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## Nanomaterials in the Workplace

### A Summary of the RAND Policy and Planning Workshop on Occupational Safety and Health

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CT-269

January 2007

Testimony presented to Public Meeting on Research Needs Related to the Environmental, Health, and Safety Aspects of Engineered Nanoscale Materials on January 4, 2007

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**The RAND Corporation**

***Nanomaterials in the Workplace: A Summary of the RAND Policy and Planning Workshop  
on Occupational Safety and Health***

**Before the Public Meeting on Research Needs Related to the Environmental, Health, and  
Safety Aspects of Engineered Nanoscale Materials**

**January 4, 2007**

Committee Members: Thank you for the opportunity to speak on the important subject of nanomaterials in the workplace. In 2005, I was the principal investigator responsible for organizing a workshop on nanotechnology and occupational health and safety. The purpose of that workshop was to collect information required to understand the options available to the National Institute for Occupational Safety and Health (NIOSH) in formulating its strategic objectives for protecting workers exposed to nanoscale materials. The workshop was held on October 17, 2005 and brought together representatives of industrial firms engaged in developing or using nanomaterials, organized labor, the insurance sector, labor unions, the occupational health and safety community, industry associations, universities and research institutions, and government agencies.

My remarks today are based on the proceedings of that workshop<sup>2</sup>, other analysis by RAND regarding the benefits of and prospects for nanomaterials<sup>3</sup>, and my review of recent reports regarding the potential risks to safety and health as related to nanomaterials. The fundamental finding of RAND's work in this area was that key components of the overall federal effort for managing the occupational risks of nanotechnology need to be reconsidered. Specifically, (1) greater interaction and cooperation is needed between the nanotechnology development and user communities and among federal agencies responsible for advancing worker safety and health; (2) because of the already considerable demands on federal agencies that have a role or interest in managing the occupational hazards of nanomaterials in the workplace, the limited resources that are available should be directed at key federal roles such as expanding the

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<sup>2</sup> Bartis, James T. and Eric Landree, *Nanomaterials in the Workplace: Policy and Planning Workshop on Occupational Safety and Health*, Santa Monica, Calif.: RAND Corporation, CF-227-NIOSH, 2006. Online at [http://www.rand.org/pubs/conf\\_proceedings/CF227/](http://www.rand.org/pubs/conf_proceedings/CF227/).

<sup>3</sup> Silbergliitt, R.S., Philip S. Antón, David R. Howell, Anny Wong, Natalie Gassman, Brian A. Jackson, Eric Landree, Shari Lawrence Pflieger, Elaine M. Newton, Felicia Wu, *The Global Technology Revolution 2020, In-Depth Analyses: Bio/Nano/materials/information Trends, Drivers, Barriers, and Social Implications*, Santa Monica, Calif.: RAND Corporation, TR-303-NIC, 2006.

fundamental knowledge of nanomaterial toxicology and providing near-term assistance to protect workers from current in-use and emerging nanomaterials; (3) the federal government's efforts to develop the knowledge base to manage occupational risks associated with nanomaterials should be undertaken by way of a unified strategy that assures appropriate safety and health research, testing, and assessments for managing the risks of occupational exposures; and (4) the level of federal resources committed to the occupational and safety risks associated with nanomaterials should be reexamined.

Since the publication of the conference proceedings in April 2006, progress has been made in addressing the first point above, namely, coordination and cooperation has certainly improved, especially considering budget constraints. For this reason, I will limit my remaining remarks to three topics: critical federal roles, the concept of a unified strategy, and federal funding issues.

### **Critical Federal Roles**

Efforts to manage the risks of nanomaterials in the workplace continue to be impeded by fundamental uncertainties in toxicology, exposure and dose monitoring, and exposure controls. The resolution of these uncertainties can be expected to apply to broad classes of nanomaterials that are likely to be beyond the commercial interest of any single firm. Further, the range of expertise required to plan and implement a research program to resolve these fundamental questions is generally beyond the capabilities of most firms, if not all firms, engaged in nanotechnology development. For this reason, it is difficult to imagine how these important fundamental questions will be resolved unless federal agencies with occupational safety and health expertise take a leading role.

Resolving uncertainties in the toxicology of emerging engineered nanomaterials is also important for protecting public health and the environment, objectives that are core missions of the U.S. Environmental Protection Agency (EPA) and the National Institute of Environmental Health Sciences (NIEHS). For this reason, RAND recommends that the government consider an approach in which EPA and NIEHS take leading roles in systematically investigating nanomaterials' toxicology. The goal of this work should be to develop a capability to predict potential toxicology based on material properties. This approach would have NIOSH toxicologists focus on dose levels and nanomaterials relevant to workplace exposures, and allow remaining NIOSH personnel and resources to focus on uncertainties associated with occupational exposures, doses, and exposure controls.

The second critical role for NIOSH is to help protect workers from the potential adverse effects of nanomaterials that are now or will soon be in workplaces. During our workshop, the participants repeatedly emphasized the possibility that some nanomaterials that are or will be entering the

workplace will result in serious harm to the health of exposed workers. According to the workshop participants, worker and public safety concerns and liability risks are causing larger companies to take a highly cautious approach. The result is that product development is more costly and product introduction is slowed. The small- and medium-sized businesses that play such an important role in nanotechnology development have an especially hard time getting access to environmental, health, and safety experts. The participants at our workshop emphasized that many small-company and university-based nanomaterial developers are highly specialized scientists who have limited understanding of the research required to establish the toxicological properties of the materials that they are developing.

