair, ACS Committee on Chemical Safety

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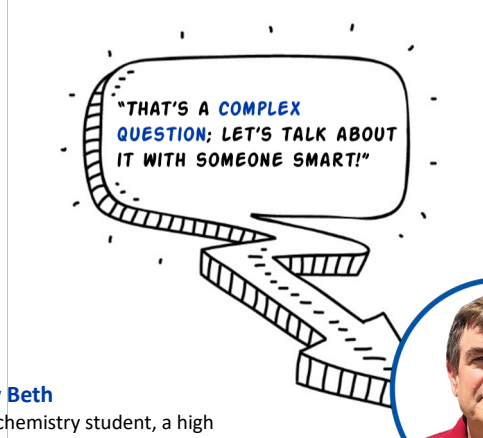
The Opening Question



KALI



Mary Beth
 (PhD chemistry student, a high school teacher, a chemical safety investigator, and now works in the chemical security field)

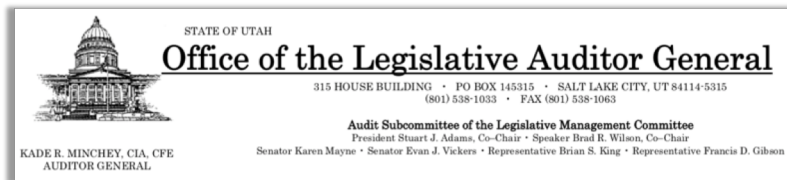


Ralph

We appreciate questions or comments that you would like to share on this topic!

2019 Case Study: Performance Audit of the University of Utah's Laboratory Safety Practices

Are sufficient policies and practices in place to prevent incidents?



- Report says the Laboratory Safety system is **“broken”**
- Administration and Staff must take ownership of their problems
- Lab safety system appears stagnant and focused on performing inspections as indicators of safety performance rather than addressing problems



Audit Recommends Tracking Whether Deficiencies Are Corrected

The report notes that investigations of other lab incidents found uncorrected repeat deficiencies were a factor in those incidents.



University of Hawaii



University of California Los Angeles



Texas Tech University

- At Utah, the auditors found that **49% of research groups** had at least one repeated major chemical safety deficiency
- Some university research personnel do not fully understand their lab safety responsibilities
- The University President recognizes these concerns and is working on solutions



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Questions from the Graduate Student Perspective after Reading the Utah Report

WHAT LAWS OR POLICIES OR REGULATIONS ADDRESS LAB SAFETY IN ACADEMIC INSTITUTIONS? HOW ARE THEY ENFORCED?

WHAT ARE RESEARCHERS EXPECTED TO KNOW? WHAT RULES ARE THEY REQUIRED TO FOLLOW?

WHOSE RESPONSIBILITY IS IT TO TEACH RESEARCHERS ABOUT THESE RULES? WHERE CAN STUDENTS LEARN IF THEY'RE NOT TAUGHT THIS IN THE COURSE OF THEIR EDUCATION?

WHAT ARE THE POTENTIAL LEGAL CONSEQUENCES IF ACADEMIC LABORATORIES DON'T FOLLOW SAFETY GUIDELINES?

HOW CAN SOMEONE REPORT SAFETY CONCERNS IN LAB SITUATIONS?



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Audience Challenge Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



Do you know what safety regulations apply to your work in the chemistry research laboratory?

- I do not know
- I know who to ask to find out
- I rely on the institution's experts to address regulatory requirements
- I have reviewed specific regulations that apply to my lab work
- This question is not applicable to me

* If your answer differs greatly from the choices above tell us in the chat!

Laboratory and Educational Demonstration Incidents (2001-2018)

