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In This Issue

Recent Government Briefs

U.S. Environmental Protection Agency (USEPA)

In December 2005, EPA released the External Review Draft Nanotechnology White Paper. This document, which is a work product of a cross-Agency workgroup of EPA's Science Policy Council, includes an extensive discussion of risk assessment and management issues associated with nanotechnology, as well as a summary of the Agency's statutory mandates. The document identifies research needs and recommends next steps for addressing science policy issues and research needs. For more information, see: http://www.epa.gov/osa/nanotech.htm.

Consumer Product Safety Commission (CPSC)

The Consumer Product Safety Commission (CPSC) recently released the three-page document "CPSC Nanomaterial Statement". In this brief statement, CPSC indicated that it will not be changing its basic approach for evaluating potential safety and health risks for the case of nanomaterial use in consumer products. Citing the "wide variation in potential health effects and the dearth of data on exposure and toxicity data of specific nanomaterials," CPSC does not make any general statements regarding the potential consumer exposures and health risks associated with nanomaterials. For more information, see: http://cpsc.gov/library/cpscnanostatement.pdf.

Reports, Reviews, and White Papers

Nanotechnology Health and Environmental Effects: An Inventory of Government-Supported Research

From the Project on Emerging Nanotechnologies at the Woodrow Wilson International Center for Scholars
www.nanotechproject.org
In light of the lack of substantial data on the human health and environmental impacts of nanomaterials, this inventory of studies will facilitate understanding of the EH&S implications of nanotechnology and aid in future research. The majority of research currently in the database is US government-funded, though it is intended to include more international research as the inventory grows. The database allows for keyword searches as well as browsing by topic. The information contained in this inventory is indispensable for anyone involved in or concerned with the safe and sustainable development of nanotechnologies.

Securing the Promise of Nanotechnology: Is the US Environmental Law Up To the Job? - October 2005

A Dialogue from the Environmental Law Institute and the Woodrow Wilson International Center for Scholars Project on Emerging Nanotechnologies
www2.eli.org/pdf/research/nanotech/d15-10.pdf
In May of 2005, a group of scientists, lawyers, and policymakers were brought together for two days to discuss how US laws and regulations, and methods such as voluntary programs and industry standards, can be used to effectively address the EH&S issues around nanotechnology. This report is a summary of that Dialogue and provides insight from a variety of perspectives.

Upcoming Meetings and Conferences

Nanotoxicology - Cambridge, MA; April 24-25, 2006

Overcoming Obstacles to Effective Research Design in Nanotoxicology
www.tfilearning.com
This conference will focus on the challenges in conducting nanotoxicology research and ways to address such challenges. Topics covered during the two-day conference will include nanoparticle transfer across biological barriers, and anticipated environmental routes and exposure levels associated with use of nanoparticles for environmental remediation.

Nanoparticles in the Workplace - Chicago, IL: May 13, 2006

American Industrial Hygiene Conference, Nanotechnology Symposium
www.aiha.org
This daylong symposium will address a broad range of topics related to nanoparticles in the workplace, from an overview of nanoparticle production to particle measurement and filtration effectiveness, in addition to an updated on government initiatives.

Hot-off-the-Presses Peer-reviewed Research Articles of Note

Muller, J; Huaux, F; Moreau, N; Misson, P; Heilier, JF; Delos, M; Arras, M; Fonseca, A; Nagy, JB;, Lison, D. 2005. "Respiratory toxicity of multi-wall carbon nanotubes." Toxicol. Appl. Pharmacol. 207(3):221-31. Abstract

Synopsis:

- This article summarizes a series of experimental studies conducted to characterize the toxicity of multi-wall carbon nanotubes (CNT) in the rat lung and *in vitro*.
- A suspension of either intact CNT or ground CNT was injected through the trachea into the lungs of rats or mice at three different dose levels, and laboratory tests were conducted to estimate lung persistence, inflammation, and fibrosis.
- The dose levels (0.5-2 mg) were selected based on recommendations in the literature for performing biopersistence studies; a single dose-level of 2 mg was used for the two positive controls (asbestos and ultrafine carbon black).
- Both intact CNT and ground CNT were found to still be present in the rat lung after 60 days (80% and 40% of the lowest dose), indicating their biopersistence in the lung. Ground CNT were found to be better dispersed in the lung, reaching down to the alveolar spaces.
- Both intact CNT and ground CNT were found to induce inflammatory and fibrotic reactions, with responses similar in magnitude to those observed for asbestos fibers that were used as a positive control.
- The authors concluded that "these results suggest that carbon nanotubes are potentially toxic to humans and that strict industrial hygiene measures should be taken to limit exposure during their manipulation."

Implications:

- This study is an advancement over prior studies of carbon nanotube toxicity that experienced difficulties in delivery of the test material to the lung.
- Study results indicate that both ground and intact CNTs elicit inflammatory and fibrotic responses in the lung, suggesting the intrinsic toxicity of these materials.
- These study findings have implications for potential workplace exposures, and the study authors recommend the application of the precautionary principle and the implementation of strict industrial hygiene measures.
- Relevance to other types of exposures (*i.e.*, via inhalation) is currently uncertain, and the study authors conclude that additional studies are needed to better characterize the toxicity of these materials in other animal models and by other modes of administration.

Robichaud, CO; Tanzil, D; Weilenmann, U; Wiesner MR. 2005. "Relative risk analysis of several manufactured nanomaterials: an insurance industry context." Environ. Sci. Technol. 39(22):8985-94. Abstract

Synopsis:

- This article presents a relative risk assessment for the industrial fabrication of several nanomaterials, with the key caveat that it does not consider any impacts or risks with the nanomaterials themselves.
- Based on their current or near-term potential for large-scale production and commercialization, the production processes for five nanomaterials were selected for analysis: (1) single-walled carbon nanotubes, (2) bucky balls (C_{60}), (3) one variety of quantum dots, (4) alumoxane nanoparticles, and (5) nano-titanium dioxide.
- Relative risk estimates were calculated for three categories of risk using an actuarial protocol developed by the insurance industry for calculating insurance premiums for chemical manufacturers: incident risk (*i.e.*, an in-process accident), normal operations risk, and latent contamination risk (*i.e.*, the potential for long-term contamination of the operations site). For comparison, relative risk scores are also provided for six commonplace processes: silicon wafer (semiconductor) production, wine production, high-density plastic (polyolefin) production, automotive lead-acid battery production, petroleum refining, and aspirin production.
- With the exception of incident risk scores for C_{60}, all nanomaterial risk scores were below those of the highest scoring non-nanomaterial processes (*i.e.*, polyolefin production and refined petroleum production) and were generally comparable to those of the lowest scoring non-nanomaterial processes (*i.e.*, wine and aspirin).
- Based on their findings, the authors concluded that "results from this analysis determined that relative environmental risk from manufacturing each of these five materials was comparatively low in relation to other common industrial manufacturing processes."

Implications:

- This study provides a baseline of information concerning potential hazards associated with the manufacture of five nanomaterials, although it does not provide any information on the direct risks associated with the manufactured nanomaterials themselves, the occupational risks associated with their handling and use or risks associated with eventual disposal.
- When interpreting the relative risk findings from this study, it is imperative that the methodological context be considered, namely that the risk rankings were developed using an insurance industry model rather

than a regulatory-based risk assessment model. As discussed in the article, this model was developed to assess differences in liability risk in terms of orders of magnitude, and as such, it makes a number of crude assumptions and has significant limitations and uncertainties.

- Although some materials conservation was assumed in the risk calculations, the study results suggest that industrial risks could be reduced by not only substituting less hazardous starting materials, but also by recycling and successful recapture of materials and other improvements in handling operations.

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