

Listing of FY 2009 nanotechnology-related environmental, health, and safety research projects

Description:

The Office of Management and Budget (OMB) requested that NNI agencies provide the NSET Subcommittee with detailed information on EHS research projects funded in FY 2009. These data were used to identify areas of strength or need when formulating the 2011 NNI EHS Research Strategy. Summaries of the data on these EHS projects are presented by core EHS research category in Chapters 2-6 of the NNI EHS Research Strategy, and six examples of research progress are highlighted in this document. A complete listing of the FY 2009 research projects is available here: (1) totals of individual projects may vary from the summary tables due to rounding and (2) informatics and modeling is a new core area and so was not part of the data call. Please contact [Liesl Heeter](#), NNCO, with questions about the tables.

The reader should note the difference between the scopes of the research included in this OMB-requested project data reported for FY 2009 and that reported for environmental, health, safety, and risk mitigation as a part of Program Component Area 7 in the annual NNI Supplement to the President's Budget.

Further description of this data call is available in the NNI EHS Research Strategy, p. 7.

*** Nanomaterial Measurement Infrastructure**

FY 2009 Data call

| | NMI Research Need | AGENCY | PROJECT TITLE OR SHORT DESCRIPTION OF RESEARCH TOPIC | RESEARCH: INTRAMURAL OR EXTRAMURAL | 2009 PROJECT FUNDING LEVEL (\$ IN THOUSANDS) |
|---|--------------------------|---------------|--|---|---|
| 1 | | NIOSH | Nanoscale Reference Materials for Respiratory Disease Prevention | Intramural | 114 |
| 1 | | NSF | MRI: Development of a Single Particle Mass Spectrometer for Field and Laboratory Studies of the Environmental Impact of Atmospheric Aerosols and Engineered Nanoparticles | Extramural | 441 |
| 1 | | NIST | Carbon Nanotube Reference Materials and Measurements: Produce reference materials, develop methods to produce carbon nanotube suspensions fractionated by characteristics such as length and type, and develop and apply methods to measure the properties of individual nanotubes | Intramural | 637 |
| 1 | | NIST | High-resolution Microscopy Methods for Nanomaterial Size and Shape Measurements: Develop and apply high resolution microscopy methods, including SI-traceable scanning electron microscopy and helium ion microscopy, to measure the size and shape of nanotubes and nanoparticles | Intramural | 400 |
| 1 | | NIST | High-resolution Microscopy Methods for Nanomaterial Size and Shape Measurements: Develop and apply high resolution microscopy methods, including SI-traceable scanning electron microscopy and helium ion microscopy, to measure the size and shape of nanotubes and nanoparticles | Intramural | 90 |
| 1 | | NIST | Optical Methods for Nanomaterial Characterization: Apply optical methods to characterize the structure of nanomaterials | Intramural | 450 |
| 1 | | NIST | Neutron Methods for Nanomaterial Characterization: Apply neutron diffraction and inelastic neutron scattering methods to characterize the structure of nanomaterials | Intramural | 93 |
| 1 | | NIST | Neutron Methods for Nanomaterial Characterization: Apply neutron diffraction and inelastic neutron scattering methods to characterize the structure of nanomaterials | Intramural | 90 |
| 1 | | NIST-ARRA | Environmental Microscopy Methods for Structure Characterization: Develop and apply environmental transmission electron microscopy methods to determine structural details in relevant media | Intramural | 750 |
| 1 | | NIST | Standard Assay Protocols and Nanoparticle Reference Materials: Develop standardized methods and reference materials supporting the measurement of key physicochemical properties of nanoparticles, including specific surface area, composition, morphology, and particle size | Intramural | 600 |
| 1 | | NIST | Titanium Dioxide Reference Materials: Develop a titanium dioxide reference material supporting physicochemical property measurements, including specific surface area, composition, morphology, particle size, and photochemical reactivity | Intramural | 80 |
| 1 | | NIST | Silicon Nanoparticle Reference Materials: develop 1 nm to 10 nm silicon nanoparticle reference materials to support measurement of size distribution, composition, and quantum efficiency | Intramural | 100 |

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FY 2009 Data call

NMI Research Need **AGENCY** **PROJECT TITLE OR SHORT DESCRIPTION OF RESEARCH TOPIC** **RESEARCH: INTRAMURAL OR EXTRAMURAL** **2009 PROJECT FUNDING LEVEL (\$ IN THOUSANDS)**