With regard to this second federal role, I understand that NIOSH has made significant progress in reaching out to the nanotechnology development community and in providing guidance on managing occupational risks. Here, the key issue is whether the level of effort by NIOSH is commensurate with the needs of the nanotechnology development community.

### **A Unified Federal Strategy**

The continued development and successful introduction of new nanomaterials require that critical knowledge gaps in occupational risk management are expeditiously addressed. Given the limited numbers of trained federal personnel and budget constraints, workshop participants suggested that NIOSH, EPA, NIEHS, and other relevant agencies collaborate to develop and implement a unified federal strategy for addressing knowledge gaps in the management of occupational risks. Under this concept, each collaborating agency will be responsible for assuring that the unified strategy covers all critical federal roles in filling knowledge gaps and providing near-term support to protect workplaces. Implementation responsibilities would be based on agency charters and capabilities, with the understanding that they must meet milestones for providing intermediate products needed by collaborating agencies. This concept of a unified federal strategy would extend beyond the coordination role currently played by the Interagency Working Group on Nanotechnology Environmental and Health Implications.

The workshop participants also suggested that federal agencies, such as the Department of Energy, the Department of Defense, the National Institutes of Health, and the National Science Foundation, that are developing specific advanced nanomaterials as part of their core missions be required to ensure that appropriate health and safety research, testing, and risk assessments are being accomplished before those materials are introduced into workplaces. While NIOSH may need to lend resources to assist these agencies in planning and implementing such work, a number of federal agencies, such as the Departments of Defense and Energy, have notable capabilities in the area of occupational health and safety.

## Resources and Funding

The deliberations of the workshop hosted by RAND imply that the promotional efforts and multi-billion-dollar investments made under the National Nanotechnology Initiative are at risk due to continuing uncertainties and liabilities associated with managing and controlling the occupational health, public health, and environmental risks posed by emerging nanomaterials. Moreover, with current funding allocations to NIOSH, EPA and related agencies, these uncertainties will not be resolved, but rather will grow as new nanomaterials are introduced.

Criticism has been directed at the level of public funding directed at managing occupational, as well as the more general public health, risks associated with exposures to nanomaterials. The federal government is the principal driving force for advances in nanoscience and nanotechnology in the United States. This federal funding is responsible for the magnitude of the number of new nanomaterials that are anticipated to enter the marketplace, and the workplace, over the next few years. The massive investment by the federal government in nanotechnology development reflects the societal, economic, and national security benefits associated with the timely commercial introduction of new nanomaterials. Given the federal government's sizable investment and promotion of these new materials, it has a particular responsibility to also invest in the requisite research necessary to protect the health and safety of workers exposed to these materials. For this reason, the level of federal resources directed at the health and safety risks associated with nanotechnology in the workplace needs to be reexamined.

I have summarized recommendations and suggestions raised by workshop participants regarding the implementation of future efforts by NIOSH, EPA, and related agencies to address occupational risks. By calling for greater collaboration and partnership within government and between government and the nanotechnology development community, the workshop participants have provided an approach that may be implemented within stricter budget and personnel allocations than what would otherwise be required. This potential savings in budget and personnel expenditures centers on limiting federal health and safety agency involvement to essential roles, operating collaboratively under a unified strategic plan, and requiring that in cases in which federal agencies are promoting the emergence of new nanomaterials, they are responsible, in the same manner as any large corporation would be, for ensuring that adequate information is available for managing occupational risks.

This work is part of a larger portfolio of established research conducted by RAND relating to occupational safety, public health, and emergency response. The RAND Center for Health and Safety in the Workplace (CHSW) was also recently established to provide objective, innovative, and cross-cutting research on occupational safety, health, and workers' compensation. It expands existing lines of RAND research on safety technology, health assessment, healthcare

management, liability and compensation, and policy planning. RAND has also expanded its research in the area of nanotechnology to include emerging trends in research and technology, and the future workforce and workplace<sup>4</sup>. The complete conference proceedings for the RAND workshop, *Nanomaterials in the Workplace*<sup>5</sup>, is available for download and may be found at the RAND website located at [www.rand.org](http://www.rand.org).

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<sup>4</sup> For example see: Silbergliitt, R.S., Philip S. Antón, David R. Howell, Anny Wong, Natalie Gassman, Brian A. Jackson, Eric Landree, Shari Lawrence Pfleeger, Elaine M. Newton, Felicia Wu, *The Global Technology Revolution 2020, In-Depth Analyses: Bio/Nano/materials/information Trends, Drivers, Barriers, and Social Implications*, Santa Monica, Calif.: RAND Corporation, TR-303-NIC, 2006.

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<sup>5</sup> Bartis, James T. and Eric Landree, *Nanomaterials in the Workplace: Policy and Planning Workshop on Occupational Safety and Health*, Santa Monica, Calif.: RAND Corporation, CF-227-NIOSH, 2006. Online at [http://www.rand.org/pubs/conf\\_proceedings/CF227/](http://www.rand.org/pubs/conf_proceedings/CF227/).