



HEALTHIER WORKPLACES | A HEALTHIER WORLD

AIHA: ACCELERATING ADVANCEMENTS IN OUR SCIENCE, PRACTICE, AND STANDARDS OF CARE

John R. Mulhausen, PhD, CIH, CSP, FAIHA

“Adaptation of Science, Risk and Culture in the New World”

AIHA YUMA Pacific Southwest Local Section 47th Annual Meeting

January 21, 2022

A WORLD WHERE ALL WORKERS AND THEIR COMMUNITIES ARE HEALTHY AND SAFE



AIHA AND OUR PROFESSION

ACCELERATING WORKER PROTECTION BY ADVANCING OUR SCIENCE, PRACTICE, AND STANDARDS OF CARE

- **Continuous Improvement: State of the Art vs. Practice**
- **AIHA / ACGIH Defining the Science**
- **Improving Exposure Judgement Accuracy**
- **AIHA Standards of Care**



AIHA AND OUR PROFESSION

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- AIHA Standards of Care





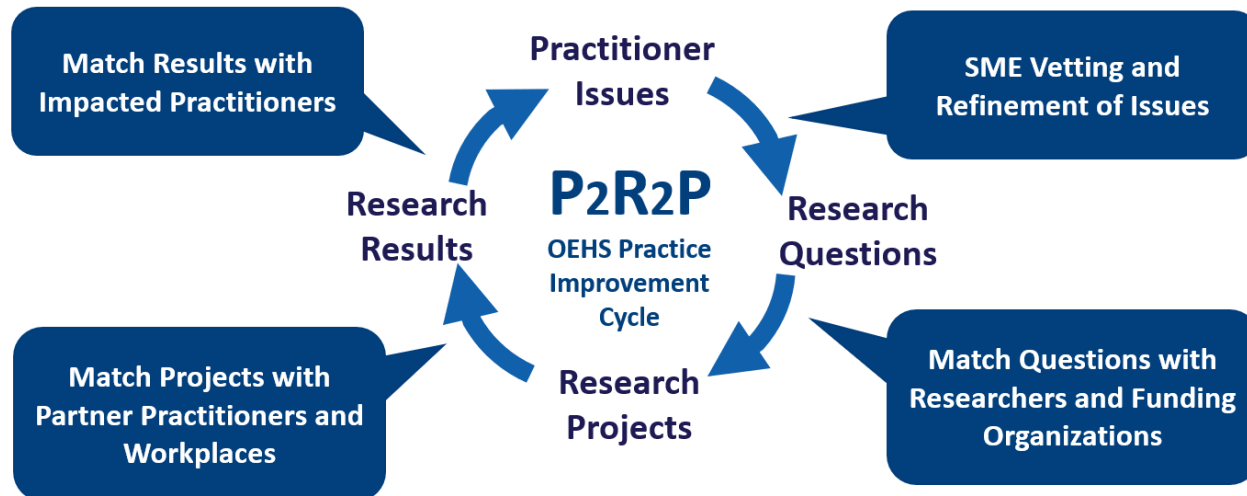
HEALTHIER WORKPLACES | A HEALTHIER WORLD

AIHA / ACGIH “DEFINING THE SCIENCE” INITIATIVE

AIHA / ACGIH DEFINING THE SCIENCE

Making Research Work for Practitioners to Improve Protection for Workers and Communities

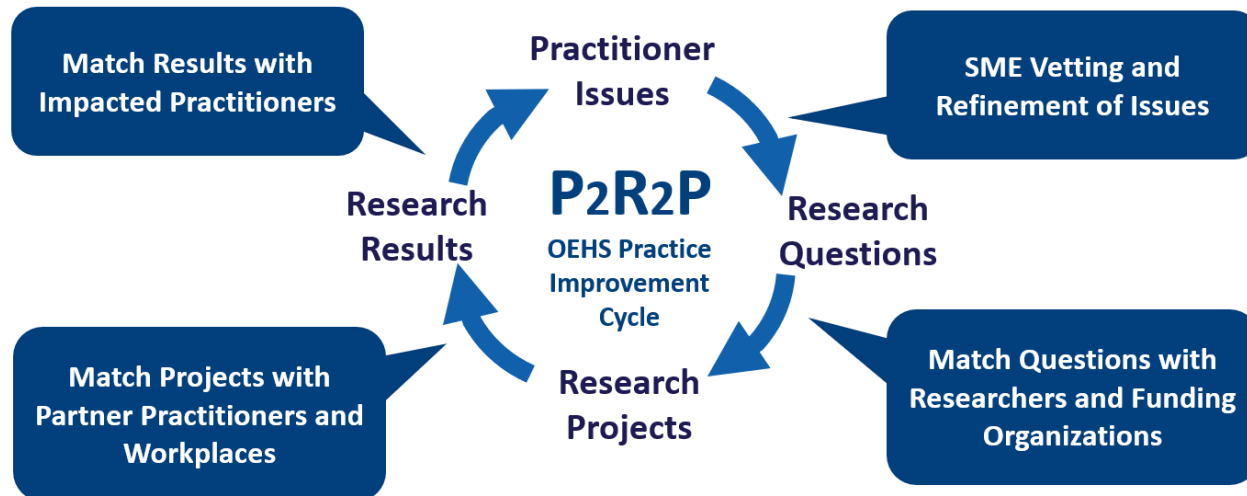
Practice-To-Research-To-Practice™



AIHA / ACGIH DEFINING THE SCIENCE

Making Research Work for Practitioners to Improve Protection for Workers and Communities

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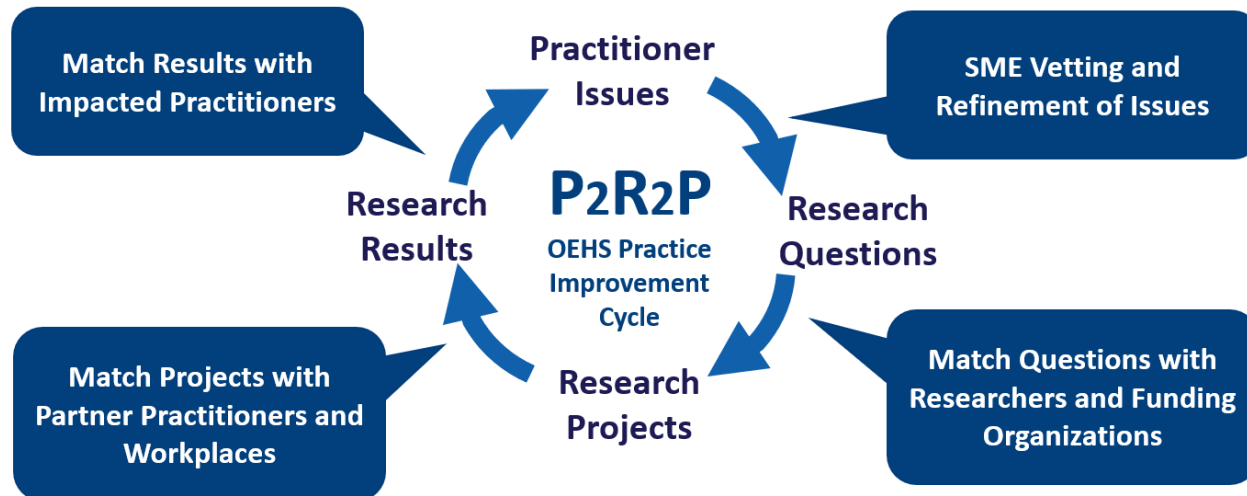


1. Identify research initiatives needed to advance the state of OEHS science to address gaps in effective and efficient practice.

AIHA / ACGIH DEFINING THE SCIENCE

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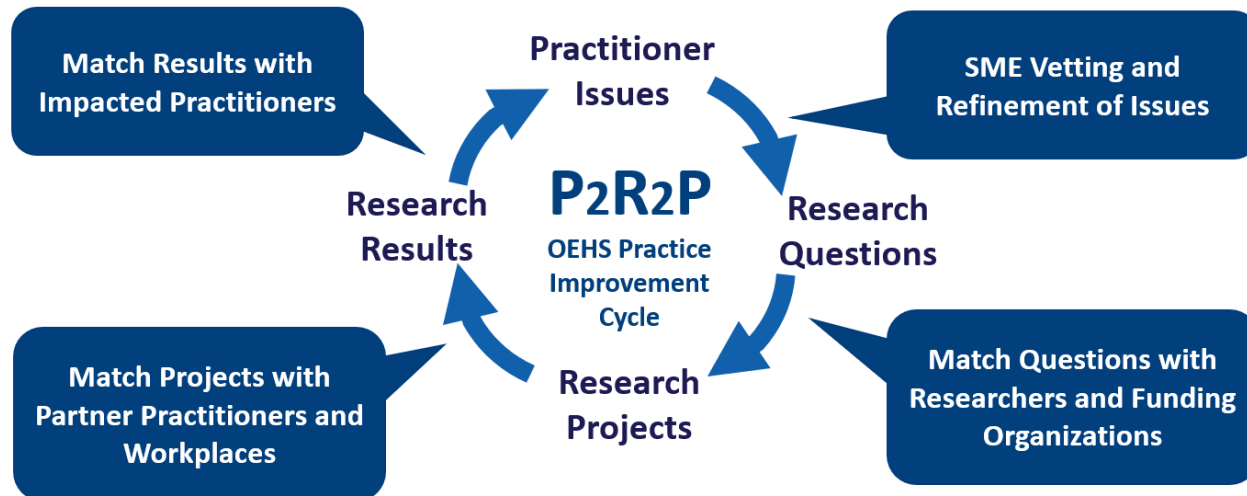


1. Identify research initiatives needed to advance the state of OEHS science to address gaps in effective and efficient practice.
2. Identify areas of practice that do not hold up to current OEHS scientific findings so that AIHA, ACGIH, and other stakeholders may improve practice through focused outreach, promotion, and training.

