NIOSH occupational exposure banding: a practical chemical risk assessment and management process

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The findings and conclusions in this presentation have not been formally reviewed by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy.
CHALLENGE

- Workers are exposed to potentially harmful chemicals in their workplace.
- Occupational exposure limits (OELs) guide risk management decisions.
- Most chemicals in use and commerce lack guidance on safe levels of exposure.
- This leaves workers at risk of exposure to chemicals that may be harmful.
- CDC Strategic Priority: Prevent illness, injury, disability, and premature death.
• Approximately 1,000 chemicals with authoritative OELs
• Approximately 85,000 chemicals in commerce.
IDEA/SOLUTION

- Innovative approach to provide guidance prescriptive enough to be used by small- and medium-sized establishments
- Occupational Exposure Banding process to provide guidance for chemicals without OELs
- Accompanying electronic tool (e-Tool)
WHAT IS OCCUPATIONAL EXPOSURE BANDING?

A mechanism to quickly and accurately assign chemicals into “categories” or “bands” based on their health outcomes and potency considerations.

- **A**
  - Dust/Particulate
  - >10 mg/m³
  - >100 ppm

- **B**
  - Gas/Vapor
  - >1 to 10 mg/m³
  - >10 to 100 ppm

- **C**
  - >0.1 to 1 mg/m³
  - >1 to 10 ppm

- **D**
  - >0.01 to 0.1 mg/m³
  - >0.1 to 1 ppm

- **E**
  - ≤0.01 mg/m³
  - ≤0.1 ppm
IS THIS THE SAME AS CONTROL BANDING? NO.

- **COSHH Essentials** is a control banding tool that helps small and medium-sized enterprises to do risk assessments for chemicals and mixtures of chemicals
  - identifies the control band (control approach),
  - produces advice on controlling risk from the chemical used in the specified task, and
  - provides written guidance and documentation as a result of the assessment
- NIOSH has reviewed control banding strategies previously
OCCUPATIONAL EXPOSURE BANDING IS DIFFERENT!

- OEBs are derived from toxicology and potency
- OEBs can be used to identify one of many control strategies
THE PROMISE OF OCCUPATIONAL EXPOSURE BANDING

- Facilitates more rapid evaluation of health risk
- Provides guidance for materials without OELs
- Highlights areas where data are missing
- Provides a screening tool for the development of RELs
- Identifies hazards to be evaluated for elimination or substitution
- Aligned with GHS for hazard communication
- Facilitates the application of Prevention through Design principles
### HOW IS THE PROCESS ORGANIZED?

Bands are assigned based on the findings for nine standard toxicological endpoints:

1. Carcinogenicity
2. Reproductive toxicity
3. Specific target organ toxicity resulting from repeated exposure
4. Acute toxicity
5. Genotoxicity
6. Skin corrosion and irritation
7. Respiratory sensitization
8. Skin sensitization
9. Serious eye damage and irritation
IDEA/SOLUTION

- Stakeholders and users have been enthusiastic and supportive of the new of the draft banding guidance and e-Tool technology.

- Innovative banding guidance to address stakeholder needs, including the following enhancements:
  - Automated e-Tool
  - Validated banding criteria and e-Tool for consistency and usability
  - Training materials
  - Detailed plan for broad dissemination
DISSEMINATION

- Occupational safety and health professionals who serve small- and medium-sized businesses
- Stakeholders from multiple organizations, including organized labor, industry safety and health professionals, and government agencies
  - Feedback is overwhelmingly positive
  - Confirmed need for a banding approach and tool
  - Suggestions for improvement – simplicity and training
BANDING E-TOOL
## Recommendation -- Rane Test 1(1)

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Source</th>
<th>Data</th>
<th>EDS</th>
<th>EDS Band</th>
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<tbody>
<tr>
<td>Carcinogenicity Quant</td>
<td>EPA IRIS Slope Factor</td>
<td>1 x 0.000001 (mg/kg-day)^1</td>
<td>30</td>
<td>C</td>
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<tr>
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<td>California Slope Factor</td>
<td>1 x 0.0000001 (mg/kg-day)^1</td>
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<td>Carcinogenicity WOE</td>
<td>U.S. EPA IRIS</td>
<td>Group C (possible human carcinogen)</td>
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<td>Reproductive Toxicity</td>
<td>U.S. EPA; IRIS</td>
<td>Rank 1; NOAEL; 90 hrs; 4.8 ppm</td>
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<td>Genotoxicity Toxicity</td>
<td>WHO: International Programme on Chemical Safety</td>
<td>Rank 1; Results: Mixed</td>
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<td>Respiratory Sensitization</td>
<td>WHO: International Programme on Chemical Safety</td>
<td>Rank 1; Results: Mixed</td>
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<td>C</td>
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<td>Skin Sensitization</td>
<td>WHO: International Programme on Chemical Safety</td>
<td>Rank 1; Type: Oral LD50; Duration: 4.00 hrs; Input: 661</td>
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<tr>
<td></td>
<td>Organization for Economic Co-operation and Development</td>
<td>Rank 1; Results: Skin corrosion/irreversible effects</td>
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<tr>
<td></td>
<td>WHO: International Programme on Chemical Safety</td>
<td>Rank 1; Results: Moderate to severe irritation</td>
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<td>Eye Irritation</td>
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<td>Rank 1; Results: Irreversible eye damage</td>
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<td>Notes</td>
<td>Carcinogenicity: Cancer Test Information: <a href="https://ntp.niehs.nih.gov/pubshealth/toc/index.html">https://ntp.niehs.nih.gov/pubshealth/toc/index.html</a></td>
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<td>STOT: STOT Test Information: <a href="https://ntp.niehs.nih.gov/testing/types/heatandsafety/index.html">https://ntp.niehs.nih.gov/testing/types/heatandsafety/index.html</a></td>
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<td>Acute Tox: Acute Toxicity Information: <a href="http://www.inchem.org/">http://www.inchem.org/</a></td>
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MORE THAN A BAND

- Identify potential health effects and target organs
- Identify health risks to improve health communication
- Inform implementation of control interventions
- Inform medical surveillance decisions
- Provide critical information in a timely fashion
NEXT STEPS

• Promote broad application of e-Tool and banding guidance
• Address public health challenge of protecting workers from the myriad chemicals lacking guidance
• Partner with AIHA and ASSP for initial dissemination and continuing widespread use in the occupational safety and health community
PROJECT TEAM

- Thomas J. Lentz, Ph.D. – Senior Industrial Hygienist
- Pranav Rane, MPH – Health Communication Specialist
- Lauralynn McKernan, Sc.D. – Senior Industrial Hygienist
- Christine Whittaker, Ph.D. – Senior Toxicologist
- Stephen Gilbert, MS – Statistician
- Jihong Chen, MS – Computer Scientist