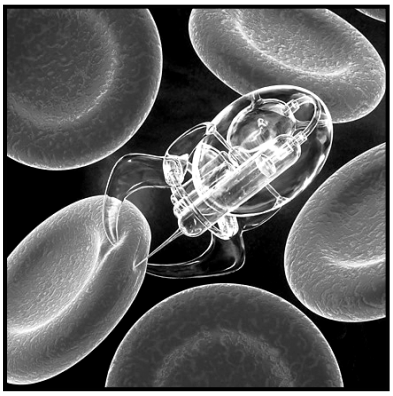
LLOYD'S

NANOTECHNOLOGY:
THE BIG QUESTIONS

Nanotechnologies are being used in many industries across the globe. Some believe they have the power to transform the world; others are concerned that the pace of change is too fast and unregulated. At best insurers may have new products to insure; and safer materials leading to lower insurance losses. At worst they could lead to unexpected life, health, workers compensation, physical damage, and pollution losses. This brief will draw attention to the nanotechnology issues that the insurance industry simply **cannot** ignore.

What is nanotechnology?

The word "nano" itself refers to the length scale (one nano-metre is one billionth of a metre) that is one thousand times smaller than the micro scale, the scale that was traditionally associated with the electronics industry. Viruses and DNA are examples of natural objects on the nano scale, where a human cell can appear enormous. The term nanotechnology refers to the engineering, measurement and understanding of nano-scaled materials and devices. Manipulating matter atom by atom and creating features on the atomic or nano-scale is now a proven technology and there is an ever growing catalogue of products that utilise nanotechnology.



What Lloyd's is doing

In collaboration with Lloyd's the Lighthill Risk Network is hosting a half-day seminar in the Old Library on the 10th of December 2007 on the risks and opportunities of nanotechnology. There will be four expert speakers from a range of backgrounds to discuss the latest developments on this Emerging Risk topic. Also in December, the Emerging Risks team will be publishing a report on nanotechnology on the Lloyd's website to try and answer some of the questions highlighted in this brief.

Benefits to the insurance industry

Aside from providing a new industry to insure, it is also important to note that nanotechnology could also bring direct benefits to risk mitigation in the form of new materials that are stronger or more adaptive than before. Cars could be made to absorb more of the impact during a crash; building materials could be made stronger and more flexible to resist damage from earthquakes, fire, flood and corrosion. Environmental cleanup operations could be made easier and cheaper with the use of specialised nano-particles. Medicine could also be transformed by nanotechnology allowing cheaper and more sensitive diagnostic tools for diseases giving insurance professionals better statistics to determine pricing. Most of these examples are not realised as yet, but a significant amount is being invested worldwide each year to develop products like these.

What is the potential market?

According to the Royal Society "nanotechnologies are widely seen as having **huge potential** in areas as diverse as healthcare, IT and energy storage" and that the scope of products that could make use of nanotechnology is enormous. Current and potential areas of application include transport, manufacturing, biomedicine, sensors, environmental management, food technology,

information and communications technology, materials, textiles, sports equipment, cosmetics, skin care and defence, though this list is by no means exhaustive. Some sources suggest that between US$30 billion to US$200 billion worth of products contained nanotechnology in the year 2005. While the value of nanotechnology contained within a product is typically only a fraction of the total value of the product, these figures do indicate the penetration of nanotechnology into commercial products. One estimate states that 15% of global manufactured goods will contain nanotechnology by the year 2014.

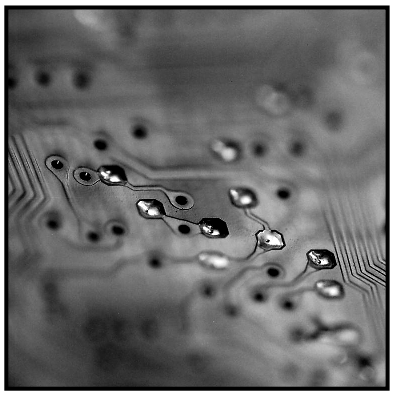
What is the impact on the environment?

