



Gradient CORPORATION

EH&S Nano News

Volume 1, No. 4

www.ehsnanonews.com

May 2006

Editor:

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Recent Government Briefs

U.S. Environmental Protection Agency (USEPA)

- (EPA) On March 13, Jim Willis, director of EPA's Chemical Control Division, briefed the Forum on State and Tribal Toxics Action (FOSTTA) on ongoing efforts at EPA to develop a stewardship program for new and existing nanoengineered materials. Willis stated that manufacturers seeking approval for new nanoscale chemicals have already made 17 requests to EPA. He also revealed EPA plans to hold two peer consultations in the spring, one regarding the types of tests and characterization data that EPA should request for nanomaterials and the other to identify information needs for understanding current and best practices for management of nanomaterials in the workplace. Willis reported that there are plans to peer-review the Science Policy Council's draft white paper in April for publication in mid-year. (As reported in BNA's Daily Environment Report on 3/14/06)
- (EPA) On March 16, EPA announced the awarding of 14 grants totaling \$5 million to universities for the study of the potential health and environmental effects of nanotechnology. Among the funded grants were studies to investigate the fate and transport of fullerenes in soil, to determine the effects of commercially available nanomaterials on the human blood coagulation system, and to develop a comprehensive, practical method for sampling, quantifying, and characterizing carbon nanotube particles in the air. Awards were made through EPA's Science to Achieve Results (STAR) research grants program in partnership with the National Science Foundation (NSF) and the National Institute for Occupational Safety and Health (NIOSH). For more information, see: http://es.epa.gov/ncer/events/news/2006/03_16_06_award.html.

Reports, Reviews, White Papers, and Books

Nanoparticle Information Library (NIL), NIOSH

<http://www2a.cdc.gov/niosh-nil/>

This indispensable database provides open access to information on various nanoparticles, with brief reports submitted by the nanotech researchers themselves. The

library is searchable by structure and element, and in addition to learning about emerging particles, you can contact the people or companies that contributed the report.

Inventory of Nanotechnology Consumer Products

Project On Emerging Nanotechnologies

<http://www.nanotechproject.org/index.php?id=44>

The Project On Emerging Nanotechnologies is a joint venture from the Woodrow Wilson International Center for Scholars and the Pew Charitable Trust. Their consumer product inventory is a searchable database with more than 200 nano-based products currently on the market. The types of products range from personal care products like face cream, to sporting goods such as a tennis racquet made of carbon nanotubes. The inventory provides a broad view of how nanotechnology is entering various markets and should be useful for consumers, researchers, and investors alike.

Upcoming Meetings and Conferences

NanoBusiness 2006 – NY, NY: May 17-19, 2006

The Official Conference of the NanoBusiness Alliance
nanobusiness2006.com

The 5th annual NanoBusiness Alliance Conference will explore issues in nanotech such as investing and commercialization, as well as current and future global opportunities. This gathering will be attended by international business leaders, investors, venture capitalists, scientists, engineers, legal professionals, and government officials.

On the afternoon of May 18, the Converging Technologies Bar Association (CTBA) is sponsoring Protecting Your Nano Assets: A Legal Tutorial. One not to miss session will be In Re International Nanotech Corporation: A Mock NEPA Hearing Exploring the Critical EH&S Implications of Nanotechnologies. **Dr. Peter Valberg, of Gradient Corporation**, will be participating in this mock hearing as the technical expert on potential health risks associated with nanomaterials. Another session of interest is Four Angry Men: Converging Technologies vs. the Patent System - a corporate roundtable on intellectual property led by the CTBA IP Committee.

In This Issue

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Members of the CTBA receive a discounted rate at registration. To learn more about membership and committee opportunities in the CTBA or receive a membership application, and obtain your member passcode for registration, call: (212) 591-CTBA or email: info@convergingtechnologies.org. Membership in the CTBA is open to attorneys as well as non-attorney professionals interested in the area of nanotechnology and converging technologies. Complete conference information and registration can be obtained by visiting www.nanobusiness2006.com.

Eighth International Conference on Nanostructured Materials – Bangalore, India: Aug 20-25, 2006

<http://met.iisc.ernet.in/~nano2006/>

This all-encompassing meeting will address the broad range of topics relevant to nano-structured materials, from nanobiotechnology to nanoelectronics. Presenters and speakers from all over the world will lead this meeting, with a focus on idea, technique, and research exchange among the attendees. This conference will be primarily technical, with many presenters on the cutting edge of nano development.