AIHA / ACGIH DEFINING THE SCIENCE

Making Research Work for Practitioners to Improve Protection for Workers and Communities

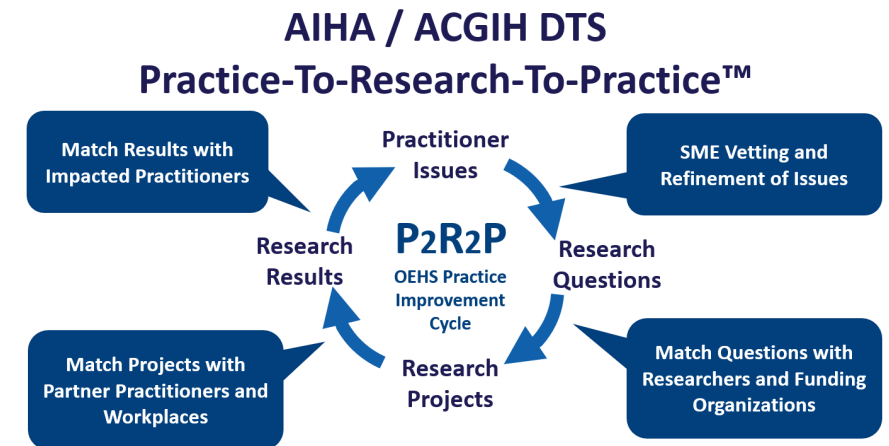
Practice-To-Research-To-Practice™



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AIHA / ACGIH DEFINING THE SCIENCE

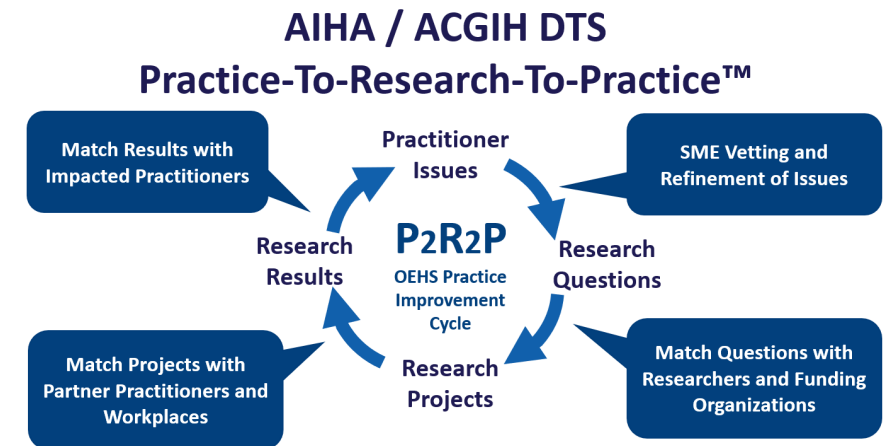
Improving Exposure Judgement Accuracy



AIHA / ACGIH DEFINING THE SCIENCE




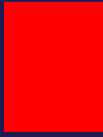
Improving Exposure Judgement Accuracy

The Science . . .



EXPOSURE RISK DECISIONS: HOW ACCURATE ARE WE?



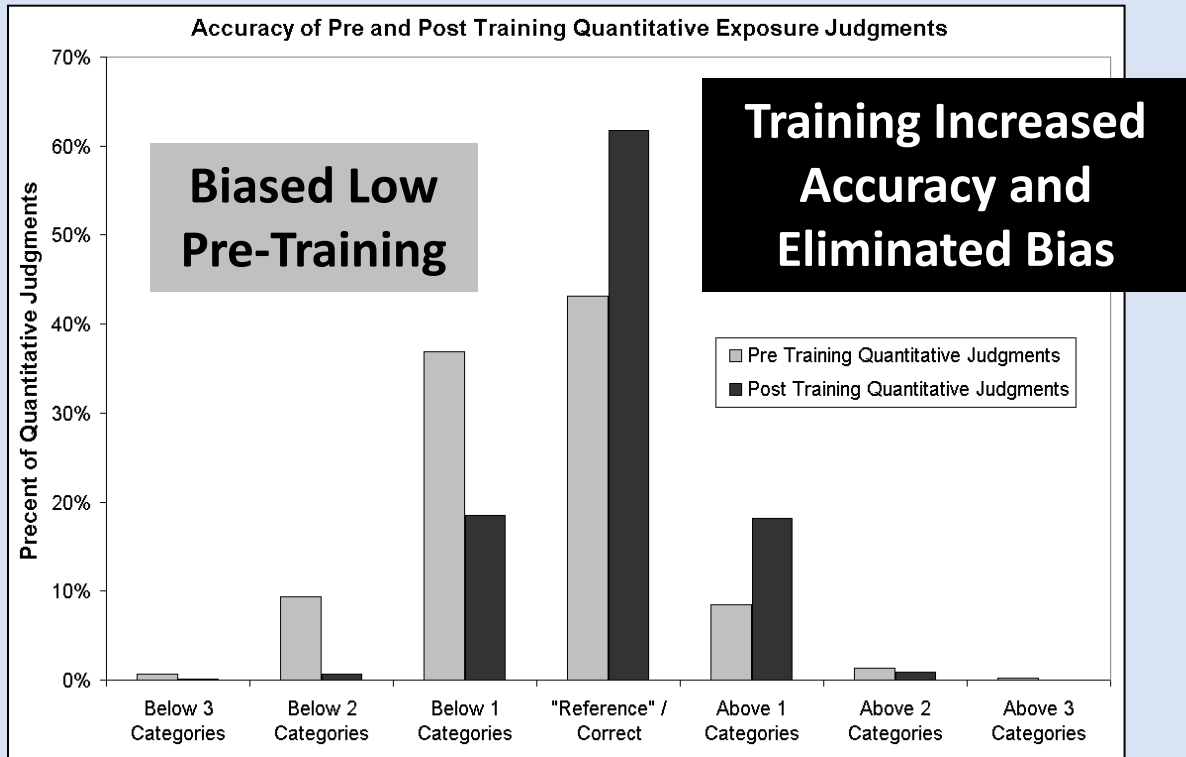
	Exposure Risk Rating Category*
	1 (<10% of OEL)
	2 (10-50% of OEL)
	3 (50-100% of OEL)
	4 (>100% of OEL)

* Decision statistic = 95th percentile

JUDGEMENT ACCURACY PRE- AND POST- STATISTICAL TRAINING

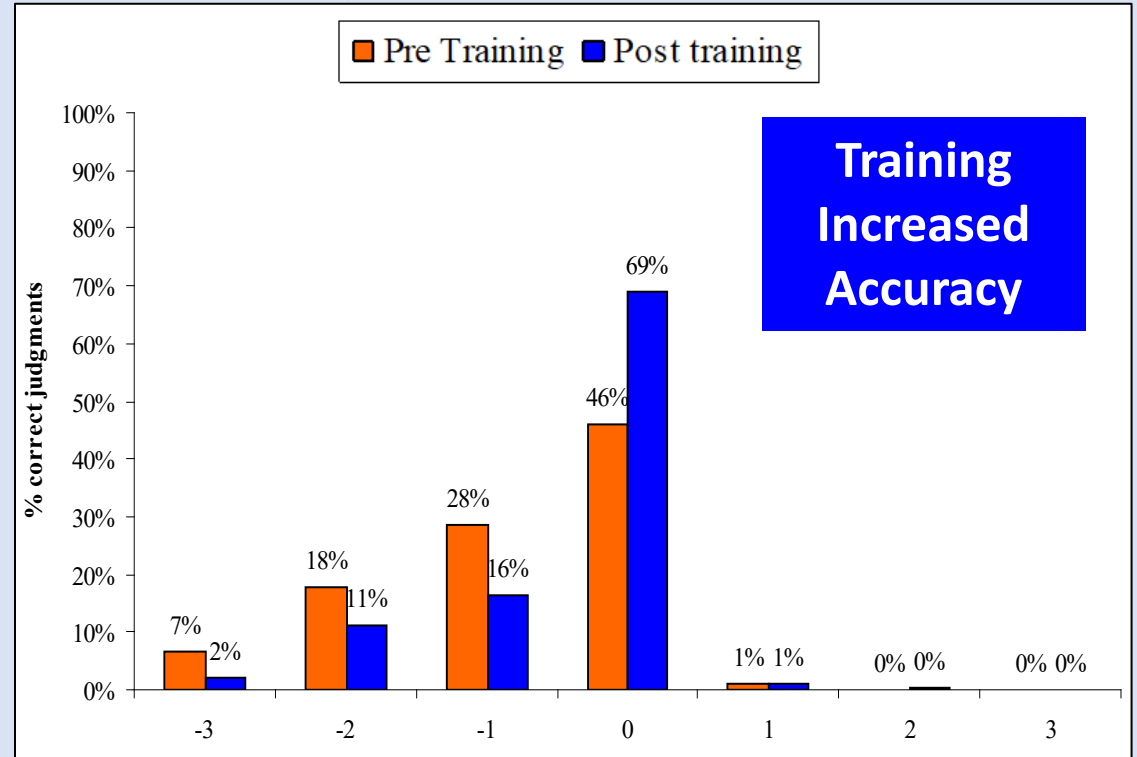
**BASED ON
MONITORING DATA**

Video Tasks



P. Logan, G. Ramachandran, J. Mulhausen and P. Hewett "Occupational Exposure Decisions: Can Limited Data Interpretation Training Help Improve Accuracy?". Annals of Occupational Hygiene - 2009

