Learnings from a community safety data sharing experiment

with thoughts on the ethics behind safety data sharing

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Presented at the 258th ACS National Meeting and Exposition, August 26, 2019 CHAS Symposium: "Connecting Professionalism, Safety & Ethics: Opportunities and Challenges "

Again

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LAB SAFETY

University of St. Andrews installs temporary labs to replace those destroyed by fire

Renovations, modular building to cost £12 million

*by **Dalmeet Singh Chawla, special to C&EN***

AUGUST 1, 2019 | APPEARED IN **VOLUME 97, ISSUE 31**

"The fire, which broke out on Feb. 10, started when "a **routine** post-experiment wash-up **went wrong**," the university previously said."

https://cen.acs.org/safety/lab-safety/University-St-Andrews-installs-temporary/97/i31

And again

Safety Alert

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Dangers of Peroxide Formers—Explosion at UMN

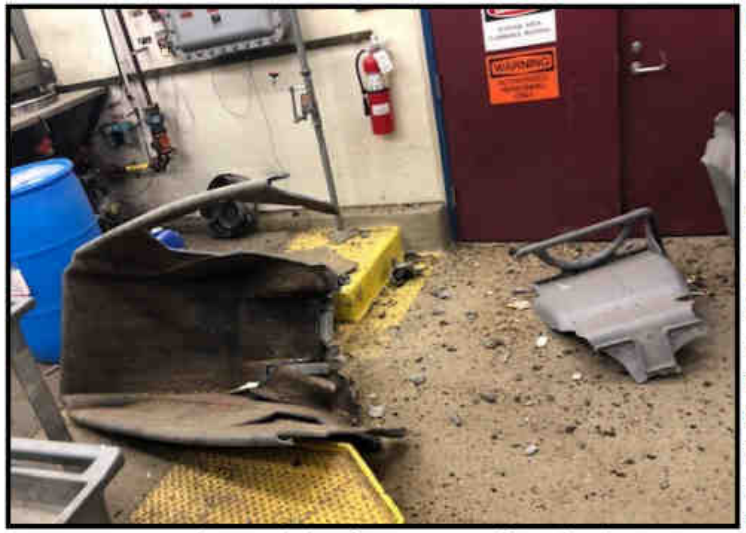

Figure 1: Damaged cart and glass fragmentation from the detonation.

Incident:

A large explosion occurred while a UHS Environmental Health and Safety Technician was processing organic waste from a laboratory cleanout. The technician was in the process of combining flammable solvent waste into a "bulking drum", which is a standard practice at our facility. Upon disposal of an emptied glass bottle into a tip cart for recycling, a large detonation occurred in the cart. The shockwave from the detonation was large enough to rip the cart in half (Figure 1), blow open the doors in the room, cause damage to adjacent rooms, and shake the windows in the facility. The technician survived the blast without major injuries.

Likely Cause of Explosion:

After a thorough investigation, the most likely cause of the explosion was determined to be **shock sensitive residue from a peroxide forming chemical** deposited inside an empty bottle. While in solution, any shock sensitive crystals may have been stabilized. After the solvent was removed and the residue dried, a detonation of the residual peroxide crystals could have been initiated by friction from the discarded bottles in the cart.

What are Peroxide Forming Chemicals (PFCs)?

PFCs are chemicals that can "auto-oxidize" with atmospheric oxygen under ambient conditions to form organic per

"The technician was in the process of combining flammable solvent waste into a "bulking drum", which is a **standard practice** at our facility."

"The shockwave from the detonation was large enough to rip the cart in half"

https://dehs.umn.edu/sites/dehs.umn.edu/files/safety_alert_-_thompson_explosion_aug19.pdf

How do we do better?

…..“incidents continue to happen. What are we missing?”

Tom Connelly, ACS CEO

Thomas Connelly, The ACS’s role in Safety, C&Enews vol 94, iss 26, p. 35
https://cen-cc-origin.acs.org/articles/94/i26/ACSs-Role-Safety.html

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Volume 94 Issue 26 | p. 35 | ACS Comments
Issue Date: June 27, 2016

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The ACS’s Role in Safety

By Thomas Connelly, ACS Executive Director and Chief Executive Officer

[+]Enlarge

Tom Connelly
Credit: Peter Cutts Photography

Over the past decade, we have witnessed tragic accidents in academic laboratories of chemistry and related sciences, as well as in high school chemistry labs. Subsequent investigations of such laboratory accidents suggest that these incidents are preventable.

Laboratory safety has been the subject of an investigation by the **Chemical Safety Board** and of studies by the **National Research Council**, the **Association of Public & Land-Grant Universities**, and the **American Chemical Society**.

