Keene STATE COLLEGE Wisdom to make a difference.

Inclusive Risk Assessment: Why and How?

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Virtual Presentation

Venue Acknowledgement

This virtual presentation is made possible by decades of computer science research supported by the federal government which led to the development of the modern Internet and the platforms it supports.

The presentation is based on my professional work supported by salaries from the University of Vermont, Cornell University and Keene State College.

This story I am sharing encompass the experiences of a variety of people I have interacted or heard the stories of with in these roles over the years, but is told from my white male perspective.

ACS CHANGE DRIVERS

A Planning Tool for Staff and Volunteers

December 2020

MARKET DISRUPTION AND ECONOMIC DOWNTURN

- The world is facing an economic downturn as a result of the COVID-19 pandemic.
- Petrochemical production and investment has been increasing leading up to 2020, revealing opportunities in emerging economies.
- Market disruptions and issues of supply pose a threat to the industry.

ACCELERATING AUTOMATION OF CHEMISTRY

- Artificial intelligence (AI) and machine learning are increasingly being used in data mining and chemical manufacturing.
- Lab-based research is more commonly being outsourced.
- Clean energy is a motivator for technological advancements.
- Automation has security and workforce implications.

STRAINED PIPELINE AND CHANGING WORKPLACE

- Economic, institutional, and immigration issues disrupt the chemistry workforce pipeline.
- Millennials and Gen Z will soon make up the majority of the global workforce.
- Advancements in technology may address workforce shortages but will require new skills of employees.
- Workplaces and meetings have shifted to being increasingly virtual.

CONTINUED GLOBALIZATION OF CHEMISTRY

- Asia is rapidly prospering and becoming the focus of the scientific enterprise.
- Foreign investment into Asia continues to grow.
- Concerns around research quality in developing markets persist.
- Recent years have seen particularly acute and intensifying geopolitical tensions.

CHEMISTRY AND SOCIAL RESPONSIBILITY

- Chemistry has room to be more diverse and representative.
- Investment in diversity, equity, inclusion, and respect (DEIR) is growing.
- Consumers have higher expectations for safe, ethical, and transparent practices in the chemical industry.
- The industry continues to move towards a “greener” future.

EMBRACING OPEN SCIENCE

- Many influential funders and policy makers support open science and require open access to articles and data.
- Revenue from open-access publishing comes at the expense of traditional subscriptions.
- Preprint publishing is a growing means by which chemistry research is disseminated.
- The COVID-19 pandemic has spurred calls for open science.

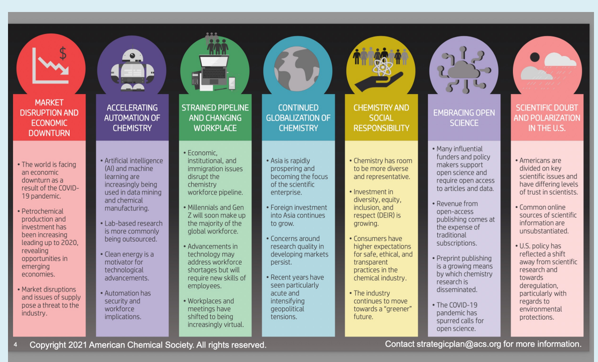
SCIENTIFIC DOUBT AND POLARIZATION IN THE U.S.

- Americans are divided on key scientific issues and have differing levels of trust in scientists.
- Common online sources of scientific information are unsubstantiated.
- U.S. policy has reflected a shift away from scientific research and towards deregulation, particularly with regards to environmental protections.

Contact strategicplan@acs.org for more information.

