Managing chemical safety as a social construct: A paradigm shift in chemistry

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Paradigms

- In 1962, Thomas Kuhn put forth the idea that subject knowledge (especially in the sciences) moves forward at a steady rate based on what is accepted in the scientific community until enough evidence accumulates which cannot be supported by current theory and a "crisis" results in a paradigm shift.

Paradigms

- Transferring chemical safety information as rules and skills applies only to specific situations

- If workers are unable to see past these rules or no rules seem to apply to the current work, they are ill equipped to make appropriate decisions or

- They may not perceive the crisis (they don't know what they don't know)

Paradigms

- High-profile events which have occurred in academic research labs over the past decade may act as indicators of a type of "crisis" pressuring the current paradigm of safety to shift (i.e., failures of the "old paradigm").

- Consider:
  - The deaths of Sheri Sangji at UCLA (2008) and Michele Dufault at Yale (2011)
  - The incidents with severe injury which occurred at Texas Tech (2010) and UH (2016)
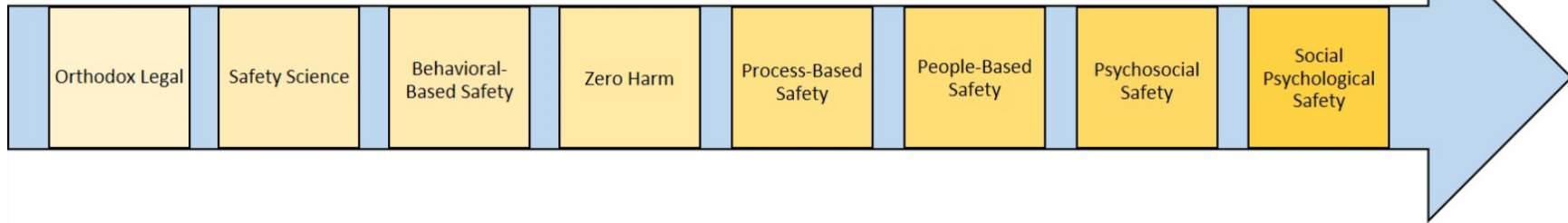
The Social Construct

Safety as a Social Construct

SCHOOLS OF THOUGHT AND PRACTICE IN SAFETY

Ideology	Orthodox	Safety Science	Behaviourism	Zero Harm	Process Safety	People-Based Safety	Human Factors	Psychosocial	Social Psychology
View of Humans	Human as servant	Human as object	Human as machine	Human as perfect	Human as part of process	Human as person	Human part of system	Humans as units of health	Human as a social being
Agents	Robens, Heinrich, Bird,	Difford, Taylorism	McSween, Lopez-Mena	DuPont, Geller	Reason, Hopkins, Hollnagel	Thomas, Reason	Dekker, Hollnagel, Green	Erikson, Dollard, Newman, Cara and MacRae	Slovic, Weick, Long
Language	Compliance, rules, controls, hazards	Hazards, barriers, preventions, hierarchies	Behaviour prevention punishment reward	All accidents are preventable, absolutes	Systems, incubation, method	Human error, due diligence	Human error, just culture	Health, well being, mental health, work-life balance, stressors	Heuristics, learning, perception, motivation, decision making, collective unconscious
View of Culture	Culture-as-rules	Culture-as-mechanics of systems	Culture-as-behaviour	Culture-as-perfect controls, perfect people	Culture-as-organisations	Culture-as-groups	Culture-as-leaders and systems	Culture-as-holistic relationships	Culture as a social construct
Key Question	How can we make people obey rules?	What is the mechanics of safety?	How can people be controlled?	How many injuries would you like today?	How does organisation affect safety?	How does the organisation affect safety?	How can people minimise human error?	How can we keep the whole person well?	How do social arrangements affect decisions?
Focus	Rules, Regulation, Hierarchy of controls	Method, order, control, conformity	Surveillance	Binary opposition fundamentalism	Improve process	Individuals in organisations	Improve systems	Well-being and mental health	Learning and social conditions
Solutions	Engineering, regulation	Increased policing and systems	Inputs and outputs	Counting injuries, punish mistakes	Understand flow and sequence	Reforming organisations	Understand human error and systems	Improving health and well being	Relinquish control, social ownership

Long, R. "**Transdisciplinary Thinking in Risk and Safety**"

Safety as a Social Construct

Risk and Safety Schools of Thought

Orthodox Legal	Safety Science	Behavioral-Based Safety	Zero Harm	Process-Based Safety	People-Based Safety	Psychosocial Safety	Social Psychological Safety

Of the systems characterized by Long, **social psychological safety**, (far right) focuses on safety culture as a *social construct* fostering the social arrangements and interpersonal relationships needed to facilitate better decision making.