| | | | | |
|---|-------|---|------------|-----|
| 1 | NIST | Three-dimensional Chemical Imaging: Develop and apply electron microscopy methods with atomic to nano resolution 3D chemical and elemental imaging capabilities to determine structural details of nanoparticles | Intramural | 150 |
| 1 | NIST | X-ray Microanalysis Methods for Elemental Analysis: Develop broadly applicable X-ray microanalysis tools to analyze and simulate X-ray signals from materials with arbitrary geometries including nanoparticles in bulk matrices and individual nanoparticles | Intramural | 150 |
| 1 | NIST | Real-time Mapping of Nanomaterial Surface Composition: Develop scanning probe microscopy and electron microscopy methods for real-time measurements and mapping of the surface composition of nanomaterials | Intramural | 44 |
| 1 | NIST | Real-time Mapping of Nanomaterial Surface Composition: Develop scanning probe microscopy and electron microscopy methods for real-time measurements and mapping of the surface composition of nanomaterials | Intramural | 54 |
| 1 | NIST | Nanoparticle Surface Characterization Methods: Develop and apply secondary ion mass spectrometry and auger electron spectroscopy to assess the effect of nanoparticle size on surface composition | Intramural | 200 |
| 1 | NIST | Single Nanoparticle Tracking Methods: Develop and apply single particle tracking methods to determine nanoparticle position and motion in relevant media | Intramural | 315 |
| 2 | NIOSH | Real-time Instrument for Nanoaerosol Exposure Measurement | Intramural | 412 |
| 2 | NIOSH | Nanoaerosol Monitoring Methods | Intramural | 102 |
| 2 | NIOSH | A Standard Method for Determining Airborne Nanoparticle Size | Intramural | 72 |
| 2 | NSF | NSEC: Institute for Nanotechnology (NU) | Extramural | 600 |
| 2 | NSF | Engineering Research Center for Extreme Ultraviolet Science and Technology | Extramural | 300 |
| 2 | NSF | CAREER: Heterogeneous Integration of Nano-Engineered Materials for High Performance, Flexible Sensor Tapes | Extramural | 450 |
| 2 | NSF | CAREER: Nano-Tip Sensor for Rapid Detection of Dissolved DNA for Environmental Monitoring | Extramural | 400 |
| 2 | NSF | CAREER: Biomolecular Nanophotonic Fabry-Perot Interferometry (BioNanoFPI) | Extramural | 35 |
| 2 | NSF | Nanoparticles Enabled Dual-Fluorescence Modulation: A New Method for Reliably Detecting Biomolecular Recognitions | Extramural | 130 |
| 2 | NSF | EPSCoR: Alabama Research Infrastructure Improvement: Nano/Bio Science and Sensors | Extramural | 300 |
| 2 | NSF | NSEC: Center Of Integrated Nanomechanical Systems (COINS, UCB) | Extramural | 750 |
| 2 | NIOSH | Nanoaerosol Surface Area Measurement Methods | Intramural | 232 |
| 2 | NIOSH | Ultrafine TiO2 Surface and Mass Concentration Analysis | Intramural | 32 |
| 2 | NIST | Uptake and Distribution of Nanomaterials in Biological Systems: Develop and apply electron microscopy methods with two- and three-dimensional imaging capabilities to assess uptake and distribution of nanoparticles and nanotubes in relevant media | Intramural | 300 |

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| | NMI Research Need | AGENCY | PROJECT TITLE OR SHORT DESCRIPTION OF RESEARCH TOPIC | RESEARCH: INTRAMURAL OR EXTRAMURAL | 2009 PROJECT FUNDING LEVEL (\$ IN THOUSANDS) |
|-------|--------------------------|---------------|--|---|---|
| 3 | NIST | | Nanomaterial Transformation Studies by Optical Methods: Develop and apply optical methods, including Raman spectroscopy, to assess surface transformations of nanomaterials synthesized at NIST and subjected to various surface treatments | Intramural | 300 |
| 3 | NSF | | Nanoscale Sensing of the Chemistry and Self-Assembly of Molecules at Interfaces Using Scanning Probe Microscopy | Extramural | 80 |
| 3 | NIST | | Synchrotron and Neutron-based Scattering Methods for Nanomaterials: Develop and apply advanced synchrotron and neutron scattering methods to measure the morphology of nanotubes and nanoparticles, and to assess the effect of fluid flow conditions on morphology, including aggregation and agglomeration | Intramural | 180 |
| 3 | NIST | | Silver Nanoparticle Dissolution and Stability Measurements: Develop and apply standard test methods to measure dissolution and assess the stability of silver nanoparticles under biologically relevant conditions, and determine the feasibility of producing a nano-silver reference material | Intramural | 304 |
| 3 | NIST | | Quartz Crystal Microbalance Methods for Nanomaterial Characterization: Develop and apply quartz crystal microbalance methods to measure mass changes in nanotubes and nanoparticles resulting from interactions with biological systems | Intramural | 65 |
| 3 | NIST | | Modeling Silver Nanoparticle Dissolution: Develop phase-field models to predict the effect of silver nanoparticle shape and surface charge on the release of silver ions in aqueous solutions, and validate the models through comparison with experimental studies conducted at the FDA | Intramural | 100 |
| 4 | NIST | | DNA Damage in Bio-organisms: Develop and apply mass spectrometry-based methodologies to assess DNA damage in bio-organisms due to the presence of nanoparticles | Intramural | 550 |
| 4 | FDA | | Analytical assay for photochemical generation of hydroxyl radical | Intramural | 29 |
| other | NSF | | IGERT Fellowships in Nanoscale Science & Engineering: The Two-University/One Campus Approach | Extramural | 300 |
| other | EPA/ORD | | Independent physicochemical analyses of commercial engineered nanomaterials for toxicity testing: accuracy of commercially derived manufactured nanomaterials analyses. | Intramural | 100 |

* Totals may vary from summary table due to rounding.

