



NATURAL RESOURCES DEFENSE COUNCIL
THE EARTH'S BEST DEFENSE

Health Concerns from Nanomaterials

CleanMed 2009, Chicago

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DEFINITION:

Nanotechnologies are the convergence of chemistry, physics, and engineering at the nanoscale, to take advantage of unique physical properties associated with small size.

The products of these efforts are called nanomaterials, consisting of nanoparticles (having one or more dimensions of 1-100 nanometers in size) and the grouping of these particles into structures that may be larger than nanoscale.

NANOTOXICOLOGY

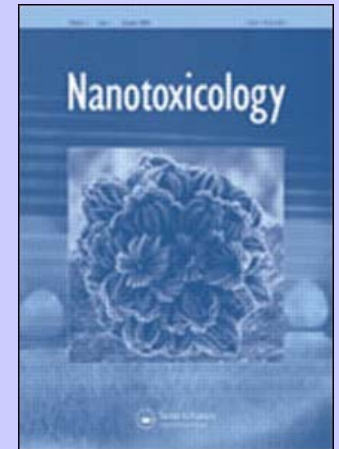
Small size increases likelihood of penetrating biological tissues

Large surface area/mass ratio increases potential for chemical reactivity

Tend to be highly persistent

Examples:

- Carbon buckyballs used as lubricant
- Carbon nanotubes used in building materials
- Titanium dioxide and aluminum oxide used in cosmetics and sunscreens
- Nanosilver used as a non-specific antimicrobial in food packaging and clothing
- Cerium oxide is used as a catalytic converter to reduce CO emissions in motor vehicle fuel



NANOTOXICOLOGY



Many nanomaterials are so small that they can enter the lungs, pass through cell membranes, and possibly penetrate the skin.

Once inside the body, they seem to have unlimited access to all tissues and organs, including the brain and possibly fetal circulation.

Animal studies suggest that nanomaterials can cause inflammation, damage brain cells and cause pre-cancerous lesions.

Ultrafine air pollution, much of which is nano-sized, is associated with reduced lung function and increased likelihood of asthma, respiratory disease, and deaths from lung and heart disease.

Nano-metals tend to induce superoxide free radicals (Science, 2006)

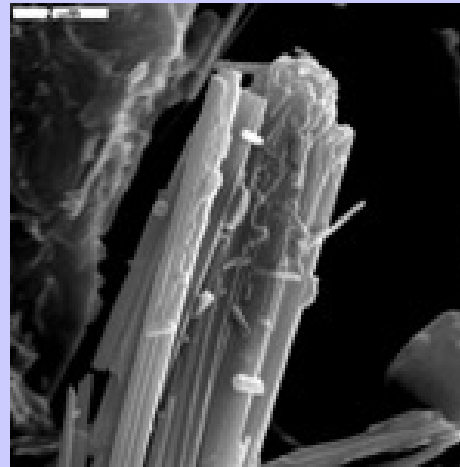
CARBON NANOTUBES ARE LIKE ASBESTOS

CNT's are long, rigid, fiber-like tubes.

They are persistent, toxic, and bioaccumulative.

Injecting the mesothelial lining of the body cavity of mice with multiwalled carbon nanotubes results in asbestos-like, length-dependent, pathogenic behavior by 7 days, including inflammation and granulomas. (2005)

Carbon nanotubes introduced into the abdominal cavity of mice show asbestos-like pathogenicity in a pilot study. (Poland et al. *Nature Nanotechnology*, 2008)



IN MEDICINE

Emend® (Merck, USA) approved by FDA in 2003 as an anti-nausea drug for chemotherapy patients. Nanocrystals.

Doxil® (ALZA Corp, USA) approved by FDA in 2005 to treat ovarian cancer and Kaposi's sarcoma. Lipid nanoparticles.

Estrasorb™ (Novavax, Inc, USA) approved by FDA in 2003 as topical estradiol lotion to treat menopause. Micellar nanoparticles.

Rapamune® (Wyeth, USA) approved by FDA in 2000 as an immunosuppressant for renal transplant patients. Nanocrystal form.

Zirconium Oxide® (Altair Nanotechnologies, Inc, USA) commercially available since 2003 for dental fillings



IN HOSPITALS

EcoTru® Professional (EnviroSystems®, USA). A hospital-grade nanoemulsive disinfectant cleaner.

Acticoat® (Smith&Nephew, Inc, USA). Nanosilver bandages. FDA approved 2005.

EnSeal Laparoscopic Vessel Fusion System (SurgRx Inc, USA). Electrode consists of millions of nanometer-sized conductive particles embedded in a temperature-sensitive material. Each particle acts like a discrete thermostatic switch to regulate the amount of current that passes into the tissue area with which it is in contact.



