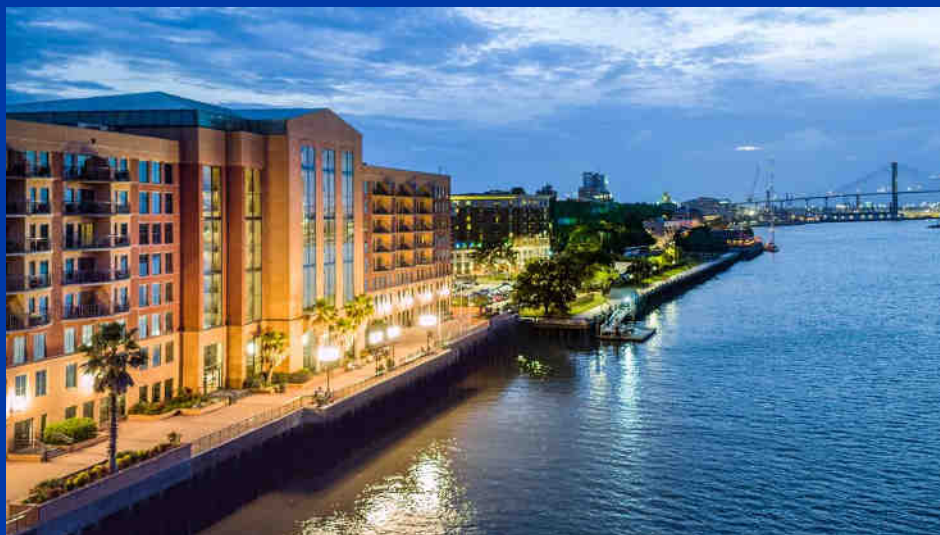


From Rules to RAMP: Embracing Safety Culture's Expanding Frontier as a Recent Graduate



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SERMACS

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Self Introduction



- University of Virginia '19
 - B.S. in Chemistry with ACS certification



- American Chemical Society (ACS) Intern
 - Scientific Advancement Division



My Perceptions of Lab Safety: THEN

General Chemistry and Organic Chemistry

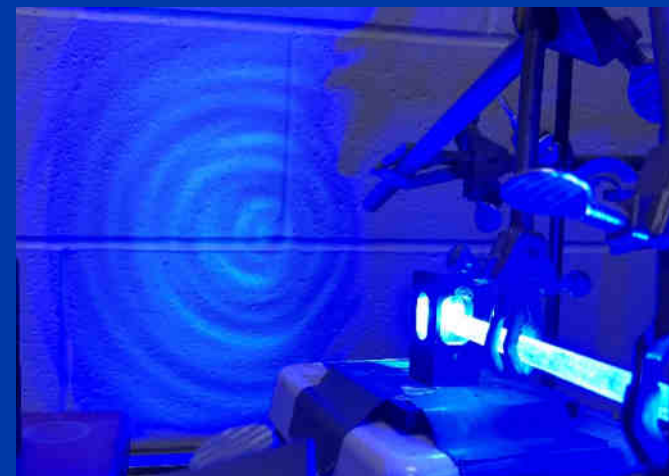
- Safety synonymous with **protection** - for everyone in the lab
 - My responsibility to respect and adhere to protocol
 - Felt safer knowing that peers were doing the same
- Safety dictated by rules designed in a **top-down** fashion
 - Procedures and SDSs provided for chemicals pertinent to experiment
 - Rules to be followed by student, enforced by TA
- Safety nearly **guaranteed** once hazards are identified
 - Know which PPE and engineering controls apply
 - Consideration of risk was coincidental rather than deliberate



My Perceptions of Lab Safety: THEN

Undergraduate Research

- Relationship to safety became more **interactive** due to experimental design
 - Mentor ≠ enforcer
 - Safety as a variable I had the power to influence
- Safety dependent on more than mere identification of hazards
 - Necessary to gauge the **probability of harm from a hazard** → Risk assessment puzzle starting to take shape







Hazard - Potential to cause harm

Risk - The combination of the likelihood of an event, its severity, and the frequency of exposure

A Call to Action: Recent Incidents in Academic Chemistry

- In 2008, a research assistant at the University of California, Los Angeles (UCLA) died from injuries sustained while working with *t*-butyl lithium.
- In 2010, a Texas Tech University (TTU) chemistry graduate student was severely injured after an energetic compound detonated.
- An ongoing series of fires during classroom demonstrations have burned students and led to multi-million dollar judgements against teachers and school districts.



