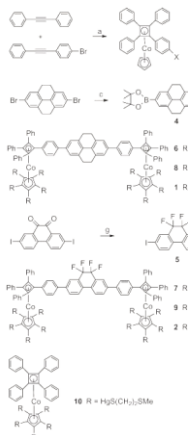


My Background

Highschool Teacher

Playing with Molecules like Tinkertoys



NSF International Research Fellowship



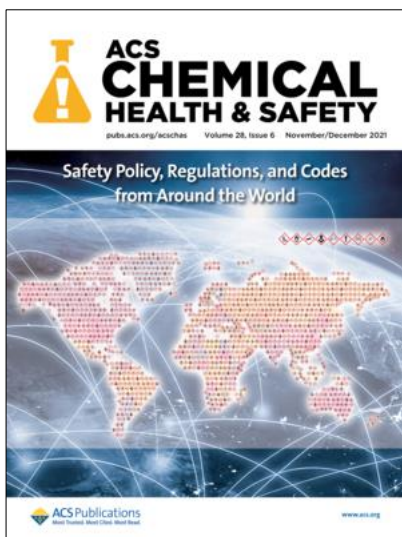
US Chemical Safety Board Major Accident Investigations



Sandia National Laboratories & ACS EIC



Journal History



- 1994 to 1998: ACS published it as a trade *Magazine* (a magazine/journal hybrid)
- Elsevier
 - 1999-2005: *Chemical Health and Safety*
 - 2006-2019: *Journal of Chemical Health and Safety*
- 2016 ACS adopted 'safety' as a core value
 - Reacquired the journal
 - *ACS Chemical Health & Safety*—First issue January 2020



Audience Survey Question

ANSWER THE QUESTION ON THE INTERACTIVE SCREEN IN ONE MOMENT



Do you know someone (including yourself) who has had a lab accident?

- Yes, I observed someone else receive a serious injury
- Yes, I received a serious injury
- Yes, but the accident did not injure anyone
- No, not yet

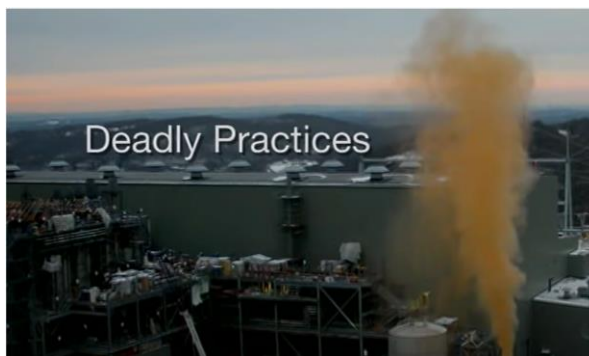
** If your answer differs greatly from the choices above tell us in the chat!*

Deadly Practices

ConAgra Natural Gas Explosion and Ammonia Release

Garner, NC, June 9, 2009

4 Fatalities, 67 Injuries, Extensive Damage



<https://youtu.be/rjxBtwl8-Tc?t=104>

https://www.csb.gov/investigations/completed-investigations/?F_InvestigationId=3557

Learning from Chemical Incidents

What do regulations say a company/university should do?