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

S.B. Lovern and R. Klaper. 2006. “Daphnia Magna Mortality When Exposed to Titanium Dioxide and Fullerene (C₆₀) Nanoparticles.” *Environ. Toxicol. Chem.* 25 (4): 1132-1137. [Abstract](#).

Synopsis:

- This article summarizes aquatic toxicity tests conducted on two different types of nanoparticles, titanium dioxide, and fullerene (C₆₀) nanoparticles.
- Specifically, titanium dioxide and fullerene nanoparticles were prepared by filtration in tetrahydrofuran or by sonication, and *Daphnia magna* were exposed to the four types of solutions at multiple concentration levels using U.S. EPA 48-hour acute toxicity tests. Survival was assessed with determination of the median lethal concentration, lowest-observable-effect concentration, and the no-observable-effect concentration.
- Both filtered C₆₀ and filtered TiO₂ showed positive exposure-response relationships for *Daphnia magna* mortality, with C₆₀ causing toxicity at lower concentrations than TiO₂ (LC50's of 460 and 5,500 ppb and 100% mortality at 880 and 10,000 ppb for filtered C₆₀ and filtered TiO₂, respectively).
- Varied and substantially lower mortality was observed for the exposures to sonicated solutions, with sonicated C₆₀ mortality fluctuating from 5% to 66% for concentrations ranging from 0 to 9,000 ppb and even concentrations as high as 500,000 ppb of TiO₂ showing only 18% mortality.

Implications:

- As discussed by the authors, this is one of the first studies to examine the impact of nanoparticles on invertebrates, and

only the second published scientific study to investigate the effect of nanoparticles on aquatic organisms.

- The study findings confirm that standard aquatic toxicity testing can provide valuable information with respect to nanoparticle toxicity.
- Given that the average diameter of TiO₂ particles is 10 to 20 nm while the average diameter of C₆₀ is only 0.72 nm, the study results are consistent with the hypothesis that size is a key modifier of the toxicity of nanoparticles. However, the authors acknowledge that other factors such as differences in reactivity of the particles may play a role in the differential toxicity of these two types of nanoparticles.
- The study results demonstrate that the way particles are prepared affects their toxicity in aquatic toxicity tests, with clumping of particles and unequal particle size distributions likely reducing the toxicity of sonicated particles relative to filtered solutions. As discussed by the study authors, this study finding has potential implications with respect to the disposal of nanoparticle waste, as well as the development of standardized testing protocols for nanoparticle toxicity.

Ryman-Rasmussen, JP; Riviere, JE; Monteiro-Riviere, NA. 2006. “Penetration of Intact Skin by Quantum Dots with Diverse Physicochemical Properties.” *Toxicol. Sci.* Epub ahead of print.

[Abstract](#).

Synopsis:

- This article summarizes a series of laboratory experiments conducted to determine if quantum dots (QD) can penetrate intact skin in a size or coating-dependent manner.
- Quantum dots of two core/shell sizes and shapes, and three different surface coatings, were topically applied to porcine skin in flow-through diffusion cells at an occupationally relevant dose for 8 hours and 24 hours.
- Using confocal microscopy to identify QD localization in the skin layers, the authors demonstrated penetration of the stratum corneum and localization within the epidermal/dermal layers by 8 hours for quantum dots of multiple core/shell sizes, shapes, and surface coatings.

Implications:

- Given their findings that quantum dots of different sizes, shapes, and surface coatings can penetrate intact skins at occupationally relevant doses and exposure durations without abrasion or mechanical stressors, the authors conclude that the skin may serve as an important portal of entry for occupational and consumer exposures to nanoparticles. Dermal penetration thus should be considered a potential exposure route in nanoparticle risk assessment.
- The authors acknowledge that although their findings indicate that in an *in vitro* study, skin appears to be surprisingly permeable to nanomaterials with diverse physicochemical properties, it is not presently known whether skin penetration of QD would occur in whole organisms or result in adverse effects.

- Differences in the dermal penetration of two of the tested QD species, namely the carboxylic acid-coated spherical QD 565 and ellipsoidal 655 species that share similar properties with the exception of shape, are suggestive of the potential importance of shape as a modifier of skin permeability.
- The authors note that they cannot completely rule out that their findings may be a result of vehicle-mediated alterations in skin permeability rather than QD-mediated dermal penetration.

