(Modelling) Indicators of Success in a Lab Safety Culture

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Today's Abstract

The term "safety culture" has a split personality. It can refer to:
- A safety management tool
or
- The social context for risk decisions made by individuals and groups.

**Hypothesis:** It seems likely that people working in an evolving safety culture will benefit from identifying objective indicators that describe how the safety culture of a group changes over time.

This presentation will explore 4 ways to approach this opportunity.
My Safety Management Education

In 1986, I was handed the UVM Hazardous Waste Program to manage as an "other duty as assigned" (along with hazcom, safety training, IAQ, etc.). The assignment was to establish “good faith” compliance with relevant regulations. The institution’s goal was to avoid becoming a Potentially Responsible Party at a Superfund site.

Over the next 7 years, this "good faith" approach resulted in 3 citations from the state of Vermont of increasing severity, leading to construction of a $2.2 million TSDF and the addition of 3 staff members (doubling the EHS staff at UVM).

In 1995, after a string of RCRA citations in higher ed, EPA New England asked the sector to “reinvent” a regulation for lab chemical waste, based on Environmental Management System theory. This project was enabled by the Project XL regulatory reinvention program and dubbed Lab-XL. The EMS approach uses the "Plan Do Check Act" cycle to support continuous improvement.

UVM joined with Boston College and UMass Boston to take on this opportunity.

- Over the course of a decade, the project evolved to take on a Balanced Scorecard approach to lab chemical waste management
- This resulting regulation was codified as RCRA Subpart K in 2008, after our data demonstrated increased pollution prevention
The Lab-XL Data Model We Used to Identify Indicators of Success

The Physical Model of Lab Chemical Use

Adding Stakeholders and Regulators to the Material Flow

Identifying Potential Indicators of Success
Applying PDCA to Lab Wastes

<table>
<thead>
<tr>
<th>Lab Waste Management phase</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan</td>
<td>Roster of lab rooms, people and science</td>
</tr>
<tr>
<td>Do</td>
<td>Budget for waste management facilities, disposal costs and staff</td>
</tr>
<tr>
<td>Check</td>
<td>• Conformance audits by internal staff</td>
</tr>
<tr>
<td></td>
<td>• Compliance inspections by regulators</td>
</tr>
<tr>
<td>Re-Act</td>
<td>Reorganizing reporting lines and budgets based on audit results (this process keeps the centralization / decentralization pendulum swinging)</td>
</tr>
</tbody>
</table>

These elements operate and change *simultaneously* and *independently*, so the system evolves unpredictably. "Culture" is how groups respond to unexpected changes.
Sustaining the XL Program: The Pivot to Culture

• Communicating with multiple stakeholders about the details of lab chemical waste management taught us to think metaphorically; this helped the 3 schools re-organize our data to tell an engaging story for both EPA and the campus community.

• In the process, we were able to leverage the cultural power of research in higher education by publishing 3 peer reviewed papers about the Lab-XL project; these publications established significant credibility within our institutions.

• We gained less credibility in the wider academic sector, where administrative waste managers were more comfortable with RCRA and less comfortable with discovery research.

• The Bottom Line:

  *Culture is Life Outside the Management System*
Chapter 5
Practices in the Danger Culture of Late Industrial Society

Arie Rip

Abstract The chapter replaces the question of risk control by one about how we handle danger in our societies and realize a measure of safety. Ongoing practices in a framework of ‘danger cultures’ are the key. The case of environmental and health inspection and the intersecting ‘social worlds’ involved, are used as a case to indicate important features.

The Illusion of Risk Control: What Does it Take to Live With Uncertainty?

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Reflections on Safety Culture

• The emotional labor associated with risky group work is embedded in safety culture practices
• Employees develop a vision for how their role connects to the organizational safety mission.
  • In the process, they use metaphors to consolidate complicated (risk) information into memorable chunks.
  • Cultures share stories to connect metaphors to explain "what practices are safe enough"
• Different risk cultures rely on different levels of Bloom's Taxonomy to manage safety/
  • This impacts where the emotional labor around risk is done
  • For example, RCRA culture is about remembering; research culture is about creating
Reasons for Safety Culture Indicators

• Develop culturally aware expectations for training and oversight programs (Plan)
• Identify safety leadership skills appropriate to the roles and responsibilities of laboratory stakeholders (Do)
• Track progress in safety culture work (Check)
• Generate ideas for improving lab safety program practices (Re-act)

• **NOT** to assess “safety performance”
• **NOT** to compare locations or disciplines
• **NOT** to generate Pass/Fail consequences
Two Concerns with this model

- It assumes a single Organizational Safety Culture; that is not my experience of academia (or Rip’s risk culture model, or Dr. Silbey’s findings described yesterday).
- It is very difficult to generate SMART goals for a Balanced Scorecard working with 24 observations.
With This in Mind, An Alternative Cultural Model: Story-Making (Model 2: Research)

Story Telling can inspire an engaged audience to generate new ideas.

