

Connecting safety culture to the educational mission

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ACS
Chemistry for Life®

My Lab Safety History

- I worked in environmental chemistry labs at **Cornell** and **UVM** for 5 years, then started the lab safety program at **UVM** in 1985
- In 2011, I went back to **Cornell** as Chemical Hygiene Officer for 3 years
- In 2014, I moved to **Keene State** to be the Environmental Safety Manager and Chemical Hygiene Officer

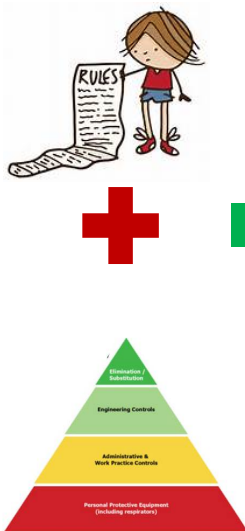


Modern Lab Safety

21st Century Lab Safety involves both Technical and Cultural Challenges

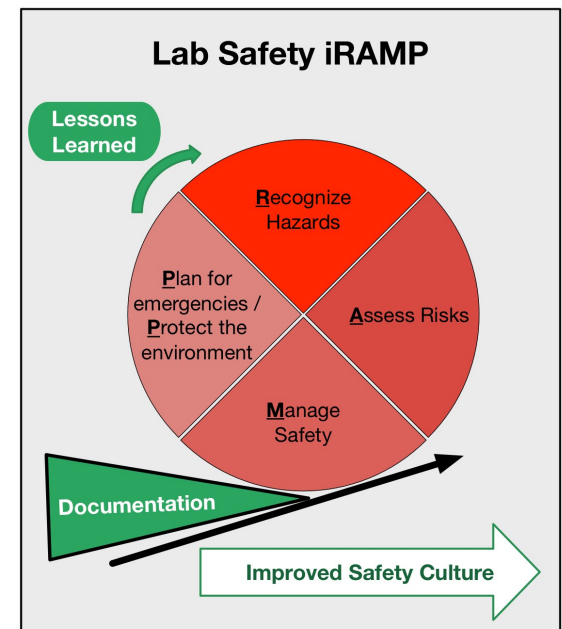
- More science
- New interdisciplinary sciences:
nano, r/sNA, big science
- Discovery education

