

# *Review of Progress and Challenges in Promoting Enhanced Safety Instruction*

**Spring 2019  
National ACS Meeting**

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Orlando FL**

*David C. Finster  
Wittenberg University*

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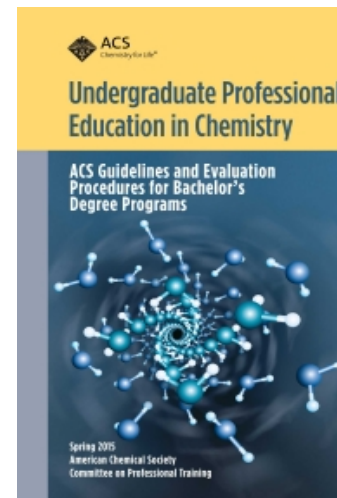
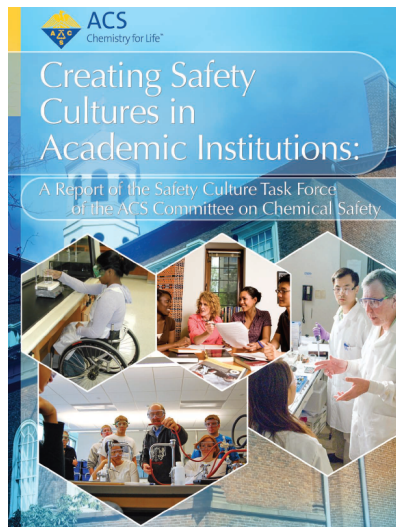
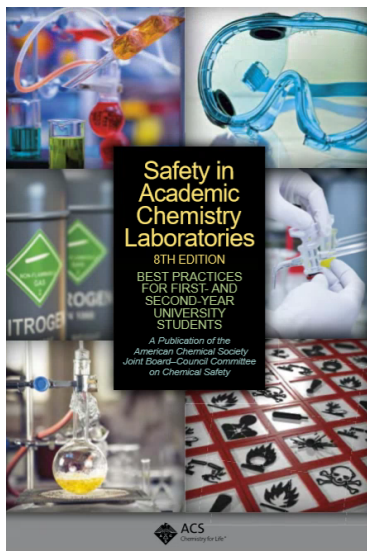
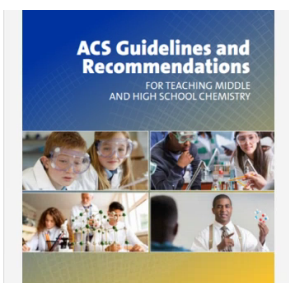
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# Review of Progress since 2008...

## CPT Guideline use of verbs (with regard to safety instruction)

2008: “must” = 0  
“should” = 4

2015: “must” = 4  
“needs to...” = 2  
“should” = 1 (for six bulleted items)



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### Laboratory Safety

Laboratory safety involves the development of skills and responsibility and must be an integral part of every chemistry curriculum. This means that safety awareness must be integrated into each laboratory course including research with increasingly broader scope at more advanced levels. The creation of a culture of laboratory safety requires a broad commitment from all levels of the educational institution. At the department level, faculty need to assume responsibility for continuing review of safety issues with students in teaching and research laboratories, especially the persons responsible for undergraduate instruction, often graduate students or instructors. Faculty must lead by example in a coordinated departmental safety effort. At the administrative level, this will involve implementation of a chemical hygiene plan that is in agreement with any campus chemical hygiene/safety efforts and must address the safe handling, storage, and disposal of chemicals. Eye wash and showers must be in operating condition, and fume hoods with proper sashes are essential. Anyone working or visiting in the lab must be wearing goggles, and consumption of food or drinks must not be permitted. A clean, uncluttered laboratory is more likely to encourage careful work.