Incident Date	Organization	City	State	Fatalities	Injuries
2001-01-23	University of California, Irvine	Irvine	California	0	3
2001-01-30	University of Utah	Salt Lake City	Utah	0	0
2002-01-02	Genoa-Kingston High School	Genoa	Illinois	0	7
2002-01-06	U.S. Army Research Laboratory	Fort Belvoir	Missouri	0	1
2002-01-08	Los Alamos National Laboratory	Los Alamos	New Mexico	0	0
2002-03-31	New Berlin West High School	New Berlin	Wisconsin	0	1
2002-02-31	University of Washington Medical Center	Seattle	Washington	0	0
2004-01-30	Frederick Weir High School	Frederick Bay	Washington	0	2
2005-05-18	Huntington Beach High School	Huntington Beach	California	0	2
2006-01-23	Western Reserve High School	Hudson	Ohio	0	4
2006-03-24	Lansing Community College	Lansing	Michigan	0	0
2006-01-30	Madison Township High School	Cape May County	New Jersey	0	5
2006-01-31	Cornell University	Ithaca	New York	0	1
2006-02-20	West Chester University	West Chester	Pennsylvania	0	2
2006-02-24	University of Denver	Denver	Colorado	0	0
2006-03-02	University of Idaho	Missoula	Idaho	0	1
2006-03-07	Saratoga Springs High School	Saratoga Springs	New York	0	8
2006-03-02	Minorsburg High School	Minorsburg	Iowa	0	3
2006-04-03	University of Maryland Eastern Shore	Baltimore	Maryland	0	1
2006-04-01	Southeast Minnesota State University	Marshall	Minnesota	0	1
2006-04-20	Scigen Research Institute	Jupiter	Florida	0	0
2006-04-21	Northwestern University	Evanston	Illinois	0	1
2006-05-05	Massachusetts Institute of Technology	Cambridge	Massachusetts	0	0
2006-05-09	Prosper High School	Dallas	Texas	0	1
2006-05-16	Georgia Institute of Technology (Georgia Tech)	Atlanta	Georgia	0	1
2006-06-08	Lafayette High School	James City	Virginia	0	1
2006-06-16	Binghamton University	Vestal	New York	0	0

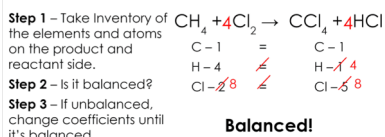
The [261] incidents occurred in a variety of organizations and settings, including:

- Private research laboratories
- Universities
- High schools
- Middle schools
- Elementary schools
- The National Laboratories
- State-run laboratories
- Educational demonstrations



https://www.csb.gov/assets/1/6/CSB_Laboratory_Incident_Data.pdf

Fundamental Legal Concepts You Need to Answer Kali's Questions



Just as you need to be comfortable with algebra to do Stoichiometry...

1. What lab safety aspect is being considered?

Review the regulatory environment.

2. Who covers that aspect here?

Agency jurisdictions are defined by media and geography.

3. How does the regulator write and when do they enforce the regulation?

Each agency has its own regulatory style.



The Regulatory Environment

Regulatory compliance and training assessment tools

To help research faculty, staff, post doctoral fellows and graduate students better understand their many regulatory compliance and training requirements, including those beyond environmental health and safety (EHS&S), Washington University in St. Louis and the University of Pennsylvania developed on-line tools to guide their staff through the process. The tools are analogous to "lab preparation" software with open resources that direct faculty, staff and students to their required training or compliance requirements. Examples of the two tools are provided along with examples of how the tools are used to improve compliance.

By Bruce Barken, Matt Finucane

INTRODUCTION

Faculty, staff, post doctoral fellows and graduate students in research laboratories have to comply with an almost overwhelming amount of regulatory requirements. In the environmental health and safety (EHS&S) field alone, depending on the research being done, they need to be aware of requirements for:

- U.S. Environmental Protection Agency (EPA), biohazard waste (and possibly air permits, Toxic Release Inventory (TRI), publicly owned treatment works (POTW) sewer discharge, and other).

Bruce Barken, MS, MBA, PE is the Assistant Vice-Chancellor for Environmental Health and Safety, Washington University in St. Louis, and he is the President Emeritus of CHEM&A. (Tel: 314 932 4836; e-mail: barken@umsl.edu)

Matt Finucane, MS, CHE is the Executive Director, Assessment, Health and Radiation Safety, University of Pennsylvania, and he is the President of CHEM&A. (Tel: 215 898 6852; e-mail: matt@chem.upenn.edu)

- U.S. Occupational Safety and Health Administration (OSHA) laboratory and hazard communication standards, as well as small fire and building codes.
- U.S. Nuclear Regulatory Commission (NRC) radioactive materials.
- National Institutes of Health (NIH) recombinant DNA research.
- U.S. Drug Enforcement Agency (DEA) mandates.
- U.S. Department of Homeland Security (DHS) Chemicals of Interest (COI).
- Centers for Disease Control and Prevention (CDC) and U.S. Department of Agriculture (USDA) Select Agent.
- U.S. Federal Aviation Administration (FAA), U.S. Department of Transportation (DOT) and International Air Transport Association (IATA), airports and transport of dangerous goods, and
- A variety of other safety requirements.