What is a Social Construct?

- A social construct is defined as "an idea that has been created and accepted by the people in a society".

- Social constructs develop as a means for humans to organize their interactions.

- Ideas are construct objects (knowledge) and culture is the way of life shared by a group of people (society).

Time is a Social Construct

Safety as a Social Construct

- For research safety to operate effectively as a social construct within the campus community, an ***individual's concept of "safety" as a construct object must fit into the communal model.***

- Likewise, to shift culture, ***the society must value the change.***

- Because campuses are communities of diverse (and often compartmentalized) activities, ***creating a common structure for research safety is as important as it is complex.***

Strategies to Develop to Shift the Paradigm

- *Establish a Common Understanding of "Safety"*

- *Create Teams*

- *Educate the Next Generation in the New Paradigm*

Define Safety

Safety Complexity on Campuses

- Many aspects of safety – personal, public, and research environments

- Numerous stakeholders – administrators, faculty, staff, graduate and undergraduate student workers must be considered as well as non-paid undergraduate students or interns working in research labs

- Faculty operate in communities of work (legal compliance and educational contract) and communities of practice (responsible conduct to academic freedom and scientific integrity)

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Can You Define Safety?

- The International Labor Organization (ILO) defines occupational safety as…

- "…the science of the anticipation, recognition, evaluation and control of hazards arising in or from the workplace that could impair the health and well-being of workers, taking into account the possible impact on the surrounding communities and the general environment."

Shift the Paradigm – Common language

- Refining a broad definition such as the one used by the ILO to meet institutional needs will
  - (1) elevate safety to discipline status;
  - (2) focus consideration of the health and well-being of people and the environment into decision making for the community; and
  - (3) clearly indicate that using risk assessment to *understand* hazards is at the heart of safety science

Create Teams

Focus Question in Social Psychological Safety

"How do social arrangements affect decision making?"

Long, R. "**Transdisciplinary Thinking in Risk and Safety**"
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Input is Valued

- Environments where those in leadership value input from the "team" creates a culture where all group members feel comfortable contributing to safe work outcomes

- This approach has been used successfully in healthcare and aviation safety

# Shift the Paradigm - Using A Team Approach

- Offers better management of the inherent risks present in novel research

- Can reduce incidents from human error

- Enables proactively implementing controls as part of the scientific method, thus reducing the perception of safety as a impediment to research

Addressing Safety Proactively

- Was recognized in 2007 by NIOSH and stakeholders in the "Prevention through Design" or PtD initiative.

- PtD is based on the principle that, "Anticipating and designing out hazards in tools, equipment, processes, materials, structures, and the organization of work is the most effective way to prevent occupational injuries, illnesses, and fatalities."