*** Human Exposure Assessment**

FY 2009 Data call

HEA Research Need AGENCY PROJECT TITLE or SHORT DESCRIPTION OF RESEARCH TOPIC RESEARCH: INTRAMURAL or EXTRAMURAL 2009 PROJECT FUNDING LEVEL (\$ in thousands)

| | | | | |
|---|----------------|---|------------|-------|
| 1 | EPA/ORD | Evaluation of physical and chemical properties that influence exposure to nanomaterials in environmental media. | Intramural | 300 |
| 1 | EPA/ORD | Platinum-Containing Nanomaterials: Sources, Speciation and Transformation in the Environment | Extramural | 150 |
| 1 | NIOSH | Dustiness of Nanomaterials 2 | Intramural | 189 |
| 1 | NIOSH | Dustiness of Nanomaterials | Intramural | 63 |
| 1 | NSF | NSEC: Center for Nano-Chemical-Electrical-Mechanical Manufacturing Systems (Nano-CEMMS) (EHS supplement) | Extramural | 200 |
| 2 | EPA/ORD | Consortium for Manufactured Nanomaterial Bioavailability & Environmental Exposure | Extramural | 1,100 |
| 3 | NIOSH | Workplace Monitoring for Carbon Nanofibers/Nanotubes | Intramural | 50 |
| 3 | NIOSH | Feasibility of Industry-wide studies of workers exposed to nano-tubes | Intramural | 13 |
| 3 | NIOSH | Titanium Dioxide (TiO ₂) Nanoparticle Exposure Study | Intramural | 43 |
| 3 | NIOSH | Nanotechnology Field Evaluations | Intramural | 187 |
| 3 | CPSC with NIST | Exposure and Fire Hazard Assessment of Nanoparticles in Fire Safe Consumer Products | Extramural | 350 |
| 3 | EPA/ORD | Investigate techniques for physical and chemical evaluation of nanoparticles in the environment. | Intramural | 300 |
| 3 | EPA/ORD | Evaluate current sampling and analysis of nanoparticles in the atmosphere. | Intramural | 300 |
| 4 | NIOSH | Nanotechnology Surveillance & Epidemiology | Intramural | 45 |

* Totals may vary from summary table due to rounding.

*** Nanomaterials and Human Health**

FY 2009 Data call

| | AGENCY | PROJECT TITLE OR SHORT DESCRIPTION OF RESEARCH TOPIC | RESEARCH: INTRAMURAL OR EXTRAMURAL | 2009 PROJECT FUNDING LEVEL (\$ IN THOUSANDS) |
|---|-----------|---|---------------------------------------|---|
| 1 | NIH/NIEHS | Biomimetic Microsystem for High Throughput Evaluation of Engineered Nanomaterials | Extramural | 84 |
| 1 | NIH/NIEHS | Statistical Models In Toxicology And Biochemistry | Extramural | 1607 |
| 1 | NIH/OD | Biomimetic Microsystem for High Throughput Evaluation of Engineered Nanomaterials | Extramural | 366 |
| 1 | NIH/OD | Predictive Toxicological Paradigms to Establish Inhalation Toxicology Models | Extramural | 544 |
| 1 | NIH/OD | Imaging nanoparticle interactions with living systems | Extramural | 425 |
| 1 | EPA/ORD | Evaluating current US EPA harmonized health effects testing guidelines for their adequacy to evaluate the toxicity of engineered manufactured nanomaterials. | Intramural | 100 |
| 1 | EPA/ORD | An integrated, multi-disciplinary testing approach to characterize the toxicity of manufactured nanomaterials in a manner allowing for their ranking/prioritizing and identification of alternative testing methods/models that will ultimately predict their toxicity/hazardous properties | Intramural | 100 |
| 1 | EPA/ORD | Evaluate current EPA and OECD toxicity testing methods for their adequacy for hazard testing nanomaterials | Intramural | 100 |
| 1 | FDA | 1. Biodistribution of Nanoparticles in Animal Models. | Intramural | 489 |
| 1 | | 2. In vitro Methods to Assess Nanoparticle Toxicity. | | |
| 1 | FDA | In vitro cytotoxicity and inflammatory potential of nano-silicon and nano-gold particles in cultured macrophages | Intramural | 330 |
| 1 | FDA | Noninvasive optical methods for bioimaging and Characterizing of nanobiomaterials in the subwavelength nanometric Range | Intramural | 480 |
| 1 | FDA | Performance of nanoscale materials in standard genotoxicity assays | Intramural | 8 |
| 1 | FDA | Interactions between nanoscale materials and model biological systems | Intramural | 242 |
| 1 | NIOSH | Pulmonary Toxicity of Metal Oxide Nanospheres and Nanowires | Intramural | 299 |
| 1 | EPA/ORD | An integrated, multi-disciplinary 2-year pilot study to assess the exposure, environmental and health implications of Envirotex, a nano enabled fuel additive. | Intramural | 300 |
| 2 | EPA/ORD | Bioavailability of Metallic Nanoparticles and Heavy Metals in Landfills | Extramural | 50 |
| 2 | NIOSH | Potential Effects of Silicon-Based Nanowires on Lung Toxicity | Intramural | 322 |
| 2 | NIOSH | Cell-based Assessment for Iron Nanoparticle-induced Health Risks | Intramural | 165 |
| 2 | NIOSH | Determination of diameter distribution for carbon nanotubes by Raman Spectroscopy | Intramural | 74 |
| 2 | NIOSH | 8875: A Personal Sampler for Assessing Inhaled Nanoparticle Exposures (9381) | Extramural | 72 |
| 2 | NSF | NNIN: National Nanotechnology User Network | Extramural | 1700 |
| 2 | NSF | Florida State University National High Magnetic Field Laboratory (NHMFL); The NHMFL's Fourier Transform-Ion Cyclotron Resonance Mass Spectrometer is unique in the world in analyzing small samples of potentially toxic nanomaterials and their environmental effects. | Extramural | 750 |
| 2 | NIH/NIEHS | Chemistry Support Services to ETP for Nanotechnology | Extramural | 100 |
| 2 | NIH/NIEHS | CHEMISTRY SUPPORT SERVICES TO THE ETP FOR NANOTECHNOLOGY | Extramural | 125 |
| 2 | NIH/NIEHS | Project 5: Quantitative Methods for Carbon-Based Nanomaterials in the Environment | Extramural | 276 |
| 2 | NIH/NIEHS | Detection of engineered nanomaterials in drinking water, food, commercial product | Extramural | 676 |
| 2 | NIH/NIEHS | Microvascular Health and Nanoparticle Exposure | Extramural | 500 |
| 2 | NIH/NIEHS | Integrated nanoparticle characterizat on and toxicity assessment | Extramural | 399 |
| 2 | NIH/NIEHS | Novel approaches to evaluate carbon nanotube health impacts | Extramural | 499 |
| 2 | NIH/NIEHS | Research Support Core D: Molecular Pathology Core | Extramural | 131 |
| 2 | NIH/NIEHS | A rapid label-free sensor for immune markers of environmental exposure for applic | Extramural | 885 |