20th Century:
Controls Based on Rules,
guided by Chemical Intuition

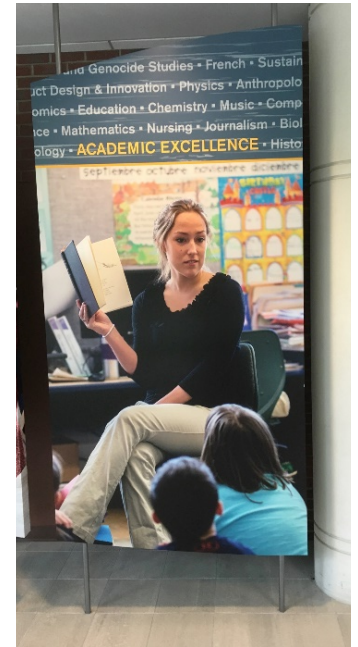
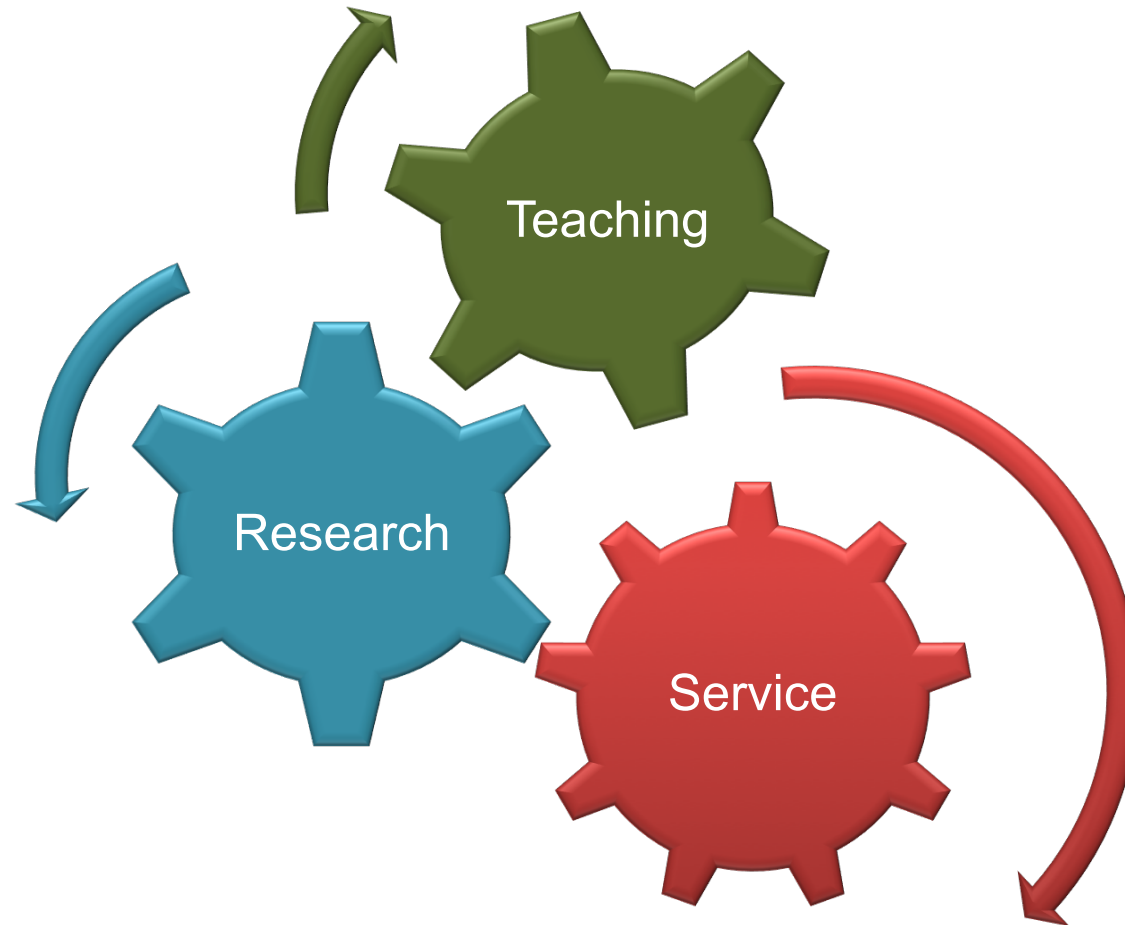


***Culture is rooted in
the organization's
mission***

21st Century:
**a Safety System based
On Risk Assessment**



The Academic Mission



***How does Lab Safety Connect to This Mission:
@ Keene State?
On other campuses?***

What are the Academic Values around Safety?

1. Safety is everyone's responsibility. It operates at an institutional level.

(community service)

2. Good science is safe science. *(research)*

3. Safety training and education are essential elements of research and education *(teaching)*

4. An improved culture of safety is necessary *(continuous improvement - not “compliance” or “zero incidents”)*

5. Diverse methods and flexible approaches are necessary *(institutionally-driven)*
MIT/Harvard example



Safety and the ACS Mission

- The ACS has over 150,000 members from academia, industry and government.
- Its structure is similar to academia:
 - **32 technical divisions** (*analogous to departments*),
 - **42 governance committees** (*analogous to a Faculty Senate*) and
 - **Staff** (*analogous to administration*) headquartered in Washington DC and Columbus, Ohio.
- It publishes 50+ academic journals, C&E News and Chemical Abstracts Services; it also has **advocacy** and **leadership** roles in the chemical enterprise.