Actual Workplace Assessments



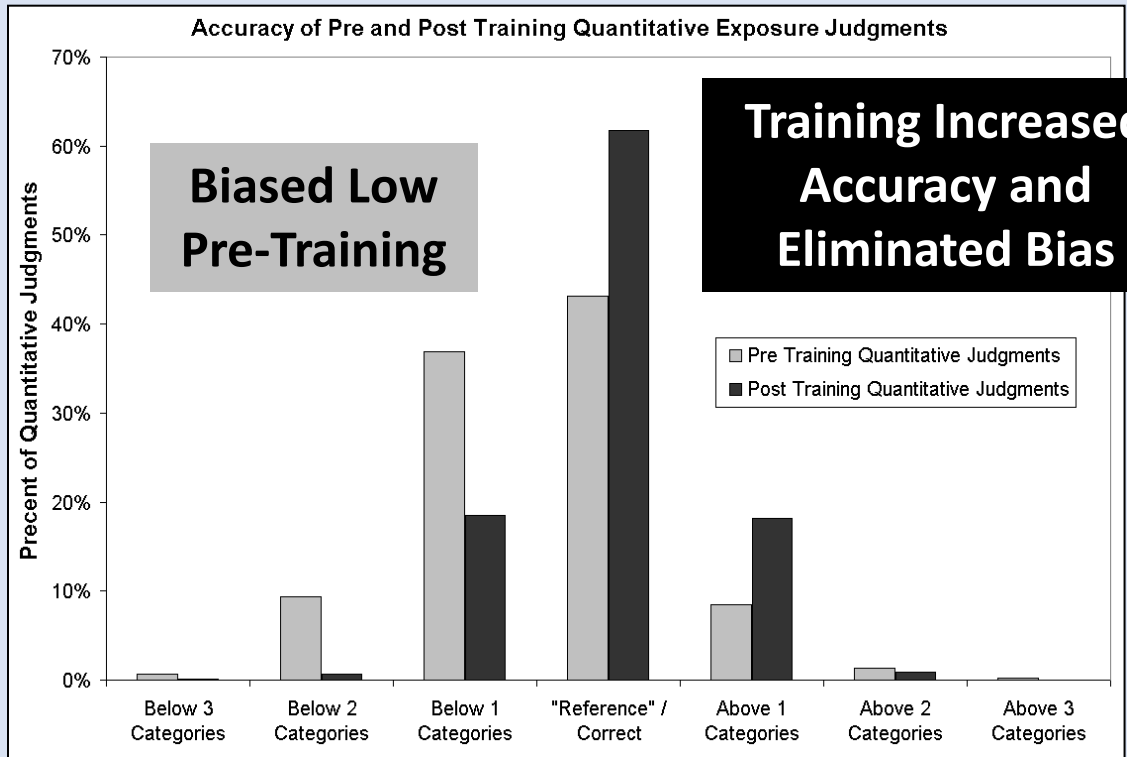
Vadali, Ramachandran, Mulhausen & Banerjee (2012): "Effect of Training on Exposure Judgment Accuracy of Industrial Hygienists", Journal of Occupational and Environmental Hygiene, 9:4, 242-256

JUDGEMENT ACCURACY PRE- AND POST- STATISTICAL TRAINING

**BASED ON
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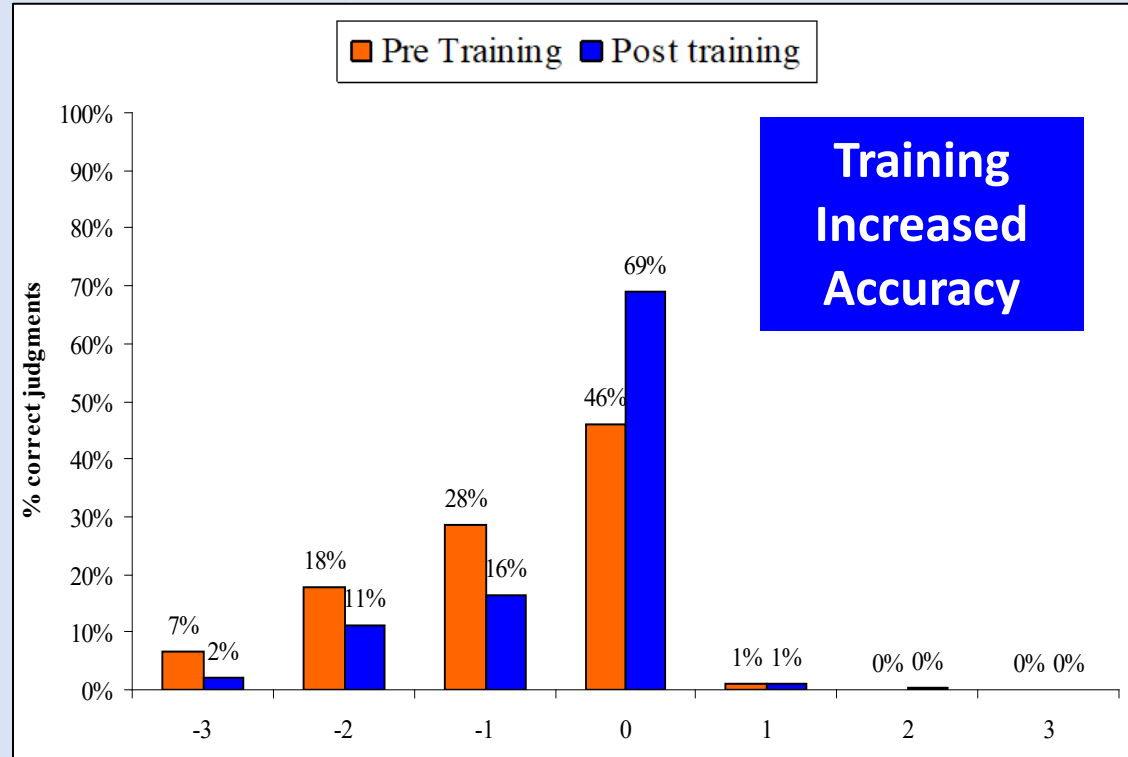
**Before Statistical Training:
Poor Accuracy & Underestimation Bias**

Video Tasks



P. Logan, G. Ramachandran, J. Mulhausen and P. Hewett "Occupational Exposure Decisions: Can Limited Data Interpretation Training Help Improve Accuracy?". Annals of Occupational Hygiene - 2009

Actual Workplace Assessments

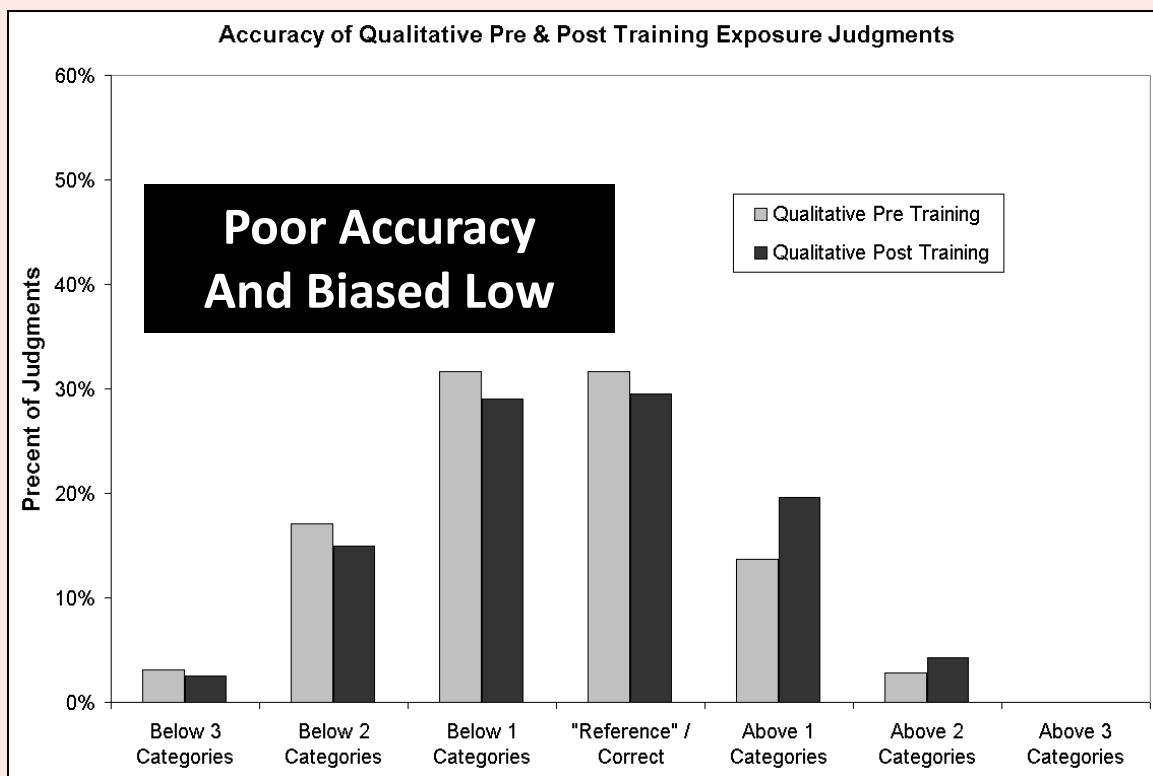


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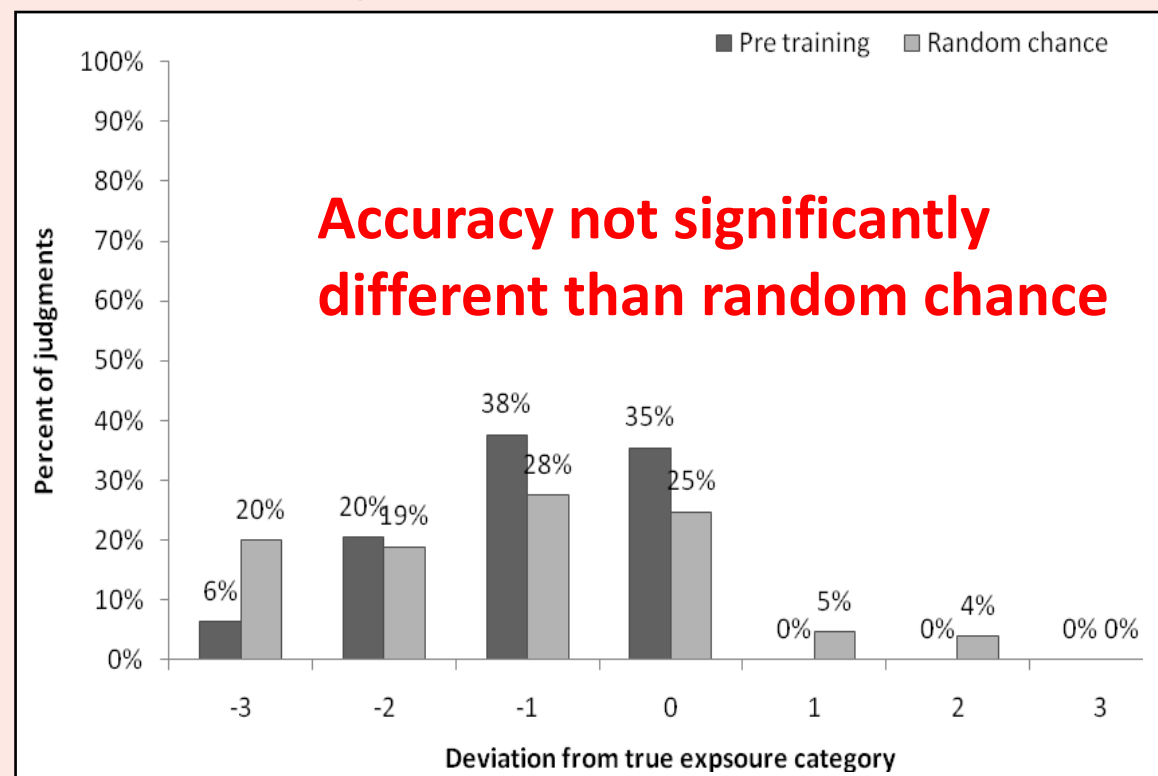
NO MONITORING
DATA AVAILABLE