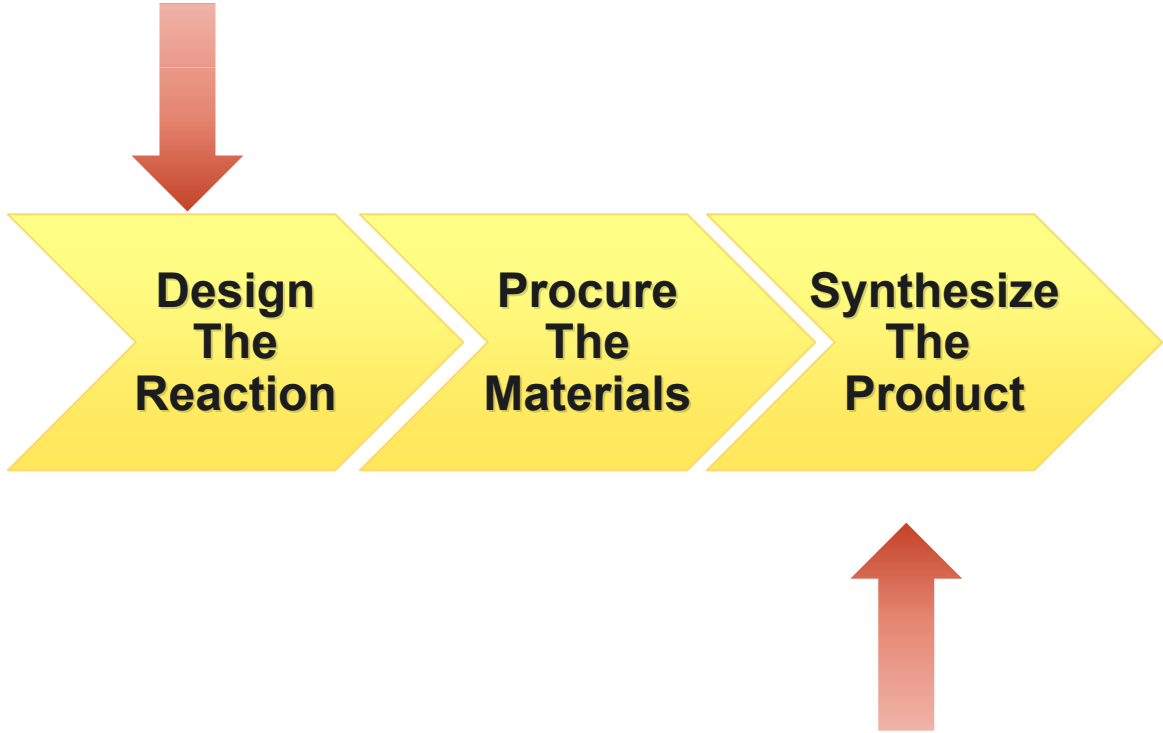
In 2012, the Safety Culture Task Force of the ACS Committee on Chemical Safety issued the report “Creating Safety Cultures in Academic Institutions,” which provides guidance, suggestions, examples, and recommendations to help strengthen the safety culture in two- and four-year undergraduate, graduate, and postdoctoral programs. Despite these and other guidelines that have been issued, incidents continue to happen. What are we missing?

What are we missing?

Technical issues

- Data sources can be
  - hard to find
  - scattered all over
  - in unusable formats
  - unknown to the scientist
- Hard to get right data at right time in the right place
- Tools can be difficult to use

Point at which chemist typically pulls safety info, from disparate sources



Point at which chemist really needs the info.

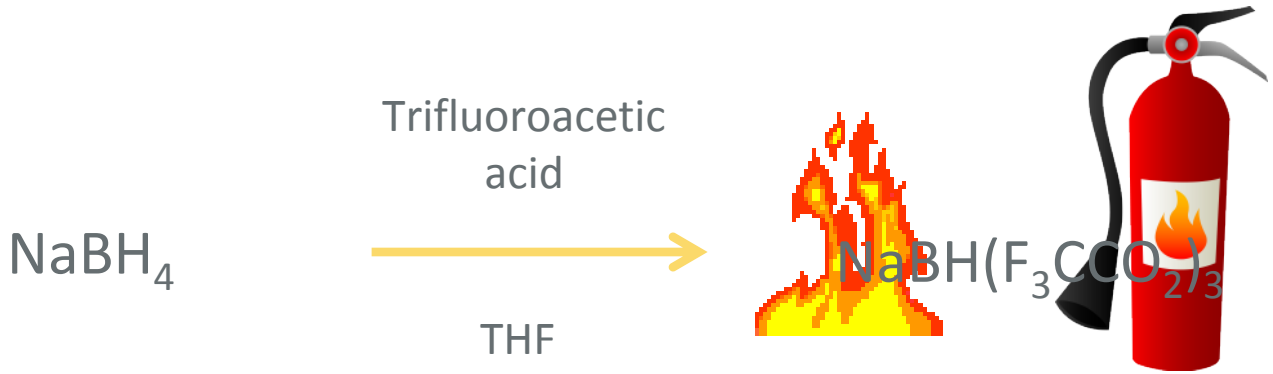
What are we missing?

People issues

- Lack of **leadership** in prioritizing safety
- Mistaken perception that safety takes **time** away from important research
- Disinclined to **share** safety learnings
  - Worry, fear & embarrassment
  - IP/liability concerns
  - Inertia
- Blame individuals; forget to look at **systemic factors**
- We are not emphasizing **learning from each other**
- Instilling and cultivating a **culture of safety** is **hard** and **never ends**!

