Supporting development of chemical risk assessment skills

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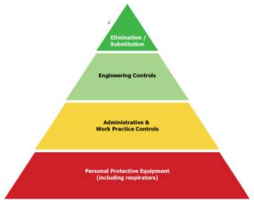
21st Century Lab Safety involves both Technical and Cultural Challenges

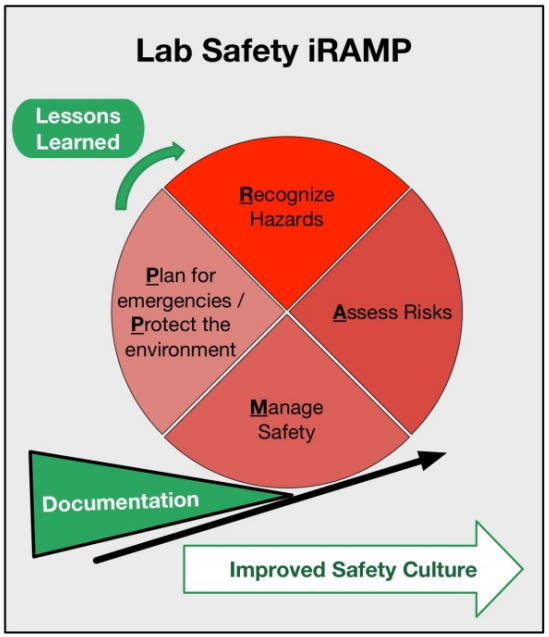
20th Century:
Control Based on Rules, guided by Chemical Intuition



Manage Hazards

Culture Change through Safety Education

21st Century:
a Safety System based on Risk Assessment

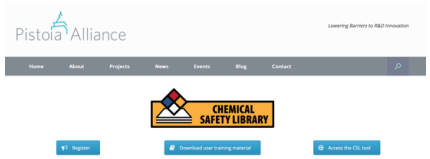


…but there is no bright line between technical learning and cultural learning; that's why educators think in terms of

knowledge, skills and attitude (culture)

Modern Lab Safety Tools

Share JHAs and Lessons Learned



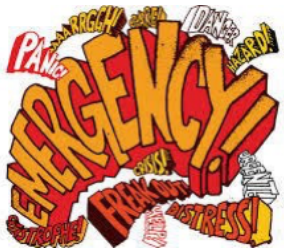
Recognize

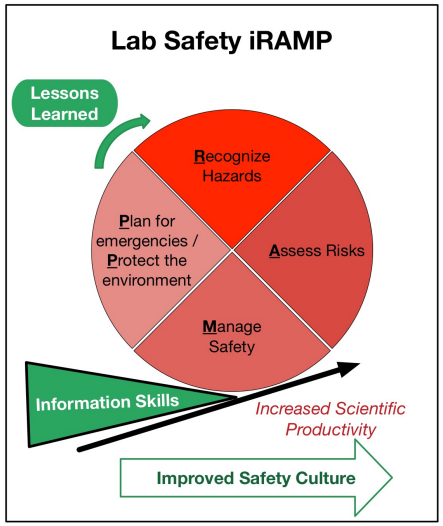
Pictogram	GHS class	Signal Words
	Explosive	Danger or Warning
	Oxidizer	Danger or Warning
	Flammable	Danger or Warning
	Corrosive	Warning only (physical)
	Compressed Gas	Warning only

Pictogram	GHS class	Signal Words
	Corrosive	Danger only (health)
	Toxic	Danger only
	Health Hazard	Danger or Warning
	Irritant	Warning only
	Environmental	Warning only

