FASTS Federation of Australian Scientific and Technological Societies

Science meets Parliament Forum

Nanotechnology and OH&S issues

7.30am – 8.30am Wednesday 18 March 2009
House of Representatives Alcove, Parliament House, Canberra

Facilitator: Niall Byrne, Science in Public Pty Ltd

Panelists

- Paul Wright, RMIT University
- Steve Mullins, Australian Council of Trade Unions
- Brian Power, Australian Nanotechnology Business Forum
- Howard Morris, Office of the Australian Safety and Compensation Council
- Maxine McCall, CSIRO

Science meets Parliament

Engineered Nanoparticles: Nanosafety issues

A/Prof. Paul Wright

NanoSafe Australia www.rmit.edu.au/nanosafe

Toxicology Key Centre,

School of Medical Sciences,

RMIT University

NanoSafe Australia

Nationwide network of toxicologists and risk assessors

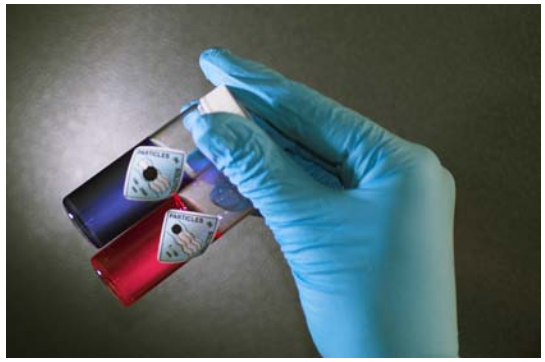
Mission:

- To support government, industry and non-government organisations (NGOs) in their efforts to understand the occupational and environmental health and safety issues surrounding nanotechnology products and their manufacturing processes
- To provide quality data for the appropriate risk assessment of nanoparticles (NP) and nanomaterials (NM)

www.rmit.edu.au/nanosafe

OHS Position Paper: Harford, Edwards, Priestly, Wright "Current OHS best practices for the Australian nanotechnology industry." *J OHS ANZ* (2007) 23(4):315-31

Nanosafety Concerns…



- Many types of engineered nanomaterials
  – not all NP or NM are alike or a hazard
- Known toxicity from some ultrafine particles
- NP toxicity varies with physical-chemical characteristics & cell type
  - Surface area & chemistry is very important
  - Carbon nanotubes: straight fibre “asbestos-like” aggregates
- Absorption & Translocation across cell membranes & along nerves
- Potential biological effects: accumulation in body; free radical damage;
  - Immune system clears particles → suppression, allergy, autoimmune

- So for Risk Assessment processes “one size will NOT fit all”

→ Concerns for inhalation, dermal & oral exposure routes

Nanosafety Concerns…

Most likely situation for ↑ toxic potential over bulk material:

- ***Insoluble*** nanoparticles
- ***Penetrates*** biological membranes
- ***Persists*** in the body

- **Such a nanoparticle would be designated a "NP of concern" (NPOC)**

We Need to:

- Adopt ***As Low As Reasonably Practicable*** (ALARP) approach
- Risk Assessment of NPOCs for ALL parts of life cycle
- Reduce handling of free particles to reduce exposure
- Implement workplace controls & develop appropriate monitoring

Smart Development of Nanotechnology

- **To harness the benefits of nanotechnologies**
  - "Greener" lifestyle; energy, water & environment; nanomedicine
  - "Open source" enabling technologies for developing countries:

  clean drinking water from home-made nanorust & baked-clay nanofilters

- **Do the "Safety-by-design" approach**
  - For the **whole life-cycle** of products
  - Built-in recycling options

- **Need to re-engineer NPOCs**
  - But 1st need to understand NP interactions in organisms and environment
  - Toxicity profiling for priority NPOCs

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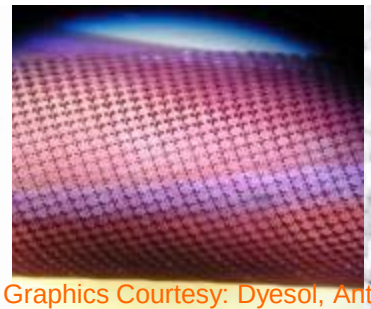
Science meets Parliament

Australian Nanotechnology & the Australian Nano Business Forum

Mr Brian Power
Australian Nano Business Forum
March 2009




Graphics Courtesy: Dyesol, Antaria, Cochlear and MiniFAB

ANBF
Australian Nano Business Forum

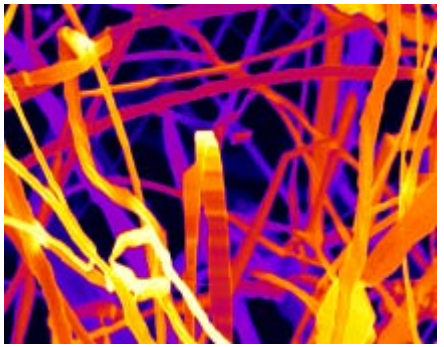
- Vision:

  "A world in which the ability to understand and control matter at a nanoscale leads to profound economic, technological and social advances"

- Mission:

  "To facilitate the uptake of nanotechnology by industry for the benefit of all Australians"

- The ANBF is a corporation limited by guarantee
  - not-for-profit, registered in the ACT