Risk Education Needs Related to the Emerging Chemical Enterprise

1. Market disruptions: today's example PFOAs
2. Social responsibility: marketing challenges has led to an interest in Greener Chemistry with a clear definition
3. Lab-based research is being outsourced and computer models replacing lab data: How is risk information collected in this process?
4. Open science: how can we share risk data in a useful way?
5. Strained chemists pipeline: risks neglected by a mono-cultural population (e.g. the pregnancy in the lab question)
6. Continued globalization: technology transfer overlooks risk technology transfer



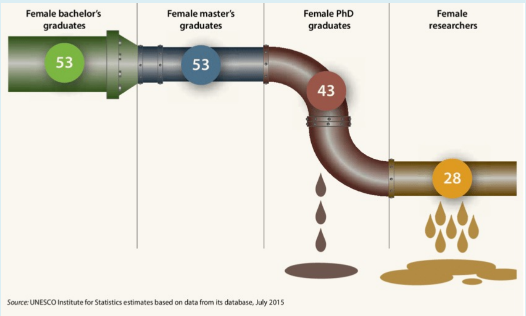
The Chemistry Pipeline DEIR Challenge

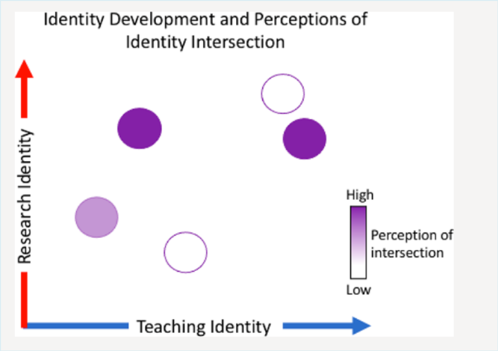
From *Integrating Social Justice into the Chemistry Curriculum: Setting the Ethical Foundation for Future Scientists*

For many years, the STEM community has bemoaned the "leaky pipeline problem," in which underrepresented groups leave the disciplines at high rates.

And yet at the same time, inadequate attention has been paid to "how these individuals experience our institutions in the classroom, the research laboratory, and the scientific culture." It is the unfortunate truth that science has a long history of being "weaponized" against marginalized populations.

One way in which this inadequate attention has been expressed in risk assessment education in the chemistry education.





Characterizing Graduate Student Identity Development in the Context of an Integrated Research and Teaching Graduate Student Training Course

Adriana Corrales and Regis Komperda*
https://doi.org/10.1021/acs.jchemed.1c00927

A Case Study in My Ethical Education and Managing Power Differentials

- In 1985, I was hired by UVM to develop a hazard communication program for the campus as a whole. I had an engineering B.S. and 5 years experience as a lab tech.
- The first step was to collect Material Safety Data Sheets for the campus chemical inventory; I was given budgetary authority to hire a temporary employee for 30 hours/week to collect chemical inventory data in UVM's labs.
- We thought that a logical place to start was the Chemistry Department stockroom; the chair of the department said there was no inventory of the stockroom and he didn't have any resources to help with this project.

The Stockroom Adventure

- We bought a portable *computer*, a *lab coat* and *some gloves* and sent our guy into the chemistry stockroom to do a **bottle by bottle inventory**, recording chemical names, quantities and CAS numbers in the computer.
- At the end of the first day (6 hours in the stockroom), **his clothes and hair stunk and he had a headache**.
- At the end of the second day, **he wasn't feeling well and his hair was brittle.**
- During the third day, **he dropped a bottle and created a mess.**

On the morning of Day 4 we had to make a decision: what next?
Our guy was willing to "give it another try".

Let me know in the chat:
1. Would you go ahead with the inventory on day 4?
2. Where in your education were you equipped to address that question?

- The chair of the chemistry department, who had a full time staff member working in the anteroom of the stockroom, didn't see what the problem was – after all, the inventory taker felt ok the next morning.
- My boss, who was the insurance manager, said "of course not"

Competing "Guiding Principles" for Professional Risk Decision Making

- **Golden Rule:** Do unto others as you would have them do unto you
- **Professional Ethics:** First, Do No Harm
- **Precautionary Principle:** Do not proceed until all risks are well understood
- **Leadership Ethic:** Don't ask someone to do something you wouldn't do yourself
- **Safety Ethic:** Don't ask someone to assume an unmanaged risk

