Environment, health, and safety

Nanotechnology and the environment

By Katie Slavin, MS, RN

NANOTECHNOLOGY is the use of innovative techniques for controlling and manipulating matter at the near-atomic scale to produce engineered materials, structures, and devices. Nanotechnology has potential applications in many areas, including consumer products, health care, transportation, energy, and agriculture. Nanotechnology also presents new strategies to advance how we measure, monitor, control, and reduce contaminants in the environment.

Products with nanoscale material are already available. For example, antibacterial wound dressings contain nanoscale silver. Nanosilver is also used widely as a protective antibacterial coating on pacifiers, handrails, socks, fingernail clippers, and additional products. Other products being manufactured include batteries, cosmetics and food products, sunscreens, and scratch- and glare-resistant coatings for eyeglasses, windows, and car mirrors.

Researchers project that the use of nanotechnology will provide cost-effective methods for harnessing renewable energy sources and keeping our environment clean. Nanotechnology will allow care providers to detect diseases at early stages, as well as treat illnesses with more effective and safer medicines.

Researchers at one university are investigating whether magnetic interactions of nanoscale rust could lead to the development of a revolutionary low-cost technology for cleaning arsenic from drinking water. At another university, researchers are using nanotechnology to engineer a gel that spurs the growth of nerve cells. If successful, this process could eventually be used to regrow lost or damaged spinal cord or brain cells.

Potential hazards of nanoparticles

Although there is currently insufficient evidence regarding detrimental health effects following occupational exposure to engineered nanoparticles, concerns have been raised regarding the potential for increased adverse health outcomes in workers exposed to these materials. Because of their small size and large surface area, engineered nanoparticles may have physical, chemical, and biological properties distinct from bulk material. Suspected properties of nanoparticles include a high rate of pulmonary deposition, the ability to travel from the lung to systemic sites, the ability to penetrate dermal barriers, and a high inflammatory potency per mass. In other words, potential hazards of nanomaterials include inhalation hazards and increased reactivity, mobility, and bioavailability hazards.

For example, nanosilver has been shown to damage human cell mitochondria, induce oxidative stress, and cause eutrophication (a process that results in excessive plant growth) in freshwater ecosystems. Nanoscale carbon used in face creams and moisturizers has been shown to be toxic to human liver cells at low levels of exposure and also has been found to cause brain damage in fish, kill water fleas, and exhibit bactericidal properties.

Medical surveillance

Considering that nanotechnology is used in pharmaceutical, biological product, and medical-device engineering for diagnosis and treatment, ANA is concerned with the adverse health effects these products may cause in nurses and other healthcare workers exposed to nanoparticle-containing material. For these reasons, ANA supports medical surveillance for workers with potential exposure to nanoparticles, recently supporting the National Institute for Occupational Safety and Health's draft document, "Interim Guidance for the Medical Screening of Workers Potentially Exposed to Engineered Nanoparticles."

ANA's position statement *Risk and Responsibility in Nursing Care* (2006) and ANA's adoption of the Precautionary Principle in 2003 support ANA's desire to ensure nurses are adequately protected from present and potential occupational hazards. Considering ANA's 2006 House of Delegates Resolution: *Nursing Practice, Chemical Exposure, and Right-to-know*, ANA also strongly encourages efforts to educate and train nursing staff on the potential exposure to hazardous materials and proper controls to eliminate or minimize exposure.

Although nanotechnology may enhance environmental and healthcare processes, allowing them to become more efficient and effective, it is prudent to protect employees exposed to nanoscale materials from any hazardous properties this matter may possess. ✭

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