Response from the Environmental Protection Agency

A. How does your agency view its research agenda as it relates to the environment?
Nanotechnology can be described as the ability to work at the molecular level, atom-by-atom, to create structures with fundamentally new organizations and characteristics. Accordingly, nanotechnology has the potential to significantly improve environmental protection. Useful applications of this emerging technology may include revolutionary advances in pollution prevention, detection, and waste treatment and remediation. To sum up – nanotechnology may well be an environmental toolkit for the 21st century.

The EPA, through the National Center for Environmental Research's (NCER) Science to Achieve Results (STAR) grant program, sponsors nanotechnology researchers pursuing a highly practical goal: development of "green" nanotechnology for a cleaner environment. The first nanotechnology solicitation, which opened in 2001, resulted in awards for 16 projects at a variety of academic institutions, totaling approximately $6 million. These grants are in the areas of sensor development, environmentally-benign manufacturing and processing, and remediation/treatment techniques. Another 16 grants were awarded in 2003 in response to a second solicitation. Most of these grants also deal with environmental applications of nanotechnology. These awards total approximately $5 million as well.

Along with the vision of nanotechnology that could lead to major advances in environmental protection are questions related to potential environmental concerns that could be associated with this new technology. Could hazardous materials be released into the environment during the use or manufacture of nanotechnologies? Could nano applications lead to biological harm by possibly accumulating in cellular material? EPA's STAR researchers will begin to address these issues in FY 2004 under a solicitation for proposals in environmental implications of manufactured nanomaterials, including toxicity, exposure, bioavailability, fate, transport and transformation. This solicitation recently closed on December 11, 2003. Future STAR researchers may provide answers to many of these questions and determine the utility of nanotechnology as a vital new tool for protecting the environment and human health.

In addition, NCER awards contracts to small businesses for development of new technologies under its Small Business Innovation Research (SBIR) program in the area entitled "Nanomaterials and Clean Technology". Information on both STAR and SBIR solicitations may be obtained from NCER's website.

B. Can the research be applied to an environmental problem or possibly prevent an environmental problem?
Pollution has long been recognized as a serious threat to both the local and global environments and to our quality of life. The development of new technologies that enable industrial economies without harming human health and the environment is of critical importance in the 21st century. Development of innovative technologies for manufacturing, transportation, and other activities

that reduce or eliminate the production of harmful by-products, or for treatment and remediation of existing toxic substances in the environment, presents major challenges for our society.

Nanoscale science and engineering can significantly improve our understanding of molecular processes that take place in the environment and help reduce pollution by leading to the development of new "green" technologies that minimize the use, production, and transportation of toxic substances. Environmental remediation will be improved by the removal of contaminants from air and water supplies to levels currently unattainable and in a cost-effective manner, and by the real-time measurement of pollutant concentrations and transport dynamics. Nanotechnology will also enable major reductions in material and energy usage, thereby aiding efforts in pollution prevention.

C. Might the research cause an environmental problem?

The environmental implications of nanotechnology, including potential risks to human health, is an important issue. Technological advances, especially those that impact goods, services, manufacturing, economic development, etc., often have major environmental and societal consequences. Assessing potential environmental problems arising from nanotechnology requires an examination of the entire life cycle of a product/technology. A careful analysis of the processes used to obtain the requisite raw materials, of the methods by which production or manufacturing is employed, of the use and application of the products, and of the lifetime and eventual disposal or reuse of the products or of the materials contained in the products will provide critical information for the understanding of potential environmental problems that might result from nanotechnology.

In order to begin to evaluate the risks of nanotechnology to human health and the environment, EPA released an RFA for research that focused on the toxicology, fate, transport, transformation, exposure, and bioavailability of manufactured nanomaterials. The proposals received under this solicitation will be peer reviewed shortly and awards are expected to be made by the end of 2004.