Overview of the Workshop

National Nanotechnology Initiative Workshop: Nanomaterials and the Environment & Instrumentation, Metrology, and Analytical Methods

October 6 & 7, 2009

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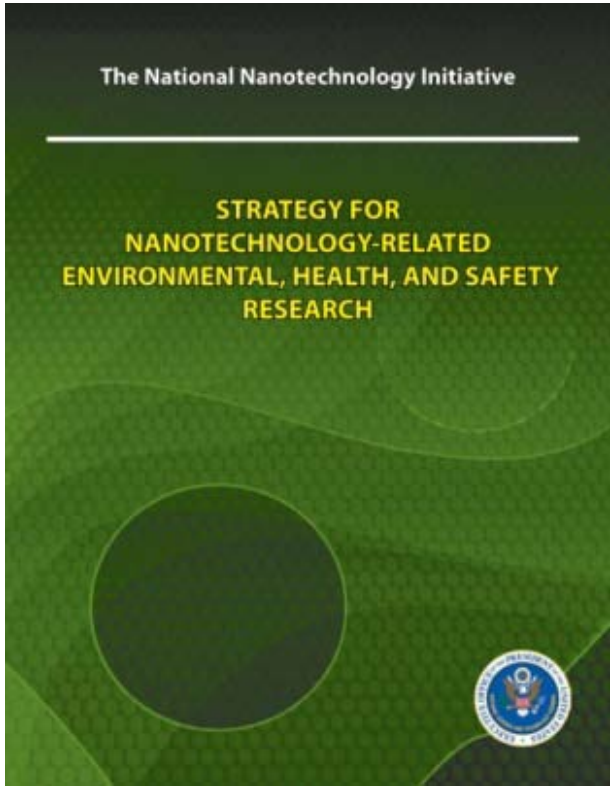
NNI Strategy for Environmental, Health, and Safety Research Needs

- Research to advance understanding of nano-related environmental, health, and safety (EHS) issues are coordinated by the Nanotechnology Environmental & Health Implications (NEHI) Working Group

- NEHI developed the *Strategy for Nanotechnology-Related Environmental, Health, and Safety Research* (Feb 2008) for addressing priority research on the EHS aspects of nanomaterials.

- The strategy outlined five categories for EHS research:
  - Instrumentation, Metrology, & Analytical Methods
  - Nanomaterials & Human Health
  - Nanomaterials & the Environment
  - Human & Environmental Exposure Assessment
  - Risk Management Methods

NNI Research Strategy & Workshop Series



The NNI's nanoEHS Series:

February 24-25, 2009
Human & Environmental Exposure Assessment

October 6-7, 2009
Nanomaterials and the Environment & Instrumentation, Metrology, and Analytical Methods

November 17-18, 2009
Nanomaterials and Human Health & Instrumentation, Metrology, and Analytical Methods

March 30-31, 2010
Capstone Meeting: Risk Management Methods & Ethical, Legal, and Societal Implications of Nanotechnology

Five Research Needs Related to the Environment

1. Understand the effects of engineered nanomaterials in individuals of a species and the applicability of testing schemes to measure effects

Work is needed to better understand the potential adverse effects of nanomaterials to biological receptors prior to their commercialization, for developing test protocols for commercial submissions for Federal consideration/approval, developing better understanding of dose-response characterization, and development of tiered testing schemes that incorporate the testing protocols for commercial submissions. Research areas noted include the following: test protocols; dose-response characterization; mode of action, leading to predictive tool development; tiered testing schemes

2. Understand environmental exposures through identification of principle sources of exposure and exposure routes

For commercial nanomaterials in particular, this research will allow identification of appropriate biological and other environmental receptors that could be affected by the release of nanomaterials. Research areas noted include the following: manufacturing and product incorporation; life-cycle exposures subsequent to product manufacture

3. Determine factors affecting the environmental transport of nanomaterials

Research areas noted include the following: key physico-chemical properties affecting transformation; key transformation processes; development of predictive tools

4. Understand transformation processes under different environmental conditions

Research areas noted include the following: key physico-chemical properties affecting transport; key transport processes; development of predictive tools

5. Evaluate abiotic and ecosystem-wide effects

Five Research Needs Related to Instrumentation, Metrology, & Analytical Methods

1. Develop methods to detect nanomaterials in biological matrices, the environment, and the workplace

Analytical methods for identifying and measuring the critical parameters related to NM in biological systems, the environment, and the workplace are not well developed or readily available. As a result these important metrics are infrequently or inaccurately reported. Further development of these methods is critical to all nanoEHS research.