Social Aspects of the Stockroom Decision

Moral Aspects

Pro: The work would benefit lab workers at UVM

Con: We were working with chemicals with unknown hazards

Individual ethics

Pro: The employee was willing to try again

Con: I didn't want to be responsible for impacting his health

Legal aspects

Pro: VOSHA required a chemical inventory

Con: UVM had a "general duty" to protect our employee's health

Professional ethics

Pro: We couldn't collect a complete set of MSDS's without an inventory

Con: I wasn't qualified to assess the safety of what I was asking my employee to do

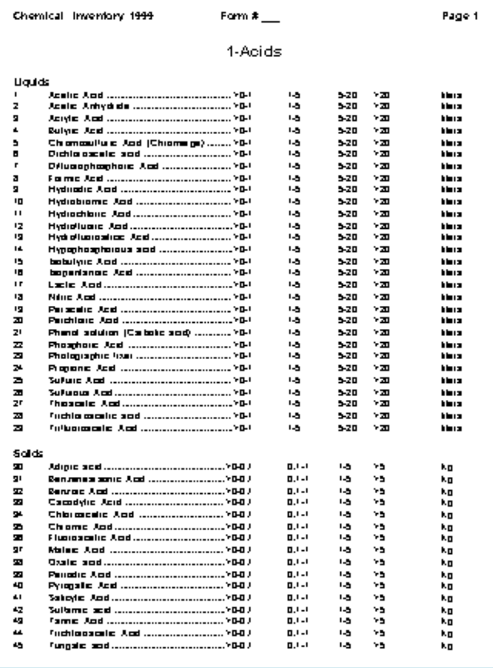
Managerial ethics

Pro: I didn't have a Plan B for collecting the data

Con: I didn't have clear priorities for the project, so we were able to change plans as we liked

The Outcome and Technical Postscript

- The inventory taker and I decided to **skip** the Chemistry stockroom and work on labs in the medical school, which had smaller chemical collections and better ventilation.
- 5 years later, we came up with a system for **estimating inventories based on general chemical classifications**. This approach satisfied the Fire Department and survived 3 VOSHA inspections.
- About 10 years later, I had the opportunity to do **air sampling** in the stockroom and there were many peaks in the spectrum, but no single chemical was clearly causing the odor.



Chemical Inventory 1999 Form # ___ Page 1

1-Acids

Liquids

1	Acetic Acid	<0-1	1-5	5-20	>20	liters
2	Acetic Anhydride	<0-1	1-5	5-20	>20	liters
3	Acrylic Acid	<0-1	1-5	5-20	>20	liters
4	Butyric Acid	<0-1	1-5	5-20	>20	liters
5	Chromosulfuric Acid (Chromerge)	<0-1	1-5	5-20	>20	liters
6	Dichloroacetic acid	<0-1	1-5	5-20	>20	liters
7	Difluorophosphoric Acid	<0-1	1-5	5-20	>20	liters
8	Formic Acid	<0-1	1-5	5-20	>20	liters
9	Hydriodic Acid	<0-1	1-5	5-20	>20	liters
10	Hydrobromic Acid	<0-1	1-5	5-20	>20	liters
11	Hydrochloric Acid	<0-1	1-5	5-20	>20	liters
12	Hydrofluoric Acid	<0-1	1-5	5-20	>20	liters
13	Hydrofluorosilicic Acid	<0-1	1-5	5-20	>20	liters
14	Hypophosphorous acid	<0-1	1-5	5-20	>20	liters
15	Isobutyric Acid	<0-1	1-5	5-20	>20	liters
16	Isopentanoic Acid	<0-1	1-5	5-20	>20	liters
17	Lactic Acid	<0-1	1-5	5-20	>20	liters
18	Nitric Acid	<0-1	1-5	5-20	>20	liters
19	Peracetic Acid	<0-1	1-5	5-20	>20	liters
20	Perchloric Acid	<0-1	1-5	5-20	>20	liters
21	Phenol solution (Carbolic acid)	<0-1	1-5	5-20	>20	liters
22	Phosphoric Acid	<0-1	1-5	5-20	>20	liters
23	Photographic fixer	<0-1	1-5	5-20	>20	liters
24	Propionic Acid	<0-1	1-5	5-20	>20	liters
25	Sulfuric Acid	<0-1	1-5	5-20	>20	liters
26	Sulfurous Acid	<0-1	1-5	5-20	>20	liters
27	Thioacetic Acid	<0-1	1-5	5-20	>20	liters
28	Trichloroacetic acid	<0-1	1-5	5-20	>20	liters
29	Trifluoroacetic Acid	<0-1	1-5	5-20	>20	liters