Guest Contributor: Sonia E. Miller

Are We There Yet? A Review of Nano-Hype: The Truth Behind the Nanotechnology Buzz. (2006) Prometheus Books ISBN 1-59102-351-3

What do you get when you mix a vocal academic who specializes in rhetoric, with nanotechnology? The answer is: Nano-Hype.

First of all, let's set the record straight. I am a friend of the author, David M. Berube. My name is mentioned in the Acknowledgments section of the book. I am cited in Chapter 1 and quoted in the promotional flyer as well as in the back cover sleeve of the book. I am regularly mentioned in his blog.

Can I be an impartial and unbiased reviewer of the book? Yes. Professor Berube captured my temperament well when he acknowledged "...her passion and zeal to speak what is on her mind."

Those who have had the pleasure and opportunity of personally knowing and dealing with Prof. Berube appreciate his sense of humor, quick wit, sharp tongue, and amazing intellectual capital. His book, Nano-Hype, gives the reader an entry into his genius, where words, concepts, and entire situations will not be found in any dictionary or wikipedia. He writes as he speaks - at lightning speed, with time enough to enjoy the ride.

There is nothing "nano" about the subject of nanotechnology or nanoscience and the technologies and scientific disciplines within which it converges. It is not just a U.S. phenomenon, but a global initiative in a "flat world" with yet uncertain societal implications.

Of particular importance in the reading is Chapter 9: Nanohazards and Nanotoxicology.

Oftentimes compared to the genetically modified organisms (GMO) fiasco and asbestos debacle, Prof. Berube dispels the claims that nanotechnology should reflect a similar fear-factor scenario. In essence, every new technology can potentially serve dual-purposes - offering substantial benefits on the one hand, with simultaneous unimaginable and unforeseeable consequences on the other. Should that, however, be the reason to harness the advance of nanotechnology? He cites historical examples of new technologies that entered the marketplace with unfounded scepticism.

Prof. Berube continues his rhetoric on the subject by dividing the "shell game being played about nanotechnology" into time frames. He details the debate over truth versus false conse-

quences by suggesting the importance of establishing clear demarcations of its advance - by breaking nanotechnology down into either "waves" such as materials or biologicals, or "ranges" such as five, ten, or more years.

These divisions are of importance to him because they reflect a mirror image of the different societal and ethical implications of nanotechnology (SEIN) - the central focus around which his environment, health, and safety (EHS) peripheral discussions revolve.

Prof. Berube alleges it is not sufficient to view future potential issues from a present perspective and that "significant social dislocations" is the problem that confronts policy makers today. He stresses that future concerns must be assessed and evaluated from a future perspective without dismissing their present day value and benefit. The reader is challenged by such a proposal to view nanotechnology from particular stages of development and their corresponding ethical dilemmas, while "retaining environmental vigilance" - one of his most pressing SEIN issues.

Here, Prof. Berube provides a primer on nanotoxicology research, listing the range of concerns while questioning if nanoparticles are biodegradable and toxic. He distinguishes a nanoparticle from a macroparticle and elaborates on their characteristics. However, his longest deliberation is about whether exposure to and/or contact with nanoparticles is directly and indirectly toxic in the workplace and to consumers, citing a litany of detailed examples of studies and conference presentations along the way, providing reading recommendations, and ultimately calling for yet more studies.

At one point, Prof. Berube equates nanotechnology with the stem-cell funding ban, expounding equal parts EHS stewardship now or anticipating the risk of watching its advance offshore. It is a cautionary tale.

While nanotechnology may have joined the ranks of the "Dummies" book series in 2005 (Richard Booker & Earl Boysen Wiley, Nanotechnology for Dummies), Nano-Hype is a serious and well-researched rendition of challenges facing nanotechnology and the extreme polar forces behind its advance.

While I do not necessarily agree with all Prof. Berube proposes - in particular that there is an absence of a regulatory framework, Nano-Hype stands out among the plethora of recently released nanotechnology books. The reader will be hard pressed to find a more researched analysis and vocal evaluation of the state of nanotechnology - and the truth behind its buzz.

Sonia E. Miller, Attorney-at-Law, is principal of S.E. MILLER LAW FIRM, whose practice areas include emerging and converging technologies, and founder and global president of the Converging Technologies Bar Association (CTBA). The opinions expressed herein are personal to the author.

Coming Next Month

- Update on the German Federal Institute of Risk Assessment (BfR) investigation of the “Magic Nano” sealing spray.
 - New Research contradicting the “conventional wisdom” that nanoparticle toxicity is dependent on particle size and surface area.
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