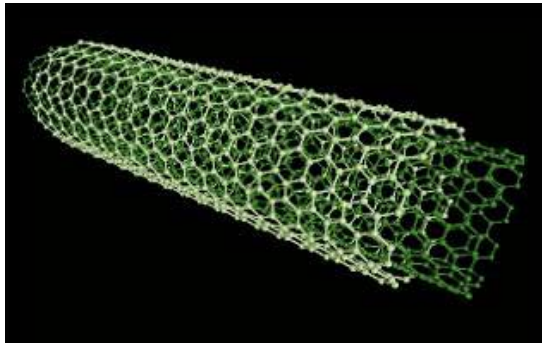


Graphics Courtesy: AIBN

Current situation

ANBF
Australian Nano Business Forum

- Nanotechnology is a scale
- It is a group of enabling technologies
- 98% of applications are safe
  - Top down processes (ie devices, intel-chips, MEMS)
- 2% of this sector is questionable:
  - Free nano particles
  - Carbon nanotubes (27 types)
  - Product & process life cycle studies required (for this 2%)



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Current situation

ANBF
Australian Nano Business Forum

- In many instances, nanosizes particles have existed for a long time (eg carbon black)
  - Our awareness is recent as we only now have the ability to see and measure these particles at the nano scale

- For some sectors, there is an established control mechanism ie TGA, NICNAS
  - More work is still required

Graphics Courtesy: Dyesol

Future steps

- What does Australia needs to do :
  - Adopt an international approach ie collaboration with international regulators as products exist and are being used now and being traded internationally
  - International Nanocode – code of conduct

Graphic Courtesy: NanoVentures, MiniFab

Responsible NanoCode

ANBF
Australian Nano Business Forum

- The NanoCode principle was an EU initiative and is being adapted or considered by most OECD countries.
- Comprises of 7 main principles
- This was put forward as an interim step to formalised guidelines in light of legislation

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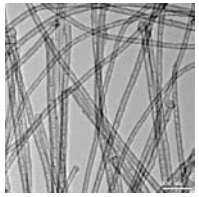
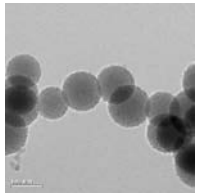
Nanotechnology Occupational Health & Safety



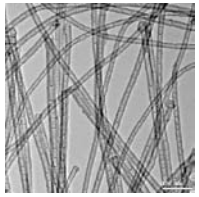


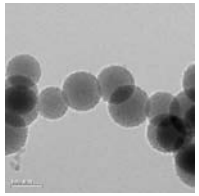
Dr Howard Morris

Nanotechnology OHS Program Manager

Australian Government
Department of Education, Employment and Workplace Relations
Office of the Australian Safety and Compensation Council

OHS REGULATORY FRAMEWORK & NANOTECHNOLOGY





WHAT WE KNOW

› OHS regulations cover nanotechnology processes & engineered nanomaterials.

› There are issues that impact on how well we can regulate.

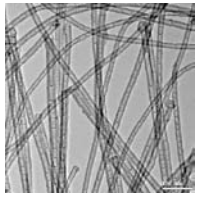
WE NEED TO KNOW MORE ABOUT……..

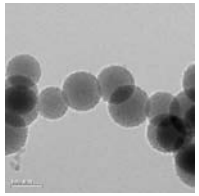
› How hazardous are engineered nanomaterials?

› How to measure emissions & exposure levels?

› The effectiveness of workplace controls in preventing exposure for various processes, tasks and nanomaterials.

NANOMATERIAL HAZARDS





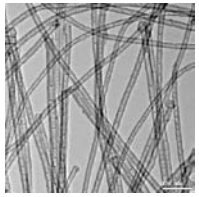
WHAT WE KNOW

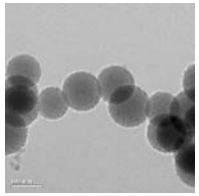
- We're all exposed to nanoparticles in the air all the time.
- Health effects from ambient or occupational air pollution by fine particulates.
- Some engineered nanomaterials will have higher toxicity, which may depend on a number of factors e.g. *chemistry, size, surface area, morphology*…
- Potential exposure routes: *Inhalation (main concern), dermal, ingestion.*

WHAT WE NEED TO KNOW MORE ABOUT…….

- Potential health effects from engineered nanomaterials, e.g. from repeat inhalation studies in rodents.
  - Informs risk management,
  - Including hazard classification, MSDS, labels……..
- Levels of exposure.
- How to predict toxicity from characteristics of engineered nanomaterials.

MEASUREMENT OF EXPOSURE TO NANOMATERIALS IN THE WORKPLACE





WHAT WE KNOW

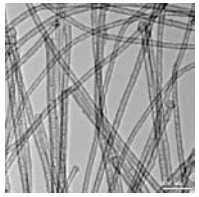
- Instruments available for examining nanoparticles in air & emissions of engineered nanomaterials.
- Combination of techniques needed (counting + SEM/TEM).
- No nanomaterial-specific personal exposure measurement techniques yet.

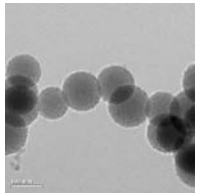
WHAT WE NEED TO DEVELOP....

- Easy to use, reliable, standard methods for measurement of emissions & exposures.
- Methods applicable to the range of nanomaterials – of different shapes, sizes, types.
- How to measure engineered nanomaterials with varying background levels of nanoparticles –

  especially for detecting emissions of small numbers of nanomaterial particles.

WORKPLACE OHS CONTROLS FOR ENGINEERED NANOMATERIALS





WHAT WE KNOW

- Tendency to agglomerate, aggregate, stick to larger particles in air and stick to surfaces.
- Well-established control methods for fine & ultrafine particles.
- Evidence that conventional controls (e.g. enclosure and local exhaust ventilation, LEV) can help prevent exposure to engineered nanomaterials.

WE NEED TO KNOW MORE ABOUT.....

Effectiveness of Controls

- Possible uses of nanomaterial substitution/modification to reduce potential hazards.
- Practical issues with engineering controls and use of protective clothing, and respirator fit issues.
- How to measure emissions & exposures.

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