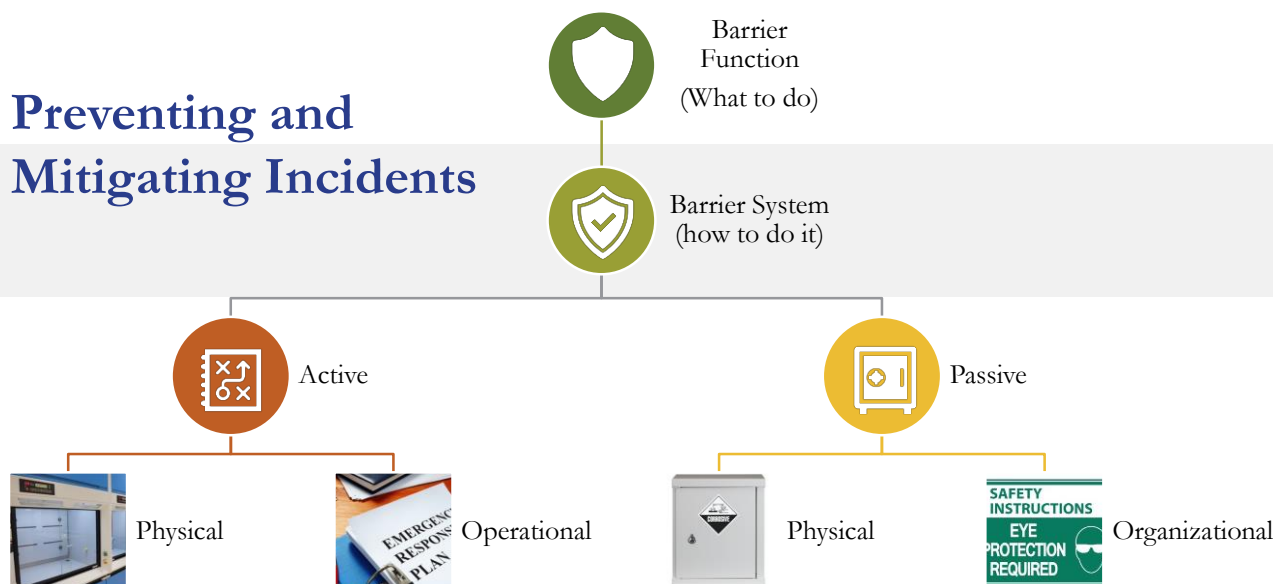
What is the “best practice”?

What does a company/university say it will do?

What does the company/university actually do?



Preventing and Mitigating Incidents



Sklet, S.; Safety barriers: Definition, classification, and performance, *J. Loss. Prev. Process Ind.* **2006**, 19(5), 494-506, <https://doi.org/10.1016/j.jlp.2005.12.004>.



Audience Survey Question

ANSWER THE QUESTION ON THE INTERACTIVE SCREEN IN ONE MOMENT



We often times have scheduled tests for physical safety equipment, such as eyewashes or fume hoods. **Do you (or does your institution) ever "test" procedures or policies by observing people performing them?**

- Yes, in our lab, we routinely observe each other to share safety feedback
- Yes, new employees are mentored about safety practices as they learn their jobs
- Yes, we provide hands-on training for use of emergency equipment such as fire extinguishers and safety showers
- No, we work from standard operating procedures that are clear