Strategic Plan for
2017 and beyond



Recent Lab Incidents

	Univ. of Minnesota 2014	Univ. of Hawaii 2016	Texas Tech 2016	Univ. of Bristol 2017
Event	<i>Unexpected Compound Exploded</i>	<i>Handling of flammable gas</i>	<i>Explosion of energetic compound</i>	<i>Inadvertent synthesis of TATP</i>
Physical Result	Injury, Damage to lab, loss of science	Loss of arm, damage to lab	Superficial injuries	Hazmat response; disruption of work
Other Results	Medical costs	\$70,000 fine; civil lawsuit against PI and institution	Medical costs	Student reported problem immediately and response ensued
Cause	Change of Chemicals -> Inadequate Risk Assessment	Inadequate Risk Assessment -> Improper Equipment; Failure to heed warning signs	Change in Process (skipped a step) -> Inadequate Risk Assessment	Change in Process (change in order of chemical additions) -> Inadequate Risk Assessment

The Goals of Lab Safety Cultural Education

- **Establish a Vision:**
not zero incidents, but
continuous improvement (aka
zero unreported incidents)
- **Develop Safety Leadership
and Empowerment skills:**
bureaucratically known as roles
and responsibilities
- **Share Lessons Learned:**
both general tips and reminders
as well as specific unexpected
reactions

SAFE SCIENCE
Actions for Laboratory Researchers

SAFE SCIENCE
Actions for Environmental Health
and Safety Staff

SAFE SCIENCE
Actions for Principal Investigators
and Department Chairs

SAFE SCIENCE
Actions for Deans and
Vice Presidents for Research

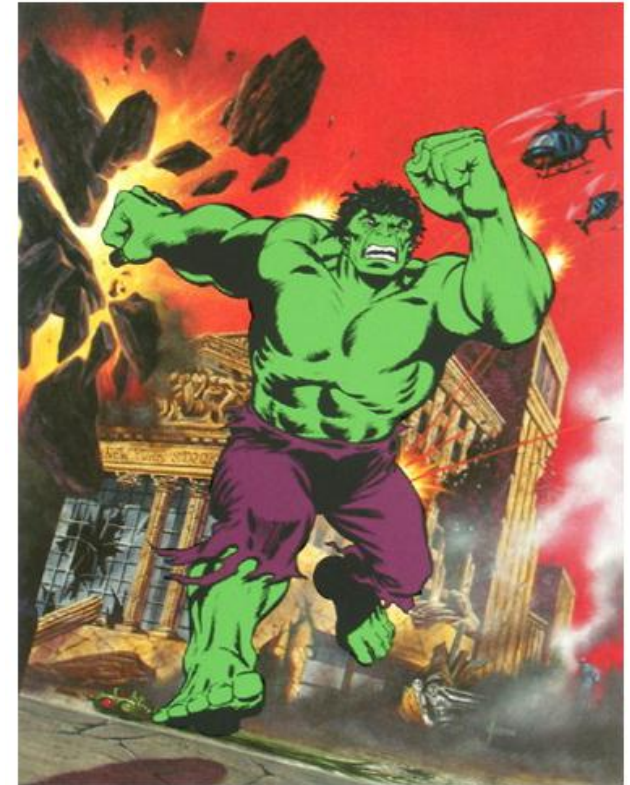
The Cultural Starting Point: The Cringe Factor