Development of safety skills may be divided into four emphasis areas.<sup>1</sup>

- Recognize Hazards
- Assess Risks
- Minimize Risks
- Prepare for Emergencies

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### Safety Guidelines for Chemical Demonstrations

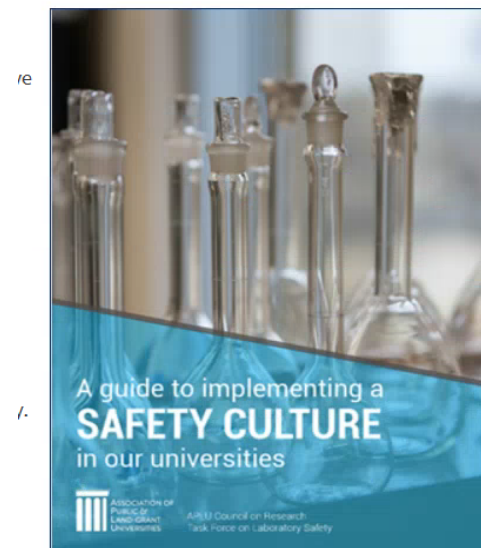
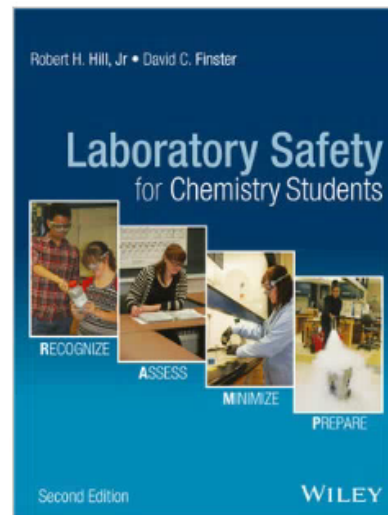
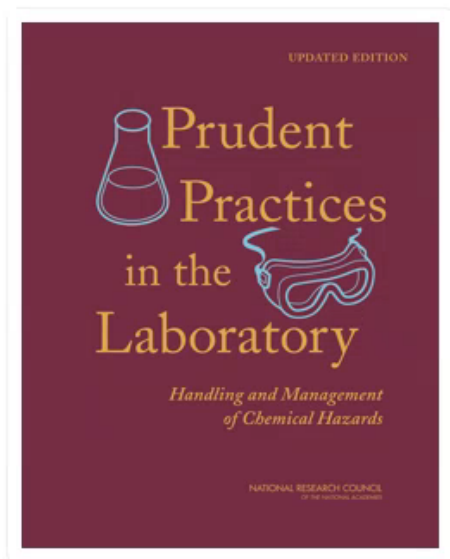
Appropriate physical and chemical demonstrations in the classroom or in a public venue have both educational and motivational value and are a long-standing pedagogy in chemical education. Individuals planning chemical demonstrations have a responsibility to follow and document safe laboratory practices for each demonstration. These guidelines have been created based on current best practices and provide a checklist of key issues for demonstrators to assure that chemical demonstrations are conducted safely and without incident. Because no such set of guidelines can address all possible issues, only persons who have appropriate education and experience in chemistry and chemical safety should perform chemical demonstrations. Accordingly, these guidelines are intended for use only by experienced chemical practitioners.

**Before the Demonstration**

1. Always follow a tested, written procedure that includes comprehensive safety precautions. Plan the demonstration at the smallest scale possible for the location and viewers.
10. Keep a spill kit nearby to contain, absorb, and neutralize any spilled chemicals.
11. Plan for appropriate handling or disposal of reaction byproducts or excess chemicals in accordance with institutional policies.

**During the Demonstration**

12. Wear appropriate personal protective equipment (PPE) for the level of risk as determined by the assessment, such as chemical splash goggles, chemical-resistant gloves, and a lab coat, to protect against the hazards. Active participants must also wear appropriate PPE.
13. Provide safety shield protection whenever there is the slightest possibility that a container, its fragments or the contents could be propelled with sufficient force to cause exposure and/or personal injury.
14. Warn members of the audience to cover their ears if a loud noise is anticipated.
15. Participants and spectators must not taste any food or non-food substances used in the demonstration.