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

Texas Tech University Lab Explosion

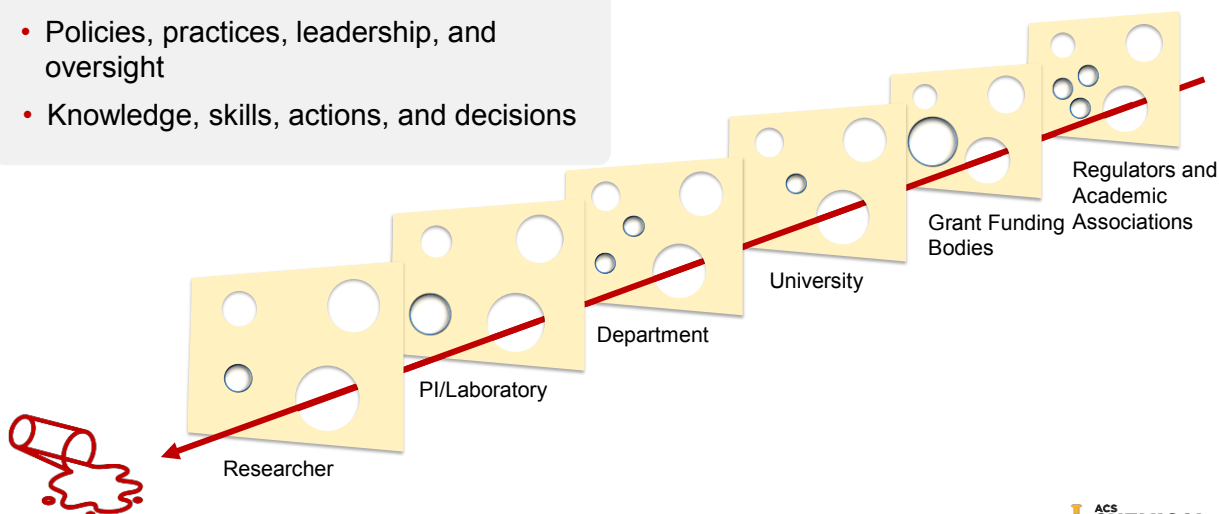
Lubbock, TX, January 7, 2010

Loss of three fingers, one eye perforated, burns to hands and face



<https://www.csb.gov/texas-tech-university-chemistry-lab-explosion/>

- Regulations and good practice guidance
- Rules and requirements
- Policies, practices, leadership, and oversight
- Knowledge, skills, actions, and decisions



Context is Everything

“Upon addition of the nitric acid, the scientist noticed fuming along with the expected exotherm. The scientist halted the addition to allow the uncapped mixture time to cool. While cooling, the scientist turned to other work on the adjacent bench. Approximately 3–4 min after setting the solution down, the chemical mixture spontaneously decomposed, exploding the glass bottle and emitting a burst of flames.

The mixture was sitting inside of a ventilated weighing station, which is frequently used to weigh out volatile or odiferous amines. The enclosure contained the blast in three directions but projected it in the direction of the open side of the box, with the scientist standing about three feet away almost directly across from it.”



Meredith, M.; Lessons Learned from a Delayed Exothermic Decomposition—Amine Neutralizations with Strong, Oxidizing Acids, *ACS Chem. Health Saf.* 2022, 29, 1, 72–78, <https://doi.org/10.1021/acs.chas.1c00042>.





*I found myself wondering why the 'use of adequate apparatus' for conducting synthetic reactions was not initially required for the work described in your paper. For example, a round bottomed flask equipped with proper stirring, a thermometer and a thermostat bath or chiller unit, to control the inevitable exotherm. **Why was the scientist adding the acid at a weighing station instead? It seems like this context would help explain why the chosen approach made sense to the scientist at the time**, otherwise it is hard as a reader to understand what the scientist was trying to do.*

"Most of the scientists and technicians who work in the laboratories are "formulation chemists", meaning that they have expertise in making and evaluating mixtures, in this case for application in polyurethane foam systems. Most mixtures for these types of systems are not reactive themselves so the different ingredients are typically added to a vessel that is sitting on a balance and then that vessel is blended with a stir bar or a bottle rolling machine. The use of small-scale synthetic glassware is not common, so when the scientist was neutralizing acids and amines, a similar "formulation" approach was taken, vs the approach that a synthetic chemist might take..."

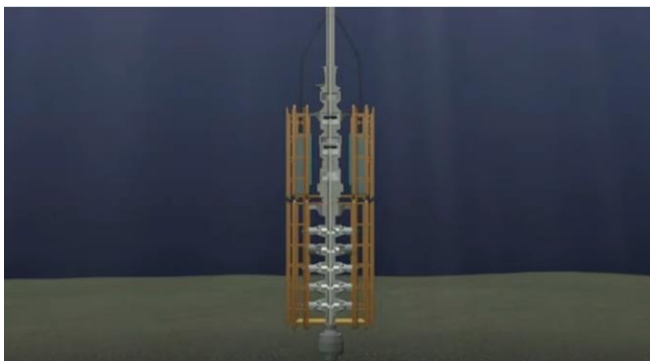
Until the date of the incident, almost all of the acids that were screened were carboxylic acids, and while their reaction with the amines is obviously energetic, no violent exotherms had been observed due to careful observation and dropwise metering of the acid. On this day, however, in a search of liquid acids in the lab storage areas, the scientist found and selected 90% nitric acid as a candidate acid to try. The scientist was not aware of the explosive nature of nitrate compounds but was prepared for an exotherm and proceeded cautiously..."