Chemical
fire, explosions, toxicity

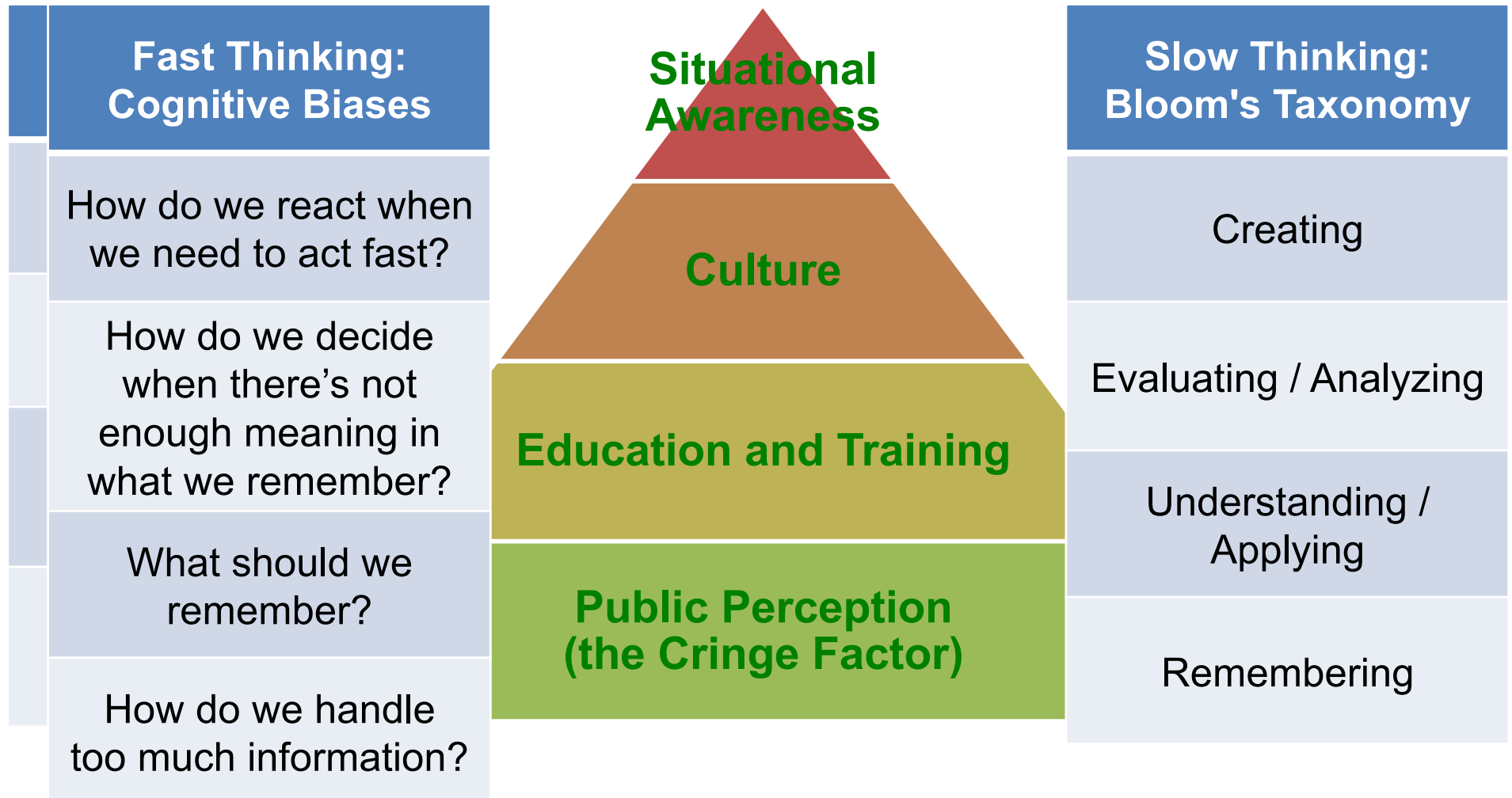


Biosafety; lasers,
3D printing

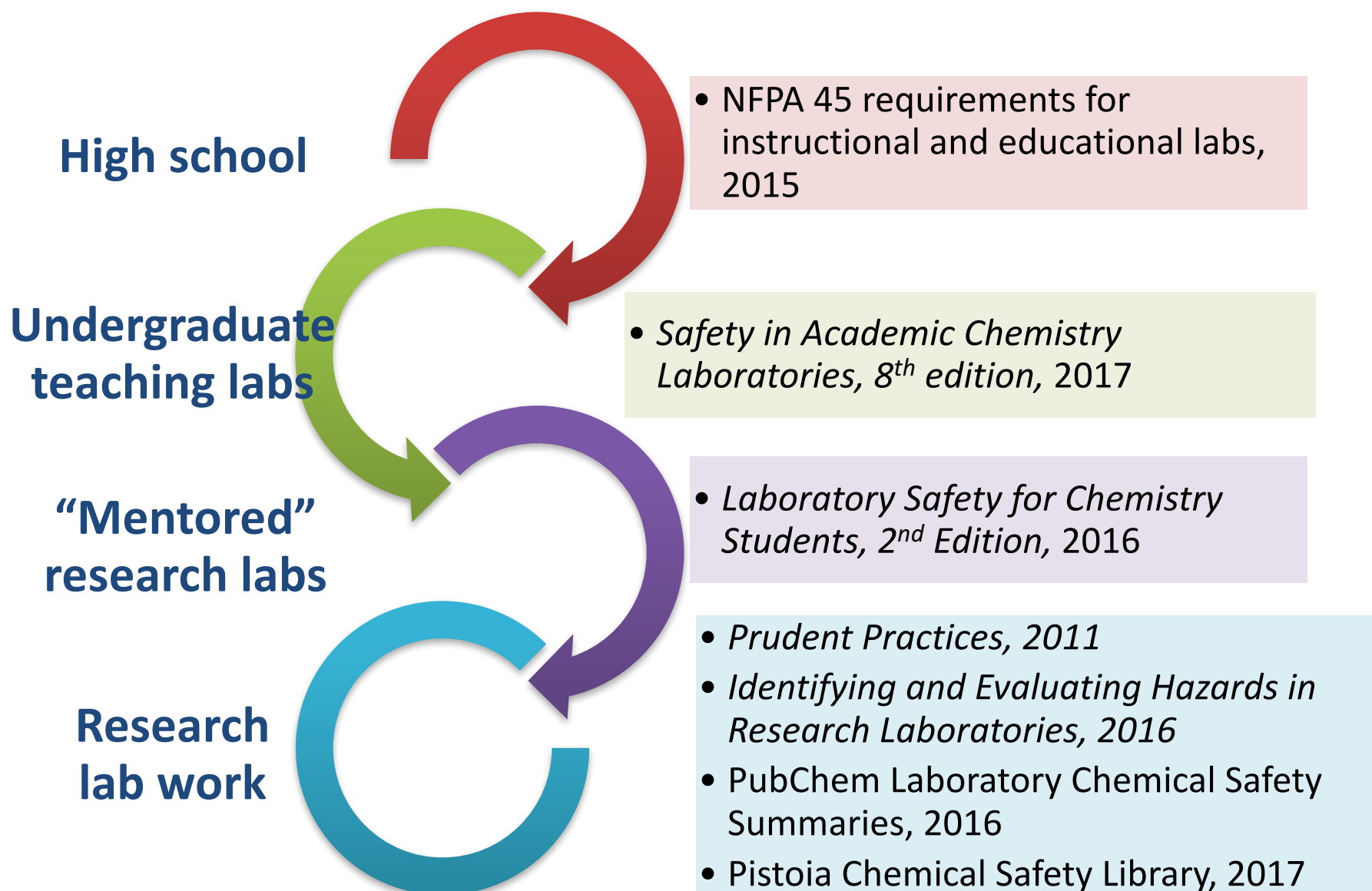
Radiation



The Safety Education Process

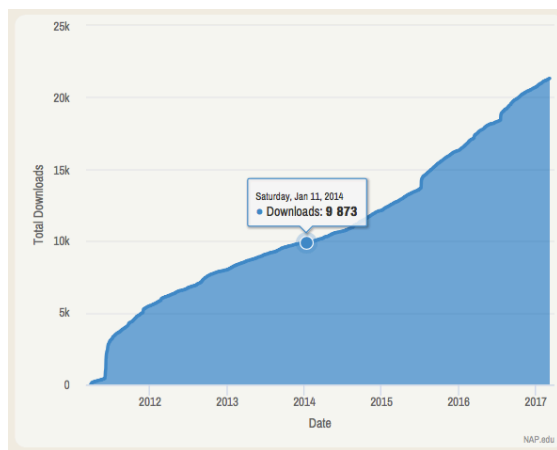
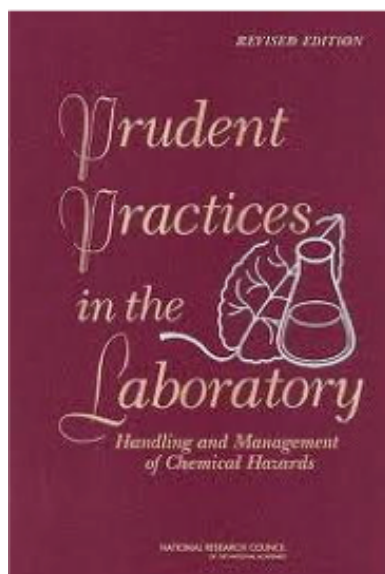


Technical Chemical Safety Resources



Risk Assessment Resources

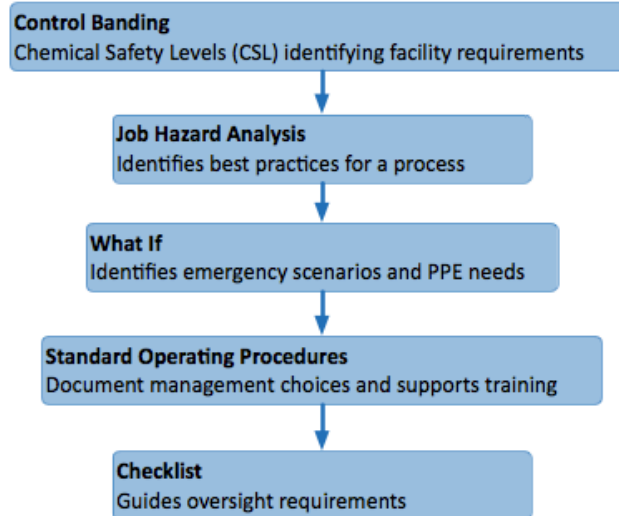
National Research Council, 2011



ACS, 2013 and 2016 (at the behest of the CSB)



* Laboratory Risk Assessment Methods Described by ACS 2013



Other Technical Tools

National Library of Medicine's Pubchem Laboratory Chemical Safety Summaries (2015)

- Modelled on LCSS format from *Prudent Practices*
- Safety information on about 103,000 chemicals
- Goes beyond SDS by including information on reactions between specific incompatible chemicals

