



Nanotechnology: An EPA Research Perspective

Factsheet

Nanotechnology is one of the top research priorities for the U.S. government. The Environmental Protection Agency (EPA) is part of the National Nanotechnology Initiative (NNI), which helps coordinate and provide direction for this emerging field. While many definitions exist, the NNI defines a nanotechnology as:

- Research and technology development at the atomic, molecular or macromolecular levels, in the length scale of approximately 1 - 100 nanometers,
- Creation and use of structures, devices and systems that have novel properties and functions because of their small and/or intermediate sizes, and
- Ability to be controlled or manipulated on the atomic scale.

How does nanotechnology relate to the environment?

The laws of quantum mechanics often cause dramatic changes in the mechanical, optical, chemical and electronic properties of materials on the nanoscale. These properties can lead to useful and enhanced applications of nanotechnology in environmental protection including green manufacturing that eliminates waste products; green energy technologies; sensors that improve monitoring; and treatment and remediation techniques for cost-effective and specific site cleanup.

Manufactured nanomaterials might also pose risks to human health or the environment because of their composition, reactivity and size. Thus, it is equally important to consider how nanomaterials could interact with the environment and the associated risks. EPA is studying the effects of engineered nanoparticles in air, soil and water to understand their fate and transport from a full lifecycle perspective. Risk assessment also includes toxicity of engineered nanomaterials, as well as the routes of exposure and potential for bioaccumulation.

What is EPA doing?

The mission of EPA is to protect human health and the environment. As new technologies are developed, EPA must assess their potential impacts on the environment and develop appropriate policies for protection through science-based decisions.

EPA has become a leader in planning research directions for the environmental applications and implications of nanotechnology through its own research programs and by participating in the interagency Nanoscale Science, Engineering and Technology subcommittee of the National Science and Technology Council, through which the NNI is managed.

In February 2007 EPA issued a “white paper” describing the key science issues that EPA should consider to ensure that society benefits from advances in environmental protection that nanotechnology could offer, and to understand and address any potential risks from environmental exposure to nanomaterials. The paper concludes with staff recommendations for addressing science issues and research needs and includes prioritized research needs within most risk assessment topic areas (e.g., human health effects research, fate and transport research) to help EPA focus on priorities for the near term. The document can be found at:

<http://www.epa.gov/osa/pdfs/nanotech/epa-nanotechnology-whitepaper-0207.pdf>



EPA's Office of Research and Development (ORD) conducts most of the Agency's nanotechnology research efforts. Currently, a team of ORD scientists and engineers are developing a nanotechnology research strategy for the Agency.

ORD scientists and engineers from the National Center for Environmental Research also organize meetings, symposia and workshops at various professional organization events to assess and direct efforts on the environmental applications and implications of nanotechnology. Collaborators include academic, federal and industrial researchers, policy scholars and nongovernmental organization representatives.

Through **EPA's Science to Achieve Results (STAR) Research Grants Program**, 86 research grants for more than \$29 million have been awarded to study the applications (~\$12 million) and implications (~\$17 million) of nanotechnology on the environment. STAR-funded research includes the development of low-cost, rapid and simplified methods to remove toxic contaminants from surface water; new sensors to measure pollutants; green manufacturing of nanomaterials; and more efficient, selective catalysts.

Current open solicitations available to researchers are:

- **Nanotechnology Research Grants Investigating Fate, Transport, Transformation, and Exposure of Engineered Nanomaterials: A Joint Research Solicitation - EPA, NSF, & DOE**
(closing August 22, 2007)
- **Detection and Monitoring of Engineered Nanomaterials** (closing September 13, 2007).

The Small Business Innovation Research (SBIR) Program was established by the Small Business Innovation Development Act of 1982, and EPA is proud to be one of the 10 federal agencies that participate in the program. The purpose of this act is to strengthen the role of small businesses in federally funded research and development and help develop a stronger national base for technical innovation. Twenty-six small companies have received 32 grants totaling more than \$2.5 million for nanotechnology research on microelectronics coatings, biocidal fungal control and fire-fighting foams for fuel and oil fires.

Since 2007, **EPA's Laboratories** have been exploring the environmental fate, transport and detection of nanomaterials; human health and ecological protocols; risk assessment; and prevention and management risks.

For more information visit:
<http://www.epa.gov/ncer/nano>

June 2007

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