http://www.epa.gov/oppt/nano/nano-facts.htm
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Pollution Prevention and Toxics

Fact Sheet for Nanotechnology under the Toxic Substances Control Act

What is Nanotechnology and What Are Nanoscale Materials?

Nanotechnology is the understanding and control of matter at dimensions of roughly one to 100 nanometers, where unique phenomena enable novel applications. A nanometer is one billionth of a meter – about one ten-thousandth the diameter of a human hair. Nanotechnology encompasses nanoscale science, engineering and technology, and involves imaging, measuring, modeling, and manipulating matter at this length scale. Nanoscale materials may have organizations and properties different than the same chemical substances displayed at a larger scale.

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Nanotechnology's Potential

Nanotechnology, by altering materials at a molecular level, allows scientists and engineers to take advantage of nanoscale properties and produce materials that are lighter, stronger, and more reactive than materials made with larger size particles of the same material. By taking advantage of these properties, nanotechnology has the potential for introducing many new and unique applications into many sectors of the American and world economies, including consumer products, medicine, transportation, energy, defense and agriculture. Nanotechnology also has the potential for reducing pollution, reducing energy consumption, and cleaning up pollution. New generations of nanomaterials will evolve, and with them new and possibly unforeseen environmental issues. EPA has the obligation and mandate to protect human health and safeguard the environment by better understanding and addressing potential risks from exposure to these nanoscale materials and products containing nanoscale materials.

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Products Resulting from Nanotechnology

Already, nanomaterial-containing products are available in U.S. markets including coatings,

computers, clothing, cosmetics, sports equipment and medical devices. A survey by EmTech Research of companies working in the field of nanotechnology has identified approximately 80 consumer products, and over 600 raw materials, intermediate components and industrial equipment items that are used by manufacturers (Small Times Media, 2005). A second survey by the Project on Emerging Nanotechnologies at the Woodrow Wilson International Center for Scholars lists over 300 consumer products (http://www.nanotechproject.org/44). Our economy will be increasingly affected by nanotechnology as more products containing nanoscale materials move from research and development into production and commerce.

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Environmental Applications of Nanotechnology

Similar to nanotechnology's success in consumer products and other sectors, nanoscale materials have the potential to improve the environment, both through direct applications of nanoscale materials to detect, prevent, and remove pollutants, as well as indirectly by using nanotechnology to design cleaner industrial processes and create environmentally responsible products. For example, nanosized cerium oxide has been developed to decrease diesel emissions; iron nanoparticles can remove contaminants from soil and ground water; and nanosized sensors hold promise for improved detection and tracking of contaminants.

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Environmental, Health and Safety Implications of Nanoscale Materials

At this early stage of development of nanotechnology, there are few detailed studies on the effects of nanoscale materials in the body or the environment. Early results are also inconclusive, and it is clear that it is not yet possible to make broad conclusions about which nanoscale substances may pose risks.

1. Some of the same special properties that make nanoscale materials useful are also properties that may pose hazards to humans and the environment, under specific conditions. For example, some nanoscale materials that enter animal tissues may be able to pass through cell membranes or cross the blood-brain barrier. This may be a beneficial characteristic for such uses as targeted drug delivery and other disease treatments, but could result in unintended impacts in other uses or applications.

There is a need for more information to assess the potential environmental, health, and safety impacts for most engineered nanoscale materials. Such information is important because EPA needs a sound scientific basis for assessing and managing unreasonable risks that may result from the introduction of nanoscale materials into the environment.

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U.S. Government Coordination on Nanotechnology

Nanotechnology is one of the top research priorities of the U.S. government. The National Nanotechnology Initiative (NNI) is a federal research and development program launched in 2001 to coordinate the efforts across the federal government in nanoscale science, engineering, and technology. EPA and 25 other federal agencies participate in the Initiative, 13 of which have a research and development budget for nanotechnology. Other federal organizations contribute with studies, applications of the results from those agencies performing research and development, and other collaborations.

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International Coordination

EPA is working collaboratively with stakeholders both domestically and internationally to address industrial chemical nanoscale materials. In December 2005, EPA hosted and chaired an international workshop on nanotechnology, under the Organization for Economic Cooperation and Development (OECD), in Washington, D.C. We are actively participating in the OECD's Working Party on Manufactured Nanomaterials to consider key issues relating to environmental health and safety.

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