On top of EHS&S requirements, they may need to meet a host of other compliance office requirements, such as:

- Food and Drug Administration (FDA), Good Manufacturing Practice (GMP).
- American Association for Accreditation and Accreditation of Animal Laboratory Care (AAALAC) Institutional Animal Care and Use Committee (IACUC).

- Health Insurance Portability and Accountability Act (HIPAA).
- Conflict of interest.
- Ethical conduct of research.
- Grant funding requirements.
- Medical billing requirements, and
- Other regulatory requirements.

To help researchers understand the many requirements, both Washington University in St. Louis (WUSTL) and the University of Pennsylvania (UPenn) separately created, in 2008, on-line compliance profile tools. The tools are designed to assist compliance and education requirements that identify compliance and education requirements that have been completed and need to be completed by faculty, staff and graduate students (Figure 1-1).

The tools allow easy query capability to allow individual researchers and department officials to check on the status of training, compliance, reports

1. Environmental Protection Agency (EPA)
2. Toxic Substance Control Act (TSCA)
3. Publicly Owned Treatment Works (POTW)
4. Occupational Safety and Health Administration (OSHA)
5. Local fire and building codes
6. Nuclear Regulatory Commission (NRC)
7. National Institutes of Health (NIH)
8. Drug Enforcement Agency (DEA)
9. Department of Homeland Security (DHS)
10. Centers for Disease Control and Prevention (CDC)
11. U.S. Department of Agriculture (USDA)
12. Federal Aviation Administration (FAA)
13. Department of Transportation (DOT)
14. International Air Transport Association (IATA)
15. Food and Drug Administration (FDA)
16. Association for the Assessment and Accreditation of Animal Laboratory Care (AAALAC)
17. Health Insurance Portability and Accountability Act (HIPAA)
18. Ethical conduct of research
19. Grant funding requirements



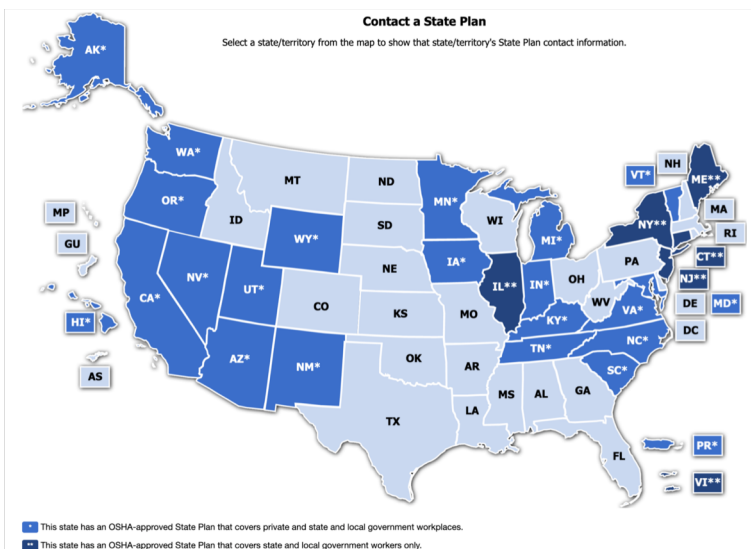
Jurisdiction by Aspect: OSHA Regulations Applicable to Labs

- **1910.1030 Bloodborne Pathogens**
- Needlestick Prevention Act (2000)
- **1910.132 – Personal Protective Equipment**
- **1910.133 – Eye and Face Protection**
- **1910.134 – Respiratory Protection**
- **1910.138 – Hand Protection**
- 1910.145 – Accident Prevention Signs & Tags
- **1910.1200 – Hazard Communication**
- **1910.1048 – Formaldehyde Standard**
- 1910.1096 – Ionizing Radiation Standard
- **1910.1450 – Occupational Exposure to Hazardous Chemicals in Laboratories (Laboratory Standard)**
- OSH Act –Section 5(a)(1) the General Duty Clause



