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Why Strong Safety Cultures Use Hazard Analysis
Graduate students conducting research – same institution, department

1st Student Reaction – exploded; acid splash in eyes, severely cut arm

2nd Student, 5 mos. later: Weighs shock-sensitive cmpd – exploded, injured by flying glass, no PPE

3rd Student, 3 mos. later: Reaction – exploded, PPE, serious injuries, hospitalized, fire fighter injured

4th Student, 2 mos. later: Reaction – unexpected reaction results in chemical exposure
CCS Task Force 2012

- *Creating Safety Cultures in Academic Institutions*

- Defines safety culture
- Identifies critical elements
- Recommendations
Strong Safety Cultures

- U.S. Nuclear Regulatory Commission (NRC)
  - A reflection of the values, which are shared throughout all levels of an organization, and which are based upon the belief that safety is important, and it is everyone’s responsibility.
  - An organization’s collective commitment, by leaders and individuals, to emphasize safety as an overriding priority to competing goals and other considerations to ensure protection of people and the environment.
Elements of Strong Safety Cultures

- Leadership in Safety
- Positive Attitude for Safety
- Education in Safety
- Learning from Incidents
- Institutional Support
- Collaborative Interactions
- Promoting Safety

Strong Safety Culture
Selected Recommendations from Safety Culture Report

- Encourage every leader to become proponent of safety and safety education, to demonstrate this care for safety in their actions with other staff members and students.
- Build awareness and caring for safety by emphasizing safety throughout the chemistry curriculum.
- Ensure graduating chemistry undergraduates have strong skills in laboratory safety and strong safety ethics by teaching safety lessons in each laboratory session, and by evaluating and testing skills throughout the educational process.
- Implement hazards analysis procedures in all new lab work, especially laboratory research.
“Leadership is influence.”
John C. Maxwell

“Leadership is the art of getting someone else to do something you want done because they want to do.”
Dwight D. Eisenhower

“Leadership is practiced no so much in words as in attitude and actions.”
Harold S. Geneen
What Leaders Do

- Leaders – Keys to building strong safety cultures
  - Lead by example
  - Inspire others to value safety
  - Build trust with open communications
  - Determine direction/emphasis
  - Show active commitment to safety
  - Set safety policies addressing responsibilities, accountability

“Example is the not the main thing in influencing others. It is the only thing.”

Albert Schweitzer
What Academic Leaders Do

- **Faculty, Lab supervisors, Staff**
  - Responsible for teaching safety
  - Set examples for students
- **Ensure students**
  - Develop strong safety knowledge, skills
  - Learn how to apply the safety process and principles of safety throughout curriculum
  - Learn safety continually during educational process to build strong positive attitude, awareness
  - Use lab safety skills to work independently
  - Test safety knowledge frequently

“Don’t worry that [students] never listen to you; Worry that they are always watching you!”
Robert Fulghum
Leaders profoundly affect safety attitudes

Positive attitude for safety requires:

- Leaders who emphasize safety
- Believing safety is important, integral to all work, worthy of time
- Repeated, continuous safety education over the long term
- Being held accountable for safety

Ambivalent, negative attitudes put all at risk

Nothing can stop the man with the right attitude from achieving his goal; nothing on earth can help the man with the wrong mental attitude.

Thomas Jefferson
Students need in-depth safety knowledge, skills

Teaching approaches

- Teach safety topics in each lab session throughout 4 yrs – Best! (suggested topics)
- Stand alone lab safety course(s)
  - Integrates safety topics into lab sessions during 1st, 2nd yrs
  - Basic safety course in 3rd yr
  - Advanced safety course in 4th yr
“The Safety Process” repeatedly applies the Four Principles of Safety

- Recognize hazards
- Assess the risks of hazards
- Minimize the risks of hazards
- Prepare for emergencies
- Remember the acronym – RAMP

Recognizing Hazards: 1st, 2nd year undergraduate topics

- Safety language (terms, signs, symbols, labels),
- Hazard information resources (SDSs, other sources)
- Hazard recognition systems – GHS, NFPA
- Introductory toxicology
- Acute toxicity
- Chronic toxicity
- Corrosives
- Flammables
- Fires
- Explosions
- Incompatibles
Assessing the Risks of Hazards: 1st, 2nd year undergraduate topics

