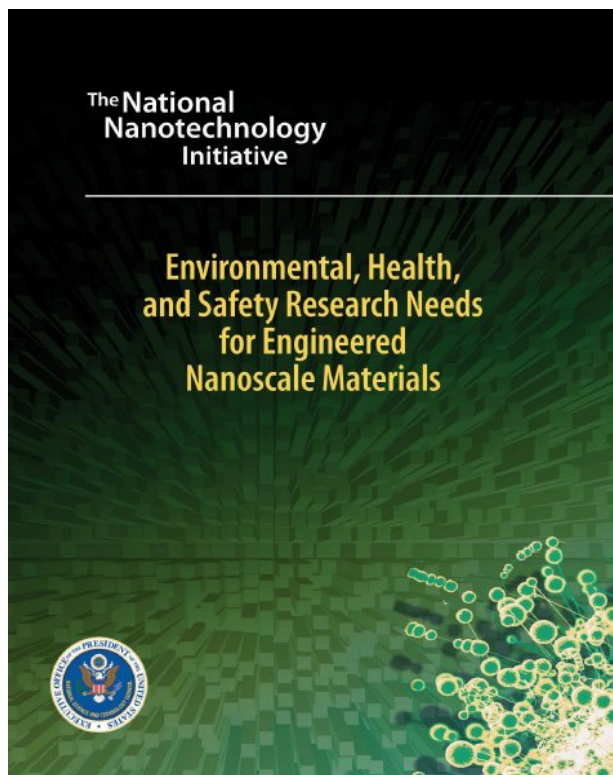


Nanomaterials and The Environment: Priority Research Areas



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Scope of Research Area 4

4. NANOMATERIALS AND THE ENVIRONMENT

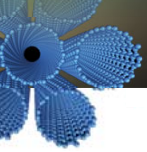
This area describes research aimed at identifying, understanding, and controlling the potential effects of engineered nanoscale materials on both relevant ecological receptors and the ecosystems that they occupy, and research on fate and transport of engineered nanoscale materials that leads to a better understanding of the mechanisms by which nanoscale materials enter, remain, degrade, and are transported through environmental media.



*Adapted from:

*Risk Assessment in the
Federal Government;
Managing the Process.*
National Academy of
Sciences. 1983.

*Science and Judgement
in Risk Assessment.*
National Research
Council. 1994.

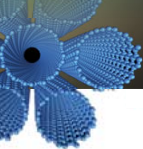


Additional Considerations

- Six research areas are identified

- One of the six areas falls within the Scope of “Instrumentation, Metrology, and Analytical Methods”
 - ❖ “Development of standardized sampling methods relevant to nanomaterials in the environment”

- Research needs in each of the five areas could address
 - The parent nanomaterial
 - The material’s environmentally-altered forms
 - Byproducts caused by reactions of nanomaterial with environmental chemicals / matrices



Research Area 1

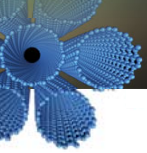
Understand Applicability of Testing Schemes for Determining Effects in Individuals of a Species

Scope

- Individuals of aquatic and terrestrial species
- Evaluate existing testing schemes, and associated test protocols
- Toxic effects, ADME and bioaccumulation
- Develop structure-activity relationships between adverse effects and nanomaterial physico-chemical properties

Rationale

- Nanoparticles could be introduced into the environment through manufacturing, use, or disposal
- Knowledge of the types of effects will enable agencies to develop appropriate testing & assessment methods



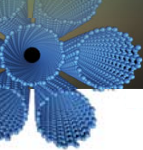
Research Area 2

Evaluate Effects Beyond those in Individuals of a Species

Scope

- Effects on biological receptors at the Population, Community or Ecosystem level
- Effects on other ecosystem components such as alterations to nutrient cycling, other physical/chemical parameters

Rationale: Complements Research Area 1, and captures effects at higher tiers



Research Area 3

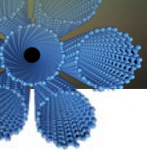
Understand the Transformation of Nanomaterials Under Different Environmental Conditions

Scope: Transformations of nanomaterials in air, water, soil, biota, and waste streams

- Laboratory-based studies and approaches that mimic environmental and biological conditions that transform & degrade nanomaterials
- Pilot-scale field studies of nanomaterials and transformations of nanomaterials

Rationale

- Knowledge gained will significantly reduce uncertainty about toxicology, exposures, risk assessment and risk management analyses
- Chemical reactions resulting from the interaction of engineered nanomaterials with environmental matrices will change some nanomaterials, and these changes may influence their behavior



Research Area 4

Determine Factors Affecting the Environmental Transport of Nanomaterials

Scope

- Understand & predict the transport within all environmental media
- Understand & predict partitioning between, air, soil, water, vegetation, sediments, suspended solids, and biota for both nanomaterials & their derivatives
- Understand the effects of nanomaterials on the transport and partitioning of other environmental chemicals

Rationale

- Allows better estimations of exposures to environmental and human receptors
- Builds on knowledge gained from Research Area 3



Research Area 5

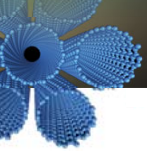
Exposure of Environmental Receptors: Identification of Principal Sources and Routes

Scope

- Identify sources of nanomaterials, and routes to the environment
- Identify environmental receptors exposed due to sources, extent to which nanomaterials bioaccumulate in those receptors, and relationship between environmental exposure and absorbed dose in receptor
- Identify factors that influence sources, receptors, and controls

Rationale

- Research on sources and receptors is a critical step in assessing environmental impact
- It is necessary to follow entire product life cycle from manufacturing, through use and disposal
- Builds on knowledge gained from Research Areas 3 & 4



Comments

- Is the breadth of this research category captured by the research needs identified?
- What criteria should be considered in setting research priorities?
- Which research need(s) should be prioritized within this category?
- Additional comments?