The Department of Energy

Nanotechnology and the Environment

A. How does your agency view its research agenda as it relates to the environment?

The Department of Energy (DOE) has four identified missions: national security, energy, the environment, and science. Most of the nanoscale science and engineering effort at DOE resides within the Office of Basic Energy Sciences, which in turn is a part of the Office of Science. As the name implies, the primary mission within this organization is the fundamental science that critically underpins the Department's other missions and the nation's capabilities.

DOE's nanoscience program includes research programs at national laboratories, universities, and other organizations as well as a major flagship activity: the development of five Nanoscale Science Research Centers (NSRCs). Environmental implications and applications of nanotechnology are explored in both. The NSRCs represent major long-term commitments to developing the infrastructure that will enable, accelerate, and inspire nanoscience in this country. They are open scientific user facilities, available via a peer-reviewed proposal process for both publishable fundamental research (at no charge) and proprietary efforts (on a cost recovery basis). Initial calls for proposals have been issued by most of the NSRCs; further information can be found at http://www.sc.doe.gov/bes/NNI.htm and the individual NSRC web sites listed therein.

B. Can the research be applied to an environmental problem or possibly prevent an environmental problem?

With respect to application towards and prevention of environmental problems, there are numerous DOE efforts in these areas involving sensors, membranes and separations, coatings, remediation, and radioactive waste containment. Some examples at the intersection of nanotechnology and the environment were discussed by DOE-supported researchers at the workshop. For instance, one program has demonstrated stabilization of enzymes in a designed matrix material with ordered nanoscale pores. Others involve contaminant transport by nanoparticles in geological systems and surface effects on thermodynamic stability and reactivity. Another presentation discussed the synthesis and application of nanosize semiconductors for photooxidation of toxic organic chemicals. These are just a few illustrative examples of the kinds of nanoscience research having environment implications and applications that are currently supported by DOE.

C. Might the research cause an environmental problem?

Possible environmental concerns relating to nanotechnology are still in the early stages of being acted on by government regulatory agencies. In order to coordinate activities, key topics are being identified and addressed largely via interagency efforts. One example was an exchange in August 2003 concerning safety and environmental aspects of ultrafine particles (less than 100 nm in diameter). This meeting of agency representatives across a variety of federal departments surveyed the state of knowledge and research in this area, and provided a forum to discuss best practices. It was organized and led by the National Nanotechnology Coordination Office.

Prepared by A.H. Carim, BES
October, 2003