Safety culture and perceptions and practice with nanomaterials in academia and industry

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Prevention of Accidents at Work
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Take home messages

• What is nano?

• What does it have to do with safety maturity?
What is nano?

• Nano – Greek ‘nanos’ meaning ‘dwarf’
• One billionth (nanosecond, nanometer, etc.)
• Nanoparticles = 1-100 nanometers (nm); $1 \times 10^{-9}$ m
Nanotechnology - properties
Can act differently than they would if they were larger:

• Smaller size gives a high surface area
• Strength & durability
• Solubility & porosity
• Melting point
• **Conductivity**
• **Reactivity**
• Etc.
Nanotechnology - applications

- Health care (monitoring, diagnosis, screening)
- Medicine/pharmaceuticals (drug delivery and treatment)
- Energy (generation, transmission, storage)
- Agriculture, manufacturing, construction & automotive
- Food and beverages
- Clothing (wearables and smart textiles)
- Electronics, security and the internet
- Cosmetics
Nanotechnology - implications

• Knowledge of the application is greater than of its implications !!

• What are the safety and health risks? Earlier examples asbestos, radiation
**Study**

How do academia and industry attain and apply knowledge about nano?

- Semi-structured interviews with OSH professionals
  - Six **academic** institutions
  - Six **industrial** companies

- **Five** topics regarding nanomaterials (coded in Nvivo pc program)
- **Five-step** safety culture maturity model
Five topics

1. **Risk comprehension**: Understanding the risks

2. **Information gathering**: Attaining guidelines, standards, safety info.

3. **Actions**: Identifying and handling risks

4. **Communication**: Educating and training employees, students, etc.

5. **Compliance**: Adherence to strategies, standards, guidelines, etc.
Occupational safety and health maturity model

- Passive
- Reactive
- Active
- Proactive
- Generative

Interview statements regarding nano:
- Risk comprehension
- Information gathering
- Actions
- Communication
- Compliance
Coding interview statements

Examples

1. **Comprehension**: Risks as a part of the job (passive)
2. **Information**: Up-to-date on legislation, certification (proactive)
3. **Action**: Trust in labelling from suppliers (active)
4. **Information**: Adapting info to context, reinforcing training (proactive)
5. **Compliance**: Walk the talk, PPE (proactive)
## Results (%)

<table>
<thead>
<tr>
<th>Safety culture level</th>
<th>OSH themes</th>
<th>Risk comprehension</th>
<th>Information gathering</th>
<th>Actions</th>
<th>Communication</th>
<th>Compliance</th>
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<tbody>
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Needs

• Information that is easily accessible, applicable and low level of complexity (easily understandable)

• Nano-specific OSH programs that cover all aspects of the life-cycle - from research and design to disposal

• Allow for flexible deployment of multilevel and integrated OSH initiatives to support sustainable nanotechnology and operational excellence
Implications

• Politicians, engineers to collaborate with communication experts and social scientists in effectively **framing** information on NM

• Both **credibility** and **culture** need to be taken into consideration
Affiliation

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Thank you for your attention

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