15-year-old student burned in high school chemistry experiment

By Robert Etkin

Updated Aug 6, 2019 - 8:30 PM



Safety as a Core Value

Professionalism, Safety, and Ethics

"We support and promote the safe, ethical, responsible, and sustainable practice of chemistry coupled with professional behavior and technical competence. We recognize a responsibility to safeguard the health of the planet through chemical stewardship."

Office of Safety Programs Mission

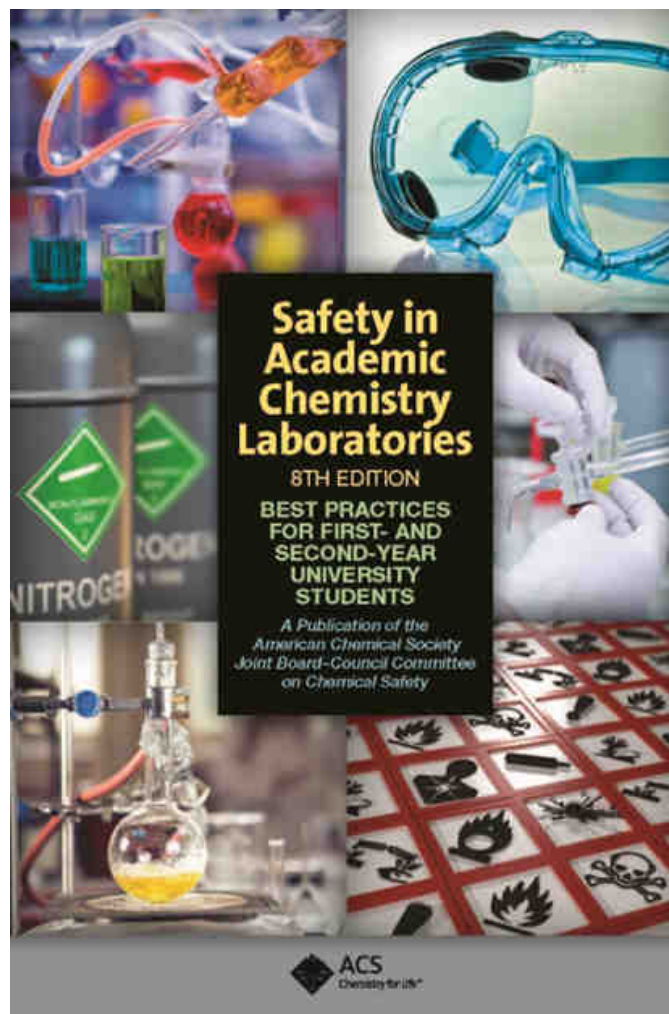
"To build communities and create products and solutions that engage, empower, and equip chemistry educators and practitioners with the skills and attitudes needed to practice chemistry safely."