However, the Story Telling model is a problem if the story changes as it is re-interpreted and shared by people with different priorities.
Elements of Lab Safety to Build Culturally Relevant Stories With

An indicator of the relevance to lab culture of this tool is that it is the most visited page on dchas.org.
## Model 3 Teaching: The Academic Education Model

<table>
<thead>
<tr>
<th>Management cycle aspect</th>
<th>Lab management practices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plan</strong></td>
<td>Semester-level flexibility is the top priority because academic lab sciences, technologies and people are significantly impacted by changes in that timeframe</td>
</tr>
<tr>
<td><strong>Do</strong></td>
<td>Routinely underfunded project work is pursued, based on student labor rates</td>
</tr>
<tr>
<td><strong>Check</strong></td>
<td>Will this work pass peer review for either funding or publishing?</td>
</tr>
<tr>
<td><strong>Re-Act</strong></td>
<td>Using scientific learning to write the next project plan</td>
</tr>
</tbody>
</table>
An Educational Model for Safety KSA Development

- Chemical Knowledge
- Lab Skills
- Scientific Culture
- Math; Information Searching; Plumbing

- Awareness of broader community's fear of hazardous chemicals; familiarity with expectations of Safe Science, APLU resources and opportunities in LST work

Levels:
- Research Chemist
- Graduate Student
- Undergraduate
- High School

Chemical Sciences and Safety Education; SACL and Prudent Practices
Model 4 Service: Identify and Work with Cultural Biases about Hazardous Waste

Risk Culture Diversity in organizations arises when varying priorities lead to “Cultural Cognitive Biases”

What Should We Remember?
What Should We Forget?

Examples of cognitive biases:
Confirmation Bias
Selective perception
Cue-dependent forgetting

Need to Act Fast
Not Enough Meaning

https://www.teachthought.com/critical-thinking/cognitive-biases/
The Lab-XL Project redistributed information roles and responsibilities from the RCRA model to an institution-based model. This meant labs could focus on scientific opportunities for waste minimization rather than RCRA waste codes. We also expanded the stakeholder pool to include emergency responders.
Potential Safety Culture Indicators

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership (aka MBWA: Management by Walking Around)</td>
<td>Number of leadership lab visits that discuss safety (see <a href="https://dchas.org/2021/05/13/bms-spyder/">https://dchas.org/2021/05/13/bms-spyder/</a>)</td>
</tr>
<tr>
<td>Communication Patterns</td>
<td>Safety messages that connect to the mission</td>
</tr>
<tr>
<td>Feedback Loops</td>
<td>Education about listening practices when safety concerns are raised</td>
</tr>
<tr>
<td>Sharing Safety Lessons Learned</td>
<td>Publishing Lessons Learned (as described in ACS Guide for Scholarly Communication)</td>
</tr>
</tbody>
</table>
All Culture Indicators are Local

Leadership tools
- Bristol Myers Squibb’s Spyder program

Safety Communication patterns
- KSC metals shop signage that supports “enclothed cognition”

Feedback loops
- KSC Wood shop signage encouraging dialogue about safety and other topics

Sharing Lessons Leaned
- Real life Data about Incidents at KSC as part of onboarding
Three Take Home Messages

This is a big topic, but key points that come out of this portion of it is:

1. Culture change programs are most effective when they fit within the larger mission of the organization. In academia, the larger mission is *teaching, research, service*.

2. Academic laboratory cultures are **internally diverse** with a wide variety of risk cultures co-existing in the same location and organizations.

3. Indicators of changes in risk culture will **evolve over time** as the culture responds to environmental changes.

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A *Safety Culture Iceberg* from Mary Beth Mulcahy's CHAS Journal Club Presentation.
Questions?

It takes a village to build a culture!

My thanks to:
• Dan Kuespert for his question the kicking off this symposium
• Arie Rip and Susan Sibley for their research
• The Lab-XL Schools for the data
• Robin Izzo and her staff for graphical thinking
• Sammye Sigmann for help in identifying how connect to academia's educational mission
• Mary Beth Mulcahy for pursuing safety culture technology transfer from the CSB to the lab setting