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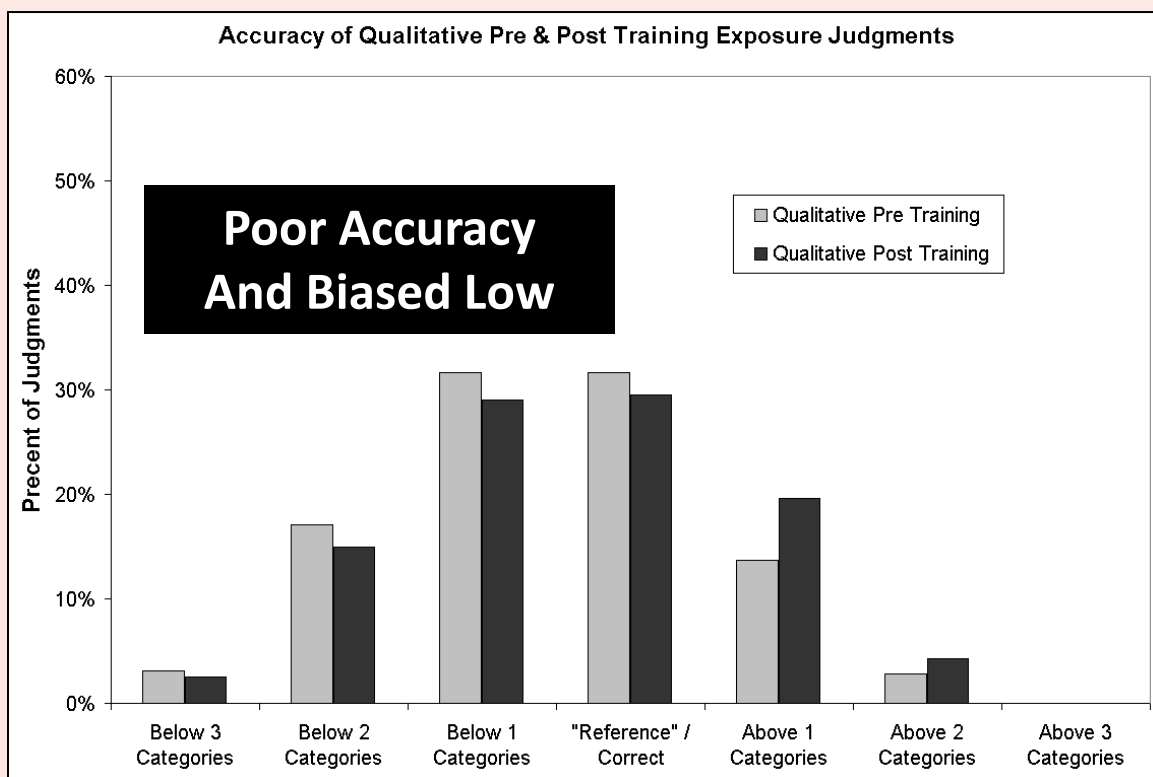
Vadali, Ramachandran, Mulhausen & Banerjee (2012): "Effect of Training on Exposure Judgment Accuracy of Industrial Hygienists", Journal of Occupational and Environmental Hygiene, 9:4, 242-256

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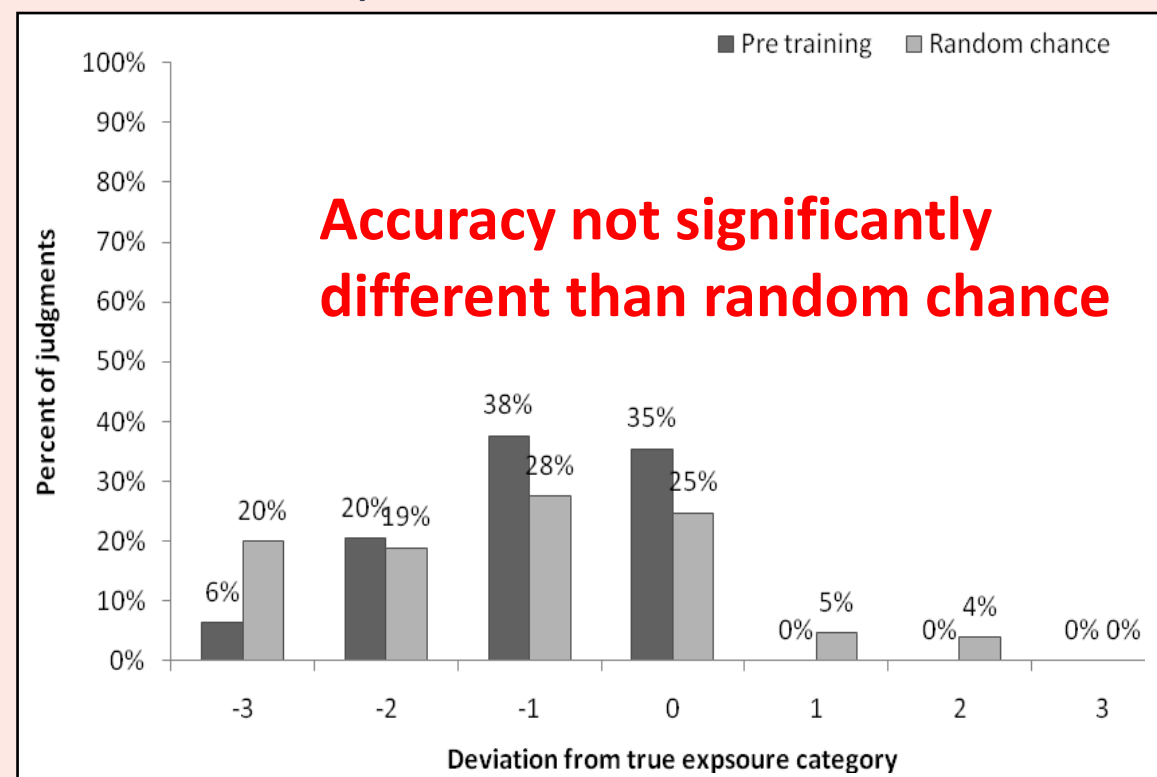
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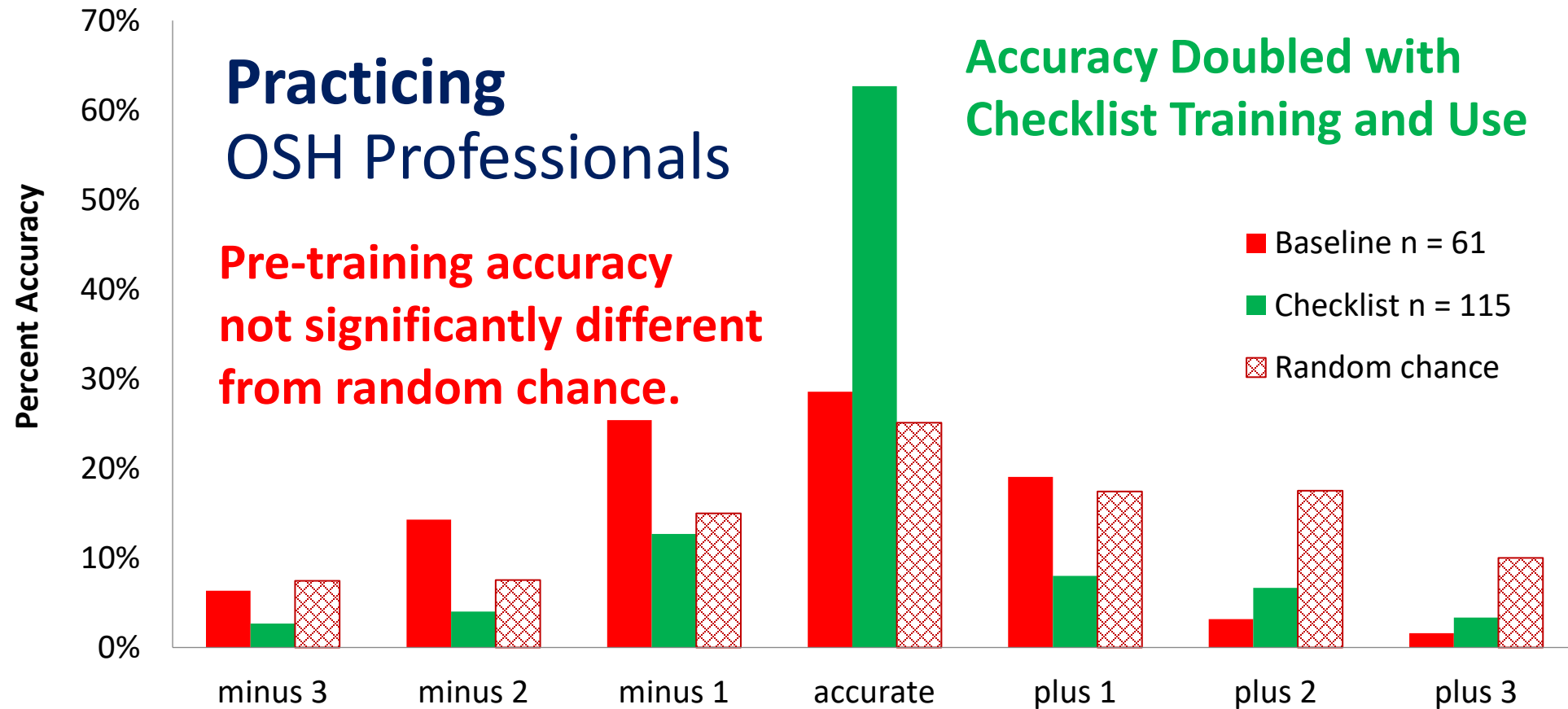
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JUDGEMENT ACCURACY PRE- AND POST- CHECKLIST TRAINING AND USE