My Contributions



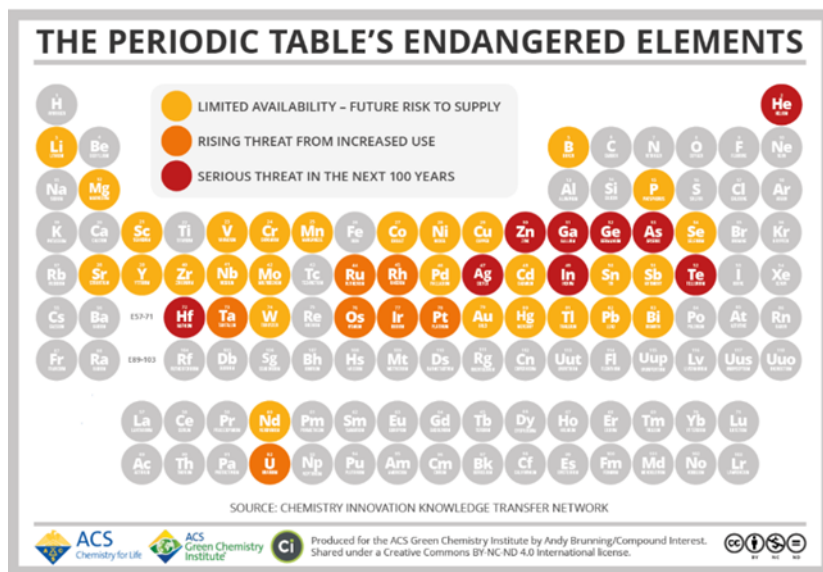
- Endangered elements ◦
- ACS safety website
- SAP keyword library
- *inChemistry* infographics
- Online laboratory safety course *
- Lab safety video series *

"Say hello to my little friend..."

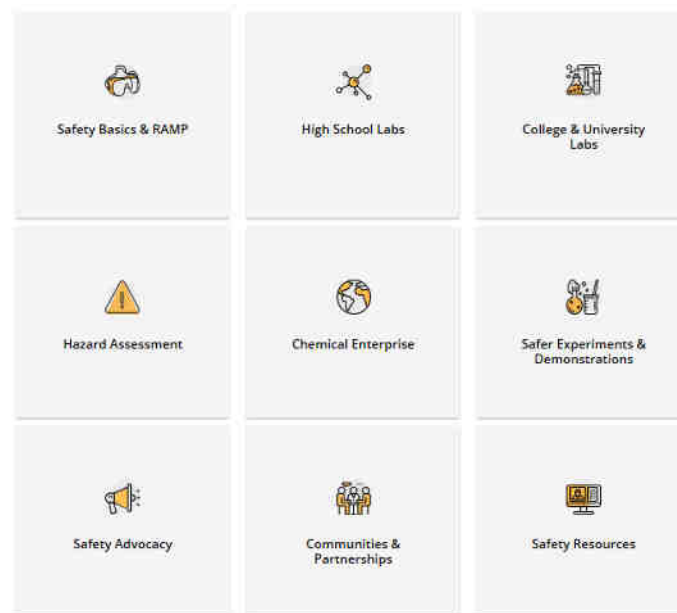


A Heterogeneous Mixture (of Projects)

- Endangered elements
 - Green Chemistry Institute



- ACS safety website



www.acs.org/safety

- Keyword library
 - Safety Advisory Panel

Topics: Hazards: chemical, biological, health 35 choices

- | | | |
|--|--------------------------|--|
| 1. Acids | 13. Endocrine disruptors | 26. Neurotoxins |
| 2. Acute toxicity | 14. Environmental hazard | 27. Non-ionizing radiation |
| 3. Allergens | 15. Explosive | 28. Oxidizing |
| 4. <u>Asphyxiants</u> | 16. Flammable | 29. Peroxide formers |
| 5. Bases / alkaline | 17. GHS categories | 30. Pyrophoric |
| 6. Biological safety / biosafety | 18. Harmful | 31. Radiation safety |
| 7. Carcinogen | 19. Hazardous catalysts | 32. Reactive |
| 8. Consumer chemicals / household products | 20. Health hazard | 33. Reproductive hazards / teratogenic |
| 9. Controlled substances | 21. Hydrogenations | 34. Research animals |
| 10. Corrosive | 22. Ionizing radiation | 35. Water-sensitive |
| 11. Dosimetry | 23. Irritants | |
| 12. Drugs / pharmaceuticals | 24. Laser safety | |
| | 25. Nanomaterials | |

inChemistry Infographics

- Risk assessment as it applies to:

- RAMP
- Mindfulness
- PPE
- GHS
- Emergency Equipment
- Heating Equipment
- Chemical Storage
- Waste Disposal
- Sharps Safety
- Fume Hoods
- Flammability and Flash Point
- Compressed Gases
- Pyrophoric Materials
- Water-Reactive Materials



ACS
Chemistry for Life

Lab Life: Emergency Equipment

This infographic provides essential information on emergency equipment, including how to use it and what to do in an emergency. It covers topics such as RAMP, preparing for emergencies, chemical spill kits, lab equipment safety, fire extinguishers, and safety showers. It also includes a section on 'What to do if you get hit by a chemical spill' and 'What to do if you get hit by a fire'.