The Pistoia Alliance project inspiration: Trifluoroacetoxyborohydride

Original synthesis described in United States Patent 4,835,278



- Exothermic Reaction
- Byproduct: hydrogen gas
- Powder dissolves rapidly, reaction not controlled, will consistently catch fire
- Lesson: Must use *pelletized* $NaBH_4$, dissolution controls reaction rate

Ensuring That Lessons Learned Are Not Forgotten, Leveraging ELN to Transform the Safety Paradigm, Mark Manfredi (BMS), ACS Fall 2016 – CHAS Division talk

Why the Pistoia Alliance?

- A global, **not-for-profit** 501(c)(6) alliance of life science companies, technology vendors, publishers, and academics and research institutions.
- Dedicated to **improving life sciences R&D** innovation and effectiveness through **collaborative projects and other activities**
- Provides a proven framework for **cross-industry collaboration**

Pistoia Alliance

CSCS

President's Startup Challenge 2019 – Pistoia Alliance

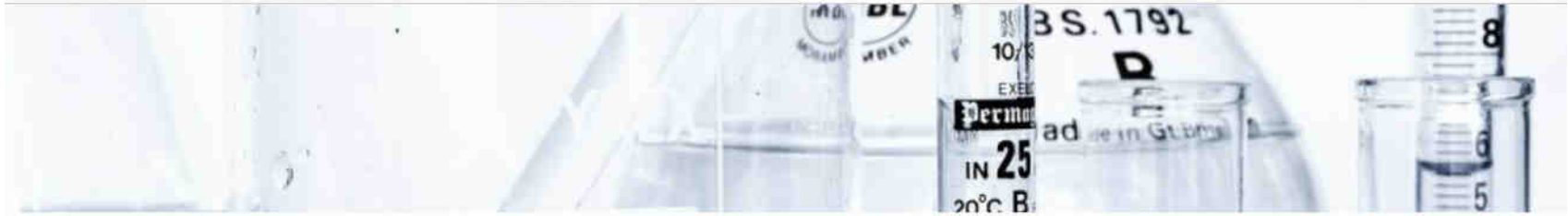
HELM – Hierarchical Editing Language for Macromolecules

The Pistoia Alliance Sequence Squeeze Competition

Chemical Safety Library

tranSMART Foundation

Goal and value proposition



The Pistoia Alliance *Chemical Safety Library* project will **capture** and **share** previously inaccessible **reaction incident** information.

Making this data available to the chemical community at large will allow companies to **learn and avoid reaction incidents** experienced by the wider community, **enhancing overall laboratory safety.**

https://www.pistoiaalliance.org/projects/chemical-safety-library/

Chemical Safety Library experiment

Fall 2016- Winter 2017

- Reviewed **existing safety data sources**
- Agreed on **data to be collected**, etc
- Configured data entry system
- PA members prepopulated the CSL public database

Spring 2017 – Fall 2018

- Community experiment began **4/2017 w 27 records**
- C&ENews **Safety Letters** included
- Datathon held
- Hackathon won by U Southampton: Alexa+CSL+ eLN
- Deposited CSL data to **PubChem**

Winter 2018 - Summer 2019

- 138 records in Database
- **Simplified** submission form
- Distributing **.csv file** upon request
- Explored **sustainability** options
- **ACS/CAS joins team** & conducts member **site visits**

Future plans

- 148 records today.
- **ACS/CAS collaborating** on “new CSL” for 2020
- **NotVoodoo** adding select CSL data
- **IUPAC** to publicize “new CSL”
- Continue to invite **new entries & provide .csv**

Validating the need for actionable safety information

Email requests for the CSL .csv file

Site Type	Year	Requests	Year	Requests	Year	Requests
	2017	154	2018	156	2019	19
Industrial		69		61		11
Academic		65		63		5
Government		12		9		1
Other		8		23		2

Note:

- Publicity efforts throughout 2017 and 2018.No significant publicity run since Fall 2018, due to partner sustainability discussions.
- Recent 2019 uptick tied to renewed public discussion of CSL project, which demonstrates the importance of continued publicity and education.
- Still some hesitation to contribute. Feedback suggests simpler system, clearer anonymity, one-on-one collaboration on data entries, and reminders would increase participation.

A professional imperative to share safety information

Karl Barry Sharpless, W. M. Keck Professor of Chemistry at The Scripps Research Institute (TSRI) and 2019 Priestley Medalist

Thanks to Matt Davenport and Jyllian Kemsley and C&ENews for giving us permission to use this audio excerpt from Stereo Chemistry: A C&EN Podcast Ep. 20: What happens when you take risks? (https://cen.acs.org/safety/Podcast-Lessons-learned-lab-safety/97/i30) by Jyllian Kemsley and Matt Davenport JULY 24, 2019 (Appeared in VOLUME 97, ISSUE 30)

An ethical imperative: why sharing is critical

Ian Tonks, Associate Professor
University of Minnesota

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What can you do to promote safety sharing?

- Set up joint safety teams at your University
- Write a safety letter to C&Enews

- To contribute to or get a copy of the CSL contact csladmin@pistoiaalliance.org

Acknowledgements

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  - Gabrielle Whittick (project manager)
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