<http://thefdp.org/default/assets/File/Presentations/OSHALabSafetyMay2018.pdf>

Jurisdiction by Geography: OSHA Coverage of Academic Institutions



OSHA COVERAGE OF ACADEMIC INSTITUTIONS		
Type	Federal OSHA	State OSHA
Private	✓	✓
Public		✓



<https://www.osha.gov/dcsp/osp>

Regulatory Style: Performance Versus Prescriptive

LABELS AND OTHER FORMS OF WARNING	
<p>Performance-Based</p> <p><i>Give an employer the latitude to determine the specific methods to use to mitigate hazard exposures.</i></p>	<p>Prescriptive Based on GHS</p> <p><i>Restrict the employer to use specific methods to use to mitigate hazard exposures.</i></p>
<p>1994</p> <ul style="list-style-type: none"> • Identity of the hazardous chemical(s); • Appropriate hazard warnings; and • Name and address of the chemical manufacturer, importer, or other responsible party. 	<p>2012</p> <ul style="list-style-type: none"> • Product identifier; • Signal word; • Hazard statement(s); • Pictogram(s); • Precautionary statement(s); and, • Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party.

The OSHA Hazard Communication Standard

CODE _____

Product Name _____ } **SAMPLE LABEL**

Company Name _____ } **Product Identifier**

Street Address _____ } **Supplier Identification**

City _____ State _____ } **Supplier Identification**

Postal Code _____ Country _____ } **Supplier Identification**

Emergency Phone Number _____ } **Supplier Identification**

Keep container tightly closed.
Store in cool, well ventilated place that is locked.
Keep away from heat/spark/open flame.
No smoking.
Only use non-sparking tools.
Use explosion-proof electrical equipment.
Take precautionary measure against static discharge.
Ground and bond container and receiving equipment.
Do not breathe vapors.
Wear Protective gloves.
Do not eat, drink or smoke when using this product.
Wash hands thoroughly after handling.
Dispose of in accordance with local, regional, national, international regulations as specified.
In Case of Fire: use dry chemical (BC) or Carbon dioxide (CO2) fire extinguisher to extinguish.
First Aid
If exposed call Poison Center.
If on skin (or hair): Take off immediately any contaminated clothing. Rinse skin with water.

Hazard Pictograms

Signal Word
Danger

Highly flammable liquid and vapor.
May cause liver and kidney damage. } **Hazard Statements**

Precautionary Statements

Supplemental Information
Directions for use _____

Fill weight: _____ Lot Number: _____
Gross weight: _____ Fill Date: _____
Expiration Date: _____



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<https://www.osha.gov/dsg/hazcom/side-by-side.html>

Regulatory Style: The OSHA Laboratory Standard

Performance Based

LABELS AND OTHER FORMS OF WARNING	
<p>Pre-Laboratory Standard</p> <ul style="list-style-type: none"> • OSHA regulated hazardous chemical exposure through substance-specific standards and exposure limits; • This worked well in industrial settings where workers were exposed to large quantities of chemicals in repetitive processes. 	<p>Post-Laboratory Standard (1990)</p> <p>OSHA acknowledged that a larger variety, but smaller amounts, of hazardous chemicals were used in laboratories. In response, OSHA created the performance-based Laboratory Standard.</p>



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<https://www.osha.gov/dsg/hazcom/side-by-side.html>

OSHA 29 CFR 1910.1450 Chemical Hygiene Plan

Chemical Hygiene Plan “a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of this section.”

Examples

1910.1450(e)(3)(ii)

Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of [PPE] and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;

1910.1450(e)(3)(v)

The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;

<https://www.osha.gov/Publications/laboratory/OSHAfactsheet-laboratory-safety-chemical-hygiene-plan.pdf>



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Audience Challenge Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



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Who do you consult when you have a need to work alone in your lab?

- My principal investigator
- My lab mate
- No one
- Environmental Health and Safety
- This question is not applicable to me

* If your answer differs greatly from the choices above tell us in the chat!

A Concrete Example: The Working Alone Question



WORKING ALONE IN THE LAB?

Watch on YouTube at: <https://youtu.be/Y8DBd45W4hY>

As the video mentions, **Prudent Practices** says: Don't conduct hazardous work alone. The Chemical Hygiene Plan should help decide what "hazardous" and "alone" mean.