*** Nanomaterials and Human Health**

FY 2009 Data call

| HH Research Need | AGENCY | PROJECT TITLE OR SHORT DESCRIPTION OF RESEARCH TOPIC | RESEARCH: INTRAMURAL OR EXTRAMURAL | 2009 PROJECT FUNDING LEVEL (\$ IN THOUSANDS) |
|------------------|-----------------------|--|---------------------------------------|---|
| 2 | NIH/NIEHS | Project 5: Nanotechnology-Based Environmental Sensing | Extramural | 11 |
| 2 | NIH/NIEHS | Nanoparticles: Synthesis, spectroscopic properties and biological activity | Extramural | 524 |
| 3 | NIH/NIEHS | Comparative In Vivo Biodistribution of Characterized Manufactured Nanomaterials | Extramural | 350 |
| 3 | NIOSH | Nanoparticles: Lung Dosimetry and Risk Assessment | Intramural | 70 |
| 3 | NIOSH | Dermal Effects of Nanoparticles | Intramural | 154 |
| 3 | NSF | CEIN: Predictive Toxicology Assessment and Safe Implementation of Nanotechnology in the Environment (UCLA) | Extramural | N/A |
| 3 | NSF | National Nanotechnology Infrastructure Network (NNIN) | Extramural | 700 |
| 3 | NIH/NICHHD | Nanoparticles in the Human Placenta: Toxicokinetics | Extramural | 77 |
| 3 | NIH/NIDCR | Biological fate and biocompatibility of dendritic and silica-based nanoconstructs | Extramural | 306 |
| 4 | NIOSH | Evaluation of the Pulmonary Deposition and Translocation of Nanomaterials | Intramural | 331 |
| 4 | NSF | Understanding the Interactions between Carbon Nanotubes and Cellular Membranes | Extramural | 380 |
| 4 | NIH/NIEHS | Chemical, Structural, and Superstructural Determinants of Nanocarbon Toxicity | Extramural | 270 |
| 4 | NIH/NIEHS | Nanoparticle properties and alveolar epithelial barrier/transport functions | Extramural | 367 |
| 4 | FDA | Characterize sunscreens and assess penetration through the skin | Intramural | 120 |
| 4 | FDA | Nanoparticle Characterization and Impact on Penetration of Bio-interfaces | Intramural | 210 |
| 4 | FDA | In vitro skin absorption of nanoparticles (liposomes) | Intramural | 330 |
| 4 | FDA | Percutaneous Absorption of dendrimers nanoparticles | Intramural | 5 |
| 4 | NIH/NIEHS | Characterization Methodologies & Proteomics to Assess Carbon Nanotube Exposure | Extramural | 600 |
| 4 | NIH/NIEHS | Neurotoxicity of Magnetic Nanoparticles | Extramural | 223 |
| 4 | | 1. Liposome Drug Delivery: Understanding Manufacturing and Product Variability. | | 100 |
| 4 | | 2. Self-NanoEmulsified Cyclosporine A: Sources and Effects of Product Variability | | |
| 4 | FDA | 3. Colloidal Iron Nano Drug Products: Stability Assessment | Intramural | |
| 4 | NIH/NIEHS | Tying Distinct Nanoparticle Properties to Cellular Interactions, Fate and Responses | Extramural | 450 |
| 4 | NIH/OD | Interactions of engineered nanomaterials with lung alveolar epithelium | Extramural | 400 |
| 5 | NIOSH | Assessment of Carbonaceous Materials on Mutagenicity | Intramural | 269 |
| 5 | EPA/ORD | Risk Assessment for Manufactured Nanoparticles Used in Consumer Products (RAMNUC) | Extramural | 500 |
| 5 | NIH/NHGRI | Chemical, Structural, and Superstructural Determinants of Nanocarbon Toxicity | Extramural | 250 |
| 5 | FDA | Immunogenicity of Protein Loaded Nanoformulations (w/ CBER) | Intramural | 30 |
| 5 | FDA | Neurotoxicity of manganese nanoparticles | Intramural | 482 |
| 5 | FDA | Neurotoxicity of silver nanoparticles | Intramural | 361 |
| 5 | FDA | Neurotoxicity of carbon nanotubes and gold nanoparticles | Intramural | 33 |
| 5 | DoD/USA/ MRMC - TATRC | NANOFABRICATED BIOARTIFICIAL KIDNEY (CA) | Extramural | 2188 |
| 5 | DoD/USA/ MRMC - TATRC | Alliance for Nano Health - Nanotechnology for improved diagnostics and therapy for disease | Extramural | 2802 |
| 5 | EPA/ORD | Safety/toxicity assessment of ceria (a model engineered NP) to the brain | Intramural | 500 |
| 5 | FDA | Blood cell and vascular compatibility of carbon fullerenes | Intramural | 205 |
| 5 | FDA | Assessing the stability of nano-scale constructs | Intramural | 397 |

