

# Fact Sheet

## NATIONAL NANOTECHNOLOGY INITIATIVE ENVIRONMENTAL, HEALTH, AND SAFETY RESEARCH STRATEGY

- 1. What is nanotechnology?** Nanotechnology is the understanding and control of matter at dimensions between approximately 1 and 100 nanometers, known as the nanoscale, where unique phenomena enable novel applications. Encompassing nanoscale science, engineering, and technology, nanotechnology involves imaging, measuring, modeling, and manipulating matter at this length scale. A nanometer is one-billionth of a meter. A sheet of paper is about 100,000 nanometers thick; a single gold atom is about a third of a nanometer in diameter. Unusual physical, chemical, and biological properties can emerge in materials at the nanoscale. These properties may differ in important ways from the properties of bulk materials and single atoms or molecules.
- 2. What is the NNI?** The United States has set the pace for nanotechnology innovation worldwide with the National Nanotechnology Initiative, NNI. Launched in 2000 with eight agencies, the NNI today consists of the individual and cooperative nanotechnology-related activities of 25 Federal agencies with a range of research, application, and regulatory roles and responsibilities. The NNI brings together the expertise needed to advance this broad and complex field—creating a framework for shared goals, priorities, and strategies that helps each participating Federal agency leverage the resources of all participating agencies.
- 3. What are the goals of the NNI?** The goals of the NNI are fourfold: (1) to advance a world-class nanotechnology R&D program; (2) to foster the transfer of new technologies into products for commercial and public benefit; (3) to develop and sustain educational resources, a skilled workforce, and the supporting infrastructure and tools to advance nanotechnology; and (4) to support responsible development of nanotechnology.
- 4. How much does the U.S. government spend on nanotechnology?** The 2012 Federal Budget provides \$2.1 billion for the National Nanotechnology Initiative (NNI), reflecting steady growth in the NNI investment. The cumulative NNI investment since fiscal year 2001, including the 2012 request, now totals over \$16.5 billion. Cumulative investments in nanotechnology-related environmental, health, and safety research since 2005 now total nearly \$575 million. Cumulative investments in education and in research on ethical, legal, and other societal dimensions of nanotechnology since 2005 total more than \$390 million.
- 5. Why is an Environmental, Health, and Safety Research Strategy necessary?** The same unique properties that characterize nanomaterials enabling new applications also carry potential risks to human health and the environment. To maximize benefits and minimize potential risks from nanotechnology, the NNI agencies have developed a research strategy specifically focused on environmental, health, and safety (EHS) aspects of the field: the 2011 NNI EHS Research Strategy. This strategy will guide Federal agencies as they establish their own nanotechnology research programs.

6. **How was the 2011 NNI EHS Research Strategy Developed?** To develop the 2011 NNI EHS Research Strategy, the NNI agencies evaluated the 2008 NNI EHS Research Strategy and research developments over the last three years. This assessment included collecting and analyzing new information from the NNI agencies responsible for overseeing the manufacture and use of engineered nanomaterials and nanotechnology-enabled products. Similarly, a wide array of stakeholders—advisors to the government, academia, industry, non-governmental and public health advocacy organizations, and the general public—gave their input to the strategy. Development of the 2011 NNI EHS Research Strategy and integration of stakeholder comments was managed by the Nanotechnology Environmental and Health Implications (NEHI) Working Group of the interagency Nanoscale Science, Engineering, and Technology (NSET) Subcommittee of the National Science and Technology Council’s Committee on Technology.
7. **How does the 2011 NNI EHS Research Strategy help achieve the goals of the NNI?** EHS research is essential to successful achievement of all four NNI goals; however, it is most closely linked to the goal of responsible development. The NNI agencies collaboratively developed a nanotechnology EHS research strategy that focuses on the use of science-based risk analysis and risk management to protect public health and the environment while also fostering the technological advancements that benefit society. The strategy serves as guidance to the Federal agencies that produce and use scientific information to develop nanotechnology risk assessments that inform risk management and regulatory decisions.
8. **How does the 2011 NNI EHS Research Strategy weigh the benefits and risks of nanotechnology?** The 2011 NNI EHS Research Strategy is grounded in the principles of risk assessment and of product life cycle analyses. Risk assessment includes understanding the magnitude of the potential exposure to humans and the environment and the magnitude of the potential hazard or effects presented by the nanomaterials. Through the risk assessment process, risks and benefits may be compared between a nanomaterial and other substances, between different nanomaterials, or for a single nanomaterial.
9. **What information is necessary for risk assessment of nanotechnology?** Integration of risk assessment with the study of life stages of nanotechnology-enabled products (NEPs) permits identification of critical risk assessment data needs. These data needs have been translated into nanoEHS research needs and organized into core nanoEHS research categories: (1) Nanomaterial Measurement Infrastructure, (2) Human Exposure Assessment, (3) Human Health, (4) Environment, and (5) Risk Assessment and Risk Management Methods. The adaptive management process also identified (6) Informatics and Modeling and ethical, legal, and societal implications of nanotechnology as important additions to the strategy.
10. **How is the 2011 NNI EHS Research Strategy structured?** The nanoEHS research needs are organized into six chapters (Chapters 2–7), covering each of the core nanoEHS research categories, followed by a chapter on the means to effectively move nanoEHS research forward (Chapter 8). Each of the first five research category chapters contains a set of goals, research needs to achieve those goals, and an analysis of ongoing research in the category.
11. **What is new in 2011 NNI EHS Research Strategy?** New in the 2011 NNI EHS Research Strategy are the chapter describing the critical role of informatics and modeling in organizing the

expanding nanoEHS knowledge base and the chapter promoting timely and effective achievement of strategic NNI nanoEHS goals.

**12. What key principles to guide participating agencies are outlined by the 2011 NNI EHS Strategy for the?** The NSET Subcommittee and its NEHI Working Group will serve as a nexus for communication about and facilitation of this focused interagency collaboration. The NEHI Working Group has identified the following key principles to assist agencies in making strategic decisions about research programs that will efficiently advance the NNI EHS research agenda while meeting their respective missions:

- **Prioritize Nanomaterials for Research**
- **Establish Standard Measurements, Terminology, and Nomenclature**
- **Maximize Data Quality**
- **Stratify Knowledge for Risk Assessment**
- **Partner to Achieve NNI EHS Research Goals**
- **Engage Internationally**

**13. How will the 2011 NNI EHS Research Strategy be implemented?** This interagency strategy document will guide programs and investment decisions by the individual agencies as well as in coordinated interagency activities in the coming years. It should be noted that the agencies have varied missions, and their individual priorities may differ in scope and focus from those outlined in this report. For these reasons, continuous coordination is essential, and agencies will work through the NSET Subcommittee, its NEHI Working Group, and the NNCO Coordinator for EHS to ensure the integration of agency implementation plans.

The NNI, as a program, does not fund research; rather, its funding is the sum of nanotechnology-related funding allocated by each of the participating agencies. Through its member agencies, the NNI informs and influences the Federal budget and planning processes.

The 2011 NNI EHS Research Strategy is predicated on both concurrent and sequential progress in all core nanoEHS research categories. Continuous coordination is essential to ensure the integration of agency implementation plans.