IN DIETARY SUPPLEMENTS



Germ slayer medication (Aluwe, LLC, USA); “At the first sign of infection (sore throat, fever, headache, stomach pain, etc) begin taking 1 tablespoon of Germ slayer every 4-6 hours till the pain has been gone for 1 full cycle“

ASAP dietary supplement (Amer Biotech labs, USA); “It is designed for those people who feel rundown and decide that they need some extra-strength help.”...“Tests have been directed by one of the leading materials science laboratory in the world at the Pennsylvania State University, under the personal direction of Professor Rustum Roy, who is regarded as one of the top materials scientists in the world”

NanoSil™ dietary supplement, and nasal spray (Conseal International, USA) "Finally! A Silver Dietary Supplement with Scientific Backing,“. Company has conducted a rat LD50 safety study.

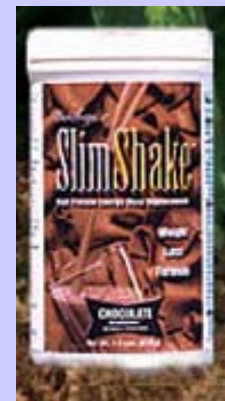


IN FOOD AND BEVERAGES

Nanoceuticals™ Slim Shake Chocolate (RBC Life Sciences, USA). Pure cocoa is added to a nano-cluster

Canola Active Oil (Shemen Industries, Israel). Uses Nano-sized self assembled structured lipids, NSSL, to deliver insoluble vitamins through the cellular membrane

Nanotea (Shenzhen Become Industry&Trade Co., China)



IN FOOD CONTACT MATERIALS

Kitchen cutting board (S Korea) nanosilver

Home and garden spray (ABL, USA) nanosilver

Adhesive for McDonald's burger containers (Ecosynthetix, USA). Uses nano-scale starch molecules that require less water and less energy to form adhesives and dry.

Aluminum foil (Melitta, Germany). With non-stick coating. "Put simply, is that the black coating material to carbon, in a glass matrix is embedded. The black area reached up to 100 degrees Celsius higher surface temperatures when cooking ... the food is prepared quickly."



NANOSILVER

In March, 2008 US EPA fined a nanotech company, ATEN Technology \$208,000 because its subsidiary, IOGEAR, was selling nanosilver as an unregistered pesticide.

In April, 2009 EPA told me that the few companies that have voluntarily asked to register their nanosilver-containing products have been rejected until they supply toxicity data on the nano-scale particle



The screenshot shows the Nanowerk website interface. At the top, there is a logo for "nanowerk" and two images: a "Confocal Raman image" and a "TERS image", both with a 200 nm scale bar. Below the logo is a navigation menu with links for Home, Databases, News, Resources, Nanowerk, Introduction to Nanotechnology, Career Center, and NanoTalk. The main content area features a news article titled "EPA fines technology company \$208,000 for 'nano coating' pesticide claims on computer peripherals". The article is dated March 7, 2008. The text of the article states that the U.S. Environmental Protection Agency (EPA) has settled with ATEN Technology, Inc., of Irvine, Calif., acting for its subsidiary IOGEAR, for selling unregistered pesticides and making unproven claims about their effectiveness. EPA maintains that IOGEAR made unsubstantiated public health claims regarding unregistered products, and their ability to control germs and pathogens -- a violation of the Federal Insecticide, Fungicide and Rodenticide Act. To the left of the article is a sidebar with "Article Tools" including Printer-friendly, E-mail this article, Daily News Email Digest, News Feeds, and a SHARE button. Below the tools is a "Research and General News" section with several news items, including "First neutrons created at the ISIS Second Target Station" (Aug 3rd, 2008), "The brightest, sharpest, fastest C-ray holograms yet" (Aug 2nd, 2008), "Advanced Energy Consortium issues request for proposals from researchers in the nanotechnology industry" (Aug 2nd, 2008), and "Size-specific cracking shakes". At the bottom right of the article, there is an image of a green computer mouse with a "Wireless! Keyboard & Mouse" label and a "Germ Free" logo.

EPA Toxics Program relying primarily on voluntary program, initiated in Jan, 2008