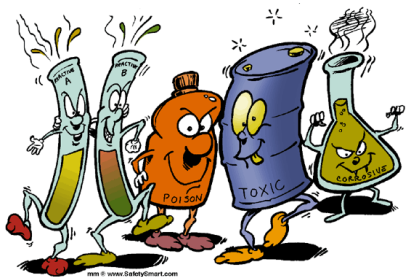
Assess

Plan

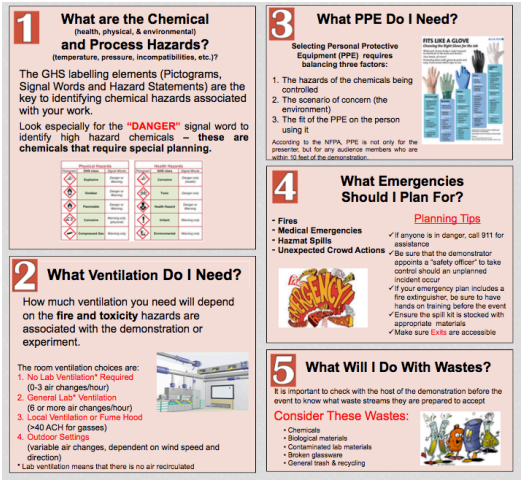




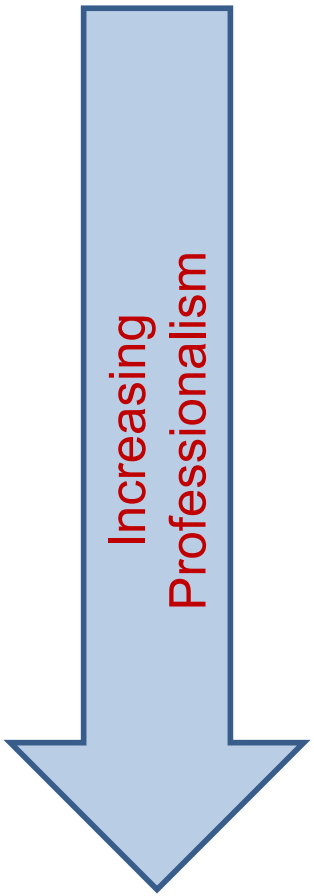
Protect



Manage



Safety Education



The four stages of learning
Unconscious incompetence
Conscious incompetence
Conscious competence
Unconscious competence (must be used to be maintained)

The Goal:

Move expectations from the ***bureaucratic approach (i.e. blame and train)*** focused on roles and responsibilities to a ***learning culture*** based on **leadership and empowerment**

This learning culture relies on people being comfortable giving and receiving feedback about where they are in this scale of safety learning.

The *Assessing* Challenge: Both Knowledge and Judgement are involved

KNOW THE DIFFERENCE BETWEEN A HAZARD AND A RISK

"Hazard" and "risk" are NOT the same.

Hazard

- A hazard causes harm.
- A hazard can be eliminated, but not reduced.

Risk

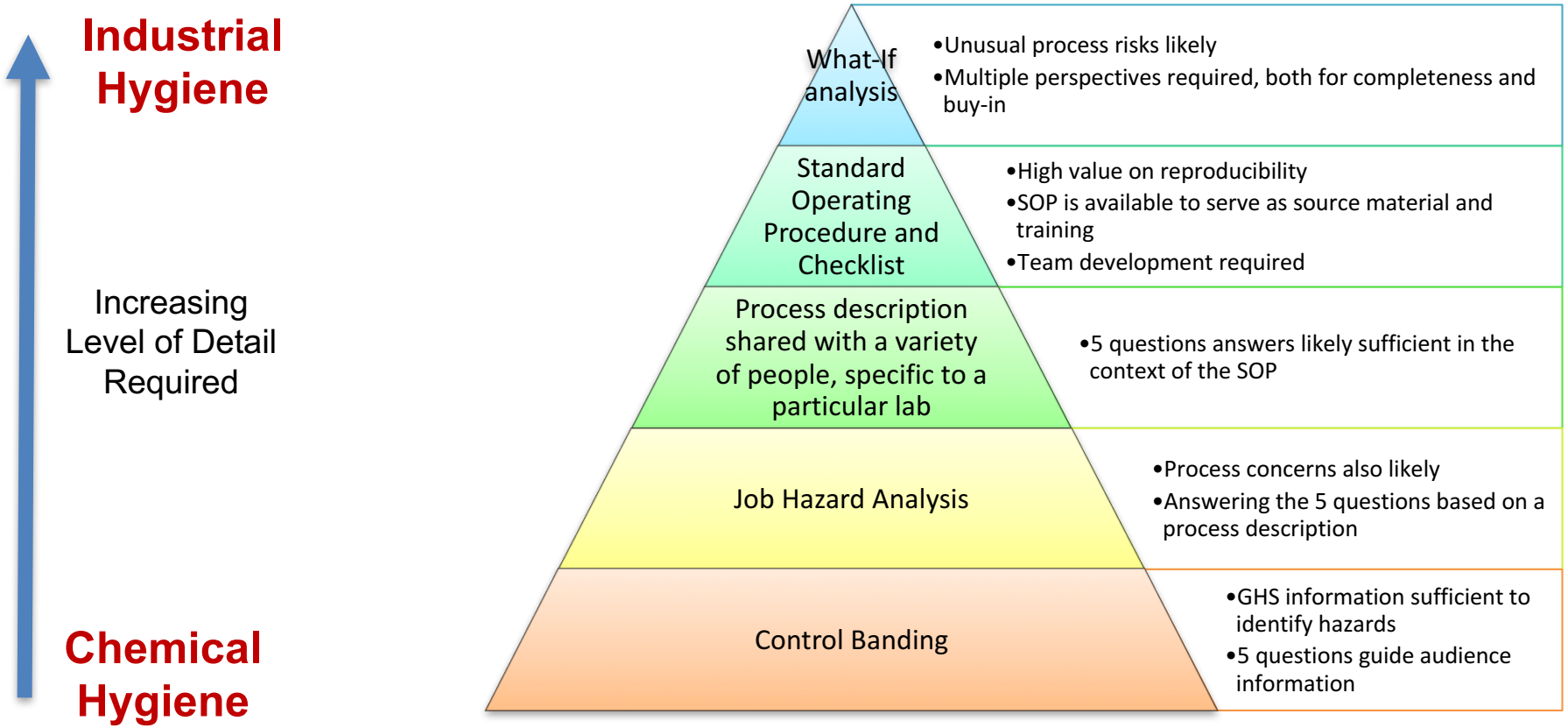
- Risk is the probability that a hazard will cause harm.
- Risk associated with a hazard can be reduced.