## Chapter (Book)

[Previous CI](#)

## Teaching Chemical Safety and Information Skills Using Risk Assessment

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Chapter 3, pp 57–92

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Peer-Reviewed Book Chapter

## Article

[Previous](#)

## The Safety “Use Case”: Co-Developing Chemical Information Management and Laboratory Safety Skills

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## Article

[Previous](#)

## Introduction to Laboratory Safety for Graduate Students: An Active-Learning Endeavor

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## Commentary

## Undergraduates Need a Safety Education!

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Feature

Chemical safety education for the 21st century —  
Fostering safety information competency in  
chemists

Samuella Sigmann

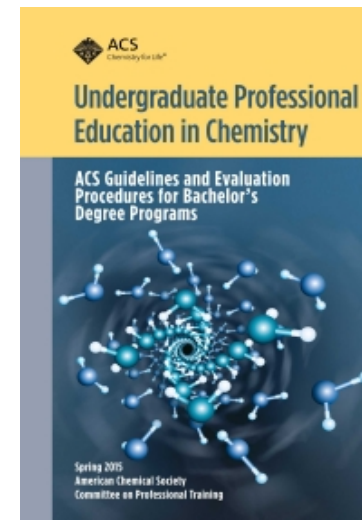
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# What remains to be done...

The 2015 ACS CPT Guidelines for Bachelor's Degree programs states:

“Classroom and laboratory discussions need to stress safe practices and should actively engage students in the **evaluation and assessment of safety risks associated with laboratory experiences**. Safety understanding and skills must be developed and assessed throughout the curriculum.”

“...**recognize chemical and physical hazards** in laboratories, **assess the risks** from these hazards, know how to **minimize the risks**, and **prepare** for emergencies.”



- Survey the chemical education landscape to determine what is being taught and how it is being taught
- Develop models of pedagogy for teaching safety
- Develop good assessments for safety learning goals
- Convince grad schools and the chemical industry to hold undergraduate programs accountable for safety learning goals
- Foster changes in faculty attitudes about safety
  - *The problem of the constant-volume and crowded curriculum*
  - *It's easier to say "no" to something when you are saying "yes" something else*

From: “Safe Science: Promoting a Culture of Safety  
in Academic Chemical Research”

A general culture change model:

- 1) Unfreezing and creating motivation for change
- 2) Learning new concepts and new meanings for old concepts
- 3) Refreezing or internalizing new concepts, meanings, and standards

CH&S culture changes:

- 1) Create compelling arguments for change
  - (CPT is doing what they can...)
  - (Graduate programs should assess safety qualifications of applicants)
  - (Industry should hire only applicants with proper safety background)
- 2) Promote the recommendations and language about safety culture
- 3) Hold faculty accountable for safety instruction and assessment
  - (department chairs, deans, provosts, presidents)



[A Guide to Implementing Safety Culture](#), APLU, 2016

president/chancellor.

**Appointed Institutional Lead and Leadership Team Responsible for Strengthening a Culture of Safety**

**Deans and Department Heads/Chairs**

**Environmental Health & Safety Personnel**

### **Faculty**

1. Facilitate open dialogue about safety in labs, studios, and field sites.
2. Conduct a hazard analysis prior to conducting any experimental procedure.
3. Ensure everyone in the lab/studio/field site receives proper safety training.
4. Lead by example, by modeling good safety behavior.
5. Incorporate considerations of safety into scholarly work, presentations, and lab meetings.
6. Discuss lessons learned from accidents, incidents, and near misses with their research group.
7. Assume ultimate responsibility for safety in their laboratory, studio, or field site.

### **Undergraduate and graduate students, postdoctoral scholars, and research personnel**

1. Be mindful of the potential risks to their safety and those of their neighbors in the lab, field, shop, studio, stage, and in the classroom.
2. Stop any experiment or activity that is potentially unsafe and notify the faculty supervisor.
3. Immediately report all accidents and incidents to the faculty supervisor.
4. Follow all verbal and written laboratory safety rules, including the appropriate use of personal protective equipment (PPE), regulations, and standard operating procedures required for the tasks assigned.
5. Conduct a hazard analysis prior to conducting any experimental procedure.
6. Include a hazard analysis in thesis, dissertation, and funding proposals.
7. Incorporate considerations of safety into presentations and lab meetings.
8. Discuss lessons learned from accidents, incidents, and near misses with faculty supervisor and fellow researchers.