The Royal Society has stated "There remains virtually no data on the potential negative impacts of nano-materials on the environment. Research into the ecotoxicology is urgently required". Research has started in this area but there are still significant gaps in the knowledge. Some nano-particles (such as copper or silver) have been shown to be harmful to aquatic life, which has environmental consequences if a large amount of the material were to be released into the environment. Removing nano-particles from the environment may also present a significant problem due to their small size. Particles could be absorbed quickly into plants and soil or transported large distances suspended in water; and how do you filter out of the environment particles only a few atoms wide?

Are there hazards to humans?

In terms of liability cover we need to know what nano-particles are hazardous to humans, and what concentrations are required to cause harm? Can nano-particles cause chronic health effects similar to asbestosis? The short answer is that **we simply do not know**. There has been a particular focus on the effect of inhalation of nano-particles such as carbon nano-tubes and initial investigations carried out show some nano-particles are acutely toxic when compared to larger particles composed of the same material. However, studies looking at the chronic effects of nano-particles are much less common, though some are underway. The UK Council for Science and Technology highlighted that there is insufficient research into the toxicology and health and environmental effects of nano-materials.

Which products use nanotechnology?



Knowing what products contain nanotechnology will assist in determining exposure to consumers and workers. The Project on Emerging Nanotechnologies, set up in part by the Woodrow Wilson International Centre for Scholars, is keeping a nanotechnology consumer products inventory. As of October 2007 there were 580 products in the database, an increase of 175% since the database was released in March 2006. The biggest category, with 61% of products, is health and fitness which includes clothing, cosmetics and sunscreens. Food and beverage products, including food supplements, make up 11% of the database. The most common nano-particles used in products are silver and carbon. Silver is used mainly for its anti-microbial properties, and carbon has many uses but is mostly used for strength or wear-resistant enhancement of materials and its electrical properties. It's also important to note that products are rarely 100% nanotechnology; nanotechnology will be added to a product and form a part of it.

Is nanotechnology regulated?

Regulation of nanotechnology is currently uses existing mechanisms with specific regulation under development. Stakeholders in nanotechnology have a wide range of opinions from seeing no need for additional regulation to believing that specific regulation is essential to mitigating the potential risks. A recent example of a lack of regulation is that some manufacturers of carbon nano-tubes are selling their product with hazard information that describes them as having similar chemical properties as graphite. Given there are studies that show that inhalation of carbon nano-tubes can cause damage to lungs, which we believe graphite does not, such an approach may be misleading. A big concern is whether existing regulation can cope with nanotechnology, and if changes do need to be made how should this be done? An important step was undertaken recently when the Organisation for Economic Co-operation and Development (OECD) released their "Nano Risk Framework" to evaluate and address the potential risks of nano-scale materials. The EU is recommending the precautionary principle for developing nanotechnology, though the US and Japan prefer a lighter regulatory touch. Under this principle the postponing cost-effective measures due to lack of scientific certainty to prevent serious threats to the environment or human health is not acceptable and suggests the use of this technology should be risk assessed appropriately before consumption by the public. Ultimately, ensuring that the diverse applications of nanotechnology have a regulatory framework is the challenge facing governments and industry.

What is the public perception?

Public opinion on nanotechnology differs between regions, though some studies show that in general the public are either not aware of nanotechnology, or if they are aware then it is viewed positively due to its potential applications. However, the potential negative impact of public opinion cannot be under-estimated as demonstrated with the genetically modified organism (GMO) industry. The EU, which took up a precautionary approach in part response to public opinion, is at odds with the US, where the public accepted the GMO technology. This disparity has resulted in very different regulation and use of the technology; could the same occur with nanotechnology?

Further information

1 The Woodrow Wilson International Centre for Scholars "Nanotechnology Consumer Products Inventory", http://www.nanotechproject.org/index.php?id=44&action=intro

2 The Royal Society's report, "Nanoscience and nanotechnologies: opportunities and uncertainties", http://www.nanotec.org.uk/finalReport.htm

3 The OECD "Nano Risk Framework", http://nanoriskframework.com

4 "Nanotechnology: Risk, Ethics and Law", Hunt and Mehta, published by Earthscan 2006

5 Lux Research, "Nanotech Report, 4th Edition, the Indispensable Reference Guide to Nanotechnology", http://www.luxresearchinc.com/press/RELEASE_TNR4.pdf

6 The Lighthill Risk Network, http://www.lighthillrisknetwork.org