Risk = hazard x exposure

Knowledge (including uncertainties)

Estimate based on scenarios

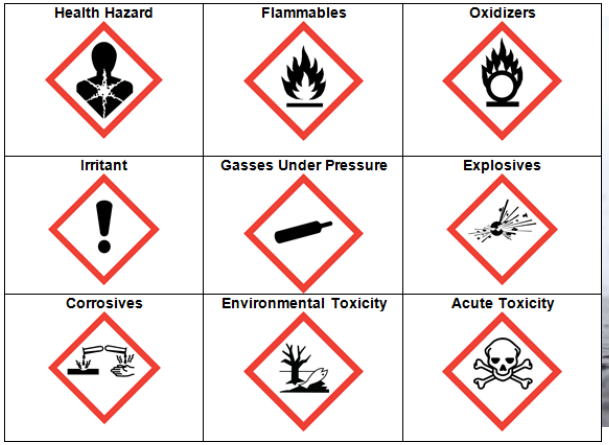
The Technical Assessment Process

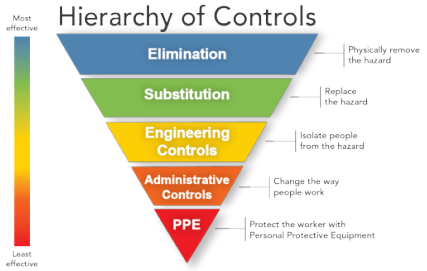


Methods from *Identifying and Evaluating Hazards in Research Laboratories*

Conducting a Job Hazard Assessment

Identify hazards → Analyze risks → Select controls





Current Academic Lab Risk Asssessment Practices

- Information Literacy needs to be applied to SDS's and other safety information sources
- Physical hazards are often overlooked because they are so well controlled in teaching labs

The Managing Safety Step:
Control Bands and Job Hazard Analysis

Use of **Chemicals of Special Concern** require process specific **job hazard analysis** to establish appropriate practices

Chemicals of Special Concern

GHS Danger Chemicals

Pictogram	GHS class	Signal Words
	Explosive	Danger or Warning
	Oxidizer	Danger or Warning
	Flammable	Danger or Warning

Pictogram	GHS class	Signal Words
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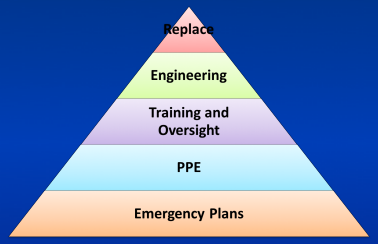


Routine "Service" Chemicals

Standard uses of "service" chemicals can rely on **control bands** to assign:

- Ventilation requirements
- Training and Oversight
- PPE
- Emergency Plans

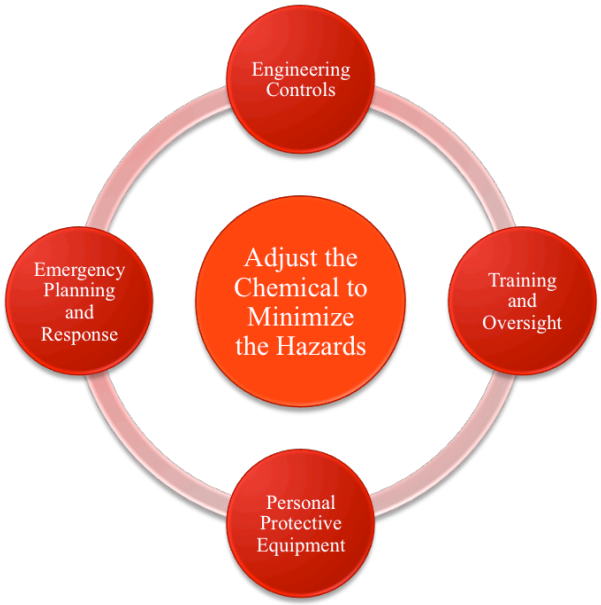
GHS Warning Chemicals

	Corrosive	Warning only (physical)
	Compressed Gas	Warning only

	Irritant	Warning only
	Environmental	Warning only

Theoretical Considerations in Control Banding

1. Control bands operate best within a specific layer of the hierarchy of controls, when based on specific hazards
2. Successful control banding programs are:
   - Scalable
   - Transferable
   - Sustainable
3. It is important to remember control bands throw away some information to support risk management judgements



Types of Control Bands

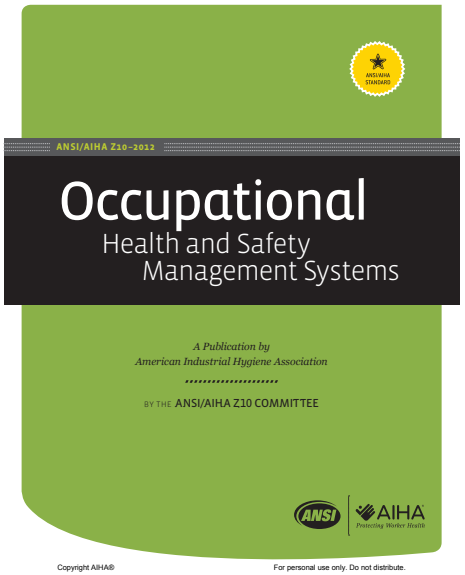
Control bands will be different for different hazards, depending on physical aspects of the hazards

Control	Hazard	Properties of Concern
General Laboratory Ventilation	Flammability; odor; inhalation toxicity	Airborne concentration relative to LEL, odor threshold, OEL
Inspection frequency	Unusual hazards	GHS Danger signal word
Training	Standard hazards	GHS classification
Personal protective equipment	Contamination, emergency releases	Concentration of solids or liquids
Waste disposal options	Ignitable, corrosive, reactive	Regulatory status (RCRA is what happens when industrial hygiene is applied to labs)
Emergency Planning	Significant scenarios	Chemical reactivity

Developing a Control Banding System

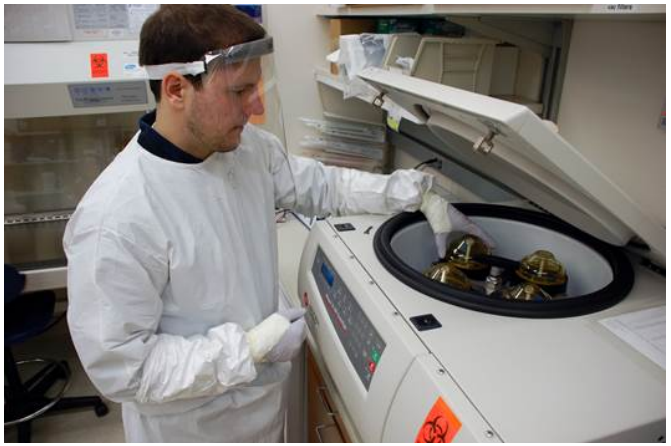
Control Banding Programs should be built around ANSI Z.10, specifically defining:

1. **Boundaries** of the program
   - OSHA lab standard quantities of chemicals
   - Rooms with single pass general ventilation
   - Chemicals with GHS hazard information available
2. **Stakeholders**
   - Roles (Powers)
   - Responsibilities (Leadership)
3. **Indicators** and **Goals**
   - Availability of chem inventory information (leading)
   - Exposure concentrations (lagging)
   - Availability of GHS hazard information (leading)
   - Frequency and effectiveness of management of change program (lagging)
4. **Change Management**



