

Loss Control Bulletin

If you watch television news, read a newspaper or magazine, or view video or printed advertising, you have probably, in some manner, been exposed to the unfamiliar terminology associated with an emerging technology, NANOTECHNOLOGY. Nanoparticle, nanometer, nanowires, nanotubes....the list of new terms expands almost as quickly as the emergent technology itself.

Nanomaterials are finding their way into a wide range of end products and uses, ranging from sunscreens to industrial coatings, cosmetics to microprocessors, tennis rackets to medicines, with the only apparent limitations being the “creativity of the human (researcher’s) mind”. Many researchers believe that nanotechnology has the potential to impact civilization similarly to the use of electricity or the invention of automobiles.

The particles making up the nanomaterials, nanoparticles, are minute particles that range in size from one to one hundred nanometers. These are EXCEPTIONALLY small particles. One nanometer is one billionth of a meter, roughly one-hundred-thousandth the width of a human hair! The particles are derived from a variety of materials that include gold, carbon, cadmium, and selenium. Nanoparticles are typically characterized by their shapes or structure. Nanotubes, nanowires, quantum dots, and fullerenes are some descriptive terms used to differentiate these particles.

While “engineered” nanoparticles are new, some nano-sized particles are “naturally occurring” and have always been present in our environment. Some are generated in natural events such as volcanic eruptions. Similar particles are also present in commonly occurring fumes, such as those produced in welding or auto emissions.

“Engineered” particles are, however, a relatively new occurrence. These particles are derived in two ways. Researchers may reduce the size of “standard materials”, which changes the characteristics of the material to suit specific needs. Carbon, for example, may become one hundred times as strong as steel. Researchers may also re-engineer the atoms and molecules of materials to develop nanoparticles that display the properties that they desire.

With the development of nanomaterials, concerns have arisen for the potential harm that these particles may create for humans.

Possible Concerns - While there has been a “rush” to market new products that may contain nanoparticles, there has been little research into the possible effects of exposures to these materials. As an example, during a period when the Federal Government invested \$1 billion in nanotechnology research, less than four percent of that money was devoted to analyzing the risk associated with their use.

It should be noted that there have been no confirmed cases of harm caused to humans by manufactured nanoparticles. However, the size of these particles allows them to be easily airborne, as well as easily transported in droplets and aerosols. This is a basis for some concern about human exposure to these particles.

Nanotechnology – Evolving Science – Safety Issues

Some recent animal research indicates that nanoparticles have possible adverse health effects. One experiment showed that animals exposed to a specific type of carbon nanotubes developed lung inflammation more quickly than when exposed to “typical” carbon. This resulted in a warning that “nanotube workers might therefore be at risk for pulmonary fibrosis or potentially fatal scarring of the lungs”.

Other experiments have shown that fullerenes, which are used in many cosmetics, readily penetrate skin. It has been revealed in these experiments that fullerenes may harm various cellular structures, including human liver cells and DNA.

While testing has been limited and much further testing may be needed to conclusively determine the risks associated with humans being exposed to nanoparticles, currently available test results would indicate that limiting exposure to these materials would be advisable.

How can workers be protected? This can be a difficult question to answer. At this point, there are no established exposure limits. Laboratory results, at least on humans, have been very limited. The effects of long-term exposure are unknown. So...what are some of the “knowns” and what action is indicated?

It is known that these particles have three primary “routes of entry”:

Inhalation – (Most prevalent route of entry) - Arises from:

- Handling particles in systems that are not enclosed
- Aerosols generated in processing
- Cleaning and maintenance of dust collection equipment
- Secondary operations (grinding, drilling, sanding, etc.) on materials containing nanoparticles

Ingestion

- Through food contamination or swallowing of particles coming from the respiratory tract
- Improper hygiene
- Food in work areas

Absorption

- By passing through the skin
- Current laboratory studies are inconclusive
- Use of personal protective equipment (gloves, etc.) is recommended

Suggested Controls:

Engineering Controls

- Enclose the source of the particles
- Use local exhaust ventilation in conjunction with enclosed systems
- Use HEPA filters similar to those used in welding fume extractors



Nanotechnology – Evolving Science – Safety Issues

Personal protective equipment

- Protective clothing
- Gloves
- Respiratory protection
- Other that may be indicated by available safety information

Education

- Use MSDS, NIOSH, Cal-OSHA as resources for training materials
- Train ALL employees including management, production workers, and office personnel
- Do not overlook CUSTOMERS, VISITORS, and VENDORS who may enter work areas

The guidelines provided in this bulletin are only intended to provide an overview of some of the more important steps that can be taken by management to establish a safe workplace. The guidelines are not considered exhaustive of all measures and controls that can be implemented by management to address all potential loss or injury producing causes. Ultimately it is the responsibility of management to take the necessary steps to provide for employee and customer safety. It is not intended as an offer to write insurance for such conditions or exposures. The liability of Republic Indemnity Company of America and its affiliated insurers is limited to the terms, limits and conditions of the insurance policies underwritten by any of them. © 2022 Republic Indemnity of America, 4500 Park Granada, Suite 300, Calabasas, CA 91302.