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## Nanotechnology: How Green Can It Be?

WASHINGTON, DC, April 26, 2007 (ENS) – The ability to use nanotechnology to reduce pollution, conserve resources and build a "clean" economy now exists, finds a new report "Green Nanotechnology: It's Easier Than You Think." But environmentalists are at odds about how green nanotechnology can be. Not all nanoparticles are harmful to human health and the environment, but some are. Nanotech critics fear that without government oversight the industry may release harmful particles into the air and water.

Nanotechnology is the ability to measure, see, manipulate and manufacture things on an atomic or molecular scale, usually between one and 100 nanometers. A nanometer is one billionth of a meter - a human hair is 100,000 nanometers wide.

The report explores potentially beneficial links between nanotechnology and green chemistry and engineering, which aim to minimize environmental impacts through resource conservation and waste elimination in processes and products.

**Scientist uses a nanolithography hot embosser to create new biohazard detection and medical diagnosis technologies.**

(Photo courtesy National Research Council of Canada)



Summarizing proceedings at a national American Chemical Society symposium and four workshops held in 2006, the report was authored by science writer Karen Schmidt for the Project on Emerging Nanotechnologies, an initiative of the Woodrow Wilson International Center for Scholars and The Pew Charitable Trusts.

A "strong marriage" between nanotechnology and the principles and practices of green chemistry and green engineering "holds the key to building an environmentally sustainable society in the 21st century," Schmidt writes.

"We think the United States is on track to be a global leader in green nanotech," said David Rejeski, director of the Project on Emerging Nanotechnologies. "The country's research and development portfolio



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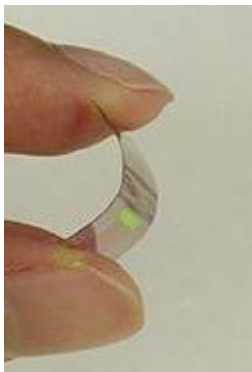
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should be directed toward this goal. We believe green nanotechnology can not only help protect the environment but also be a source of American jobs and company profits in the future."

Nanotechnology can be utilized to clean up toxic waste sites. Chemist Vicki Colvin and her Rice University colleagues, for instance, have discovered that magnetic nanoparticles can remove more than 99 percent of the arsenic in a solution, while their counterparts at Oklahoma State University have engineered nanoscale sensors that can detect pollutants at the level of parts per billion.



**A flexible photovoltaic cell based on nanomaterials made at the University of Michigan Department of Materials Science and Engineering** (Photo courtesy [U. Michigan](#))

Nanotechnology has opened new ways of making inexpensive solar cells as well as improving the performance and lowering the cost of fuel cells, the energy source for future cars and trucks.

University of Oregon chemist James Hutchison uses DNA molecules in a process that holds promise for building nanoscale patterns on silicon chips. The experimental method saves materials and requires less water and solvent than the traditional methods.

Other researchers are investigating nanoscale approaches to replace lead and other toxic materials in electronics manufacturing.

"We are on an unsustainable path," said Paul Anastas, director of the American Chemical Society's Green Chemistry Institute. "It is not as though nanotechnology will be an option; it is going to be essential for coming up with sustainable technologies."

The report concludes with recommendations for proactive federal policy measures to help the field of nanotechnology to "grow up" green, ranging from developing metrics for evaluating bottom-line environmental impacts to using federal procurement to foster demand for green nanoproducts.

"Nanotechnology potentially is a doubly green dream. It offers us the opportunity to make products and processes green from the beginning," said Barbara Karn, an environmental scientist who helped organize the green nanotechnology programs with the Project on Emerging Nanotechnologies.

"And it allows us to substitute more environmentally-friendly chemicals, materials and manufacturing processes for older, more polluting ones,"

said Karn.

But there is a controversy brewing among environmentalists about how green nanotechnology can be without government regulation.

In an open letter issued April 12, a coalition of public interest, environmental and labor organizations criticized a voluntary research safety plan for the nanotech industry. The "Nano Risk Framework" is proposed by Environmental Defense, a conservation group, in partnership with DuPont, one of the companies involved in nanotechnology development.

The intent of the Framework, say DuPont and Environmental Defense is "to define a systematic and disciplined process for identifying, managing, and reducing any environmental, health, and safety risks of engineered nanomaterials across all stages of a product's lifecycle."



**Nanotech critics worry that harmful nanoparticles might escape from labs into the environment. (Photo courtesy [Nanotechnology Info](#))**

Critics, including Friends of the Earth, Greenpeace, the International Center for Technology Assessment, the Natural Resources Defense Council, the Silicon Valley Toxics Coalition, the AFL-CIO, and two other labor unions, said the Framework reflects corporate interests and is "at best, a public-relations campaign that detracts from urgent worldwide oversight priorities."

"We reject outright the proposed voluntary framework as fundamentally flawed," the coalition wrote in an open letter to the international nanotechnology community. "We strongly object to any process in which broad public participation in government oversight of nanotech policy is usurped by industry and its allies."

"We made the decision not to engage in this process out of well-grounded concerns that our participation - even our skeptical participation - would be used to legitimize the proposed framework as a starting point or ending point for discussing nanotechnology policy, oversight and risk analysis," the coalition wrote.

With the value of nanotech-enabled products entering the global market

expected to grow from \$30 billion in 2005 to \$2.6 trillion by 2014, "numerous uncertainties exist regarding possible impacts on the environment and human health," Karn and her colleagues said in a March report on the risks of nanotechnology.

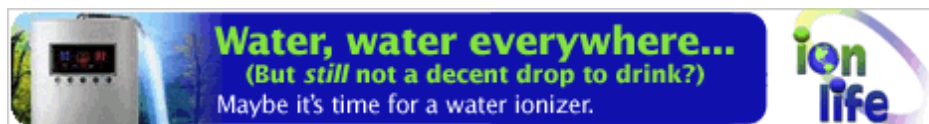
"The lack of toxicity data specific to nanomaterials is a repeating theme in this and in other studies related to nanotech environmental, health, and safety concerns," said Andrew Maynard, chief scientist for the Project on Emerging Nanotechnologies.

"Nanotechnology is no longer a scientific curiosity. Its products are in the workplace, the environment, and home. But if people are to realize nanotechnology's benefits - in electronics, medicine, sustainable energy, and better materials for building, clothing and packaging," Maynard said.

"The federal government needs an effective risk research strategy and sufficient funding in agencies responsible for oversight to do the job," he said.

"The report calls for international cooperation and coordination - among governments, university researchers, corporations, and consumer and other groups - to help address critical data needs," Karn said.

Project on Emerging Nanotechnologies researchers stress the need for nano-specific protocols and practical methodologies for toxicology studies as well as studies on the fate and transport of nanoparticles.



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