Meredith, M.; Lessons Learned from a Delayed Exothermic Decomposition—Amine Neutralizations with Strong, Oxidizing Acids, ACS Chem. Health Saf. 2022, 29, 1, 72–78, <https://doi.org/10.1021/acs.chas.1c00042>.

Macondo Blowout and Explosion

April 20, 2020

4 Fatalities, 17 airlifted for critical physical injuries; many others injured – burns, broken bones, anguish, Worst oil spill in US history

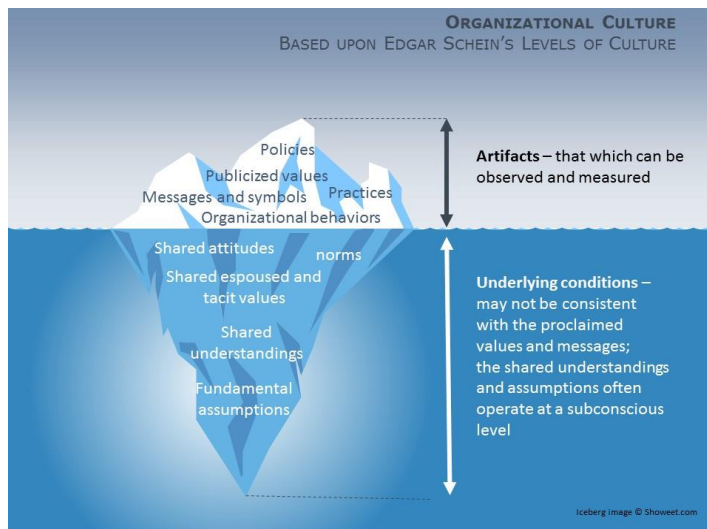


<https://youtu.be/FCVCOWejlag?t=222>

<https://www.csb.gov/macondo-blowout-and-explosion/>

There's Safety, There's Culture, but Is There Safety Culture?

<https://pubs.acs.org/doi/10.1021/acs.chas.1c00058>



Based on: Schein, Edgar H. 2004. *Organizational Culture and Leadership*, 3rd ed., Jossey-Bass: San Francisco, CA, pp 25-37



Audience Survey Question

ANSWER THE QUESTION ON THE INTERACTIVE SCREEN IN ONE MOMENT



30

Have you ever taken a safety culture survey for your lab organization?

- Yes, and the results of the survey led to changes in safety practices in our lab
- Yes, and the results of the survey were shared with everyone, although I didn't see any changes as a result
- Yes, but I don't know what happened to the results
- No

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

There's Safety, There is Culture, but is there Safety Culture?



Employees shall observe and report unsafe situations/activities

Transocean crews required to submit daily START (See, Think, Act, Reinforce, Track) card

- Crewmembers believed the focus on the quantity not quality of observation.
- "people [tried] not to rat people out so to speak, you know like you wanted to be helpful, [...] whereas some of the higher-ups in the office, they kind of wanted to weed out problems ..."
- "I've seen guys get fired for someone [writing] a bad START card about them"



Volume 3 of the CSB Macondo Investigation Report, Section 3.3, p 143-144.