2. Understand how chemical and physical modifications affect the properties of nanomaterials

Research in this priority research need provides information on how such changes or modifications to nanomaterials may affect their behavior, including their degradation and their uptake by biological materials. Modifications may also affect the chemical and physical properties of nanomaterials and the methods necessary to detect the nanomaterials in human and environmental media

3. Develop methods for standardizing assessment of particle size, size distribution, shape, structure, and surface area

This research need seeks to provide rapid, statistically valid, standardized methods for measuring particle size, size distribution, shape, structure, and surface area of nanomaterials.

4. Develop certified reference materials for chemical and physical characterization of nanomaterials

This research need seeks the development of reference materials for the chemical and physical characterization of nanomaterials. Reference materials are beneficial for calibration of instruments or analytical processes used to assess the chemical or physical properties of nanomaterials. They are also needed to assess the quality or comparability of results from tests or assays designed to determine the toxicity of health-benefit or drug-related materials.

5. Develop methods to characterize a nanomaterial's spatio-chemical composition, purity and heterogeneity

At the nanoscale, single defects and slight changes to surface dimension and composition can dramatically influence reactivity; hence, proper characterization of spatial composition is critical. This research need seeks methods to characterize a nanomaterial's spatial composition, the identification of possible defects or impurities, and batch-to-batch variation in nanomaterial production or biological activity.

EPA's Nanomaterial Research Strategy (NRS)

- Announced last week. Available at EPA's new nano web site, www.epa.gov/nanoscience
- Developed in coordination with the 2008 NNI strategy; both are consistent with one another.
- Presents key themes and science questions for EPA's integrated extramural and intramural research program.
- Establishes critical paths for 2009 – 2014 period.
- The NNI workshops will inform the implementation of the strategy.

EPA NRS Science Questions Related to This Workshop

- What technologies exist, can be modified, or must be developed to detect and quantify nanomaterials in environmental media and biological samples?
- What are the major processes and/or properties that govern the environmental fate, transport, and transformation of nanomaterials, and how are these related to the materials' p-chem properties?
- What are the exposures that may result from nanomaterial releases?
- What are the ecological effects of nanomaterials and their applications, and how can these effects be quantified and predicted?

For more information, contact Jeff Morris, National Program Director for Nanotechnology, at morris.jeff@epa.gov.

Charge for this Workshop

- **We need your help:**
  - What is the state of research in the Ten Areas Noted for Environment, and Instrumentation/Metrology/Analytical Methods?
  - What additional research needs, if any, should be considered?
  - Which research needs should be addressed in the near-, medium- and long-term to best support responsible innovation and regulatory decision-making?

- **Respond to Charge questions in Technical Sessions, based on:**
  - Plenary Session on Uncertainty
  - Case Scenario
  - Perspective Sharing Session
  - Your Individual Knowledge and Perspectives

- **Consider both Environmental Fate and Effects Research Needs, as well as Instrumentation / Metrology / Analytical Methods' Needs**

Proceedings from this NNI Research Strategy Workshop

- **Process for Completing this Workshop's Proceedings:**
  - Summary of the workshop outcomes will be drafted by workshop planning team and subject matter experts
  - Participant comments should be emailed to environment@nnco.nano.gov by October 31, 2009
  - Draft report will go back to all participants for comment
- **Workshop Proceedings will inform and shape the Federal approach to nanotechnology-related EHS research as part of the adaptive management and iterative process described in the Research Strategy**

Workshop Overview - Tuesday

- **This Morning:**
  - Perspectives from Stakeholders
  - Case study perspective from EPA Workshop
  - Nanoparticle Scenario as a Thought Starter
  - Initial Identification of Top Research Needs

- **This Afternoon:**
  - Five Panels Identify Top Research Needs
    1. Presentations by Invited Experts
    2. Discussion of Research Needs Amongst Invited Experts
    3. Open Discussion on Research Needs

Workshop Overview - Wednesday

- **Wednesday Morning:**
  - Recap of Yesterday's Panel Findings
  - Second Set of Five Panels Identify Top Research Needs

- **Wednesday Afternoon:**
  - Recap of Morning Panel Findings
  - Reconcile two sets of Panel Findings and Compare to NNI Research Priorities

Other Information

- Webcast of this Morning's Plenary Session
  - Online participants may email in comments via the webcast
- Sign up outside for Technical Sessions
- Sign up outside for Public comments:
  - Tues 5:00 pm, and Wed 3:45 pm (3 minutes)
- Comments and Suggestion box
- Lunch options in your folder
- Breaks
- Speakers' Time Slots