Solids

30	Adipic acid	<0-0.1	0.1-1	1-5	>5	kg
31	Benzenearsonic Acid	<0-0.1	0.1-1	1-5	>5	kg
32	Benzoic Acid	<0-0.1	0.1-1	1-5	>5	kg
33	Cacodylic Acid	<0-0.1	0.1-1	1-5	>5	kg
34	Chloroacetic Acid	<0-0.1	0.1-1	1-5	>5	kg
35	Chromic Acid	<0-0.1	0.1-1	1-5	>5	kg
36	Fluoroacetic Acid	<0-0.1	0.1-1	1-5	>5	kg
37	Maleic Acid	<0-0.1	0.1-1	1-5	>5	kg
38	Oxalic acid	<0-0.1	0.1-1	1-5	>5	kg
39	Periodic Acid	<0-0.1	0.1-1	1-5	>5	kg
40	Pyrogallic Acid	<0-0.1	0.1-1	1-5	>5	kg
41	Salicylic Acid	<0-0.1	0.1-1	1-5	>5	kg
42	Sulfamic acid	<0-0.1	0.1-1	1-5	>5	kg
43	Tannic Acid	<0-0.1	0.1-1	1-5	>5	kg
44	Trichloroacetic Acid	<0-0.1	0.1-1	1-5	>5	kg
45	Tungstic acid	<0-0.1	0.1-1	1-5	>5	kg

Thought Question: Why were the Wetterhahn and UCLA situations different from my experience at UVM?

- What were the technical similarities and differences between the UVM situation and those situation?
- What were the cultural similarities and differences in those situations?
- How do we manage competing social priorities in a research setting?
- Was the difference the hazard level of the situation?
- More ethical decision-making?
- Luck?

The Impact of Power Differentials on Lab Safety Culture

Safety culture and the issue of power

Stian Antonsen *

NTNU Social Research Ltd., Dragvoll Gaard, N-7491 Trondheim, Norway

	Three-dimensional view		
	Two-dimensional view		
	One-dimensional view		
Key elements	**First dimension**	**Second dimension**	**Third dimension**
Object of analysis	- Behaviour - Concrete decisions - Issues	Interpretive understanding of intentional action Non-decisions Potential issues	Evaluative theorization of interests in action Political agenda Issues and potential issues
Indicators	Overt conflict	Covert conflict	Latent conflict

Fig. 1. The three-dimensional model of power. Adapted from Lukes (1974).

*The article argues that issues of culture and power are so intertwined that **safety culture research** should incorporate perspectives of power and conflict. This is necessary in order to be able to give a realistic account of the dynamics of organizational life. Introducing a more power-oriented view on safety culture can also serve as the basis for important ethical considerations regarding the improvement of safety culture.*

Professionalism, Safety, and Ethics

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

Exclusionary Risk Assessment Habits

Jargon

- Inside lingo can hide intragroup confusion (e.g. RCRA waste codes)
- Jargon does not translate well to external groups (HF vs. HCI)

Limiting the scope of the assessment and detail discussed

- Outsourcing regulatory risks to EHS
- Assigning physical and health risks to students and staff

Using Risk Math

- Risks are seldom evenly distributed among stakeholders, particularly in small groups
- Risk calculations hide the variation of risk between stakeholders; both in terms of likelihood or consequence

Excluding specific populations from risk considerations

- Woman
- Contact lens wearers
- Pregnant people
- Blind people

Improving Risk Assessment Practices: Safety Culture and Inclusive Risk Assessment

- People not involved in your risk assessment are not part of your safety culture.
- A safety culture is fostered by a risk assessment process that includes all relevant stakeholders
- The RAMP process is a structure to bring a variety of stakeholders together to develop a risk assessment.