## Appendix B: Suggested Duties of Institutional Personnel

### President or Chancellor (7 bullets)

### Provost, Vice President, or Vice Chancellor (7 bullets)

### Deans and other Administrators (7 bullets)

### Department Chairs (13 bullets)

### Faculty

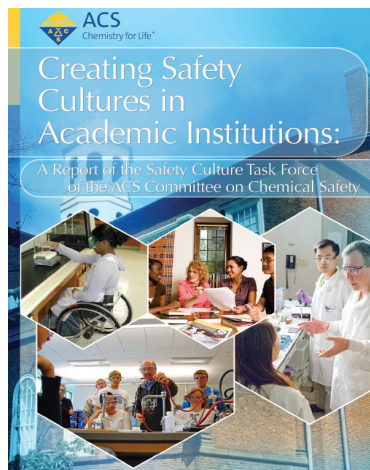
- Implements the curricular goals for safety education;
- Ensures principle-based safety education and safety training is provided to students and staff within their laboratories;
- Ensures safety is discussed at the beginning of each research group meeting;
- Ensures new graduate students have received a principle-based safety course and specific safety training relating to their areas of research;
- Participates in the development of the Chemical Hygiene Plan (CHP);
- Works with the CHO in documenting the safety training of laboratory members;
- Documents all safety training that individual employees and students receive;
- Serves as a safety advisor and mentor for staff and students who work and study under their supervision;
- Enforces all health and safety practices, protocols, and rules within his or her laboratory space;
- Ensures the appropriate personal protective equipment is available and used by all personnel in the laboratory;
- Reviews new laboratory procedures for potential risks;
- Ensures all visitors (including vendors and contractors) follow the safety rules;
- Ensures all laboratory incidents are reported to the chair; and
- Reports promptly any facility problem or improperly functioning equipment to the appropriate office or individual.

### Staff (8 bullets)

### Chemical Hygiene Officer, Departmental Safety Officer (9 bullets)

### Safety Council (campus-wide) (6 bullets)

### Safety Committees (7 bullets)





## Department Review Matrix of Safety Culture Task Force Recommendation List

9/3/12

D = department task; C = CHO task; U = University task

Recommendation	Comment	..... Action/Status .....					
		D	C	U	Address	Improve	OK
1. Establish the <b>lines of authority</b> for safety; develop a <b>safety policy</b> that includes laboratory safety, and includes <b>safety responsibilities</b> in the job descriptions and performance plans of all employees.							
2. <b>Encourage every leader</b> to become a proponent of safety and safety education, and to demonstrate this care for safety in their actions with other staff members and students.							
3. Establish a strong, effective <b>safety management system</b> and safety program for the institution, including laboratory safety.							
4. Ensure <b>graduating chemistry undergraduate students have strong skills</b> in laboratory safety and strong safety ethics by teaching safety lessons in each laboratory session, and by evaluating and testing these skills throughout the educational process (Table 1).							
5. Ensure all faculty, staff, and graduate and undergraduate students involved in teaching, managing, or overseeing students in laboratory courses and sessions have successfully <b>completed a course in lab safety</b> .							
6. <b>Implement hazards analysis</b> procedures in all new lab work, especially laboratory research.							
7. <b>Build awareness</b> and caring for safety by emphasizing safety throughout the chemistry curricula.							
8. Include safety education and training (for undergraduate students, graduate students, and postdoctoral scholars participating in proposed research) <b>in research grant proposals</b> , and oversight of research for safety.							
9. <b>Adopt a personal credo</b> : the "Safety Ethic"—value safety, work safely, prevent at-risk behavior, promote safety, and accept responsibility for safety.							
10. Establish and maintain an <b>Incident Reporting System, an Incident Investigation System, and an Incident Database</b> that should include not only employees, but also—graduate students, postdoctoral scholars, and other nonemployees.							

Faculty need to value safety more and insert this into the curriculum.

*What do we need to do foster this culture change?  
(We know what they need to do...)*