

## Federal Government Nanotechnology Environment, Health and Safety (EHS) Research

### Near-term Annual Funding Options

Table 1. Summary of near-term annual funding options for nanotechnology EHS research and development (R&D). These figures are over and above current and planned agency investment for EHS-related research.

Agency	Low Option (\$millions)	Medium Option (\$millions)	High Option (\$millions)
EPA	5	11	15
NIH	2	16	42
NIOSH	10	16.5	21
NIST		2	9
FDA			5
Cross-Agency	3	4.5	8
<b>Totals</b>	<b>20</b>	<b>50</b>	<b>100</b>

- **Low-level funding option (\$20 million per year in new funds)**
  - **Maintain existing research programs**, while increasing federal funding for targeted nanotechnology EHS R&D by \$20 million per year.
  - **Compared to medium and high options:** this is the triage option—it addresses the most immediate critical issues, but leaves much essential research unaddressed.
  - **Target research that addresses critical needs**, including exposure monitoring, exposure control, toxicity testing of “high concern” materials such as carbon nanotubes, evaluation of potential health impacts.
  - **Funding increases (over and above current R&D investments):**
    - **EPA: \$5 million.** Priority research areas: Sources and routes of environmental exposure and release, nanomaterial dispersion, transformation, fate, persistence and bioaccumulation, environmental exposure measurement methods, ecotoxicology.
    - **NIH: \$2 million (NIEHS).** Priority research areas: Toxicity testing methods and endpoints.
    - **NIOSH: \$10 million.** Priority areas: Workplace exposure measurement methods, guidelines on good work practices, exposure control, occupational sources and routes of exposure, human toxicity screening test.
    - **Cross-agency funding: \$3 million.** Priority areas: Supporting the development, implementation and periodic review and revision of a National Nanotechnology EHS Research Strategy, support for interagency communication, collaboration and coordination.
- **Mid-level funding option (\$50 million per year in new funds)**
  - **Maintain existing research programs**, while increasing funding for targeted nanotechnology EHS R&D by \$50 million per year.
  - **Compared to low and high options:** addresses critical issues through targeted research, while beginning to expand the new knowledge base essential to dealing with more complex nanotechnologies. Does not address some high priority issues.
  - **Target research that addresses critical and high priority needs**, and begin funding exploratory research that extends the nanotechnology EHS-relevant knowledge base.
  - **Funding increases (over and above current R&D investments):**
    - **EPA: \$11 million.** Priority research areas: Sources and routes of environmental exposure and release, nanomaterial dispersion, transformation, fate, persistence and bioaccumulation, environmental exposure measurement methods, ecotoxicology, life-cycle approaches to addressing nanotechnology risks.
    - **NIH: \$16 million (NIEHS/NIH).** Priority research areas: Toxicity testing methods and endpoints, evaluating “high concern” nanomaterial toxicity, detecting nanomaterials in biological matrices, understanding nanomaterial-biological interfaces.
    - **NIOSH: \$16.5 million.** Priority areas: Workplace exposure measurement methods, evaluating occupational exposures, guidelines on good work practices, exposure control,

*occupational sources and routes of exposure, human toxicity screening test, exposure metrics, human health implications of exposure, organ-specific dose-response, physical hazards.*

- **NIST: \$2 million.** Priority areas: Development of EHS-relevant material characterization methods and standards.
  - **Cross-agency funding: \$4.5 million.** Priority areas: Supporting the development, implementation and periodic review and revision of a national Nanotechnology EHS Research Strategy, support for interagency communication, collaboration and coordination, new methods for proactive risk evaluation.
- **High-level funding option (\$100 million per year in new funds)**
    - **Maintain existing research programs**, while increasing funding for targeted and exploratory nanotechnology EHS R&D by \$100 million per year.
    - **Compared to low and medium options:** strategically addresses highest priority issues through targeted research, while strategically expanding the new knowledge base essential to dealing with more complex nanotechnologies.
    - **Funding increases (over and above current R&D investments):**
      - **EPA: \$15 million.** Priority research areas: Sources and routes of environmental exposure and release, nanomaterial dispersion, transformation, fate, persistence and bioaccumulation, environmental exposure measurement methods, ecotoxicology, life-cycle approaches to addressing nanotechnology risks.
      - **NIH: \$42 million (NIEHS/NIH).** Priority research areas: Toxicity testing methods and endpoints, evaluating nanomaterial toxicity, detecting nanomaterials in biological matrices, understanding nanomaterial-biological interfaces, developing predictive toxicology capabilities.
      - **NIOSH: \$21 million.** Priority areas: Workplace exposure measurement methods, evaluating occupational exposures, guidelines on good work practices, exposure control, occupational sources and routes of exposure, human toxicity screening test, exposure metrics, human health implications of exposure, organ-specific dose-response, physical hazards, reducing occupational risks through material substitution.
      - **NIST: \$9 million.** Priority areas: Development of EHS-relevant material characterization methods and standards, development of reference materials for nanotechnology EHS studies.
      - **FDA: \$5 million.** Priority areas: Addressing the potential health implications of nanotechnology in food products, cosmetics and drugs.
      - **Cross-agency funding: \$8 million.** Priority areas: Supporting the development, implementation and periodic review and revision of a national Nanotechnology EHS Research Strategy, support for interagency communication, collaboration and coordination, new methods for proactive risk evaluation, informatics for nanomaterials, new risk assessment tools.

### Overarching Organizational Issues

- **Establish leadership with authority and accountability** for nanotechnology EHS research within the federal government.
- **Enable coordination and cooperation between agencies** that supports and expedites science-based policy decisions on nanotechnology safety issues.
- **Support the development and implementation of a National Nanotechnology EHS Research Strategy** that is formulated, reviewed and revised by an independent group of stakeholders.
- **Periodically review federal nanotechnology EHS R&D against the National Nanotechnology EHS Research Strategy** and revise/realign the research portfolio accordingly.
- Develop a plan for transitioning between existing research programs and a more robust research strategy over a four-year period, which couples research initiatives to oversight information needs.