Addressing Safety Proactively

- Operates at the highest level of the control hierarchy

Control Hierarchy
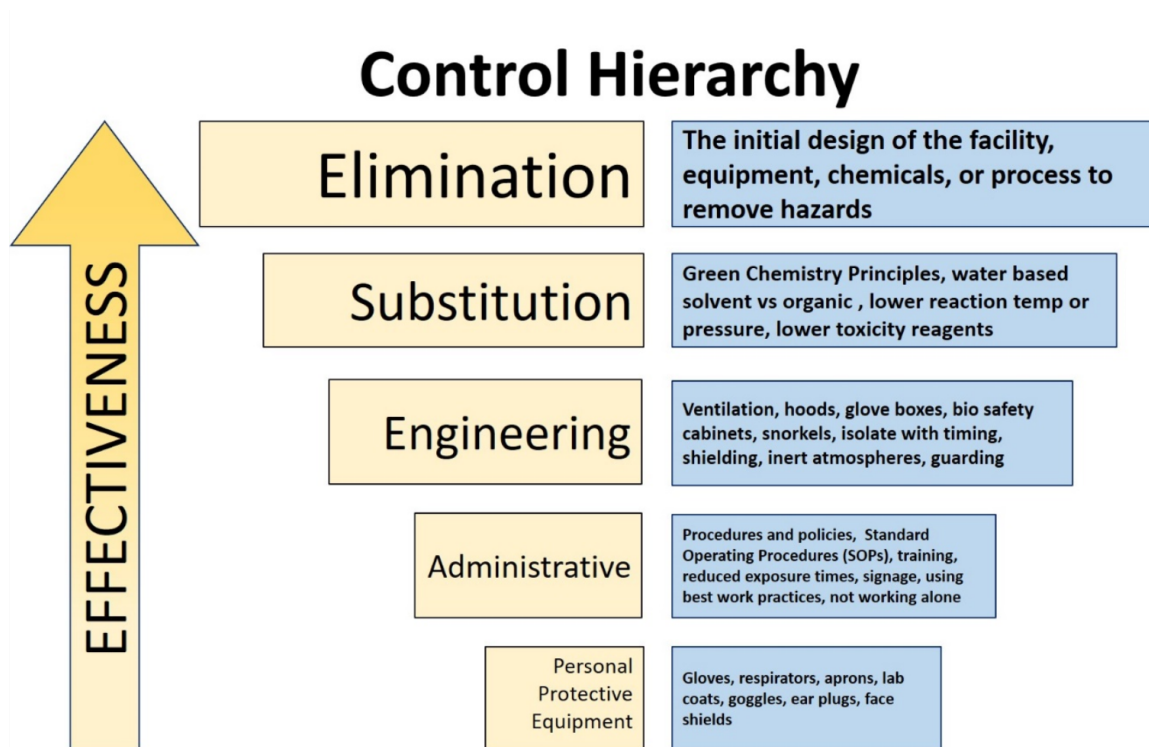
Build Your Team

- Including students in the "team" facilitates transitioning their mind from a teaching lab perspective of "do your own work" to a research perspective where teamwork is valued.

- When students become part of a "team", they are empowered to have input into their own safety which also helps them transition more successfully from a student to a professional chemist.

Consider Embedded Safety Professionals

- Housed locally, therefore can be involved in the "planning phases"
- Familiar with how academic research happens and understands how researchers work and think
- Can be faculty and report to the chair or dean
- Can be a liaison to EHS and represent faculty
- Focused on education and promotion of safe research
- Reduces "Us v. Them" dynamic

Educate the Next Generation in the New Paradigm

Language in the Social Construct

- In Long's comparison chart he emphasizes that, "risks, intrinsic motivation, heuristics, learning, mind, conversation" are the language of social psychological safety.

- We use **heuristics** daily to make fast decisions based on the *knowledge we have* and rules often cannot provide students with the knowledge needed to evaluate new situations.
  - Common sense
  - Rules of thumb
  - Educated guess

Transferring Knowledge

- Kuhn pointed out that in the sciences, textbooks are the primary way that established paradigms are communicated to new learners

- Because lecture textbooks rarely discuss the safety aspects of science, attitude and knowledge gaps are built into the professional scientist's educational process – "setting them up for failure"

Shift the Paradigm – Transferring Knowledge

- Chemistry laboratory procedures and lecture textbooks need to include concepts of safety science

- Transfer of safety information will improve when as it is included regularly in research papers, presentations, and posters

- Lessons learned must be shared to help students further develop critical thinking skills and reinforce a generative safety culture

Shift the Paradigm – Safety Education

- Creates knowledgeable students who
  - become empowered workers and informed mentors
  - can find reliable safety information beyond the Safety Data Sheet (SDS) allowing understanding of hazards and risks
  - can implement hazard controls more effectively using improved heuristics
  - engage their team in informed conversations when feeling unsafe

Looking Forward

OLD PARADIGM → **NEW PARADIGM**

(K) SAFETY INFORMATION TRANSFER…

...is based primarily on training compartmentalized topics built on compliance with regulations

→ ...involves developing chemical safety competencies by including chemical information literacy, communication, teamwork, and ethics learned as *educational subjects integrated into the curriculum*

(S) TECHNICAL ASPECTS OF SAFETY ARE TRANSFERRED…

...as procedural skills learned during laboratory work and as "common sense"

→ ....by teaching students to control risk using *hazard identification and risk assessment applied to laboratory work*

(A) THE SAFETY CULTURE PARADIGM IS BASED ON…

...enforcement & compliance

→ *...leadership and empowerment*

SAFETY MANAGEMENT IS BASED ON…

...a bureaucratic system which relies on training, rules, and punishment & control

→ ...the development of a **social construct that is** *resilient, transferrable, sustainable, and compatible with discovery research*

The New Paradigm

- Shifting paradigms does not necessarily mean that all aspects of the existing one should be thrown away
- Rules must still be utilized for novice workers and to create learning competencies that will be deepened and broadened by students
- Training is still needed for specific tasks
- Regulations must be addressed – the laws of the society cannot be broken under the cover of academic freedom.

The New Paradigm

- Rules, regulations, and training do not create a generative safety construct for academic research
- A community approach with a common language, teamwork, and education is needed
- Safety culture will improve as competencies in the discipline of safety are added to the curriculum and texts (from high school through graduate school)
- "The (new) way we do things"

Questions???