Pistoia Alliance Chemical Safety Library (2017)

- Pre-competitive collaboration between pharma companies

Pubchem OPEN CHEMISTRY DATABASE

Search Compounds

LCSS Laboratory Chemical Safety Summary for CID 180

Download Share Help

Acetone

PubChem CID: 180

Chemical Names: Acetone; 2-propanone; Propanone; Dimethyl ketone; Methyl ketone; 67-64-1

Molecular Formula: C_3H_6O or CH_3COCH_3 or $(CH_3)_2CO$

Molecular Weight: 58.08 g/mol

PUBCHEM > COMPOUND > ACETONE > LCSS

Read about the LCSS project

Contents

- 1 GHS Classification
- 2 Identifiers
- 3 Physical Properties
- 4 Toxicity Data
- 5 Exposure Limits
- 6 Health and Symptoms
- 7 First Aid
- 8 Flammability and Explosivity
- 9 Stability and Reactivity
- 10 Storage and Handling
- 11 Cleanup and Disposal
- 12 Information Sources

1 GHS Classification

Signal: **Danger**

GHS Hazard Statements

H225: Highly flammable liquid and vapor [Danger Flammable liquids - Category 2]

H332: Causes eye irritation [Warning Serious eye damage/eye irritation - Category 2B]

H336: May cause drowsiness or dizziness [Warning Specific target organ toxicity, single exposure; Narcotic effects - Category 3]

H361: Suspected of damaging fertility or the unborn child [Warning Reproductive toxicity - Category 2]

H372: Causes damage to organs through prolonged or repeated exposure [Danger Specific target organ toxicity, repeated exposure - Category 1]

Precautionary Statement Codes

P201, P202, P210, P233, P240, P241, P242, P243, P260, P261, P264, P270, P271, P280, P281, P303+P361+P353, P304+P340, P305+P351+P338, P308+P313, P312, P314, P331+P313, P332+P313, P337+P313, P403+P233, P403+P235, P405, and P501

(The corresponding statement to each P-code can be found here.)