*** Nanomaterials and Human Health**

FY 2009 Data call

| | AGENCY | PROJECT TITLE OR SHORT DESCRIPTION OF RESEARCH TOPIC | RESEARCH: INTRAMURAL OR EXTRAMURAL | 2009 PROJECT FUNDING LEVEL (\$ IN THOUSANDS) |
|---|-----------|---|---------------------------------------|---|
| 5 | NIOSH | Lung Effects of Resistance Spot Welding Using Adhesives | Intramural | 205 |
| 5 | NIOSH | Systematic Microvascular Dysfunction Effects of Ultra Fine vs. Fine Particles | Intramural | 730 |
| 5 | NIOSH | Neurotoxicity After Pulmonary Exposure to Welding Fumes Containing Manganese | Intramural | 426 |
| 5 | NIOSH | Investigations of Multi-Walled Carbon Nanotube Toxicity | Intramural | 91 |
| 5 | NIOSH | Induction of Lung Fibrosis by Cerium Oxide in Diesel Exhaust | Intramural | 280 |
| 5 | NIOSH | WC-Co nanoparticles in initiating angiogenesis by reactive oxygen species | Intramural | 289 |
| 5 | NIST/MSEL | Tissue Engineered Scaffolds for Nanoparticle Cell interactions | Intramural | 116 |
| 5 | NIST/MSEL | Tissue Engineered Scaffolds for Nanoparticle Cell interactions | Intramural | 215 |
| 5 | NSF | Multifunctional Mesoporous Silica Nanoparticles for Intracellular Controlled Release | Extramural | 130 |
| 5 | NIH/NIEHS | Cardiovascular Toxicity of Subchronic Inhalation Exposure to Fullerene C60 | Extramural | 74 |
| 5 | NIOSH | Nanoparticle Properties and Mechanisms Causing Lung Fibrosis | Intramural | 282 |
| 5 | NIH/NIEHS | STUDIES TO EVALUATE TOXICOLOGIC AND CARCINOGENIC POTENTIAL OF TEST AGENTS | Extramural | 300 |
| 5 | NIH/NIEHS | Role of Physico-chemical Properties in the Reprotoxicity of Inhaled Cd NP. | Extramural | 400 |
| 5 | NIH/NIEHS | Bioactivity of engineered fiber-shaped nanomaterials | Extramural | 450 |
| 5 | NIH/NIEHS | Hazard Assessment and Risk Estimation of Inhaled Nanomaterials Exposure | Extramural | 427 |
| 5 | NIH/NIEHS | Project 2: Toxicity of Metallic Nanoparticles and Carbon Nanotubes | Extramural | 262 |
| 5 | NIH/NIEHS | Project 2: Toxicity of Metallic Nanoparticles and Carbon Nanotubes | Extramural | 20 |
| 5 | NIH/NIEHS | Project 6: Nanomaterial Design for Environmental Health and Safety | Extramural | 16 |
| 5 | NIH/NIEHS | Project 2: Toxicity of Metallic Nanoparticles and Carbon Nanotubes | Extramural | 18 |
| 5 | NIH/NIEHS | Project 6: Nanomaterial Design for Environmental Health and Safety | Extramural | 14 |
| 5 | NIH/NIEHS | Nano-Biological Interactions and Toxicity of Engineered Metal Oxide Particles | Extramural | 347 |
| 5 | NIH/NIEHS | Neurotoxicity of nanomaterials: evaluation of subcellular redox state | Extramural | 296 |
| 5 | NIH/NIEHS | Sytems Analysis of Nanoparticle Biocompatibility | Extramural | 462 |
| 5 | NIH/NIEHS | Defining nanomaterial-biological interactions to enhance biocompatibility and bio | Extramural | 296 |
| 5 | NIH/NIEHS | Chemical, Structural, and Superstructural Determinants of Nanocarbon Toxicity | Extramural | 123 |
| 5 | NIH/NIEHS | Remote Microvascular Dysfunction After Particulate Matter Exposure | Extramural | 355 |
| 5 | NIH/NIEHS | Modulation of Qdot nanoparticle toxicity by glutathione in GCL transgenic mice | Extramural | 471 |
| 5 | NIH/NIEHS | Cardio-vascular Impact of Inhaled Multi-wall Carbon Nanotubes | Extramural | 342 |
| 5 | NIH/NIEHS | Bioavailability and toxicity of engineered nanomaterials | Extramural | 28 |
| 5 | NIH/NIEHS | Facility Core B--Pulmonary Toxicology | Extramural | 263 |
| 5 | NIH/OD | Hazard Assessment and Risk Estimation of Inhaled Nanomaterials Exposure | Extramural | 650 |
| 5 | NIST | Surface Affinity of Carbon Nanotubes: Develop measurement methods to assess the surface affinity of carbon nanotubes to biological surfaces | Intramural | 150 |
| 5 | NIH/NIGMS | Nanoparticle Effects on Epithelial Cell Protein Expression and Function | Extramural | 285 |
| 5 | NIH/NIGMS | Nanoparticle Effects on Epithelial Cell Protein Expression and Function | Extramural | 363 |