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Lesson Learned 1: Every Chemical Regulation Has its Own Story

- Chemical Regulatory History is still being written and can be expected to change significantly at least **every 5 years** in some aspect or another
- OSHA Inspections generally occur **in response to incidents or complaints** (5 OSHA inspections in 25 years on one campus). EPA inspections are likely to occur more often.
- Legal regulations are not the only rules that impact lab research. Often "**voluntary**" **guidelines** are more carefully followed than regulatory requirements for liability reasons.



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Lesson Learned 2: Don't Expect Agencies to Talk to Each Other



- The regulatory enforcement **strategy is different** for every environmental media, and **agencies don't coordinate** their regulations
- Inspectors come in with **different expectations**, based on the type of regulatory program they represent (federal vs state vs. local; air vs. water vs. hazmat; bio vs. rad vs. chemical vs. physical hazards).
- Understanding a regulator's **priorities** and building a ongoing **relationship** with the regulators goes a long way. But they aren't your friends.



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Lesson Learned 3: The "Use Cost" of Chemicals is Way Higher Than the List Price

- Disposal, emergency response, chemical storage and regulatory costs **all need to be taken into account** when calculating the life cycle cost of a chemical
- Legal costs can take **years to determine** and are **far higher** than first guesses
- This means that there is a lot of **legal ambiguity** because there is a lot more **financial incentive** to settle than address complex legal questions

The Bucket List

Getting rid of lab waste? Here's how to dispose of it.

<p>Chemical Waste Pail</p> <ul style="list-style-type: none"> Designate and label for lab specific use Chlorine Bromine gas Contaminated solids including plastic and glass No sharps Provided by EPS (6-3473) 	<p>Radioactive Solid Waste Container</p> <ul style="list-style-type: none"> Contaminated plastics and solids Ensure tag provided is completed before pickup No liquid containers vials Provided by EPS (6-3473) 	<p>Radioactive Liquid Waste Container</p> <ul style="list-style-type: none"> Radioactive aqueous liquid waste No liquid contribution vial contents Green tag, half life <30 days Blue tag, half life >30 days & <90 days Yellow tag, half life >90 days Provided by EPS (6-3473) 	<p>Biohazard Waste Pail</p> <ul style="list-style-type: none"> Risk Group 2 biologically contaminated solids No liquid sharps, Risk Group 1 biologicals or animal anatomical waste Provided by EPS (6-3473) Some locations receive pairs that are reused 	<p>Biohazard Bag</p> <ul style="list-style-type: none"> Biologically contaminated solids only No sharps Purchased by lab 	<p>Sharps Container (DCA Approved)</p> <ul style="list-style-type: none"> Needles, syringes, lancets, blades, etc. Designate, separate and label as Biological, Chemical or Radioactive waste Purchased by lab
<p>Animal Anatomical Waste Pail</p> <ul style="list-style-type: none"> All animal anatomical waste All materials contaminated with horns requiring incineration Biologs, provided by DCM can be used to transport tissue to DCM Obituous waste No biologically or chemically contaminated bedding Provided by EPS (6-3473) 	<p>Recycling Bin</p> <ul style="list-style-type: none"> Uncontaminated paper Empty boxes Cardboard Provided by FAS (6-5711) 	<p>Regular Garbage</p> <ul style="list-style-type: none"> Uncontaminated refuse (paper towels, pipet wrappers, etc.) Decontaminated Risk Group 1 biological solids Provided by Carsteking (8-6252) 	<p>Amber Laboratory Glass Tote</p> <ul style="list-style-type: none"> Uncontaminated colored glass (triple rinsed) No hazardous materials, garbage or gloves No cover glass Provided by FAS (6-5711) 	<p>Teal Laboratory Glass Tote</p> <ul style="list-style-type: none"> Uncontaminated clear glass (triple rinsed) No hazardous materials, garbage or gloves No cover glass Provided by FAS (6-5711) 	<p>Orange Laboratory Plastic Tote</p> <ul style="list-style-type: none"> Uncontaminated laboratory plastics (triple rinsed) No hazardous materials, garbage or gloves Provided by FAS (6-5711)