NO MONITORING
DATA AVAILABLE

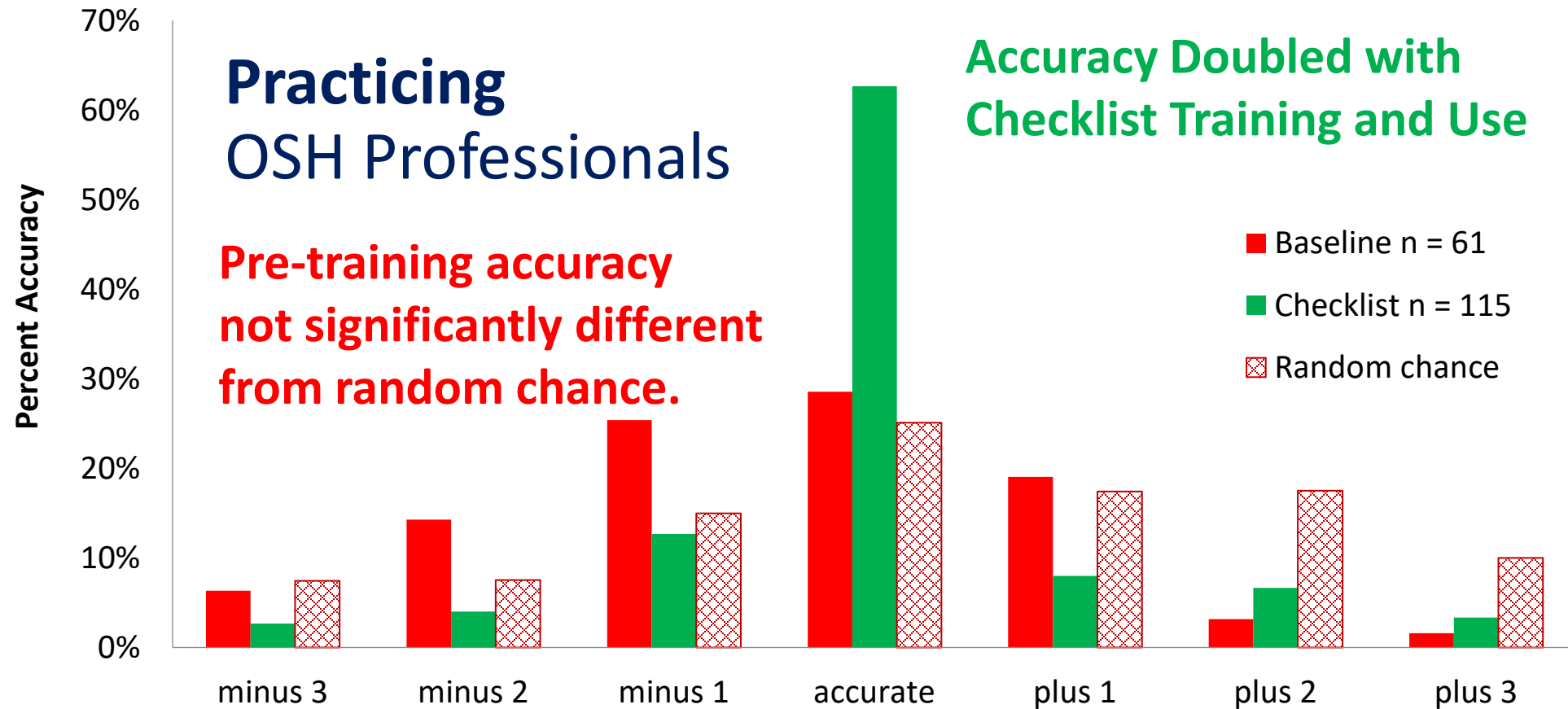


Susan F. Arnold; Mark Stenzel; Daniel Drolet; Gurumurthy Ramachandran; "Using Checklists and Algorithms to Improve Qualitative Exposure Judgment Accuracy", *Journal of Occupational and Environmental Hygiene* 2016, 13, 159-168.

JUDGEMENT ACCURACY PRE- AND POST- CHECKLIST TRAINING AND USE

NO MONITORING
DATA AVAILABLE

Before Checklist Training and Use:
Poor Accuracy & Underestimation Bias



Susan F. Arnold; Mark Stenzel; Daniel Drolet; Gurumurthy Ramachandran; "Using Checklists and Algorithms to Improve Qualitative Exposure Judgment Accuracy", *Journal of Occupational and Environmental Hygiene* 2016, 13, 159-168.

HOW CAN WE IMPROVE OUR JUDGMENTS?

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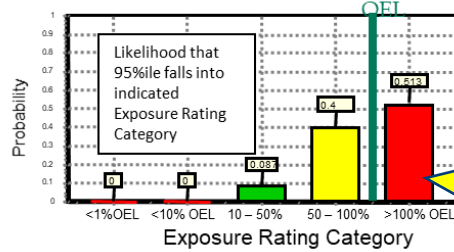
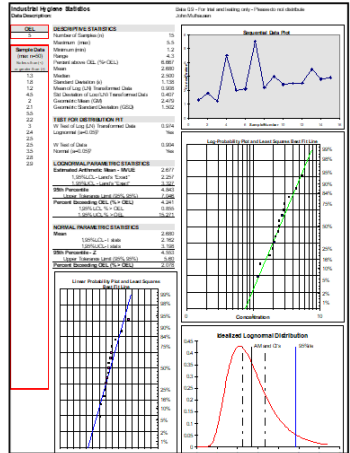
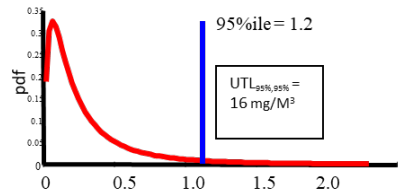
**BASED ON
MONITORING DATA**

HOW CAN WE IMPROVE OUR JUDGMENTS?

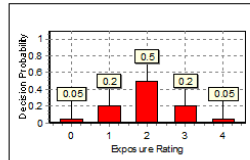
BASED ON
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Use Statistical Tools . . .

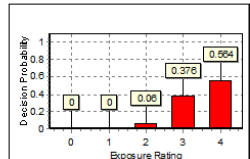
IH Data Analyst



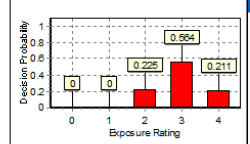
Initial Qualitative Assessment or Validated Model



Monitoring Results



Integrated Exposure Assessment



FREE POWERFUL TOOLS!!

Expostats

Calculation parameters

Exposure limit: 100

Credible interval probability: 90

Overexposure risk threshold: 5

Data: 28.9, 19.4, <5.5, 149.9, 26.42, 56.1

Sequential plot

The sequential plot presents the estimated exposure distribution assuming 250 exposure measurements have been collected. If the measurements represent 6h TWA values, this would represent approximately a full year of exposure. The OEL is shown as a dashed red horizontal line. The point estimate of the selected percentile is shown as a blue continuous line.

Density plot

The graph below shows the probability density curve of the estimated underlying distribution of exposures. The OEL is represented by a dashed red vertical bar, and the selected percentile is shown by a blue vertical bar.

Risk band plot

The graph below provides the probability distribution of the uncertainty around the selected percentile across five categories: probability that true 95th percentile is below 1% of the OEL, between 1% and 50% of the OEL, between 50% and 100% of the OEL, and greater than the OEL. The scheme is based on the classification adopted by the AIHA. The red column in the graph below represents the probability of an overexposure situation (overexposure risk).

AIHA: Exposure Categories Distribution (95th perc)

Results

Geometric Mean: 77.1, UCL₉₅: 111, GSD: 2.51, 3.55

Percentile	Estimate	UCL ₉₅	UCL ₉₉
95th	348	417	674

Exceedance Fraction (%): 0.46, 1.27, 4.14

Arithmetic Mean: 119, 136, 197

Exposure Profile

AIHA: Exposure Categories Distribution (95th perc)

Category	Probability
< 1%	0.0%
[1-10%]	0.0%
[10-50%]	58.6%
[50-100%]	38.2%
> OEL	3.2%

AIHA: Exposure Categories Distribution (95th perc)

GM: 78.2, GSD: 2.33, Percentile: 314

AIHA IHSTAT®

HOW CAN WE IMPROVE OUR JUDGMENTS?

NO MONITORING
DATA AVAILABLE

HOW CAN WE IMPROVE OUR JUDGMENTS?

NO MONITORING
DATA AVAILABLE

Learn From Our Colleagues in Cognitive Psychology . . .

Work in Other Disciplines: Physicians, Pilots, . . .

- Humans are more often biased and inaccurate than we know
- Our “gut” is wrong much more often than we know . . . or want to know
- As individuals we think we are the accurate one, it is “the person next to us that isn’t so good”

HOW CAN WE IMPROVE OUR JUDGMENTS?