*** Nanomaterials and Human Health**

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|------------------|------------|---|--|---|
| 5 | NIOSH | Nanoparticle Properties and Mechanisms Causing Lung Fibrosis | Intramural | 282 |
| 6 | FDA | In vivo disposition and toxicity of nanoparticles in adult and pregnant mice | Intramural | 693 |
| 6 | NIH/NIEHS | Lung Toxicity of Carbon Nanotubes in Models of Pre-Existing Respiratory Disease | Extramural | 101 |
| 6 | NIH/OD | Lung Toxicity of Carbon Nanotubes in Models of Pre-Existing Respiratory Disease | Extramural | 540 |
| Other/multiple | DOD/USAF | Exploiting Advances in Biotechnology for Force Protection | Extramural | 607 |
| Other/multiple | EPA/ORD | Comprehensive environmental assessment case studies of nanoscale titanium dioxide | Intramural | 200 |
| Other/multiple | EPA/ORD | Workshop to identify and prioritize research needed to support a Comprehensive Environmental Assessment of nanoscale titanium dioxide | Intramural | 200 |
| Other/multiple | EPA/ORD | Comprehensive environmental assessment case studies of nanoscale silver | Intramural | 100 |
| Other/multiple | NIOSH | Osteopontin and Carbon Nanotubes | Intramural | 189 |
| Other/multiple | NIOSH | Nanotechnology Safety & Health Research Coordination | Intramural | 241 |
| Other/multiple | NIH/NCI | Phase I Study of the BikDD Nanoparticle for Advanced Cancer of the Pancreas | Extramural | 339 |
| Other/multiple | NIH/NCI | Molecular mechanism of antiangiogenic properties of gold nanoparticle | Extramural | 282 |
| Other/multiple | NIH/NCI | Cancer Molecular Imaging | Extramural | 493 |
| Other/multiple | NIH/NCI | Rapid release paclitaxel nanoparticles for bladder cancer intravesical therapy | Extramural | 400 |
| Other/multiple | NIH/NCI | Pharmacokinetics, Biodistribution and Biocompatibility Core | Extramural | 145 |
| Other/multiple | NIH/NCI | TOXICITY CORE | Extramural | 116 |
| Other/multiple | NIH/NCI | Pharmacology and Toxicology Core | Extramural | 413 |
| Other/multiple | NIH/NCI | Education Core | Extramural | 394 |
| Other/multiple | NIH/NIAMS | Imaging of Inflammation and Treatment: Basic and Translational Potential | Extramural | 326 |
| Other/multiple | NIH/NIEHS | Project 6: Sensing Superfund Chemicals with Recombinant Systems | Extramural | 19 |
| Other/multiple | NIH/NIEFHS | Project 7: Chloro-Organic Degradation by Nanosized Metallic Systems and by Chelat | Extramural | 19 |
| Other/multiple | NIH/NIEHS | Project 6: Sensing Superfund Chemicals with Recombinant Systems | Extramural | 28 |

* Totals may vary from summary table due to rounding.

NB: For Research Need 1, subsequent to publication, 3 projects were disqualified, for a total of 14 projects.