Improving Risk Assessment Practices: Diversify the Team

A broader team helps:

- Identify **unrecognized hazards**
- Reprioritize risks by better understanding their **potential impacts**
- Recognize **management resource gaps**
- Supporting teamwork during an **emergency**

Homework

Online Ethics Center

FOR ENGINEERING AND SCIENCE

Upcoming Talk: Teaching Sustainability and Environmental Justice in Engineering Ethics

Presenter: Dr. Glen Miller

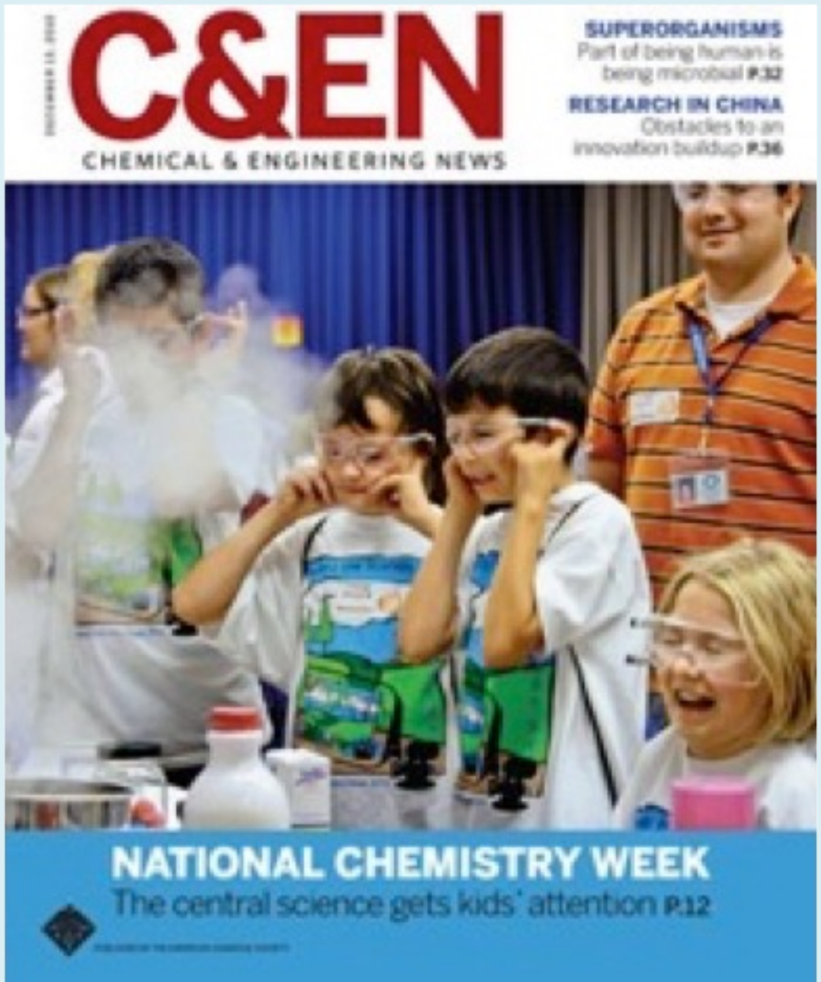
Discussant: Dr. Jennifer Richter

Date: Mar. 23, 2022; 12:00-1:00 p.m. (Eastern)

Register Here

https://virginia.zoom.us/webinar/register/WN_NLakTe_2Q2WiAzIzS0346w

Questions?



COVER: *Students from Meadowview Elementary School in Snow Hill, Tenn., react with surprise to a chemistry demonstration during the Northeast Tennessee Section's 20th annual Celebration of Chemistry. Cindy Williams*