NO MONITORING
DATA AVAILABLE

The Key is “Slow Thinking” (Daniel Kahneman’s *Thinking Fast and Slow*)

Fast Thinking:

- Reflexive, quick, emotion-driven and instinctive – brain stem & hormones
- Good for the many routine decisions that we make every day.
- **Reliance on emotion and individual experiences can lead to biases and faulty decision making.**

Slow Thinking:

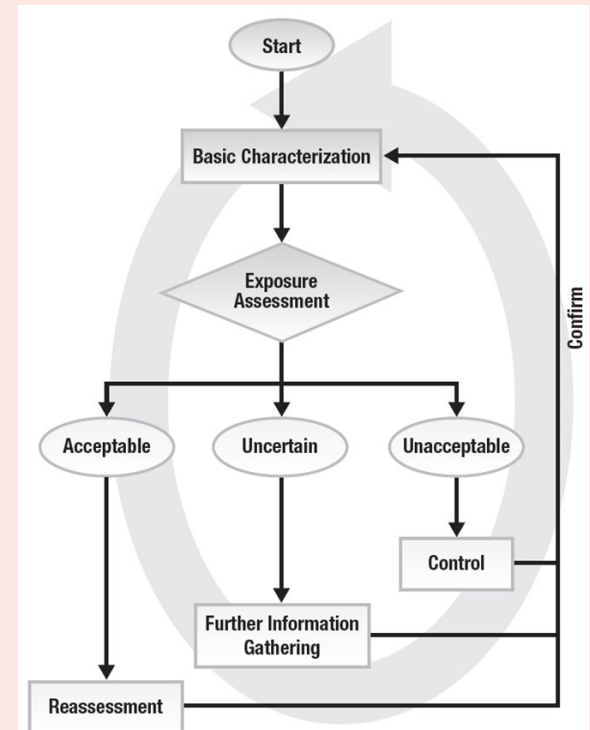
- Deliberate and logical. Learned algorithms, data analysis
- Requires energy and conscious focus.
- **Serves us well when we have important decisions to make.**

HOW CAN WE IMPROVE OUR JUDGMENTS?

NO MONITORING DATA AVAILABLE

- Systematic Exposure Decision Process
- Document Results and Rationale for Judgments
e.g. Checklist Tool
- Document Exposure Determinants
e.g. Modeling
- Discussion with Colleagues
- Focused Training, Coaching, and Practice
- Accurate Feedback Mechanisms
e.g. Compare initial qualitative judgment to final result from the statistical analysis of monitoring data

Implement The AIHA Strategy



SEG	Agent / Chemical	OEL	Initial Exposure Rating	Initial Certainty Rating	Final Exposure Rating	Final Certainty Rating

A blue double-headed arrow is positioned between the 'Initial Exposure Rating' and 'Final Exposure Rating' columns, indicating a comparison or transition between the two states.

AIHA / ACGIH DEFINING THE SCIENCE

Improving Exposure Judgement Accuracy

Next Steps . . .

- AIHA and ACGIH in discussions regarding coordinated actions to drive improvements in exposure judgment accuracy
- Other Organizations . . .
- Local Sections . . .

Exposure Judgement Accuracy Improvement Initiative Phases	Year									
	1	2	3	4	5	6	7	8	9	10
1: "Hyper-Marketing" of Need to Change and Tools / Techniques to Improve	■	■	■	■	■					
2: Evaluate Effectiveness of Existing Tools / Techniques			■	■	■					
3: Develop New Tools / Techniques to Fill Gaps				■	■	■	■			
4: Communication & Marketing to Drive Use of Improved Tools/Techniques						■	■	■	■	■



HEALTHIER WORKPLACES | A HEALTHIER WORLD

AIHA STANDARDS OF CARE

STANDARDS OF CARE

Defined:

Minimum expected standards of practice and performance established for a particular profession or function

STANDARDS OF CARE

Are:

Expected standards of practice and performance (What one does)

Are Not:

Competencies (What one knows)

AIHA STANDARDS OF CARE INITIATIVE

- The protection of workers and communities depends on the performance of risk management programs. As currently implemented, the effectiveness of those risk protection programs is highly variable, resulting in excessive risk for many workers and communities.
- This AIHA effort seeks to elevate the performance of all risk management programs, especially those which are underperforming, by documenting a summary of minimum expected standards of care or performance for critical aspects of risk management programs and practices.

***A WORLD WHERE ALL WORKERS AND THEIR
COMMUNITIES ARE HEALTHY AND SAFE***



A Simple Example –

Consider Scenarios Assessed and Managed by Two OEHS Professionals “A” and “B” :



OEHS Professional A:

- Practice based solely on basic regulatory compliance.
- Uses OSHA PELs exclusively

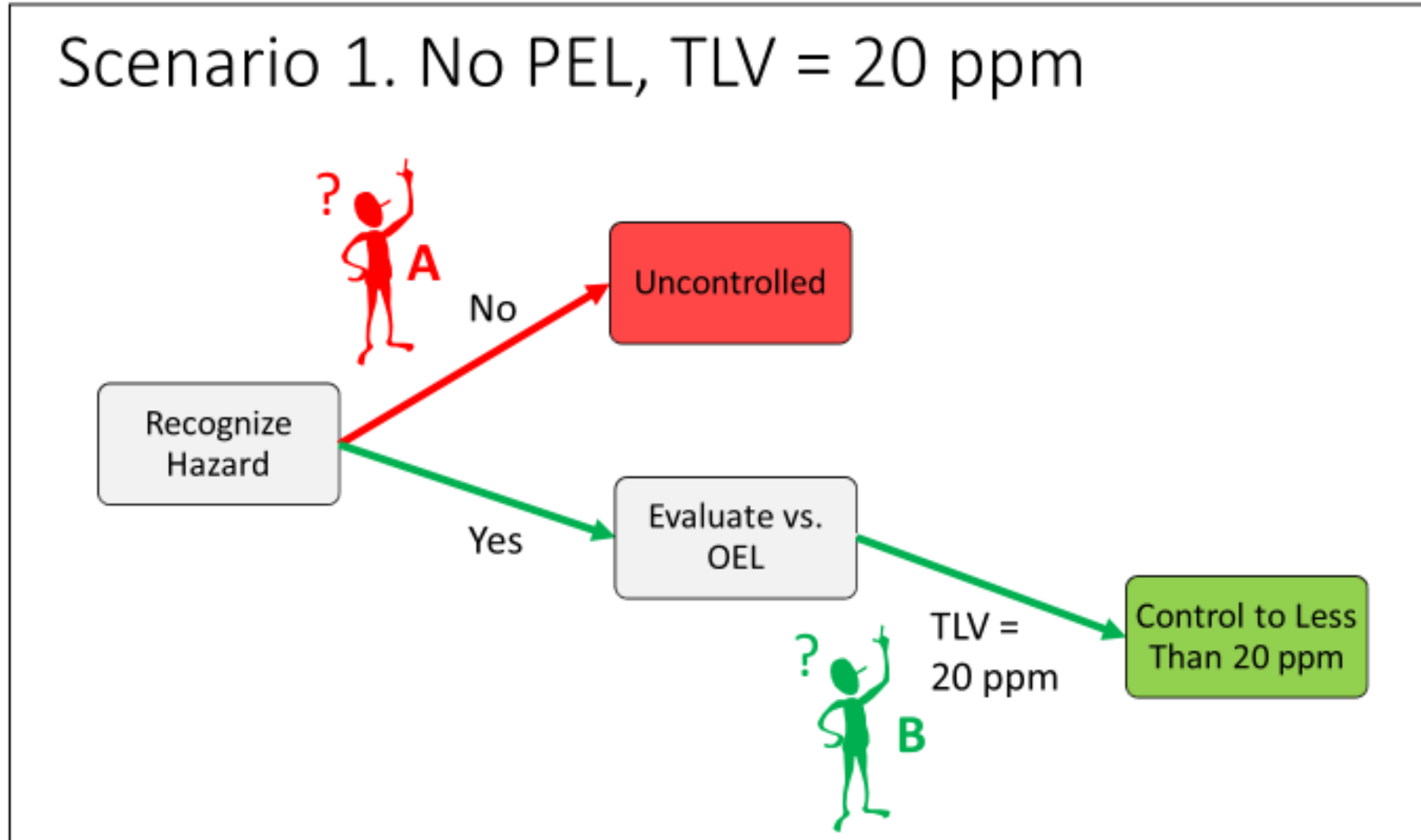


OEHS Professional B:

- Takes a comprehensive approach, considering all potential hazards, whether regulated or not.
- Uses lower of PEL or ACGIH TLV