*** Nanomaterials and the Environment**

FY 2009 Data call

| ENV Research Need | AGENCY | PROJECT TITLE OR SHORT DESCRIPTION OF RESEARCH TOPIC | RESEARCH: INTRAMURAL OR EXTRAMURAL | 2009 PROJECT FUNDING LEVEL (\$ IN THOUSANDS) |
|-------------------|--|--|------------------------------------|--|
| 1 | EPA/ORD | A Focus on Nanoparticulate Aerosol and Atmospherically Processed Nanoparticulate Aerosol | Intramural | 50 |
| 1 | EPA/ORD | Evaluate exposure modeling capabilities for nanomaterials, and develop multimedia modeling capability to support model-based exposure and risk assessments for land-based nanomaterial releases to the environment. | Intramural | 200 |
| 2 | EPA/ORD | Investigate the stability and mobility of nanoparticles in aqueous systems. | Intramural | 200 |
| 2 | DOD/USAF | Safer Nanomaterials and Nanomanufacturing | Extramural | 315 |
| 2 | EPA/ORD | Environmental characterization of selected nanomaterials for identification of controlling properties, including environmental fate of inorganic nanomaterials in water and soil, and bioavailability and biotransformation of nanomaterials in soil and water | Intramural | 800 |
| 3 | NSF | CRC: Collaborative Research: Structure-Sorption Relationships In Disordered Iron-oxyhydroxides | Extramural | 70 |
| 3 | NSF | CAREER: Understanding Carbon Nanoassembly in Biological and Environmental Systems | Extramural | 75 |
| 3 | EPA/ORD | Emulsified nano ZVI for remediation of contaminated ground water | Intramural | 100 |
| 3 | EPA/ORD | Treatment of persistent contaminants with bimetallic nanomaterials | Extramural | 100 |
| 3 | NSF | The Design of Multifunctional Colloidal Nanostructures for Environmental Remediation of Chlorinated Hydrocarbons | Extramural | 180 |
| 3 | EPA/ORD | Investigate the relationship between physical properties of fullerenes and their transformation process in ecosystems. | Intramural | 200 |
| 3 | NSF | Study and Development of a New Type of Water Nanofiltration Membrane with an Ordered, Sub-one-nanometer Size Pore System | Intramural | 280 |
| 3 | NSF | EPSCoR: Delaware Research Infrastructure Improvement Program: Environmental science | Extramural | 300 |
| 3 | NIST | Rational Design of High-Purity Carbon Nanotube Dispersions Through Acute and Full Life-Cycle Toxicity Studies | Intramural | 351 |
| 3 | NSF | CAREER: Research and Education of Adsorption and Desorption of Air Pollutants on Engineered Nanomaterials | Extramural | 405 |
| 3 | NSF | Center of Advanced Materials for Purification of Water with Systems (UIUC) | Extramural | 500 |
| 3 | DOE | Microbially Mediated Transformation of Metal Oxide and Metal Nanoparticles | Extramural | 505 |
| 3 | NSF | A Comprehensive Approach to Understanding Chemistry at Interfaces and Atmospheric Implications. | Extramural | 2,000 |
| 4 | NIFA | Community Behavior in Pseudomonas Chlororaphis 06: It's in the Genes | Extramural | 61 |
| 4 | NSF | Plant Uptake and Interaction with Nanoparticles | Extramural | 103 |
| 4 | DOD/USAF | Minority Leaders Program | Extramural | 151 |
| 4 | NSF | Career: Environmental Impacts of Nanomaterials in Engineered Water Systems: Biological and Physical Effects on Microorganisms | Extramural | 400 |
| 5 | EHS Research Strategy, p. 63: "there was 1 project focused on this research need, and two other large projects supported this and other research needs." | | | N/A |
| Multiple | DOE | Retention/Release of Engineered Nanoporous Silicate Particles (ENSPs) and its influence on the Mobility of Radionuclides in Subsurface Sediments | Intramural | 394 |
| Multiple | DOE | Potential Impact and Risks of Palladium Nanoparticles Released as a Result of Energy Generation and Used for In Situ Groundwater Remediation | Extramural | 420 |
| Multiple | DOE | Predicting the Stability/Status and Mobility of Engineered Nanomaterials After Their Release into Soils and Groundwaters | Extramural | 500 |