View GHS Classification from all (5) sources.

from NITE-CMAC

Pistoia Alliance

Lowering Barriers to R&D Innovation

Home About Projects News Events Blog Contact

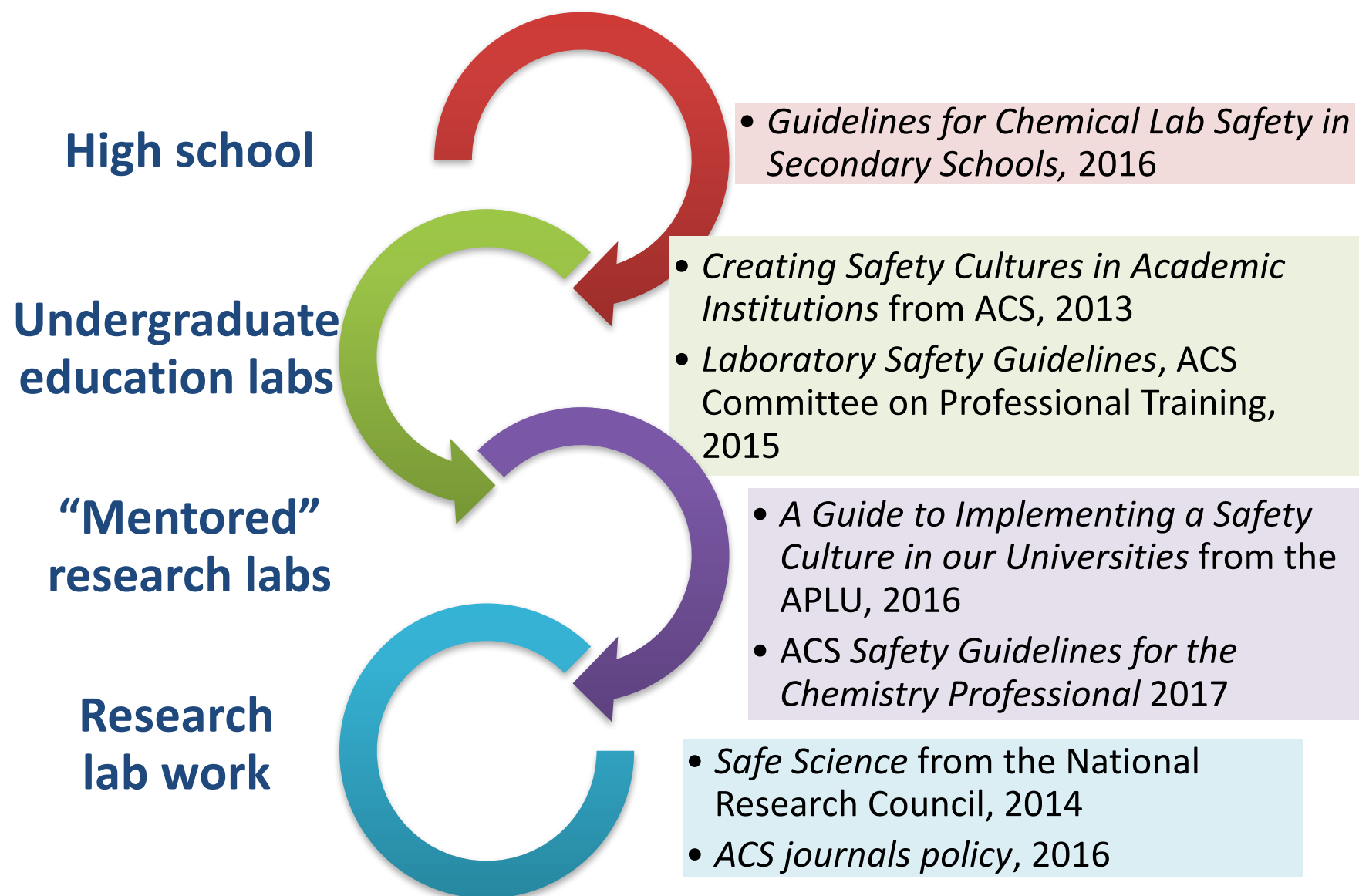
CHEMICAL SAFETY LIBRARY

Register

Download user training material

Access the CSL tool

Cultural Lab Safety Resources



A 2016 Cultural Initiative: ACS Publications Safety Policy



EDITORIAL

Ingredients for a Positive Safety Culture



[Home](#) > [Volume 94 Issue 48](#) > ACS journals enact new safety policy

Volume 94 Issue 48 | p. 7 | News of The Week

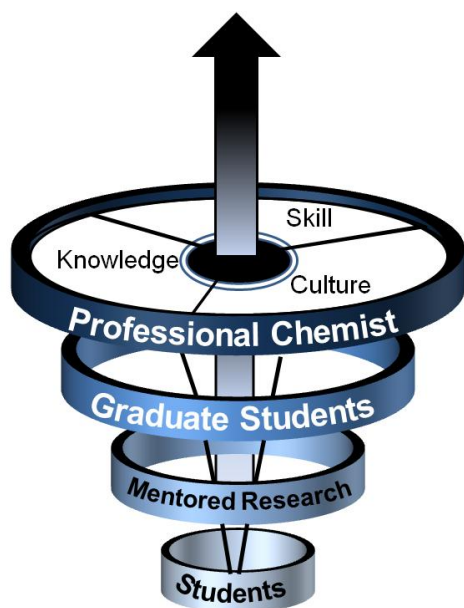
Issue Date: December 5, 2016 | Web Date: December 1, 2016

ACS journals enact new safety policy

Authors to be required to address novel or significant hazards

By Jyllian Kemsley

Spiral Learning Model for Lab Safety Competencies



Developmental stage	Knowledge	Skills	Cultural Aspects
Professional chemist	Identify and estimate significance of emerging risks	Make risk decisions and teach risk assessment	Accountable for group safety performance
Graduate researcher	Develop procedures with risks in mind	Use Risk Assessment tools to assess risks for review by professionals	Oversee others' safety practices
Mentored researcher (CURE, REU, etc.)	Review procedure and locate information to identify hazards	Learn to use Risk Assessment tools	Raise questions and concerns related to risk
Student	Based on prerequisite requirements	Identify applicable rules	Respect Rules

Future Work

- **Surveys of the Chemistry Community**
 - needs for technical support
 - best practices in risk assessment
 - safety culture perceptions and education needs
- **Maintaining Educational and Technical Support**
 - Further development of guidance documents and ACS safety web site
 - RAMP templates and content in outreach materials
 - Outreach with these tools
- **Matching cultural message to the appropriate media**
 - Safety tools and templates
 - Case studies
 - Videos and social media



Ongoing ACS Lab Safety Culture Resources

- **The Safety Zone:** <http://cenblog.org/the-safety-zone/>
A blog covering chemical safety **events and lessons learned**. The lead writer is C&EN associate editor Dr. Jyllian Kemsley.
- **Committee on Chemical Safety:** <http://www.acs.org/safety>
Peer reviewed documents from the CCS on a variety of both technical and educational topics
- **Division of Chemical Health and Safety:** <http://www.dchas.org>
Chemical safety research (broadly construed) from DCHAS technical symposia and articles from the *Journal of Chemical Health and Safety*



Questions?

Education and Training

Frazz by Jef Mallett

