

Nanoparticles

Information Sheet

November 2010

Nanotechnology is a broad term which describes a range of technologies which operate at a scale of 1 to 100 nanometres (nm). 1 nm is equal to 1 billionth of a metre. Materials at this scale display novel properties, which creates the potential for new applications with enhanced functionalities.

Nanomaterials or ('nano-objects') are defined in ISO/TS 27687:2008 as materials with one, two, or three external dimensions in the size range from approximately 1 – 100 nm. Subcategories of nano-objects include nanoplates, nanofibres and nanoparticles.

The key industries using engineered nanoparticles are: information and communication technology (ICT); industrial sectors such as the manufacture of paints and pigments and research and development (R&D) of medical devices, diagnostic devices and pharmaceuticals.



Routes of Exposure

The three main exposure routes are inhalation, ingestion and dermal contact. The most common methods of exposure to workers are by inhaling a gas or an aerosol, making skin contact with the substance, ingesting the material, absorbing the substance through eye contact, or suffering an injection. Workers may become exposed to nanoparticles in open systems of production where nanoparticles are used, working with nanoparticles in liquids, conducting maintenance work e.g. cleaning extraction systems etc. The handling of nanostructured powders (i.e. traditionally defined as those with grain sizes smaller than 100 nm) may result in airborne nanoparticulate exposure.

Potential Health Effects

Although insufficient data currently exist to demonstrate that nanoparticles present a hazard to human health,

emerging evidence suggests a potential concern given the altered physico-chemical properties of nanoparticles, when compared to their bulk counterparts. Identifying the hazards arising from different types of nanoparticles is difficult because research on the health effects is still at an early stage.

It is important to note that:

- Information currently available in for example, safety data sheets (SDSs), may not be relevant for the same materials at the nanoscale.
- Conventional sampling and detection methods for carrying out occupational hygiene monitoring may not suffice.
- Current occupational exposure limit values (OELVs) as published in the Chemical Agents Code of Practice may not be relevant for nanoparticles, as these OELVs were developed for the bulk forms of the substances.

Recommended Control Measures

Where there is uncertainty as to the existence or extent of risks of injury to the worker, a precautionary approach must be adopted.

Engineering Controls

- **Total enclosure of the process:** All operations in which there is deliberate release of nanomaterials into the air should be performed in contained installations, or where employees are otherwise isolated from the processes (i.e. in a cabin). Based on current knowledge, systems normally used to contain gaseous emissions would be appropriate.
- **Containment control:** All processes where there is a likelihood of dust formation should be carried out with extract ventilation. Regular maintenance and performance testing of extraction facilities should be carried out. Extracted air should not be re-circulated without exhaust air purification.

Administrative Controls

- Reduce the number of employees exposed.
- Reduce time spent by the employee(s) on the process.
- Limit the process to certain areas.
- Post appropriate signs.
- Deny unauthorised access to these areas.
- Ensure employees are trained and informed of the specific hazards.
- Ensure work wear is cleaned by the employer, and stored separately from non-work clothing.
- Ensure cleaning of the workplace is planned and carried out regularly.

Health Advice

Currently, no specific measurable health effects have been uniquely associated with exposure to nanomaterials (other than those already associated with larger variants of the same materials). Therefore due to insufficient

scientific and medical evidence, and the current lack of adequate methods to measure exposure to nanoparticles, the Authority does not currently recommend occupational health screening.

Key Points

- ☑ When assessing the hazards associated with nanoparticles, their size, shape, composition and surface charge are important parameters for consideration.
- ☑ Traditional validated toxicological techniques, designed for chemical substances may not be sufficient in the analysis of nanoparticle toxicity.
- ☑ Not all nanomaterials have been found to induce more pronounced toxicity than the bulk form of the same substance.
- ☑ Evaluation of nanoparticle properties should be carried out on a case by case basis.
- ☑ There is a need to stay up to date with the latest information as developments in the area are progressing rapidly.
- ☑ Although the same principles of risk assessment apply to nanomaterials, it is important to know that currently there are gaps in the knowledge relating to the properties of nanomaterials.
- ☑ Employers must apply the hierarchy of controls in order to protect the safety, health and welfare of workers.

Further information:

- The Health and Safety Authority's website www.hsa.ie
- Contact the Health and Safety Authority at wcu@hsa.ie or LoCall 1890 289 389.