*** Nanomaterials and the Environment**

FY 2009 Data call

| ENV Research Need | AGENCY | PROJECT TITLE OR SHORT DESCRIPTION OF RESEARCH TOPIC | RESEARCH: | 2009 PROJECT FUNDING LEVEL |
|-------------------|-----------------------|--|--------------------------|----------------------------|
| | | | INTRAMURAL OR EXTRAMURAL | (\$ IN THOUSANDS) |
| Multiple | EPA (STAR), NSF & DOE | The Fate of Organic Nanoparticles Used for Heavy Metal Remediation | Extramural | 456 |
| Multiple | EPA/ORD | Environmental characterization of selected nanomaterials for identification of controlling properties, including environmental fate of inorganic nanomaterials in water and soil, and bioavailability and biotransformation of nanomaterials in soil and water | Intramural | 100 |
| Multiple | EPA/ORD | DUKE CEINT: Center for the Environmental Implications of Nanotechnology | Extramural | 200 |
| Multiple | EPA/ORD | Investigate the stability and mobility of nanoparticles in aqueous systems. | Intramural | 200 |
| Multiple | EPA/ORD | Model the local-scale fate and transport of a combusted nanomaterial and its effect on regional-scale air quality. | Intramural | 300 |
| Multiple | EPA/ORD | UCLA UC-CEIN: Predictive Toxicology Assessment and Safe Implementation of Nanotechnology in the Environment | Intramural | 800 |
| Multiple | EPA/ORD | Centers for the Environmental Implications of Nanotechnology | Extramural | 1,000 |
| Multiple | EPA/ORD | Transatlantic Initiative for Nanotechnology and the Environment | Extramural | 2,000 |
| Multiple | EPA/ORD | UCLA UC-CEIN: Predictive Toxicology Assessment and Safe Implementation of Nanotechnology in the Environment | Extramural | 4,200 |
| Multiple | EPA/ORD | Center for Environmental Implications of Nanotechnology | | 14,375 |
| Multiple | NIFA | IMPACT, DETECTION AND TRACKING OF NANOPARTICLES IN AGRICULTURE: A FOCUS ON CROPS AND ASSOCIATED SOIL MICROBES | Extramural | 442 |
| Multiple | NIST | Behavior of Nanoparticles in Water Media: Assess the behavior of nanotubes and nanoparticles in environmentally relevant water systems, including sewage treatment plants and swimming pools | Intramural | 152 |
| Multiple | NSF | Environmental Biogeochemistry and nanoscience: Applications to Toxic Metal Transport in the Environment | Extramural | 60 |
| Multiple | NSF | Report on fate and transport of nanomaterials in air. | Extramural | 100 |
| Multiple | NSF | Carbon Nanotubes in Soils: Transport, Filtration, and Impact on Soil Microbial Community | Extramural | 123 |
| Multiple | NSF | Bionanomaterial Uptake and Fate in Corbicula fluminea | Extramural | 240 |
| Multiple | NSF | NSEC: Center for Biological and Environmental Nanotechnology (CBEN, Rice U.) (EHS supplement) | Extramural | 350 |
| Multiple | NSF | Fate and Transport of Metal-Based Nanoparticles in the Subsurface | Extramural | 350 |
| Multiple | NSF | NSEC: Center Of Integrated Nanomechanical Systems (COINS) (EHS Supplement) | Extramural | 400 |
| Multiple | NSF | NSEC: Center Of Integrated Nanomechanical Systems (COINS) (EHS Supplement) | Extramural | 400 |
| Multiple | NSF | NSEC: Center for Biological and Environmental Nanotechnology (Rice U.) | Extramural | 1,000 |
| Multiple | NSF | DUKE CEINT: Center for the Environmental Implications of Nanotechnology. | Extramural | 2,575 |
| Multiple | NSF | A Comprehensive Approach to Understanding Chemistry at Interfaces and Atmospheric Implications | Extramural | 5,200 |

* Totals may vary from summary table due to rounding.

Risk Assessment and Risk Management Methods

FY 2009 Data call

| RAMM Research Need | AGENCY | PROJECT TITLE OR SHORT DESCRIPTION OF RESEARCH TOPIC | RESEARCH: INTRAMURAL OR EXTRAMURAL | 2009 PROJECT FUNDING LEVEL (\$ IN THOUSANDS) |
|--------------------|---------|---|---------------------------------------|---|
| 1 | FDA | Evaluation of the applicability of standard assays to genotoxicity of engineered nanomaterials | Intramural | 714 |
| 1 | FDA | To determine migration of organic and inorganic chemicals into food simulants from polymer-clay nanocomposite (PCN) packaging materials | Intramural | 301 |
| 1 | FDA | NCTR/ARL-ORA Nanotechnology Core Facility | Intramural | 328 |
| 1 | NIOSH | Explosivity and Flammability of Carbon Nanotubes | Intramural | 25 |
| 1 | NSF | REU Site: Incorporating Ethical Decisions into Nanomanufacturing Research | Extramural | 299 |
| 1 | EPA/ORD | Develop greener synthesis strategies for metal, metal oxide, and composite nanomaterials | Intramural | 100 |
| 2 | NIOSH | Assessing the Utility of Control Banding in the U.S. | Intramural | 5 |
| 2 | NIOSH | Nanoparticle Penetration Through Protective Clothing (NORA funded) | Intramural | 128 |
| 2 | NIOSH | Penetration of nanoparticles through respirator filter media | Intramural | 239 |
| 2 | NSF | WORKSHOP on Manufactured Nanoparticle Environmental Impacts and Behavior, March 9-10, 2009 in Houston TX | Extramural | 20 |
| 2 | NSF | NSEC: Network for Hierarchical Manufacturing (U. Mass.) | Extramural | 100 |
| 2 | NSF | NSEC: Center for High Rate Nanomanufacturing (Northeastern U.) | Extramural | 400 |
| 2 | NSF | NSEC: Center for Templated Synthesis and Assembly at the Nanoscale (U. Wisc.) | Extramural | 500 |
| 2 | NIOSH | Current Intelligence Bulletin: Carbon Nanotubes | Intramural | 12 |
| 2 | NIOSH | Nanotechnology Information Dissemination | Intramural | 58 |
| 2 | NIOSH | Nanotech Emphasis Area Coordination | Intramural | 172 |
| 3 | EPA/ORD | Holistic life cycle assessment for a metal based nanocomponent, initially cradle-to-gate then holistic full-cycle assessment for decision support | Intramural | 100 |
| 3 | EPA/ORD | Life cycle assessment case study on Li ion batteries | Intramural | 50 |
| 3 | EPA/ORD | Comparative thermodynamic assessment of a nanocomponent and related life cycle inventory | Intramural | 50 |
| 3 | EPA/ORD | Develop nanoparticle synthesis using high-efficiency reactor | Intramural | 100 |
| 5 | NSF | NSEC: CENTER FOR NANOTECHNOLOGY IN SOCIETY AT ARIZONA STATE UNIVERSITY | Extramural | 200 |

* Totals may vary from summary table due to rounding.

NB: Subsequent to publication, Research Need 2 was discovered to have excluded some funding. The amended total is \$1,634,000.