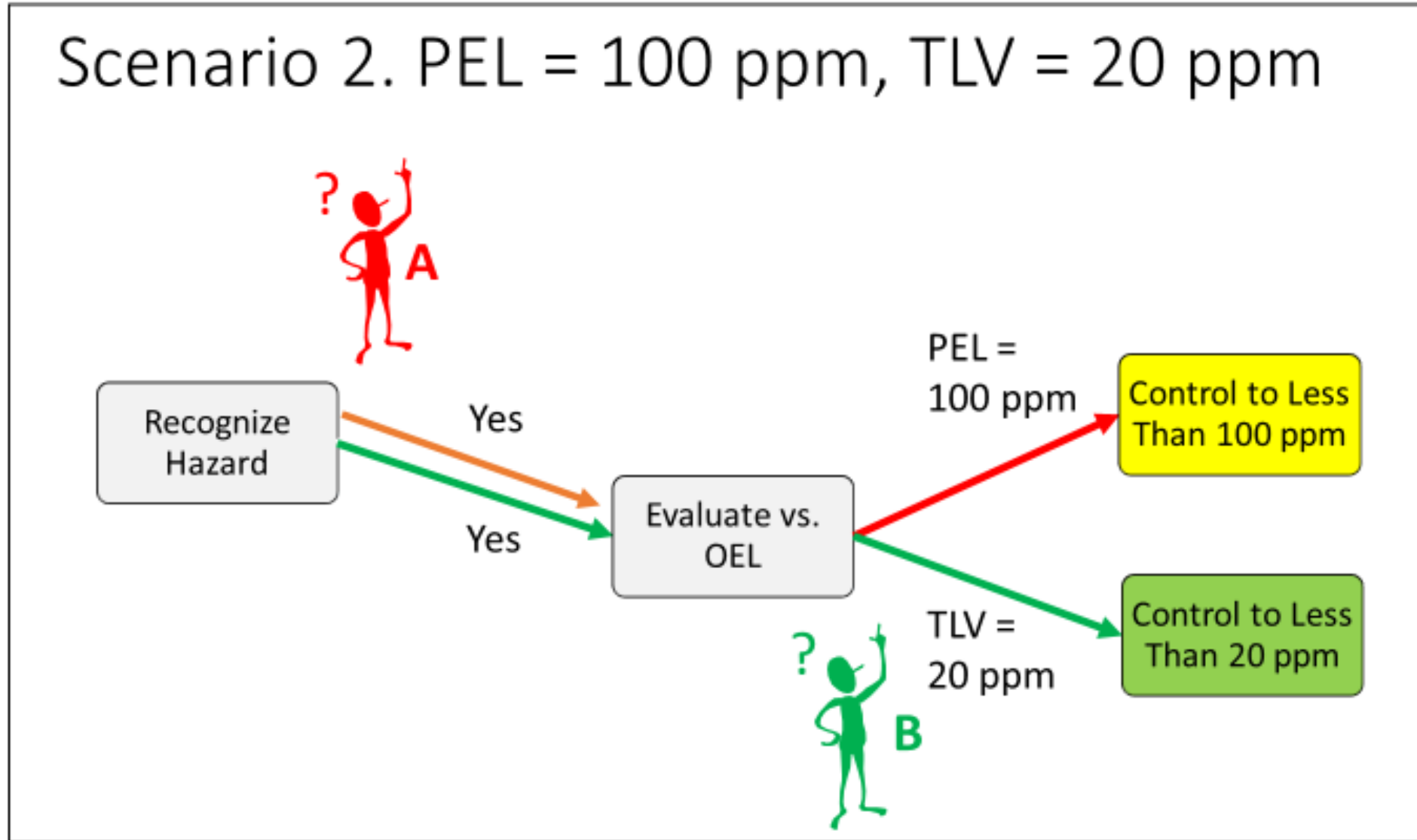
A Simple Example –

Consider Scenarios Assessed and Managed by Two OEHS Professionals “A” and “B” :

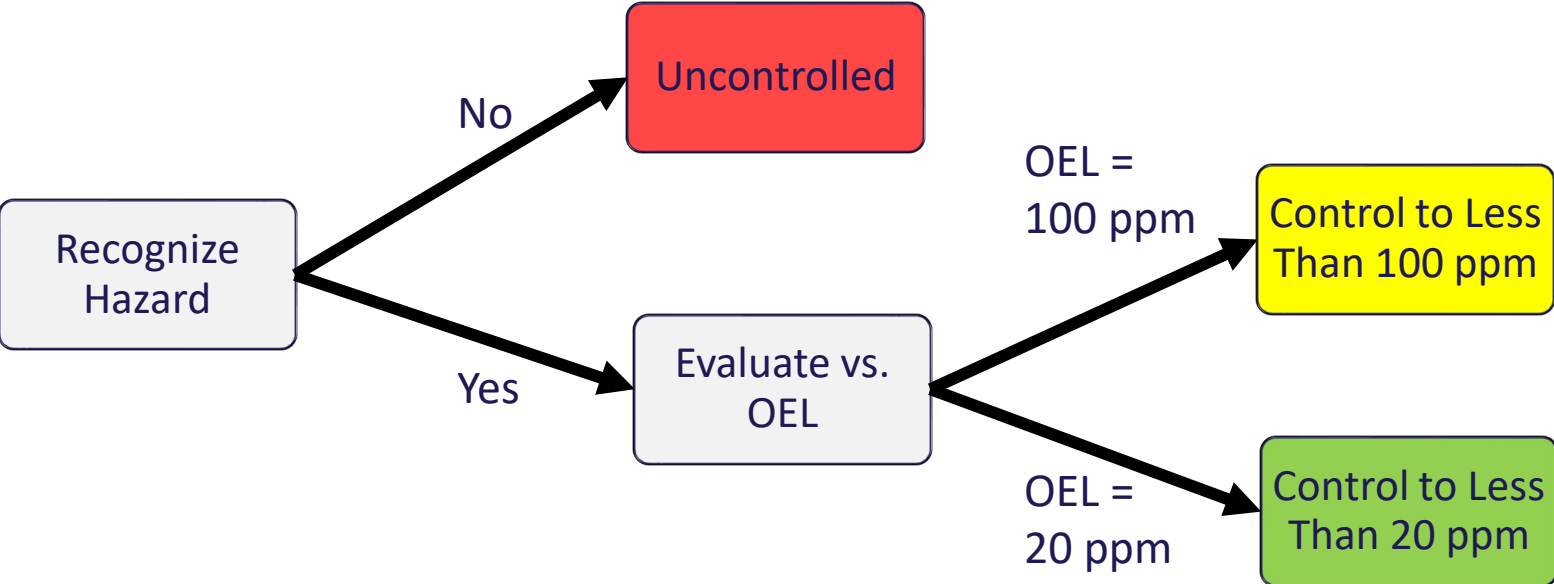


A Simple Example –

Consider Scenarios Assessed and Managed by Two OEHS Professionals “A” and “B” :

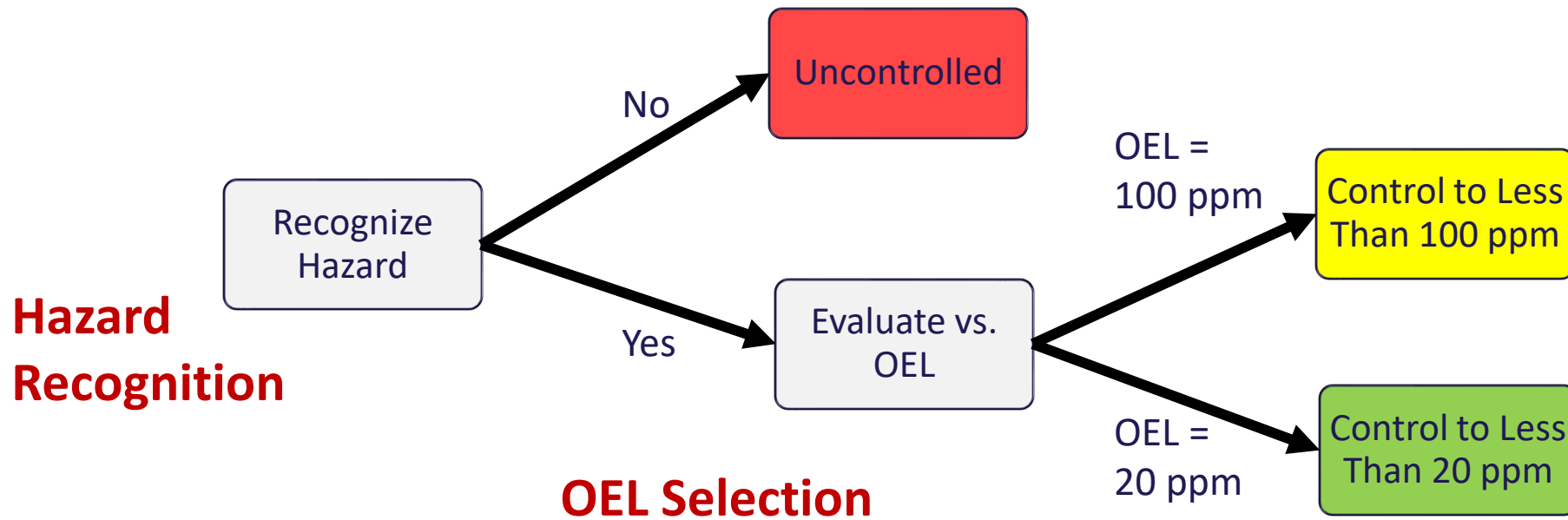


IDENTIFY RISK-CRITICAL PRACTICES AND STANDARDS OF CARE



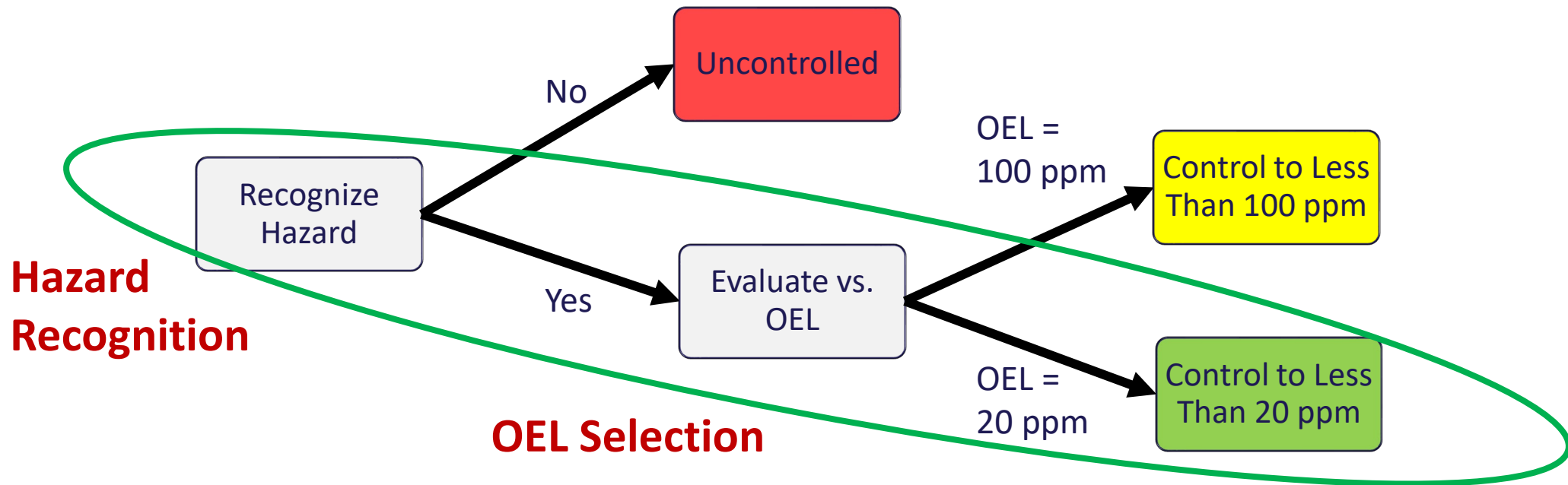
IDENTIFY RISK-CRITICAL PRACTICES AND STANDARDS OF CARE

1. Risk-critical practices can be defined for OEHS risk management processes and programs.



IDENTIFY RISK-CRITICAL PRACTICES AND STANDARDS OF CARE

1. Risk-critical practices can be defined for OEHS risk management processes and programs.
2. Minimally acceptable professional expectations for those risk-critical practices can be identified.