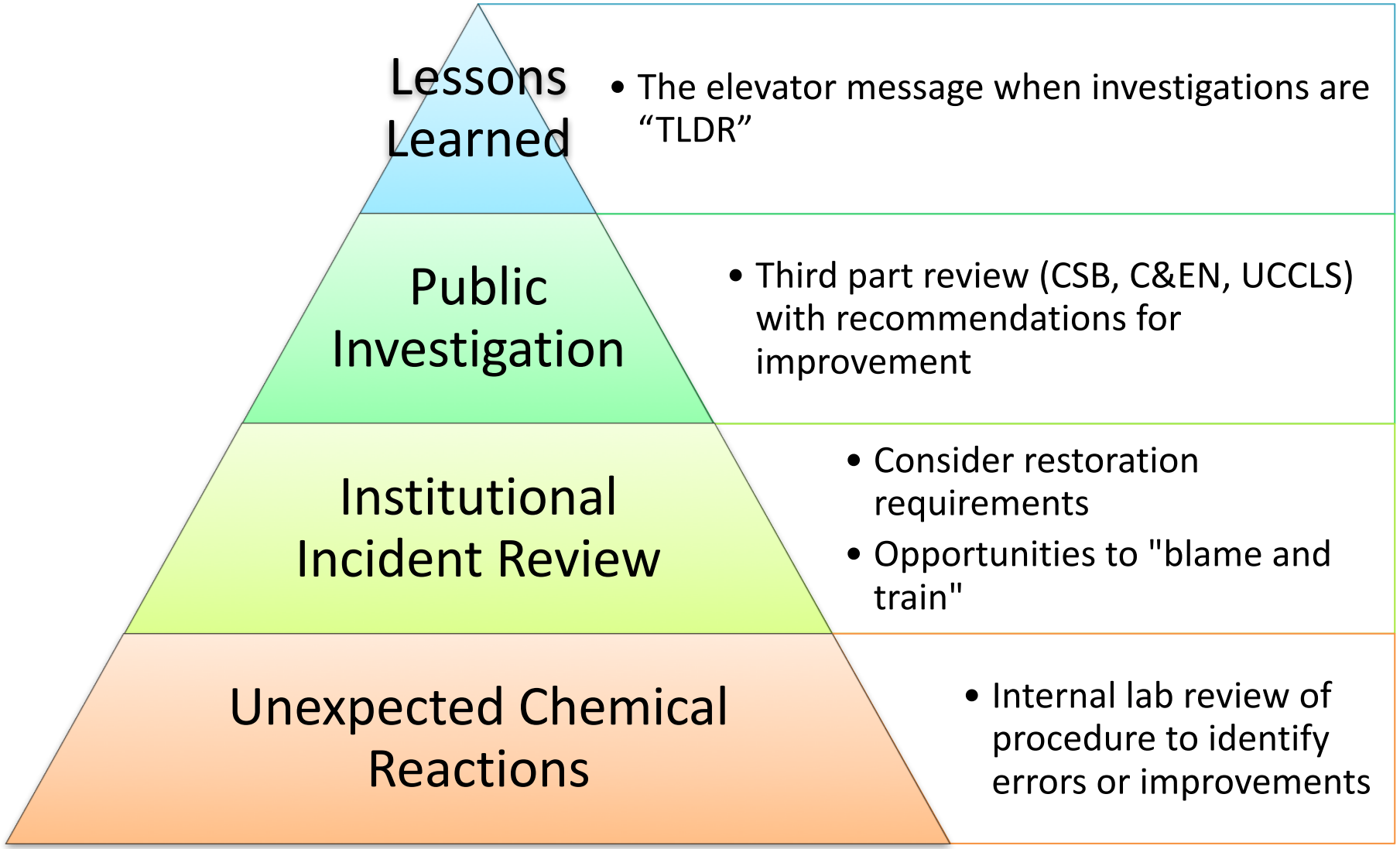
A Clash of Control Bands

"My chemical safety folks are upset with the below photo of a researcher in a BSL-2 lab. They say a face shield alone offers insufficient splash protection. They say that a face shield should only be used for splash protection when the user is ALSO using goggles or safety glasses.



"But my biosafety folks quote the BMBL for BSL-2, which says, "Eye and face protection (goggles, mask, face shield or other splatter guard) is used for anticipated splashes or sprays of infectious or other hazardous materials when the microorganisms must be handled outside the BSC or containment device." They claim that the face shield alone is sufficient, appropriate and correct, as it s the photo."

Different Types of Accident Follow up



Questions?


PATH OF LEAST RESISTANCE
OF COURSE IT'S SLIPPERY.
9-16
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Questions?

GHS + Assessment -> Lab Management + Institutional Support