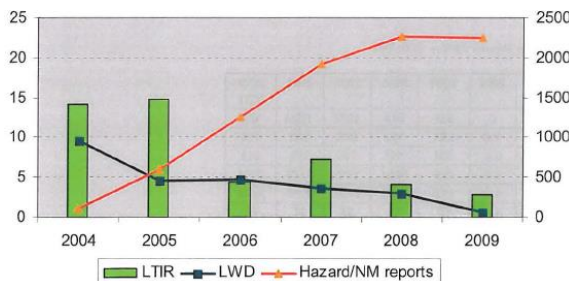


Safety Culture: Same Policy, Different Attitudes



Employees shall observe and report unsafe situations/activities

- Workers initially against forced reporting
- Attitudes changed when tools and work equipment that were worn were repaired or replaced



Read, B. R.; Zartl-Klik, A.; Veit, C.; Samhaber, R.; Zepic, H.; *Safety Leadership that Engages the Workforce to Create Sustainable HSE Performance*; The SPE International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production held in Rio de Janeiro, Brazil, 12-14 April 2010.





Audience Survey Question

ANSWER THE QUESTION ON THE INTERACTIVE SCREEN IN ONE MOMENT



Have you ever done an internet search for lab safety information?

- Yes, and was able to find exactly what I needed
- Yes, and I was able to find helpful information to answer my question
- Yes, but I was unable to find helpful information
- No, I rely on paper resources and face to face advice from other lab workers to answer safety questions

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

Peer Reviewed Case Studies

Lessons Learn—Fluoride Exposure

<https://pubs.acs.org/doi/10.1021/acs.chas.9b00015>

Serious Explosion during a Large-Scale preparation of an Amine by Alane (AlH_3) Reduction of a Nitrile Bearing a CF_3 Group

<https://pubs.acs.org/doi/10.1021/acs.chas.0c00045>

Near Miss Involving Red Phosphorus

<https://pubs.acs.org/doi/10.1021/acs.chas.0c00059>

Lesson Learned from an Explosion during Chemical Synthesis: Discussion and Preventative Strategies

<https://pubs.acs.org/doi/10.1021/acs.chas.9b00028>

Chemical Safety: TATP Formation in 2-Propanol

<https://pubs.acs.org/doi/10.1021/acs.chas.0c00061>

Chronic Lung Impact on Laboratory Worker Exposed to Chloramines and Cyanogen Chloride

<https://pubs.acs.org/doi/10.1021/acs.chas.9b00020>



DANGER!



Peer Reviewed Methods/Protocols

Review of the Performance, Selection, and Use of Gloves for Chemical Protection

<https://pubs.acs.org/doi/10.1021/acs.chas.1c00084>

Facile Grignard Reaction Demonstration Using Molecular Sieved Dried Solvent

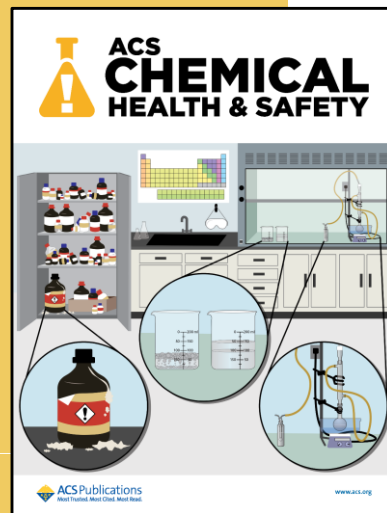
<https://pubs.acs.org/doi/10.1021/acs.chas.1c00015>

Safe Piranhas: A Review of Methods and Protocols

<https://pubs.acs.org/doi/10.1021/acs.chas.1c00094>

Safe Handling of Cannulas and Needles in Chemistry Laboratories

<https://pubs.acs.org/doi/10.1021/acs.chas.1c00069>



Different Perspectives = Different Points of View

“ Can we place the structure of the acid since it was already mentioned in the paper? ”

“ “Given that the presence of metal ions can drive release of flammable gas...” → I anticipate the gas being released should be oxygen, and thus should not be regarded as flammable. ”

“ It is also unclear when we pull protocols from the internet what other policies may exist that may further support a procedure, e.g. a quantity limit. ”

“ The paper would be very useful for me as an EHS professional being asked to review work by someone else with those reagents. ”

“ I know of a research group in a pharma company that used something like near 2 metric ton of Piranha mixture for an oxidation reaction. ”



A

Well that explains the horrible traffic. Thank goodness I was on a bike!