Lab Life: Waste Disposal

How you dispose of chemicals has an impact that extends beyond the laboratory. Be smart about your chemical waste practices with these tips, and get guidance from instructors and research advisors before disposing of chemicals and lab equipment.

What chemicals are waste?

- Reacts vigorously with air or water
- Corrosive or irritant
- Toxic or highly flammable
- Oxidizing or reducing
- Volatile or otherwise hazardous

Consequences of improper disposal

- Health implications when in contact with skin or eyes
- Injury
- Damage to facilities and equipment
- Environmental soil and drinking water
- Higher disposal costs

Storage tips

- Use proper container, amount, labeling, and date
- Label what wastes can be mixed together
- Label waste storage containers clearly and accurately

Common Hazardous Waste

- Organic solvents: Chloroform, Acetone, etc.
- Heavy metals: As, Hg, Cd, Pb, Cr, Ni, Cu, Zn, Ag
- Corrosive liquids: Sulfuric acid, Nitric acid, Hydrochloric acid

COMMON HAZARD LABELS

Corrosive, Toxic, Flammable, Irritant, Oxidizing, etc.

Disposal Routes

- Organic solvent (non-halogenated)
- Organics for certain halogenated and metals
- Laboratory waste for approved waste
- Regulate heat for waste (water, glass, etc.)

Keeping it Green

Using green chemistry principles from start to finish reduces the amount of hazardous waste to manage.

- Atom economy (use reagents that are recycled, high yield, and/or other factors)
- Less hazardous chemical synthesis (use less toxic reagents, avoid hazardous solvents, use safer materials)
- Safer solvents and auxiliaries (use water, ethanol, etc. instead of benzene, toluene, etc.)

Online Laboratory Safety Course



- Intended audience:
Undergraduate students who have completed 2 semesters of general chemistry with lab and 1 semester of organic chemistry with lab
- Intended outcome:
Nurture risk-based safety cultures and improve chemical safety awareness



Safety Video Project: Background



- 6 safety videos at high school level
 - Safety Mindset
 - Safety Data Sheet (SDS)
 - How to Dress for the Lab and PPE
 - Preparing for Emergencies
 - RAMP (for Students)
 - RAMP (for Teachers)
- 2 short animated videos for research audience
 - *Working Alone in the Lab?*
 - *Conducting Lab Risk Assessments*



Laboratory Safety Video Series

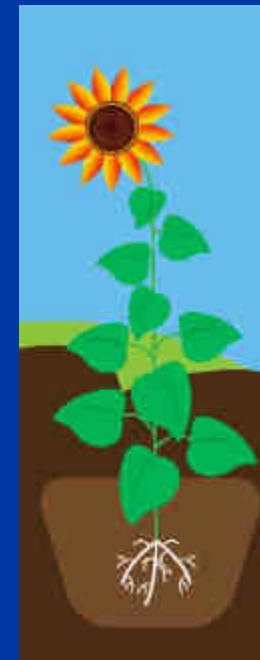
- Status: Planning stages
- Intended audience:
 - Undergraduate students who are enrolled in general chemistry lab
- Intended outcome:
 - Nurture risk-based safety cultures and improve chemical safety awareness



My Perceptions of Lab Safety: NOW

ACS Internship

- Safety is an **inviting** effort
 - Dependent upon shared values, not just actions
 - How safety is prioritized impacts quality of a safety culture
- Safety calls for **critical thinking**
 - Prepares individuals to adapt to unfamiliar situations in the lab
- Safety cultures **normalize risk assessments**
 - Rules are justified through an ongoing analysis of relevant risks



Contact us with
questions or comments:

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