Emerging Issues & Trends in Safety and Health: Nanotechnology

Troy Winters
Senior Health & Safety Officer
Canadian Union of Public Employees
Vice Chair, CSA Technical Committee OHS - Nanotechnology
What is Nanotechnology?

- Nanoscience and nanotechnology are the study and application of extremely small things.
- Application of nanotechnology involve the ability to see and to control individual atoms and molecules.
How Small??

SIZE COMPARISON

Electron Microscope
- Water
- Glucose
- Antibody
- Virus
- Bacteria
- Cancer cell

Optical Microscope

Unaided Eye
- A period
- Baseball

Size (nm)

0.1  1  10  100  1,000  10,000  100,000  1,000,000  10,000,000  100,000,000
Nanotechnology in Today’s World

• The next industrial revolution is already here...
• By the end of 2011 the total *government* funding for nanotechnology research worldwide will be $65 billion, rising to $100 billion by 2014. (2011 estimate, Cientifica)*
• All told, nanotechnologies are estimated to have impacted $251 billion across the global economy in 2009. This is estimated to grow to $2.4 trillion by 2015 (Lux Research, 2010)
Health Risks of Nanomaterials

• How can the material enter the body?
• Where does it go and how does it change once it gets there?
Health Risks of Nanomaterials

• What aspects of the material end up causing harm?
• How much material is needed for serious harm to occur?
• How should the toxicity of the material be assessed?
How will people end up being exposed?

Health care
Automobile (and aerospace) industry
Chemical industry
Electronics and communication
Construction
How should exposure be measured

• Very technical.
• See related ISO standards
Can exposures be adequately controlled?

• Absolutely!

• Risk assessment is an essential preliminary step to determine what control level must be implemented.

• In the absence of adequate knowledge of the toxicity and behaviour of airborne nanoparticles, and the absence of specific standards or regulations, strict control measures should be put in place to minimize, as much as possible, the risk to workers of pulmonary and cutaneous absorption.
Control

• Elimination
• Substitution
• Engineering techniques
• Administrative means
• Personal protective means
Legal and other Requirements

- Currently no specific laws about ‘nano’ in the OHS Act or Regs.
- So where do we get guidance??
- Standards...
A standard, defined as:

**standard** – *a document, established by consensus and approved by a recognized body that provides for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at achievement of the optimum degree of order in a given context*

- Standards should be based on the consolidated results of science, technology and experience, aimed at the promotion of optimum community benefits
Canada

• Canada, as a member ISO/IEC country, participates through a mirror committee of volunteers (referred to as the Nano SMC) which is a SCC Mirror Committee (SMC) for both ISO/TC229 and IEC/TC113.

• The committee is facilitated by Standards Council of Canada (SCC) and CSA Group (CSA).
Canada

• International standards in various forms are developed with input from volunteer Canada experts.

• CSA Technical Committee has balanced membership from government, industry, labour, and users in Canada.
CSA Z12885-12 Nanotechnologies - Health and safety practices in occupational settings relevant to nanotechnologies

- CSA Z12885-12 is based on the first WG3 OHS
- Significantly different with CAN/CSA Z1000, Occupational Health and Safety (OHS) Management framework
- Added Canada-generated content, related to OHS nano-research in Canada
CAN/CSA-ISO/TR 13121:13 Nanotechnologies - Nanomaterial risk evaluation

- Nanomaterials' properties, hazards and exposure
- Evaluating and managing risks
- Deciding, acting, reviewing and adapting
- Informative annexes including:
  - Physical and chemical properties
  - Tiered testing approach
  - Health and environmental hazard data
  - Output worksheet and other reference material
ISO/TR 13329:2012 Nanotechnologies – Safety Data Sheet (SDS) preparation for manufactured nanomaterials

• Provides guidance on the development of safety data sheets (SDSs) for manufactured nanomaterials (and materials or products that contain manufactured nanomaterials), and provides additional information on safety issues associated with manufactured nanomaterials.

- The concept of control banding or performance-based occupational exposure limits (Figure 5) was developed in the late 1980s by occupational health experts in the pharmaceutical industry.
CSA Z12901-15 Control banding

• As the principle of control banding was applied to dangerous chemicals, chemical mixtures, and fumes.

• The premise of CB is that the greater the potential for harm, the greater the degree of control needed to manage the situation and make the risk “acceptable.”
Control Banding Example

• Band 1: Use good industrial hygiene practice and general ventilation.
• Band 2: Use engineering control, typically local exhaust ventilation.
• Band 3: Enclose the process.
• Band 4: Seek expert advice.
Thank You