One person seriously injured in 'minor' Amgen lab blast in South San Francisco
mercurynews.com

Two people were injured Wednesday afternoon in a 'minor' laboratory explosion at biotech firm Amgen's South San Francisco lab facility, a fire

Like · Comment · Share · 10 hours ago ·

E likes this.



M

Thank goodness you don't work at Amgen.

12 minutes ago · Like



M

The description sounds like when that Mary

Beth girl blew herself up in grad school.

11 minutes ago · Like



A

Exactly what I was thinking, mix organic solvent with oxidizing agent...go boom.

7 minutes ago via mobile · Like · 1



Patient : MULCAHY, MARY
Acct# :
Adm Dt : 09/29/2001
Att Phys :
PC Phys :
Pt SS# :
Carrier#1: CU STUDENTS MEGA LIFE
Policy # :

DATE OF EVALUATION: 09/29/2001

CHIEF COMPLAINT: Elbow laceration and left side laceration from exploding glass container.

HISTORY OF PRESENT ILLNESS: This 26-year-old graduate student was working in the laboratory cleaning chemicals when ethanol and nitric acid placed in a sealed glass bottle exploded, sustaining the above-mentioned injuries to left elbow and left flank. She denies other injuries. No facial trauma. The patient was treated with brisk shower and irrigation at the scene, was transported by EMS after an IV was placed and stable vital signs in route without further complaint other than localized pain.

HISTORY: Rule out foreign body.

FINDINGS: No radiopaque foreign body is seen projected over the abdomen.

HISTORY: Rule out fracture.

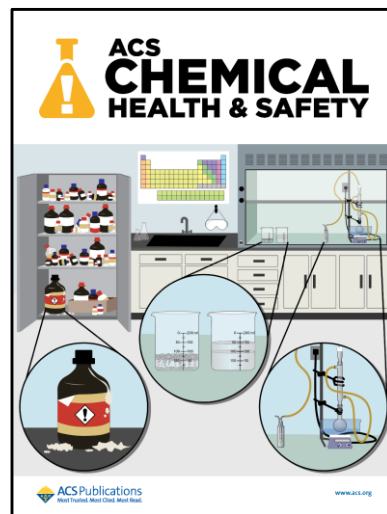
FINDINGS: Osseous structures are intact without evidence of fractures.

TIME	NARRATIVE	INITIALS
1845	Multiple 5-9 mm reddish areas on the forearm "shales"	
	These are acid burns "washed arms, face, eyes for 30 min prior to arrival in H ₂ O, 5" diameter open laceration on side around flank No further wound no active bleed	



Journal Scope & Audience

“ACS *Chemical Health & Safety* is a global platform for ensuring that all members of the chemical enterprise receive access to new research, safety information, regulatory updates, effective chemical hygiene practices, and hazard assessment tools.”



Receive e-Alerts

<https://go.acs.org/ACSCHASalerts>

Register for an ACS CHAS Workshop!



BUILDING A SAFETY CULTURE IN YOUR LAB

Sat., Feb. 26, 2022 @ 1PM – 4PM EST



A proactive laboratory safety culture is the key to a safer laboratory. This workshop will explore what this means and provide concrete tools you can use to support a safety culture in your lab.

EMPOWERING ACADEMIC RESEARCHERS TO STRENGTHEN SAFETY CULTURE

Sun, March 20, 2022 @ 2PM – 6PM EDT



Also known as the Lab Safety Teams workshop, taught by chemistry graduate students with experience with implementing and maintaining laboratory safety programs at their home institution.

<https://dchas.org/2022/02/01/workshops2022>