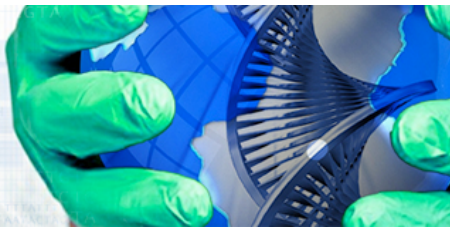
FACT SHEET | 13 January 2015

The health impacts of nanomaterials



What are nanomaterials?

Nanomaterials are objects with one or more dimensions, or surface structures, on the nano-scale. The nano-scale ranges from approximately 1-100 nanometres - with one nanometre being one billionth of a metre.

Our exposure to nanomaterials is increasing rapidly

While the nanotechnology industry is growing exponentially, research into the human health impacts of nanomaterials is still in its infancy. As the industry expands so does our exposure to nanomaterials – in food, cosmetics, water, plants, and a host of consumer products that remain unlabelled.

Health Concerns

Although the impacts of these novel materials on human health are largely unknown, one thing that is clear is that nanomaterials behave differently to bulk particles of the same chemicals. As the size of particles is reduced to the nano-scale the relative surface area and chemical reactivity increases. Free radical production is believed to be one of the main causes of nanomaterial toxicity and can cause cell damage and even cell death.[1] Nanomaterials can gain access to the body via the airways, skin or ingestion. Once there, they have been found to translocate to the liver, spleen, heart and brain[2] and may remain the body for extended periods.[3]

Preliminary evidence suggests that nanomaterials in processed food may be associated with rising levels of immune system dysfunction, inflammation of the gastro-intestinal tract and Crohn's disease.[4]

Scientists have warned that the main health concerns with nanomaterials will result from chronic low dose exposures over a life time - potentially leading to increased incidences of degenerative diseases.[5]

Nanomaterials can cause autoimmune problems

Groundbreaking research by US and Irish scientists found that a range of different nanomaterials, including carbon black, carbon nanotubes and silicon dioxide, all cause amino acid changes in human cells and in the lungs of mice. Human proteins which incorporate these modified amino acids can no longer function properly and are destroyed and eliminated by the body's defence system. Furthermore, once programmed to get rid of these proteins, the immune system can start attacking its own tissues and organs, thereby causing the autoimmune processes which may result in rheumatoid arthritis. [6]

Nanomaterials can cross the placenta

A number of animal studies have shown placental transfer and foetal uptake of gold, radiolabelled carbon, silver, silica and titanium dioxide nanoparticles and quantum dots. Scientists have warned that the enhanced sensitivity of the foetus may mean that even low doses of nanomaterials can cause adverse effects.[7]

Nano-silver - a biocide - is one of the most widely used nanomaterials.[8] A recent study found that exposure to nanosilver caused zebra fish embryos to develop with head abnormalities and no eyes. Zebra fish have been widely used as a model organism for the study of embryological development in other vertebrates including humans.[9]

A study looking at nanoparticles of titanium dioxide, which are widely used in consumer products including sunscreen, found that pregnant mice transferred the particles to their offspring. This resulted in brain damage, nerve system damage and reduced sperm production in male offspring.[10]

Nanomaterials can penetrate the skin

Several peer-reviewed studies have shown skin penetration by nanomaterials.[11] Research by the Australian Government's Commonwealth Scientific and Industrial Research Organisation (CSIRO) found small amounts of zinc from nano sunscreen in the blood and urine of human trial participants. However it is not clear whether the zinc was absorbed in nanoparticle or dissolved form, so this requires further research.[12] This obviously has potential implications for sunscreen safety, and the leader of CSIRO's Nanosafety group warned in 2008 that in a worst-case scenario, nano-ingredients in sunscreens could cause skin cancer.[13]

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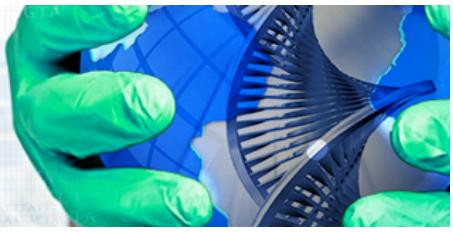

Some nanomaterials have asbestos like properties

Carbon nanotubes are used in a range of applications including sports equipment, electrical equipment, solar cells, water filters and textiles. They have asbestos like qualities and have been categorised as a hazardous chemical by Safe Work Australia.[14]

Other regulators are regulating nano-ingredients in consumer products

The European Parliament has passed laws that require manufactured nanomaterials in sunscreens, cosmetics, food additives[15] and biocides[16] to go through nano-specific safety assessment before they can be sold, and to be listed on product labels.

Nanomaterials should be assessed and regulated as new chemicals

In Australia the overwhelming majority of nanomaterials remain unregulated.[17] Although many nanomaterials pose greater toxicity risks than bulk forms of the same material, if a chemical has been approved, it is legal to sell it in nano form. There is no requirement for new safety testing, product labelling, or measures to protect workers and ensure safety.

In 2004, the UK Royal Society recommended that, given the serious health concerns, nanomaterials should be subject to new safety assessments before being allowed in consumer products. A 2007 Federal Government commissioned review identified the failure to do so as an important regulatory gap.

What needs to happen?

Friends of the Earth is calling for:

1. A mandatory register of nanomaterials to allow the tracking of nanomaterials through the supply chain and risk assessments to be conducted;
2. A moratorium on the commercial release of products containing nanomaterials until testing has determined that they are safe;
3. The labelling of all products containing nanomaterials to allow consumer choice.

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