The screenshot shows the EPA website's navigation and content for the Nanotechnology and the Environment section. The header includes the EPA logo, the text "U.S. ENVIRONMENTAL PROTECTION AGENCY", and the page title "Nanotechnology and the Environment". A search bar is present with the text "Search: All EPA Nanotechnology and the Environment" and a "Go" button. Below the search bar is a breadcrumb trail: "You are here: EPA » Prevention, Pesticides and Toxic Substances » Pollution Prevention and Toxics » Nanotechnology under the Toxic Substances Control Act » Nanoscale Materials Stewardship Program". The main heading is "Nanoscale Materials Stewardship Program". Underneath, it says "On this page:" followed by a list of links: "Under the Basic Program", "Under the In-Depth Program", "More on the Basic Program", "More on the In-Depth Program", "Program Participants", "Evaluation", "How to Participate in the NMSP", and "Background". To the right, there are two green callout boxes. The first is titled "More Information" and contains the text "Read about Nanotechnology under the Toxic Substances Control Act." The second is titled "Interested in the Nanoscale Materials Stewardship Program (NMSP)?" and contains the text "The NMSP continues to grow. See current NMSP participants. EPA welcomes new participants and submissions. Please submit your contact information." A sidebar on the left contains a vertical menu with links: Home, Information, Partnerships and Programs, Concerned Citizens, Grants & Funding, Rules & Regulations, Information Sources, Publications, News and Awareness, and Methods & Guidelines. At the bottom left of the sidebar is the "KTDS" logo.

U.S. ENVIRONMENTAL PROTECTION AGENCY

Nanotechnology and the Environment

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You are here: EPA » [Prevention, Pesticides and Toxic Substances](#) » [Pollution Prevention and Toxics](#) » [Nanotechnology under the Toxic Substances Control Act](#) » Nanoscale Materials Stewardship Program

Nanoscale Materials Stewardship Program

On this page:

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- [More on the Basic Program](#)
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- [How to Participate in the NMSP](#)
- [Background](#)

January 28, 2008 - EPA launched the Nanoscale Materials Stewardship Program (NMSP). The NMSP will help provide a firmer scientific foundation for regulatory decisions by encouraging submission and development of information including risk management practices for nanoscale materials.

More Information

Read about [Nanotechnology under the Toxic Substances Control Act](#).

Interested in the Nanoscale Materials Stewardship Program (NMSP)?

The NMSP continues to grow. See [current NMSP participants](#). EPA welcomes new participants and submissions. [Please submit your contact information](#).

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LATEST NEWS

[\[PPC\]](#) Moody's cuts Pilgrim's Pride to 'Caa2'; outlook negative

Voluntary regulation doesn't work, SEC's Cox says

By Rex Nutting

Last update: 10:32 a.m. EDT Oct. 23, 2008 | [Comments: 13](#)

WASHINGTON (MarketWatch) -- Financial regulators made "fateful mistakes" that helped drive the global financial system to the brink, said Chris Cox, chairman of the Securities and Exchange Commission, in congressional testimony Thursday. Cox said he and other regulators have learned many lessons, chiefly that "voluntary regulation does not work." Cox urged Congress to fill "regulatory gaps" that are still putting the economy at risk. "The lessons of the credit crisis all point to the need for strong and effective regulation, but without major holes or gaps." Cox said Congress should appoint a select committee to address the challenges of regulation on a comprehensive basis. ■

FOOD AND DRUG ADMINISTRATION (FDA)

- FDA does not have authority to require cosmetic companies to submit safety data
- FDA does not have authority to obtain post-market health and safety data for any products

CONSUMER PRODUCT SAFETY COMMISSION

- CPSAct prohibits the agency from imposing mandatory safety standards if the industry agrees to write its own standards
- CPSAct prohibits the agency from informing the public about a product without pre-approval of the manufacturer
- CPSC has no authority to require pre-market testing; only has authority to implement post-market product recalls



 **U.S. Consumer Product Safety Commission**      

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Recalls and Product Safety News

The U.S. Consumer Product Safety Commission is charged with protecting the public from unreasonable risks of serious injury or death from more than 15,000 types of consumer products. You can find information on over 4,000 product recalls and recall alerts using the various searches on this page.

IN CANADA

In Feb, 2009 Canada will require companies to report quantity, usage, and toxicity information on nanomaterials

The information required includes basic information on the quantity of the substance that is manufactured or imported, its use, physical and chemical properties, toxicity data, and any safety procedures.

Mandatory for companies that manufactured or imported more than 1 kilogram (2.2 pounds) of a nanomaterial, either alone or in a mixture, during 2008

Companies will have four months to comply

EUROPEAN UNION

In March, 2009 Members of the European Parliament ruled that nanomaterials may only be placed on the market after being subject to an approved nano-specific, standardized, safety assessment that is free of animal-testing.

Members of the European Parliament also voted in favor of mandatory labeling of manufactured nanomaterial ingredients and of ethical and environmental assessment.

The amendments to the Novel Foods Directive still have to be agreed with national governments represented in the Council of the European Union before becoming law

NRDC RECOMMENDATIONS

- **Retailers and formulators** should request full life-cycle environment, health, and safety (EHS) impact assessments from suppliers;
- **Workplace** procedures should be set to prevent exposure to staff and patients, and to prevent environmental releases
- **Regulators** should evaluate the potential hazards of nanomaterials as distinct from normal scale materials.

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