Office of Environmental Health & Safety
www.ehs.utoronto.ca

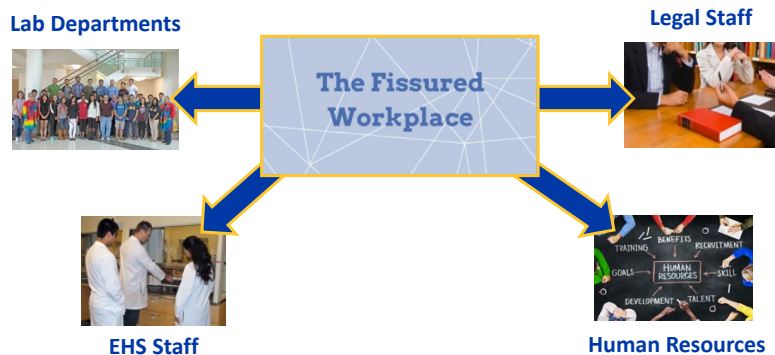
EPS: Environmental Protection Services, a subsidiary of Environmental Health & Safety
FAS: Facilities & Services



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Lesson Learned 4: Like Science, Compliance is a Team Sport

- While OSHA recognizes the reality of the “fissured workplace”, **regulators expect “the employer” to assure compliance**. In specific situations, you can expect regulators to “follow the money” to determine liability.
- In the face of the “fissured workplace”, many disciplines must **work together** to understand the best approach to “staying legal” in a rapidly changing environment.



“fissured workplace,” means that in more and more workplaces, the employment relationship has been broken into pieces, often shifted...to individuals who are treated as independent contractors. David Weil and Tanya Goldman

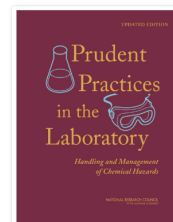


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Lesson Learned 5: Where to Find Out More



- **Chemists:** Prudent Practices and institutional resources
- **Decision-makers:** Consultants
- **Educators:** AACT, NSTA, local authorities, chemical suppliers and consultants
- **The Public:** Local public health authorities, including relevant OSHA offices, household hazard waste programs, fire departments



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<https://www.nap.edu/catalog/12654/prudent-practices-in-the-laboratory-handling-and-management-of-chemical>

Audience Challenge Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



How much do you feel government regulations impact your lab work?

- I don't notice any impact
- I rely on my host institution to address this concern
- I worry about it, but have not changed any plans due to it
- I have stopped work due to regulatory concerns
- This question is not applicable to me

** If your answer differs greatly from the choices above tell us in the chat!*


Back to the Opening Question: What Can a Grad Student Do?

Who should a grad student talk to if they're worried about safety in their lab?

- Their Principle Investigator
- The Department Chair
- Environmental Health and Safety Department
- OSHA
- A lawyer



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**c&en's
STEREO
CHEMISTRY**



Episode 20



Podcast: Lessons learned in lab safety

Four chemists share their stories of lab accidents with *Stereo Chemistry* to help the scientific community become safer

By Jillian Kennedy and Matt Doveyport
JULY 24, 2019 | APPEARED IN VOLUME 97, ISSUE 30



<https://cen.acs.org/safety/Podcast-Lessons-learned-lab-safety/97/i30>

Episode 21



Credit: Shutterstock/C&EN

Podcast: Building a culture of safety

Stereo Chemistry examines how organizations are making safety a priority to prevent and prepare for accidents rather than react to them

By Jillian Kennedy, Matt Doveyport
AUGUST 10, 2019



<https://cen.acs.org/safety/lab-safety/Podcast-Building-culture-safety/97/web/2019/08>

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Lab Safety for Researchers: Responsibilities, Regulations, and Lessons Learned



Mary Beth Mulcahy

Principal Member of the Technical Staff, Global Chemical and Biological Security (GCBS) group, Sandia National Laboratories



Kali Miller

Development Editor in the Publications Division, American Chemical Society



Ralph Stuart

Chemical Hygiene Officer, Keene State College and Chair, ACS Committee on Chemical Safety

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How has ACS Webinars benefited you?



"Hearing the perspective of the presenters was very helpful. I made a post-it note for myself to remind me to say "I care about you and because I care about you I am concerned that you are putting your eyesight at risk when you don't wear your goggles."



<http://bit.ly/SafetyCultureVideo>

Fan of the Week

Ann Klotz, Chemical Hygiene Officer and Chemical Technician, Siena College, ACS member for 21 years!



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Sammie Sigmann,
2019 Chair ACS
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