



## **Nanotechnology: a quickly emerging field promising benefits and significant risks**

May 21, 2008

This backgrounder provides context for CIELAP's most recent policy document -- *Update on a Framework for Canadian Nanotechnology Policy: A Second Discussion Paper*, published in April 2008. This publication can be found on CIELAP's website at [www.cielap.org](http://www.cielap.org). CIELAP has been examining nanotechnology policy in Canada since 2006 as part of its commitment to provide policy advice on emerging technologies. Those who reference this background document should be aware that nanotechnology is developing rapidly and information can become quickly outdated.

### What is Nanotechnology

- Nanotechnology refers to the manipulation of materials at the nanoscale, the scale of atoms and molecules. (Considered to range from one to one hundred nanometers.)
- One nanometer is a billionth of a meter, which is about a hundred thousand times smaller than the cross section width of a human hair, and a thousand times smaller than a red blood cell.
- The building blocks for nanotechnology are the chemical elements and compounds that make up all materials.
- Nanotechnology is valuable because at this scale materials can exhibit novel properties that are different from the same substance's properties at the macro or even micro scales. Colour, conductivity, elasticity, reactivity, strength, and other properties change in surprising and potentially useful ways.
- Nanotechnology is about developing ways to use and control these novel properties.

### Background

- Since the 1980s and 90s, nanotechnology has developed rapidly. Since 2006, the number of consumer products using nanotechnology has almost tripled from 212 to more than 600. Many more products are expected in fields including medical applications, cosmetics, industrial coatings and environmental sensors and remediation.<sup>1</sup>
- In Canada, approximately 80 companies have been identified as working on products that contain nano-materials.
- Nanotechnology is a "platform" technology. Platform technologies are significant breakthroughs that are central to the further direction of technological change in society (like the internet and electricity). Nanotechnology is extremely important to Canada's future economic success.

## Concerns

- Scientists, governments and civil society organizations around the world are playing catch-up to create the tools, knowledge and institutional arrangements necessary to benefit from this technology while avoiding potential negative impacts.
- Despite nanotechnology's immense potential and significance, there is no formal regulatory or explicit public policy framework in Canada to manage the technology's risks and benefits. There is also no mechanism that requires the government to inform and consult with the public about it.
- The environmental and health effects of nanomaterials are largely unknown. However, numerous studies have shown that because of the high surface-area-to-volume ratio and higher reactivity of nanostructures, large doses of nanomaterials can cause cells and organs to demonstrate a toxic response, even when the material is non-toxic at the (larger) microscale or macroscale. Inflammation is a common response.<sup>2</sup>
- Nanoparticles are seen to be central in the link between air pollution and heart disease. When taken into the lungs nanoparticles have been shown to cause oxidative injury, creating irreversible damage in DNA and, ultimately, leading to vascular disease and heart attacks.
- Developing countries are very concerned about being left out of the benefits of nanotechnology. They are also concerned about the displacement of their workers in traditional sectors.

## Facts on Nanotechnology Research & Development

- Buckyballs, discovered in 1985, are hollow spheres of 60 carbon molecules. They can withstand enormous pressure. Buckyballs can be used as containers to, for instance, deliver drugs to specific sites in the body.
- Carbon nanotubes are like stretched-out buckyballs. They are six times lighter and many times stronger than steel and can be used as either semi-conductors or insulators. They can be used in energy-related applications and can be added to materials to improve strength without increasing weight.
- Some analysts estimate that, by 2015, \$1 trillion worth of products will use some form of nanotechnology. Nanotechnology is hailed by some as a major driver for the next post-industrial revolution.
- At present, 20 countries are selling products containing nanomaterials. The United States leads internationally with 52 percent or 247 consumer products that contain nanotechnology. East Asia now boasts 123 products, a 58 percent increase over last year.<sup>3</sup> These products include food containers and dietary supplements.
- A public nano portal website is currently being developed by Health Canada and will be in operation in 2008.

### **For further information please contact:**

Carolyn Webb, CIELAP Communications & Project Development Officer  
416-923-3529 ext 26; carolyn@cielap.org

Additional CIELAP Materials on Nanotechnology

**Discussion Paper on a Policy Framework for Nanotechnology (March 2007)**

[http://cielap.org/pub/pub\\_NanoFramework.html](http://cielap.org/pub/pub_NanoFramework.html)

**Nanotechnology Factsheet (2006)**

[http://cielap.org/pub/pub\\_InnoTechBio.html](http://cielap.org/pub/pub_InnoTechBio.html)

Other Nanotech Links

**NRC National Institute for Nanotechnology:**

[http://nint-innt.nrc-cnrc.gc.ca/main\\_e.html](http://nint-innt.nrc-cnrc.gc.ca/main_e.html)

**National Research Council Canada:**

[http://www.nrc-cnrc.gc.ca/randd/areas/nanotechnology\\_e.html](http://www.nrc-cnrc.gc.ca/randd/areas/nanotechnology_e.html)

**Woodrow Wilson International Center for Scholars:**

[http://www.wilsoncenter.org/index.cfm?topic\\_id=166192&fuseaction=topics.item&news\\_id=237776](http://www.wilsoncenter.org/index.cfm?topic_id=166192&fuseaction=topics.item&news_id=237776)

Document References:

---

<sup>1</sup> *Project on Emerging Nanotechnologies*. Woodrow Wilson Center for Scholars. Accessed May 6 2008  
<[http://www.wilsoncenter.org/index.cfm?fuseaction=topics.home&topic\\_id=166192](http://www.wilsoncenter.org/index.cfm?fuseaction=topics.home&topic_id=166192)>.

<sup>2</sup> International Risk Governance Council. *Nanotechnology Risk Governance: Recommendations for a global, coordinated approach to the governance of potential risks*. Geneva, (2007). 9. <[http://www.cielap.org/misc/PB\\_nanoFINAL2\\_2\\_\[1\]](http://www.cielap.org/misc/PB_nanoFINAL2_2_[1])>.

<sup>3</sup> *Project on Emerging Nanotechnologies*. Woodrow Wilson Center for Scholars. Accessed May 6 2008  
<[http://www.wilsoncenter.org/index.cfm?fuseaction=topics.home&topic\\_id=166192](http://www.wilsoncenter.org/index.cfm?fuseaction=topics.home&topic_id=166192)>.