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SCHOOL OF GRADUATE STUDIES
NANO AND PHYSICAL SCIENCES

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Risk Assessment of Products of Nanotechnologies

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Nanomaterials, typically defined as manufactured materials that have at least 1 dimension <100 nm, have been used or proposed for use in a variety of products, ranging from computers, clothing, cosmetics, medical devices, coatings and fuel cells, to environmental bio-remediation. It is estimated that by 2015 about 10% of output from the chemicals sector will have some influence from nanotechnology. Given that this is still a new and emerging technology, there are opportunities to consider how to address potential health risks in the regulatory and policy framework prior to widespread use. There has been some evaluation of potential health risks from nanomaterials, but to date, but these have not been pursued in a systematic way.
The process of risk assessment consists of the following steps: i) hazard identification and characterization, i.e. the qualitative and/or quantitative identification of biological, chemical, and physical agents capable of causing adverse health effects; ii) exposure assessment, and iii) risk characterization, that is the process of the qualitative/quantitative estimation of the probability of the occurrence and severity of known or potential adverse health effects in a given population based on hazard identification, hazard characterization and exposure assessment.
Some specific hazards include the possibility of some nanoparticles to induce protein fibrillation, the possible pathological effects caused by specific types of carbon nanotubes, the induction of genotoxicity, and size effects in terms of biodistribution.
Knowledge is gradually becoming available also on the behaviour of manufactured nanoparticles in the environment in terms of the development of possible fate scenarios.
Although for some manufactured nanomaterials adverse effects were observed they should not be extrapolated to other manufactured nanomaterials.
One of the main limitations in the risk assessment of nanomaterials is the general lack of high quality exposure data both for humans and the environment. A differentiation between background and incidental exposure is generally difficult in real life situations as the methods employed mainly measure the presence of nanoparticles and do not generally discriminate between the different types of particles (engineered or naturally occurring) that may be present.
These observations indicate potential hazards that should be taken into consideration in the safety evaluation of manufactured nanomaterials. As there is not yet a generally applicable paradigm for nanomaterial hazard identification, a case by case approach for the risk assessment is warranted.