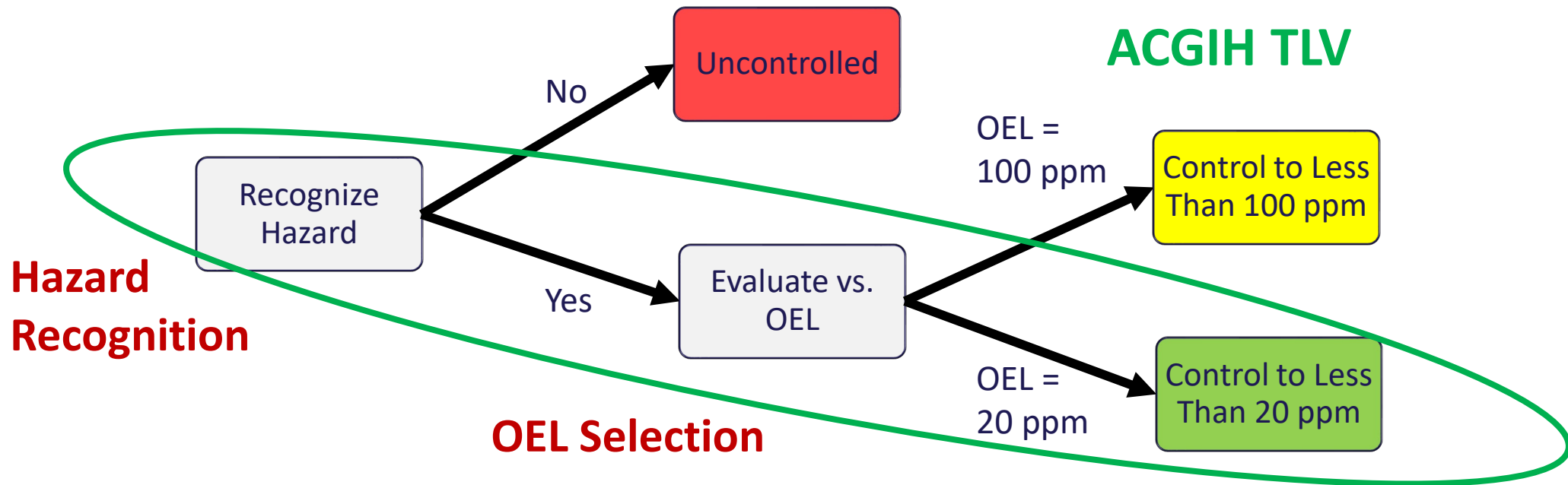


IDENTIFY RISK-CRITICAL PRACTICES AND STANDARDS OF CARE

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Standards of Care:

- Comprehensive Approach
- Use Lower of PEL or ACGIH TLV



RISK-CRITICAL PRACTICES AND STANDARDS OF CARE

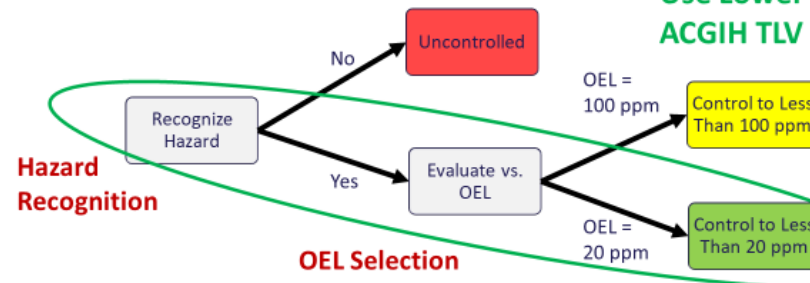
OEHS Process/Program Risk-Critical Practices		
OEHS Process / Program	Risk-Critical Practice	Standard of Care
Hazard Recognition	No Hazard Recognition	
	Compliance Focus	
	Comprehensive Approach	X
OEL Selection	Apply Only PEL	
	Apply Lowest: PEL or TLV	X

IDENTIFY RISK-CRITICAL PRACTICES AND STANDARDS OF CARE

1. Risk-critical practices can be defined for OEHS risk management processes and programs.
2. Minimally acceptable professional expectations for those risk-critical practices can be identified.

Standards of Care:

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RISK-CRITICAL PRACTICES AND STANDARDS OF CARE

OEHS Process/Program Risk-Critical Practices				
OEHS Process / Program	Risk-Critical Practice	Standard of Care	Best Practice	References
Hazard Recognition	No Hazard Recognition			
	Compliance Focus			
	Comprehensive Approach	X	X	
OEL Selection	Apply Only PEL			
	Apply Lowest: PEL or TLV	X		
Program XXX	Practice A			
	Practice B			
	Practice C	X	X	
Program YYY	Practice A			
	Practice B	X		
	Practice C		X	

AIHA STANDARDS OF CARE INITIATIVE

Goal: Document a concise, easy to use summary of minimum recommended global standards of care for the professional practice of OEHS that incorporate best risk management practices whenever feasible.

OEHS Process/Program Risk-Critical Practices				
OEHS Process / Program	Risk-Critical Practice	Standard of Care	Best Practice	References
Hazard Recognition	No Hazard Recognition			
	Compliance Focus			
	Comprehensive Approach	X	X	
OEL Selection	Apply Only PEL			
	Apply Lowest: PEL or TLV	X		
Program XXX	Practice A			
	Practice B			
	Practice C	X	X	
Program YYY	Practice A			
	Practice B	X		
	Practice C		X	

AIHA STANDARDS OF CARE INITIATIVE

Next Steps . . .

- AIHA Standards of Care Advisory Group
- Other Organizations . . .

Standards of Care Initiative Phase	Year					
	1	2	3	4	5	6
1: Define Scope and Strategy	■					
2: Collect Input	■	■	■			
3: Feedback on Drafts		■	■	■	■	
4: Finalize SOC v1			■	■	■	
5: Update and Maintenance				■	■	■

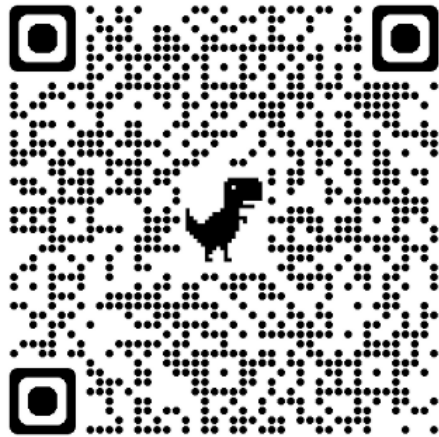


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LEARN MORE:

Click [here](#) to access the **Defining The Science Home Page**



<https://www.aiha.org/get-involved/volunteer-groups/defining-the-science-advisory-group>

Defining the Science Advisory Group

Formed in 2021, the mission of the Defining the Science Advisory Group (DTS-AG) is to develop and maintain a national IH/OEHS research agenda endorsed by the AIHA Board of Directors. The DTS-AG is a collaborative venture between AIHA and ACGIH and includes representatives from both organizations.

LEARN MORE:

- **Papers:**

- Logan P., G. Ramachandran, J. Mulhausen, and P. Hewett:” Occupational Exposure Decisions: Can Limited Data Interpretation Training Help Improve Accuracy?” *Annals of Occupational Hygiene*, Vol. 53, No. 4, pp. 311–324, 2009.
- Logan P., G. Ramachandran, J. Mulhausen, S. Banerjee, and P. Hewett “Desktop Study of Occupational Exposure Judgments: Do Education and Experience Influence Accuracy?” *Journal of Occupational and Environmental Hygiene*, 8:12, 746-758, 2011.
- Vadali, M. G. Ramachandran, J. Mulhausen, S. Banerjee, "Effect of Training on Exposure Judgment Accuracy of Industrial Hygienists”. *Journal of Occupational & Environmental Hygiene*. 9: 242–256, 2012.
- Arnold S., M. Stenzel, D. Drolet, G. Ramachandran; “Using Checklists and Algorithms to Improve Qualitative Exposure Judgment Accuracy”, *Journal of Occupational and Environmental Hygiene*, 13, 159-168, 2016

- **Books:**

- *A Strategy for Assessing and Managing Occupational Exposures*. 4th Ed. AIHA Press. 2015.

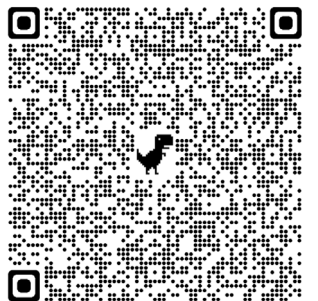
LEARN MORE:

- **Opinion:**

- Mulhausen, J. “Faulty Judgment” President’s Message. The Synergist. (November 2021).
- Mulhausen, J. “How to Improve Exposure Judgments” President’s Message. The Synergist. (December 2021).
- Mulhausen, J. “Standards of Care: Competence PLUS Performance” President’s Message. The Synergist. (January 2022).

- **Video Webinar:**

- Mulhausen, J. “Top 10 Imperatives for the AIHA Exposure Risk Management Process.” Free from AIHA at:
https://online-ams.aiha.org/amsssa/ecssashop.show_product_detail?p_mode=detail&p_product_serno=2650&p_cust_id=&p_order_serno=&p_promo_cd=&p_price_cd=&p_category_id=&p_session_serno=72069269&p_trans_ty=



A WORLD WHERE ALL WORKERS AND THEIR COMMUNITIES ARE HEALTHY AND SAFE