- Routes of exposure
- Basic risk assessment
- Evaluating risks of toxic hazards
- Hazard rating systems – GHS & NFPA
- Occupational exposure limits
- Learning lessons from incidents
Minimizing the Risks of Hazards: 1\textsuperscript{st}, 2\textsuperscript{nd} year undergraduate topics

- Managing risks
- Eye protection
- Skin protection
- Laboratory hoods and ventilation
- Safety standards for safety equipment
- Handling chemical wastes
- Storing flammables and corrosives
Preparing for emergencies: 1st, 2nd year undergraduate topics

- Responding to emergencies
- Evacuation actions
- Fire emergencies
- Classes of fires
- Fire triangle/fire tetrahedron
- Types of fire extinguishers
- Actions for chemical spills
- Emergency eye washes and safety showers
- Elementary first-aid
- Emergencies with gases
Recognizing Hazards: 3rd, 4th year undergraduate topics

- How the body handles toxic chemicals
  - Carcinogens
  - Sensitizers
  - Irritants
  - Reproductive toxicants
  - Peroxides
  - Reactive/unstable chemicals
  - Compressed gases
  - Pressurized systems

- Cryogenics
- Catalysts
- Runaway reactions
- Nanomaterials
- Biological hazards
- Electrical hazards
- Ionizing and non-ionizing radiation
- Laboratory shop hazards
- Chemical hygiene plans
- Housekeeping
Recognizing Peroxide Hazards

- Why peroxides can be dangerous
- Structure of peroxides, hydroperoxides, superoxides
- Structure activity relationships
- How do peroxides form
- Compounds forming peroxides
- Detecting peroxides
- Treating peroxides
- Storing chemicals that form peroxides
- Emergency actions for peroxide-containing chemicals
Assessing the Risks of Hazards: 3\textsuperscript{rd}, 4\textsuperscript{th} year undergraduate topics

- Risk assessment tools
- Developing safety plans for experiments
- Working in a new laboratory
- Chemical exposure assessment methods
Minimizing the Risks of Hazards: 3rd, 4th year undergraduate topics

- Safety for common laboratory procedures
- Radiation safety
- Laser safety
- Biological safety
- Biological safety cabinets
- Protective clothing
- Respirators
- Safety in research laboratories
- Conducing safety inspections
- Managing chemicals
- Chemical inventories and storage
- Advanced chemical waste management
- Process safety
- Safety laws/regulations
- Chemical security
Preparing for emergencies: 3rd, 4th year undergraduate topics

- Planning for emergencies in experiments
- Emergency response chemistry
- Working with outside emergency responders
- Emergency drills and exercises
Laboratory Research

- Research by nature
  - Investigates new phenomena, processes, materials
  - Fluid process
  - Changes, adapts to recent results
  - May be risky
- Research hazards:
  - Chemicals, products, processes, equipment, side-reactions

"Research is what I am doing when I don’t know what I am doing.”

Wernher von Braun
What is Hazard Analysis

- **Hazard Analysis** – the process of hazard identification, evaluation, and control

- Applying *Hazard Analysis* to Research
  - Identification – Recognize hazards
  - Evaluation – Assess the risk of hazards
  - Control – Minimize the risk of hazards
  - Prepare for emergencies
Hazard Analysis Tools

- Are available
- Can be adapted to research
- One tool may not fit all research
- Must find tool(s) that works best
- CCS Website: [www.acs.org/safety](http://www.acs.org/safety)
- Seek feedback: [safety@acs.org](mailto:safety@acs.org)
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What Might You Conclude About?

- Leadership in Safety
- Positive Attitude for Safety
- Education in Safety
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- Institutional Support
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Strong Safety Culture
Safety - integral part of work
Leaders require safety
Positive attitudes want safety
Faculty teach safety
Researchers apply safety – hazard analysis
Everyone learns from safety
Steps to Prevention!

“Prevention is better than cure.”
Desiderius Erasmus